Kivy Documentation

Release 1.9.0-dev

www.kivy.org

CONTENTS

Welcome to Kivy's documentation. Kivy is an open source software library for the rapid development of applications equipped with novel user interfaces, such as multi-touch apps.

We recommend that you get started with *Getting Started*. Then head over to the *Programming Guide*. We also have *Create an application* if you are impatient.

You are probably wondering why you should be interested in using Kivy. There is a document outlining our *Philosophy* that we encourage you to read, and a detailed *Architectural Overview*.

If you want to contribute to Kivy, make sure to read *Contributing*. If your concern isn't addressed in the documentation, feel free to *Contact Us*.

Part I

USER’S GUIDE

This part of the documentation explains the basic ideas behind Kivy’s design and why you’d want to use it. It goes on with a discussion of the architecture and shows you how to create stunning applications in a short time using the framework.

CHAPTER

ONE

INSTALLATION

We try not to reinvent the wheel, but to bring something innovative to the market. As a consequence, we're focused on our own code and use pre-existing, high-quality third-party libraries where possible. To support the full, rich set of features that Kivy offers, several other libraries are required. If you do not use a specific feature (e.g. video playback), you don't need the corresponding dependency. That said, there is one dependency that Kivy **does** require: Cython.

In addition, you need a Python 2.x (2.7 <= x < 3.0) or 3.x (3.3 <= x) interpreter. If you want to enable features like windowing (i.e. open a Window), audio/video playback or spelling correction, additional dependencies must be available. For these, we recommend Pygame, Gst-Python and Enchant, respectively.

NOTE: Currently, packaging only works with Python 2.7. We are working on Python 3.3+ support, but for now if you plan to distribute your package on any platform you should use Python 2.7.

Other optional libraries (mutually independent) are:

- OpenCV 2.0 – Camera input.
- PIL – Image and text display.
- PyCairo – Text display.
- PyEnchant – Spelling correction.
- PyGST – Audio/video playback and camera input.

That said, **DON'T PANIC**!

We don't expect you to install all those things on your own. Instead, we have created nice portable packages that you can use directly, and they already contain the necessary packages for your platform. We just want you to know that there are alternatives to the defaults and give you an overview of the things Kivy uses internally.

1.1 Stable Version

The latest stable version can be found on Kivy's website at http://kivy.org/#download. Please refer to the installation instructions for your specific platform:

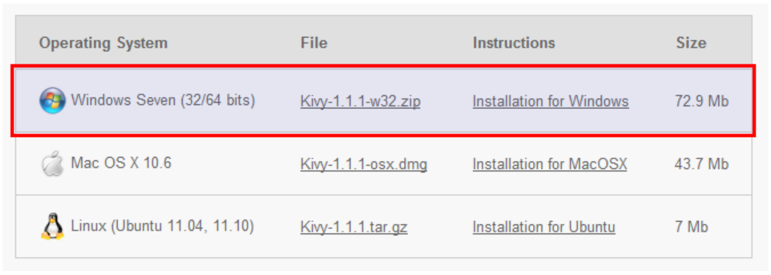
1.1.1 Installation on Windows

For Windows, we provide what we call a 'portable package'. This is the easiest way to get Kivy running as you don't have to install anything "system" wide. You can just unzip & run it.

This installation method is simple because it bundles the Python interpreter together with the Kivy environment and libraries. If you wish to install Kivy into an existing Python environment or install the development environment, please see the *Other Environments* section below.

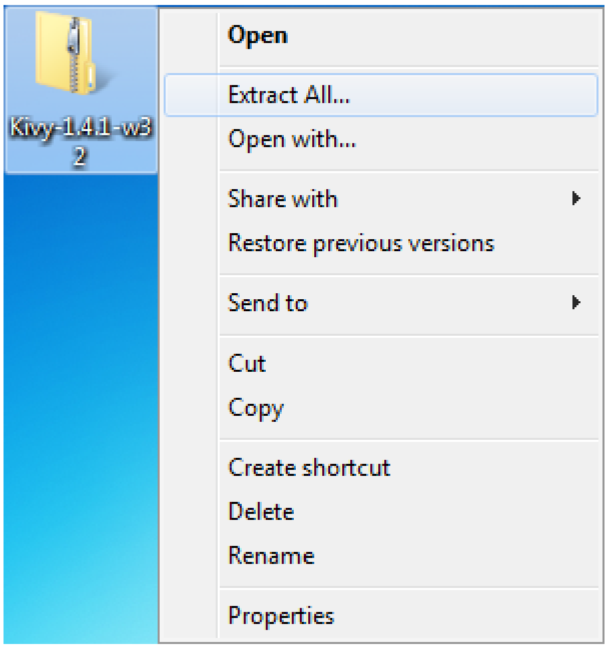
Installing the portable version

1. Download the latest version from http://kivy.org/#download



Operating System	File	Instructions	Size
Windows Seven (32/64 bits)	Kivy-1.1.1-w32.zip	Installation for Windows	72.9 Mb
Mac OS X 10.6	Kivy-1.1.1-osx.dmg	Installation for MacOSX	43.7 Mb
Linux (Ubuntu 11.04, 11.10)	Kivy-1.1.1.tar.gz	Installation for Ubuntu	7 Mb

2. Unzip the package



3. In the folder where you unzipped the package, you have a script called *kivy.bat*. Use this file for launching any kivy application as described below.

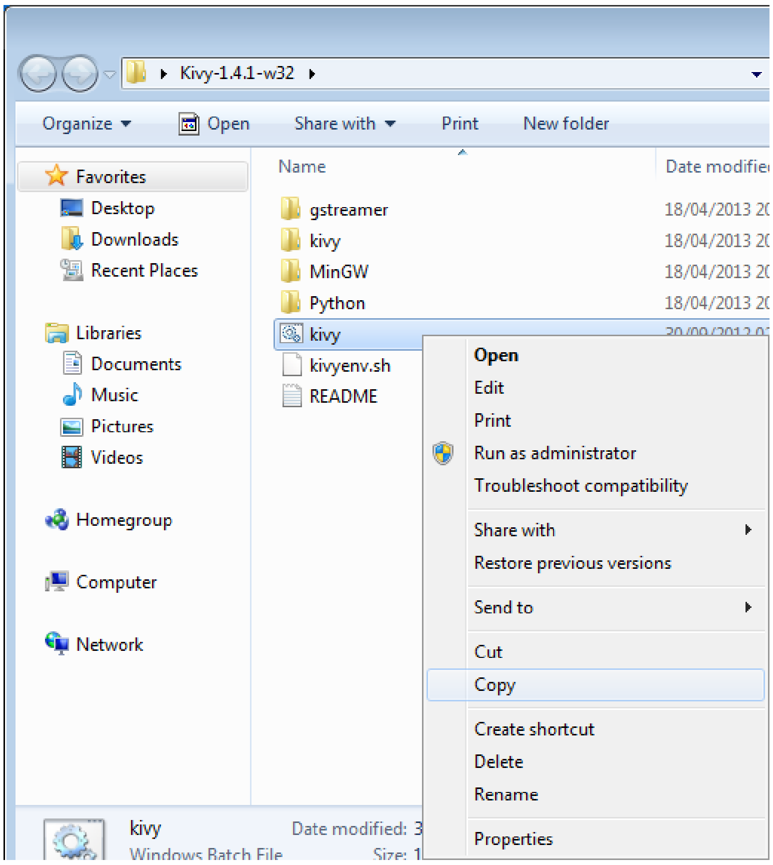
   Note: Launching the kivy.bat file will open a command window already set up to run kivy's Python. The environment settings are only changed for this command window and will not effect the system environment.

Start a Kivy Application

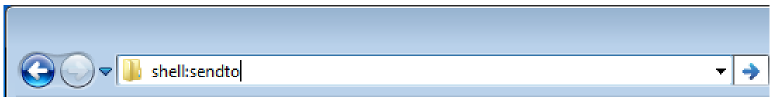
Send-to method

You can launch a .py file with our Python using the Send-to menu:

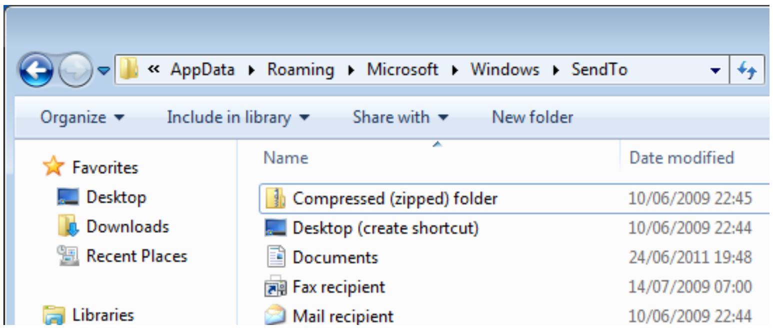
1. Copy the kivy.bat file to the Clipboard



2. Open Windows explorer (File explorer in Windows 8), and to go the address 'shell:sendto'

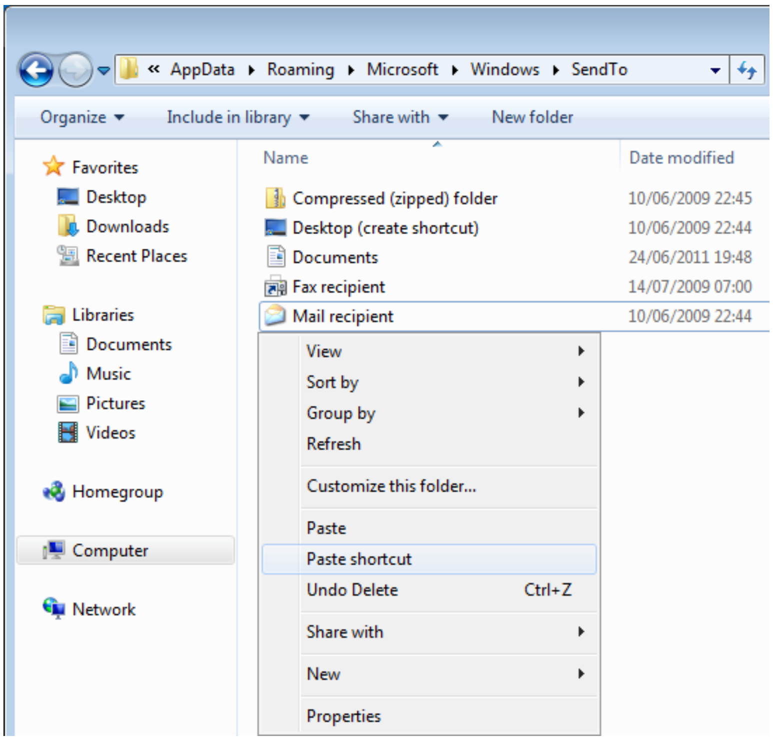


3. You should get the special Windows directory *SendTo*



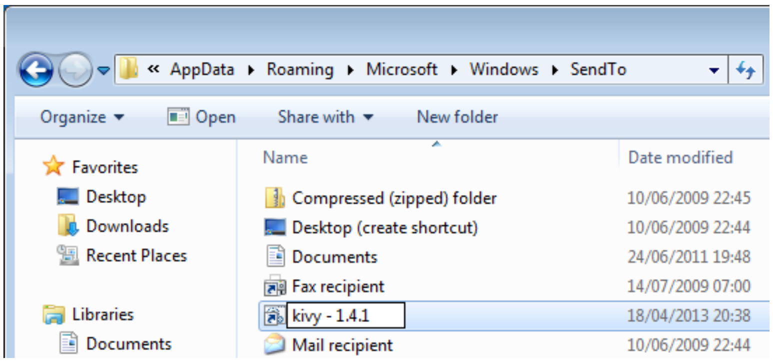
Name	Date modified
Compressed (zipped) folder	10/06/2009 22:45
Desktop (create shortcut)	10/06/2009 22:44
Documents	24/06/2011 19:48
Fax recipient	14/07/2009 07:00
Mail recipient	10/06/2009 22:44

4. Paste the previously copied kivy.bat file **as a shortcut**



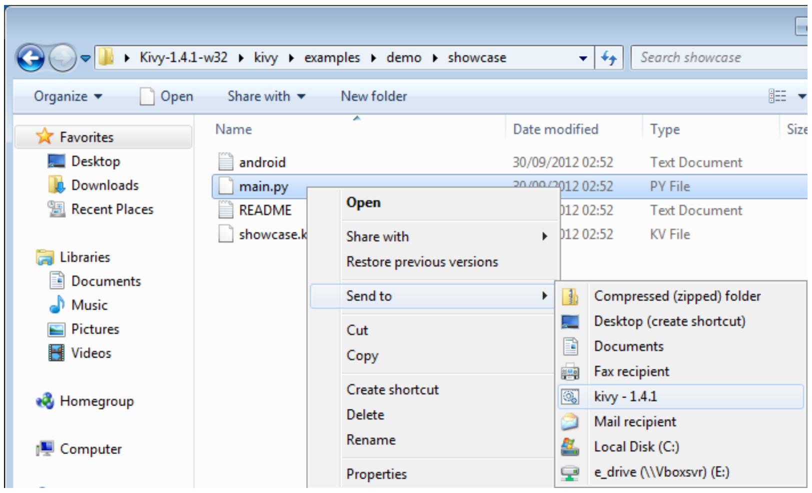
Name	Date modified
Compressed (zipped) folder	10/06/2009 22:45
Desktop (create shortcut)	10/06/2009 22:44
Documents	24/06/2011 19:48
Fax recipient	14/07/2009 07:00
Mail recipient	10/06/2009 22:44

5. Rename it to Kivy <kivy-version>



Name	Date modified
Compressed (zipped) folder	10/06/2009 22:45
Desktop (create shortcut)	10/06/2009 22:44
Documents	24/06/2011 19:48
Fax recipient	14/07/2009 07:00
kivy - 1.4.1	18/04/2013 20:38
Mail recipient	10/06/2009 22:44

You can now execute your application by right clicking on the .py file -> "Send To" -> "Kivy <version>".



Name	Date modified	Type	Size
android	30/09/2012 02:52	Text Document	
main.py	30/09/2012 02:52	PY File	
README	012 02:52	Text Document	
showcase.k	012 02:52	KV File	

Double-click method

There are some simple steps that you need to complete in order to be able to launch Kivy applications by just double-clicking them:

1. Right click on the main Python file (.py file extention) of the application you want to launch
2. From the context menu that appears, select *Open With*
3. Browse your hard disk drive and find the file `kivy.bat` from the portable package. Select it.
4. Select "Always open the file with..." if you don't want to repeat this procedure every time you double click a .py file.
5. You are done. Open the file.

The next time you double click a .py file, it will be executed with the version of Python that Kivy ships with.

Note: On Windows we have to ship our own version of Python since it's not installed by default on Windows (unlike Mac OS X and Linux). By following the steps above, you will set Kivy's version of Python as the default for opening .py files for your user. Normally this should not be harmful as it's just a normal version of Python with the *necessary third party libraries* added to the module search path. If you do encounter unexpected problems, please *Contact Us*.

Start from the Command-line (using bash)

If you just want to use or develop with the latest stable Kivy version, this can be achieved using the console. You will need a minimalist GNU system installed. We recommend msysGit.

When you install msysGit, you must select these options:

- Don't replace windows shell
- Checkout as-is, commit as-is (no CLRF replacement!)

You'll have an icon "Git bash" on your desktop. This is the console we want:

1. Start "Git bash"
2. `cd <directory of portable kivy>`
3. `source kivyenv.sh <full directory path of portable kivy>` # (don't use .)

You are now ready to launch Python/Kivy from the command-line! Just do:

```
python <filename.py>
```

Also, all other scripts and binaries are available, such as:

- cython
- gcc / make...
- easy_install
- gst-inspect-0.10

Start from the Command-line or Double-click (using Python launcher for Windows)

The Python launcher for Windows is available as a separate download from pylauncher, but is most conveniently installed by simply installing Python 3.3 (or later). Don't worry, this installation is designed to cause minimum disruption, it will run your latest Python 2 by default.

The launcher defines a PY command which can launch scripts for any version of Python installed on the workstation. It also connects itself as the default processor for all files with a .py extension. It scans the Python file to see if the first line starts with the string "#!" and, if it does, uses that string to select the appropriate version of Python to run. We will define a customized command so that we can tell it to start the correct version of python for Kivy.

Create a file named `py.ini` and place it either in your users `application data` directory, or in `C:\Windows`. It will contain the path used to start Kivy. I put my Kivy installation at `C:\utils\kivy` so my copy says:

```
[commands]
kivy="c:\utils\kivy\kivy.bat"
```

(You could also add commands to start other script interpreters, such as jython or IronPython.)

Now add a new first line to your `main.py` specifying your Python of choice:

```
#!/usr/bin/kivy
```

You can now launch your Kivy (or any other Python script) either by double-clicking or typing:

```
py <filename.py>
```

Programs without a `#!` first line will continue to be run be the default Python version 2 interpreter. Programs beginning with `#!/usr/bin/python3` will launch Python 3.

The `/usr/bin` part will be ignored by the Windows launcher, we add it so that Linux users will also be able to pick a specific Python version. (On my Linux workstation, `/usr/bin/kivy` is soft-linked to a virtualenv.) NOTE: In order to work correctly on Linux, your Python file must be saved with Unix-style (LF-only) line endings.

Full documentation can be found at: Python3.3 docs and PEP 397.

Use development Kivy

Warning: Using the latest development version can be risky and you might encounter issues during development. If you encounter any bugs, please report them.

If you want to use the latest development version of Kivy, you can follow these steps:

1. Download and install Kivy for Windows as explained above
2. Go into the portable Kivy directory. This contains the *kivy.bat* file and the *Python*, *kivy*, *Mingw* folders etc.
3. Rename the kivy directory to kivy.stable
4. Download the latest development version of Kivy from GitHub
5. Extract the zip into the Kivy portable directory
6. Rename the directory named "kivy-<some hash>" to just "kivy"
7. Launch kivy.bat
8. Go to the Kivy portable directory/kivy
9. Type:

   ```
   make force
   ```

10. That's all, you have a latest development version!

Note: If you get errors you may need to upgrade Cython:

1. Launch kivy.bat
2. `pip install --upgrade cython`

Other Environments

Using Kivy with an existing Python installation.

Creating a 64 bit development environment with MinGW.

Package Contents

The latest Windows package contains:

- Latest stable kivy version
- Python 2.7.1
- Glew 1.5.7
- Pygame 1.9.2
- Cython 0.14
- MinGW
- GStreamer
- Setuptools

1.1.2 Installation on MacOSX

Note: This method has only been tested on Mac OSX 10.7 Lion 64-bit. For versions prior to 10.7 or 10.7 32-bit, you have to install the components yourself. We suggest using homebrew to do that.

There can be a limitation on some OS X with more than one monitor. The application will crash when you try to start it on the second monitor.

For Mac OS X 10.7 and later, we provide a Kivy.app with all dependencies bundled. Download it from our Download Page. It comes as a .dmg file that contains:

- Kivy.app
- Readme.txt
- An Examples folder
- A script to install a *kivy* command for shell usage

To install Kivy, you must:

1. Download the latest version from http://kivy.org/#download
2. Double-click to open it
3. Drag the Kivy.app into your Applications folder
4. Make sure to read the Readme.txt

Installing the dev version

Step 1. Follow the procedure mentioned above to install kivy stable. step 2 Open a terminal and type the following commands into it:

```
cd /Applications/Kivy.app/Contents/Resources/
mv kivy kivy_stable
git clone http://github.com/kivy/kivy
cd kivy
make
```

That's it. You now have the latest kivy from github.

Start any Kivy Application

You can run any Kivy application by simply dragging the application's main file onto the Kivy.app icon. Just try this with any python file in the examples folder.

Start from the Command Line

If you want to use Kivy from the command line, double-click the `Make Symlinks` script after you have dragged the Kivy.app into the Applications folder. To test if it worked:

1. Open Terminal.app and enter:

   ```
   $ kivy
   ```

   You should get a Python prompt.

2. In there, type:

   ```
   >>> import kivy
   ```

   If it just goes to the next line without errors, it worked.

3. Running any Kivy application from the command line is now simply a matter of executing a command like the following:

   ```
   $ kivy yourapplication.py
   ```

1.1.3 Installation on Linux

Using software packages

For installing distribution relative packages .deb/.rpm/...

Ubuntu / Kubuntu / Xubuntu / Lubuntu (Saucy and above)

0. In case you want to use Python3, add this Pygame PPA before

   ```
   $ sudo add-apt-repository ppa:thopiekar/pygame
   ```

   ** These Pygame packages are neither provided nor supported by the Kivy project. ** Please contact the creator of the package(s) or maintainer of the sourcecode for further help.

1. Add one of the PPAs as you prefer

stable builds $ sudo add-apt-repository ppa:kivy-team/kivy

nightly builds $ sudo add-apt-repository ppa:kivy-team/kivy-daily

2. Update your packagelist using your package manager
3. Install Kivy

   Python2 - python-kivy $ sudo apt-get install python-kivy

   Python3 - python3-kivy $ sudo apt-get install python3-kivy

   optionally the examples - kivy-examples $ sudo apt-get install kivy-examples

Debian (Jessie or newer)

1. Add one of the PPAs to your sources.list in apt manually or via Synaptic
   - Jessie/Testing:

     stable builds deb http://ppa.launchpad.net/kivy-team/kivy/ubuntu trusty main

     daily builds deb http://ppa.launchpad.net/kivy-team/kivy-daily/ubuntu trusty main
   - Sid/Unstable:

     stable builds deb http://ppa.launchpad.net/kivy-team/kivy/ubuntu utopic main

     daily builds deb http://ppa.launchpad.net/kivy-team/kivy-daily/ubuntu utopic main

   Notice: Wheezy is not supported - You'll need to upgrade to Jessie at least!
2. Add the GPG key to your apt keyring by executing

   as user:

   ```
   sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys A863D2D6
   ```

   as root:

   ```
   apt-key adv --keyserver keyserver.ubuntu.com --recv-keys A863D2D6
   ```
3. Refresh your package list and install **python-kivy** and/or **python3-kivy** and optionally the examples found in **kivy-examples**

Linux Mint

1. Find out on which Ubuntu release your installation is based on, using this overview.
2. Continue as described for Ubuntu above, depending on which version your installation is based on.

Bodhi Linux

1. Find out which version of the distribution you are running and use the table below to find out on which Ubuntu LTS it is based.

Bodhi 1 Ubuntu 10.04 LTS aka Lucid (No packages, just manual install)

Bodhi 2 Ubuntu 12.04 LTS aka Precise

Bodhi 3 Ubuntu 14.04 LTS aka Trusty

2. Continue as described for Ubuntu above, depending on which version your installation is based on.

OpenSuSE

1. To install kivy go to http://software.opensuse.org/package/python-Kivy and use the "1 Click Install" for your openSuse version. You might need to make the latest kivy version appear in the list by clicking on "Show unstable packages". We prefer to use packages by " devel:languages:python".
2. If you would like access to the examples, please select **python-Kivy-examples** in the upcomming installation wizard.

Fedora

1. Adding the repository via the terminal:

   Fedora 18

```
$ sudo yum-config-manager --add-repo=http://download.opensuse.org/repositories/home:/thop
```

   Fedora 17

```
$ sudo yum-config-manager --add-repo=http://download.opensuse.org/repositories/home:/thop
```

   Fedora 16

```
$ sudo yum-config-manager --add-repo=http://download.opensuse.org/repositories/home:/thop
```

2. Use your preferred package-manager to refresh your packagelists
3. Install **python-Kivy** and optionally the examples, as found in **python-Kivy-examples**

Gentoo

1. There is a kivy ebuild (kivy stable version)

   emerge Kivy

2. available USE-flags are:

   cairo: Standard flag, let kivy use cairo graphical libraries. camera: Install libraries needed to support camera. doc: Standard flag, will make you build the documentation localy. examples: Standard flag, will give you kivy examples programs. garden: Install garden tool to manage user maintained widgets. gstreamer: Standard flag, kivy will be able to use audio/video streaming libraries. spell: Standard flag, provide enchant to use spelling in kivy apps.

1.1.4 Using software bundles (also known as tarballs)

Providing dependencies

General

The following software is needed, even if your distribution is not listed above:

- Python >= 2.7 and Python < 3
- PyGame
- PyEnchant
- gst-python
- Cython >= 0.15

We prefer to use a package-manager to provide these dependencies.

Ubuntu

```
$ sudo apt-get install pkg-config python-setuptools python-pygame python-opengl \
  python-gst0.10 python-enchant gstreamer0.10-plugins-good python-dev \
  build-essential libgl1-mesa-dev libgles2-mesa-dev cython
```

Upgrade Cython (<= Oneiric [11.10])

Using Cython's daily PPA

```
    $ sudo add-apt-repository ppa:cython-dev/master-ppa
    $ sudo apt-get update
    $ sudo apt-get install cython
```

Using PIP

```
    $ sudo apt-get install python-pip
    $ sudo pip install --upgrade cython
```

Fedora

```
$ sudo yum install python-distutils-extra python-enchant freeglut PyOpenGL \
SDL_ttf-devel SDL_mixer-devel pygame pygame-devel khrplatform-devel \
mesa-libGLES mesa-libGLES-devel gstreamer-plugins-good gstreamer \
gstreamer-python mtdev-devel python-pip
$ sudo pip install --upgrade cython
$ sudo pip install pygments
```

OpenSuse

```
$ sudo zypper install python-distutils-extra python-pygame python-opengl \
python-gstreamer-0_10 python-enchant gstreamer-0_10-plugins-good \
python-devel Mesa-devel python-pip
$ zypper install -t pattern devel_C_C++
$ sudo pip install --upgrade cython
$ sudo pip install pygments
```

Mageia 1 onwards

```
$ su
# urpmi python-setuptools python-pygame python-opengl \
gstreamer0.10-python python-enchant gstreamer0.10-plugins-good \
python-cython lib64python-devel lib64mesagl1-devel lib64mesaegl1-devel \
lib64mesaglesv2_2-devel make gcc
# easy_install pip
# pip install --upgrade cython
# pip install pygments
```

1.1.5 *Installation in a Virtual Environment with System Site Packages*

This is a recommended compromise between installing Kivy and its dependencies system wide and installing as much as possible into a virtual environment.

Ubuntu 12.04 with Python 2.7

Install System-wide Dependencies

Note that these commands will remove any pre-existing versions of python-virtualenv and replace it with the current version. It will also remove cython, numpy, and pygame installed from your Linux distro's repository and replace them with current versions from pip or the pygame Mercurial repository.

```
# Install necessary system packages
sudo apt-get install -y build-essential mercurial git python2.7 \
python-setuptools python-dev ffmpeg libsdl-image1.2-dev \
libsdl-mixer1.2-dev libsdl-ttf2.0-dev libsmpeg-dev libsdl1.2-dev \
libportmidi-dev libswscale-dev libavformat-dev libavcodec-dev zlib1g-dev

# Bootstrap a current Python environment
    sudo apt-get remove --purge -y python-virtualenv python-pip
    sudo easy_install-2.7 -U pip
    sudo pip2.7 install -U virtualenv

    # Install current version of Cython
    sudo apt-get remove --purge -y cython
    sudo pip2.7 install -U cython

    # Install other PyGame dependencies
    sudo apt-get remove --purge -y python-numpy
    sudo pip2.7 install -U numpy

    # Install PyGame
    sudo apt-get remove --purge python-pygame
    hg clone https://bitbucket.org/pygame/pygame
    cd pygame
    python2.7 setup.py build
    sudo python2.7 setup.py install
    cd ..
    sudo rm -rf pygame
```

Create a Kivy Virtualenv

```
# Create a vitualenv
rm -rf venv
virtualenv -p python2.7 --system-site-packages venv

# Install stable version of Kivy into the virtualenv
venv/bin/pip install kivy
# For the development version of Kivy, use the following command instead
# venv/bin/pip install git+https://github.com/kivy/kivy.git@master

# Install development version of buildozer into the virtualenv
venv/bin/pip install git+https://github.com/kivy/buildozer.git@master

# Install development version of plyer into the virtualenv
venv/bin/pip install git+https://github.com/kivy/plyer.git@master

# Install a couple of dependencies for KivyCatalog
venv/bin/pip install -U pygments docutils
```

Ubuntu 12.04 with Python 3.3

Install System-wide Dependencies

Note that these commands will remove any pre-existing versions of python-virtualenv and replace it with the current version. It will also remove cython, numpy, and pygame installed from your Linux distro's repository and replace them with current versions from pip or the pygame Mercurial repository.

```
# Bootstrap Python3.3
    sudo apt-get install python-software-properties
    sudo add-apt-repository ppa:fkrull/deadsnakes
    sudo apt-get update

    # Install necessary system packages
    sudo apt-get install -y build-essential mercurial git python3.3 \
    python3.3-dev ffmpeg libsdl-image1.2-dev libsdl-mixer1.2-dev \
    libsdl-ttf2.0-dev libsmpeg-dev libsdl1.2-dev libportmidi-dev \
    libswscale-dev libavformat-dev libavcodec-dev zlib1g-dev

    # Bootstrap current setuptools
    wget https://bitbucket.org/pypa/setuptools/raw/bootstrap/ez_setup.py -O - | sudo python3.3

    # Bootstrap a current Python environment
    sudo apt-get remove --purge -y python-virtualenv python-pip
    sudo easy_install-3.3 -U pip
    sudo pip3.3 install -U virtualenv

    # Install current version of Cython
    sudo apt-get remove --purge -y cython
    sudo pip3.3 install -U cython

    # Install other PyGame dependencies
    sudo apt-get remove --purge -y python-numpy
    sudo pip3.3 install -U numpy

    # Install PyGame
    hg clone https://bitbucket.org/pygame/pygame
    cd pygame
    python3.3 setup.py build
    sudo python3.3 setup.py install
    cd ..
    sudo rm -rf pygame
```

Create a Kivy Virtualenv

```
# Create a vitualenv
rm -rf venv
virtualenv -p python3.3 --system-site-packages venv

# Install stable version of Kivy into the virtualenv
venv/bin/pip install kivy
# For the development version of Kivy, use the following command instead
# venv/bin/pip install git+https://github.com/kivy/kivy.git@master

# Install development version of buildozer into the virtualenv
#venv/bin/pip install git+https://github.com/kivy/buildozer.git@master

# Install development version of plyer into the virtualenv
venv/bin/pip install git+https://github.com/kivy/plyer.git@master

# Install a couple of dependencies for KivyCatalog
venv/bin/pip install -U pygments docutils
```

Start from the Command Line

We ship some examples that are ready-to-run. However, theses examples are packaged inside the package. This means you must first know where easy_install has installed your current kivy package, and then go to the examples directory:

```
$ python -c "import pkg_resources; print(pkg_resources.resource_filename('kivy', '../share/kivy-e
```

And you should have a path similar to:

```
/usr/local/lib/python2.6/dist-packages/Kivy-1.0.4_beta-py2.6-linux-x86_64.egg/share/kivy-examples
```

Then you can go to the example directory, and run it:

```
# launch touchtracer
$ cd <path to kivy-examples>
$ cd demo/touchtracer
$ python main.py

# launch pictures
$ cd <path to kivy-examples>
$ cd demo/pictures
$ python main.py
```

If you are familiar with Unix and symbolic links, you can create a link directly in your home directory for easier access. For example:

1. Get the example path from the command line above
2. Paste into your console:

```
     $ ln -s <path to kivy-examples> ~/
```

3. Then, you can access to kivy-examples directly in your home directory:

```
$ cd ~/kivy-examples
```

If you wish to start your Kivy programs as scripts (by typing *./main.py*) or by double-clicking them, you will want to define the correct version of Python by linking to it. Something like:

```
$ sudo ln -s /usr/bin/python2.7 /usr/bin/kivy
```

Or, if you are running Kivy inside a virtualenv, link to the Python interpreter for it, like:

```
$ sudo ln -s /home/your_username/Envs/kivy/bin/python2.7 /usr/bin/kivy
```

Then, inside each main.py, add a new first line:

```
#!/usr/bin/kivy
```

NOTE: Beware of Python files stored with Windows-style line endings (CR-LF). Linux will not ignore the <CR> and will try to use it as part of the file name. This makes confusing error messages. Convert to Unix line endings.

1.1.6 Installation on Android

Kivy is a Python framework, and simply installing it on an Android device the same way as on a desktop machine will do nothing. However, you can compile a Kivy application to a standard Android APK that will run just like a normal java app on (more or less) any device.

We provide several different tools to help you run code on an Android device, covered fully in the *Android packaging documentation*. These include creating a fully standalone APK that may be released on an Android store, as well as the ability to run your Kivy apps without a compilation step using our pre-prepared Kivy Launcher app.

1.1.7 Installation on Raspberry Pi

Note: The current Kivy port works partially: keyboard is not currently working.

Manual installation

1. Add APT sources for Gstreamer 1.0 in */etc/apt/sources.list*:

```
deb http://vontaene.de/raspbian-updates/ . main
```

2. Install the dependencies:

```
sudo apt-get update
sudo apt-get install pkg-config libgl1-mesa-dev libgles2-mesa-dev \
   python-pygame python-setuptools libgstreamer1.0-dev git-core \
   gstreamer1.0-plugins-{bad,base,good,ugly} gstreamer1.0-{omx,alsa}
```

3. Install pip from source:

```
wget https://raw.github.com/pypa/pip/master/contrib/get-pip.py
sudo python get-pip.py
```

4. Install Cython from sources (debian package are outdated):

```
    sudo pip install cython
```

5. Clone and compile Kivy:

```
    git clone https://github.com/kivy/kivy
    cd kivy
```

6. Build and use kivy inplace (best for development):

```
    make
    echo "export PYTHONPATH=$(pwd):\$PYTHONPATH" >> ~/.profile
    source ~/.profile
```

7. Or install Kivy globally on your system:

```
    python setup.py build
    sudo python setup.py install
```

Running the demo

Go to your *kivy/examples* folder, you'll have tons of demo you could try.

You could start the showcase:

```
cd kivy/examples/demo/showcase
python main.py
```

3d monkey demo is also fun too see:

```
cd kivy/examples/3Drendering
python main.py
```

Where to go ?

We made few games using GPIO / physical input we got during Pycon 2013: a button and a tilt. Checkout the https://github.com/kivy/piki. You will need to adapt the GPIO pin in the code.

A video to see what we were doing with it: http://www.youtube.com/watch?v=NVM09gaX6pQ

1.1.8 Troubleshooting on Mac OS X

Having trouble installing Kivy on Mac OS X? This page contains issues

"Unable to find any valuable Window provider" Error

If you get an error like this:

```
$ python main.py
[INFO   ] Kivy v1.8.0-dev
[INFO   ] [Logger      ] Record log in /Users/audreyr/.kivy/logs/kivy_13-07-07_2.txt
[INFO   ] [Factory     ] 143 symbols loaded
[DEBUG  ] [Cache       ] register <kv.lang> with limit=None, timeout=Nones
[DEBUG  ] [Cache       ] register <kv.image> with limit=None, timeout=60s
[DEBUG  ] [Cache       ] register <kv.atlas> with limit=None, timeout=Nones
[INFO   ] [Image       ] Providers: img_imageio, img_tex, img_dds, img_pil, img_gif (img_pygame i
[DEBUG  ] [Cache       ] register <kv.texture> with limit=1000, timeout=60s
[DEBUG  ] [Cache       ] register <kv.shader> with limit=1000, timeout=3600s
```

```
[DEBUG  ] [App          ] Loading kv <./pong.kv>
[DEBUG  ] [Window       ] Ignored <egl_rpi> (import error)
[DEBUG  ] [Window       ] Ignored <pygame> (import error)
[WARNING] [WinPygame    ] SDL wrapper failed to import!
[DEBUG  ] [Window       ] Ignored <sdl> (import error)
[DEBUG  ] [Window       ] Ignored <x11> (import error)
[CRITICAL] [Window       ] Unable to find any valuable Window provider at all!
[CRITICAL] [App          ] Unable to get a Window, abort.
```

Then most likely Kivy cannot import PyGame for some reason. Continue on to the next section.

Check for Problems with Your PyGame Installation

First, check that you have a working version of PyGame.

Start up the interactive Python interpreter and try to import pygame:

```
$ python
Python 2.7.3 (v2.7.3:70274d53c1dd, Apr  9 2012, 20:52:43)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
Python 2.7.3 (v2.7.3:70274d53c1dd, Apr  9 2012, 20:52:43)
Type "copyright", "credits" or "license" for more information.
>>> import pygame
```

If you can import pygame without problems, then skip to the next section.

But if you get an error, then PyGame is not working as it should.

Here's an example of a PyGame error:

```
ImportError                               Traceback (most recent call last)
<ipython-input-1-4a415d16fbed> in <module>()
----> 1 import pygame

/Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/pygame/__init__.py
     93
     94 #first, the "required" modules
---> 95 from pygame.base import *
     96 from pygame.constants import *
     97 from pygame.version import *

ImportError: dlopen(/Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages
  Referenced from: /Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/
  Expected in: flat namespace
 in /Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/pygame/base.so
```

And here is another example of a PyGame error:

```
ImportError                               Traceback (most recent call last)
<ipython-input-1-4a415d16fbed> in <module>()
----> 1 import pygame

/Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/pygame/__init__.py
     93
     94 #first, the "required" modules
---> 95 from pygame.base import *
     96 from pygame.constants import *
     97 from pygame.version import *
```

```
ImportError: dlopen(/Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages
    /Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/pygame/base.so:
```

The easiest way to resolve these PyGame import errors is:

1. **Delete the `pygame` package. (For example, if you get the error above,** delete /Library/Frameworks/Python.framework/Versions/2.7/lib/python2.7/site-packages/pygame/ and the accompanying egg.
2. **Try installing a PyGame binary for your version of Mac OS X. Download it** from http://www.pygame.org/download.shtml.
3. Repeat this process and try different PyGame Mac OS X binaries until you find one that works.

1.2 Development Version

The development version is for developers and testers. Note that when running a development version, you're running potentially broken code at your own risk. To use the development version, you will first need to install the dependencies. Thereafter, you will need to set up Kivy on your computer in a way that allows for easy development. For that, please see our *Contributing* document.

1.2.1 Installing Dependencies

To install Kivy's dependencies, follow the guide below for your platform.

Ubuntu

For Ubuntu 12.04 and above (tested to 14.04), simply enter the following command that will install all necessary packages:

```
$ sudo apt-get install python-setuptools python-pygame python-opengl \
  python-gst0.10 python-enchant gstreamer0.10-plugins-good python-dev \
  build-essential libgl1-mesa-dev-lts-quantal libgles2-mesa-dev-lts-quantal\
  python-pip
```

For older versions of Ubuntu, this one should work:

```
$ sudo apt-get install python-setuptools python-pygame python-opengl \
  python-gst0.10 python-enchant gstreamer0.10-plugins-good python-dev \
  build-essential libgl1-mesa-dev libgles2-mesa-dev zlib1g-dev python-pip
```

Kivy requires a recent version of Cython, so it's better to use the last version published on pypi:

```
$ sudo pip install --upgrade cython
```

Mac OS X

You will need to install at least the following:

- PyGame - we recommend installing from a binary packaged for your version of Mac OS X. Download it from http://www.pygame.org/download.shtml

If you run into problems, please read *Troubleshooting on Mac OS X*.

1.2.2 Installing Kivy for Development

Now that you've installed all the required dependencies, it's time to download and compile a development version of Kivy:

```
$ # Download Kivy from GitHub
$ git clone git://github.com/kivy/kivy.git
$ cd kivy

$ # Compile:
$ python setup.py build_ext --inplace -f
```

If you have the `make` command available, you can also use the following shortcut to compile (does the same as the last command):

```
$ make
```

Warning: By default, versions 2.7 to 2.7.2 of Python use the gcc compiler which ships with earlier versions of XCode. As of version 4.2, only the clang compiler is shipped with XCode by default. This means that if you build using XCode 4.2 or above, you need to ensure you have at least Python 2.7.3 installed, but prefferably the latest version (2.7.5 at the time of writing).

If you want to modify the Kivy code itself, set up the PYTHONPATH environment variable to point at your clone. This way you don't have to install (`setup.py install`) after every tiny modification. Python will instead import Kivy from your clone.

Alternatively, if you don't want to make any changes to Kivy itself, you can also run (as admin, e.g. with sudo):

```
$ python setup.py install
```

If you want to contribute code (patches, new features) to the Kivy code base, please read *Contributing*.

1.2.3 Running the test suite

To help detect issues and behaviour changes in Kivy, a set of unittests are provided. A good thing to do is to run them just after your Kivy installation, and every time you intend to push a change. If you think something was broken in Kivy, perhaps a test will show this? If not, it might be a good time to write one .)

Kivy tests are based on nosetest, which you can install from your package manager or using pip :

> $ pip install nose

To run the test suite, do :

> $ make test

1.2.4 Uninstalling Kivy

If you are mixing multiple Kivy installations, you might be confused about where each Kivy version is located. Please note that you might need to follow these steps multiple times if you have multiple Kivy versions installed in the Python library path. To find your current installed version, you can use the command line:

```
$ python -c 'import kivy; print(kivy.__path__)'
```

Then, remove that directory recursively.

If you have installed Kivy with easy_install on linux, the directory may contain a “egg” directory. Remove that as well:

```
$ python -c 'import kivy; print(kivy.__path__)'
['/usr/local/lib/python2.7/dist-packages/Kivy-1.0.7-py2.7-linux-x86_64.egg/kivy']
$ sudo rm -rf /usr/local/lib/python2.7/dist-packages/Kivy-1.0.7-py2.7-linux-x86_64.egg
```

If you have installed with apt-get, do:

```
$ sudo apt-get remove --purge python-kivy
```

CHAPTER

TWO

PHILOSOPHY

In case you are wondering what Kivy is all about and what sets it apart from other solutions, this document is for you.

2.1 Why bother?

Why would you want to use Kivy? After all, there are many great toolkits (or frameworks, or platforms) available out there – for free. You have Qt and Flash, to name just two good choices for application development. Many of these numerous solutions already support Multi-Touch, so what is it that makes Kivy special and worth using?

2.1.1 Fresh

Kivy is made for today and tomorrow. Novel input methods such as Multi-Touch have become increasingly important. We created Kivy from scratch, specifically for this kind of interaction. That means we were able to rethink many things in terms of human computer interaction, whereas older (not to mean 'outdated', rather 'well-established') toolkits carry their legacy, which is often a burden. We're not trying to force this new approach to using a computer into the corset of existing models (say single-pointer mouse interaction). We want to let it flourish and let you explore the possibilities. *This* is what really sets Kivy apart.

2.1.2 Fast

Kivy is fast. This applies to both *application development* and *application execution* speeds. We have optimized Kivy in many ways. We implement time-critical functionality on the *C level* to leverage the power of existing compilers. More importantly, we also use *intelligent algorithms* to minimize costly operations. We also use the *GPU* wherever it makes sense in our context. The computational power of today's graphics cards surpasses that of today's CPUs by far for some tasks and algorithms, especially drawing. That's why we try to let the GPU do as much of the work as possible, thus increasing performance considerably.

2.1.3 Flexible

Kivy is flexible. This means it can be run on *a variety of different devices*, including Android powered smartphones and tablets. We support *all major operating systems* (Windows, Linux, OS X). Being flexible also means that Kivy's fast-paced development allows it to *adapt to new technologies quickly*. More than once have we added support for new external devices and software protocols, sometimes even before they were released. Lastly, Kivy is also flexible in that it is possible to use it in combination with a great number of different third-party solutions. For example, on Windows we support WM_TOUCH, which means that any device that has Windows 7 Pen & Touch drivers will *just work* with Kivy. On OS X you can use Apple's Multi-Touch capable devices, such as trackpads and mice. On Linux, you can use HID kernel input events. In addition to that, we support TUIO (Tangible User Interface Objects) and a number of other input sources.

2.1.4 Focused

Kivy is focused. You can write a simple application with a few lines of code. Kivy programs are created using the *Python* programming language, which is incredibly versatile and powerful, yet easy to use. In addition, we created our own description language, the *Kivy Language*, for creating sophisticated user interfaces. This language allows you to set up, connect and arrange your application elements quickly. We feel that allowing you to focus on the essence of your application is more important than forcing you to fiddle with compiler settings. We took that burden off your shoulders.

2.1.5 Funded

Kivy is actively developed by professionals in their field. Kivy is a community-influenced, professionally developed and commercially backed solution. Some of our core developers develop Kivy for a living. Kivy is here to stay. It's not a small, vanishing student project.

2.1.6 Free

Kivy is free to use. You don't have to pay for it. You don't even have to pay for it if you're making money out of selling an application that uses Kivy.

CHAPTER

THREE

CONTRIBUTING

There are many ways in which you can contribute to Kivy. Code patches are just one thing amongst others that you can submit to help the project. We also welcome feedback, bug reports, feature requests, documentation improvements, advertisement & advocating, testing, graphics contributions and many other ideas. Just talk to us if you want to help, and we will help you help us.

3.1 Feedback

This is by far the easiest way to contribute something. If you're using Kivy for your own project, don't hesitate sharing. It doesn't have to be a high-class enterprise app, obviously. It's just incredibly motivating to know that people use the things you develop and what it enables them to do. If you have something that you would like to tell us, please don't hesitate. Screenshots and videos are also very welcome! We're also interested in the problems you had when getting started. Please feel encouraged to report any obstacles you encountered such as missing documentation, misleading directions or similar. We are perfectionists, so even if it's just a typo, let us know.

3.2 Reporting an Issue

If you found anything wrong, a crash, segfault, missing documentation, invalid spelling or just weird examples, please take 2 minutes to report the issue.

1. Move your logging level to debug by editing *<user_directory>/.kivy/config.ini*:

```
[kivy]
log_level = debug
```

2. Execute your code again, and copy/paste the complete output to http://gist.github.com/, including the log from Kivy and the python backtrace.

3. Open https://github.com/kivy/kivy/issues/

4. Set the title of your issue

5. Explain exactly what to do to reproduce the issue and paste the link of the output posted on http://gist.github.com/

6. Validate the issue and you're done!

If you are feeling up to it, you can also try to resolve the bug, and contribute by sending us the patch :) Read the next section to find out how to do this.

3.3 Code Contributions

Code contributions (patches, new features) are the most obvious way to help with the project's development. Since this is so common we ask you to follow our workflow to most efficiently work with us. Adhering to our workflow ensures that your contribution won't be forgotten or lost. Also, your name will always be associated with the change you made, which basically means eternal fame in our code history (you can opt-out if you don't want that).

3.3.1 Coding style

- If you haven't done it yet, read the PEP8 about coding style in python.
- Activate the pep8 check on git commits like this:

```
make hook
```

This will pass the code added to the git staging zone (about to be committed) through a pep8 checker program when you do a commit, and ensure that you didn't introduce pep8 errors. If you did, the commit will be rejected: please correct the errors and try again.

3.3.2 Performance

- take care of performance issues: read Python performance tips
- cpu intensive parts of Kivy are written in cython: if you are doing a lot of computation, consider using it too.

3.3.3 Git & GitHub

We use git as our version control system for our code base. If you have never used git or a similar DVCS (or even any VCS) before, we strongly suggest you take a look at the great documentation that is available for git online. The Git Community Book or the Git Screencasts are both great ways to learn git. Trust us when we say that git is a great tool. It may seem daunting at first, but after a while you'll (hopefully) love it as much as we do. Teaching you git, however, is well beyond the scope of this document.

Also, we use GitHub to host our code. In the following we will assume that you have a (free) GitHub account. While this part is optional, it allows for a tight integration between your patches and our upstream code base. If you don't want to use GitHub, we assume you know what you are doing anyway.

3.3.4 Code Workflow

So here is the initial setup to begin with our workflow (you only need to do this once to install Kivy). Basically you follow the installation instructions from *Installing Kivy for Development*, but you don't clone our repository, you fork it. Here are the steps:

1. Log in to GitHub
2. Create a fork of the Kivy repository by clicking the *fork* button.
3. Clone your fork of our repository to your computer. Your fork will have the git remote name 'origin' and you will be on branch 'master':

```
git clone https://github.com/username/kivy.git
```

4. Compile and set up PYTHONPATH or install (see *Installing Kivy for Development*).
5. Install our pre-commit hook that ensures your code doesn't violate our styleguide by executing *make hook* from the root directory of your clone. This will run our styleguide check whenever you do a commit, and if there are violations in the parts that you changed, your commit will be aborted. Fix & retry.
6. Add the kivy repo as a remote source:

```
git remote add kivy https://github.com/kivy/kivy.git
```

Now, whenever you want to create a patch, you follow the following steps:

1. See if there is a ticket in our bug tracker for the fix or feature and announce that you'll be working on it if it doesn't yet have an assignee.
2. Create a new, appropriately named branch in your local repository for that specific feature or bugfix. (Keeping a new branch per feature makes sure we can easily pull in your changes without pulling any other stuff that is not supposed to be pulled.):

```
git checkout -b new_feature
```

3. Modify the code to do what you want (e.g., fix it).
4. Test the code. Try to do this even for small fixes. You never know whether you have introduced some weird bug without testing.
5. Do one or more minimal, atomic commits per fix or per feature. Minimal/Atomic means *keep the commit clean*. Don't commit other stuff that doesn't logically belong to this fix or feature. This is **not** about creating one commit per line changed. Use `git add -p` if necessary.
6. Give each commit an appropriate commit message, so that others who are not familiar with the matter get a good idea of what you changed.
7. Once you are satisfied with your changes, pull our upstream repository and merge it with you local repository. We can pull your stuff, but since you know exactly what's changed, you should do the merge:

```
git pull kivy master
```

8. Push your local branch into your remote repository on GitHub:

```
git push origin new_feature
```

9. Send a *Pull Request* with a description of what you changed via the button in the GitHub interface of your repository. (This is why we forked initially. Your repository is linked against ours.)

Warning: If you change parts of the code base that require compilation, you will have to recompile in order for your changes to take effect. The `make` command will do that for you (see the Makefile if you want to know what it does). If you need to clean your current directory from compiled files, execute `make clean`. If you want to get rid of **all** files that are not under version control, run `make distclean` (**Caution:** If your changes are not under version control, this command will delete them!)

Now we will receive your pull request. We will check whether your changes are clean and make sense (if you talked to us before doing all of this we will have told you whether it makes sense or not). If so, we will pull them and you will get instant karma. Congratulations, you're a hero!

3.4 Documentation Contributions

Documentation contributions generally follow the same workflow as code contributions, but are just a bit more lax.

1. Following the instructions above,
   (a) Fork the repository.
   (b) Clone your fork to your computer.
   (c) Setup kivy repo as a remote source.
2. Install python-sphinx. (See `docs/README` for assistance.)
3. Use ReStructuredText_Markup to make changes to the HTML documentation in docs/sources.

To submit a documentation update, use the following steps:

1. Create a new, appropriately named branch in your local repository:

```
git checkout -b my_docs_update
```

2. Modify the documentation with your correction or improvement.
3. Re-generate the HTML pages, and review your update:

```
make html
```

4. Give each commit an appropriate commit message, so that others who are not familiar with the matter get a good idea of what you changed.
5. Keep each commit focused on a single related theme. Don't commit other stuff that doesn't logically belong to this update.
6. Push to your remote repository on GitHub:

```
git push
```

7. Send a *Pull Request* with a description of what you changed via the button in the GitHub interface of your repository.

We don't ask you to go through all the hassle just to correct a single typo, but for more complex contributions, please follow the suggested workflow.

3.4.1 Docstrings

Every module/class/method/function needs a docstring, so use the following keywords when relevant:

- `.. versionadded::` to mark the version in which the feature was added.
- `.. versionchanged::` to mark the version in which the behaviour of the feature was changed.
- `.. note::` to add additional info about how to use the feature or related feature.
- `.. warning::` to indicate a potential issue the user might run into using the feature.

Examples:

```
def my_new_feature(self, arg):
    """
    New feature is awesome
    .. versionadded:: 1.1.4

    .. note:: This new feature will likely blow your mind

    .. warning:: Please take a seat before trying this feature
    """
```

Will result in:

def my_new_feature(self, arg): """ New feature is awesome

New in version 1.1.4.

Note: This new feature will likely blow your mind

Warning: Please take a seat before trying this feature

"""

When refering to other parts of the api use:

- `:mod:‘~kivy.module‘` to refer to a module
- `:class:‘~kivy.module.Class‘` to refer to a class
- `:meth:‘~kivy.module.Class.method‘` to refer to a method
- `:doc:‘api-kivy.module‘` to refer to the documentation of a module (same for a class and a method)

Obviously replacing *module Class* and *method* with their real name, and using using '.' to separate modules refering to imbricated modules, e.g:

```
:mod:‘~kivy.uix.floatlayout‘
:class:‘~kivy.uix.floatlayout.FloatLayout‘
:meth:‘~kivy.core.window.WindowBase.toggle_fullscreen‘
:doc:‘/api-kivy.core.window‘
```

Will result in:

`floatlayout` `FloatLayout` `toggle_fullscreen()` *Window*

:doc: and *:mod:* are essentially the same, except for an anchor in the url which makes *:doc:* prefered for the cleaner url.

To build your documentation, run:

```
make html
```

If you updated your kivy install, and have some trouble compiling docs, run:

```
make clean force html
```

The docs will be generated in `docs/build/html`. For more information on docstring formatting, please refer to the official Sphinx Documentation.

3.5 Unit tests contributions

For the testing team, we have the document *Unit tests* that explains how Kivy unit tests work and how you can create your own. Use the same approach as the *Code Workflow* to submit new tests.

3.5.1 Unit tests

Tests are located in the kivy/tests folder. If you find a bug in Kivy, a good thing to do can be to write a minimal case showing the issue and to ask core devs if the behaviour shown is intended or a real bug. If you write your code as a unittest , it will prevent the bug from coming back unnoticed in the future, and will make Kivy a better, stronger project. Writing a unittest may be a really good way to get familiar with Kivy while doing something useful.

Unit tests are seperated into two cases:

- Non graphical unit tests: theses are standard unit tests that can run in a console
- Graphical unit tests: theses need a GL context, and work via image comparison

To be able to run unit tests, you need to install nose (http://code.google.com/p/python-nose/), and coverage (http://nedbatchelder.com/code/coverage/). You can use easy_install for that:

```
sudo easy_install nose coverage
```

Then, in the kivy directory:

```
make test
```

How it works

All the tests are located in *kivy/tests*, and the filename starts with *test_<name>.py*. Nose will automatically gather all the files and classes inside this folder, and use them to generate test cases.

To write a test, create a file that respects the previous naming, then start with this template:

```
import unittest

class XXXTestCase(unittest.TestCase):

    def setUp(self):
        # import class and prepare everything here.
        pass

    def test_YYY(self):
        # place your test case here
        a = 1
        self.assertEqual(a, 1)
```

Replace *XXX* with an appropriate name that covers your tests cases, then replace 'YYY' with the name of your test. If you have any doubts, check how the other tests have been written.

Then, to execute them, just run:

```
make test
```

If you want to execute that file only, you can run:

```
nosetests kivy/tests/test_yourtestcase.py
```

GL unit tests

GL unit test are more difficult. You must know that even if OpenGL is a standard, the output/rendering is not. It depends on your GPU and the driver used. For these tests, the goal is to save the output of the rendering at frame X, and compare it to a reference image.

Currently, images are generated at 320x240 pixels, in *png* format.

Note: Currently, image comparison is done per-pixel. This means the reference image that you generate will only be correct for your GPU/driver. If somebody can implement image comparison with "delta" support, patches are welcome :)

To execute GL unit tests, you need to create a directory:

```
mkdir kivy/tests/results
make test
```

The results directory will contain all the reference images and the generated images. After the first execution, if the results directory is empty, no comparison will be done. It will use the generated images as reference. After the second execution, all the images will be compared to the reference images.

A html file is available to show the comparison before/after the test, and a snippet of the associated unit test. It will be generated at:

> kivy/tests/build/index.html

Note: The build directory is cleaned after each call to *make test*. If you don't want that, just use nosetests command.

Writing GL Unit tests

The idea is to create a root widget, as you would do in `build()`, or in `kivy.base.runTouchApp()`. You'll give that root widget to a rendering function which will capture the output in X frames.

Here is an example:

```
from common import GraphicUnitTest

class VertexInstructionTestCase(GraphicUnitTest):

    def test_ellipse(self):
        from kivy.uix.widget import Widget
        from kivy.graphics import Ellipse, Color
        r = self.render

        # create a root widget
        wid = Widget()

        # put some graphics instruction on it
        with wid.canvas:
            Color(1, 1, 1)
            self.e = Ellipse(pos=(100, 100), size=(200, 100))

        # render, and capture it directly
        r(wid)

        # as alternative, you can capture in 2 frames:
        r(wid, 2)

        # or in 10 frames
        r(wid, 10)
```

Each call to *self.render* (or *r* in our example) will generate an image named as follows:

```
<classname>_<funcname>-<r-call-count>.png
```

r-call-count represents the number of times that *self.render* is called inside the test function.

The reference images are named:

```
ref_<classname>_<funcname>-<r-call-count>.png
```

You can easily replace the reference image with a new one if you wish.

Coverage reports

Coverage is based on the execution of previous tests. Statistics on code coverage are automatically calculated during execution. You can generate an html report of the coverage with the command:

```
make cover
```

Then, open *kivy/htmlcov/index.html* with your favorite web browser.

3.6 GSOC

3.6.1 Google Summer of Code - 2014

Introduction

Kivy is a cross-platform, business friendly, GPU Accelerated open source Python library for rapid development of applications that make use of innovative user interfaces, such as multi-touch apps.

We are hoping to participate in Google Summer of Code 2014 under PSF. This page showcases some ideas for gsoc projects and corresponding guidelines for students contributing to the Kivy Framework.

Requirements

It is assumed that the incoming student meets some basic requirements as highlighted here:

- Intermediate level familiarity with python
- Comfortable with git and github (Kivy and its sister projects are all managed on github)
- Comfortable with event driven programming.
- Has suitable tools/environment for kivy or the sister project you are going to work on. For example to be able to work on pyobjus you would need access to an iOS device, mac with xcode and a developer license, to work on pyjnius you would need an android device, and to work on plyer you would need access to hardware for both platforms.

Additional desired skills may be listed with specific projects.

Familiarize yourself with the contributing guide http://kivy.org/docs/contribute.html We can help you get up to speed, however students demonstrating ability in advance will be given preference.

How to get setup

For Kivy Easiest way is to follow the installation instructions for the development version for your specific platform

http://kivy.org/docs/installation/installation.html#development-version

For the rest it's usually sufficient to install the relevant project from git and add it to your PYTHONPATH.

eg.. for pyjnius:

```
git clone http://github.com/kivy/pyjnius
export PYTHONPATH=/path/to/pyjnius:$PYTHONPATH
```

Project Ideas

The mentors list is only of potential mentors for a particular project and not final.

Enhancements to Kivy

Inspector:

Description:

Redo or improve the inspector module to include the following features:

- Use Python introspection to enhance current state of inspector.
- Extend Inspectors debugging capabilities to the whole app.
- Introduce automatic crash reporting.
- Possibly launch debugger automatically when Kivy app crashes.

Reference:

- http://kivy.org/docs/api-kivy.modules.html
- http://kivy.org/docs/api-kivy.modules.inspector.html

Expected Outcome: A fully functional Inspector module that facilitates debugging at any stage, including crash reports and a debugging console.

- **Mentors**: Akshay Arora, Gabriel Pettier
- **Task level**: Intermediate

Graphics Pipeline Enhancements:

Description:

We have a lot of ideas around the graphics pipeline:

- Merging instructions
- VBOs to reduce GL calls
- Helpers to create shaders dynamically according to the current vertex format
- Improving 3D support.
- Add Bounding-Box calculation / selection on the tree only if requested
- Unit tests to quantify the amount of improvements achieved.

Reference:

- http://kivy.org/docs/api-kivy.graphics.html
- http://www.khronos.org/opengles/

Expected Outcome: Significant improvement in the graphics pipeline that can be quantfied by tests.

- **Mentors**: Jacob Kovac, Mathieu Virbel
- **Task level**: Intermediate/Advanced

- **Desired Skills**: Familiarity with OpenGL ES and Cython, desire to learn about advanced rendering algorithms and solve difficult puzzles.

Embedded Support:

Description: Add full support for major embedded platforms like Beagle Board and Raspberry Pi. Kivy already has partial support for RPi. It would be great to have support for other major embedded platforms.

This would involve:

- Native Keyboard Provider.
- Window provider for Beagle board using hooks to the driver for hardware acceleration inspiration can be taken from the rpi window provider https://github.com/kivy/kivy/blob/master/kivy/core/window/window_egl_rpi.py.
- Ensuring at least one of the backends for each of the core providers work on the embedded hardware with acceptable performance. Namely: Text, Window, Audio, Video, Keyboard, Clipboard, and Image Providers

Reference:

- https://github.com/kivy/kivy/blob/master/kivy/core/window/window_egl_rpi.py.
- http://kivy.org/docs/api-kivy.core.html
- http://kivy.org/docs/guide/architecture.html#architecture
- http://kivy.org/docs/guide/architecture.html#providers

Expected Outcome: Full Working support for the embedded platforms. This would include support for at least one of the backends for each core providers mentioned above to achieve feature parity with other platforms.

- **Mentors**: Gabriel Pettier, Mathieu Virbel
- **Requirements**: Access to specific embedded hardware.
- **Task level**: Intermediate/Advanced
- **Desired Skills**: Familiarity with programming on the specific embedded hardware.

Enhancements to Mobile Platforms

Plyer:

Description: Plyer is a platform-independant api to use features commonly found on various platforms, especially mobile ones, in Python. The idea is to provide a stable API to the user for accessing features of their desktop or mobile device.

The student would work on facades and implementation for Accelerometer, GPS, SMS, Contact etc., including porting facades from SL4A (Scripting Layer for Android) to Plyer for easy integration and compatibility.

Under the hood you'll use PyJNIus and PyOBJus. This probably would also include improving PyObjus and PyJnius to handle interfaces that they can't right now.

References:

- https://github.com/kivy/plyer
- https://github.com/kivy/pyjnius
- https://github.com/kivy/pyobjus

Expected Outcome: Platform independent api for accessing most platform specific features.

- **Mentors**: Gabriel Pettier, Akshay Arora, Alexander Taylor, Ben Rousch.
- **Requirements**: Access to Linux, Windows, OS X, iOS device, Android device.
- **Task level**: Intermediate/Advanced.
- **Desired Skills**: Familiarity with Pyjnius, PyObjus.

Enhancements to Toolchain

Python-for-iOS:

Description: An iOS interface for building a app for the app store based on the idea of Python for Android, https://github.com/kivy/python-for-android

Current state: Kivy iOS achieves this but in a more restricted monolith manner. We'd like to replace it with a more modular tool that is more extensible.

References:

- https://github.com/kivy/python-for-android
- https://github.com/kivy/kivy-ios

Expected Outcome: A new, modular and extendable toolchain.

- **Mentors**: Thomas Hansen, Mathieu Virbel
- **Requirements**: Access to iOS, Android device along with a developer license.
- **Task level**: Intermediate/Advanced
- **Desired Skills**: Familiarity with xcode, objc. Cross-platform compilation skills are heavily required.

Buildozer:

Description: Buildozer is a Python tool for creating application packages easily. The goal is to have one "buildozer.spec" file in your app directory, describing your application requirements and settings such as title, icon, included modules etc. Buildozer will use that spec to create a package for Android, iOS, Windows, OS X and/or Linux.

Buildozer currently supports packaging for Android via the python-for-android project, and for iOS via the kivy-ios project. This project would involve extending this support to other package formats and operating systems, e.g. RPM, DEB, DMG, EXE. You will need to write new buildozer target code to support these formats.

This project would also involve optimizations to the final package formats, e.g. introspect the python files, extract all the symbols (global variables / functions / class / class methods), mark all the necessary symbols (whitelist) and generate a stripped version of all the python files without the unnecessary symbols.

References:

- https://github.com/kivy/Buildozer
- https://github.com/kivy/buildozer/tree/master/buildozer/targets

Expected Outcome: Running *buildoer deb debug* or *buildozer deb release* should result in a .deb package that can be directly be used to install on the target machine, or the equivalent for other package and binary formats.

- **Mentors**: Gabriel Pettier, Akshay Arora, Alexander Taylor, Ben Rousch
- **Requirements**: Access to linux, Windows, OS X, iOS, Android.
- **Task level**: Intermediate

SDL2 Backends:

Description: SDL2 backend providers for Kivy, including porting the mobile toolchains to SDL2. Part of the work is already done. What left is mostly

- Hashing out distribution mechanisms for the lib.
- Porting mobile backends for ios and android to SDL2. Partial work on this has already been going on.
- Unit tests for the new sdl2 backends making sure apps work the same on SDL2 as on other backends.
- Performace testing. Looking at the difference between SDL2 and other providers to ascertain wether sdl2 could be used as the default provider giving it priority

References: https://github.com/kivy/kivy/tree/sdl2-support

Expected Outcome: Completing the existing and adding new SDL2 core providers and support for using sdl2 on mobiles.

- **Mentors**: Akshay Arora, Jacob Kovac, Mathieu Virbel
- **Requirements:** Access to Linux, Windows, OS X, iOS, Android.
- **Task level**: Intermediate/Advanced

Anything Else ?

- Let your imagination run wild, and show what Kivy is capable of!

How to Contact devs

Ask your questions on the Kivy users forums http://kivy.org/#forum

Or send a mail at kivy-users@googlegroups.com

Make sure to Join kivy-dev user group too @ https://groups.google.com/forum/#!forum/kivy-dev

You can also try to contact us on IRC (online chat), To get the irc handles of the devs mentioned above visit http://kivy.org/#aboutus

but make sure to read the IRC rules before connecting. http://webchat.freenode.net/?nick=kvuser_GSOC_.&channels=

How to be a good student

If you want to participate as a student and want to maximize your chances of being accepted, start talking to us today and try fixing some smaller problems to get used to our workflow. If we know you can work well with us, that'd be a big plus.

Here's a checklist:

- Make sure to read through the website and at least skim the documentation.
- Look at the source code.
- Read our contribution guidelines.
- Pick an idea that you think is interesting from the ideas list or come up with your own idea.
- Do some research **yourself**. GSoC is not about us teaching you something and you getting paid for that. It is about you trying to achieve agreed upon goals by yourself with our support. The main driving force in this should be, obviously, yourself. Many students pop up and ask what

they should do. Well, we don't know because we know neither your interests nor your skills. Show us you're serious about it and take the initiative.

- Write a draft proposal about what you want to do. Include what you understand the current state is (very roughly), what you would like to improve, how, etc.
- Discuss that proposal with us in a timely manner. Get feedback.
- Be patient! Especially on IRC. We will try to get to you if we're available. If not, send an email and just wait. Most questions are already answered in the docs or somewhere else and can be found with some research. If your questions don't reflect that you've actually thought through what you're asking, it might not be well received.

CHAPTER

FOUR

FAQ

There are a number of questions that repeatedly need to be answered. The following document tries to answer some of them.

4.1 Technical FAQ

4.1.1 Fatal Python error: (pygame parachute) Segmentation Fault

Most of time, this issue is due to the usage of old graphics drivers. Install the latest graphics driver available for your graphics card, and it should be ok.

If not, this means you have probably triggered some OpenGL code without an available OpenGL context. If you are loading images, atlases, using graphics instructions, you must spawn a Window first:

```
# method 1 (preferred)
from kivy.base import EventLoop
EventLoop.ensure_window()

# method 2
from kivy.core.window import Window
```

If not, please report a detailed issue on github by following the instructions in the *Reporting an Issue* section of the *Contributing* documentation. This is very important for us because that kind of error can be very hard to debug. Give us all the information you can give about your environment and execution.

4.1.2 undefined symbol: glGenerateMipmap

You graphics card or its drivers might be too old. Update your graphics drivers to the latest available version and retry.

4.1.3 ImportError: No module named event

If you use Kivy from our development version, you must compile it before using it. In the kivy directory, do:

```
make force
```

4.1.4 Pip installation failed

Installing Kivy using Pip is not currently supported. Because Pip forces the usage of setuptools, setuptools hacks build_ext to use pyrex for generating .c, meaning there is no clean solution to hack against both weird behaviors to use Cython. (Reference: http://mail.scipy.org/pipermail/nipy-devel/2011-March/005709.html)

Solution: use *easy_install*, as our documentation said.

4.1.5 GStreamer compatibility

Starting from 1.8.0 version, Kivy now use by default the Gi bindings, on the platforms that have Gi. We are still in a transition, as Gstreamer 0.10 is now unmaintained by the Gstreamer team. But 1.0 is not accessible with Python everywhere. Here is the compatibility table you can use.

Gstreamer version	Bindings	Status	Remarks
0.10	pygst	Works	Lot of issues remain with 0.10
0.10	gi	Buggy	Internal issues with pygobject, and video doesn't play.
1.0	pygst	•	No pygst bindings exists for 1.0
1.0	gi	Works*	Linux: works OSX: works with brew Windows: No python bindings available

Also, we have no reliable way to check if you have 1.0 installed on your system. Trying to import gi, and then pygst, will fail.

So currently:

- if you are on Windows: stay on Gstreamer 0.10 with pygst.
- if you are on OSX/Linux: install Gstreamer 1.0.x
- if you are on OSX/Linux and doesn't want to install 1.0: *export KIVY_VIDEO=pygst*

If you are on OSX, Brew now have *pygobject3*. You must install it, and re-install gstreamer with introspection options:

```
$ brew install pygobject3
$ brew install gstreamer --with-gobject-introspection
$ brew install gst-plugins-base --with-gobject-introspection
$ brew install gst-plugins-good --with-gobject-introspection
$ brew install gst-plugins-bad --with-gobject-introspection
$ brew install gst-plugins-ugly --with-gobject-introspection

# then add the gi into your PYTHONPATH (as they don't do it for you)
$ export PYTHONPATH=$PYTHONPATH:/usr/local/opt/pygobject3/lib/python2.7/site-packages

# test it
$ python -c 'import gi; from gi.repository import Gst; print Gst.version()'
(1L, 2L, 1L, 0L)
```

4.2 Android FAQ

4.2.1 could not extract public data

This error message can occur under various circumstances. Ensure that:

- you have a phone with an sdcard
- you are not currently in "USB Mass Storage" mode
- you have permissions to write to the sdcard

In the case of the "USB Mass Storage" mode error, and if you don't want to keep unplugging the device, set the usb option to Power.

4.2.2 Crash on touch interaction on Android 2.3.x

There have been reports of crashes on Adreno 200/205 based devices. Apps otherwise run fine but crash when interacted with/through the screen.

These reports also mentioned the issue being resolved when moving to an ICS or higher rom.

4.2.3 Is it possible to have a kiosk app on android 3.0 ?

Thomas Hansen have wrote a detailed answer on the kivy-users mailing list:

> https://groups.google.com/d/msg/kivy-users/QKoCekAR1c0/yV-85Y_iAwoJ

Basically, you need to root the device, remove the SystemUI package, add some lines to the xml configuration, and you're done.

4.2.4 What's the difference between python-for-android from Kivy and SL4A?

Despite having the same name, Kivy's python-for-android is not related to the python-for-android project from SL4A, Py4A, or android-python27. They are distinctly different projects with different goals. You may be able to use Py4A with Kivy, but no code or effort has been made to do so. The Kivy team feels that our python-for-android is the best solution for us going forward, and attempts to integrate with and support Py4A is not a good use of our time.

4.3 Project FAQ

4.3.1 Why do you use Python? Isn't it slow?

Let us try to give a thorough answer; please bear with us.

Python is a very agile language that allows you to do many things in a (by comparison) short time. For many development scenarios, we strongly prefer writing our application quickly in a high-level language such as Python, testing it, then optionally optimizing it.

But what about speed? If you compare execution speeds of implementations for a certain set of algorithms (esp. number crunching) you will find that Python is a lot slower than say, C++. Now you may be even more convinced that it's not a good idea in our case to use Python. Drawing sophisticated graphics (and we are not talking about your grandmother's OpenGL here) is computationally quite expensive and given that we often want to do that for rich user experiences, that would be a fair argument. **But**, in virtually every case your application ends up spending most of the time (by far) executing the same part of the code. In Kivy, for example, these parts are event dispatching and graphics drawing. Now Python allows you to do something to make these parts much faster.

By using Cython, you can compile your code down to the C level, and from there your usual C compiler optimizes things. This is a pretty pain free process and if you add some hints to your code, the result becomes even faster. We are talking about a speed up in performance by a factor of anything between 1x and up to more than 1000x (greatly depends on your code). In Kivy, we did this for you and implemented the portions of our code, where efficiency really is critical, on the C level.

For graphics drawing, we also leverage today's GPUs which are, for some tasks such as graphics rasterization, much more efficent than a CPU. Kivy does as much as is reasonable on the GPU to maximize performance. If you use our Canvas API to do the drawing, there is even a compiler that we invented which optimizes your drawing code automatically. If you keep your drawing mostly on the GPU, much of your program's execution speed is not determined by the programming language used, but by the graphics hardware you throw at it.

We believe that these (and other) optimizations that Kivy does for you already make most applications fast enough by far. Often you will even want to limit the speed of the application in order not to waste resources. But even if this is not sufficient, you still have the option of using Cython for your own code to *greatly* speed it up.

Trust us when we say that we have given this very careful thought. We have performed many different benchmarks and come up with some clever optimizations to make your application run smoothly.

4.3.2 Does Kivy support Python 3.x?

Yes! As of version 1.8.0 Kivy supports both Python >= 2.7 and Python >= 3.3 with the same codebase.

However, be aware that while Kivy will run in Python 3.3+, packaging support is not yet complete. If you plan to create mobile apps for Android or iOS, you should use Python 2.7 for now.

4.3.3 I've already started with Python 3.x! Is there anything I can do?

Be patient. We're working on it. :)

If you can't wait, you could try using the 3to2 tool, which converts valid Python 3 syntax to Python 2. However, be warned that this tool does not work for all Python 3 code.

4.3.4 How is Kivy related to PyMT?

Our developers are professionals and are pretty savvy in their area of expertise. However, before Kivy came around there was (and still is) a project named PyMT that was led by our core developers. We learned a great deal from that project during the time that we developed it. In the more than two years of research and development we found many interesting ways to improve the design of our framework. We have performed numerous benchmarks and as it turns out, to achieve the great speed and flexibility that Kivy has, we had to rewrite quite a big portion of the codebase, making this a backwards-incompatible but future-proof decision. Most notable are the performance increases, which are just incredible. Kivy starts and operates just so much faster, due to these heavy optimizations. We also had the opportunity to work with businesses and associations using PyMT. We were able to test our product on a large diversity of setups and made PyMT work on all of them. Writing a system such as Kivy or PyMT is one thing. Making it work under all these different conditions is another. We have a good background here, and brought our knowledge to Kivy.

Furthermore, since some of our core developers decided to drop their full-time jobs and turn to this project completely, it was decided that a more professional foundation had to be laid. Kivy is that foundation. It is supposed to be a stable and professional product. Technically, Kivy is not really a successor to PyMT because there is no easy migration path between them. However, the goal is the same: Producing high-quality applications for novel user interfaces. This is why we encourage everyone to base new projects on Kivy instead of PyMT. Active development of PyMT has stalled. Maintenance patches are still accepted.

4.3.5 Do you accept patches?

Yes, we love patches. In order to ensure a smooth integration of your precious changes however, please make sure to read our contribution guidelines. Obviously we don't accept every patch. Your patch has to be consistent with our styleguide and, more importantly, make sense. It does make sense to talk to us before you come up with bigger changes, especially new features.

4.3.6 Does the Kivy project participate in Google's Summer of Code ?

Potential students ask whether we participate in GSoC. The clear answer is: Indeed. :-)

If you want to participate as a student and want to maximize your chances of being accepted, start talking to us today and try fixing some smaller (or larger, if you can ;-) problems to get used to our workflow. If we know you can work well with us, that'd be a big plus.

Here's a checklist:

- Make sure to read through the website and at least skim the documentation.
- Look at the source code.
- Read our contribution guidelines.
- Pick an idea that you think is interesting from the ideas list (see link above) or come up with your own idea.
- Do some research **yourself**. GSoC is not about us teaching you something and you getting paid for that. It is about you trying to achieve agreed upon goals by yourself with our support. The main driving force in this should be, obviously, yourself. Many students come up and ask what they should do. Well, we don't know because we know neither your interests nor your skills. Show us you're serious about it and take initiative.
- Write a draft proposal about what you want to do. Include what you understand the current state is (very roughly), what you would like to improve and how, etc.
- Discuss that proposal with us in a timely manner. Get feedback.
- Be patient! Especially on IRC. We will try to get to you if we're available. If not, send an email and just wait. Most questions are already answered in the docs or somewhere else and can be found with some research. If your questions don't reflect that you've actually thought through what you're asking, it might not be well received.

Good luck! :-)

CHAPTER

FIVE

CONTACT US

You can contact us in several different ways:

5.1 Issue Tracker

If you have found an issue with the code or have a feature request, please see our issue tracker. If there is no issue yet that matches your inquiry, feel free to create a new one. Please make sure you receive the mails that github sends if we comment on the issue in case we need more information. For bugs, please provide all the information necessary, like the operating system you're using, the **full error message** or any other logs, a description of what you did to trigger the bug and what the actual bug was, as well as anything else that might be of interest. Obviously, we can only help if you tell us precisely what the actual problem is.

5.2 Mail

For users of our framework, there is a mailing list for support inquiries on the kivy-users Google Group. Use this list if you have issues with your Kivy-based app. We also have a mailing list for matters that deal with development of the actual Kivy framework code on the kivy-dev Google Group.

5.3 IRC

#Kivy on irc.freenode.net

IRC is great for real-time communication, but please make sure to **wait** after you asked your question. If you just join, ask and quit we have **no way** of knowing who you were and where we're supposed to send our answer. Also, keep in mind we're mostly based in Europe, so take into account any timezone issues. If you're unlucky more than once, try the mailing list.

If you don't have an IRC client, you can also use Freenode's web chat, but please, don't close the browser window too soon. Just enter `#kivy` in the channels field.

Please read our Community Guidelines before asking for help on the mailing list or IRC channel.

Part II
PROGRAMMING GUIDE

CHAPTER

SIX

KIVY BASICS

6.1 Installation of the Kivy environment

Kivy depends on many Python libraries, such as pygame, gstreamer, PIL, Cairo, and more. They are not all required, but depending on the platform you're working on, they can be a pain to install. For Windows and MacOS X, we provide a portable package that you can just unzip and use.

- *Installation on Windows*
- *Installation on MacOSX*
- *Installation on Linux*

If you want to install everything yourself, ensure that you have at least Cython and Pygame. A typical pip installation looks like this:

```
pip install cython
pip install hg+http://bitbucket.org/pygame/pygame
pip install kivy
```

The development version can be installed with git:

```
git clone https://github.com/kivy/kivy
make
```

6.2 Create an application

Creating a kivy application is as simple as:

- sub-classing the `App` class
- implementing its `build()` method so it returns a `Widget` instance (the root of your widget tree)
- instantiating this class, and calling its `run()` method.

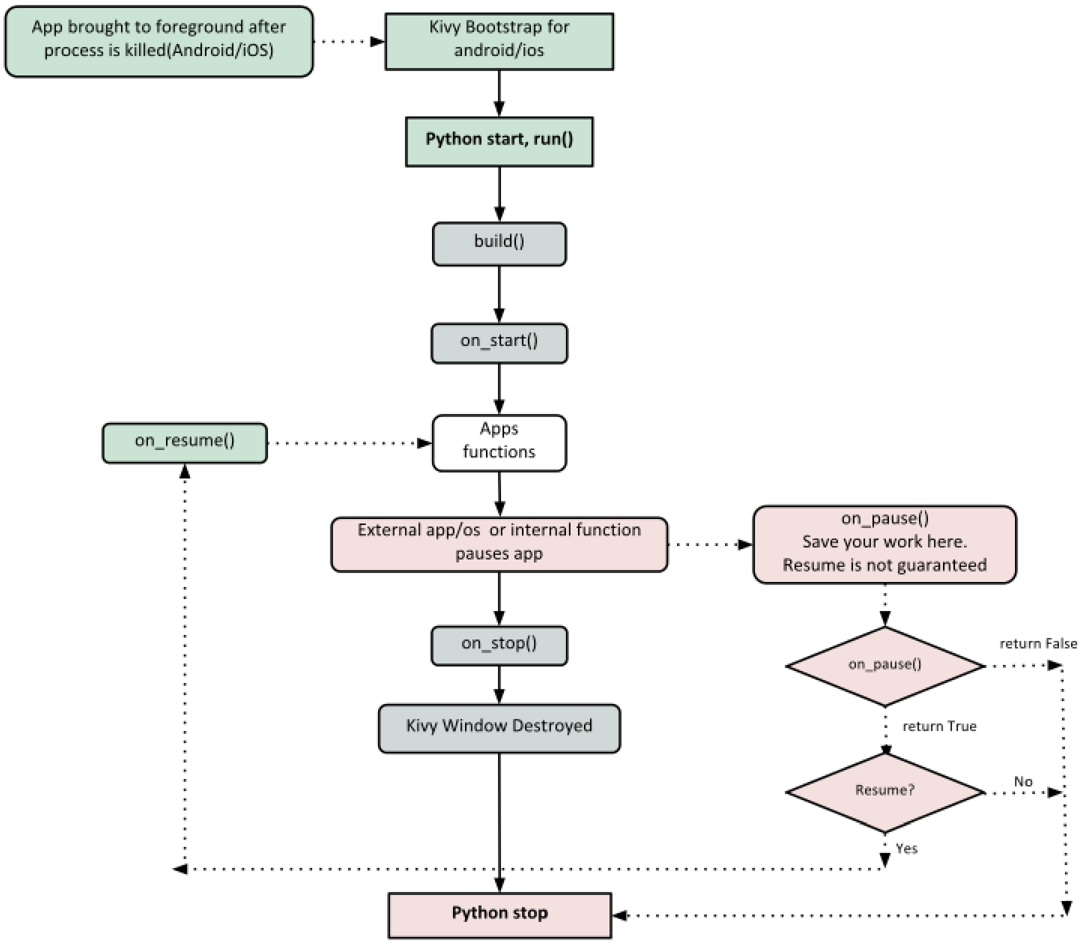
Here is an example of a minimal application:

```
import kivy
kivy.require('1.0.6') # replace with your current kivy version !

from kivy.app import App
from kivy.uix.label import Label


class MyApp(App):
    def build(self):
        return Label(text='Hello world')


if __name__ == '__main__':
    MyApp().run()
```

You can save this to a text file, *main.py* for example, and run it.

6.3 Kivy App Life Cycle

First off, let's get familiar with the Kivy app life cycle.



App brought to foreground after process is killed(Android/iOS)
Kivy Bootstrap for android/ios
Python start, run()
build()
on_start()
on_resume()
Apps functions
External app/os or internal function pauses app
on_pause() Save your work here. Resume is not guaranteed
on_stop()
on_pause()
return False
return True
Kivy Window Destroyed
Resume?
No
Yes
Python stop

As you can see above, for all intents and purposes, our entry point into our App is the run() method, and in our case that is "MyApp().run()". We will get back to this, but let's start from the third line:

```
from kivy.app import App
```

It's required that the base Class of your App inherits from the *App* class. It's present in the kivy_installation_dir/kivy/app.py.

Note: Go ahead and open up that file if you want to delve deeper into what the Kivy App class does. We encourage you to open the code and read through it. Kivy is based on Python and uses Sphinx for documentation, so the documentation for each class is in the actual file.

Similarly on line 2:

```
from kivy.uix.label import Label
```

One important thing to note here is the way packages/classes are laid out. The `uix` module is the section that holds the user interface elements like layouts and widgets.

Moving on to line 5:

```
class MyApp(App):
```

This is where we are *defining* the Base Class of our Kivy App. You should only ever need to change the name of your app *MyApp* in this line.

Further on to line 7:

```
def build(self):
```

As highlighted by the image above, show casing the *Kivy App Life Cycle*, this is the function where you should initialize and return your *Root Widget*. This is what we do on line 8:

```
return Label(text='Hello world')
```

Here we initialize a Label with text 'Hello World' and return it's instance. This Label will be the Root Widget of this App.

Note: Python uses indentation to denote code blocks, therefore take note that in the code provided above, at line 9 the class and function definition ends.

Now on to the portion that will make our app run at line 11 and 12:

```
if __name__ == '__main__':
    MyApp().run()
```

Here the class *MyApp* is initialized and it's run() method called. This initializes and starts our Kivy application.

6.4 Running the application

To run the application, follow the instructions for your operating system:

Linux Follow the instructions for *running a Kivy application on Linux*:

```
        $ python main.py
```

Windows Follow the instructions for *running a Kivy application on Windows*:

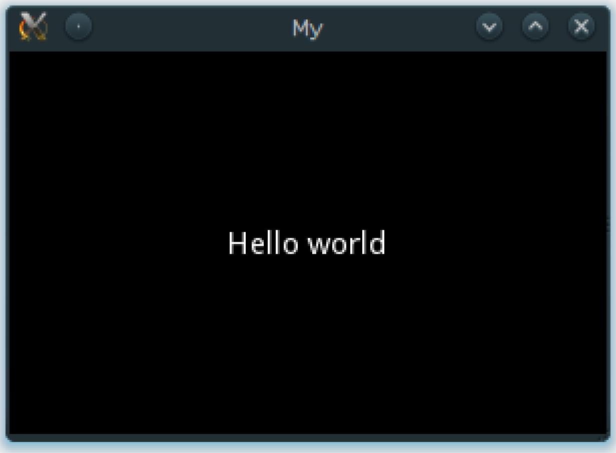
```
        $ python main.py
        # or
        C:\appdir>kivy.bat main.py
```

Mac OS X Follow the instructions for *running a Kivy application on MacOSX*:

```
        $ kivy main.py
```

Android Your application needs some complementary files to be able to run on Android.
See *Create a package for Android* for further reference.

A window should open, showing a single Label (with the Text 'Hello World') that covers the entire window's area. That's all there is to it.



Hello world

6.5 Customize the application

Lets extend this application a bit, say a simple UserName/Password page.

```
from kivy.app import App
from kivy.uix.gridlayout import GridLayout
from kivy.uix.label import Label
from kivy.uix.textinput import TextInput


class LoginScreen(GridLayout):

    def __init__(self, **kwargs):
        super(LoginScreen, self).__init__(**kwargs)
        self.cols = 2
        self.add_widget(Label(text='User Name'))
        self.username = TextInput(multiline=False)
        self.add_widget(self.username)
        self.add_widget(Label(text='password'))
        self.password = TextInput(password=True, multiline=False)
        self.add_widget(self.password)


class MyApp(App):

    def build(self):
        return LoginScreen()


if __name__ == '__main__':
    MyApp().run()
```

At the next line we import a `Gridlayout`:

```
from kivy.uix.gridlayout import GridLayout
```

This class is used as a Base for our Root Widget (LoginScreen) defined at line 9:

```
class LoginScreen(GridLayout):
```

At line 12 in the class LoginScreen, we overload the method `__init__()` so as to add widgets and to define their behavior:

```
def __init__(self, **kwargs):
    super(LoginScreen, self).__init__(**kwargs)
```

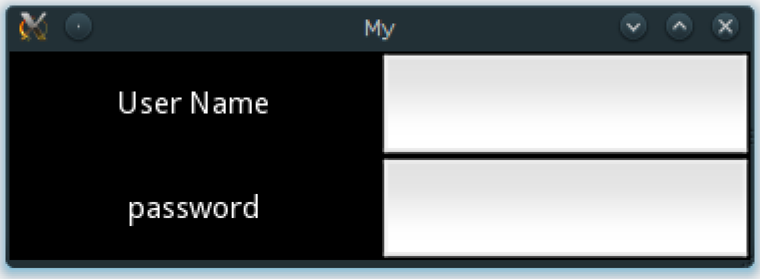
One should not forget to call super in order to implement the functionality of the original class being overloaded. Also note that it is good practice not to omit the ***kwargs* while calling super, as they are sometimes used internally.

Moving on to Line 15 and beyond:

```
self.cols = 2
self.add_widget(Label(text='User Name'))
self.username = TextInput(multiline=False)
self.add_widget(self.username)
self.add_widget(Label(text='password'))
self.password = TextInput(password=True, multiline=False)
self.add_widget(self.password)
```

We ask the GridLayout to manage it's children in two columns and add a `Label` and a `TextInput` for the username and password.

Running the above code will give you a window that should look like this:



Try re-sizing the window and you will see that the widgets on screen adjust themselves according to the size of the window without you having to do anything. This is because widgets use size hinting by default.

The code above doesn't handle the input from the user, does no validation or anything else. We will delve deeper into this and `Widget` size and positioning in the coming sections.

6.6 Platform specifics

Opening a Terminal application and setting the kivy environment variables.

On Windows, just double click the kivy.bat and a terminal will be opened with all the required variables already set.

On nix* systems, open the terminal of your choice and if kivy isn't installed globally:

```
    export python=$PYTHONPATH:/path/to/kivy_installation
```

CHAPTER

SEVEN

CONTROLLING THE ENVIRONMENT

Many environment variables are available to control the initialization and behavior of Kivy.

For example, for restricting text rendering to PIL implementation:

```
$ KIVY_TEXT=pil python main.py
```

Environment variable can be set before importing kivy:

```
import os
os.environ['KIVY_TEXT'] = 'pil'
import kivy
```

7.1 Path control

New in version 1.0.7.

You can control the default directories where config files, modules, extensions, and kivy data are located.

KIVY_DATA_DIR Location of the Kivy data, default to *<kivy path>/data*

KIVY_EXTS_DIR Location of the Kivy extensions, default to *<kivy path>/extensions*

KIVY_MODULES_DIR Location of the Kivy modules, default to *<kivy path>/modules*

KIVY_HOME Location of the Kivy home. This directory is used for local configuration, and must be in a writable location.

Defaults to:

- Desktop: *<user home>/.kivy*
- Android: *<android app path>/.kivy*
- iOS: *<user home>/Documents/.kivy*

New in version 1.9.0.

KIVY_SDL2_PATH If set, the SDL2 libraries and headers from this path are used when compiling kivy instead of the ones installed system-wide. To use the same libraries while running a kivy app, this path must be added at the start of the PATH environment variable.

New in version 1.9.0.

7.2 Configuration

KIVY_USE_DEFAULTCONFIG If this name is found in environ, Kivy will not read the user config file.

KIVY_NO_CONFIG If set, no configuration file will be read or write, and no user configuration directory too.

KIVY_NO_FILELOG If set, logs will be not print on a file

KIVY_NO_CONSOLELOG If set, logs will be not print on the console

7.3 Restrict core to specific implementation

`kivy.core` try to select the best implementation available for your platform. For testing or custom installation, you might want to restrict the selector to a specific implementation.

KIVY_WINDOW Implementation to use for creating the Window

Values: pygame, x11, sdl, egl_rpi

KIVY_TEXT Implementation to use for rendering text

Values: pil, pygame, sdlttf

KIVY_VIDEO Implementation to use for rendering video

Values: pygst, gstplayer, pyglet, ffmpeg, null

KIVY_AUDIO Implementation to use for playing audio

Values: gstplayer, pygst, sdl, pygame

KIVY_IMAGE Implementation to use for reading image

Values: pil, pygame, imageio, tex, dds, gif

KIVY_CAMERA Implementation to use for reading camera

Values: videocapture, avfoundation, pygst, opencv

KIVY_SPELLING Implementation to use for spelling

Values: enchant, osxappkit

KIVY_CLIPBOARD Implementation to use for clipboard management

Values: pygame, dummy, android

7.4 Metrics

KIVY_DPI If set, the value will be used for `Metrics.dpi`.

New in version 1.4.0.

KIVY_METRICS_DENSITY If set, the value will be used for `Metrics.density`.

New in version 1.5.0.

KIVY_METRICS_FONTSCALE

If set, the value will be used for `Metrics.fontscale`.

New in version 1.5.0.

7.5 Graphics

KIVY_GLES_LIMITS Whether the GLES2 restrictions are enforced (the default, or if set to 1). If set to false, Kivy will not be trully GLES2 compatible.

Following is a list of the potential incompatibilities that result when set to true.

Mesh indices	If true, the number of indices in a mesh is limited to 65535
Texture blit	When blitting to a texture, the data (color and buffer) format must be the same format as the one used at the texture creation. On desktop, the conversion of different color is correctly handled by the driver, while on Android, most of devices fail to do it. Ref: https://github.com/kivy/kivy/issues/1600

New in version 1.8.1.

CHAPTER

EIGHT

CONFIGURE KIVY

The configuration file for kivy is named *config.ini*, and adheres to the standard INI format.

8.1 Locating the configuration file

The location of the configuration file is controlled by the environment variable *KIVY_HOME*:

```
<KIVY_HOME>/config.ini
```

On desktop, this defaults to:

```
<HOME_DIRECTORY>/.kivy/config.ini
```

Therefore, if your user is named "tito", the file will be here:

- Windows: `C:\Users\tito\.kivy\config.ini`
- MacOSX: `/Users/tito/.kivy/config.ini`
- Linux: `/home/tito/.kivy/config.ini`

On Android, this defaults to:

```
<ANDROID_APP_PATH>/.kivy/config.ini
```

If your app is named "org.kivy.launcher", the file will be here:

```
/data/data/org.kivy.launcher/files/.kivy/config.ini
```

On iOS, this defaults to:

```
<HOME_DIRECTORY>/Documents/.kivy/config.ini
```

8.2 Understanding config tokens

All the configuration tokens are explained in the `kivy.config` module.

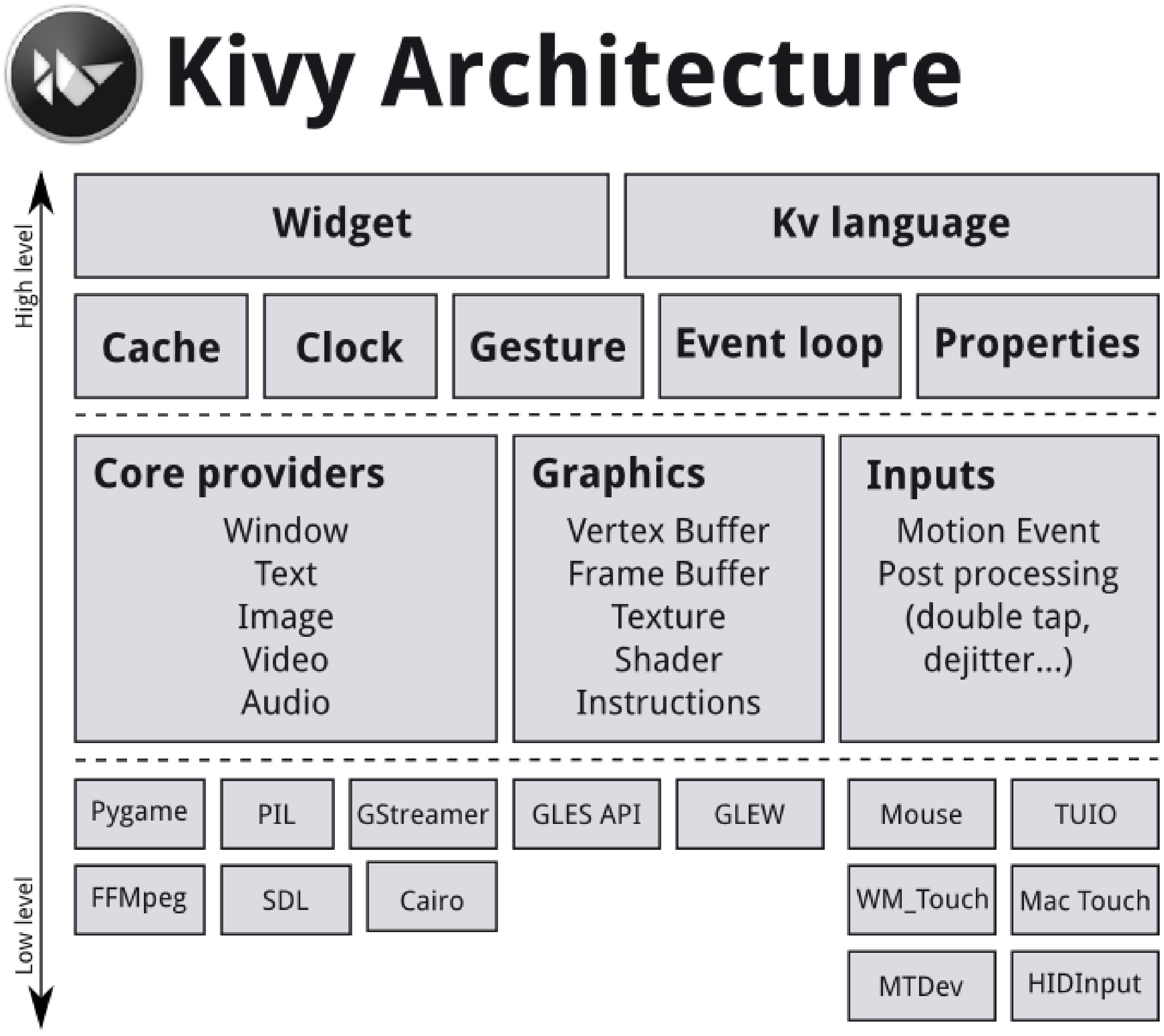
CHAPTER

NINE

ARCHITECTURAL OVERVIEW

We would like to take a moment to explain how we designed Kivy from a software engineering point of view. This is key to understanding how everything works together. If you just look at the code, chances are you will get a rough idea already, but since this approach certainly is daunting for most users, this section explains the basic ideas of the implementation in more detail. You can skip this section and refer to it later, but we suggest at least skimming it for a rough overview.

Kivy consists of several building blocks that we will explain shortly. Here is a graphical summary of the architecture:



9.1 Core Providers and Input Providers

One idea that is key to understanding Kivy's internals is that of modularity and abstraction. We try to abstract basic tasks such as opening a window, displaying images and text, playing audio, getting images from a camera, spelling correction and so on. We call these *core* tasks. This makes the API both easy to use and easy to extend. Most importantly, it allows us to use – what we call – specific providers for the respective scenarios in which your app is being run. For example, on OSX, Linux and Windows, there are different native APIs for the different core tasks. A piece of code that uses one of these specific APIs to talk to the operating system on one side and to Kivy on the other (acting as an intermediate communication layer) is what we call a *core provider*. The advantage of using specialized core providers for each platform is that we can fully leverage the functionality exposed by the operating system and act as efficiently as possible. It also gives users a choice. Furthermore, by using libraries that are shipped with any one platform, we effectively reduce the size of the Kivy distribution and make packaging easier. This also makes it easier to port Kivy to other platforms. The Android port benefited greatly from this.

We follow the same concept with input handling. *An input provider* is a piece of code that adds support for a specific input device, such as Apple's trackpads, TUIO or a mouse emulator. If you need to add support for a new input device, you can simply provide a new class that reads your input data from your device and transforms them into Kivy basic events.

9.2 Graphics

Kivy's graphics API is our abstraction of OpenGL. On the lowest level, Kivy issues hardware-accelerated drawing commands using OpenGL. Writing OpenGL code however can be a bit confusing, especially to newcomers. That's why we provide the graphics API that lets you draw things using simple metaphors that do not exist as such in OpenGL (e.g. Canvas, Rectangle, etc.).

All of our widgets themselves use this graphics API, which is implemented on the C level for performance reasons.

Another advantage of the graphics API is its ability to automatically optimize the drawing commands that your code issues. This is especially helpful if you're not an expert at tuning OpenGL. This makes your drawing code more efficient in many cases.

You can, of course, still use raw OpenGL commands if you prefer. The version we target is OpenGL 2.0 ES (GLES2) on all devices, so if you want to stay cross-platform compatible, we advise you to only use the GLES2 functions.

9.3 Core

The code in the core package provides commonly used features, such as:

Clock You can use the clock to schedule timer events. Both one-shot timers and periodic timers are supported.

Cache If you need to cache something that you use often, you can use our class for that instead of writing your own.

Gesture Detection We ship a simple gesture recognizer that you can use to detect various kinds of strokes, such as circles or rectangles. You can train it to detect your own strokes.

Kivy Language The kivy language is used to easily and efficiently describe user interfaces.

Properties These are not the normal properties that you may know from python. They are our own property classes that link your widget code with the user interface description.

9.4 UIX (Widgets & Layouts)

The UIX module contains commonly used widgets and layouts that you can reuse to quickly create a user interface.

Widgets Widgets are user interface elements that you add to your program to provide some kind of functionality. They may or may not be visible. Examples would be a file browser, buttons, sliders, lists and so on. Widgets receive MotionEvents.

Layouts You use layouts to arrange widgets. It is of course possible to calculate your widgets' positions yourself, but often it is more convenient to use one of our ready made layouts. Examples would be Grid Layouts or Box Layouts. You can also nest layouts.

9.5 Modules

If you've ever used a modern web browser and customized it with some add-ons then you already know the basic idea behind our module classes. Modules can be used to inject functionality into Kivy programs, even if the original author did not include it.

An example would be a module that always shows the FPS of the current application and some graph depicting the FPS over time.

You can also write your own modules.

9.6 Input Events (Touches)

Kivy abstracts different input types and sources such as touches, mice, TUIO or similar. What all of these input types have in common is that you can associate a 2D onscreen-position with any individual input event. (There are other input devices such as accelerometers where you cannot easily find a 2D position for e.g. a tilt of your device. This kind of input is handled separately. In the following we describe the former types.)

All of these input types are represented by instances of the Touch() class. (Note that this does not only refer to finger touches, but all the other input types as well. We just called it *Touch* for the sake of simplicity. Think of it of something that *touches* the user interface or your screen.) A touch instance, or object, can be in one of three states. When a touch enters one of these states, your program is informed that the event occurred. The three states a touch can be in are:

Down A touch is down only once, at the very moment where it first appears.

Move A touch can be in this state for a potentially unlimited time. A touch does not have to be in this state during its lifetime. A 'Move' happens whenever the 2D position of a touch changes.

Up A touch goes up at most once, or never. In practice you will almost always receive an up event because nobody is going to hold a finger on the screen for all eternity, but it is not guaranteed. If you know the input sources your users will be using, you will know whether or not you can rely on this state being entered.

9.7 Widgets and Event Dispatching

The term *widget* is often used in GUI programming contexts to describe some part of the program that the user interacts with. In Kivy, a widget is an object that receives input events. It does not necessarily have to have a visible representation on the screen. All widgets are arranged in a *widget tree* (which is a tree data structure as known from computer science classes): One widget can have any number of child widgets or none. There is exactly one *root widget* at the top of the tree that has no parent widget, and all other widgets are directly or indirectly children of this widget (which is why it's called the root).

When new input data is available, Kivy sends out one event per touch. The root widget of the widget tree first receives the event. Depending on the state of the touch, the on_touch_down, on_touch_move or on_touch_up event is dispatched (with the touch as the argument) to the root widget, which results in the root widget's corresponding on_touch_down, on_touch_move or on_touch_up event handler being called.

Each widget (this includes the root widget) in the tree can choose to either digest or pass the event on. If an event handler returns True, it means that the event has been digested and handled properly. No further processing will happen with that event. Otherwise, the event handler passes the widget on to its own children by calling its superclass's implementation of the respective event handler. This goes all the way up to the base Widget class, which – in its touch event handlers – does nothing but pass the touches to its children:

```
# This is analogous for move/up:
def on_touch_down(self, touch):
    for child in self.children[:]:
        if child.dispatch('on_touch_down', touch):
            return True
```

This really is much easier than it first seems. An example of how this can be used to create nice applications quickly will be given in the following section.

Often times you will want to restrict the *area* on the screen that a widget watches for touches. You can use a widget's collide_point() method to achieve this. You simply pass it the touch's position and it returns True if the touch is within the 'watched area' or False otherwise. By default, this checks the rectangular region on the screen that's described by the widget's pos (for position; x & y) and size (width & height), but you can override this behaviour in your own class.

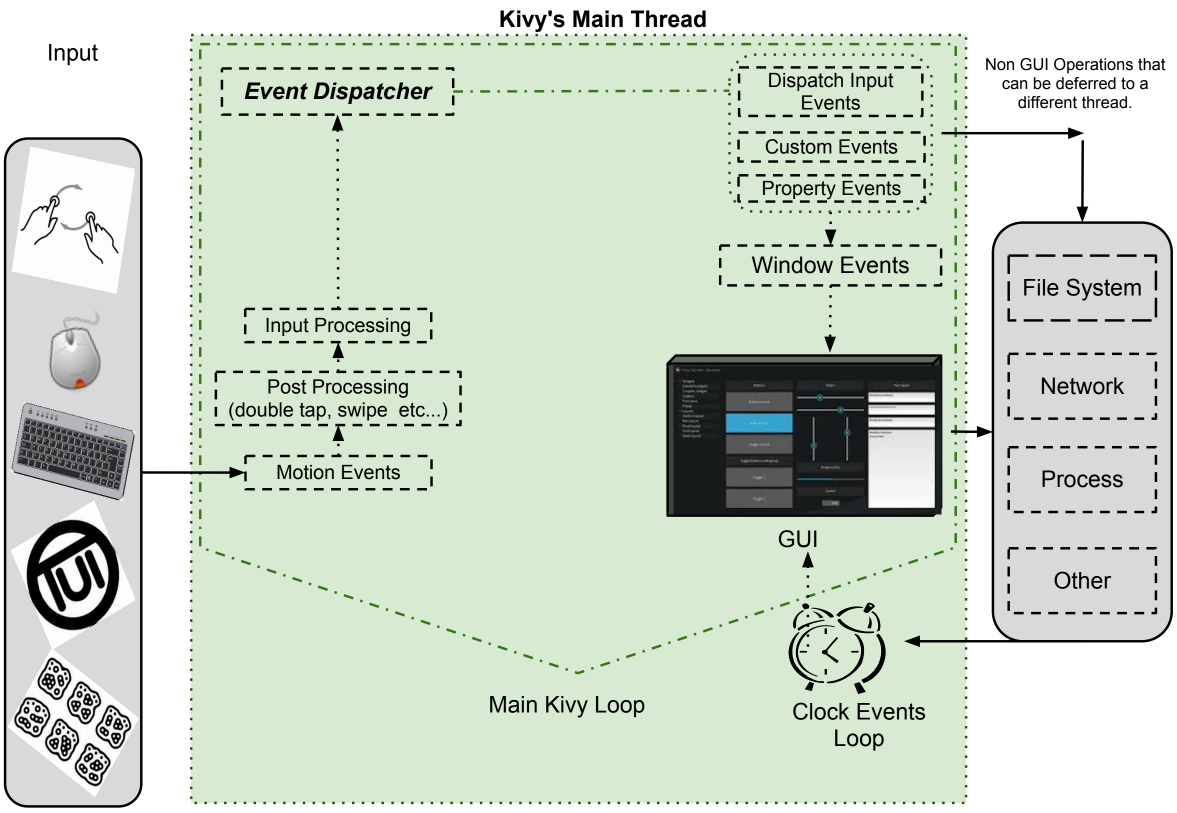
CHAPTER

TEN

EVENTS AND PROPERTIES

Events are an important part of Kivy programming. That may not be surprising to those with GUI development experience, but it's an important concept for newcomers. Once you understand how events work and how to bind to them, you will see them everywhere in Kivy. They make it easy to build whatever behavior you want into Kivy.

The following illustration shows how events are handled in the Kivy framework.



10.1 Introduction to the Event Dispatcher

One of the most important base classes of the framework is the `EventDispatcher` class. This class allows you to register event types, and to dispatch them to interested parties (usually other event dispatchers). The `Widget`, `Animation` and `Clock` classes are examples of event dispatchers.

EventDispatcher objects depend on the main loop to generate and handle events.

10.2 Main loop

As outlined in the illustration above, Kivy has a *main loop*. This loop is running during all of the application's lifetime and only quits when exiting the application.

Inside the loop, at every iteration, events are generated from user input, hardware sensors or a couple of other sources, and frames are rendered to the display.

Your application will specify callbacks (more on this later), which are called by the main loop. If a callback takes too long or doesn't quit at all, the main loop is broken and your app doesn't work properly anymore.

In Kivy applications, you have to avoid long/infinite loops or sleeping. For example the following code does both:

```
while True:
    animate_something()
    time.sleep(.10)
```

When you run this, the program will never exit your loop, preventing Kivy from doing all of the other things that need doing. As a result, all you'll see is a black window which you won't be able to interact with. Instead, you need to "schedule" your `animate_something()` function to be called repeatedly.

10.2.1 Scheduling a repetitive event

You can call a function or a method every X times per second using `schedule_interval()`. Here is an example of calling a function named my_callback 30 times per second:

```
def my_callback(dt):
    print 'My callback is called', dt
Clock.schedule_interval(my_callback, 1 / 30.)
```

You have two ways of unscheduling a previously scheduled event. The first would be to use `unschedule()`:

```
Clock.unschedule(my_callback)
```

Or, you can return False in your callback, and your event will be automatically unscheduled:

```
count = 0
def my_callback(dt):
    global count
    count += 1
    if count == 10:
        print 'Last call of my callback, bye bye !'
        return False
    print 'My callback is called'
Clock.schedule_interval(my_callback, 1 / 30.)
```

10.2.2 Scheduling a one-time event

Using `schedule_once()`, you can call a function "later", like in the next frame, or in X seconds:

```
def my_callback(dt):
    print 'My callback is called !'
Clock.schedule_once(my_callback, 1)
```

This will call `my_callback` in one second. The second argument is the amount of time to wait before calling the function, in seconds. However, you can achieve some other results with special values for the second argument:

- If X is greater than 0, the callback will be called in X seconds
- If X is 0, the callback will be called after the next frame
- If X is -1, the callback will be called before the next frame

The -1 is mostly used when you are already in a scheduled event, and if you want to schedule a call BEFORE the next frame is happening.

A second method for repeating a function call is to first schedule a callback once with `schedule_once()`, and a second call to this function inside the callback itself:

```
def my_callback(dt):
    print 'My callback is called !'
    Clock.schedule_once(my_callback, 1)
Clock.schedule_once(my_callback, 1)
```

While the main loop will try to keep to the schedule as requested, there is some uncertainty as to when exactly a scheduled callback will be called. Sometimes another callback or some other task in the application will take longer than anticipated and thus the timing can be a little off.

In the latter solution to the repetitive callback problem, the next iteration will be called at least one second after the last iteration ends. With `schedule_interval()` however, the callback is called every second.

10.2.3 Trigger events

If you want to schedule a function to be called only once for the next frame, like a trigger, you might be tempted to achieve that like so:

```
Clock.unschedule(my_callback)
Clock.schedule_once(my_callback, 0)
```

This way of programming a trigger is expensive, since you'll always call unschedule, whether or not you've even scheduled it. In addition, unschedule needs to iterate the weakref list of the Clock in order to find your callback and remove it. Use a trigger instead:

```
trigger = Clock.create_trigger(my_callback)
# later
trigger()
```

Each time you call trigger(), it will schedule a single call of your callback. If it was already scheduled, it will not be rescheduled.

10.3 Widget events

A widget has 2 default types of events:

- Property event: if your widget changes its position or size, an event is fired.
- Widget-defined event: e.g. an event will be fired for a Button when it's pressed or released.

For a discussion on how widget touch events managed and propagated, please refer to the *Widget touch event bubbling* section.

10.4 Creating custom events

To create an event dispatcher with custom events, you need to register the name of the event in the class and then create a method of the same name.

See the following example:

```
class MyEventDispatcher(EventDispatcher):
    def __init__(self, **kwargs):
        self.register_event_type('on_test')
        super(MyEventDispatcher, self).__init__(**kwargs)

    def do_something(self, value):
        # when do_something is called, the 'on_test' event will be
        # dispatched with the value
        self.dispatch('on_test', value)

    def on_test(self, *args):
        print "I am dispatched", args
```

10.5 Attaching callbacks

To use events, you have to bind callbacks to them. When the event is dispatched, your callbacks will be called with the parameters relevant to that specific event.

A callback can be any python callable, but you need to ensure it accepts the arguments that the event emits. For this, it's usually safest to accept the **args* argument, which will catch all arguments in the *args* list.

Example:

```
def my_callback(value, *args):
    print "Hello, I got an event!", args


ev = MyEventDispatcher()
ev.bind(on_test=my_callback)
ev.do_something('test')
```

Pleases refer to the `kivy.event.EventDispatcher.bind()` method documentation for more examples on how to attach callbacks.

10.6 Introduction to Properties

Properties are an awesome way to define events and bind to them. Essentially, they produce events such that when an attribute of your object changes, all properties that reference that attribute are automatically updated.

There are different kinds of properties to describe the type of data you want to handle.

- `StringProperty`
- `NumericProperty`
- `BoundedNumericProperty`
- `ObjectProperty`

- DictProperty
- ListProperty
- OptionProperty
- AliasProperty
- BooleanProperty
- ReferenceListProperty

10.7 Declaration of a Property

To declare properties, you must declare them at the class level. The class will then do the work to instantiate the real attributes when your object is created. These properties are not attributes: they are mechanisms for creating events based on your attributes:

```
class MyWidget(Widget):

    text = StringProperty('')
```

When overriding *__init__*, *always* accept ***kwargs* and use *super()* to call the parent's *__init__* method, passing in your class instance:

```
def __init__(self, **kwargs):
    super(MyWidget, self).__init__(**kwargs)
```

10.8 Dispatching a Property event

Kivy properties, by default, provide an *on_<property_name>* event. This event is called when the value of the property is changed.

Note: If the new value for the property is equal to the current value, then the *on_<property_name>* event will not be called.

For example, consider the following code:

```
1  class CustomBtn(Widget):
2
3      pressed = ListProperty([0, 0])
4
5      def on_touch_down(self, touch):
6          if self.collide_point(*touch.pos):
7              self.pressed = touch.pos
8              return True
9          return super(CustomBtn, self).on_touch_down(touch)
10
11     def on_pressed(self, instance, pos):
12         print ('pressed at {pos}'.format(pos=pos))
```

In the code above at line 3:

```
pressed = ListProperty([0, 0])
```

We define the *pressed* Property of type ListProperty, giving it a default value of *[0, 0]*. From this point forward, the *on_pressed* event will be called whenever the value of this property is changed.

At Line 5:

```
def on_touch_down(self, touch):
    if self.collide_point(*touch.pos):
        self.pressed = touch.pos
        return True
    return super(CustomBtn, self).on_touch_down(touch)
```

We override the `on_touch_down()` method of the Widget class. Here, we check for collision of the *touch* with our widget.

If the touch falls inside of our widget, we change the value of *pressed* to touch.pos and return True, indicating that we have consumed the touch and don't want it to propagate any further.

Finally, if the touch falls outside our widget, we call the original event using *super(...)* and return the result. This allows the touch event propagation to continue as it would normally have occured.

Finally on line 11:

```
def on_pressed(self, instance, pos):
    print ('pressed at {pos}'.format(pos=pos))
```

We define an *on_pressed* function that will be called by the property whenever the property value is changed.

Note: This *on_<prop_name>* event is called within the class where the property is defined. To monitor/observe any change to a property outside of the class where it's defined, you should bind to the property as shown below.

Binding to the property

How to monitor changes to a property when all you have access to is a widget instance? You *bind* to the property:

```
your_widget_instance.bind(property_name=function_name)
```

For example, consider the following code:

```
class RootWidget(BoxLayout):

    def __init__(self, **kwargs):
        super(RootWidget, self).__init__(**kwargs)
        self.add_widget(Button(text='btn 1'))
        cb = CustomBtn()
        cb.bind(pressed=self.btn_pressed)
        self.add_widget(cb)
        self.add_widget(Button(text='btn 2'))

    def btn_pressed(self, instance, pos):
        print ('pos: printed from root widget: {pos}'.format(pos=.pos))
```

If you run the code as is, you will notice two print statements in the console. One from the *on_pressed* event that is called inside the *CustomBtn* class and another from the *btn_pressed* function that we bind to the property change.

The reason that both functions are called is simple. Binding doesn't mean overriding. Having both of these functions is redundant and you should generally only use one of the methods of listening/reacting to property changes.

You should also take note of the parameters that are passed to the *on_<property_name>* event or the function bound to the property.

```
def btn_pressed(self, instance, pos):
```

The first parameter is *self*, which is the instance of the class where this function is defined. You can use an in-line function as follows:

```
cb = CustomBtn()

def _local_func(instance, pos):
    print ('pos: printed from root widget: {pos}'.format(pos=.pos))

cb.bind(pressed=_local_func)
self.add_widget(cb)
```

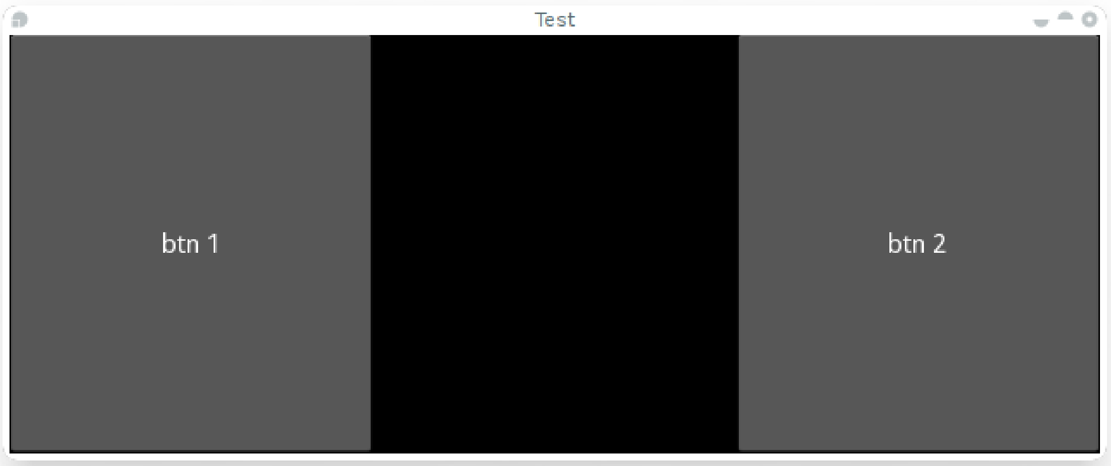
The first parameter would be the *instance* of the class the property is defined.

The second parameter would be the *value*, which is the new value of the property.

Here is the complete example, derived from the snippets above, that you can use to copy and paste into an editor to experiment.

```
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.uix.button import Button
from kivy.uix.boxlayout import BoxLayout
from kivy.properties import ListProperty

class RootWidget(BoxLayout):

    def __init__(self, **kwargs):
        super(RootWidget, self).__init__(**kwargs)
        self.add_widget(Button(text='btn 1'))
        cb = CustomBtn()
        cb.bind(pressed=self.btn_pressed)
        self.add_widget(cb)
        self.add_widget(Button(text='btn 2'))

    def btn_pressed(self, instance, pos):
        print ('pos: printed from root widget: {pos}'.format(pos=pos))

class CustomBtn(Widget):

    pressed = ListProperty([0, 0])

    def on_touch_down(self, touch):
        if self.collide_point(*touch.pos):
            self.pressed = touch.pos
            # we consumed the touch. return False here to propagate
            # the touch further to the children.
            return True
        return super(CustomBtn, self).on_touch_down(touch)

    def on_pressed(self, instance, pos):
        print ('pressed at {pos}'.format(pos=pos))

class TestApp(App):

    def build(self):
        return RootWidget()


if __name__ == '__main__':
    TestApp().run()
```

Running the code above will give you the following output:



Our CustomBtn has no visual representation and thus appears black. You can touch/click on the black area to see the output on your console.

10.9 Compound Properties

When defining an `AliasProperty`, you normally define a getter and a setter function yourself. Here, it falls on to you to define when the getter and the setter functions are called using the *bind* argument.

Consider the following code.

```
cursor_pos = AliasProperty(_get_cursor_pos, None, bind=(
    'cursor', 'padding', 'pos', 'size', 'focus',
    'scroll_x', 'scroll_y'))
'''Current position of the cursor, in (x, y).

:attr:`cursor_pos` is a :class:`~kivy.properties.AliasProperty`, read-only.
'''
```

Here *cursor_pos* is a `AliasProperty` which uses the *getter* *_get_cursor_pos* with the *setter* part set to None, implying this is a read only Property.

The bind argument at the end defines that *on_cursor_pos* event is dispatched when any of the properties used in the *bind=* argument change.

CHAPTER

ELEVEN

INPUT MANAGEMENT

11.1 Input architecture

Kivy is able to handle most types of input: mouse, touchscreen, accelerometer, gyroscope, etc. It handles the native multitouch protocols on the following platforms: Tuio, WM_Touch, MacMultitouchSupport, MT Protocol A/B and Android.

The global architecture can be viewed as:

```
Input providers -> Motion event -> Post processing -> Dispatch to Window
```

The class of all input events is the `MotionEvent`. It generates 2 kinds of events:

- Touch events: a motion event that contains at least an X and Y position. All the touch events are dispatched across the Widget tree.
- No-touch events: all the rest. For example, the accelerometer is a continuous event, without position. It never starts or stops. These events are not dispatched across the Widget tree.

A Motion event is generated by an `Input Provider`. An Input Provider is responsible for reading the input event from the operating system, the network or even from another application. Several input providers exist, such as:

- `TuioMotionEventProvider`: create a UDP server and listen for TUIO/OSC messages.
- `WM_MotionEventProvider`: use the windows API for reading multitouch information and sending it to Kivy.
- `ProbeSysfsHardwareProbe`: In Linux, iterate over all the hardware connected to the computer, and attaches a multitouch input provider for each multitouch device found.
- and much more!

When you write an application, you don't need to create an input provider. Kivy tries to automatically detect available hardware. However, if you want to support custom hardware, you will need to configure kivy to make it work.

Before the newly-created Motion Event is passed to the user, Kivy applies post-processing to the input. Every motion event is analyzed to detect and correct faulty input, as well as make meaningful interpretations like:

- Double/triple-tap detection, according to a distance and time threshold
- Making events more accurate when the hardware is not accurate
- Reducing the amount of generated events if the native touch hardware is sending events with nearly the same position

After processing, the motion event is dispatched to the Window. As explained previously, not all events are dispatched to the whole widget tree: the window filters them. For a given event:

- if it's only a motion event, it will be dispatched to `on_motion()`
- if it's a touch event, the (x,y) position of the touch (0-1 range) will be scaled to the Window size (width/height), and dispatched to:
  - `on_touch_down()`
  - `on_touch_move()`
  - `on_touch_up()`

11.2 Motion event profiles

Depending on your hardware and the input providers used, more information may be made available to you. For example, a touch input has an (x,y) position, but might also have pressure information, blob size, an acceleration vector, etc.

A profile is a string that indicates what features are available inside the motion event. Let's imagine that you are in an `on_touch_move` method:

```
def on_touch_move(self, touch):
    print(touch.profile)
    return super(..., self).on_touch_move(touch)
```

The print could output:

```
['pos', 'angle']
```

Warning: Many people mix up the profile's name and the name of the corresponding property. Just because `'angle'` is in the available profile doesn't mean that the touch event object will have an `angle` property.

For the `'pos'` profile, the properties `pos`, `x`, and `y` will be available. With the `'angle'` profile, the property `a` will be available. As we said, for touch events `'pos'` is a mandatory profile, but not `'angle'`. You can extend your interaction by checking if the `'angle'` profile exists:

```
def on_touch_move(self, touch):
    print('The touch is at position', touch.pos)
    if 'angle' in touch.profile:
        print('The touch angle is', touch.a)
```

You can find a list of available profiles in the `motionevent` documentation.

11.3 Touch events

A touch event is a specialized `MotionEvent` where the property `is_touch` evaluates to True. For all touch events, you automatically have the X and Y positions available, scaled to the Window width and height. In other words, all touch events have the `'pos'` profile.

You must take care of matrix transformation in your touch as soon as you use a widget with matrix transformation. Some widgets such as `Scatter` have their own matrix transformation, meaning the touch must be multiplied by the scatter matrix to be able to correctly dispatch touch positions to the Scatter's children.

- Get coordinate from parent space to local space: `to_local()`
- Get coordinate from local space to parent space: `to_parent()`

- Get coordinate from local space to window space: `to_window()`
- Get coordinate from window space to local space: `to_widget()`

You must use one of them to scale coordinates correctly to the context. Let's look the scatter implementation:

```
def on_touch_down(self, touch):
    # push the current coordinate, to be able to restore it later
    touch.push()

    # transform the touch coordinate to local space
    touch.apply_transform_2d(self.to_local)

    # dispatch the touch as usual to children
    # the coordinate in the touch is now in local space
    ret = super(..., self).on_touch_down(touch)

    # whatever the result, don't forget to pop your transformation
    # after the call, so the coordinate will be back in parent space
    touch.pop()

    # return the result (depending what you want.)
    return ret
```

11.3.1 Touch shapes

If the touch has a shape, it will be reflected in the 'shape' property. Right now, only a `ShapeRect` can be exposed:

```
from kivy.input.shape import ShapeRect

def on_touch_move(self, touch):
    if isinstance(touch.shape, ShapeRect):
        print('My touch have a rectangle shape of size',
            (touch.shape.width, touch.shape.height))
    # ...
```

11.3.2 Double tap

A double tap is the action of tapping twice within a time and a distance. It's calculated by the doubletap post-processing module. You can test if the current touch is one of a double tap or not:

```
def on_touch_down(self, touch):
    if touch.is_double_tap:
        print('Touch is a double tap !')
        print(' - interval is', touch.double_tap_time)
        print(' - distance between previous is', touch.double_tap_distance)
    # ...
```

11.3.3 Triple tap

A triple tap is the action of tapping thrice within a time and a distance. It's calculated by the tripletap post-processing module. You can test if the current touch is one of a triple tap or not:

```
def on_touch_down(self, touch):
    if touch.is_triple_tap:
        print('Touch is a triple tap !')
        print(' - interval is', touch.triple_tap_time)
        print(' - distance between previous is', touch.triple_tap_distance)
    # ...
```

11.3.4 Grabbing touch events

It's possible for the parent widget to dispatch a touch event to a child widget from within `on_touch_down`, but not from `on_touch_move` or `on_touch_up`. This can happen in certain scenarios, like when a touch movement is outside the bounding box of the parent, so the parent decides not to notify its children of the movement.

But you might want to do something in `on_touch_up`. Say you started something in the `on_touch_down` event, like playing a sound, and you'd like to finish things on the `on_touch_up` event. Grabbing is what you need.

When you grab a touch, you will always receive the move and up event. But there are some limitations to grabbing:

- You will receive the event at least twice: one time from your parent (the normal event), and one time from the window (grab).
- You might receive an event with a grabbed touch, but not from you: it can be because the parent has sent the touch to its children while it was in the grabbed state.
- The touch coordinate is not translated to your widget space because the touch is coming directly from the Window. It's your job to convert the coordinate to your local space.

Here is an example of how to use grabbing:

```
def on_touch_down(self, touch):
    if self.collide_point(*touch.pos):

        # if the touch collides with our widget, let's grab it
        touch.grab(self)

        # and accept the touch.
        return True

def on_touch_up(self, touch):
    # here, you don't check if the touch collides or things like that.
    # you just need to check if it's a grabbed touch event
    if touch.grab_current is self:

        # ok, the current touch is dispatched for us.
        # do something interesting here
        print('Hello world!')

        # don't forget to ungrab ourself, or you might have side effects
        touch.ungrab(self)

        # and accept the last up
        return True
```

11.3.5 Touch Event Management

In order to see how touch events are controlled and propogated between widgets, please refer to the *Widget touch event bubbling* section.

CHAPTER

TWELVE

WIDGETS

12.1 Introduction to Widget

A Widget is the base building block of GUI interfaces in Kivy. It provides a Canvas that can be used to draw on screen. It receives events and reacts to them. For a in-depth explanation about the Widget class, look at the module documentation.

12.2 Manipulating the Widget tree

Widgets in Kivy are organized in trees. Your application has a *root widget*, which usually has children that can have children of their own. Children of a widget are represented as the children attribute, a Kivy ListProperty.

The widget tree can be manipulated with the following methods:

- add_widget(): add a widget as a child
- remove_widget(): remove a widget from the children list
- clear_widgets(): remove all children from a widget

For example, if you want to add a button inside a BoxLayout, you can do:

```
layout = BoxLayout(padding=10)
button = Button(text='My first button')
layout.add_widget(button)
```

The button is added to layout: the button's parent property will be set to layout; the layout will have the button added to its children list. To remove the button from the layout:

```
layout.remove_widget(button)
```

With removal, the button's parent property will be set to None, and the layout will have button removed from its children list.

If you want to clear all the children inside a widget, use clear_widgets() method:

```
layout.clear_widgets()
```

Warning: Never manipulate the children list yourself, unless you really know what you are doing. The widget tree is associated with a graphic tree. For example, if you add a widget into the children list without adding its canvas to the graphics tree, the widget will be a child, yes, but nothing will be drawn on the screen. Moreover, you might have issues on further calls of add_widget, remove_widget and clear_widgets.

12.3 Traversing the Tree

The Widget class instance's `children` list property contains all the children. You can easily traverse the tree by doing:

```
root = BoxLayout()
# ... add widgets to root ...
for child in root.children:
    print(child)
```

However, this must be used carefuly. If you intend to modify the children list with one of the methods shown in the previous section, you must use a copy of the list like this:

```
for child in root.children[:]:
    # manipulate the tree. For example here, remove all widgets that have a
    # width < 100
    if child.width < 100:
        root.remove_widget(child)
```

Widgets don't influence the size/pos of their children by default. The `pos` attribute is the absolute position in screen co-ordinates (unless, you use the `relativelayout`. More on that later) and `size`, is an absolute size.

12.4 Widgets Z Index

The order of drawing widgets is based on position in the widget tree. The last widget's canvas is drawn last (on top of everything else inside its parent). add_widget takes a *index* parameter:

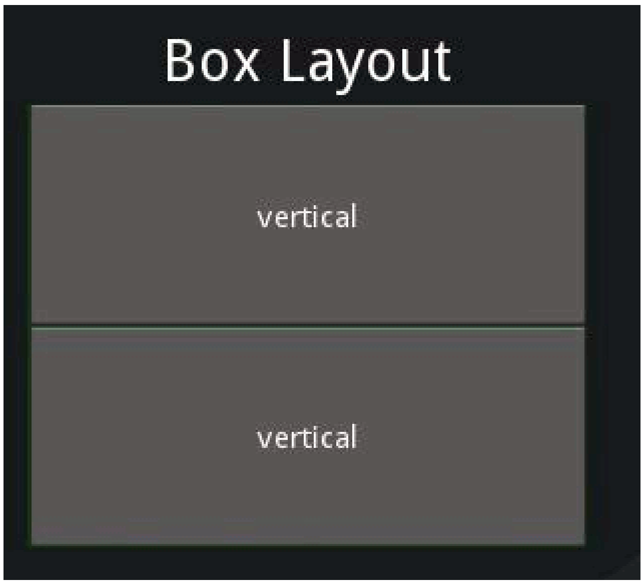
```
root.add_widget(widget, index)
```

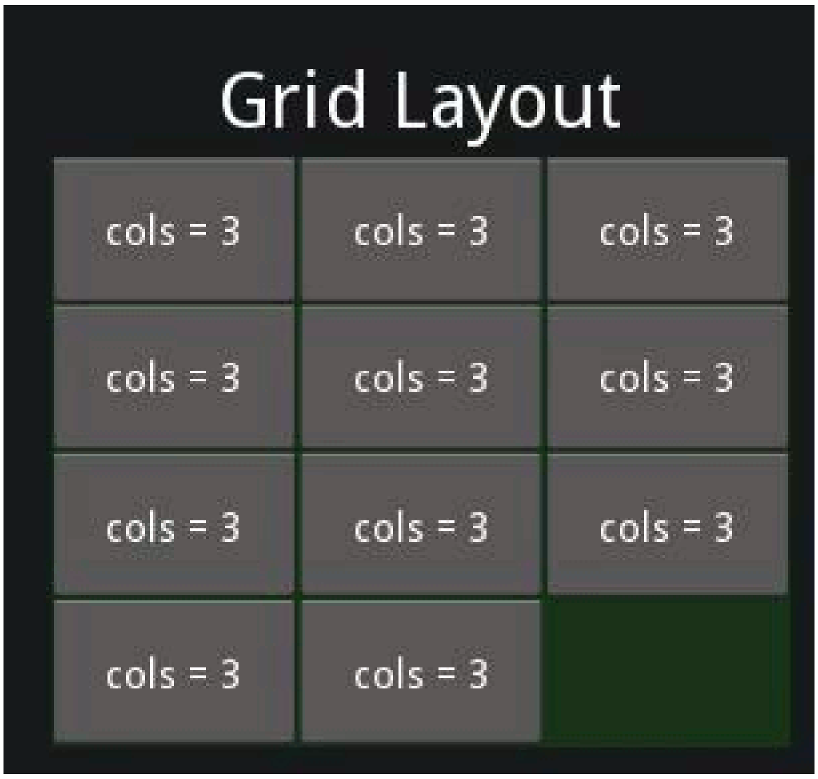
for setting the z-index.

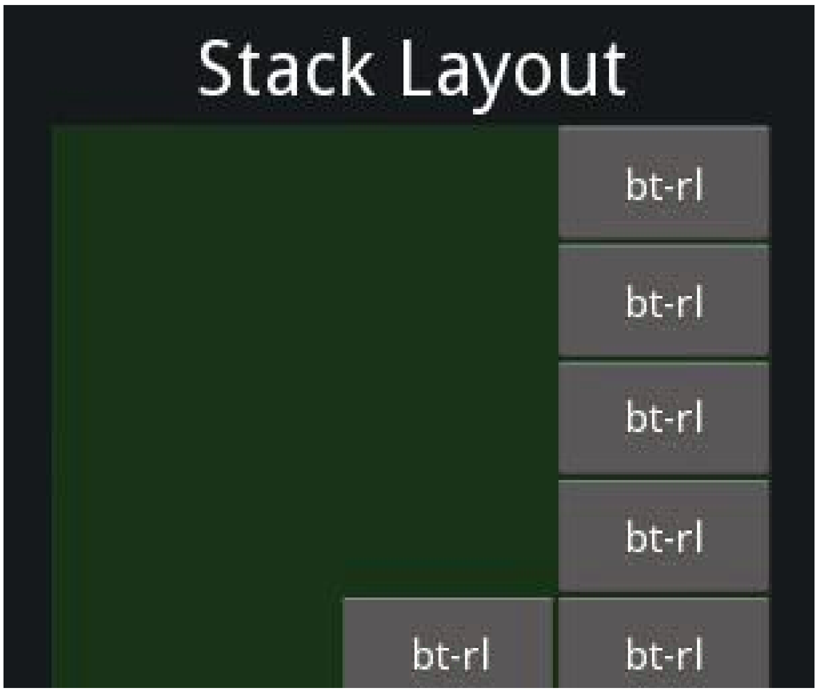
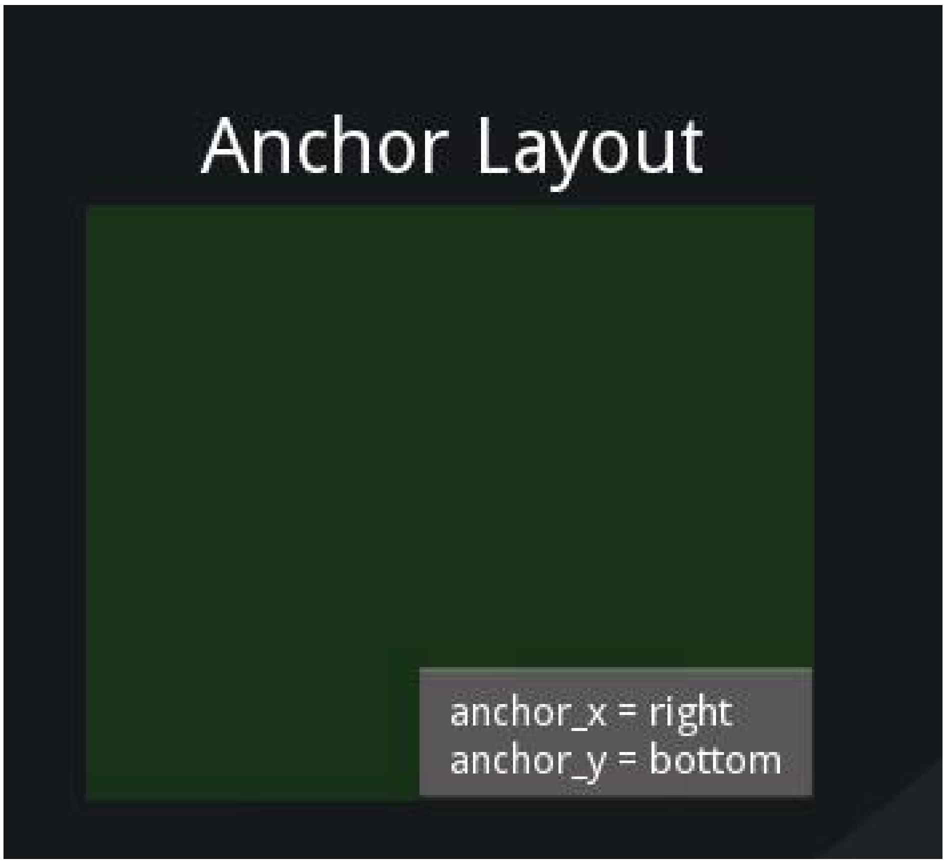
12.5 Organize with Layouts

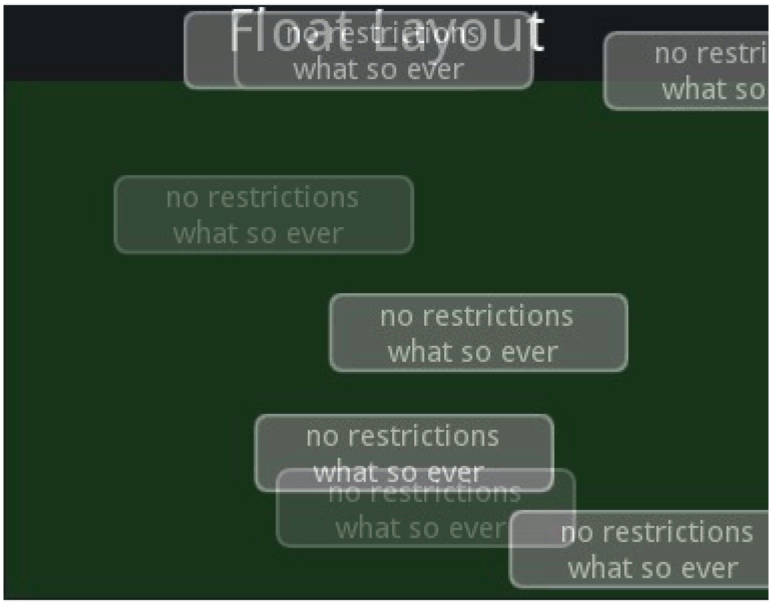
`layout` is a special kind of widget that controls the size and position of its children. There are different kinds of layouts, allowing for different automatic organization of their children. Layouts use `size_hint` and `pos_hint` properties to determine the `size` and `pos` of their `children`.

BoxLayout: Arranges widgets in an adjacent manner (either vertically or horizontally) manner, to fill all the space. The size_hint property of children can be used to change proportions allowed to each child, or set fixed size for some of them.


Box Layout
vertical
vertical


Grid Layout
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3
cols = 3


Stack Layout
bt-rl
bt-rl
bt-rl
bt-rl
bt-rl
bt-rl

Anchor Layout
anchor_x = right
anchor_y = bottom



GridLayout: Arranges widgets in a grid. You must specify at least one dimension of the grid so kivy can compute the size of the elements and how to arrange them.

StackLayout: Arranges widgets adjacent to one another, but with a set size in one of the dimensions, without trying to make them fit within the entire space. This is useful to display children of the same predefined size.

AnchorLayout: A simple layout only caring about children positions. It allows putting the children at a position relative to a border of the layout. *size_hint* is not honored.

FloatLayout: Allows placing children with arbitrary locations and size, either absolute or relative to the layout size. Default size_hint (1, 1) will make every child the same size as the whole layout, so you probably want to change this value if you have more than one child. You can set size_hint to (None, None) to use absolute size with *size*. This widget honors *pos_hint* also, which as a dict setting position relative to layout position.

RelativeLayout: Behaves just like FloatLayout, except children positions are relative to layout position, not the screen.

Examine the documentation of the individaul layouts for a more in-depth understanding.

`size_hint` and `pos_hint`:

- `floatlayout`
- `boxlayout`
- `gridlayout`
- `stacklayout`
- `relativelayout`
- `anchorlayout`

`size_hint` is a `ReferenceListProperty` of `size_hint_x` and `size_hint_y`. It excepts values from *0* to *1* or *None* and defaults to *(1, 1)*. This signifies that if the widget is in a layout, the layout will allocate it as much place as possible in both directions (relative to the layouts size).

Setting `size_hint` to (0.5, 0.8), for example, will make the widget 50% the width and 80% the height of available size for the `Widget` inside a `layout`.

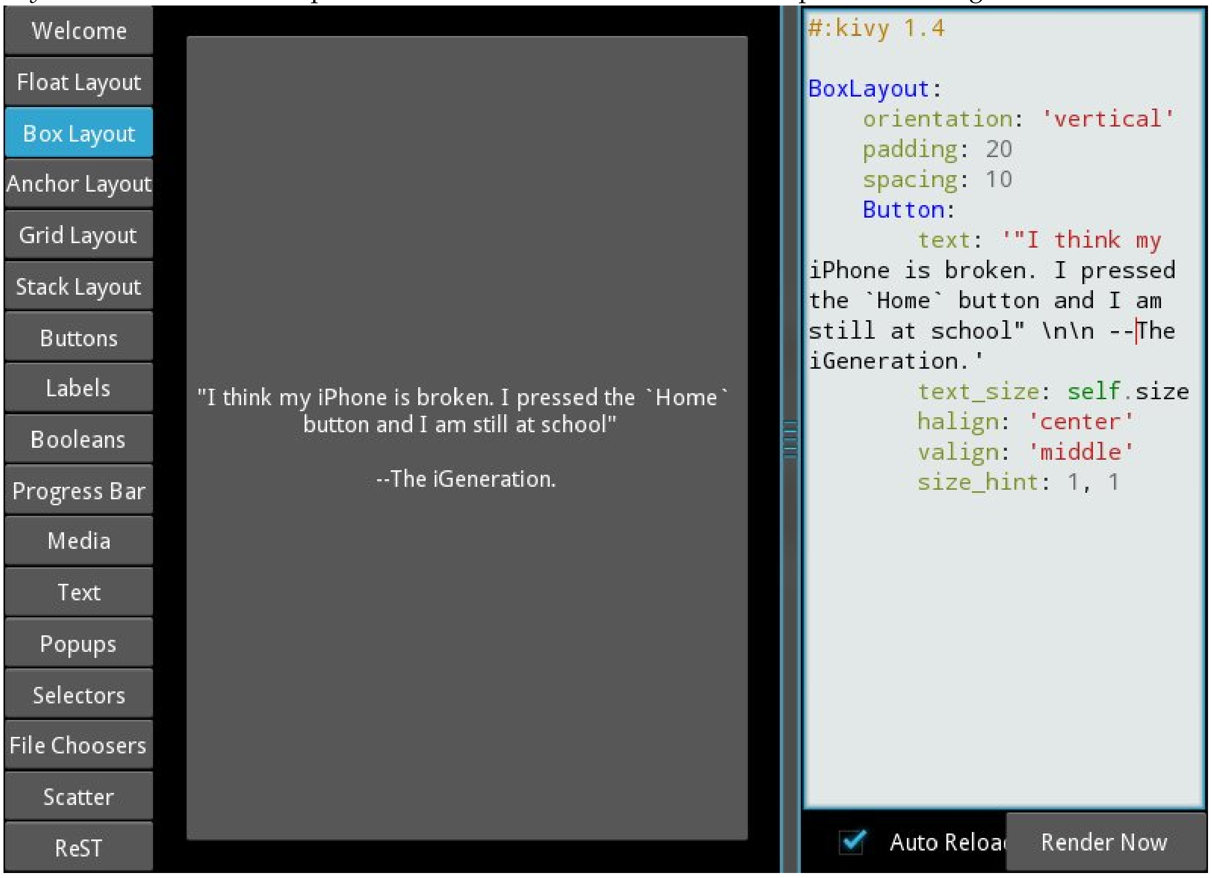
Consider the following example:

```
BoxLayout:
    Button:
        text: 'Button 1'
        # default size_hint is 1, 1, we don't need to specify it explicitly
        # however it's provided here to make things clear
        size_hint: 1, 1
```

load kivy catalog:

```
cd $KIVYDIR/examples/demo/kivycatalog
python main.py
```

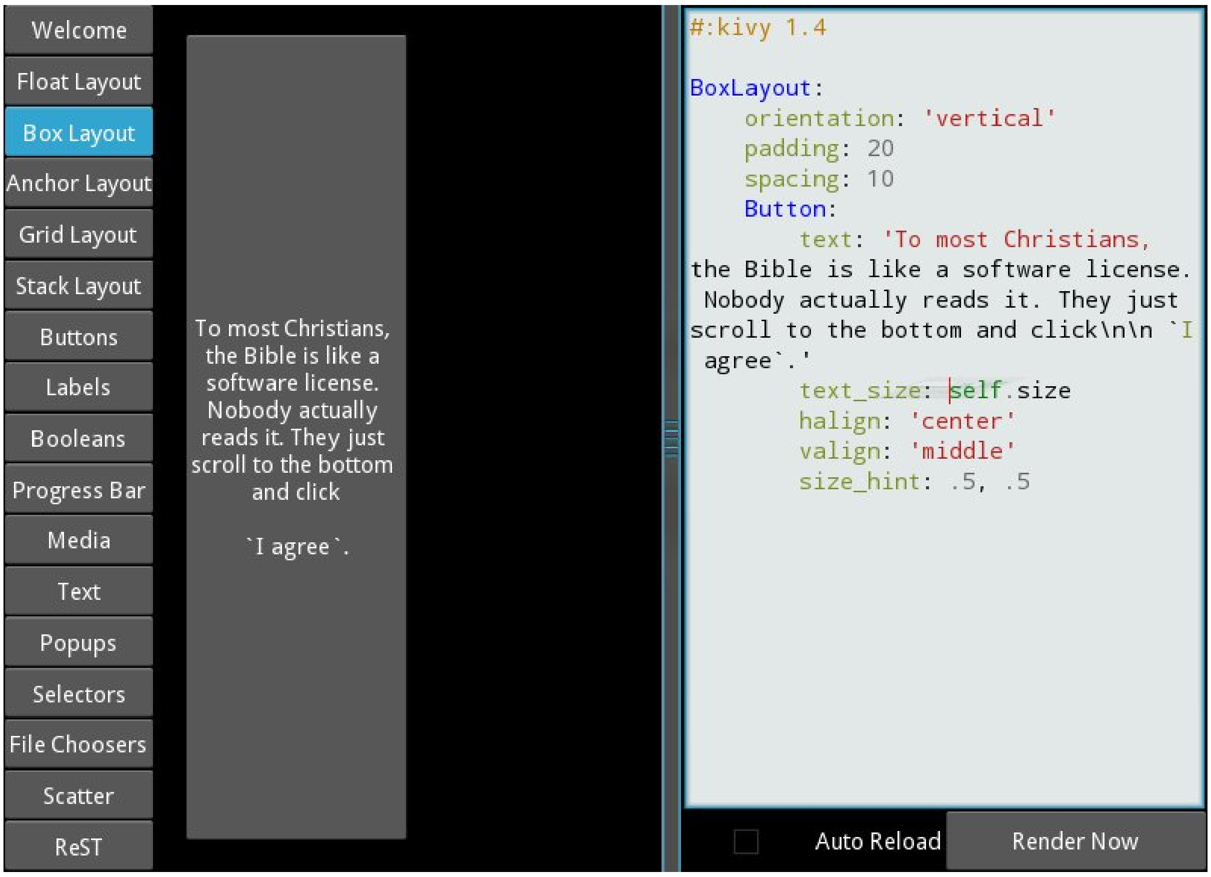
Replace $KIVYDIR with the directory of your installation of Kivy. Click on the button labeled *Box Layout* from the left. Now paste the code from above into the editor panel on the right.



```
#:kivy 1.4

BoxLayout:
    orientation: 'vertical'
    padding: 20
    spacing: 10
    Button:
        text: '"I think my
iPhone is broken. I pressed
the `Home` button and I am
still at school" \n\n --The
iGeneration.'
        text_size: self.size
        halign: 'center'
        valign: 'middle'
        size_hint: 1, 1
```

As you can see from the image above, the *Button* takes up 100% of the layout `size`.

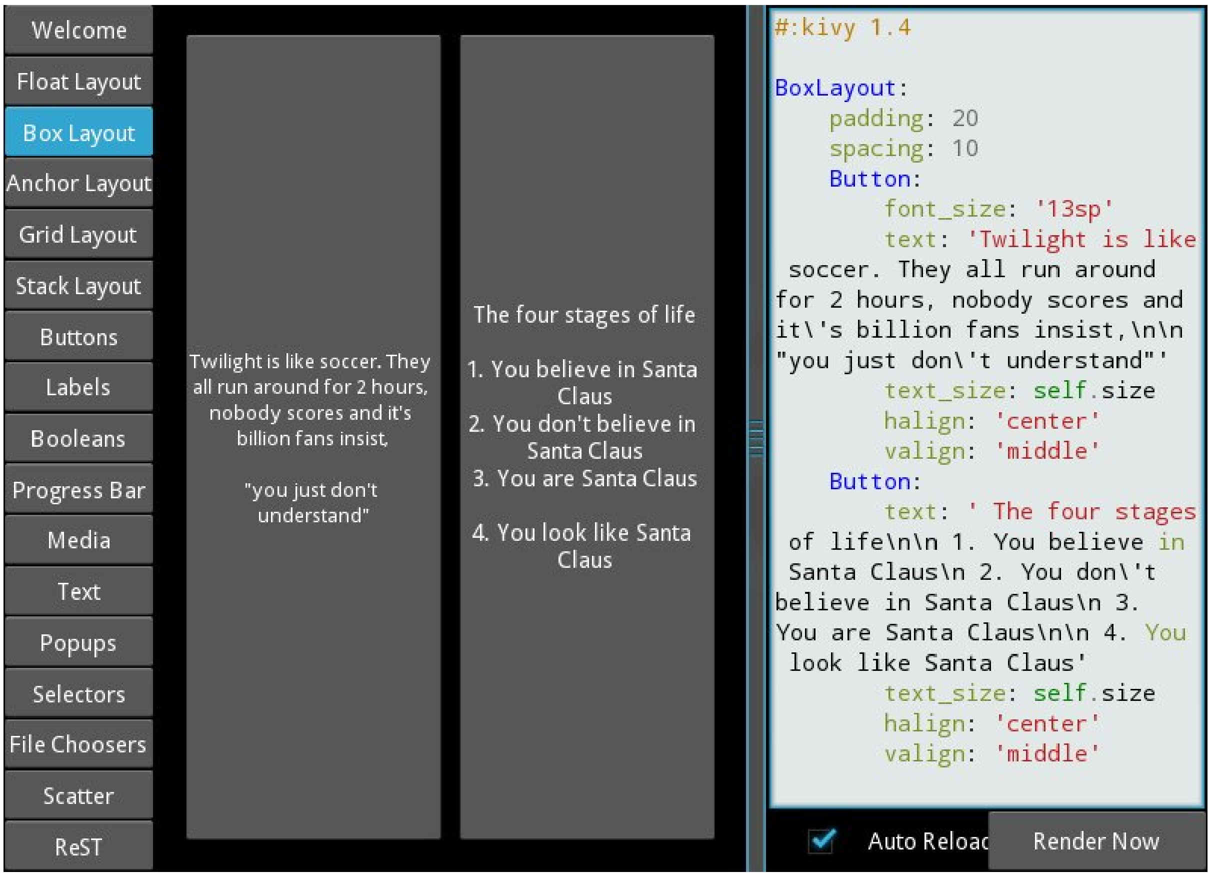
Changing the `size_hint_x`/`size_hint_y` to .5 will make the `Widget` take 50% of the `layout` `width`/`height`.



```
#:kivy 1.4

BoxLayout:
    orientation: 'vertical'
    padding: 20
    spacing: 10
    Button:
        text: 'To most Christians,
the Bible is like a software license.
 Nobody actually reads it. They just
scroll to the bottom and click\n\n `I
 agree`.'
        text_size: self.size
        halign: 'center'
        valign: 'middle'
        size_hint: .5, .5
```

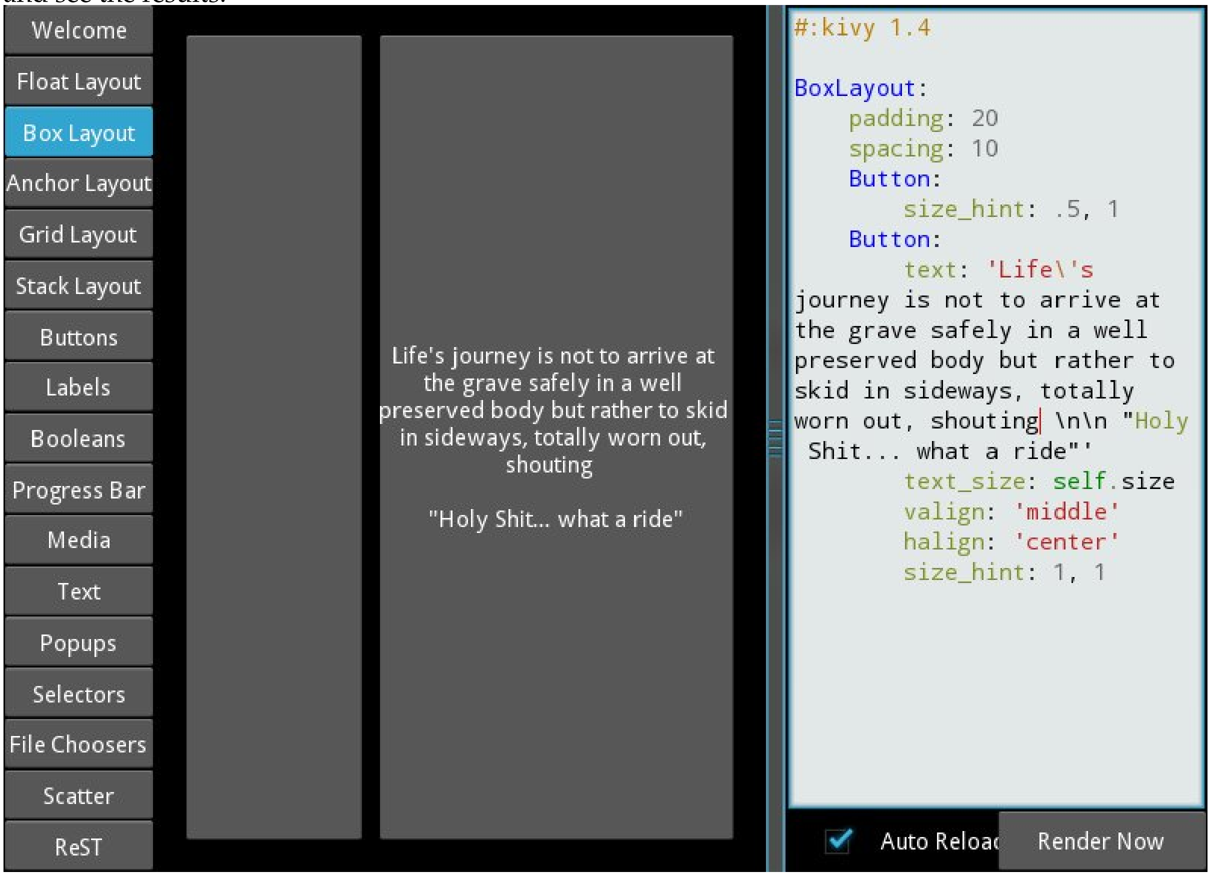
You can see here that, although we specify `size_hint_x` and `size_hint_y` both to be .5, only `size_hint_x` seems to be honored. That is because `boxlayout` controls the `size_hint_y` when `orientation` is *vertical* and `size_hint_x` when `orientation` is 'horizontal'. The controlled dimension's size is calculated depending upon the total no. of `children` in the `boxlayout`. In this example, one child has `size_hint_y` controlled (.5/.5 = 1). Thus, the widget takes 100% of the parent layout's height.

Let's add another `Button` to the `layout` and see what happens.


Welcome
Float Layout
Box Layout
Anchor Layout
Grid Layout
Stack Layout
Buttons
Labels
Booleans
Progress Bar
Media
Text
Popups
Selectors
File Choosers
Scatter
ReST
Twilight is like soccer. They all run around for 2 hours, nobody scores and it's billion fans insist,
"you just don't understand"
The four stages of life
1. You believe in Santa Claus
2. You don't believe in Santa Claus
3. You are Santa Claus
4. You look like Santa Claus
Auto Reload
Render Now

```
#:kivy 1.4

BoxLayout:
    padding: 20
    spacing: 10
    Button:
        font_size: '13sp'
        text: 'Twilight is like
 soccer. They all run around
for 2 hours, nobody scores and
it\'s billion fans insist,\n\n
"you just don\'t understand"'
        text_size: self.size
        halign: 'center'
        valign: 'middle'
    Button:
        text: ' The four stages
 of life\n\n 1. You believe in
 Santa Claus\n 2. You don\'t
believe in Santa Claus\n 3.
You are Santa Claus\n\n 4. You
 look like Santa Claus'
        text_size: self.size
        halign: 'center'
        valign: 'middle'
```

boxlayout by its very nature divides the available space between its children equally. In our example, the proportion is 50-50, because we have two children. Let's use size_hint on one of the children and see the results.



```
#:kivy 1.4

BoxLayout:
    padding: 20
    spacing: 10
    Button:
        size_hint: .5, 1
    Button:
        text: 'Life\'s
journey is not to arrive at
the grave safely in a well
preserved body but rather to
skid in sideways, totally
worn out, shouting \n\n "Holy
 Shit... what a ride"'
        text_size: self.size
        valign: 'middle'
        halign: 'center'
        size_hint: 1, 1
```

If a child specifies size_hint, this specifies how much space the Widget will take out of the size given to it by the boxlayout. In our example, the first Button specifies .5 for size_hint_x. The space for the widget is calculated like so:

```
first child's size_hint devided by
first child's size_hint + second child's size_hint + ...n(no of children)

.5/(.5+1) = .333...
```

The rest of the BoxLayout's width is divided among the rest of the children. In our example, this means the second Button takes up 66.66% of the layout width.

Experiment with size_hint to get comfortable with it.

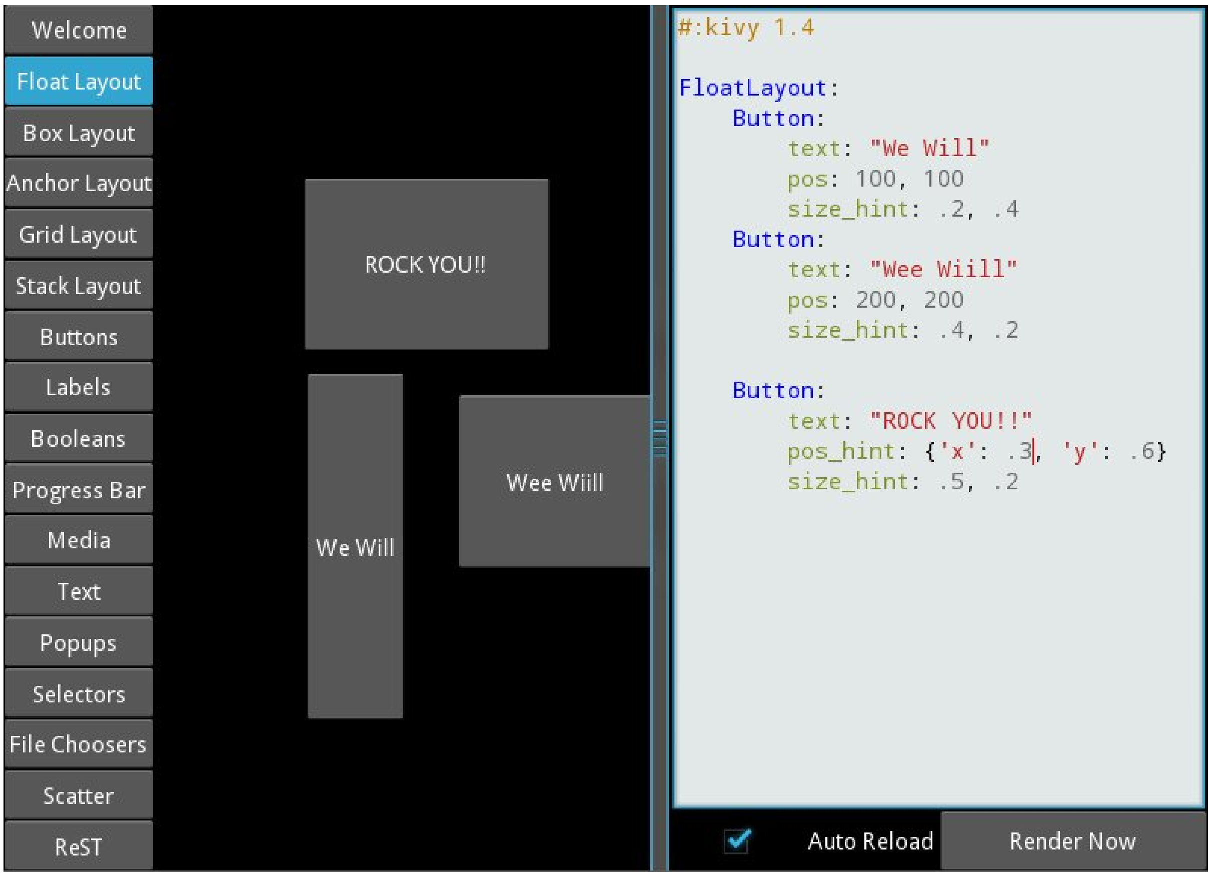
If you want to control the absolute size of a Widget, you can set size_hint_x/size_hint_y or both to *None* so that the widget's width and or height attributes will be honored.

pos_hint is a dict, which defaults to empty. As for size_hint, layouts honor pos_hint differently, but generally you can add values to any of the pos attributes (x, y, left, top, center_x, center_y) to have the Widget positioned relative to its parent.

Let's experiment with the following code in kivycatalog to understand pos_hint visually:

```
FloatLayout:
    Button:
        text: "We Will"
        pos: 100, 100
        size_hint: .2, .4
    Button:
        text: "Wee Wiill"
        pos: 200, 200
        size_hint: .4, .2

    Button:
        text: "ROCK YOU!!"
        pos_hint: {'x': .3, 'y': .6}
        size_hint: .5, .2
```

This gives us:



```
#:kivy 1.4

FloatLayout:
    Button:
        text: "We Will"
        pos: 100, 100
        size_hint: .2, .4
    Button:
        text: "Wee Wiill"
        pos: 200, 200
        size_hint: .4, .2

    Button:
        text: "ROCK YOU!!"
        pos_hint: {'x': .3, 'y': .6}
        size_hint: .5, .2
```

As with `size_hint`, you should experiment with `pos_hint` to understand the effect it has on the widget positions.

12.6 Adding a Background to a Layout

One of the frequently asked questions about layouts is::

```
"How to add a background image/color/video/... to a Layout"
```

Layouts by their nature have no visual representation: they have no canvas instructions by default. However you can add canvas instructions to a layout instance easily, as with adding a colored background:

In Python:

```
from kivy.graphics import Color, Rectangle

with layout_instance.canvas.before:
    Color(0, 1, 0, 1) # green; colors range from 0-1 instead of 0-255
    self.rect = Rectangle(size=layout_instance.size,
                          pos=layout_instance.pos)
```

Unfortunately, this will only draw a rectangle at the layout's initial position and size. To make sure the rect is drawn inside the layout, when the layout size/pos changes, we need to listen to any changes and update the rectangles size and pos. We can do that as follows:

```
with layout_instance.canvas.before:
    Color(0, 1, 0, 1) # green; colors range from 0-1 instead of 0-255
    self.rect = Rectangle(size=layout_instance.size,
                          pos=layout_instance.pos)
```

```
def update_rect(instance, value):
    instance.rect.pos = instance.pos
    instance.rect.size = instance.size

# listen to size and position changes
layout_instance.bind(pos=update_rect, size=update_rect)
```

In kv:

```
FloatLayout:
    canvas.before:
        Color:
            rgba: 0, 1, 0, 1
        Rectangle:
            # self here refers to the widget i.e BoxLayout
            pos: self.pos
            size: self.size
```

The kv declaration sets an implicit binding: the last two kv lines ensure that the `pos` and `size` values of the rectangle will update when the `pos` of the `floatlayout` changes.

Now we put the snippets above into the shell of Kivy App.

Pure Python way:

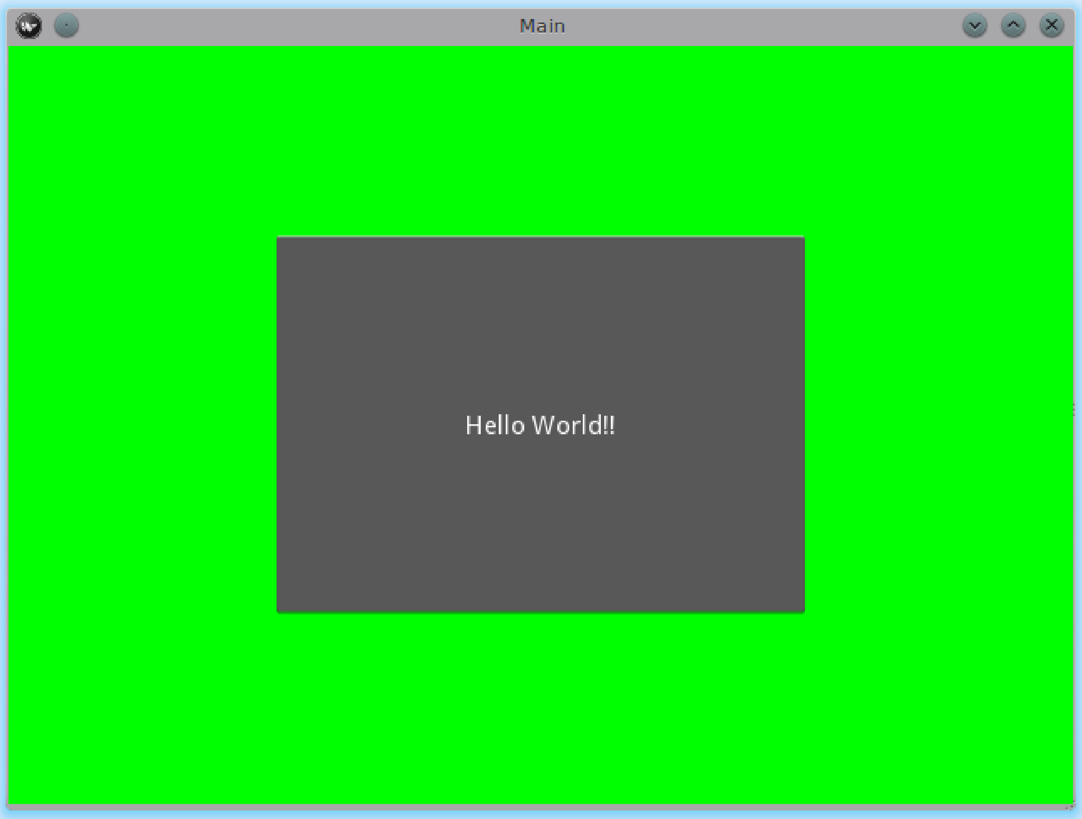
```
from kivy.app import App
from kivy.graphics import Color, Rectangle
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.button import Button


class RootWidget(FloatLayout):

    def __init__(self, **kwargs):
        # make sure we aren't overriding any important functionality
        super(RootWidget, self).__init__(**kwargs)

        # let's add a Widget to this layout
        self.add_widget(
            Button(
                text="Hello World",
                size_hint=(.5, .5),
                pos_hint={'center_x': .5, 'center_y': .5}))


class MainApp(App):

    def build(self):
        self.root = root = RootWidget()
        root.bind(size=self._update_rect, pos=self._update_rect)

        with root.canvas.before:
            Color(0, 1, 0, 1)  # green; colors range from 0-1 not 0-255
            self.rect = Rectangle(size=root.size, pos=root.pos)
        return root

    def _update_rect(self, instance, value):
        self.rect.pos = instance.pos
        self.rect.size = instance.size
```

```
if __name__ == '__main__':
    MainApp().run()
```

Using the kv Language:

```
from kivy.app import App
from kivy.lang import Builder


root = Builder.load_string('''
FloatLayout:
    canvas.before:
        Color:
            rgba: 0, 1, 0, 1
        Rectangle:
            # self here refers to the widget i.e FloatLayout
            pos: self.pos
            size: self.size
    Button:
        text: 'Hello World!!'
        size_hint: .5, .5
        pos_hint: {'center_x':.5, 'center_y': .5}
''')

class MainApp(App):

    def build(self):
        return root

if __name__ == '__main__':
    MainApp().run()
```

Both of the Apps should look something like this:



To add a color to the background of a **custom layouts rule/class **

The way we add background to the layout's instance can quickly become cumbersome if we need to use multiple layouts. To help with this, you can subclass the Layout and create your own layout that adds a background.

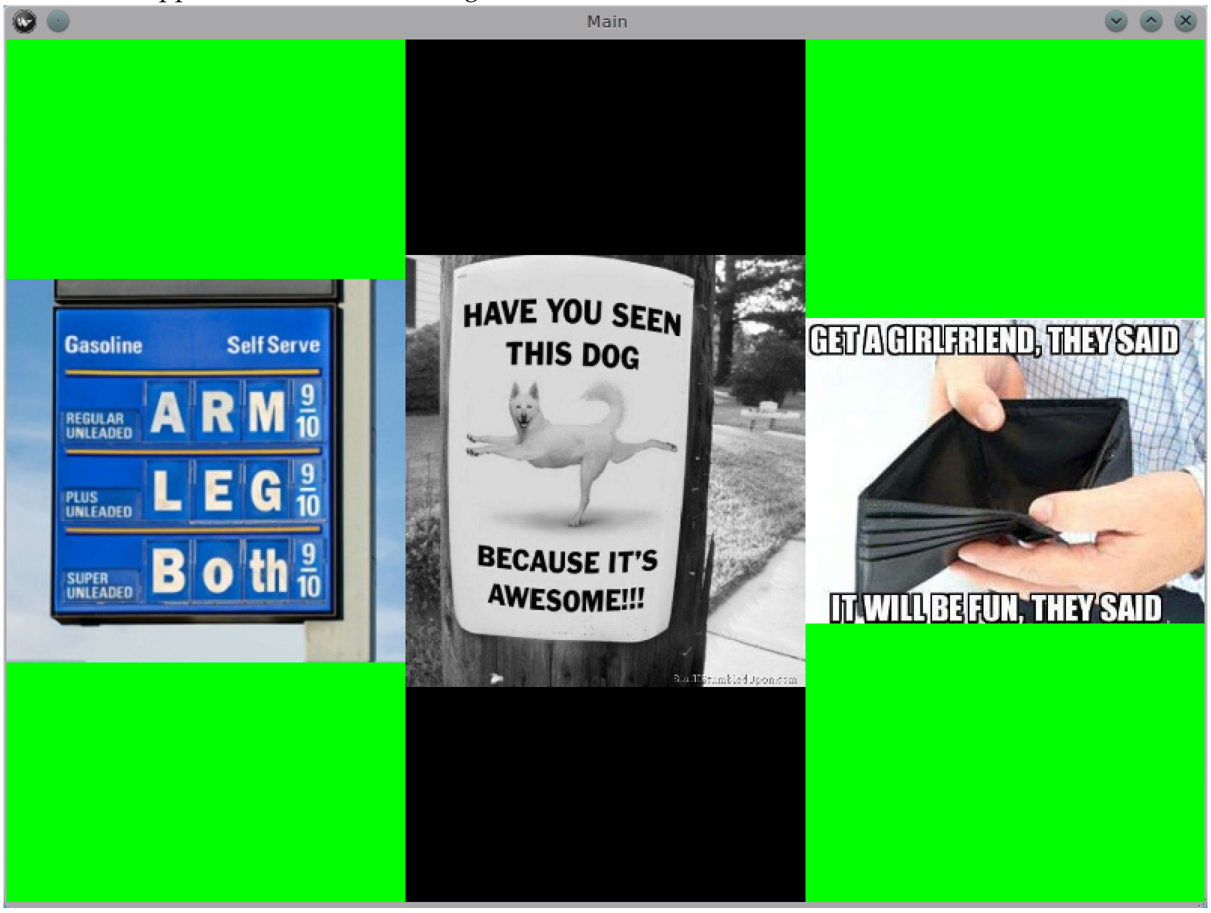
Using Python:

```
from kivy.app import App
from kivy.graphics import Color, Rectangle
from kivy.uix.boxlayout import BoxLayout
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.image import AsyncImage


class RootWidget(BoxLayout):
    pass


class CustomLayout(FloatLayout):

    def __init__(self, **kwargs):
        # make sure we aren't overriding any important functionality
        super(CustomLayout, self).__init__(**kwargs)

        with self.canvas.before:
            Color(0, 1, 0, 1)  # green; colors range from 0-1 instead of 0-255
            self.rect = Rectangle(size=self.size, pos=self.pos)

        self.bind(size=self._update_rect, pos=self._update_rect)
    def _update_rect(self, instance, value):
        self.rect.pos = instance.pos
        self.rect.size = instance.size


class MainApp(App):

    def build(self):
        root = RootWidget()
        c = CustomLayout()
        root.add_widget(c)
        c.add_widget(
            AsyncImage(
                source="http://www.everythingzoomer.com/wp-content/uploads/2013/01/Monday-joke-28
                size_hint= (1, .5),
                pos_hint={'center_x':.5, 'center_y':.5}))
        root.add_widget(AsyncImage(source='http://www.stuffistumbledupon.com/wp-content/uploads/2
        c = CustomLayout()
        c.add_widget(
            AsyncImage(
                source="http://www.stuffistumbledupon.com/wp-content/uploads/2012/04/Get-a-Girlfr
                size_hint= (1, .5),
                pos_hint={'center_x':.5, 'center_y':.5}))
        root.add_widget(c)
        return root

if __name__ == '__main__':
    MainApp().run()
```

Using the kv Language:

```
from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.boxlayout import BoxLayout
from kivy.lang import Builder


Builder.load_string('''
<CustomLayout>
    canvas.before:
        Color:
            rgba: 0, 1, 0, 1
        Rectangle:
            pos: self.pos
            size: self.size

<RootWidget>
    CustomLayout:
        AsyncImage:
            source: 'http://www.everythingzoomer.com/wp-content/uploads/2013/01/Monday-joke-289x2
            size_hint: 1, .5
            pos_hint: {'center_x':.5, 'center_y': .5}
    AsyncImage:
        source: 'http://www.stuffistumbledupon.com/wp-content/uploads/2012/05/Have-you-seen-this-
    CustomLayout
        AsyncImage:
            source: 'http://www.stuffistumbledupon.com/wp-content/uploads/2012/04/Get-a-Girlfrien
            size_hint: 1, .5
            pos_hint: {'center_x':.5, 'center_y': .5}
''')

class RootWidget(BoxLayout):
    pass

class CustomLayout(FloatLayout):
    pass

class MainApp(App):

    def build(self):
        return RootWidget()

if __name__ == '__main__':
    MainApp().run()
```

Both of the Apps should look something like this:



Defining the background in the custom layout class, assures that it will be used in every instance of CustomLayout.

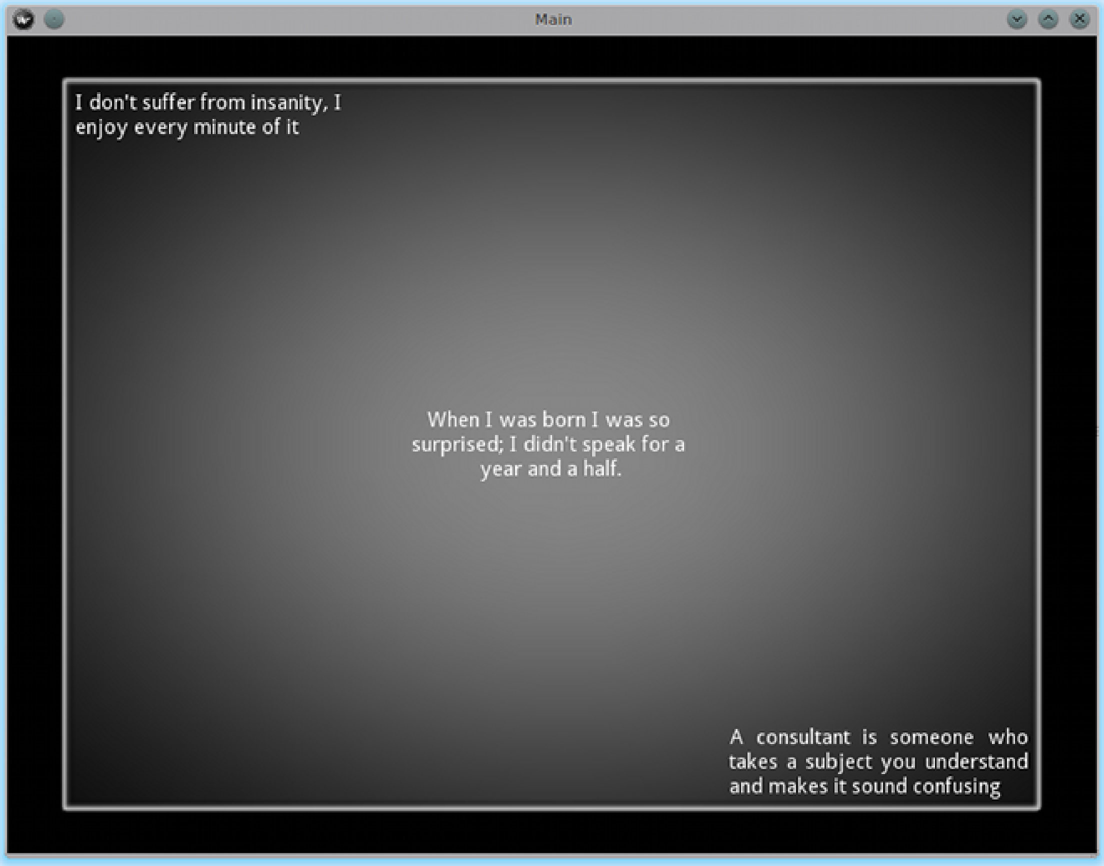
Now, to add an image or color to the background of a built-in Kivy layout, **globally**, we need to override the kv rule for the layout in question. Consider GridLayout:

```
<GridLayout>
    canvas.before:
        Color:
            rgba: 0, 1, 0, 1
        BorderImage:
            source: '../examples/widgets/sequenced_images/data/images/button_white.png'
            pos: self.pos
            size: self.size
```

Then, when we put this snippet into a Kivy app:

```
from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.lang import Builder


Builder.load_string('''
<GridLayout>
    canvas.before:
        BorderImage:
            # BorderImage behaves like the CSS BorderImage
            border: 10, 10, 10, 10
            source: '../examples/widgets/sequenced_images/data/images/button_white.png'
            pos: self.pos
            size: self.size

<RootWidget>
    GridLayout:
        size_hint: .9, .9
        pos_hint: {'center_x': .5, 'center_y': .5}
        rows:1
        Label:
            text: "I don't suffer from insanity, I enjoy every minute of it"
            text_size: self.width-20, self.height-20
            valign: 'top'
        Label:
            text: "When I was born I was so surprised; I didn't speak for a year and a half."
            text_size: self.width-20, self.height-20
            valign: 'middle'
            halign: 'center'
        Label:
            text: "A consultant is someone who takes a subject you understand and makes it sound
            text_size: self.width-20, self.height-20
            valign: 'bottom'
            halign: 'justify'
''')

class RootWidget(FloatLayout):
    pass


class MainApp(App):

    def build(self):
        return RootWidget()

if __name__ == '__main__':
    MainApp().run()
```

The result should look something like this:



I don't suffer from insanity, I enjoy every minute of it

When I was born I was so surprised; I didn't speak for a year and a half.

A consultant is someone who takes a subject you understand and makes it sound confusing

As we are overriding the rule of the class GridLayout, any use of this class in our app will display that image.

How about an **Animated background**?

You can set the drawing instructions like Rectangle/BorderImage/Ellipse/... to use a particular texture:

```
Rectangle:
    texture: reference to a texture
```

We use this to display an animated background:

```
from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.gridlayout import GridLayout
from kivy.uix.image import Image
from kivy.properties import ObjectProperty
from kivy.lang import Builder


Builder.load_string('''
<CustomLayout>
    canvas.before:
        BorderImage:
            # BorderImage behaves like the CSS BorderImage
            border: 10, 10, 10, 10
            texture: self.background_image.texture
            pos: self.pos
            size: self.size
<RootWidget>
    CustomLayout:
        size_hint: .9, .9
        pos_hint: {'center_x': .5, 'center_y': .5}
        rows:1
        Label:
            text: "I don't suffer from insanity, I enjoy every minute of it"
            text_size: self.width-20, self.height-20
            valign: 'top'
        Label:
            text: "When I was born I was so surprised; I didn't speak for a year and a half."
            text_size: self.width-20, self.height-20
            valign: 'middle'
            halign: 'center'
        Label:
            text: "A consultant is someone who takes a subject you understand and makes it sound
            text_size: self.width-20, self.height-20
            valign: 'bottom'
            halign: 'justify'
''')


class CustomLayout(GridLayout):

    background_image = ObjectProperty(
        Image(
            source='../examples/widgets/sequenced_images/data/images/button_white_animated.zip',
            anim_delay=.1))


class RootWidget(FloatLayout):
    pass


class MainApp(App):

    def build(self):
        return RootWidget()

if __name__ == '__main__':
    MainApp().run()
```

To try to understand what is happening here, start from line 13:

```
texture: self.background_image.texture
```

This specifies that the *texture* property of *BorderImage* will be updated whenever the *texture* property of *background_inage* updates. We define the background_image property at line 40:

```
background_image = ObjectProperty(...
```

This sets up *background_image* as an `ObjectProperty` in which we add an `Image` widget. An image widget has a *texture* property; where you see *self.background_image.texture*, this sets a reference, *texture*, to this property. The `Image` widget supports animation: the texture of the image is updated whenever the animation changes, and the texture of BorderImage instruction is updated in the process.

You can also just blit custom data to the texture. For details, look at the documention of `Texture`.

12.7 Nesting Layouts

Yes! It is quite fun to see how extensible the process can be.

12.8 Size and position metrics

Kivy's default unit for length is the pixel, all sizes and positions are expressed in it by default. You can express them in other units, which is useful to achieve better consistency across devices (they get converted to the size in pixels automatically).

Available units are `pt`, `mm`, `cm`, `inch`, `dp` and `sp`. You can learn about their usage in the `metrics` documentation.

You can also experiment with the `screen` usage to simulate various devices screens for your application.

12.9 Screen Separation with Screen Manager

If your application is composed of various screens, you likely want an easy way to navigate from one `Screen` to another. Fortunately, there is the `ScreenManager` class, that allows you to define screens separately, and to set the `TransitionBase` from one to another.

CHAPTER

THIRTEEN

GRAPHICS

13.1 Introduction to Canvas

Widgets graphical representation is done using a canvas, which you can see both as an unlimited drawing board, and as a set of drawing instructions, there are numerous different instructions you can apply (add) to your canvas, but there is two main kind of them:

- `context instructions`
- `vertex instructions`

Context instructions don't draw anything, but they change the results of the vertex instructions.

Canvasses can contain two subsets of instructions. They are the `canvas.before` and the `canvas.after` instruction groups. The instructions in these groups will be executed before and after the `canvas` group respectively. This means that they will appear under (be executed before) and above (be executed after) them. Those groups are not created until the user accesses them.

To add a canvas instruction to a widget, you use the canvas context:

```
class MyWidget(Widget):
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        with self.canvas:
            # add your instruction for main canvas here

        with self.canvas.before:
            # you can use this to add instructions rendered before

        with self.canvas.after:
            # you can use this to add instructions rendered after
```

13.2 Context instructions

Context instructions manipulate the opengl context, you can rotate, translate, and scale your canvas, attach a texture or change the drawing color, this one is the most commonly used, but others are really useful too:

```
with self.canvas.before:
    Color(1, 0, .4, mode='rgb')
```

13.3 Drawing instructions

Drawing instructions are ranging from very simple ones, to draw a line or a polygon, to more complex ones, like meshes or bezier curves:

```
with self.canvas:
   # draw a line using the default color
   Line(points=(x1, y1, x2, y2, x3, y3))

   # lets draw a semi-transparent red square
   Color(1, 0, 0, .5, mode='rgba')
   Rectangle(pos=self.pos, size=self.size)
```

13.4 Manipulating instructions

Sometime, you want to update or remove the instructions you added to a canvas, this can be done in various ways depending on your needs:

You can keep a reference to your instructions and update them:

```
class MyWidget(Widget):
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        with self.canvas:
            self.rect = Rectangle(pos=self.pos, size=self.size)

        self.bind(pos=self.update_rect)
        self.bind(size=self.update_rect)

    def update_rect(self, *args):
        self.rect.pos = self.pos
        self.rect.size = self.size
```

Or you can clean your canvas and start fresh:

```
class MyWidget(Widget):
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        self.draw_my_stuff()

        self.bind(pos=self.draw_my_stuff)
        self.bind(size=self.draw_my_stuff)

    def draw_my_stuff(self):
        self.canvas.clear()

        with self.canvas:
            self.rect = Rectangle(pos=self.pos, size=self.size)
```

Note that updating the instructions is considered the best practise as it involves less overhead and avoids creating new instructions.

CHAPTER

FOURTEEN

KV LANGUAGE

14.1 Concept behind the language

As your application grow more complex, it's common that the construction of widget trees and explicit declaration of bindings, becomes verbose and hard to maintain. The *KV* Language is a attempt to overcome these short-comings.

The *KV* language (sometimes called kvlang, or kivy language), allows you to create your widget tree in a declarative way and to bind widget properties to each other or to callbacks in a natural manner. It allows for very fast prototyping and agile changes to your UI. It also facilitates a good separation between the logic of your application and it's User Interface.

14.2 How to load KV

There are two ways to load Kv code into your application:

- By name convention:

  Kivy looks for a Kv file with the same name as your App class in lowercase, minus "App" if it ends with 'App'. E.g:

```
MyApp -> my.kv.
```

  If this file defines a *Root Widget* it will be attached to the App's *root* attribute and used as the base of the application widget tree.

- `Builder`: You can tell Kivy to directly load a string or a file. If this string or file defines a root widget, it will be returned by the method:

```
Builder.load_file('path/to/file.kv')
```

  or:

```
Builder.load_string(kv_string)
```

14.3 Rule context

A Kv source constitutes of *rules*, which are used to describe the content of a Widget, you can have one *root* rule, and any number of *class* or *template* rules.

The *root* rule is declared by declaring the class of your root widget, without any indentation, followed by *:* and will be set as the *root* attribute of the App instance:

```
Widget:
```

A *class* rule, declared by the name of a widget class between < > and followed by :, defines how any instance of that class will be graphically represented:

```
<MyWidget>:
```

Rules use indentation for delimitation, as python, indentation should be of four spaces per level, like the python good practice recommendations.

There are three keywords specific to Kv language:

- *app*: always refers to the instance of your application.
- *root*: refers to the base widget/template in the current rule
- *self*: always refer to the current widget

14.4 Special syntaxes

There are two special syntax to define values for the whole Kv context:

To import something from python:

```
#:import name x.y.z
```

Is equivalent to:

```
from x.y import z as name
```

in python.

To set a global value:

```
#:set name value
```

Is equivalent to:

```
name = value
```

in python.

14.5 Instantiate children

To declare the widget has a child widget, instance of some class, just declare this child inside the rule:

```
MyRootWidget:
    BoxLayout:
        Button:
        Button:
```

The example above defines that our root widget, an instance of *MyRootWidget*, which has a child that is an instance of the `BoxLayout`. That BoxLayout further has two children, instances of the `Button` class.

A python equivalent of this code could be:

```
root = MyRootWidget()
box = BoxLayout()
box.add_widget(Button())
box.add_widget(Button())
root.add_widget(box)
```

Which you may find less nice, both to read and to write.

Of course, in python, you can pass keyword arguments to your widgets at creation to specify their behaviour. For example, to set the number of columns of a `gridlayout`, we would do:

```
grid = GridLayout(cols=3)
```

To do the same thing in kv, you can set properties of the child widget directly in the rule:

```
GridLayout:
    cols: 3
```

The value is evaluated as a python expression, and all the properties used in the expression will be observed, that means that if you had something like this in python (this assume *self* is a widget with a *data* `ListProperty`):

```
grid = GridLayout(cols=len(self.data))
self.bind(data=grid.setter('cols'))
```

To have your display updated when your data change, you can now have just:

```
GridLayout:
    cols: len(root.data)
```

14.6 Event Bindings

You can bind to events in Kv using the ":" syntax, that is, associating a callback to an event:

```
Widget:
    on_size: my_callback()
```

You can pass the values dispatched by the signal using the *args* keyword:

```
TextInput:
    on_text: app.search(args[1])
```

More complex expressions can be used, like:

```
pos: self.center_x - self.texture_size[0] / 2., self.center_y - self.texture_size[1] / 2.
```

This expression listens for a change in `center_x`, `center_y`, and `texture_size`. If one of them changes, the expression will be re-evaluated to update the `pos` field.

You can also handle `on_` events inside your kv language. For example the TextInput class has a `focus` property whose auto-generated `on_focus` event can be accessed inside the kv language like so:

```
TextInput:
    on_focus: print(args)
```

14.7 Extend canvas

Kv lang can be used to define the canvas instructions of your widget like this:

```
MyWidget:
    canvas:
        Color:
            rgba: 1, .3, .8, .5
        Line:
            points: zip(self.data.x, self.data.y)
```

And they get updated when properties values change.

Of course you can use *canvas.before* and *canvas.after*.

14.8 Referencing Widgets

In a widget tree there is often a need to access/reference other widgets. Kv Language provides a way to do this using id's. Think of them as class level variables that can only be used in the Kv language. Consider the following:

```
<MyFirstWidget>:
    Button:
        id: f_but
    TextInput:
        text: f_but.state

<MySecondWidget>:
    Button:
        id: s_but
    TextInput:
        text: s_but.state
```

An `id` is limited in scope to the rule it is declared in, so in the code above `s_but` can not be accessed outside the <MySecondWidget> rule.

An `id` is a `weakref` to the widget and not the widget itself. As a consequence, storing the `id` is not sufficient to keep the widget from being garbage collected. To demonstrate:

```
<MyWidget>:
    label_widget: label_widget
    Button:
        text: 'Add Button'
        on_press: root.add_widget(label_widget)
    Button:
        text: 'Remove Button'
        on_press: root.remove_widget(label_widget)
    Label:
        id: label_widget
        text: 'widget'
```

Although a reference to `label_widget` is stored in `MyWidget`, it is not sufficient to keep the object alive once other references have been removed because it's only a weakref. Therefore, after the remove button is clicked (which removes any direct reference to the widget) and the window is resized (which calls the garbage collector resulting in the deletion of `label_widget`), when the add button is clicked to add the widget back, a `ReferenceError: weakly-referenced object no longer exists` will be thrown.

To keep the widget alive, a direct reference to the `label_widget` widget must be kept. This is achieved using `id.__self__` or `label_widget.__self__` in this case. The correct way to do this would be:

```
<MyWidget>:
    label_widget: label_widget.__self__
```

14.9 Accessing Widgets defined inside Kv lang in your python code

Consider the code below in my.kv:

```
<MyFirstWidget>:
    # both these variables can be the same name and this doesn’t lead to
    # an issue with uniqueness as the id is only accessible in kv.
    txt_inpt: txt_inpt
    Button:
        id: f_but
    TextInput:
        id: txt_inpt
        text: f_but.state
        on_text: root.check_status(f_but)
```

In myapp.py:

```
...
class MyFirstWidget(BoxLayout):

    txt_inpt = ObjectProperty(None)

    def check_status(self, btn):
        print('button state is: {state}'.format(state=btn.state))
        print('text input text is: {txt}'.format(txt=self.txt_inpt))
...
```

txt_inpt is defined as a `ObjectProperty` initialized to *None* inside the Class.:

```
txt_inpt = ObjectProperty(None)
```

At this point self.txt_inpt is *None*. In Kv lang this property is updated to hold the instance of the `TextInput` referenced by the id *txt_inpt*.:

```
txt_inpt: txt_inpt
```

From this point onwards, *self.txt_inpt* holds a reference to the widget identified by the id *txt_input* and can be used anywhere in the class, as in the function *check_status*. In contrast to this method you could also just pass the *id* to the function that needs to use it, like in case of *f_but* in the code above.

There is a simpler way to access the ids as defined in the kv language for example:

```
<Marvel>
  Label:
    id: loki
    text: 'loki: I AM YOUR GOD!'
  Button:
    id: hulk
    text: "press to smash loki"
    on_release: root.hulk_smash()
```

In your python code:

```
class Marvel(BoxLayout):

    def hulk_smash(self):
        self.ids.hulk.text = "hulk: puny god!"
        self.ids.loki.text = "loki: >_<!!!"
```

When your kv file is parsed, kivy collects all the widgets tagged with id’s and places them in this *self.ids* dictionary type property. That means you can also iterate over these widgets and access them dictionary style:

```
for key, val in self.ids.items():
    print("key={0}, val={1}".format(key, val))
```

14.10 Dynamic Classes

Consider the code below:

```
<MyWidget>:
    Button:
        text: "Hello world, watch this text wrap inside the button"
        text_size: self.size
        font_size: '25sp'
        markup: True
    Button:
        text: "Even absolute is relative to itself"
        text_size: self.size
        font_size: '25sp'
        markup: True
    Button:
        text: "Repeating the same thing over and over in a comp = fail"
        text_size: self.size
        font_size: '25sp'
        markup: True
    Button:
```

Instead of having to repeat the same values for every button, we can just use a template instead, like so:

```
<MyBigButt@Button>:
    text_size: self.size
    font_size: '25sp'
    markup: True

<MyWidget>:
    MyBigButt:
        text: "Hello world, watch this text wrap inside the button"
    MyBigButt:
        text: "Even absolute is relative to itself"
    MyBigButt:
        text: "repeating the same thing over and over in a comp = fail"
    MyBigButt:
```

This class, created just by the declaration of this rule, inherits from the Button class and allows us to change default values and create bindings for all its instances without adding any new code on the Python side.

14.11 Re-using styles in multiple widgets

Consider the code below in my.kv:

```
<MyFirstWidget>:
    Button:
        on_press: self.text(txt_inpt.text)
    TextInput:
        id: txt_inpt

<MySecondWidget>:
    Button:
        on_press: self.text(txt_inpt.text)
    TextInput:
        id: txt_inpt
```

In myapp.py:

```
class MyFirstWidget(BoxLayout):

    def text(self, val):
        print('text input text is: {txt}'.format(txt=val))

class MySecondWidget(BoxLayout):

    writing = StringProperty('')

    def text(self, val):
        self.writing = val
```

Because both classes share the same .kv style, this design can be simplified if we reuse the style for both widgets. You can do this in .kv as follows. In my.kv:

```
<MyFirstWidget,MySecondWidget>:
    Button:
        on_press: self.text(txt_inpt.text)
    TextInput:
        id: txt_inpt
```

By separating the class names with a comma, all the classes listed in the declaration will have the same kv properties.

14.12 Designing with the Kivy Language

One of aims of the Kivy language is to Separate the concerns of presentation and logic. The presentation (layout) side is addressed by your kv file and the logic by your py file.

14.12.1 The code goes in py files

Let's start with a little example. First, the Python file named *main.py*:

```
import kivy
kivy.require('1.0.5')

from kivy.uix.floatlayout import FloatLayout
from kivy.app import App
from kivy.properties import ObjectProperty, StringProperty


class Controller(FloatLayout):
    '''Create a controller that receives a custom widget from the kv lang file.

    Add an action to be called from the kv lang file.
    '''
    label_wid = ObjectProperty()
    info = StringProperty()

    def do_action(self):
        self.label_wid.text = 'My label after button press'
        self.info = 'New info text'


class ControllerApp(App):

    def build(self):
        return Controller(info='Hello world')

if __name__ == '__main__':
    ControllerApp().run()
```

In this example, we are creating a Controller class with 2 properties:

- `info` for receving some text
- `label_wid` for receving the label widget

In addition, we are creating a `do_action()` method that will use both of these properties. It will change the `info` text and change text in the `label_wid` widget.

14.12.2 The layout goes in controller.kv

Executing this application without a corresponding *.kv* file will work, but nothing will be shown on the screen. This is expected, because the `Controller` class has no widgets in it, it's just a `FloatLayout`. We can create the UI around the `Controller` class in a file named *controller.kv*, which will be loaded when we run the `ControllerApp`. How this is done and what files are loaded is described in the `kivy.app.App.load_kv()` method.

```
#:kivy 1.0

<Controller>:
    label_wid: my_custom_label

    BoxLayout:
        orientation: 'vertical'
        padding: 20

        Button:
            text: 'My controller info is: ' + root.info
            on_press: root.do_action()

        Label:
            id: my_custom_label
            text: 'My label before button press'
```

One label and one button in a vertical `BoxLayout`. Seems very simple. There are 3 things going on here:

1. Using data from the `Controller`. As soon as the `info` property is changed in the controller, the expression `text: 'My controller info is: ' + root.info` will automatically be re-evaluated, changing the text in the `Button`.
2. Giving data to the `Controller`. The expression `id: my_custom_label` is assigning the created `Label` the id of `my_custom_label`. Then, using `my_custom_label` in the expression `label_wid: my_custom_label` gives the instance of that `Label` widget to your `Controller`.
3. Creating a custom callback in the `Button` using the `Controller`'s `on_press` method.

- `root` and `self` are reserved keywords, useable anywhere. `root` represents the top widget in the rule and `self` represents the current widget.
- You can use any id declared in the rule the same as `root` and `self`. For example, you could do this in the `on_press()`:

```
Button:
    on_press: root.do_action(); my_custom_label.font_size = 18
```

And that's that. Now when we run *main.py*, *controller.kv* will be loaded so that the `Button` and `Label` will show up and respond to our touch events.

CHAPTER

FIFTEEN

INTEGRATING WITH OTHER FRAMEWORKS

New in version 1.0.8.

15.1 Using Twisted inside Kivy

Note: You can use the *kivy.support.install_twisted_reactor* function to install a twisted reactor that will run inside the kivy event loop.

Any arguments or keyword arguments passed to this function will be passed on the threadedselect reactors interleave function. These are the arguments one would usually pass to twisted's reactor.startRunning

Warning: Unlike the default twisted reactor, the installed reactor will not handle any signals unnless you set the 'installSignalHandlers' keyword argument to 1 explicitly. This is done to allow kivy to handle the signals as usual, unless you specifically want the twisted reactor to handle the signals (e.g. SIGINT).

The kivy examples include a small example of a twisted server and client. The server app has a simple twisted server running and logs any messages. The client app can send messages to the server and will print its message and the repsonse it got. The examples are based mostly on the simple Echo example from the twisted docs, which you can find here:

- http://twistedmatrix.com/documents/current/_downloads/simpleserv.py
- http://twistedmatrix.com/documents/current/_downloads/simpleclient.py

To try the example, run echo_server_app.py first, and then launch echo_client_app.py. The server will reply with simple echo messages to anything the client app sends when you hit enter after typing something in the textbox.

15.1.1 Server App

```
# install_twisted_rector must be called before importing  and using the reactor
from kivy.support import install_twisted_reactor
install_twisted_reactor()


from twisted.internet import reactor
from twisted.internet import protocol
```

```
class EchoProtocol(protocol.Protocol):
    def dataReceived(self, data):
        response = self.factory.app.handle_message(data)
        if response:
            self.transport.write(response)

class EchoFactory(protocol.Factory):
    protocol = EchoProtocol
    def __init__(self, app):
        self.app = app


from kivy.app import App
from kivy.uix.label import Label

class TwistedServerApp(App):
    def build(self):
        self.label = Label(text="server started\n")
        reactor.listenTCP(8000, EchoFactory(self))
        return self.label

    def handle_message(self, msg):
        self.label.text  = "received:  %s\n" % msg

        if msg == "ping":  msg =  "pong"
        if msg == "plop":  msg = "kivy rocks"
        self.label.text += "responded: %s\n" % msg
        return msg


if __name__ == '__main__':
    TwistedServerApp().run()
```

15.1.2 Client App

```
#install_twisted_rector must be called before importing the reactor
from kivy.support import install_twisted_reactor
install_twisted_reactor()


#A simple Client that send messages to the echo server
from twisted.internet import reactor, protocol

class EchoClient(protocol.Protocol):
    def connectionMade(self):
        self.factory.app.on_connection(self.transport)

    def dataReceived(self, data):
        self.factory.app.print_message(data)

class EchoFactory(protocol.ClientFactory):
    protocol = EchoClient
    def __init__(self, app):
        self.app = app

    def clientConnectionLost(self, conn, reason):
        self.app.print_message("connection lost")
    def clientConnectionFailed(self, conn, reason):
        self.app.print_message("connection failed")


from kivy.app import App
from kivy.uix.label import Label
from kivy.uix.textinput import TextInput
from kivy.uix.boxlayout import BoxLayout

# A simple kivy App, with a textbox to enter messages, and
# a large label to display all the messages received from
# the server
class TwistedClientApp(App):
    connection = None

    def build(self):
        root = self.setup_gui()
        self.connect_to_server()
        return root

    def setup_gui(self):
        self.textbox = TextInput(size_hint_y=.1, multiline=False)
        self.textbox.bind(on_text_validate=self.send_message)
        self.label = Label(text='connecting...\n')
        self.layout = BoxLayout(orientation='vertical')
        self.layout.add_widget(self.label)
        self.layout.add_widget(self.textbox)
        return self.layout

    def connect_to_server(self):
        reactor.connectTCP('localhost', 8000, EchoFactory(self))

    def on_connection(self, connection):
        self.print_message("connected succesfully!")
        self.connection = connection

    def send_message(self, *args):
        msg = self.textbox.text
        if msg and self.connection:
            self.connection.write(str(self.textbox.text))
            self.textbox.text = ""

    def print_message(self, msg):
        self.label.text += msg + "\n"


if __name__ == '__main__':
    TwistedClientApp().run()
```

CHAPTER

SIXTEEN

BEST PRACTICES

16.1 Designing your Application code

16.2 Handle Window re-sizing

16.3 Managing resources

- Atlas
- **Cache**
  - Images
  - Text

16.4 Platform consideration

16.5 Tips and Tricks

- Skinning
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- Kivy-Remote-Shell

CHAPTER

SEVENTEEN

ADVANCED GRAPHICS

CHAPTER

EIGHTEEN

PACKAGING YOUR APPLICATION

18.1 Create a package for Windows

Packaging your application for the Windows platform can only be done inside the Windows OS. The following process has been tested on Windows 7 and the portable package of Kivy.

The package will be either 32 or 64 bits depending on which version of Python you ran it with.

NOTE: Currently, packages for Windows can only be generated with Python 2.7. Python 3.3+ support is on the way...

18.1.1 Requirements

- Latest Kivy (the whole portable package, not only the github sourcecode)
- PyInstaller 2.1

18.1.2 Create the spec file

For this example, we'll package the touchtracer example and embed a custom icon. The touchtracer example is the *kivy\examples\demo\touchtracer* directory and the main file is named *main.py*.

1. Double click on the Kivy.bat and a console will open.
2. Go to the pyinstaller 2.1 directory and create the initial spec:

```
cd pyinstaller-2.1
python pyinstaller.py --name touchtracer ..\kivy\examples\demo\touchtracer\main.py
```

   You can also add an *icon.ico* file to the application folder in order to create an icon for the executable. If you don't have a .ico file available, you can convert your *icon.png* file to ico using the web app ConvertICO. Save the *icon.ico* in the touchtracer directory and type:

```
python pyinstaller.py --name touchtracer --icon ..\kivy\examples\demo\touchtracer\icon.ico .
```

   For more options, please consult the PyInstaller 2 Manual.

3. The spec file will be *touchtracer.spec* located in inside the pyinstaller + *touchtracer* directory. Now we need to edit the spec file to add kivy hooks to correctly build the exe. Open the spec file with your favorite editor and add theses lines at the beginning of the spec:

```
from kivy.tools.packaging.pyinstaller_hooks import install_hooks
install_hooks(globals())
```

In the *Analysis()* function, remove the *hookspath=None* parameter. If you don't do this, the kivy package hook will not be used at all.

Then you need to change the *COLLECT()* call to add the data for touchtracer (*touchtracer.kv*, *particle.png*, ...). Change the line to add a *Tree()* object. This Tree will search and add every file found in the touchtracer directory to your final package:

```
coll = COLLECT( exe, Tree('../kivy/examples/demo/touchtracer/'),
               a.binaries,
               #...
               )
```

4. We are done. Your spec is ready to be executed!

18.1.3 Build the spec

1. Double click on *Kivy.bat*
2. Go to the pyinstaller directory, and build the spec:

```
cd pyinstaller-2.1
python pyinstaller.py touchtracer\touchtracer.spec
```

3. The package will be in the *touchtracer**dist**touchtracer* directory.

18.1.4 Including Gstreamer

If you wish to use Gstreamer, you'll need to further modify the spec file.

1. Kivy does some magic when trying to find which version of gstreamer and its bindings are available. In order for pyinstaller to find the correct gstreamer modules, you have to import core.video in the spec file before doing anything:

```
from kivy.tools.packaging.pyinstaller_hooks import install_hooks
import kivy.core.video
```

2. You'll need to include the gstreamer directory, found in the kivy distribution, in the COLLECT call. You can specify the direct path, or get it from the environment. In addition, the contents of the gstreamer/bin directory need to be included in the top level directory, otherwise the build process may have trouble finding dlls (this will create a second copy of the contents of bin):

```
import os
gst_plugin_path = os.environ.get('GST_PLUGIN_PATH').split('lib')[0]
COLLECT(exe, Tree(...),
        Tree(gst_plugin_path),
        Tree(os.path.join(gst_plugin_path, 'bin')),
        ...)
```

Following is an example of how to bundle the videoplayer at *kivy/examples/widgets/videoplayer.py*. From kivy.bat:

```
cd pyinstaller-2.1
python pyinstaller.py --name gstvideo ..\kivy\examples\widgets\videoplayer.py
```

Now edit the spec file. At the top of the file add:

```
import os
from kivy.tools.packaging.pyinstaller_hooks import install_hooks
import kivy.core.video
```

```
install_hooks(globals())
gst_plugin_path = os.environ.get('GST_PLUGIN_PATH').split('lib')[0]
```

Remove the hookspath parameter, and change:

```
coll = COLLECT(exe,
               a.binaries,
               ...
```

to:

```
coll = COLLECT(exe, Tree('../kivy/examples/widgets'),
               Tree(gst_plugin_path),
               Tree(os.path.join(gst_plugin_path, 'bin')),
               a.binaries,
               ...
```

This will include gstreamer and the example video files in examples/widgets. To build, run:

```
python pyinstaller.py gstvideo/gstvideo.spec
```

Then you should find gstvideo.exe in PyInstaller-2.1/gstvideo/dist/gstvideo, which when run will play a video.

18.2 Create a package for Android

You can create a package for android using the python-for-android project. This page explains how to download and use it directly on your own machine (see *Packaging with python-for-android*), use the prebuilt *Kivy Android VM* image, or use the *Buildozer* tool to automate the entire process. You can also see *Packaging your application for the Kivy Launcher* to run kivy programs without compiling them.

For new users, we recommend using *Buildozer* as the easiest way to make a full APK. You can also run your Kivy app without a compilation step with the *Kivy Launcher* app.

Kivy applications can be *released on an Android market* such as the Play store, with a few extra steps to create a fully signed APK.

The Kivy project includes tools for accessing Android APIs to accomplish vibration, sensor access, texting etc. These, along with information on debugging on the device, are documented at the *main Android page*.

> NOTE: Currently, packages for Android can only be generated with Python 2.7. Python 3.3+ support is on the way...

18.2.1 Buildozer

Buildozer is a tool that automates the entire build process. It downloads and sets up all the prequisites for python-for-android, including the android SDK and NDK, then builds an apk that can be automatically pushed to the device.

Buildozer currently works only in Linux, and is an alpha release, but it already works well and can significantly simplify the apk build.

You can get buildozer at https://github.com/kivy/buildozer:

```
git clone https://github.com/kivy/buildozer.git
cd buildozer
sudo python2.7 setup.py install
```

This will install buildozer in your system. Afterwards, navigate to your project directory and run:

```
buildozer init
```

This creates a *buildozer.spec* file controlling your build configuration. You should edit it appropriately with your app name etc. You can set variables to control most or all of the parameters passed to python-for-android.

Finally, plug in your android device and run:

```
buildozer android debug deploy run
```

to build, push and automatically run the apk on your device.

Buildozer has many available options and tools to help you, the steps above are just the simplest way to build and run your APK. The full documentation is available here. You can also check the Buildozer README at https://github.com/kivy/buildozer.

18.2.2 Packaging with python-for-android

This section describes how to download and use python-for-android directly.

You'll need:

- A linux computer or a *virtual machine*
- Java
- Python 2.7 (not 2.6.)
- Jinja2 (python module)
- Apache ant
- Android SDK

Setup Python for Android

First, install the prerequisites needed for the project:

> http://python-for-android.readthedocs.org/en/latest/prerequisites/

Then open a console and type:

```
git clone git://github.com/kivy/python-for-android
```

Build your distribution

The distribution is a "directory" containing a specialized python compiled for Android, including only the modules you asked for. You can, from the same python-for-android, compile multiple distributions. For example:

- One containing a minimal support without audio / video
- Another containing audio, openssl etc.

To do that, you must use the script named *distribute.sh*:

```
./distribute.sh -m "kivy"
```

The result of the compilation will be saved into *dist/default*. Here are other examples of building distributions:

```
./distribute.sh -m "openssl kivy"
./distribute.sh -m "pil ffmpeg kivy"
```

Note: The order of modules provided are important, as a general rule put dependencies first and then the dependent modules, C libs come first then python modules.

To see the available options for distribute.sh, type:

```
./distribute.sh -h
```

Note: To use the latest Kivy development version to build your distribution, link "P4A_kivy_DIR" to the kivy folder environment variable to the kivy folder location. On linux you would use the export command, like this:

```
export P4A_kivy_DIR=/path/to/cloned/kivy/
```

Package your application

Inside the distribution (*dist/default* by default), you have a tool named *build.py*. This is the script that will create the APK for you:

```
./build.py --dir <path to your app>
           --name "<title>"
           --package <org.of.your.app>
           --version <human version>
           --icon <path to an icon to use>
           --orientation <landscape|portrait>
           --permission <android permission like VIBRATE> (multiple allowed)
           <debug|release> <installd|installr|...>
```

An example of using multiple permissions:

```
--permission INTERNET --permission WRITE_EXTERNAL_STORAGE
```

Full list of available permissions are documented here: http://developer.android.com/reference/android/Manifest.per

For example, if we imagine that the touchtracer demo of Kivy is in the directory ~/kivy/examples/demo/touchtracer, you can do:

```
./build.py --dir ~/kivy/examples/demo/touchtracer \
    --package org.demo.touchtracer \
    --name "Kivy Touchtracer" --version 1.1.0 debug installd
```

You need to be aware that the default target Android SDK version for the build will be SDK v.8, which is the minimum required SDK version for kivy. You should either install this API version, or change the AndroidManifest.xml file (under dist/.../) to match your own target SDK requirements.

The debug binary will be generated in bin/KivyTouchtracer-1.1.0-debug.apk. The *debug* and *installd* parameters are commands from the Android project itself. They instruct *build.py* to compile the APK in debug mode and install on the first connected device.

You can then install the APK directly to your Android device as follows:

```
adb install -r bin/KivyTouchtracer-1.1.0-debug.apk
```

18.2.3 Packaging your application for the Kivy Launcher

The Kivy launcher is an Android application that runs any Kivy examples stored on your SD Card. To install the Kivy launcher, you must:

1. Go to the Kivy Launcher page on the Google Play Store
2. Click on Install
3. Select your phone… And you're done!

If you don't have access to the Google Play Store on your phone/tablet, you can download and install the APK manually from http://kivy.org/#download.

Once the Kivy launcher is installed, you can put your Kivy applications in the Kivy directory in your external storage directory (often available at `/sdcard` even in devices where this memory is internal), e.g.:

```
/sdcard/kivy/<yourapplication>
```

`<yourapplication>` should be a directory containing:

```
# Your main application file:
main.py
# Some info Kivy requires about your app on android:
android.txt
```

The file *android.txt* must contain:

```
title=<Application Title>
author=<Your Name>
orientation=<portrait|landscape>
```

These options are just a very basic configuration. If you create your own APK using the tools above, you can choose many other settings.

Installation of Examples

Kivy comes with many examples, and these can be a great place to start trying the Kivy launcher. You can run them as below:

```
#. Download the 'Kivy demos for Android <http://kivy.googlecode.com/files/kivydemo-for-android.zi
#. Unzip the contents and go to the folder 'kivydemo-for-android'
#. Copy all the the subfolders here to
```

/sdcard/kivy

1. Run the launcher and select one of the Pictures, Showcase, Touchtracer, Cymunk or other demos…

18.2.4 Release on the market

If you have built your own APK with Buildozer or with python-for-android, you can create a release version that may be released on the Play store or other Android markets.

To do this, you must run Buildozer with the `release` parameter (e.g. `buildozer android release`), or if using python-for-android use the `--release` option to build.py. This creates a release APK in the `bin` directory, which you must properly sign and zipalign. The procedure for doing this is described in the Android documentation at http://developer.android.com/guide/publishing/app-signing.html - all the necessary tools come with the Android SDK.

18.2.5 Targeting Android

Kivy is designed to operate identically across platforms and as a result, makes some clear design decisions. It includes its own set of widgets and by default, builds an APK with all the required core dependencies and libraries.

It is possible to target specific Android features, both directly and in a (somewhat) cross-platform way. See the *Using Android APIs* section of the *Kivy on Android documentation* for more details.

18.3 The Kivy Android Virtual Machine

18.3.1 Introduction

Currently, Kivy Android applications can only be built in a Linux enironment configured with python-for-android, the Android SDK and the Android NDK. As this enviroment in not only tricky to setup but also impossible on Windows or MacOSX operating systems, we provide a fully configured VirtualBox disk image to ease your building woes.

If you are not familiar with virtualization, we encourage you to read the Wikipedia Virtualization page.

18.3.2 Getting started

1. Download the disc image from here, in the *Virtual Machine* section. It is aproximately 1GB. Extract the file and remember the location of the extracted vdi file.
2. Download the version of VirtualBox for your machine from the VirtualBox download area and install it.
3. Start VirtualBox, click on "New" in the left top. Then select "linux" and "Ubuntu 32".
4. Under "Hard drive", choose "Use an existing virtual hard drive file". Search for your vdi file and select it.
5. Go to the "Settings" for your virtual machine. In the "Display -> Video" section, increase video ram to 32mb or above. Enable 3d acceleration to improve the user experience.
6. Start the Virtual machine and follow the instructions in the readme file on the desktop.

18.3.3 Building the APK

Once the VM is loaded, you can follow the instructions from *Packaging with python-for-android*. You don't need to download with *git clone* though, as python-for-android is already installed and set up in the virtual machine home directory.

18.3.4 Hints and tips

1. Shared folders

   Generally, your development environment and toolset are set up on your host machine but the APK is build in your guest. VirtualBox has a feature called 'Shared folders' which allows your guest direct access to a folder on your host.

   If it often convenient to use this feature (usually with 'Permanent' and 'Auto-mount' options) to copy the built APK to the host machine so it can form part of your normal dev environment. A simple script can easily automate the build and copy/move process.

2. Copy and paste

By default, you will not be able to share clipboard items between the host and the guest machine. You can achieve this by enabling the "bi-directional" shared clipboard option under "Settings -> General -> Advanced".

3. Snapshots

   If you are working on the Kivy development branch, pulling the latest version can sometimes break things (as much as we try not to). You can guard against this by taking a snapshot before pulling. This allows you to easily restore your machine to it's previous state should you have the need.

18.4 Kivy on Android

You can run Kivy applications on Android, on (more or less) any device with OpenGL ES 2.0 (Android 2.2 minimum). This is standard on modern devices; Google reports the requirement is met by 99.9% of devices.

Kivy APKs are normal Android apps that you can distribute like any other, including on stores like the Play store. They behave properly when paused or restarted, may utilise Android services and have access to most of the normal java API as described below.

Follow the instructions below to learn how to *package your app for Android*, *debug your code on the device*, and *use Android APIs* such as for vibration and reading sensors.

18.4.1 Package for Android

The Kivy project provides all the necessary tools to package your app on Android, including building your own standalone APK that may be distributed on a market like the Play store. This is covered fully in the *Create a package for Android* documentation.

18.4.2 Debugging your application on the Android platform

You can view the normal output of your code (stdout, stderr), as well as the normal Kivy logs, through the Android logcat stream. This is accessed through adb, provided by the Android SDK. You may need to enable adb in your device's developer options, then connect your device to your computer and run:

```
adb logcat
```

You'll see all the logs including your stdout/stderr and Kivy logger.

If you packaged your app with Buildozer, the *adb* tool may not be in your `$PATH` and the above command may not work. You can instead run:

```
buildozer android logcat
```

to run the version installed by Buildozer, or find the SDK tools at `$HOME/.buildozer/android/platform`.

You can also run and debug your application using the Kivy Launcher. If you run your application this way, you will find log files inside the "/.kivy/logs" sub-folder within your application folder.

18.4.3 Using Android APIs

Although Kivy is a Python framework, the Kivy project maintains tools to easily use the normal java APIs, for everything from vibration to sensors to sending messages through SMS or email.

For new users, we recommend using *Plyer*. For more advanced access or for APIs not currently wrapped, you can use *Pyjnius* directly. Kivy also supplies an *android module* for basic Android functionality.

User contributed Android code and examples are available on the Kivy wiki.

Plyer

Plyer is a pythonic, platform-independent API to use features commonly found on various platforms, particularly mobile ones. The idea is that your app can call simply call a Plyer function, such as to present a notification to the user, and Plyer will take care of doing so in the right way regardless of the platform or operating system. Internally, Plyer uses Pyjnius (on Android), Pyobjus (on iOS) and some platform specific APIs on desktop platforms.

For instance, the following code would make your Android device vibrate, or raise a NotImplementedError that you can handle appropriately on other platforms such as desktops that don't have appropriate hardware::

```
from plyer import vibrator
vibrator.vibrate(10)  # vibrate for 10 seconds
```

Plyer's list of supported APIs is growing quite quickly, you can see the full list in the Plyer README.

Pyjnius

Pyjnius is a Python module that lets you access java classes directly from Python, automatically converting arguments to the right type, and letting you easily convert the java results to Python.

Pyjnius can be obtained from github, and has its own documentation.

Here is a simple example showing Pyjnius' ability to access the normal Android vibration API, the same result of the plyer code above:

```
# 'autoclass' takes a java class and gives it a Python wrapper
from jnius import autoclass

# Context is a normal java class in the Android API
Context = autoclass('android.content.Context')

# PythonActivity is provided by the Kivy bootstrap app in python-for-android
PythonActivity = autoclass('org.renpy.android.PythonActivity')

# The PythonActivity stores a reference to the currently running activity
# We need this to access the vibrator service
activity = PythonActivity.mActivity

# This is almost identical to the java code for the vibrator
vibrator = activity.getSystemService(Context.VIBRATOR_SERVICE)

vibrator.vibrate(10000)  # The value is in milliseconds - this is 10s
```

This code directly follows the java API functions to call the vibrator, with Pyjnius automatically translating the api to Python code and our calls back to the equivalent java. It is much more verbose and java-like than Plyer's version, for no benefit in this case, though Plyer does not wrap every API available to Pyjnius.

Pyjnius also has powerful abilities to implement java interfaces, which is important for wrapping some APIs, but these are not documented here - you can see Pyjnius' own documentation.

Android module

Python-for-android includes a python module (actually cython wrapping java) to access a limited set of Android APIs. This has been largely superseded by the more flexible Pyjnius and Plyer as above, but may still occasionally be useful. The available functions are given in the python-for-android documentation.

This includes code for billing/IAP and creating/accessing Android services, which is not yet available in the other tools above.

18.4.4 Status of the Project and Tested Devices

These sections previously described the existence of Kivy's Android build tools, with their limitations and some devices that were known to work.

The Android tools are now quite stable, and should work with practically any device; our minimum requirements are OpenGL ES 2.0 and Android 2.2. These are very common now - Kivy has even been run on an Android smartwatch!

A current technical limitation is that the Android build tools compile only ARM APKs, which will not run on Android devices with x86 processors (these are currently rare). This should be added soon.

As Kivy works fine on most devices, the list of supported phones/tablets has been retired - all Android devices are likely to work if they meet the conditions above.

18.5 Creating packages for MacOSX

Packaging your application for the MacOSX 10.6 platform can only be done inside MacOSX. The following method has only been tested inside VirtualBox and MacOSX 10.6, using the portable package of Kivy.

The package will only work for the 64 bit MacOSX. We no longer support 32 bit MacOSX platforms.

NOTE: Currently, packages for OSX can only be generated with Python 2.7. Python 3.3+ support is on the way...

18.5.1 Requirements

- Latest Kivy (the whole portable package, not only the github sourcecode)
- PyInstaller 2.0

Please ensure that you have installed the Kivy DMG and installed the *make-symlink* script. The *kivy* command must be accessible from the command line.

Thereafter, download and decompress the PyInstaller 2.0 package.

Warning: It seems that the latest PyInstaller has a bug affecting Mach-O binaries. (http://www.pyinstaller.org/ticket/614). To correct the issue, type:

```
cd pyinstaller-2.0/PyInstaller/lib/macholib
curl -O https://bitbucket.org/ronaldoussoren/macholib/raw/e32d04b5361950a9343ca453d75602b65787f2
```

In version 2.1, the issue has already been corrected.

18.5.2 Create the spec file

As an example, we'll package the touchtracer demo, using a custom icon. The touchtracer code is in the *../kivy/examples/demo/touchtracer/* directory, and the main file is named *main.py*. Replace both path/filename according to your system.

1. Open a console.
2. Go to the pyinstaller directory, and create the initial specs:

```
cd pyinstaller-2.0
kivy pyinstaller.py --windowed --name touchtracer ../kivy/examples/demo/touchtracer/main.py
```

3. The specs file is named *touchtracer/touchtracer.spec* and located inside the pyinstaller directory. Now we need to edit the spec file to add kivy hooks to correctly build the executable. Open the spec file with your favorite editor and put theses lines at the start of the spec:

```
from kivy.tools.packaging.pyinstaller_hooks import install_hooks
install_hooks(globals())
```

   In the *Analysis()* method, remove the *hookspath=None* parameter. If you don't do this, the kivy package hook will not be used at all.

   Then, you need to change the *COLLECT()* call to add the data of touchtracer (*touchtracer.kv*, *particle.png*, ...). Change the line to add a Tree() object. This Tree will search and add every file found in the touchtracer directory to your final package:

```
coll = COLLECT( exe, Tree('../kivy/examples/demo/touchtracer/'),
               a.binaries,
               #...
               )
```

4. We are done. Your spec is ready to be executed!

18.5.3 Build the spec and create a DMG

1. Open a console.
2. Go to the pyinstaller directory, and build the spec:

```
cd pyinstaller-2.0
kivy pyinstaller.py touchtracer/touchtracer.spec
```

3. The package will be the *touchtracer/dist/touchtracer* directory. Rename it to .app:

```
pushd touchtracer/dist
mv touchtracer touchtracer.app
hdiutil create ./Touchtracer.dmg -srcfolder touchtracer.app -ov
popd
```

4. You will now have a Touchtracer.dmg available in the *touchtracer/dist* directory.

18.5.4 Including Gstreamer

If you want to read video files, audio, or camera, you will need to include gstreamer. By default, only pygst/gst files are discovered, but all the gst plugins and libraries are missing. You need to include them in your .spec file too, by adding one more arguments to the *COLLECT()* method:

```
import os
gst_plugin_path = os.environ.get('GST_PLUGIN_PATH').split(':')[0]

coll = COLLECT( exe, Tree('../kivy/examples/demo/touchtracer/'),
               Tree(os.path.join(gst_plugin_path, '..')),
               a.binaries,
               #...
               )
```

For Kivy.app < 1.4.1, you also need to update one script included in our Kivy.app. Go to */Applications/Kivy.app/Contents/Resources/kivy/kivy/tools/packaging/pyinstaller_hooks/*, and edit the file named *rt-hook-kivy.py*, and add this line at the end:

```
environ['GST_PLUGIN_PATH'] = join(root, '..', 'gst-plugins')
```

18.6 Create a package for IOS

New in version 1.2.0.

Warning: This process is still under development.

The overall process for creating a package for IOS can be explained in 4 steps:

1. Compile python + modules for IOS
2. Create an Xcode project
3. Populate the Xcode project with your application source code
4. Customize

This process has been tested with Xcode 4.2.

NOTE: Currently, packages for iOS can only be generated with Python 2.7. Python 3.3+ support is on the way...

18.6.1 Prerequisites

You need to install some dependencies, like cython or mercurial. If you're using Xcode 4.3, then you also need to install autotools. We encourage you to use Homebrew to install thoses dependencies:

```
brew install autoconf automake libtool pkg-config mercurial
brew link libtool
brew link mercurial
sudo easy_install pip
sudo pip install cython
```

For more detail, see *IOS Prerequisites*. Just ensure that everything is ok before starting the second step!

18.6.2 Compile the distribution

Open a terminal, and type:

```
$ git clone git://github.com/kivy/kivy-ios
$ cd kivy-ios
$ tools/build-all.sh
```

If you don't want to compile all the things needed for kivy, edit and change *tools/build-all.sh* to your needs.

Most of the python distribution will be packed into a *python27.zip*. If you experience any issues or would like more detail on this process, please refer to *Compiling for IOS*.

18.6.3 Create an Xcode project

Before proceeding to the next step, ensure your application entry point is a file named *main.py*.

We provide a script that creates an initial Xcode project to start with. In the command line below, replace *test* with your project name. It must be a name without any spaces or illegal characters:

```
$ tools/create-xcode-project.sh test /path/to/your/appdir
```

Note: You must use a fully qualified path to your application directory.

Now you can open the Xcode project:

```
$ open app-test/test.xcodeproj
```

18.6.4 Customize

You can customize the build in many ways:

1. Minimize the *build/python/lib/python27.zip*: this contains all the python modules. You can edit the zip file and remove all the files you'll not use (reduce encodings, remove xml, email...)
2. Remove the .a not used: in Xcode, select your target, go in *Build Phases*, then check the *Link Binary With Libraries*. You can remove the libraries not used by your application.
3. Change the icon, orientation, etc... According to the Apple policy :)
4. Go to the settings panel > build, search for "strip" options, and triple-check that they are all set to NO. Stripping does not work with Python dynamic modules and will remove needed symbols.
5. Indicate a launch image in portrait/landscape for iPad with and without retina display.

Launch Images are supported. By default, XCode want you to build an Image Sets. This is your responsability to fill all the images needed for the Sets, depending of your target. However, Kivy use SDL, and as soon as the application starts the SDL main, the launch image will disapear. To prevent that, you need to have 2 files named *Default.png* and *Default-Landscape.png*, and put them in the *Resources* folder in Xcode (not in your application folder)

18.6.5 Known issues

Currently, the project has a few known issues (we'll fix these in future versions):

- You can't export your project outside the kivy-ios directory because the libraries included in the project are relative to it.
- Removing some libraries (like SDL_Mixer for audio) is currently not possible because the kivy project requires it.
- And more, just too technical to be written here.

18.6.6 FAQ

Application quit abnormally!

By default, all the print statements to the console and files are ignored. If you have an issue when running your application, you can activate the log by commenting out this line in *main.m*:

```
putenv("KIVY_NO_CONSOLELOG=1");
```

Then you should see all the Kivy logging on the Xcode console.

How can Apple accept a python app ?

We managed to merge the app binary with all the libraries into a single binary, called libpython. This means all binary modules are loaded beforehand, so nothing is dynamically loaded.

Have you already submited a Kivy application to the App store ?

Yes, check:

- Defletouch on iTunes,
- ProcessCraft on iTunes

For a more complete list, visit the Kivy wiki.

18.7 IOS Prerequisites

The following guide assumes:

- XCode 5.1
- MacOSX 10.9

Your experience may vary with different versions.

18.7.1 Getting started

In order to submit any application to the iTunes store, you will need an iOS Developer License. For testing, you will need an actual device as kivy does not yet support the iOS emulators that Apple supplies.

Please note that in order to test on the device, you need to register these devices and install your "provisioning profile" on them. Please refer to the Apple's Getting started guide for more information.

18.7.2 Homebrew

We use the Homebrew package mananger for OSX to install some of the dependencies and tools used by Kivy. It's a really helpful tool and is an Open Source project hosted on Github.

Due to the nature of package management (complications with versions and Operating Systems), this process can be error prone and cause failures in the build process. The **Missing requirement: <pkg> is not installed!** message is typically such an error.

The first thing is to ensure you have run the following commands:

```
brew install autoconf automake libtool pkg-config mercurial
brew link libtool
brew link mercurial
sudo easy_install pip
sudo pip install cython
```

If you still receive build errors, check your Homebrew is in a healthy state:

```
brew doctor
```

For further help, please refer to the Homebrew wiki.

The last, final and desperate step to get things working might be to remove Homebrew altogether, get the lastest version, install that and then re-install the dependencies.

> How to Uninstall and Remove Homebrew for Mac OSX

18.8 Compiling for IOS

(work in progess)

18.8.1 Creating your distribution

Kivy uses a shell script to build your distribution and package all it's contents such that it can be used by XCode to compile your final iOS program (an *.ipa* file).

This process involves running all the required code and libraries through a compiler and linker in order to create a single, stand-alone set of binaries and source files. These files comprize you *distribution*.

18.8.2 Using the "build_all.sh" script

The kivy-ios package provides a generic script, "tools/build_all.sh", that creates a complete distribution for you.

You may want edit/copy this file in order to customize your distribution for various reasons:

```
* Minimize the size of your package by removing unused libraries
* Customize the packing by adding/removing script items
* Troubleshooting
```

The minimizing and customizing options are obviously desirable and relativly simple as the build script is a standard bash shell script.

18.8.3 The build process

Initially, your kivy-ios checkout will contain two folders: *tools* and *src*. The first time you run it, the script will download the latest versions of the packages kivy-ios uses. This means it might fail if any packages are not available or cannot be downloaded.

These downloaded packages are stored in a hidden *.cache* subfolder. The build process then extracts these files to a *tmp* subfolder, builds the packages and places the build in the *build* subfolder. Be careful: if this process is interrupted, it might leave corrupt files in any of these locations.

If you wish to force a fresh build of all the packages, you should delete all of these other folders (*.cache*, *tmp* and *build*) and re-run the 'build_all.sh' script.

18.8.4 Troubleshooting

Isolating problems

The kivy-ios project uses many libraries which may change and break things independently of kivy. It may thus sometimes be necessary to remove any packages which do not compile in order to complete your build or isolate the offending package.

The 'build-all.sh' script assembles many sub-scripts into one, comprehensive build script. If you open this file, you will see something similar to:

```
#!/bin/bash

. $(dirname $0)/environment.sh

try $(dirname $0)/build-libffi.sh
try $(dirname $0)/build-python.sh
try $(dirname $0)/reduce-python.sh
...
```

You can comment out problematic scripts using the hash (#) symbol. Some scripts are essential (e.g. *build-python.sh*), but others can be safely removed if your application does not require them.

We hope you never have to care about this, but if you encounter an error which you cannot resolve, this may help. Remember, you can always *contact us* for help.

Clang compiler issues

Some dependencies for compiling cython with pip on OSX may fail to compile with the Clang (Apple's C) compiler displaying the message:

```
clang: error: unknown argument: '-mno-fused-madd' [-Wunused-command-line-argument-hard-error-in-f
clang: note: this will be a hard error (cannot be downgraded to a warning) in the future
error: command 'cc' failed with exit status 1
```

Here is a workaround:

```
export CFLAGS=-Qunused-arguments
sudo -E pip install cython
```

The -E flag passes the environment to the sudo shell.

18.8.5 Further reading

Kivy iOS support is a work-in-progress and we are busy trying to improve and document this process. Until such time as this is complete, you may find the following links useful.

- iOS Tips
- HTTPS (SSL) support

Part III
TUTORIALS

CHAPTER

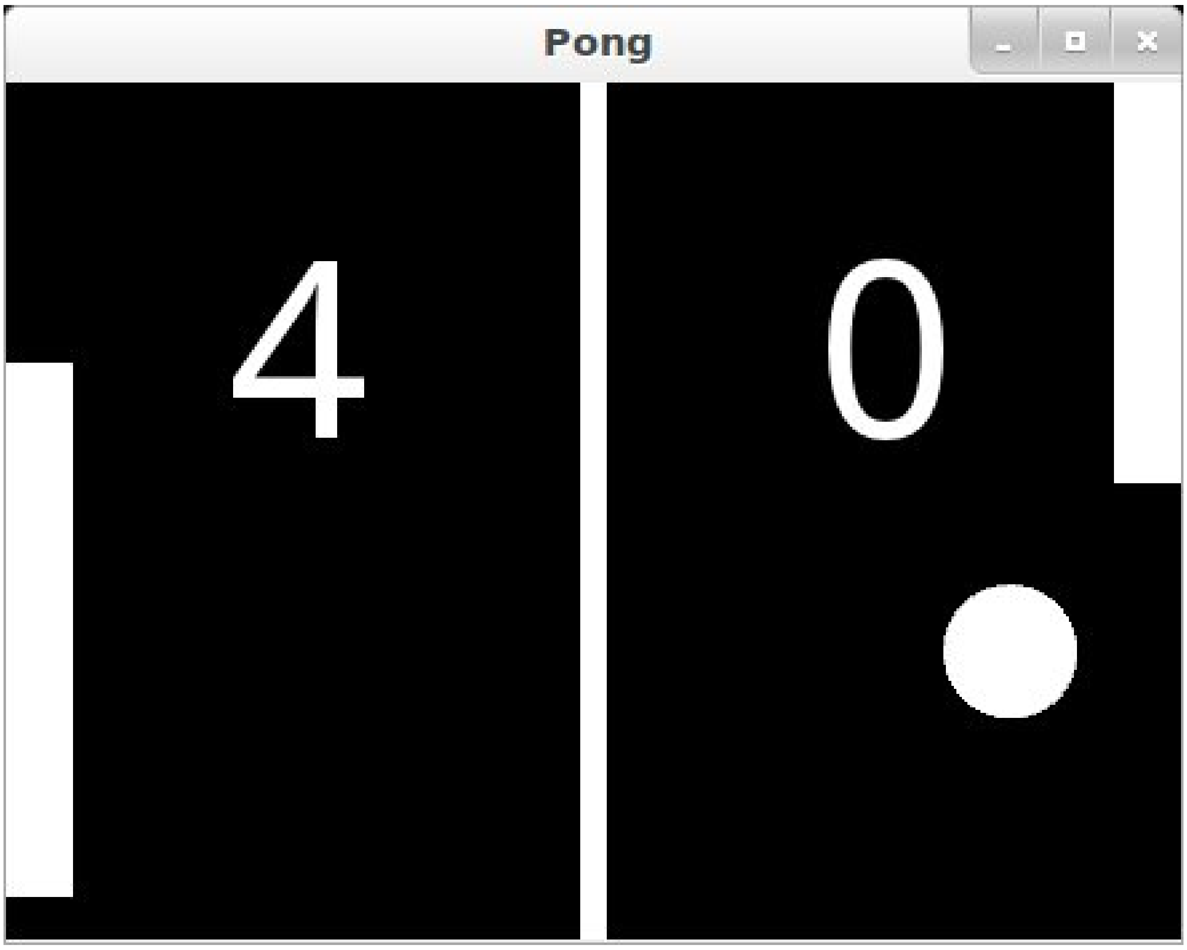
NINETEEN

PONG GAME TUTORIAL

19.1 Introduction

Welcome to the Pong tutorial

This tutorial will teach you how to write pong using Kivy. We'll start with a basic application like the one described in the *Create an application* and turn it into a playable pong game, describing each step along the way.



Here is a check list before starting this tutorial:

- You have a working Kivy installation. See the *Installation* section for detailed descriptions
- You know how to run a basic Kivy application. See *Create an application* if you don't.

If you have read the programming guide, and understand both basic Widget concepts (*A Simple Paint App*) and basic concepts of the kv language (*Kv language*), you can probably skip the first 2 steps and go straight to step 3.

Note: You can find the entire source code, and source code files for each step in the Kivy examples directory under *tutorials/pong/*

Ready? Sweet, let's get started!

19.2 Getting Started

Getting Started

Let's start by getting a really simple Kivy app up and running. Create a directory for the game and a file named *main.py*

```python
from kivy.app import App
from kivy.uix.widget import Widget


class PongGame(Widget):
    pass


class PongApp(App):
    def build(self):
        return PongGame()


if __name__ == '__main__':
    PongApp().run()
```

Go ahead and run the application. It should just show a black window at this point. What we've done is create a very simple Kivy `App`, which creates an instance of our `PongGame` Widget class and returns it as the root element for the applications UI, which you should imagine at this point as a hierarchical tree of Widgets. Kivy places this widget-tree in the default Window. In the next step, we will draw the Pong background and scores by defining how the `PongGame widget` looks.

19.3 Add Simple Graphics

Creation of pong.kv

We will use a .kv file to define the look and feel of the `PongGame` class. Since our `App` class is called `PongApp`, we can simply create a file called `pong.kv` in the same directory that will be automatically loaded when the application is run. So create a new file called `*pong.kv*` and add the following contents.

```
#:kivy 1.0.9

<PongGame>:
    canvas:
        Rectangle:
            pos: self.center_x - 5, 0
            size: 10, self.height

    Label:
        font_size: 70
        center_x: root.width / 4
        top: root.top - 50
        text: "0"

    Label:
        font_size: 70
        center_x: root.width * 3 / 4
        top: root.top - 50
        text: "0"
```

Note: COMMON ERROR: The name of the kv file, e.g. pong.kv, must match the name of the app, e.g. PongApp (the part before the App ending).

If you run the app now, you should see a vertical bar in the middle, and two zeros where the player scores will be displayed.

19.3.1 Explaining the Kv File Syntax

Before going on to the next step, you might want to take a closer look at the contents of the kv file we just created and figure out what is going on. If you understand what's happening, you can probably skip ahead to the next step.

On the very first line we have:

```
#:kivy 1.0.9
```

This first line is required in every kv file. It should start with `#:kivy` followed by a space and the Kivy version it is intended for (so Kivy can make sure you have at least the required version, or handle backwards compatibility later on).

After that, we begin defining rules that are applied to all `PongGame` instances:

```
<PongGame>:
    ...
```

Like Python, kv files use indentation to define nested blocks. A block defined with a class name inside the < and > characters is a `Widget` rule. It will be applied to any instance of the named class. If you replaced `PongGame` with `Widget` in our example, all Widget instances would have the vertical line and the two Label widgets inside them because it would define these rules for all Widget instances.

Inside a rule section, you can add various blocks to define the style and contents of the widgets they will be applied to. You can:

- set property values,
- add child widgets
- define a *canvas* section in which you can add Graphics instructions that define how the widget is rendered.

The first block inside the `<PongGame>` rule we have is a *canvas* block:

```
<PongGame>:
    canvas:
        Rectangle:
            pos: self.center_x - 5, 0
            size: 10, self.height
```

So this canvas block says that the `PongGame` widget should draw some graphics primitives. In this case, we add a rectangle to the canvas. We set the pos of the rectangle to be 5 pixels left of the horizontal center of the widget, and 0 for y. The size of the rectangle is set to 10 pixels in width, and the widgets' height in height. The nice thing about defining the graphics like this, is that the rendered rectangle will be automatically updated when the properties of any widgets used in the value expression change.

Note: Try to resize the application window and notice what happens. That's right, the entire UI resizes automatically. The standard behaviour of the Window is to resize an element based on its property *size_hint*. The default widget size_hint is (1,1), meaning it will be stretched 100% in both x-direction and y-direction and hence fill the available space. Since the pos and size of the rectangle and center_x and top of the score labels were defined within the context of the `PongGame` class, these properties will automatically update when the corresponding widget properties change. Using the Kv language gives you automatic property binding. :)

The last two sections we add look pretty similar. Each of them adds a Label widget as a child widget to the `PongGame` widget. For now, the text on both of them is just set to *"0"*. We'll hook that up to the actual score once we have the logic implemented, but the labels already look good since we set a bigger font_size, and positioned them relatively to the root widget. The `root` keyword can be used inside the child block to refer back to the parent/root widget the rule applies to (`PongGame` in this case):

```
<PongGame>:
    # ...

    Label:
        font_size: 70
        center_x: root.width / 4
        top: root.top - 50
        text: "0"

    Label:
        font_size: 70
        center_x: root.width * 3 / 4
        top: root.top - 50
        text: "0"
```

19.4 Add the Ball

Add the Ball

Ok, so we have a basic pong arena to play in, but we still need the players and a ball to hit around. Let's start with the ball. We'll add a new *PongBall* class to create a widget that will be our ball and make it bounce around.

19.4.1 PongBall Class

Here is the Python code for the PongBall class:

```
class PongBall(Widget):

    # velocity of the ball on x and y axis
    velocity_x = NumericProperty(0)
    velocity_y = NumericProperty(0)

    # referencelist property so we can use ball.velocity as
    # a shorthand, just like e.g. w.pos for w.x and w.y
    velocity = ReferenceListProperty(velocity_x, velocity_y)

    # ‘‘move‘‘ function will move the ball one step. This
    #  will be called in equal intervals to animate the ball
    def move(self):
        self.pos = Vector(*self.velocity) + self.pos
```

And here is the kv rule used to draw the ball as a white circle:

```
<PongBall>:
    size: 50, 50
    canvas:
        Ellipse:
            pos: self.pos
            size: self.size
```

To make it all work, you also have to add the imports for the *Properties* Property classes used and the `Vector`.

Here is the entire updated python code and kv file for this step:

main.py:

```
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.properties import NumericProperty, ReferenceListProperty
from kivy.vector import Vector


class PongBall(Widget):
    velocity_x = NumericProperty(0)
    velocity_y = NumericProperty(0)
    velocity = ReferenceListProperty(velocity_x, velocity_y)

    def move(self):
        self.pos = Vector(*self.velocity) + self.pos


class PongGame(Widget):
    pass


class PongApp(App):
    def build(self):
        return PongGame()


if __name__ == '__main__':
    PongApp().run()
```

pong.kv:

```
#:kivy 1.0.9

<PongBall>:
    size: 50, 50
    canvas:
        Ellipse:
            pos: self.pos
            size: self.size

<PongGame>:
    canvas:
        Rectangle:
            pos: self.center_x-5, 0
            size: 10, self.height

    Label:
        font_size: 70
        center_x: root.width / 4
        top: root.top - 50
        text: "0"

    Label:
        font_size: 70
        center_x: root.width * 3 / 4
        top: root.top - 50
        text: "0"

    PongBall:
        center: self.parent.center
```

Note that not only a <*PongBall*> widget rule has been added, but also a child widget *PongBall* in the <*PongGame*> widget rule.

19.5 Adding Ball Animation

Making the ball move

Cool, so now we have a ball, and it even has a `move` function... but it's not moving yet. Let's fix that.

19.5.1 Scheduling Functions on the Clock

We need the `move` method of our ball to be called regularly. Luckily, Kivy makes this pretty easy by letting us schedule any function we want using the `Clock` and specifying the interval:

```
Clock.schedule_interval(game.update, 1.0/60.0)
```

This line for example, would cause the `update` function of the game object to be called once every 60th of a second (60 times per second).

19.5.2 Object Properties/References

We have another problem though. We'd like to make sure the PongBall has its `move` function called regularly, but in our code we don't have any references to the ball object since we just added it via the kv file inside the kv rule for the `PongGame` class. The only reference to our game is the one we return in the applications build method.

Since we're going to have to do more than just move the ball (e.g. bounce it off the walls and later the players racket), we'll probably need an `update` method for our `PongGame` class anyway. Furthermore, given that we have a reference to the game object already, we can easily schedule its new `update` method when the application gets built:

```
class PongGame(Widget):

    def update(self, dt):
        # call ball.move and other stuff
        pass

class PongApp(App):

    def build(self):
        game = PongGame()
        Clock.schedule_interval(game.update, 1.0/60.0)
        return game
```

However, that still doesn't change the fact that we don't have a reference to the `PongBall` child widget created by the kv rule. To fix this, we can add an `ObjectProperty` to the PongGame class, and hook it up to the widget created in the kv rule. Once that's done, we can easily reference the ball property inside the `update` method and even make it bounce of the edges:

```
class PongGame(Widget):
    ball = ObjectProperty(None)

    def update(self, dt):
        self.ball.move()

        # bounce off top and bottom
        if (self.ball.y < 0) or (self.ball.top > self.height):
            self.ball.velocity_y *= -1

        # bounce off left and right
        if (self.ball.x < 0) or (self.ball.right > self.width):
            self.ball.velocity_x *= -1
```

Don't forget to hook it up in the kv file, by giving the child widget an id and setting the PongGame's `ball` ObjectProperty to that id:

```
<PongGame>:
    ball: pong_ball

    # ... (canvas and Labels)

    PongBall:
        id: pong_ball
        center: self.parent.center
```

Note: At this point everything is hooked up for the ball to bounce around. If your coding along as we go, you might be wondering why the ball isn't moving anywhere. The ball's velocity is set to 0 on both x and y. In the code listing below, a `serve_ball` method is added to the `PongGame` class and called in the apps `build` method. It sets a random x and y velocity for the ball, and also resets the position, so we can use it later to reset the ball when a player has scored a point.

Here is the entire code for this step:

main.py:

```
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.properties import NumericProperty, ReferenceListProperty,\
    ObjectProperty
from kivy.vector import Vector
from kivy.clock import Clock
from random import randint


class PongBall(Widget):
    velocity_x = NumericProperty(0)
    velocity_y = NumericProperty(0)
    velocity = ReferenceListProperty(velocity_x, velocity_y)

    def move(self):
        self.pos = Vector(*self.velocity) + self.pos


class PongGame(Widget):
    ball = ObjectProperty(None)

    def serve_ball(self):
        self.ball.center = self.center
        self.ball.velocity = Vector(4, 0).rotate(randint(0, 360))

    def update(self, dt):
        self.ball.move()

        #bounce off top and bottom
        if (self.ball.y < 0) or (self.ball.top > self.height):
            self.ball.velocity_y *= -1

        #bounce off left and right
        if (self.ball.x < 0) or (self.ball.right > self.width):
            self.ball.velocity_x *= -1


class PongApp(App):
    def build(self):
        game = PongGame()
        game.serve_ball()
        Clock.schedule_interval(game.update, 1.0 / 60.0)
        return game


if __name__ == '__main__':
    PongApp().run()
```

pong.kv:

```
#:kivy 1.0.9

<PongBall>:
    size: 50, 50
    canvas:
        Ellipse:
            pos: self.pos
            size: self.size

<PongGame>:
    ball: pong_ball

    canvas:
        Rectangle:
            pos: self.center_x-5, 0
            size: 10, self.height

    Label:
        font_size: 70
        center_x: root.width / 4
        top: root.top - 50
        text: "0"

    Label:
        font_size: 70
        center_x: root.width * 3 / 4
        top: root.top - 50
        text: "0"

    PongBall:
        id: pong_ball
        center: self.parent.center
```

19.6 Connect Input Events

Adding Players and reacting to touch input

Sweet, our ball is bouncing around. The only things missing now are the movable player rackets and keeping track of the score. We won't go over all the details of creating the class and kv rules again, since those concepts were already covered in the previous steps. Instead, lets focus on how to move the Player widgets in response to user input. You can get the whole code and kv rules for the `PongPaddle` class at the end of this section.

In Kivy, a widget can react to input by implementing the `on_touch_down`, the `on_touch_move` and the `on_touch_up` methods. By default, the Widget class implements these methods by just calling the corresponding method on all it's child widgets to pass on the event until one of the children returns `True`.

Pong is pretty simple. The rackets just need to move up and down. In fact it's so simple, we don't even really need to have the player widgets handle the events themselves. We'll just implement the `on_touch_move` function for the `PongGame` class and have it set the position of the left or right player based on whether the touch occurred on the left or right side of the screen.

Check the `on_touch_move` handler:

```python
def on_touch_move(self, touch):
    if touch.x < self.width/3:
        self.player1.center_y = touch.y
    if touch.x > self.width - self.width/3:
        self.player2.center_y = touch.y
```

We'll keep the score for each player in a `NumericProperty`. The score labels of the `PongGame` are kept updated by changing the NumericProperty `score`, which in turn updates the `PongGame` child labels text property. This binding occurs because Kivy `properties` automatically bind to any references in their corresponding kv files. When the ball escapes out of the sides, we'll update the score and serve the ball again by changing the `update` method in the `PongGame` class. The `PongPaddle` class also implements a `bounce_ball method`, so that the ball bounces differently based on where it hits the racket. Here is the code for the *PongPaddle* class:

```python
class PongPaddle(Widget):

    score = NumericProperty(0)

    def bounce_ball(self, ball):
        if self.collide_widget(ball):
            speedup  = 1.1
            offset = 0.02 * Vector(0, ball.center_y-self.center_y)
            ball.velocity =  speedup * (offset - ball.velocity)
```

Note: This algorithm for ball bouncing is very simple, but will have strange behavior if the ball hits the paddle from the side or bottom...this is something you could try to fix yourself if you like.

And here it is in context. Pretty much done:

main.py:

```python
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.properties import NumericProperty, ReferenceListProperty,\
    ObjectProperty
from kivy.vector import Vector
from kivy.clock import Clock


class PongPaddle(Widget):
    score = NumericProperty(0)

    def bounce_ball(self, ball):
        if self.collide_widget(ball):
            vx, vy = ball.velocity
            offset = (ball.center_y - self.center_y) / (self.height / 2)
            bounced = Vector(-1 * vx, vy)
            vel = bounced * 1.1
            ball.velocity = vel.x, vel.y + offset


class PongBall(Widget):
    velocity_x = NumericProperty(0)
    velocity_y = NumericProperty(0)
    velocity = ReferenceListProperty(velocity_x, velocity_y)

    def move(self):
        self.pos = Vector(*self.velocity) + self.pos


class PongGame(Widget):
    ball = ObjectProperty(None)
    player1 = ObjectProperty(None)
    player2 = ObjectProperty(None)

    def serve_ball(self, vel=(4, 0)):
        self.ball.center = self.center
        self.ball.velocity = vel

    def update(self, dt):
        self.ball.move()

        #bounce of paddles
        self.player1.bounce_ball(self.ball)
        self.player2.bounce_ball(self.ball)

        #bounce ball off bottom or top
        if (self.ball.y < self.y) or (self.ball.top > self.top):
            self.ball.velocity_y *= -1

        #went of to a side to score point?
        if self.ball.x < self.x:
            self.player2.score += 1
            self.serve_ball(vel=(4, 0))
        if self.ball.x > self.width:
                self.player1.score += 1
                self.serve_ball(vel=(-4, 0))

    def on_touch_move(self, touch):
        if touch.x < self.width / 3:
            self.player1.center_y = touch.y
        if touch.x > self.width - self.width / 3:
            self.player2.center_y = touch.y


class PongApp(App):
    def build(self):
        game = PongGame()
        game.serve_ball()
        Clock.schedule_interval(game.update, 1.0 / 60.0)
        return game


if __name__ == '__main__':
    PongApp().run()
```

pong.kv:

```
#:kivy 1.0.9

<PongBall>:
    size: 50, 50
    canvas:
        Ellipse:
            pos: self.pos
            size: self.size

<PongPaddle>:
    size: 25, 200
    canvas:
        Rectangle:
            pos:self.pos
            size:self.size

<PongGame>:
    ball: pong_ball
    player1: player_left
    player2: player_right

    canvas:
        Rectangle:
            pos: self.center_x-5, 0
            size: 10, self.height

    Label:
        font_size: 70
        center_x: root.width / 4
        top: root.top - 50
        text: str(root.player1.score)

    Label:
        font_size: 70
        center_x: root.width * 3 / 4
        top: root.top - 50
        text: str(root.player2.score)

    PongBall:
        id: pong_ball
        center: self.parent.center

    PongPaddle:
        id: player_left
        x: root.x
        center_y: root.center_y

    PongPaddle:
        id: player_right
        x: root.width-self.width
        center_y: root.center_y
```

19.7 Where To Go Now?

Have some fun

Well, the pong game is pretty much complete. If you understood all of the things that are covered in this tutorial, give yourself a pat on the back and think about how you could improve the game. Here are a few ideas of things you could do:

- Add some nicer graphics / images (hint check out the source property on the graphics instructions like Circle or Rectangle, to set an image as the texture for it)
- Make the game end after a certain score. Maybe once a player has 10 points, you can display a large "PLAYER 1 WINS" label and/or add a main menu to start, pause and reset the game (hint: check out the `Button` and `Label` classes and figure out how to use their *add_widget* & *remove_widget* functions to add or remove widgets dynamically.
- Make it a 4 player Pong Game. Most tablets have Multi-Touch support, so wouldn't it be cool to have a player on each side and have four people play at the same time?
- Fix the simplistic collision check so hitting the ball with an end of the paddle results in a more realistic bounce.

Note: You can find the entire source code and source code files for each step in the Kivy examples directory under tutorials/pong/

CHAPTER

TWENTY

A SIMPLE PAINT APP

In the following tutorial, you will be guided through the creation of your first widget. This provides powerful and important knowledge when programming Kivy applications, as it lets you create completely new user interfaces with custom elements for your specific purpose.

20.1 Basic Considerations

When creating an application, you have to ask yourself three important questions:

- What data does my application process?
- How do I visually represent that data?
- How does the user interact with that data?

If you want to write a very simple line drawing application for example, you most likely want the user to just draw on the screen with his/her fingers. That's how the user *interacts* with your application. While doing so, your application would memorize the positions where the user's finger were, so that you can later draw lines between those positions. So the points where the fingers were would be your *data* and the lines that you draw between them would be your *visual representation*.

In Kivy, an application's user interface is composed of Widgets. Everything that you see on the screen is somehow drawn by a widget. Often you would like to be able to reuse code that you already wrote in a different context, which is why widgets typically represent one specific instance that answers the three questions above. A widget encapsulates data, defines the user's interaction with that data and draws its visual representation. You can build anything from simple to complex user interfaces by nesting widgets. There are many widgets built in, such as buttons, sliders and other common stuff. In many cases, however, you need a custom widget that is beyond the scope of what is shipped with Kivy (e.g. a medical visualization widget).

So keep these three questions in mind when you design your widgets. Try to write them in a minimal and reusable manner (i.e. a widget does exactly what its supposed to do and nothing more. If you need more, write more widgets or compose other widgets of smaller widgets. We try to adhere to the Single Responsibility Principle).

20.2 Paint Widget

We're sure one of your childhood dreams has always been creating your own multitouch paint program. Allow us to help you achieve that. In the following sections you will successively learn how to write a program like that using Kivy. Make sure that you have read and understood *Create an application*. You have? Great! Let's get started!

20.2.1 Initial Structure

Let's start by writing the very basic code structure that we need. By the way, all the different pieces of code that are used in this section are also available in the `examples/guide/firstwidget` directory that comes with Kivy, so you don't need to copy & paste it all the time. Here is the basic code skeleton that we will need:

```python
1  from kivy.app import App
2  from kivy.uix.widget import Widget
3
4
5  class MyPaintWidget(Widget):
6      pass
7
8
9  class MyPaintApp(App):
10     def build(self):
11         return MyPaintWidget()
12
13
14 if __name__ == '__main__':
15     MyPaintApp().run()
```

This is actually really simple. Save it as paint.py. If you run it, you should only see a black screen. As you can see, instead of using a built-in widget such as a Button (see *Create an application*), we are going to write our own widget to do the drawing. We do that by creating a class that inherits from `Widget` (line 5-6) and although that class does nothing yet, we can still treat it like a normal Kivy widget (line 11). The `if __name__ ...` construct (line 14) is a Python mechanism that prevents you from executing the code in the if-statement when importing from the file, i.e. if you write `import paint`, it won't do something unexpected but just nicely provide the classes defined in the file.

Note: You may be wondering why you have to import App and Widget separately, instead of doing something like `from kivy import *`. While shorter, this would have the disadvantage of polluting your namespace and make the start of the application potentially much slower. It can also introduce ambiguity into class and variable naming, so is generally frowned upon in the Python community. The way we do it is faster and cleaner.

20.2.2 Adding Behaviour

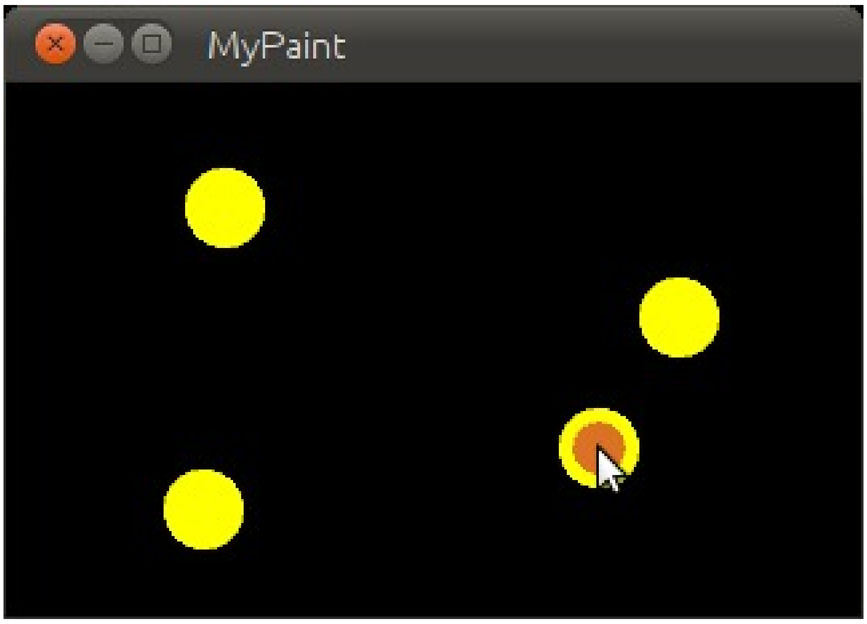
Let's now add some actual behaviour to the widget, i.e. make it react to user input. Change the code like so:

```python
from kivy.app import App
from kivy.uix.widget import Widget


class MyPaintWidget(Widget):
    def on_touch_down(self, touch):
        print(touch)

class MyPaintApp(App):
    def build(self):
        return MyPaintWidget()


if __name__ == '__main__':
    MyPaintApp().run()
```

This is just to show how easy it is to react to user input. When a `MotionEvent` (i.e. a touch, click, etc.) occurs, we simply print the information about the touch object to the console. You won't see anything on the screen, but if you observe the command-line from which you are running the program, you will see a message for every touch. This also demonstrates that a widget does not have to have a visual representation.

Now that's not really an overwhelming user experience. Let's add some code that actually draws something into our window:

```
1  from kivy.app import App
2  from kivy.uix.widget import Widget
3  from kivy.graphics import Color, Ellipse
4
5
6  class MyPaintWidget(Widget):
7
8      def on_touch_down(self, touch):
9          with self.canvas:
10             Color(1, 1, 0)
11             d = 30.
12             Ellipse(pos=(touch.x - d / 2, touch.y - d / 2), size=(d, d))
13
14
15 class MyPaintApp(App):
16
17     def build(self):
18         return MyPaintWidget()
19
20
21 if __name__ == '__main__':
22     MyPaintApp().run()
```



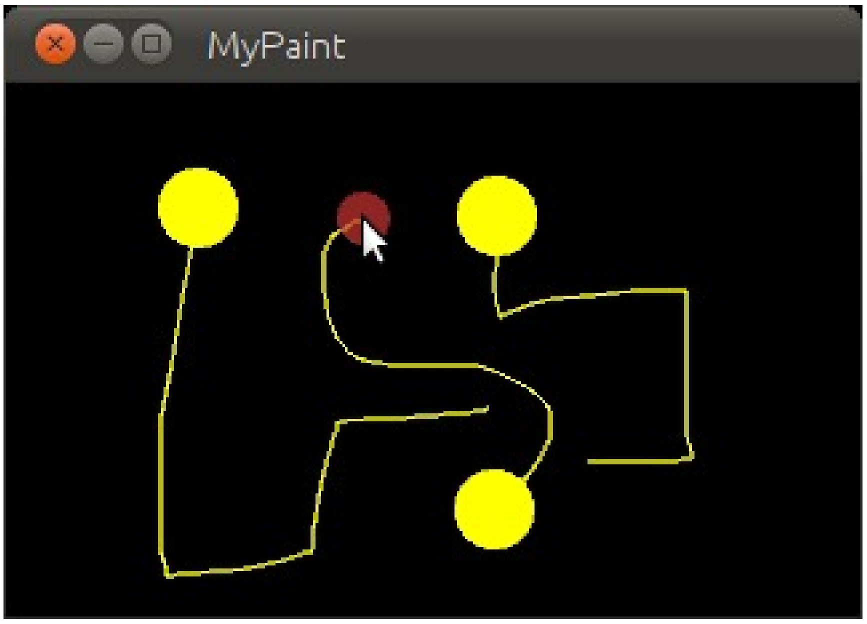
If you run your code with these modifications, you will see that every time you touch, there will be a small yellow circle drawn where you touched. How does it work?

- Line 8: We use Python's `with` statement with the widget's `Canvas` object. This is like an area in which the widget can draw things to represent itself on the screen. By using the `with` statement with it, all successive drawing commands that are properly indented will modify this canvas. The `with` statement also makes sure that after our drawing, internal state can be cleaned up properly.

- Line 9: You might have guessed it already: This sets the `Color` for successive drawing operations to yellow (default color format is RGB, so (1, 1, 0) is yellow). This is true until another `Color` is set. Think of this as dipping your brushes in that color, which you can then use to draw on a canvas until you dip the brushes into another color.
- Line 10: We specify the diameter for the circle that we are about to draw. Using a variable for that is preferable since we need to refer to that value multiple times and we don't want to have to change it in several places if we want the circle bigger or smaller.
- Line 11: To draw a circle, we simply draw an `Ellipse` with equal width and height. Since we want the circle to be drawn where the user touches, we pass the touch's position to the ellipse. Note that we need to shift the ellipse by `-d/2` in the x and y directions (i.e. left and downwards) because the position specifies the bottom left corner of the ellipse's bounding box, and we want it to be centered around our touch.

That was easy, wasn't it? It gets better! Update the code to look like this:

```python
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.graphics import Color, Ellipse, Line


class MyPaintWidget(Widget):

    def on_touch_down(self, touch):
        with self.canvas:
            Color(1, 1, 0)
            d = 30.
            Ellipse(pos=(touch.x - d / 2, touch.y - d / 2), size=(d, d))
            touch.ud['line'] = Line(points=(touch.x, touch.y))

    def on_touch_move(self, touch):
        touch.ud['line'].points += [touch.x, touch.y]


class MyPaintApp(App):

    def build(self):
        return MyPaintWidget()


if __name__ == '__main__':
    MyPaintApp().run()
```



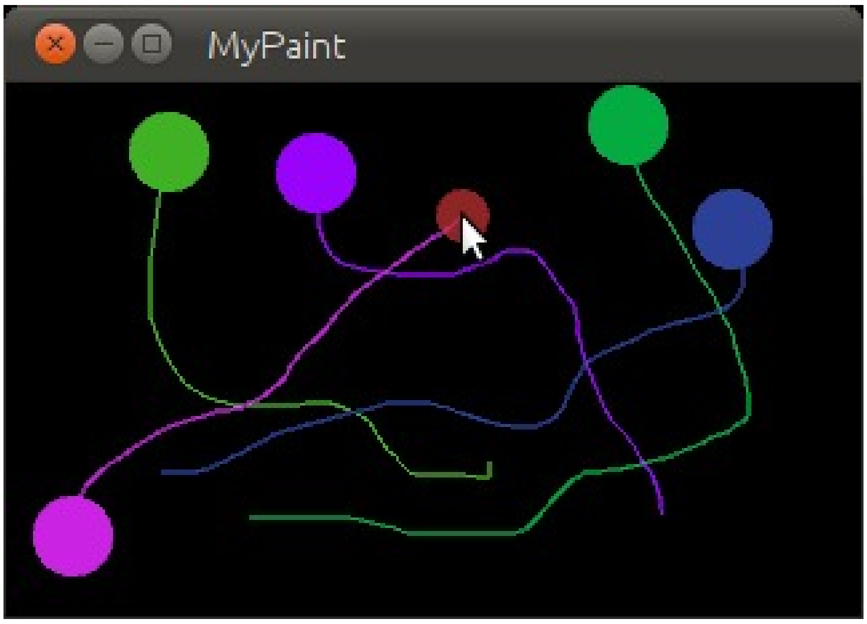
This is what has changed:

- Line 3: We now not only import the `Ellipse` drawing instruction, but also the `Line` drawing instruction. If you look at the documentation for `Line`, you will see that it accepts a `points` argument that has to be a list of 2D point coordinates, like `(x1, y1, x2, y2, ..., xN, yN)`.
- Line 13: This is where it gets interesting. `touch.ud` is a Python dictionary (type <dict>) that allows us to store *custom attributes* for a touch.
- Line 13: We make use of the Line instruction that we imported and set a Line up for drawing. Since this is done in `on_touch_down`, there will be a new line for every new touch. By creating the line inside the `with` block, the canvas automatically knows about the line and will draw it. We just want to modify the line later, so we store a reference to it in the `touch.ud` dictionary under the arbitrarily chosen but aptly named key 'line'. We pass the line that we're creating the initial touch position because that's where our line will begin.
- Lines 15: We add a new method to our widget. This is similar to the `on_touch_down` method, but instead of being called when a *new* touch occurs, this method is being called when an *existing* touch (for which `on_touch_down` was already called) moves, i.e. its position changes. Note that this is the **same** `MotionEvent` object with updated attributes. This is something we found incredibly handy and you will shortly see why.
- Line 16: Remember: This is the same touch object that we got in `on_touch_down`, so we can simply access the data we stored away in the `touch.ud` dictionary! To the line we set up for this touch earlier, we now add the current position of the touch as a new point. We know that we need to extend the line because this happens in `on_touch_move`, which is only called when the touch has moved, which is exactly why we want to update the line. Storing the line in the `touch.ud` makes it a whole lot easier for us as we don't have to maintain our own touch-to-line bookkeeping.

So far so good. This isn't exactly beautiful yet, though. It looks a bit like spaghetti bolognese. How about giving each touch its own color? Great, let's do it:

```
from random import random
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.graphics import Color, Ellipse, Line


```

```
 7  class MyPaintWidget(Widget):
 8
 9      def on_touch_down(self, touch):
10          color = (random(), random(), random())
11          with self.canvas:
12              Color(*color)
13              d = 30.
14              Ellipse(pos=(touch.x - d / 2, touch.y - d / 2), size=(d, d))
15              touch.ud['line'] = Line(points=(touch.x, touch.y))
16
17      def on_touch_move(self, touch):
18          touch.ud['line'].points += [touch.x, touch.y]
19
20
21  class MyPaintApp(App):
22
23      def build(self):
24          return MyPaintWidget()
25
26
27  if __name__ == '__main__':
28      MyPaintApp().run()
```



Here are the changes:

- Line 1: We import Python's random() function that will give us random values in the range of [0., 1.).
- Line 10: In this case we simply create a new tuple of 3 random float values that will represent a random RGB color. Since we do this in `on_touch_down`, every new touch will get its own color. Don't get confused by the use of tuples. We're just binding the tuple to `color` for use as a shortcut within this method because we're lazy.
- Line 12: As before, we set the color for the canvas. Only this time we use the random values we generated and feed them to the color class using Python's tuple unpacking syntax (since the Color class expects three individual color components instead of just 1. If we were to pass the tuple directly, that would be just 1 value being passed, regardless of the fact that the tuple itself contains 3 values).

This looks a lot nicer already! With a lot of skill and patience, you might even be able to create a nice little drawing!

Note: Since by default the `Color` instructions assume RGB mode and we're feeding a tuple with three random float values to it, it might very well happen that we end up with a lot of dark or even black colors if we are unlucky. That would be bad because by default the background color is dark as well, so you wouldn't be able to (easily) see the lines you draw. There is a nice trick to prevent this: Instead of creating a tuple with three random values, create a tuple like this: `(random(), 1., 1.)`. Then, when passing it to the color instruction, set the mode to HSV color space: `Color(*color, mode='hsv')`. This way you will have a smaller number of possible colors, but the colors that you get will always be equally bright: only the hue changes.

20.2.3 Bonus Points

At this point, we could say we are done. The widget does what it's supposed to do: it traces the touches and draws lines. It even draws circles at the positions where a line begins.

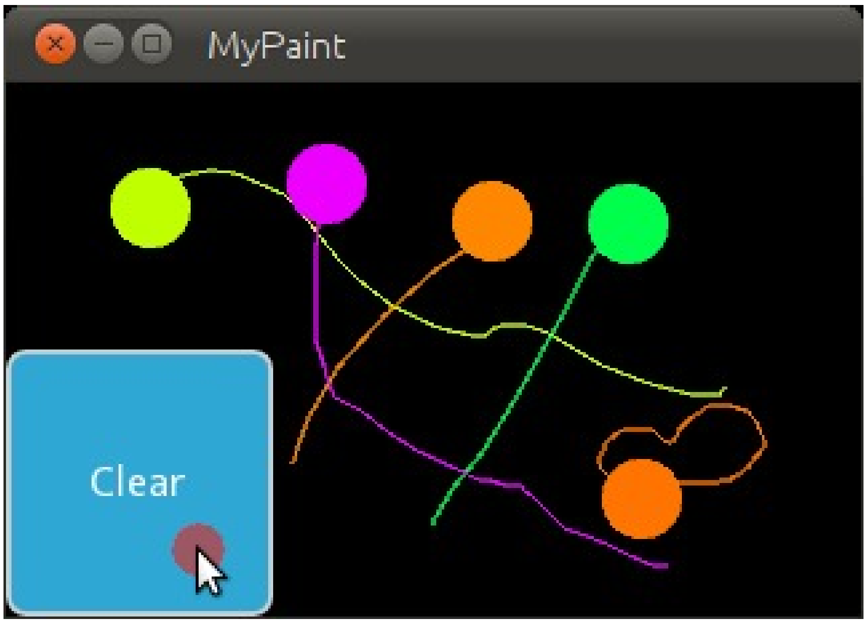
But what if the user wants to start a new drawing? With the current code, the only way to clear the window would be to restart the entire application. Luckily, we can do better. Let us add a *Clear* button that erases all the lines and circles that have been drawn so far. There are two options now:

- We could either create the button as a child of our widget. That would imply that if you create more than one widget, every widget gets its own button. If you're not careful, this will also allow users to draw on top of the button, which might not be what you want.
- Or we set up the button only once, initially, in our app class and when it's pressed we clear the widget.

For our simple example, it doesn't really matter that much. For larger applications you should give some thought to who does what in your app. We'll go with the second option here so that you see how you can build up your application's widget tree in your app class's `build()` method. We'll also change to the HSV color space (see preceding note):

```
from random import random
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.uix.button import Button
from kivy.graphics import Color, Ellipse, Line


class MyPaintWidget(Widget):

    def on_touch_down(self, touch):
        color = (random(), 1, 1)
        with self.canvas:
            Color(*color, mode='hsv')
            d = 30.
            Ellipse(pos=(touch.x - d / 2, touch.y - d / 2), size=(d, d))
            touch.ud['line'] = Line(points=(touch.x, touch.y))

    def on_touch_move(self, touch):
        touch.ud['line'].points += [touch.x, touch.y]


class MyPaintApp(App):

    def build(self):
        parent = Widget()
        painter = MyPaintWidget()
```

```
27         clearbtn = Button(text='Clear')
28         parent.add_widget(painter)
29         parent.add_widget(clearbtn)
30 
31         def clear_canvas(obj):
32             painter.canvas.clear()
33         clearbtn.bind(on_release=clear_canvas)
34 
35         return parent
36 
37 
38 if __name__ == '__main__':
39     MyPaintApp().run()
```



Here's what happens:

- Line 4: We added an import statement to be able to use the `Button` class.
- Line 25: We create a dummy `Widget()` object as a parent for both our painting widget and the button we're about to add. This is just a poor-man's approach to setting up a widget tree hierarchy. We could just as well use a layout or do some other fancy stuff. Again: this widget does absolutely nothing except holding the two widgets we will now add to it as children.
- Line 26: We create our `MyPaintWidget()` as usual, only this time we don't return it directly but bind it to a variable name.
- Line 27: We create a button widget. It will have a label on it that displays the text 'Clear'.
- Line 28 & 29: We set up the widget hierarchy by making both the painter and the clearbtn children of the dummy parent widget. That means *painter* and *clearbtn* are now siblings in the usual computer science tree terminology.
- Lines 31 & 32: Up to now, the button did nothing. It was there, visible, and you could press it, but nothing would happen. We change that here: we create a small, throw-away function that is going to be our callback function when the button is pressed. The function just clears the painter's canvas' contents, making it black again.
- Line 33: We bind the button's on_release event (which is fired when the button is pressed and then released) to the callback we just defined.

Note: The Kivy Widget class, by design, is kept simple. There are no general properties such as background color and border color. Instead, the examples and documentation illustrate how to easily handle such simple things yourself, as we have done here, setting the color for the canvas, and drawing the shape. From a simple start, you can move to more elaborate customization. Higher-level built-in widgets, deriving from Widget, such as Button, do have convenience properties such as background_color, but these vary by widget. Use the API docs to see what is offered by a widget, and subclass if you need to add more functionality.

Congratulations! You've written your first Kivy widget. Obviously this was just a quick introduction. There is much more to discover. We suggest taking a short break to let what you just learned sink in. Maybe draw some nice pictures to relax? If you feel like you've understood everything and are ready for more, we encourage you to read on.

Part IV

API REFERENCE

The API reference is a lexicographic list of all the different classes, methods and features that Kivy offers.

CHAPTER

TWENTYONE

KIVY FRAMEWORK

Kivy is an open source library for developing multi-touch applications. It is completely cross-platform (Linux/OSX/Win) and released under the terms of the MIT License.

It comes with native support for many multi-touch input devices, a growing library of multi-touch aware widgets and hardware accelerated OpenGL drawing. Kivy is designed to let you focus on building custom and highly interactive applications as quickly and easily as possible.

With Kivy, you can take full advantage of the dynamic nature of Python. There are thousands of high-quality, free libraries that can be integrated in your application. At the same time, performance-critical parts are implemented in the C language.

See http://kivy.org for more information.

`kivy.`**`require`**`(`*version*`)`

Require can be used to check the minimum version required to run a Kivy application. For example, you can start your application code like this:

```
import kivy
kivy.require('1.0.1')
```

If a user attempts to run your application with a version of Kivy that is older than the specified version, an Exception is raised.

The Kivy version string is built like this:

```
X.Y.Z[-tag[-tagrevision]]

X is the major version
Y is the minor version
Z is the bugfixes revision
```

The tag is optional, but may be one of 'dev', 'alpha', or 'beta'. The tagrevision is the revision of the tag.

Warning: You must not ask for a version with a tag, except -dev. Asking for a 'dev' version will just warn the user if the current Kivy version is not a -dev, but it will never raise an exception. You must not ask for a version with a tagrevision.

`kivy.`**`kivy_configure`**`()`

Call post-configuration of Kivy. This function must be called if you create the window yourself.

`kivy.`**`kivy_register_post_configuration`**`(`*callback*`)`

Register a function to be called when kivy_configure() is called.

Warning: Internal use only.

kivy.**kivy_options** = {'window': ('egl_rpi', 'pygame', 'sdl', 'x11', 'sdl2'), 'camera': ('opencv', 'gi', 'pygst', 'videoca
    Global settings options for kivy

kivy.**kivy_base_dir** = '/home/kivy/Buildbot-2.7/doc/build/kivy'
    Kivy directory

kivy.**kivy_modules_dir** = '/home/kivy/Buildbot-2.7/doc/build/kivy/modules'
    Kivy modules directory

kivy.**kivy_data_dir** = '/home/kivy/Buildbot-2.7/doc/build/kivy/data'
    Kivy data directory

kivy.**kivy_shader_dir** = '/home/kivy/Buildbot-2.7/doc/build/kivy/data/glsl'
    Kivy glsl shader directory

kivy.**kivy_icons_dir** = '/home/kivy/Buildbot-2.7/doc/build/kivy/data/icons/'
    Kivy icons config path (don't remove the last '')

kivy.**kivy_home_dir** = ''
    Kivy user-home storage directory

kivy.**kivy_userexts_dir** = ''
    Kivy user extensions directory

kivy.**kivy_config_fn** = ''
    Kivy configuration filename

kivy.**kivy_usermodules_dir** = ''
    Kivy user modules directory

21.1 Animation

`Animation` and `AnimationTransition` are used to animate `Widget` properties. You must specify at least a property name and target value. To use an Animation, follow these steps:

- Setup an Animation object
- Use the Animation object on a Widget

21.1.1 Simple animation

To animate a Widget's x or y position, simply specify the target x/y values where you want the widget positioned at the end of the animation:

```
anim = Animation(x=100, y=100)
anim.start(widget)
```

The animation will last for 1 second unless `duration` is specified. When anim.start() is called, the Widget will move smoothly from the current x/y position to (100, 100).

21.1.2 Multiple properties and transitions

You can animate multiple properties and use built-in or custom transition functions using `transition` (or the *t=* shortcut). For example, to animate the position and size using the 'in_quad' transition:

```
anim = Animation(x=50, size=(80, 80), t='in_quad')
anim.start(widget)
```

Note that the *t=* parameter can be the string name of a method in the `AnimationTransition` class or your own animation function.

21.1.3 Sequential animation

To join animations sequentially, use the '+' operator. The following example will animate to x=50 over 1 second, then animate the size to (80, 80) over the next two seconds:

```
anim = Animation(x=50) + Animation(size=(80, 80), duration=2.)
anim.start(widget)
```

21.1.4 Parallel animation

To join animations in parallel, use the '&' operator. The following example will animate the position to (80, 10) over 1 second, whilst in parallel animating the size to (800, 800):

```
anim = Animation(pos=(80, 10))
anim &= Animation(size=(800, 800), duration=2.)
anim.start(widget)
```

Keep in mind that creating overlapping animations on the same property may have unexpected results. If you want to apply multiple animations to the same property, you should either schedule them sequentially (via the '+' operator or using the *on_complete* callback) or cancel previous animations using the `cancel_all` method.

21.1.5 Repeating animation

New in version 1.8.0.

Note: This is currently only implemented for 'Sequence' animations.

To set an animation to repeat, simply set the `Sequence.repeat` property to *True*:

```
anim = Animation(...) + Animation(...)
anim.repeat = True
anim.start(widget)
```

For flow control of animations such as stopping and cancelling, use the methods already in place in the animation module.

class `kivy.animation.`**`Animation`**`(`***kw*`)`

Bases: `kivy.event.EventDispatcher`

Create an animation definition that can be used to animate a Widget.

Parameters

***duration* or *d*: float, defaults to 1.**Duration of the animation, in seconds.

***transition* or *t*: str or func**Transition function for animate properties. It can be the name of a method from `AnimationTransition`.

***step* or *s*: float**Step in milliseconds of the animation. Defaults to 1 / 60.

Events

***on_start*: widget**Fired when the animation is started on a widget.

***on_complete*: widget**Fired when the animation is completed or stopped on a widget.

***on_progress*: widget, progression**Fired when the progression of the animation is changing.

Changed in version 1.4.0: Added s/step parameter.

animated_properties
Return the properties used to animate.

cancel(*widget*)
Cancel the animation previously applied to a widget. Same effect as `stop`, except the *on_complete* event will *not* be triggered!

New in version 1.4.0.

static **cancel_all**(*widget*, **largs*)
Cancel all animations that concern a specific widget / list of properties. See `cancel`.

Example:

```
anim = Animation(x=50)
anim.start(widget)

# and later
Animation.cancel_all(widget, 'x')
```

New in version 1.4.0.

cancel_property(*widget*, *prop*)
Even if an animation is running, remove a property. It will not be animated further. If it was the only/last property being animated, the animation will be canceled (see `cancel`)

New in version 1.4.0.

duration
Return the duration of the animation.

have_properties_to_animate(*widget*)
Return True if a widget still has properties to animate.

New in version 1.8.0.

start(*widget*)
Start the animation on a widget.

stop(*widget*)
Stop the animation previously applied to a widget, triggering the *on_complete* event.

static **stop_all**(*widget*, **largs*)
Stop all animations that concern a specific widget / list of properties.

Example:

```
anim = Animation(x=50)
anim.start(widget)

# and later
Animation.stop_all(widget, 'x')
```

stop_property(*widget*, *prop*)
Even if an animation is running, remove a property. It will not be animated futher. If it was the only/last property being animated, the animation will be stopped (see `stop`).

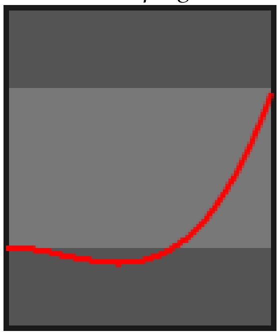
transition
Return the transition of the animation.

class `kivy.animation.`**`AnimationTransition`**
Bases: `object`

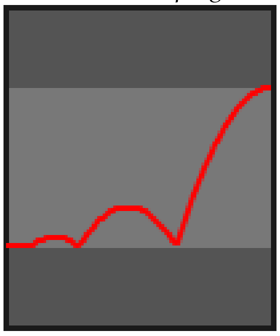
Collection of animation functions to be used with the Animation object. Easing Functions ported to Kivy from the Clutter Project http://www.clutter-project.org/docs/clutter/stable/ClutterAlpha.html

The *progress* parameter in each animation function is in the range 0-1.

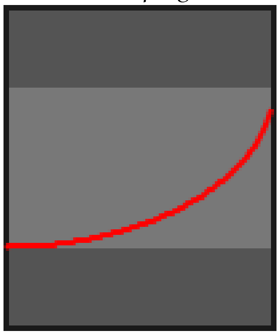
static **`in_back`**(*progress*)



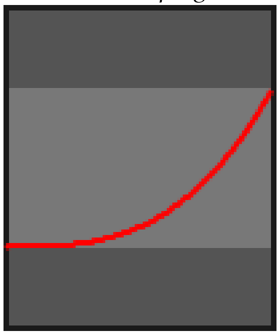
static **`in_bounce`**(*progress*)



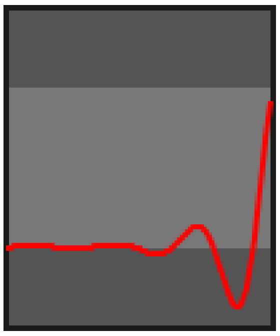
static **`in_circ`**(*progress*)



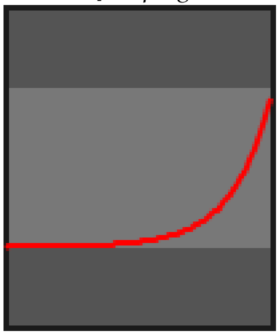
static **`in_cubic`**(*progress*)



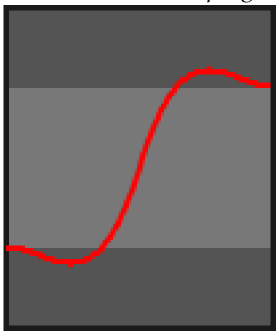
static **`in_elastic`**(*progress*)



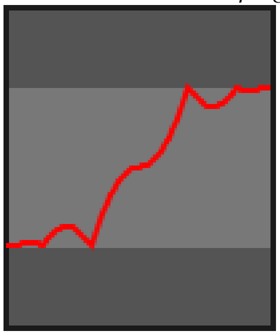
static **`in_expo`**(*progress*)



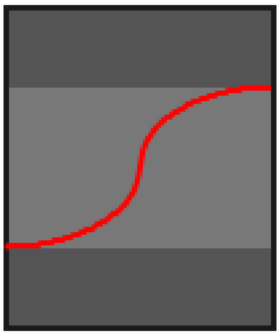
static **`in_out_back`**(*progress*)



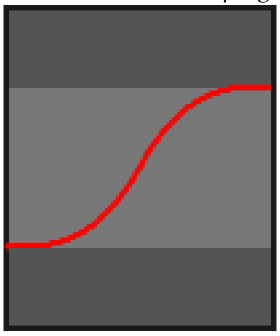
static **`in_out_bounce`**(*progress*)



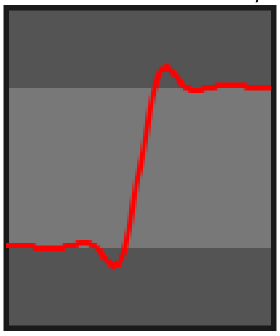
static **`in_out_circ`**(*progress*)



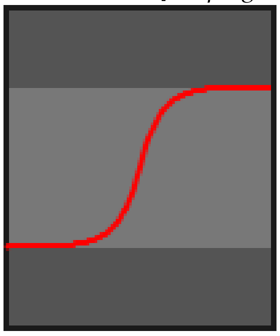
static **`in_out_cubic`**(*progress*)



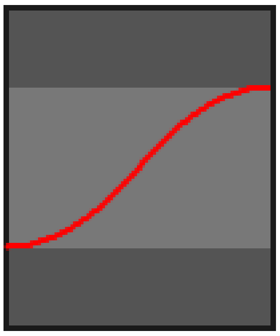
static **`in_out_elastic`**(*progress*)



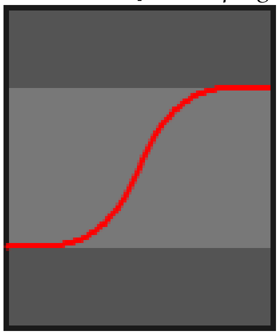
static **`in_out_expo`**(*progress*)



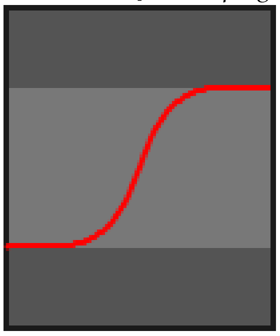
static **`in_out_quad`**(*progress*)



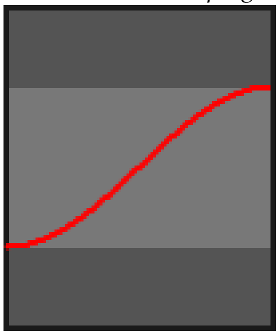
static `in_out_quart`(*progress*)



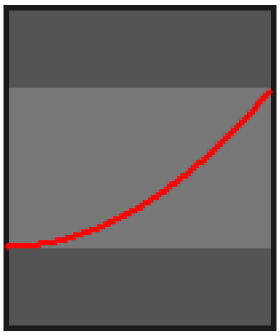
static `in_out_quint`(*progress*)



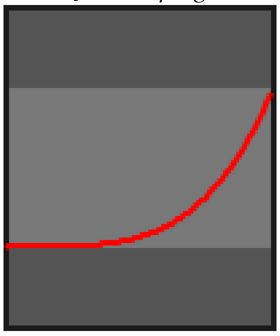
static `in_out_sine`(*progress*)



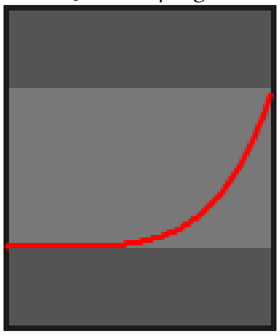
static `in_quad`(*progress*)



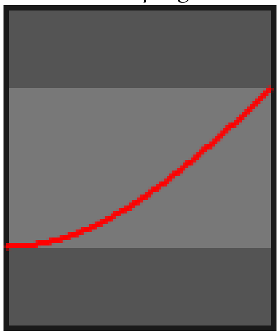
static **`in_quart`**(*progress*)



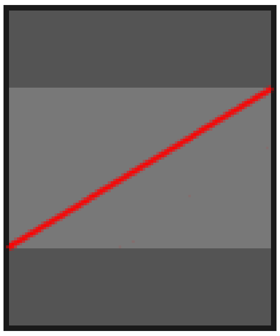
static **`in_quint`**(*progress*)



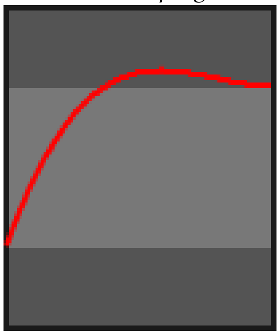
static **`in_sine`**(*progress*)



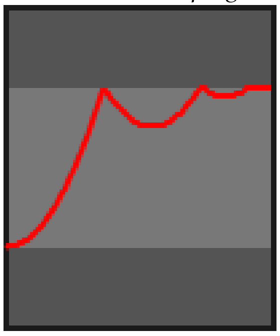
static **`linear`**(*progress*)



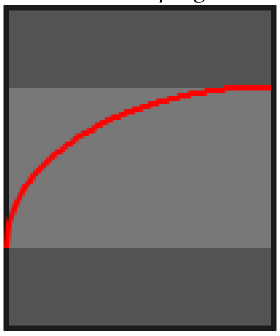
static **`out_back`**(*progress*)



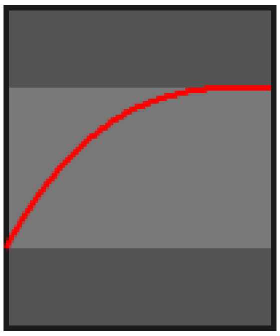
static **`out_bounce`**(*progress*)



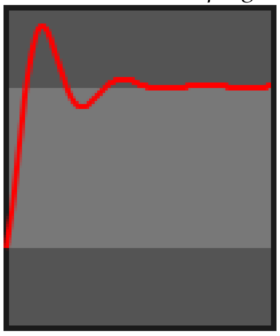
static **`out_circ`**(*progress*)



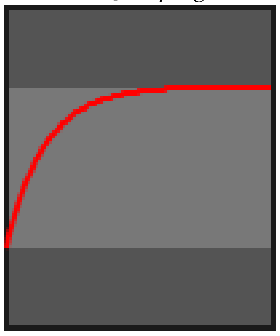
static **`out_cubic`**(*progress*)



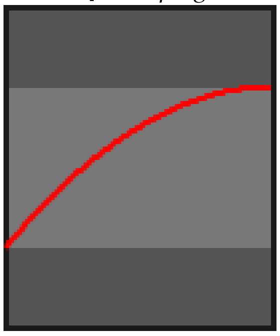
static **`out_elastic`**(*progress*)



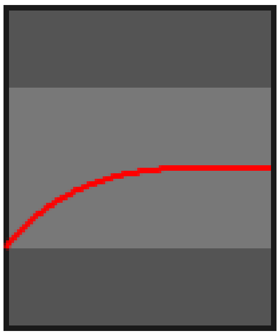
static **`out_expo`**(*progress*)



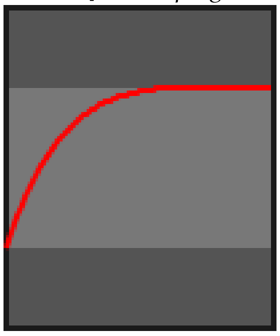
static **`out_quad`**(*progress*)



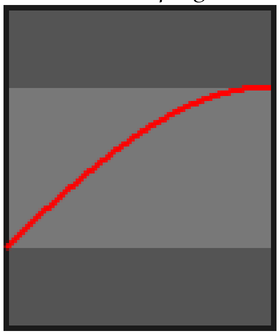
static **`out_quart`**(*progress*)



static **out_quint**(*progress*)



static **out_sine**(*progress*)



21.2 Application

The `App` class is the base for creating Kivy applications. Think of it as your main entry point into the Kivy run loop. In most cases, you subclass this class and make your own app. You create an instance of your specific app class and then, when you are ready to start the application's life cycle, you call your instance's `App.run()` method.

21.2.1 Creating an Application

Method using build() override

To initialize your app with a widget tree, override the `build()` method in your app class and return the widget tree you constructed.

Here's an example of a very simple application that just shows a button:

```
'''
Application example using build() + return
==========================================
An application can be built if you return a widget on build(), or if you set
self.root.
'''

import kivy
kivy.require('1.0.7')

from kivy.app import App
from kivy.uix.button import Button


class TestApp(App):

    def build(self):
        # return a Button() as a root widget
        return Button(text='hello world')

if __name__ == '__main__':
    TestApp().run()
```

The file is also available in the examples folder at `kivy/examples/application/app_with_build.py`.

Here, no widget tree was constructed (or if you will, a tree with only the root node).

Method using kv file

You can also use the *Kivy Language* for creating applications. The .kv can contain rules and root widget definitions at the same time. Here is the same example as the Button one in a kv file.

Contents of 'test.kv':

```
#:kivy 1.0

Button:
    text: 'Hello world'
```

Contents of 'main.py':

```
'''
Application from a .kv
======================

The root application is created from the corresponding .kv. Check the test.kv
file to see what will be the root widget.
'''

import kivy
kivy.require('1.0.7')

from kivy.app import App


class TestApp(App):
    pass

if __name__ == '__main__':
    TestApp().run()
```

See `kivy/examples/application/app_with_kv.py`.

The relation between main.py and test.kv is explained in `App.load_kv()`.

21.2.2 Application configuration

New in version 1.0.7.

Use the configuration file

Your application might want to have its own configuration file. The App is able to handle an INI file automatically. You add your section/key/value in the App.build_config() method by using the *config* parameter (which is an instance of ConfigParser):

```
class TestApp(App):
    def build_config(self, config):
        config.setdefaults('section1', {
            'key1': 'value1',
            'key2': '42'
        })
```

As soon as you add one section in the config, a file is created on the disk and named from the mangled name of your class. "TestApp" will give a config file-name "test.ini" with the content:

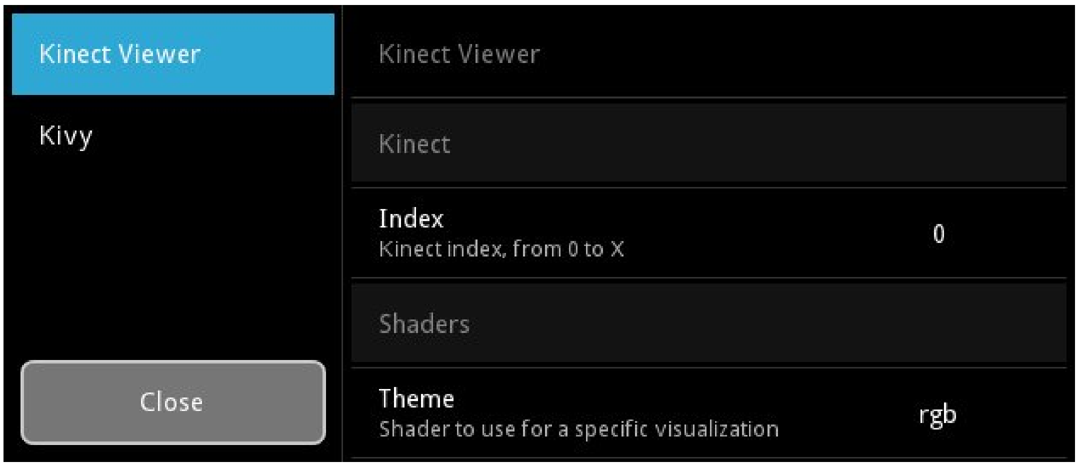
```
[section1]
key1 = value1
key2 = 42
```

The "test.ini" will be automatically loaded at runtime and you can access the configuration in your App.build() method:

```
class TestApp(App):
    def build_config(self, config):
        config.setdefaults('section1', {
            'key1': 'value1',
            'key2': '42'
        })

    def build(self):
        config = self.config
        return Label(text='key1 is %s and key2 is %d' % (
            config.get('section1', 'key1'),
            config.getint('section1', 'key2')))
```

Create a settings panel

Your application can have a settings panel to let your user configure some of your config tokens. Here is an example done in the KinectViewer example (available in the examples directory):


Kinect Viewer
Kivy
Close
Kinect Viewer
Kinect
Index
Kinect index, from 0 to X
0
Shaders
Theme
Shader to use for a specific visualization
rgb

You can add your own panels of settings by extending the `App.build_settings()` method. Check the `Settings` about how to create a panel, because you need a JSON file / data first.

Let's take as an example the previous snippet of TestApp with custom config. We could create a JSON like this:

```
[
    { "type": "title",
      "title": "Test application" },

    { "type": "options",
      "title": "My first key",
      "desc": "Description of my first key",
      "section": "section1",
      "key": "key1",
      "options": ["value1", "value2", "another value"] },

    { "type": "numeric",
      "title": "My second key",
      "desc": "Description of my second key",
      "section": "section1",
      "key": "key2" }
]
```

Then, we can create a panel using this JSON to automatically create all the options and link them to our `App.config` ConfigParser instance:

```
class TestApp(App):
    # ...
    def build_settings(self, settings):
        jsondata = """... put the json data here ..."""
        settings.add_json_panel('Test application',
            self.config, data=jsondata)
```

That's all! Now you can press F1 (default keystroke) to toggle the settings panel or press the "settings" key on your android device. You can manually call `App.open_settings()` and `App.close_settings()` if you want to handle this manually. Every change in the panel is automatically saved in the config file.

You can also use `App.build_settings()` to modify properties of the settings panel. For instance, the default panel has a sidebar for switching between json panels whose width defaults to 200dp. If you'd prefer this to be narrower, you could add:

```
settings.interface.menu.width = dp(100)
```

to your `build_settings()` method.

You might want to know when a config value has been changed by the user in order to adapt or reload your UI. You can then overload the `on_config_change()` method:

```
class TestApp(App):
    # ...
    def on_config_change(self, config, section, key, value):
        if config is self.config:
            token = (section, key)
            if token == ('section1', 'key1'):
                print('Our key1 have been changed to', value)
            elif token == ('section1', 'key2'):
                print('Our key2 have been changed to', value)
```

The Kivy configuration panel is added by default to the settings instance. If you don't want this panel, you can declare your Application as follows:

```
class TestApp(App):
    use_kivy_settings = False
    # ...
```

This only removes the Kivy panel but does not stop the settings instance from appearing. If you want to prevent the settings instance from appearing altogether, you can do this:

```
class TestApp(App):
    def open_settings(self, *largs):
        pass
```

21.2.3 Profiling with on_start and on_stop

It is often useful to profile python code in order to discover locations to optimise. The standard library profilers (http://docs.python.org/2/library/profile.html) provides multiple options for profiling code. For profiling the entire program, the natural approaches of using profile as a module or profile's run method does not work with Kivy. It is however, possible to use `App.on_start()` and `App.on_stop()` methods:

```
import cProfile

class MyApp(App):
    def on_start(self):
        self.profile = cProfile.Profile()
        self.profile.enable()

    def on_stop(self):
        self.profile.disable()
        self.profile.dump_stats('myapp.profile')
```

This will create a file called *myapp.profile* when you exit your app.

21.2.4 Customising layout

You can choose different settings widget layouts by setting `App.settings_cls`. By default, this is a `Settings` class which provides the pictured sidebar layout, but you could set it to any of the other layouts provided in `kivy.uix.settings` or create your own. See the module documentation for `kivy.uix.settings` for more information.

You can customise how the settings panel is displayed by overriding `App.display_settings()` which is called before displaying the settings panel on the screen. By default, it simply draws the panel on top of the window, but you could modify it to (for instance) show the settings in a `Popup` or add it to your app's ScreenManager if you are using one. If you do so, you should also modify App.close_settings() to exit the panel appropriately. For instance, to have the settings panel appear in a popup you can do:

```
def display_settings(self, settings):
    try:
        p = self.settings_popup
    except AttributeError:
        self.settings_popup = Popup(content=settings,
                                    title='Settings',
                                    size_hint=(0.8, 0.8))
        p = self.settings_popup
    if p.content is not settings:
        p.content = settings
    p.open()

def close_settings(self, *args):
    try:
        p = self.settings_popup
        p.dismiss()
    except AttributeError:
        pass # Settings popup doesn't exist
```

Finally, if you want to replace the current settings panel widget, you can remove the internal references to it using App.destroy_settings(). If you have modified App.display_settings(), you should be careful to detect if the settings panel has been replaced.

21.2.5 Pause mode

New in version 1.1.0.

Warning: This mode is experimental, and designed for phones/tablets. There are some cases where your application could crash on resume.

On tablets and phones, the user can switch at any moment to another application. By default, your application will close and the App.on_stop() event will be fired.

If you support Pause mode, when switching to another application, your application will wait indefinitely until the user switches back to your application. There is an issue with OpenGL on Android devices: it is not guaranteed that the OpenGL ES Context will be restored when your app resumes. The mechanism for restoring all the OpenGL data is not yet implemented in Kivy.

The currently implemented Pause mechanism is:

1. Kivy checks every frame if Pause mode is activated by the Operating System due to the user switching to another application, a phone shutdown or any other reason.
2. App.on_pause() is called:
3. If False is returned (default case), then App.on_stop() is called.
4. Otherwise the application will sleep until the OS resumes our App
5. When the app is resumed, App.on_resume() is called.
6. If our app memory has been reclaimed by the OS, then nothing will be called.

Here is a simple example of how on_pause() should be used:

```
class TestApp(App):

   def on_pause(self):
      # Here you can save data if needed
      return True

   def on_resume(self):
      # Here you can check if any data needs replacing (usually nothing)
      pass
```

Warning: Both *on_pause* and *on_stop* must save important data because after *on_pause* is called, *on_resume* may not be called at all.

class `kivy.app.`**`App`**(***kwargs*)

Bases: `kivy.event.EventDispatcher`

Application class, see module documentation for more information.

Events

on_start:Fired when the application is being started (before the `runTouchApp()` call.

on_stop:Fired when the application stops.

on_pause:Fired when the application is paused by the OS.

on_resume:Fired when the application is resumed from pause by the OS. Beware: you have no guarantee that this event will be fired after the *on_pause* event has been called.

Changed in version 1.7.0: Parameter *kv_file* added.

Changed in version 1.8.0: Parameters *kv_file* and *kv_directory* are now properties of App.

`build`()

Initializes the application; it will be called only once. If this method returns a widget (tree), it will be used as the root widget and added to the window.

ReturnsNone or a root `Widget` instance if no self.root exists.

`build_config`(*config*)

New in version 1.0.7.

This method is called before the application is initialized to construct your `ConfigParser` object. This is where you can put any default section / key / value for your config. If anything is set, the configuration will be automatically saved in the file returned by `get_application_config()`.

Parameters

config: **`ConfigParser`**Use this to add default section / key / value items

`build_settings`(*settings*)

New in version 1.0.7.

This method is called when the user (or you) want to show the application settings. It is called once when the settings panel is first opened, after which the panel is cached. It may be called again if the cached settings panel is removed by `destroy_settings()`.

You can use this method to add settings panels and to customise the settings widget e.g. by changing the sidebar width. See the module documentation for full details.

Parameters

settings: **`Settings`**Settings instance for adding panels

close_settings(**largs*)
Close the previously opened settings panel.

ReturnsTrue if the settings has been closed.

config = None
Returns an instance of the `ConfigParser` for the application configuration. You can use this to query some config tokens in the `build()` method.

create_settings()
Create the settings panel. This method will normally be called only one time per application life-time and the result is cached internally, but it may be called again if the cached panel is removed by `destroy_settings()`.

By default, it will build a settings panel according to `settings_cls`, call `build_settings()`, add a Kivy panel if `use_kivy_settings` is True, and bind to on_close/on_config_change.

If you want to plug your own way of doing settings, without the Kivy panel or close/config change events, this is the method you want to overload.

New in version 1.8.0.

destroy_settings()
New in version 1.8.0.

Dereferences the current settings panel if one exists. This means that when `App.open_settings()` is next run, a new panel will be created and displayed. It doesn't affect any of the contents of the panel, but lets you (for instance) refresh the settings panel layout if you have changed the settings widget in response to a screen size change.

If you have modified `open_settings()` or `display_settings()`, you should be careful to correctly detect if the previous settings widget has been destroyed.

directory
New in version 1.0.7.

Return the directory where the application lives.

display_settings(*settings*)
New in version 1.8.0.

Display the settings panel. By default, the panel is drawn directly on top of the window. You can define other behaviour by overriding this method, such as adding it to a ScreenManager or Popup.

You should return True if the display is successful, otherwise False.

Parameters

settings: **`Settings`**You can modify this object in order to modify the settings display.

get_application_config(*defaultpath='%(appdir)s/%(appname)s.ini'*)
New in version 1.0.7.

Changed in version 1.4.0: Customized the default path for iOS and Android platforms. Added a defaultpath parameter for desktop OS's (not applicable to iOS and Android.)

Return the filename of your application configuration. Depending on the platform, the application file will be stored in different locations:

- on iOS: <appdir>/Documents/.<appname>.ini
- on Android: /sdcard/.<appname>.ini
- otherwise: <appdir>/<appname>.ini

When you are distributing your application on Desktops, please note that if the application is meant to be installed system-wide, the user might not have write-access to the application directory. If you want to store user settings, you should overload this method and change the default behavior to save the configuration file in the user directory.:

```
class TestApp(App):
    def get_application_config(self):
        return super(TestApp, self).get_application_config(
            '~/.%(appname)s.ini')
```

Some notes:

- The tilda '~' will be expanded to the user directory.
- %(appdir)s will be replaced with the application `directory`
- %(appname)s will be replaced with the application `name`

`get_application_icon`()
Return the icon of the application.

`get_application_name`()
Return the name of the application.

static **`get_running_app`**()
Return the currently running application instance.

New in version 1.1.0.

`icon`
Icon of your application. The icon can be located in the same directory as your main file. You can set this as follows:

```
class MyApp(App):
    def build(self):
        self.icon = 'myicon.png'
```

New in version 1.0.5.

Changed in version 1.8.0: *icon* is now a `StringProperty`. Don't set the icon in the class as previously stated in the documentation.

Note: For Kivy prior to 1.8.0, you need to set this as follows:

```
class MyApp(App):
    icon = 'customicon.png'
```

`kv_directory`
Path of the directory where application kv is stored, defaults to None

New in version 1.8.0.

If a kv_directory is set, it will be used to get the initial kv file. By default, the file is assumed to be in the same directory as the current App definition file.

`kv_file`
Filename of the Kv file to load, defaults to None.

New in version 1.8.0.

If a kv_file is set, it will be loaded when the application starts. The loading of the "default" kv file will be prevented.

load_config()

(internal) This function is used for returning a ConfigParser with the application configuration. It's doing 3 things:

1.Creating an instance of a ConfigParser

2.Loading the default configuration by calling `build_config()`, then

3.If it exists, it loads the application configuration file, otherwise it creates one.

Returns`ConfigParser` instance

load_kv(*filename=None*)

This method is invoked the first time the app is being run if no widget tree has been constructed before for this app. This method then looks for a matching kv file in the same directory as the file that contains the application class.

For example, say you have a file named main.py that contains:

```
class ShowcaseApp(App):
    pass
```

This method will search for a file named *showcase.kv* in the directory that contains main.py. The name of the kv file has to be the lowercase name of the class, without the 'App' postfix at the end if it exists.

You can define rules and a root widget in your kv file:

```
<ClassName>: # this is a rule
    ...

ClassName: # this is a root widget
    ...
```

There must be only one root widget. See the *Kivy Language* documentation for more information on how to create kv files. If your kv file contains a root widget, it will be used as self.root, the root widget for the application.

Note: This function is called from `run()`, therefore, any widget whose styling is defined in this kv file and is created before `run()` is called (e.g. in *__init__*), won't have its styling applied. Note that `build()` is called after `load_kv` has been called.

name

New in version 1.0.7.

Return the name of the application based on the class name.

on_config_change(*config*, *section*, *key*, *value*)

Event handler fired when a configuration token has been changed by the settings page.

on_pause()

Event handler called when Pause mode is requested. You should return True if your app can go into Pause mode, otherwise return False and your application will be stopped (the default).

You cannot control when the application is going to go into this mode. It's determined by the Operating System and mostly used for mobile devices (android/ios) and for resizing.

The default return value is False.

New in version 1.1.0.

on_resume()

Event handler called when your application is resuming from the Pause mode.

New in version 1.1.0.

> **Warning:** When resuming, the OpenGL Context might have been damaged / freed. This is where you can reconstruct some of your OpenGL state e.g. FBO content.

on_start()

Event handler for the *on_start* event which is fired after initialization (after build() has been called) but before the application has started running.

on_stop()

Event handler for the *on_stop* event which is fired when the application has finished running (i.e. the window is about to be closed).

open_settings(**largs*)

Open the application settings panel. It will be created the very first time, or recreated if the previously cached panel has been removed by `destroy_settings()`. The settings panel will be displayed with the `display_settings()` method, which by default adds the settings panel to the Window attached to your application. You should override that method if you want to display the settings panel differently.

ReturnsTrue if the settings has been opened.

options = None

Options passed to the __init__ of the App

root = None

The *root* widget returned by the `build()` method or by the `load_kv()` method if the kv file contains a root widget.

root_window

New in version 1.9.0.

Returns the root window instance used by `run()`.

run()

Launches the app in standalone mode.

settings_cls

New in version 1.8.0.

The class to used to construct the settings panel and the instance passed to `build_config()`. You should use either `Settings` or one of the provided subclasses with different layouts (`SettingsWithSidebar`, `SettingsWithSpinner`, `SettingsWithTabbedPanel`, `SettingsWithNoMenu`). You can also create your own Settings subclass. See the documentation of `Settings` for more information.

`settings_cls` is an `ObjectProperty` and defaults to `SettingsWithSpinner` which displays settings panels with a spinner to switch between them. If you set a string, the `Factory` will be used to resolve the class.

stop(**largs*)

Stop the application.

If you use this method, the whole application will stop by issuing a call to `stopTouchApp()`.

title

Title of your application. You can set this as follows:

```
class MyApp(App):
    def build(self):
        self.title = 'Hello world'
```

New in version 1.0.5.

Changed in version 1.8.0: *title* is now a `StringProperty`. Don't set the title in the class as previously stated in the documentation.

Note: For Kivy < 1.8.0, you can set this as follows:

```
class MyApp(App):
    title = 'Custom title'
```

If you want to dynamically change the title, you can do:

```
from kivy.base import EventLoop
EventLoop.window.title = 'New title'
```

`use_kivy_settings` = True

New in version 1.0.7.

If True, the application settings will also include the Kivy settings. If you don't want the user to change any kivy settings from your settings UI, change this to False.

`user_data_dir`

New in version 1.7.0.

Returns the path to the directory in the users file system which the application can use to store additional data.

Different platforms have different conventions with regards to where the user can store data such as preferences, saved games and settings. This function implements these conventions. The <app_name> directory is created when the property is called, unless it already exists.

On iOS, *~/Documents<app_name>* is returned (which is inside the app's sandbox).

On Android, */sdcard/<app_name>* is returned.

On Windows, *%APPDATA%/<app_name>* is returned.

On Mac OSX, *~/Library/Application Support/<app_name>* is returned.

On Linux, *$XDG_CONFIG_HOME/<app_name>* is returned.

21.3 Asynchronous data loader

This is the Asynchronous Loader. You can use it to load an image and use it, even if data are not yet available. You must specify a default loading image when using the loader:

```
from kivy.loader import Loader
image = Loader.image('mysprite.png')
```

You can also load an image from a url:

```
image = Loader.image('http://mysite.com/test.png')
```

If you want to change the default loading image, you can do:

```
Loader.loading_image = Image('another_loading.png')
```

21.3.1 Tweaking the asynchronous loader

New in version 1.6.0.

You can tweak the loader to provide a better user experience or more performance, depending of the images you are going to load. Take a look at the parameters:

- `Loader.num_workers` - define the number of threads to start for loading images.
- `Loader.max_upload_per_frame` - define the maximum image uploads in GPU to do per frame.

class `kivy.loader.`**`LoaderBase`**

Bases: `object`

Common base for the Loader and specific implementations. By default, the Loader will be the best available loader implementation.

The _update() function is called every 1 / 25.s or each frame if we have less than 25 FPS.

`error_image`

Image used for error. You can change it by doing:

```
Loader.error_image = 'error.png'
```

Changed in version 1.6.0: Not readonly anymore.

`image`(*filename*, *load_callback=None*, *post_callback=None*, ***kwargs*)

Load a image using the Loader. A ProxyImage is returned with a loading image. You can use it as follows:

```
from kivy.app import App
from kivy.uix.image import Image
from kivy.loader import Loader

class TestApp(App):
    def _image_loaded(self, proxyImage):
        if proxyImage.image.texture:
            self.image.texture = proxyImage.image.texture

    def build(self):
        proxyImage = Loader.image("myPic.jpg")
        proxyImage.bind(on_load=self._image_loaded)
        self.image = Image()
        return self.image

TestApp().run()
```

In order to cancel all background loading, call *Loader.stop()*.

`loading_image`

Image used for loading. You can change it by doing:

```
Loader.loading_image = 'loading.png'
```

Changed in version 1.6.0: Not readonly anymore.

`max_upload_per_frame`

The number of images to upload per frame. By default, we'll upload only 2 images to the GPU per frame. If you are uploading many small images, you can easily increase this parameter to 10 or more. If you are loading multiple full HD images, the upload time may have consequences and block the application. If you want a smooth experience, use the default.

As a matter of fact, a Full-HD RGB image will take ~6MB in memory, so it may take time. If you have activated mipmap=True too, then the GPU must calculate the mipmap of these big images too, in real time. Then it may be best to reduce the `max_upload_per_frame` to 1 or 2. If you want to get rid of that (or reduce it a lot), take a look at the DDS format.

New in version 1.6.0.

`num_workers`

Number of workers to use while loading (used only if the loader implementation supports it). This setting impacts the loader only on initialization. Once the loader is started, the setting has no impact:

```
from kivy.loader import Loader
Loader.num_workers = 4
```

The default value is 2 for giving a smooth user experience. You could increase the number of workers, then all the images will be loaded faster, but the user will not been able to use the application while loading. Prior to 1.6.0, the default number was 20, and loading many full-hd images was completly blocking the application.

New in version 1.6.0.

`pause``()`

Pause the loader, can be useful during interactions.

New in version 1.6.0.

`resume``()`

Resume the loader, after a `pause()`.

New in version 1.6.0.

`run``(`**largs*`)`

Main loop for the loader.

`start``()`

Start the loader thread/process.

`stop``()`

Stop the loader thread/process.

class `kivy.loader.`**`ProxyImage`**`(`*arg, **kwargs*`)`

Bases: `kivy.core.image.Image`

Image returned by the Loader.image() function.

Properties

loaded: **bool, defaults to False**This value may be True if the image is already cached.

Events

*on_load*Fired when the image is loaded or changed.

21.4 Atlas

New in version 1.1.0.

Atlas is a class for managing texture atlases: packing multiple textures into one. With it, you reduce the number of images loaded and speedup the application loading.

An Atlas is composed of:

- a json file (.atlas) that contains all the information about the images contained inside the atlas.

- one or multiple atlas images associated with the atlas definition.

21.4.1 Definition of .atlas

A file with `<basename>.atlas` is a json file formatted like this:

```
{
    "<basename>-<index>.png": {
        "id1": [ <x>, <y>, <width>, <height> ],
        "id2": [ <x>, <y>, <width>, <height> ],
        # ...
    },
    # ...
}
```

Example of the Kivy `defaulttheme.atlas`:

```
{
    "defaulttheme-0.png": {
        "progressbar_background": [431, 224, 59, 24],
        "image-missing": [253, 344, 48, 48],
        "filechooser_selected": [1, 207, 118, 118],
        "bubble_btn": [83, 174, 32, 32],
        # ... and more ...
    }
}
```

21.4.2 How to create an Atlas

Warning: The atlas creation requires Imaging/PIL. This will be removed in the future when the Kivy core Image is able to support loading / blitting / saving operations.

You can directly use this module to create atlas files with this command:

```
$ python -m kivy.atlas <basename> <size> <list of images...>
```

Let's say you have a list of images that you want to put into an Atlas. The directory is named `images` with lots of png files inside:

```
$ ls
images
$ cd images
$ ls
bubble.png bubble-red.png button.png button-down.png
```

You can combine all the png's into one and generate the atlas file with:

```
$ python -m kivy.atlas myatlas 256 *.png
Atlas created at myatlas.atlas
1 image have been created
$ ls
bubble.png bubble-red.png button.png button-down.png myatlas.atlas
myatlas-0.png
```

As you can see, we get 2 new files: `myatlas.atlas` and `myatlas-0.png`.

Note: When using this script, the ids referenced in the atlas are the base names of the images without the extension. So, if you are going to name a file `../images/button.png`, the id for this image will be `button`.

If you need path information included, you should include `use_path` as follows:

```
$ python -m kivy.atlas use_path myatlas 256 *.png
```

In which case the id for `../images/button.png` will be `images_button`

21.4.3 How to use an Atlas

Usually, you would use the atlas as follows:

```
a = Button(background_normal='images/button.png',
           background_down='images/button_down.png')
```

In our previous example, we have created the atlas containing both images and put them in `images/myatlas.atlas`. You can use url notation to reference them:

```
atlas://path/to/myatlas/id
# will search for the ``path/to/myatlas.atlas`` and get the image ``id``
```

In our case, it would be:

```
atlas://images/myatlas/button
```

Note: In the atlas url, there is no need to add the `.atlas` extension. It will be automatically append to the filename.

21.4.4 Manual usage of the Atlas

```
>>> from kivy.atlas import Atlas
>>> atlas = Atlas('path/to/myatlas.atlas')
>>> print(atlas.textures.keys())
['bubble', 'bubble-red', 'button', 'button-down']
>>> print(atlas['button'])
<kivy.graphics.texture.TextureRegion object at 0x2404d10>
```

class `kivy.atlas.`**`Atlas`**(*filename*)

Bases: `kivy.event.EventDispatcher`

Manage texture atlas. See module documentation for more information.

static **`create`**(*outname, filenames, size, padding=2, use_path=False*)

This method can be used to create an atlas manually from a set of images.

Parameters

***outname*: str**Basename to use for `.atlas` creation and `-<idx>.png` associated images.

***filenames*: list**List of filenames to put in the atlas.

***size*: int or list (width, height)**Size of the atlas image.

***padding*: int, defaults to 2**Padding to put around each image.

Be careful. If you're using a padding < 2, you might have issues with the borders of the images. Because of the OpenGL linearization, it might use the pixels of the adjacent image.

If you're using a padding >= 2, we'll automatically generate a "border" of 1px around your image. If you look at the result, don't be scared if the image inside is not exactly the same as yours :).

***use_path*: bool, defaults to False**If True, the relative path of the source png file names will be included in the atlas ids rather that just in the file names. Leading dots and slashes will be excluded and all other slashes in the path will be replaced with underscores. For example, if *use_path* is False (the default) and the file name is `../data/tiles/green_grass.png`, the id will be `green_grass`. If *use_path* is True, it will be `data_tiles_green_grass`.

Changed in version 1.8.0: Parameter use_path added

`filename`

Filename of the current Atlas.

`filename` is an `AliasProperty` and defaults to None.

`textures`

List of available textures within the atlas.

`textures` is a `DictProperty` and defaults to {}.

21.5 Cache manager

The cache manager can be used to store python objects attached to a unique key. The cache can be controlled in two ways: with a object limit or a timeout.

For example, we can create a new cache with a limit of 10 objects and a timeout of 5 seconds:

```
# register a new Cache
Cache.register('mycache', limit=10, timeout=5)

# create an object + id
text = 'objectid'
instance = Label(text=text)
Cache.append('mycache', text, instance)

# retrieve the cached object
instance = Cache.get('mycache', label)
```

If the instance is NULL, the cache may have trashed it because you've not used the label for 5 seconds and you've reach the limit.

class `kivy.cache.`**`Cache`**

Bases: `object`

See module documentation for more information.

static **`append`**(*category*, *key*, *obj*, *timeout=None*)

Add a new object to the cache.

Parameters

category[str] Identifier of the category.

key[str] Unique identifier of the object to store.

obj[object] Object to store in cache.

timeout[double (optional)] Time after which to delete the object if it has not been used. If None, no timeout is applied.

static **`get`**(*category*, *key*, *default=None*)
Get a object from the cache.

Parameters

category[str] Identifier of the category.

key[str] Unique identifier of the object in the store.

default[anything, defaults to None] Default value to be returned if the key is not found.

static **`get_lastaccess`**(*category*, *key*, *default=None*)
Get the objects last access time in the cache.

Parameters

category[str] Identifier of the category.

key[str] Unique identifier of the object in the store.

default[anything, defaults to None] Default value to be returned if the key is not found.

static **`get_timestamp`**(*category*, *key*, *default=None*)
Get the object timestamp in the cache.

Parameters

category[str] Identifier of the category.

key[str] Unique identifier of the object in the store.

default[anything, defaults to None] Default value to be returned if the key is not found.

static **`print_usage`**()
Print the cache usage to the console.

static **`register`**(*category*, *limit=None*, *timeout=None*)
Register a new category in the cache with the specified limit.

Parameters

category[str] Identifier of the category.

limit[int (optional)] Maximum number of objects allowed in the cache. If None, no limit is applied.

timeout[double (optional)] Time after which to delete the object if it has not been used. If None, no timeout is applied.

static **`remove`**(*category*, *key=None*)
Purge the cache.

Parameters

category[str] Identifier of the category.

key[str (optional)] Unique identifier of the object in the store. If this arguement is not supplied, the entire category will be purged.

21.6 Clock object

The `Clock` object allows you to schedule a function call in the future; once or repeatedly at specified intervals. You can get the time elapsed between the scheduling and the calling of the callback via the *dt* argument:

```
# dt means delta-time
def my_callback(dt):
    pass

# call my_callback every 0.5 seconds
Clock.schedule_interval(my_callback, 0.5)

# call my_callback in 5 seconds
Clock.schedule_once(my_callback, 5)

# call my_callback as soon as possible (usually next frame.)
Clock.schedule_once(my_callback)
```

Note: If the callback returns False, the schedule will be removed.

If you want to schedule a function to call with default arguments, you can use the functools.partial python module:

```
from functools import partial

def my_callback(value, key, *largs):
    pass

Clock.schedule_interval(partial(my_callback, 'my value', 'my key'), 0.5)
```

Conversely, if you want to schedule a function that doesn't accept the dt argument, you can use a lambda expression to write a short function that does accept dt. For Example:

```
def no_args_func():
    print("I accept no arguments, so don't schedule me in the clock")

Clock.schedule_once(lambda dt: no_args_func(), 0.5)
```

Note: You cannot unschedule an anonymous function unless you keep a reference to it. It's better to add *args to your function definition so that it can be called with an arbitrary number of parameters.

Important: The callback is weak-referenced: you are responsible for keeping a reference to your original object/callback. If you don't keep a reference, the ClockBase will never execute your callback. For example:

```
class Foo(object):
    def start(self):
        Clock.schedule_interval(self.callback, 0.5)

    def callback(self, dt):
        print('In callback')

# A Foo object is created and the method start is called.
# Because no reference is kept to the instance returned from Foo(),
# the object will be collected by the Python Garbage Collector and
# your callback will be never called.
Foo().start()

# So you should do the following and keep a reference to the instance
# of foo until you don't need it anymore!
foo = Foo()
foo.start()
```

21.6.1 Schedule before frame

New in version 1.0.5.

Sometimes you need to schedule a callback BEFORE the next frame. Starting from 1.0.5, you can use a timeout of -1:

```
Clock.schedule_once(my_callback, 0) # call after the next frame
Clock.schedule_once(my_callback, -1) # call before the next frame
```

The Clock will execute all the callbacks with a timeout of -1 before the next frame even if you add a new callback with -1 from a running callback. However, `Clock` has an iteration limit for these callbacks: it defaults to 10.

If you schedule a callback that schedules a callback that schedules a .. etc more than 10 times, it will leave the loop and send a warning to the console, then continue after the next frame. This is implemented to prevent bugs from hanging or crashing the application.

If you need to increase the limit, set the `max_iteration` property:

```
from kivy.clock import Clock
Clock.max_iteration = 20
```

21.6.2 Triggered Events

New in version 1.0.5.

A triggered event is a way to defer a callback exactly like schedule_once(), but with some added convenience. The callback will only be scheduled once per frame even if you call the trigger twice (or more). This is not the case with `Clock.schedule_once()`:

```
# will run the callback twice before the next frame
Clock.schedule_once(my_callback)
Clock.schedule_once(my_callback)

# will run the callback once before the next frame
t = Clock.create_trigger(my_callback)
t()
t()
```

Before triggered events, you may have used this approach in a widget:

```
def trigger_callback(self, *largs):
    Clock.unschedule(self.callback)
    Clock.schedule_once(self.callback)
```

As soon as you call *trigger_callback()*, it will correctly schedule the callback once in the next frame. It is more convenient to create and bind to the triggered event than using `Clock.schedule_once()` in a function:

```
from kivy.clock import Clock
from kivy.uix.widget import Widget

class Sample(Widget):
    def __init__(self, **kwargs):
        self._trigger = Clock.create_trigger(self.cb)
        super(Sample, self).__init__(**kwargs)
        self.bind(x=self._trigger, y=self._trigger)

    def cb(self, *largs):
        pass
```

Even if x and y changes within one frame, the callback is only run once.

Note: ClockBase.create_trigger() also has a timeout parameter that behaves exactly like ClockBase.schedule_once().

21.6.3 Threading

New in version 1.9.0.

Often, other threads are used to schedule callbacks with kivy's main thread using ClockBase. Therefore, it's important to know what is thread safe and what isn't.

All the ClockBase and ClockEvent methods are safe with respect to kivy's thread. That is, it's always safe to call these methods from a single thread that is not the kivy thread. However, there are no guarantees as to the order in which these callbacks will be executed.

Calling a previously created trigger from two different threads (even if one of them is the kivy thread), or calling the trigger and its ClockEvent.cancel() method from two different threads at the same time is not safe. That is, although no exception will be raised, there no guarantees that calling the trigger from two different threads will not result in the callback being executed twice, or not executed at all. Similarly, such issues might arise when calling the trigger and canceling it with ClockBase.unschedule() or ClockEvent.cancel() from two threads simultaneously.

Therefore, it is safe to call ClockBase.create_trigger(), ClockBase.schedule_once(), ClockBase.schedule_interval(), or call or cancel a previously created trigger from an external thread. The following code, though, is not safe because it calls or cancels from two threads simultaneously without any locking mechanism:

```
event = Clock.create_trigger(func)

# in thread 1
event()
# in thread 2
event()
# now, the event may be scheduled twice or once

# the following is also unsafe
# in thread 1
event()
# in thread 2
event.cancel()
# now, the event may or may not be scheduled and a subsequent call
# may schedule it twice
```

Note, in the code above, thread 1 or thread 2 could be the kivy thread, not just an external thread.

kivy.clock.**Clock** = None

Instance of ClockBase.

class kivy.clock.**ClockBase**

Bases: kivy.clock._ClockBase

A clock object with event support.

create_trigger(*callback*, *timeout=0*)
Create a Trigger event. Check module documentation for more information.

ReturnsA ClockEvent instance. To schedule the callback of this instance, you can call it.

New in version 1.0.5.

frames
Number of internal frames (not necesseraly drawed) from the start of the clock.

New in version 1.8.0.

frames_displayed
Number of displayed frames from the start of the clock.

frametime
Time spent between the last frame and the current frame (in seconds).

New in version 1.8.0.

get_boottime()
Get the time in seconds from the application start.

get_fps()
Get the current average FPS calculated by the clock.

get_rfps()
Get the current "real" FPS calculated by the clock. This counter reflects the real framerate displayed on the screen.

In contrast to get_fps(), this function returns a counter of the number of frames, not the average of frames per second.

get_time()
Get the last tick made by the clock.

max_iteration
New in version 1.0.5: When a schedule_once is used with -1, you can add a limit on how iteration will be allowed. That is here to prevent too much relayout.

schedule_interval(*callback*, *timeout*)
Schedule an event to be called every <timeout> seconds.

ReturnsA ClockEvent instance. As opposed to create_trigger() which only creates the trigger event, this method also schedules it.

schedule_once(*callback*, *timeout=0*)
Schedule an event in <timeout> seconds. If <timeout> is unspecified or 0, the callback will be called after the next frame is rendered.

ReturnsA ClockEvent instance. As opposed to create_trigger() which only creates the trigger event, this method also schedules it.

Changed in version 1.0.5: If the timeout is -1, the callback will be called before the next frame (at tick_draw()).

tick()
Advance the clock to the next step. Must be called every frame. The default clock has a tick() function called by the core Kivy framework.

tick_draw()
Tick the drawing counter.

unschedule(*callback*, *all=True*)
Remove a previously scheduled event.

Parameters

***callback*: `ClockEvent` or a callable.**If it's a `ClockEvent` instance, then the callback associated with this event will be canceled if it is scheduled. If it's a callable, then the callable will be unscheduled if it is scheduled.

***all*: bool**If True and if *callback* is a callable, all instances of this callable will be unscheduled (i.e. if this callable was scheduled multiple times). Defaults to *True*.

Changed in version 1.9.0: The all parameter was added. Before, it behaved as if *all* was *True*.

class `kivy.clock.`**`ClockEvent`**(*clock*, *loop*, *callback*, *timeout*, *starttime*, *cid*, *trigger=False*)

Bases: `object`

A class that describes a callback scheduled with kivy's `Clock`. This class is never created by the user; instead, kivy creates and returns an instance of this class when scheduling a callback.

Warning: Most of the methods of this class are internal and can change without notice. The only exception are the `cancel()` and `__call__()` methods.

`cancel`()

Cancels the callback if it was scheduled to be called.

`kivy.clock.`**`mainthread`**(*func*)

Decorator that will schedule the call of the function for the next available frame in the mainthread. It can be useful when you use `UrlRequest` or when you do Thread programming: you cannot do any OpenGL-related work in a thread.

Please note that this method will return directly and no result can be returned:

```
@mainthread
def callback(self, *args):
    print('The request succedded!',
          'This callback is called in the main thread.')

self.req = UrlRequest(url='http://...', on_success=callback)
```

New in version 1.8.0.

21.7 Compatibility module for Python 2.7 and > 3.3

`kivy.compat.`**`PY2`** **= True**

True if Python 2 intepreter is used

`kivy.compat.`**`string_types`**

String types that can be used for checking if a object is a string

alias of `basestring`

21.8 Configuration object

The `Config` object is an instance of a modified Python ConfigParser. See the ConfigParser documentation for more information.

Kivy has a configuration file which determines the default settings. In order to change these settings, you can alter this file manually or use the Config object. Please see the *Configure Kivy* section for more information.

Note: To avoid instances where the config settings do not work or they are not applied before window creation (like setting an initial window size), Config.set should be used before importing any modules that affect the application window (ie. importing Window). Ideally, these settings should be declared right at the start of your main.py script.

21.8.1 Usage of the Config object

To read a configuration token from a particular section:

```
>>> from kivy.config import Config
>>> Config.getint('kivy', 'show_fps')
0
```

Change the configuration and save it:

```
>>> Config.set('postproc', 'retain_time', '50')
>>> Config.write()
```

Changed in version 1.7.1: The ConfigParser should work correctly with utf-8 now. The values are converted from ascii to unicode only when needed. The method get() returns utf-8 strings.

21.8.2 Available configuration tokens

kivy

***desktop*: int, 0 or 1** This option controls desktop OS specific features, such as enabling drag-able scroll-bar in scroll views, disabling of bubbles in TextInput etc. 0 is disabled, 1 is enabled.

***exit_on_escape*: int, 0 or 1** Enables exiting kivy when escape is pressed. 0 is disabled, 1 is enabled.

***keyboard_layout*: string** Identifier of the layout to use.

***keyboard_mode*: string** Specifies the keyboard mode to use. If can be one of the following:

- '' - Let Kivy choose the best option for your current platform.
- 'system' - real keyboard.
- 'dock' - one virtual keyboard docked to a screen side.
- 'multi' - one virtual keyboard for every widget request.
- 'systemanddock' - virtual docked keyboard plus input from real keyboard.
- 'systemandmulti' - analogous.

***log_dir*: string** Path of log directory.

***log_enable*: int, 0 or 1** Activate file logging. 0 is disabled, 1 is enabled.

***log_level*: string, one of 'debug', 'info', 'warning', 'error' or 'critical'** Set the minimum log level to use.

***log_name*: string** Format string to use for the filename of log file.

***window_icon*: string** Path of the window icon. Use this if you want to replace the default pygame icon.

postproc

***double_tap_distance*: float** Maximum distance allowed for a double tap, normalized inside the range 0 - 1000.

***double_tap_time*: int** Time allowed for the detection of double tap, in milliseconds.

***ignore*: list of tuples** List of regions where new touches are ignored. This configuration token can be used to resolve hotspot problems with DIY hardware. The format of the list must be:

```
ignore = [(xmin, ymin, xmax, ymax), ...]
```

All the values must be inside the range 0 - 1.

***jitter_distance*: int** Maximum distance for jitter detection, normalized inside the range 0 - 1000.

***jitter_ignore_devices*: string, separated with commas** List of devices to ignore from jitter detection.

***retain_distance*: int** If the touch moves more than is indicated by retain_distance, it will not be retained. Argument should be an int between 0 and 1000.

***retain_time*: int** Time allowed for a retain touch, in milliseconds.

***triple_tap_distance*: float** Maximum distance allowed for a triple tap, normalized inside the range 0 - 1000.

***triple_tap_time*: int** Time allowed for the detection of triple tap, in milliseconds.

graphics

***borderless*: int , one of 0 or 1** If set to *1*, removes the window border/decoration.

***fbo*: string, one of 'hardware', 'software' or 'force-hardware'** Selects the FBO backend to use.

***fullscreen*: int or string, one of 0, 1, 'fake' or 'auto'** Activate fullscreen. If set to *1*, a resolution of *width* times *height* pixels will be used. If set to *auto*, your current display's resolution will be used instead. This is most likely what you want. If you want to place the window in another display, use *fake*, or set the *borderless* option from the graphics section, then adjust *width*, *height*, *top* and *left*.

***height*: int** Height of the `Window`, not used if *fullscreen* is set to *auto*.

***left*: int** Left position of the `Window`.

***maxfps*: int, defaults to 60** Maximum FPS allowed.

'multisamples': int, defaults to 2 Sets the MultiSample Anti-Aliasing (MSAA) level. Increasing this value results in smoother graphics but at the cost of processing time.

Note: This feature is limited by device hardware support and will have no effect on devices which do not support the level of MSAA requested.

***position*: string, one of 'auto' or 'custom'** Position of the window on your display. If *auto* is used, you have no control of the initial position: *top* and *left* are ignored.

***show_cursor*: int, one of 0 or 1** Show the cursor on the screen.

***top*: int** Top position of the `Window`.

***resizable*: int, one of 0 or 1** If 0, the window will have a fixed size. If 1, the window will be resizable.

***rotation*: int, one of 0, 90, 180 or 270** Rotation of the `Window`.

width: **int** Width of the `Window`, not used if *fullscreen* is set to *auto*.

input You can create new input devices using this syntax:

```
# example of input provider instance
yourid = providerid,parameters

# example for tuio provider
default = tuio,127.0.0.1:3333
mytable = tuio,192.168.0.1:3334
```

See also:

Check the providers in kivy.input.providers for the syntax to use inside the configuration file.

widgets

scroll_distance: **int** Default value of the `scroll_distance` property used by the `ScrollView` widget. Check the widget documentation for more information.

scroll_friction: **float** Default value of the `scroll_friction` property used by the `ScrollView` widget. Check the widget documentation for more information.

scroll_timeout: **int** Default value of the `scroll_timeout` property used by the `ScrollView` widget. Check the widget documentation for more information.

scroll_stoptime: **int** Default value of the `scroll_stoptime` property used by the `ScrollView` widget. Check the widget documentation for more information.

Deprecated since version 1.7.0: Please use `effect_cls` instead.

scroll_moves: **int** Default value of the `scroll_moves` property used by the `ScrollView` widget. Check the widget documentation for more information.

Deprecated since version 1.7.0: Please use `effect_cls` instead.

modules You can activate modules with this syntax:

```
modulename =
```

Anything after the = will be passed to the module as arguments. Check the specific module's documentation for a list of accepted arguments.

Note: These options control only the initalization of the app and a restart is required for value changes to take effect.

Changed in version 1.9.0: *borderless* has been added to the graphics section. The *fake* option of *fullscreen* in the graphics section has been deprecated, use the *borderless* option instead.

Changed in version 1.8.0: *systemanddock* and *systemandmulti* has been added as possible values for *keyboard_mode* in the kivy section. *exit_on_escape* has been added to the kivy section.

Changed in version 1.2.0: *resizable* has been added to graphics section.

Changed in version 1.1.0: tuio no longer listens by default. Window icons are not copied to user directory anymore. You can still set a new window icon by using the `window_icon` config setting.

Changed in version 1.0.8: *scroll_timeout*, *scroll_distance* and *scroll_friction* have been added. *list_friction*, *list_trigger_distance* and *list_friction_bound* have been removed. *keyboard_type* and *keyboard_layout* have been removed from the widget. *keyboard_mode* and *keyboard_layout* have been added to the kivy section.

`kivy.config.`**`Config`** = **None**
Kivy configuration object. Its `name` is *'kivy'*

class `kivy.config.`**`ConfigParser`**`(`*name=''*`)`

Bases: `ConfigParser.ConfigParser`, `object`

Enhanced ConfigParser class that supports the addition of default sections and default values.

By default, the kivy ConfigParser instance, `Config`, is given the name *'kivy'* and the ConfigParser instance used by App, `build_settings()`, is given the name *'app'*.

Parameters

name: **string**The name of the instance. See `name`. Defaults to ''.

..versionchanged:: 1.9.0 Each ConfigParser can now be named, `name`. You can get the ConfigParser associated with a name using `get_configparser()`. In addition, you can now control the config values with `ConfigParserProperty`.

New in version 1.0.7.

`add_callback``(`*callback, section=None, key=None*`)`

Add a callback to be called when a specific section/key changed. If you don't specify a section or a key, it will call the callback for all section/keys changes.

Callbacks will receive 3 arguments: the section, key and value.

New in version 1.4.1.

`adddefaultsection``(`*section*`)`

Add a section if the section is missing.

static **`get_configparser`**`(`*name*`)`

Returns the `ConfigParser` instance whose name is *name*, or None if not found.

Parameters

name: **string**The name of the `ConfigParser` instance to return.

`getdefault``(`*section, option, defaultvalue*`)`

Get an option. If not found, it will return the default value.

`getdefaultint``(`*section, option, defaultvalue*`)`

Get an option. If not found, it will return the default value. The return value will be always converted as an integer.

New in version 1.6.0.

`name`

The name associated with this ConfigParser instance, if not ''. Defaults to ''. It can be safely dynamically changed or set to ''.

When a ConfigParser is given a name, that config object can be retrieved using `get_configparser()`. In addition, that config instance can also be used with a `ConfigParserProperty` instance that set its *config* value to this name.

Setting more than one ConfigParser with the same name will raise a *ValueError*.

`read``(`*filename*`)`

Read only one filename. In contrast to the original ConfigParser of Python, this one is able to read only one file at a time. The last read file will be used for the `write()` method.

Changed in version 1.9.0: `read()` now calls the callbacks if read changed any values.

`remove_callback``(`*callback, section=None, key=None*`)`

Removes a callback added with `add_callback()`. `remove_callback()` must be called with the same parameters as `add_callback()`.

Raises a *ValueError* if not found.

New in version 1.9.0.

set(*section, option, value*)
Functions similarly to PythonConfigParser's set method, except that the value is implicitly converted to a string.

setall(*section, keyvalues*)
Set a lot of keys/values in one section at the same time.

setdefault(*section, option, value*)
Set the default value of a particular option.

setdefaults(*section, keyvalues*)
Set a lot of keys/value defaults in one section at the same time.

update_config(*filename, overwrite=False*)
Upgrade the configuration based on a new default config file. Overwrite any existing values if overwrite is True.

write()

Write the configuration to the last file opened using the`read()` method.

Return True if the write finished successfully.

21.9 Context

New in version 1.8.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

Kivy has a few "global" instances that are used directly by many pieces of the framework: *Cache*, *Builder*, *Clock*.

TODO: document this module.

kivy.context.**register_context**(*name, cls, *args, **kwargs*)
Register a new context.

kivy.context.**get_current_context**()
Return the current context.

21.10 Event dispatcher

All objects that produce events in Kivy implement the `EventDispatcher` which provides a consistent interface for registering and manipulating event handlers.

Changed in version 1.0.9: Property discovery and methods have been moved from the `Widget` to the `EventDispatcher`.

class kivy.event.**EventDispatcher**
Bases: `kivy.event.ObjectWithUid`

Generic event dispatcher interface.

See the module docstring for usage.

bind()
Bind an event type or a property to a callback.

Usage:

```
# With properties
def my_x_callback(obj, value):
    print('on object', obj, 'x changed to', value)
def my_width_callback(obj, value):
    print('on object', obj, 'width changed to', value)
self.bind(x=my_x_callback, width=my_width_callback)

# With event
def my_press_callback(obj):
    print('event on object', obj)
self.bind(on_press=my_press_callback)
```

In general, property callbacks are called with 2 arguments (the object and the property's new value) and event callbacks with one argument (the object). The example above illustrates this.

The following example demonstrates various ways of using the bind function in a complete application:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.app import App
from kivy.uix.button import Button
from functools import partial


class DemoBox(BoxLayout):
    """
    This class demonstrates various techniques that can be used for binding to
    events. Although parts could me made more optimal, advanced Python concepts
    are avoided for the sake of readability and clarity.
    """
    def __init__(self, **kwargs):
        super(DemoBox, self).__init__(**kwargs)
        self.orientation = "vertical"

        # We start with binding to a normal event. The only argument
        # passed to the callback is the object which we have bound to.
        btn = Button(text="Normal binding to event")
        btn.bind(on_press=self.on_event)

        # Next, we bind to a standard property change event. This typically
        # passes 2 arguments: the object and the value
        btn2 = Button(text="Normal binding to a property change")
        btn2.bind(state=self.on_property)

        # Here we use anonymous functions (a.k.a lambdas) to perform binding.
        # Their advantage is that you can avoid declaring new functions i.e.
        # they offer a concise way to "redirect" callbacks.
        btn3 = Button(text="Using anonymous functions.")
        btn3.bind(on_press=lambda x: self.on_event(None))

        # You can also declare a function that accepts a variable number of
        # positional and keyword arguments and use introspection to determine
        # what is being passed in. This is very handy for debugging as well
        # as function re-use. Here, we use standard event binding to a function
        # that accepts optional positional and keyword arguments.
        btn4 = Button(text="Use a flexible function")
        btn4.bind(on_press=self.on_anything)

        # Lastly, we show how to use partial functions. They are sometimes
```

```
            # difficult to grasp, but provide a very flexible and powerful way to
            # reuse functions.
            btn5 = Button(text="Using partial functions. For hardcores.")
            btn5.bind(on_press=partial(self.on_anything, "1", "2", monthy="python"))

            for but in [btn, btn2, btn3, btn4, btn5]:
                self.add_widget(but)

        def on_event(self, obj):
            print("Typical event from", obj)

        def on_property(self, obj, value):
            print("Typical property change from", obj, "to", value)

        def on_anything(self, *args, **kwargs):
            print('The flexible function has *args of', str(args),
                "and **kwargs of", str(kwargs))


    class DemoApp(App):
        def build(self):
            return DemoBox()

    if __name__ == "__main__":
        DemoApp().run()
```

When binding a function to an event, a kivy.weakmethod.WeakMethod of the callback is saved, and when dispatching the callback is removed if the callback reference becomes invalid. For properties, the actual callback is saved.

Another difference between binding to an event vs a property; when binding to a property, if this callback has already been bound to this property, it won't be added again. For events, we don't do this check.

create_property()

Create a new property at runtime.

New in version 1.0.9.

Changed in version 1.8.0: *value* parameter added, can be used to set the default value of the property. Also, the type of the value is used to specialize the created property.

Changed in version 1.9.0: In the past, if *value* was of type *bool*, a *NumericProperty* would be created, now a *BooleanProperty* is created.

Warning: This function is designed for the Kivy language, don't use it in your code. You should declare the property in your class instead of using this method.

Parameters

name: **string**Name of the property

value: **object, optional**Default value of the property. Type is also used for creating more appropriate property types. Defaults to None.

```
    >>> mywidget = Widget()
    >>> mywidget.create_property('custom')
    >>> mywidget.custom = True
    >>> print(mywidget.custom)
    True
```

dispatch()

Dispatch an event across all the handlers added in bind/fast_bind(). As soon as a handler returns True, the dispatching stops.

The function collects all the positional and keyword arguments and passes them on to the handlers.

Note: The handlers are called in reverse order than they were registered with `bind()`.

Parameters

event_type: **str**the event name to dispatch.

Changed in version 1.9.0: Keyword arguments collection and forwarding was added. Before, only positional arguments would be collected and forwarded.

events()

Return all the events in the class. Can be used for introspection.

New in version 1.8.0.

fast_bind()

A method for faster binding. This method is somewhat different than `bind()` and is meant for more advanced users and internal usage. It can be used as long as the following points are heeded.

- As opposed to `bind()`, it does not check that this function and largs/kwargs has not been bound before to this name. So binding the same callback multiple times will just keep adding it.
- Although `bind()` creates a `WeakMethod` when binding to an event, this method stores the callback directly.
- This method returns True if *name* was found and bound, and *False*, otherwise. It does not raise an exception, like `bind()`, would if the property *name* is not found.

When binding a callback with largs and/or kwargs, `fast_unbind()` must be used for unbinding. If no largs and kwargs are provided, `unbind()` may be used as well.

This method passes on any caught positional and/or keyword arguments to the callback, removing the need to call partial. When calling the callback the expended largs are passed on followed by instance/value (just instance for kwargs) followed by expended kwargs.

Following is an example of usage similar to the example in `bind()`:

```
class DemoBox(BoxLayout):

    def __init__(self, **kwargs):
        super(DemoBox, self).__init__(**kwargs)
        self.orientation = "vertical"

        btn = Button(text="Normal binding to event")
        btn.fast_bind('on_press', self.on_event)

        btn2 = Button(text="Normal binding to a property change")
        btn2.fast_bind('state', self.on_property)

        btn3 = Button(text="A: Using function with args.")
        btn3.fast_bind('on_press', self.on_event_with_args, 'right',
                       tree='birch', food='apple')

        btn4 = Button(text="Unbind A.")
        btn4.fast_bind('on_press', self.unbind_a, btn3)

        btn5 = Button(text="Use a flexible function")
        btn5.fast_bind('on_press', self.on_anything)

        btn6 = Button(text="B: Using flexible functions with args. For hardcores.")
        btn6.fast_bind('on_press', self.on_anything, "1", "2", monthy="python")

        btn7 = Button(text="Force dispatch B with different params")
        btn7.fast_bind('on_press', btn6.dispatch, 'on_press', 6, 7, monthy="other python

        for but in [btn, btn2, btn3, btn4, btn5, btn6, btn7]:
            self.add_widget(but)

    def on_event(self, obj):
        print("Typical event from", obj)

    def on_event_with_args(self, side, obj, tree=None, food=None):
        print("Event with args", obj, side, tree, food)

    def on_property(self, obj, value):
        print("Typical property change from", obj, "to", value)

    def on_anything(self, *args, **kwargs):
        print('The flexible function has *args of', str(args),
            "and **kwargs of", str(kwargs))
        return True

    def unbind_a(self, btn, event):
        btn.fast_unbind('on_press', self.on_event_with_args, 'right',
                        tree='birch', food='apple')
```

Note: Since the kv lang uses this method to bind, one has to implement this method, instead of `bind()` when creating a non `EventDispatcher` based class used with the kv lang. See `Observable` for an example.

New in version 1.9.0.

fast_unbind()

Similar to `fast_bind()`.

When unbinding from a property `unbind()` will unbind all callbacks that match the callback, while this method will only unbind the first (as it is assumed that the combination of func and largs/kwargs are uniquely bound).

To unbind, the same positional and keyword arguments passed to `fast_bind()` must be passed on to fast_unbind.

New in version 1.9.0.

get_property_observers()

Returns a list of methods that are bound to the property/event passed as the *name* argument:

```
widget_instance.get_property_observers('on_release')
```

New in version 1.8.0.

Changed in version 1.9.0: To keep compatibility, callbacks bound with `fast_bind()` will also only return the callback function and not their provided args.

getter()
Return the getter of a property.

New in version 1.0.9.

is_event_type()
Return True if the event_type is already registered.

New in version 1.0.4.

properties()
Return all the properties in the class in a dictionary of key/property class. Can be used for introspection.

New in version 1.0.9.

property()
Get a property instance from the property name. If quiet is True, None is returned instead of raising an exception when *name* is not a property. Defaults to *False*.

New in version 1.0.9.

ReturnsA Property derived instance corresponding to the name.

Changed in version 1.9.0: quiet was added.

proxy_ref
Default implementation of proxy_ref, returns self. ..versionadded:: 1.9.0

register_event_type()
Register an event type with the dispatcher.

Registering event types allows the dispatcher to validate event handler names as they are attached and to search attached objects for suitable handlers. Each event type declaration must:

1.start with the prefix *on_*.

2.have a default handler in the class.

Example of creating a custom event:

```
class MyWidget(Widget):
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        self.register_event_type('on_swipe')

    def on_swipe(self):
        pass

def on_swipe_callback(*largs):
    print('my swipe is called', largs)
w = MyWidget()
w.dispatch('on_swipe')
```

setter()
Return the setter of a property. Use: instance.setter('name'). The setter is a convenient callback function useful if you want to directly bind one property to another. It returns a partial function that will accept (obj, value) args and results in the property 'name' of instance being set to value.

New in version 1.0.9.

For example, to bind number2 to number1 in python you would do:

```
class ExampleWidget(Widget):
    number1 = NumericProperty(None)
    number2 = NumericProperty(None)

    def __init__(self, **kwargs):
        super(ExampleWidget, self).__init__(**kwargs)
        self.bind(number1=self.setter('number2'))
```

This is equivalent to kv binding:

```
<ExampleWidget>:
    number2: self.number1
```

unbind()

Unbind properties from callback functions with similar usage as bind().

One difference between unbinding from an event vs. property, is that when unbinding from an event, we stop after the first callback match. For properties, we remove all matching callbacks.

Note, a callback bound with fast_bind() without any largs or kwargs is equivalent to one bound with bind() so either unbind() or fast_unbind() will unbind it.

unregister_event_types()

Unregister an event type in the dispatcher.

class kivy.event.**ObjectWithUid**

Bases: object

(internal) This class assists in providing unique identifiers for class instances. It it not intended for direct usage.

class kivy.event.**Observable**

Bases: kivy.event.ObjectWithUid

Observable is a stub class defining the methods required for binding. EventDispatcher is (the) one example of a class that implements the binding interface. See EventDispatcher for details.

New in version 1.9.0.

fast_bind()

See EventDispatcher.fast_bind().

Note: To keep backward compatibility with derived classes which may have inherited from Observable before, the fast_bind() method was added. The default implementation of fast_bind() and fast_unbind() is to create a partial function that it passes to bind. However, fast_unbind() is fairly inefficient since we have to lookup this partial function before we can call unbind(). It is recommended to overwrite these methods in derived classes to bind directly for better performance.

fast_unbind()

See fast_bind().

21.11 Factory object

The factory can be used to automatically register any class or module and instantiate classes from it anywhere in your project. It is an implementation of the Factory Pattern.

The class list and available modules are automatically generated by setup.py.

Example for registering a class/module:

```
>>> from kivy.factory import Factory
>>> Factory.register('Widget', module='kivy.uix.widget')
>>> Factory.register('Vector', module='kivy.vector')
```

Example of using the Factory:

```
>>> from kivy.factory import Factory
>>> widget = Factory.Widget(pos=(456,456))
>>> vector = Factory.Vector(9, 2)
```

Example using a class name:

```
>>> from kivy.factory import Factory
>>> Factory.register('MyWidget', cls=MyWidget)
```

By default, the first classname you register via the factory is permanent. If you wish to change the registered class, you need to unregister the classname before you re-assign it:

```
>>> from kivy.factory import Factory
>>> Factory.register('MyWidget', cls=MyWidget)
>>> widget = Factory.MyWidget()
>>> Factory.unregister('MyWidget')
>>> Factory.register('MyWidget', cls=CustomWidget)
>>> customWidget = Factory.MyWidget()
```

`kivy.factory.`**`Factory`** **= <kivy.factory.FactoryBase object at 0x963d10c>**

Factory instance to use for getting new classes

21.12 Geometry utilities

This module contains some helper functions for geometric calculations.

`kivy.geometry.`**`circumcircle`**`(`*a, b, c*`)`

Computes the circumcircle of a triangle defined by a, b, c. See: http://en.wikipedia.org/wiki/Circumscribed_circle

Parameters

a[iterable containing at least 2 values (for x and y)] The 1st point of the triangle.

b[iterable containing at least 2 values (for x and y)] The 2nd point of the triangle.

c[iterable containing at least 2 values (for x and y)] The 3rd point of the triangle.

Return

A tuple that defines the circle :

- The first element in the returned tuple is the center as (x, y)
- The second is the radius (float)

`kivy.geometry.`**`minimum_bounding_circle`**`(`*points*`)`

Returns the minimum bounding circle for a set of points.

For a description of the problem being solved, see the Smallest Circle Problem.

The function uses Applet's Algorithm, the runtime is O(h^3, *n), where h is the number of points in the convex hull of the set of points. **But** it runs in linear time in almost all real world cases. See: http://tinyurl.com/6e4n5yb

Parameters

points[iterable] A list of points (2 tuple with x,y coordinates)

Return

A tuple that defines the circle:

- The first element in the returned tuple is the center (x, y)
- The second the radius (float)

21.13 Gesture recognition

This class allows you to easily create new gestures and compare them:

```
from kivy.gesture import Gesture, GestureDatabase

# Create a gesture
g = Gesture()
g.add_stroke(point_list=[(1,1), (3,4), (2,1)])
g.normalize()

# Add it to the database
gdb = GestureDatabase()
gdb.add_gesture(g)

# And for the next gesture, try to find it!
g2 = Gesture()
# ...
gdb.find(g2)
```

Warning: You don't really want to do this: it's more of an example of how to construct gestures dynamically. Typically, you would need a lot more points, so it's better to record gestures in a file and reload them to compare later. Look in the examples/gestures directory for an example of how to do that.

class `kivy.gesture.`**`Gesture`**(*tolerance=None*)

A python implementation of a gesture recognition algorithm by Oleg Dopertchouk: http://www.gamedev.net/reference/articles/article2039.asp

Implemented by Jeiel Aranal (chemikhazi@gmail.com), released into the public domain.

`add_stroke`(*point_list=None*)

Adds a stroke to the gesture and returns the Stroke instance. Optional point_list argument is a list of the mouse points for the stroke.

`dot_product`(*comparison_gesture*)

Calculates the dot product of the gesture with another gesture.

`get_rigid_rotation`(*dstpts*)

Extract the rotation to apply to a group of points to minimize the distance to a second group of points. The two groups of points are assumed to be centered. This is a simple version that just picks an angle based on the first point of the gesture.

`get_score`(*comparison_gesture, rotation_invariant=True*)

Returns the matching score of the gesture against another gesture.

`normalize`(*stroke_samples=32*)

Runs the gesture normalization algorithm and calculates the dot product with self.

class `kivy.gesture.`**`GestureDatabase`**

Bases: `object`

Class to handle a gesture database.

add_gesture(*gesture*)
Add a new gesture to the database.

find(*gesture, minscore=0.9, rotation_invariant=True*)
Find a matching gesture in the database.

gesture_to_str(*gesture*)
Convert a gesture into a unique string.

str_to_gesture(*data*)
Convert a unique string to a gesture.

class kivy.gesture.**GestureStroke**
Gestures can be made up of multiple strokes.

add_point(*x=x_pos, y=y_pos*)
Adds a point to the stroke.

center_stroke(*offset_x, offset_y*)
Centers the stroke by offseting the points.

normalize_stroke(*sample_points=32*)
Normalizes strokes so that every stroke has a standard number of points. Returns True if stroke is normalized, False if it can't be normalized. sample_points controls the resolution of the stroke.

points_distance(*point1=GesturePoint, point2=GesturePoint*)
Returns the distance between two GesturePoints.

scale_stroke(*scale_factor=float*)
Scales the stroke down by scale_factor.

stroke_length(*point_list=None*)
Finds the length of the stroke. If a point list is given, finds the length of that list.

21.14 Interactive launcher

New in version 1.3.0.

The `InteractiveLauncher` provides a user-friendly python shell interface to an `App` so that it can be prototyped and debugged interactively.

Note: The Kivy API intends for some functions to only be run once or before the main EventLoop has started. Methods that can normally be called during the course of an application will work as intended, but specifically overriding methods such as `on_touch()` dynamically leads to trouble.

21.14.1 Creating an InteractiveLauncher

Take your existing subclass of `App` (this can be production code) and pass an instance to the `InteractiveLauncher` constructor.:

```
from kivy.interactive import InteractiveLauncher
from kivy.app import App
from kivy.uix.button import Button

class MyApp(App):
    def build(self):
        return Button(test='Hello Shell')

launcher = InteractiveLauncher(MyApp())
launcher.run()
```

After pressing *enter*, the script will return. This allows the interpreter to continue running. Inspection or modification of the `App` can be done safely through the InteractiveLauncher instance or the provided `SafeMembrane` class instances.

Note: If you want to test this example, start Python without any file to have already an interpreter, and copy/paste all the lines. You'll still have the interpreter at the end + the kivy application running.

21.14.2 Interactive Development

IPython provides a fast way to learn the Kivy API. The `App` instance and all of it's attributes, including methods and the entire widget tree, can be quickly listed by using the '.' operator and pressing 'tab'. Try this code in an Ipython shell.:

```
from kivy.interactive import InteractiveLauncher
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.graphics import Color, Ellipse

class MyPaintWidget(Widget):
    def on_touch_down(self, touch):
        with self.canvas:
            Color(1, 1, 0)
            d = 30.
            Ellipse(pos=(touch.x - d/2, touch.y - d/2), size=(d, d))


class TestApp(App):
    def build(self):
        return Widget()


i = InteractiveLauncher(TestApp())
i.run()
i.       # press 'tab' to list attributes of the app
i.root.  # press 'tab' to list attributes of the root widget

# App is boring.  Attach a new widget!
i.root.add_widget(MyPaintWidget())

i.safeIn()
# The application is now blocked.
# Click on the screen several times.
i.safeOut()
# The clicks will show up now

# Erase artwork and start over
i.root.canvas.clear()
```

Note: All of the proxies used in the module store their referent in the `_ref` attribute, which can be accessed directly if needed, such as for getting doc strings. `help()` and `type()` will access the proxy, not its referent.

21.14.3 Directly Pausing the Application

Both the InteractiveLauncher and SafeMembrane hold internal references to the EventLoop's 'safe' and 'confirmed' threading.Event objects. You can use their safing methods to control the application manually.

SafeMembrane.safeIn() will cause the application to pause and SafeMembrane.safeOut() will allow a paused application to continue running. This is potentially useful for scripting actions into functions that need the screen to update etc.

Note: The pausing is implemented via the Clocks' schedule_once() method and occurs before the start of each frame.

21.14.4 Adding Attributes Dynamically

Note: This module uses threading and object proxies to encapsulate the running App. Deadlocks and memory corruption can occur if making direct references inside the thread without going through the provided proxy(s).

The InteractiveLauncher can have attributes added to it exactly like a normal object and if these were created from outside the membrane, they will not be threadsafe because the external references to them in the python interpreter do not go through InteractiveLauncher's membrane behavior, inherited from SafeMembrane.

To threadsafe these external references, simply assign them to SafeMembrane instances of themselves like so:

```
from kivy.interactive import SafeMembrane

interactiveLauncher.attribute = myNewObject
# myNewObject is unsafe
myNewObject = SafeMembrane(myNewObject)
# myNewObject is now safe.  Call at will.
myNewObject.method()
```

TODO

Unit tests, examples, and a better explanation of which methods are safe in a running application would be nice. All three would be excellent.

Could be re-written with a context-manager style i.e.:

```
with safe:
    foo()
```

Any use cases besides compacting code?

class kivy.interactive.**SafeMembrane**(*ob*, **args*, ***kwargs*)

Bases: object

This help is for a proxy object. Did you want help on the proxy's referent instead? Try using help(<instance>._ref)

The SafeMembrane is a threadsafe proxy that also returns attributes as new thread-safe objects and makes thread-safe method calls, preventing thread-unsafe objects from leaking into the user's environment.

safeIn()
Provides a thread-safe entry point for interactive launching.

safeOut()
Provides a thread-safe exit point for interactive launching.

class kivy.interactive.**InteractiveLauncher**(*app=None*, **args*, ***kwargs*)
Bases: kivy.interactive.SafeMembrane

Proxy to an application instance that launches it in a thread and then returns and acts as a proxy to the application in the thread.

21.15 Kivy Base

This module contains core Kivy functionality and is not intended for end users. Feel free to look though it, but calling any of these methods directly may well result in unpredicatable behavior.

21.15.1 Event loop management

kivy.base.**EventLoop** = **<kivy.base.EventLoopBase object at 0x992986c>**
EventLoop instance

class kivy.base.**EventLoopBase**
Bases: kivy.event.EventDispatcher

Main event loop. This loop handles the updating of input and dispatching events.

add_event_listener(*listener*)
Add a new event listener for getting touch events.

add_input_provider(*provider*, *auto_remove=False*)
Add a new input provider to listen for touch events.

add_postproc_module(*mod*)
Add a postproc input module (DoubleTap, TripleTap, DeJitter RetainTouch are defaults).

close()
Exit from the main loop and stop all configured input providers.

dispatch_input()
Called by idle() to read events from input providers, pass events to postproc, and dispatch final events.

ensure_window()
Ensure that we have a window.

exit()
Close the main loop and close the window.

idle()
This function is called after every frame. By default:

- it "ticks" the clock to the next frame.
- it reads all input and dispatches events.
- it dispatches *on_update*, *on_draw* and *on_flip* events to the window.

on_pause()
Event handler for *on_pause* which will be fired when the event loop is paused.

on_start()
Event handler for *on_start* which will be fired right after all input providers have been started.

on_stop()
Event handler for *on_stop* events which will be fired right after all input providers have been stopped.

post_dispatch_input(*etype*, *me*)
This function is called by dispatch_input() when we want to dispatch an input event. The event is dispatched to all listeners and if grabbed, it's dispatched to grabbed widgets.

remove_event_listener(*listener*)
Remove an event listener from the list.

remove_input_provider(*provider*)
Remove an input provider.

remove_postproc_module(*mod*)
Remove a postproc module.

run()
Main loop

set_window(*window*)
Set the window used for the event loop.

start()
Must be called only once before run(). This starts all configured input providers.

stop()
Stop all input providers and call callbacks registered using EventLoop.add_stop_callback().

touches
Return the list of all touches currently in down or move states.

class kivy.base.**ExceptionHandler**
Bases: object

Base handler that catches exceptions in runTouchApp(). You can subclass and extend it as follows:

```
class E(ExceptionHandler):
    def handle_exception(self, inst):
        Logger.exception('Exception catched by ExceptionHandler')
        return ExceptionManager.PASS

ExceptionManager.add_handler(E())
```

All exceptions will be set to PASS, and logged to the console!

handle_exception(*exception*)
Handle one exception, defaults to returning ExceptionManager.STOP.

class kivy.base.**ExceptionManagerBase**
ExceptionManager manages exceptions handlers.

add_handler(*cls*)
Add a new exception handler to the stack.

handle_exception(*inst*)
Called when an exception occured in the runTouchApp() main loop.

remove_handler(*cls*)
Remove a exception handler from the stack.

kivy.base.**ExceptionManager** = **<kivy.base.ExceptionManagerBase instance at 0x9849b2c>**
Instance of a ExceptionManagerBase implementation.

`kivy.base.`**`runTouchApp`**`(`*widget=None, slave=False*`)`
: Static main function that starts the application loop. You can access some magic via the following arguments:

  Parameters

  <empty>To make dispatching work, you need at least one input listener. If not, application will leave. (MTWindow act as an input listener)

  widgetIf you pass only a widget, a MTWindow will be created and your widget will be added to the window as the root widget.

  slaveNo event dispatching is done. This will be your job.

  widget + slaveNo event dispatching is done. This will be your job but we try to get the window (must be created by you beforehand) and add the widget to it. Very usefull for embedding Kivy in another toolkit. (like Qt, check kivy-designed)

`kivy.base.`**`stopTouchApp`**`()`
: Stop the current application by leaving the main loop

21.16 Kivy Language

The Kivy language is a language dedicated to describing user interface and interactions. You could compare this language to Qt's QML (http://qt.nokia.com), but we included new concepts such as rule definitions (which are somewhat akin to what you may know from CSS), templating and so on.

Changed in version 1.7.0: The Builder doesn't execute canvas expressions in realtime anymore. It will pack all the expressions that need to be executed first and execute them after dispatching input, just before drawing the frame. If you want to force the execution of canvas drawing, just call `Builder.sync`.

An experimental profiling tool for the kv lang is also included. You can activate it by setting the environment variable *KIVY_PROFILE_LANG=1*. It will then generate an html file named *builder_stats.html*.

21.16.1 Overview

The language consists of several constructs that you can use:

Rules A rule is similar to a CSS rule. A rule applies to specific widgets (or classes thereof) in your widget tree and modifies them in a certain way. You can use rules to specify interactive behaviour or use them to add graphical representations of the widgets they apply to. You can target a specific class of widgets (similar to the CSS concept of a *class*) by using the `cls` attribute (e.g. `cls=MyTestWidget`).

A Root Widget You can use the language to create your entire user interface. A kv file must contain only one root widget at most.

Dynamic Classes *(introduced in version 1.7.0)* Dynamic classes let you create new widgets and rules on-the-fly, without any Python declaration.

Templates (deprecated) *(introduced in version 1.0.5, deprecated from version 1.7.0)* Templates were used to populate parts of an application, such as styling the content of a list (e.g. icon on the left, text on the right). They are now deprecated by dynamic classes.

21.16.2 Syntax of a kv File

A Kivy language file must have `.kv` as filename extension.

The content of the file should always start with the Kivy header, where *version* must be replaced with the Kivy language version you're using. For now, use 1.0:

```
#:kivy '1.0'

# content here
```

The *content* can contain rule definitions, a root widget, dynamic class definitions and templates:

```
# Syntax of a rule definition. Note that several Rules can share the same
# definition (as in CSS). Note the braces: they are part of the definition.
<Rule1,Rule2>:
    # .. definitions ..

<Rule3>:
    # .. definitions ..

# Syntax for creating a root widget
RootClassName:
    # .. definitions ..

# Syntax for creating a dynamic class
<NewWidget@BaseClass>:
    # .. definitions ..

# Syntax for create a template
[TemplateName@BaseClass1,BaseClass2]:
    # .. definitions ..
```

Regardless of whether it's a rule, root widget, dynamic class or template you're defining, the definition should look like this:

```
# With the braces it's a rule. Without them, it's a root widget.
<ClassName>:
    prop1: value1
    prop2: value2

    canvas:
        CanvasInstruction1:
            canvasprop1: value1
        CanvasInstruction2:
            canvasprop2: value2

    AnotherClass:
        prop3: value1
```

Here *prop1* and *prop2* are the properties of *ClassName* and *prop3* is the property of *AnotherClass*. If the widget doesn't have a property with the given name, an `ObjectProperty` will be automatically created and added to the instance.

AnotherClass will be created and added as a child of the *ClassName* instance.

- The indentation is important and must be consistent. The spacing must be a multiple of the number of spaces used on the first indented line. Spaces are encouraged: mixing tabs and spaces is not recommended.
- The value of a property must be given on a single line (for now at least).
- The *canvas* property is special: you can put graphics instructions in it to create a graphical representation of the current class.

Here is a simple example of a kv file that contains a root widget:

```
#:kivy 1.0

Button:
    text: 'Hello world'
```

Changed in version 1.7.0: The indentation is not limited to 4 spaces anymore. The spacing must be a multiple of the number of spaces used on the first indented line.

Both the `load_file()` and the `load_string()` methods return the root widget defined in your kv file/string. They will also add any class and template definitions to the `Factory` for later usage.

21.16.3 Value Expressions, on_property Expressions, ids and Reserved Keywords

When you specify a property's value, the value is evaluated as a Python expression. This expression can be static or dynamic, which means that the value can use the values of other properties using reserved keywords.

self The keyword self references the "current widget instance":

```
Button:
    text: 'My state is %s' % self.state
```

root This keyword is available only in rule definitions and represents the root widget of the rule (the first instance of the rule):

```
<MyWidget>:
    custom: 'Hello world'
    Button:
        text: root.custom
```

app This keyword always refers to your app instance. It's equivalent to a call to `kivy.app.App.get_running_app()` in Python.:

```
Label:
    text: app.name
```

args This keyword is available in on_<action> callbacks. It refers to the arguments passed to the callback.:

```
TextInput:
    on_focus: self.insert_text("Focus" if args[1] else "No focus")
```

ids

Class definitions may contain ids which can be used as a keywords::

```
<MyWidget>:
    Button:
        id: btn1
    Button:
        text: 'The state of the other button is %s' % btn1.state
```

Please note that the *id* will not be available in the widget instance: it is used exclusively for external references. *id* is a weakref to the widget, and not the widget itself. The widget itself can be accessed with *id.__self__* (*btn1.__self__* in this case).

When the kv file is processed, weakrefs to all the widgets tagged with ids are added to the root widgets *ids* dictionary. In other words, following on from the example above, the buttons state could also be accessed as follows:

```
widget = MyWidget()
state = widget.ids["btn1"].state

# Or, as an alternative syntax,
state = widget.ids.btn1.state
```

Note that the outermost widget applies the kv rules to all its inner widgets before any other rules are applied. This means if an inner widget contains ids, these ids may not be available during the inner widget's *__init__* function.

Valid expressons

There are two places that accept python statments in a kv file: after a property, which assigns to the property the result of the expression (such as the text of a button as shown above) and after a on_property, which executes the statement when the property is updated (such as on_state).

In the former case, the expression can only span a single line, cannot be extended to multiple lines using newline escaping, and must return a value. An example of a valid expression is `text: self.state and ('up' if self.state == 'normal' else 'down')`.

In the latter case, multiple single line statements are valid including multi-line statements that escape their newline, as long as they don't add an indentation level.

Examples of valid statements are:

```
on_press: if self.state == 'normal': print('normal')
on_state:
    if self.state == 'normal': print('normal')
    else: print('down')
    if self.state == 'normal': \
    print('multiline normal')
    for i in range(10): print(i)
    print([1,2,3,4,
    5,6,7])
```

An example of a invalid statement:

```
on_state:
    if self.state == 'normal':
        print('normal')
```

21.16.4 Relation Between Values and Properties

When you use the Kivy language, you might notice that we do some work behind the scenes to automatically make things work properly. You should know that *Properties* implement the Observer Design Pattern. That means that you can bind your own function to be called when the value of a property changes (i.e. you passively *observe* the property for potential changes).

The Kivy language detects properties in your *value* expression and will create create callbacks to automatically update the property via your expression when changes occur.

Here's a simple example that demonstrates this behaviour:

```
Button:
    text: str(self.state)
```

In this example, the parser detects that *self.state* is a dynamic value (a property). The `state` property of the button can change at any moment (when the user touches it). We now want this button to display its own state as text, even as the state changes. To do this, we use the state property of the Button and use it in the value expression for the button's *text* property, which controls what text is displayed on the button (We also convert the state to a string representation). Now, whenever the button state changes, the text property will be updated automatically.

Remember: The value is a python expression! That means that you can do something more interesting like:

```
Button:
    text: 'Plop world' if self.state == 'normal' else 'Release me!'
```

The Button text changes with the state of the button. By default, the button text will be 'Plop world', but when the button is being pressed, the text will change to 'Release me!'.

21.16.5 Graphical Instructions

The graphical instructions are a special part of the Kivy language. They are handled by the 'canvas' property definition:

```
Widget:
    canvas:
        Color:
            rgb: (1, 1, 1)
        Rectangle:
            size: self.size
            pos: self.pos
```

All the classes added inside the canvas property must be derived from the `Instruction` class. You cannot put any Widget class inside the canvas property (as that would not make sense because a widget is not a graphics instruction).

If you want to do theming, you'll have the same question as in CSS: which rules have been executed first? In our case, the rules are executed in processing order (i.e. top-down).

If you want to change how Buttons are rendered, you can create your own kv file and add something like this:

```
<Button>:
    canvas:
        Color:
            rgb: (1, 0, 0)
        Rectangle:
            pos: self.pos
            size: self.size
        Rectangle:
            pos: self.pos
            size: self.texture_size
            texture: self.texture
```

This will result in buttons having a red background with the label in the bottom left, in addition to all the preceding rules. You can clear all the previous instructions by using the *Clear* command:

```
<Button>:
    canvas:
        Clear
        Color:
            rgb: (1, 0, 0)
        Rectangle:
            pos: self.pos
            size: self.size
        Rectangle:
            pos: self.pos
            size: self.texture_size
            texture: self.texture
```

Then, only your rules that follow the *Clear* command will be taken into consideration.

21.16.6 Dynamic classes

Dynamic classes allow you to create new widgets on-the-fly, without any python declaration in the first place. The syntax of the dynamic classes is similar to the Rules, but you need to specify the base classes you want to subclass.

The syntax looks like:

```
# Simple inheritance
<NewWidget@Button>:
    # kv code here ...

# Multiple inheritance
<NewWidget@ButtonBehavior+Label>:
    # kv code here ...
```

The @ character is used to seperate your class name from the classes you want to subclass. The Python equivalent would have been:

```
# Simple inheritance
class NewWidget(Button):
    pass

# Multiple inheritance
class NewWidget(ButtonBehavior, Label):
    pass
```

Any new properties, usually added in python code, should be declared first. If the property doesn't exist in the dynamic class, it will be automatically created as an `ObjectProperty` (pre 1.8.0) or as an appropriate typed property (from version 1.8.0).

Changed in version 1.8.0: If the property value is an expression that can be evaluated right away (no external binding), then the value will be used as default value of the property, and the type of the value will be used for the specialization of the Property class. In other terms: if you declare *hello: "world"*, a new `StringProperty` will be instantiated, with the default value *"world"*. Lists, tuples, dictionaries and strings are supported.

Let's illustrate the usage of theses dynamic classes with an implementation of a basic Image button. We could derive our classes from the Button and just add a property for the image filename:

```
<ImageButton@Button>:
    source: None

    Image:
        source: root.source
        pos: root.pos
        size: root.size

# let's use the new classes in another rule:
<MainUI>:
    BoxLayout:
        ImageButton:
            source: 'hello.png'
            on_press: root.do_something()
        ImageButton:
            source: 'world.png'
            on_press: root.do_something_else()
```

In Python, you can create an instance of the dynamic class as follows:

```
from kivy.factory import Factory
button_inst = Factory.ImageButton()
```

Note: Using dynamic classes, a child class can be declared before it's parent. This however, leads to the unintuitive situation where the parent properties/methods override those of the child. Be careful if you choose to do this.

21.16.7 Templates

Changed in version 1.7.0: Template usage is now deprecated. Please use Dynamic classes instead.

Syntax of templates

Using a template in Kivy requires 2 things :

1. a context to pass for the context (will be ctx inside template).
2. a kv definition of the template.

Syntax of a template:

```
# With only one base class
[ClassName@BaseClass]:
    # .. definitions ..

# With more than one base class
[ClassName@BaseClass1,BaseClass2]:
    # .. definitions ..
```

For example, for a list, you'll need to create a entry with a image on the left, and a label on the right. You can create a template for making that definition easier to use. So, we'll create a template that uses 2 entries in the context: an image filename and a title:

```
[IconItem@BoxLayout]:
    Image:
        source: ctx.image
    Label:
        text: ctx.title
```

Then in Python, you can instantiate the template using:

```
from kivy.lang import Builder

# create a template with hello world + an image
# the context values should be passed as kwargs to the Builder.template
# function
icon1 = Builder.template('IconItem', title='Hello world',
    image='myimage.png')

# create a second template with other information
ctx = {'title': 'Another hello world',
       'image': 'myimage2.png'}
```

```
icon2 = Builder.template('IconItem', **ctx)
# and use icon1 and icon2 as other widget.
```

Template example

Most of time, when you are creating a screen in the kv lang, you use a lot of redefinitions. In our example, we'll create a Toolbar, based on a BoxLayout, and put in a few `Image` widgets that will react to the *on_touch_down* event.:

```
<MyToolbar>:
    BoxLayout:
        Image:
            source: 'data/text.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_text()

        Image:
            source: 'data/image.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_image()

        Image:
            source: 'data/video.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_video()
```

We can see that the size and size_hint attribute are exactly the same. More than that, the callback in on_touch_down and the image are changing. Theses can be the variable part of the template that we can put into a context. Let's try to create a template for the Image:

```
[ToolbarButton@Image]:

    # This is the same as before
    size: self.texture_size
    size_hint: None, None

    # Now, we are using the ctx for the variable part of the template
    source: 'data/%s.png' % ctx.image
    on_touch_down: self.collide_point(*args[1].pos) and ctx.callback()
```

The template can be used directly in the MyToolbar rule:

```
<MyToolbar>:
    BoxLayout:
        ToolbarButton:
            image: 'text'
            callback: root.create_text
        ToolbarButton:
            image: 'image'
            callback: root.create_image
        ToolbarButton:
            image: 'video'
            callback: root.create_video
```

That's all :)

Template limitations

When you are creating a context:

1. you cannot use references other than "root":

```
        <MyRule>:
            Widget:
                id: mywidget
                value: 'bleh'
            Template:
                ctxkey: mywidget.value # << fail, this references the id
                # mywidget
```

2. not all of the dynamic parts will be understood:

```
        <MyRule>:
            Template:
                ctxkey: 'value 1' if root.prop1 else 'value2' # << even if
                # root.prop1 is a property, if it changes value, ctxkey
                # will not be updated
```

21.16.8 Redefining a widget's style

Sometimes we would like to inherit from a widget in order to use its Python properties without also using its .kv defined style. For example, we would like to inherit from a Label, but we would also like to define our own canvas instructions instead of automatically using the canvas instructions inherited from the Label. We can achieve this by prepending a dash (-) before the class name in the .kv style definition.

In myapp.py:

```
class MyWidget(Label):
    pass
```

and in my.kv:

```
<-MyWidget>:
    canvas:
        Color:
            rgb: 1, 1, 1
        Rectangle:
            size: (32, 32)
```

MyWidget will now have a Color and Rectangle instruction in its canvas without any of the instructions inherited from the Label.

21.16.9 Lang Directives

You can use directives to add declarative commands, such as imports or constant definitions, to the lang files. Directives are added as comments in the following format:

```
#:<directivename> <options>
```

import <package>

New in version 1.0.5.

Syntax:

```
#:import <alias> <package>
```

You can import a package by writing:

```
#:import os os

<Rule>:
    Button:
        text: os.getcwd()
```

Or more complex:

```
#:import ut kivy.utils

<Rule>:
    canvas:
        Color:
            rgba: ut.get_random_color()
```

New in version 1.0.7.

You can directly import classes from a module:

```
#: import Animation kivy.animation.Animation
<Rule>:
    on_prop: Animation(x=.5).start(self)
```

set <key> <expr>

New in version 1.0.6.

Syntax:

```
#:set <key> <expr>
```

Set a key that will be available anywhere in the kv. For example:

```
#:set my_color (.4, .3, .4)
#:set my_color_hl (.5, .4, .5)

<Rule>:
    state: 'normal'
    canvas:
        Color:
            rgb: my_color if self.state == 'normal' else my_color_hl
```

include <file>

New in version 1.9.0.

Syntax:

```
#:include [force] <file>
```

Includes an external kivy file. This allows you to split complex widgets into their own files. If the include is forced, the file will first be unloaded and then reloaded again. For example:

```
# Test.kv
#:include mycomponent.kv
#:include force mybutton.kv

<Rule>:
    state: 'normal'
    MyButton:
    MyComponent:
```

```
# mycomponent.kv
#:include mybutton.kv

<MyComponent>:
    MyButton:
```

```
# mybutton.kv

<MyButton>:
    canvas:
        Color:
            rgb: (1.0, 0.0, 0.0)
        Rectangle:
            pos: self.pos
            size: (self.size[0]/4, self.size[1]/4)
```

class `kivy.lang.`**`Observable`**

Bases: `kivy.event.ObjectWithUid`

`Observable` is a stub class defining the methods required for binding. `EventDispatcher` is (the) one example of a class that implements the binding interface. See `EventDispatcher` for details.

New in version 1.9.0.

`fast_bind``()`

See `EventDispatcher.fast_bind()`.

Note: To keep backward compatibility with derived classes which may have inherited from `Observable` before, the `fast_bind()` method was added. The default implementation of `fast_bind()` and `fast_unbind()` is to create a partial function that it passes to bind. However, `fast_unbind()` is fairly inefficient since we have to lookup this partial function before we can call `unbind()`. It is recommended to overwrite these methods in derived classes to bind directly for better performance.

`fast_unbind``()`

See `fast_bind()`.

`kivy.lang.`**`Builder`** **= <kivy.lang.BuilderBase object at 0x96654cc>**

Main instance of a `BuilderBase`.

class `kivy.lang.`**`BuilderBase`**

Bases: `object`

The Builder is responsible for creating a `Parser` for parsing a kv file, merging the results into its internal rules, templates, etc.

By default, `Builder` is a global Kivy instance used in widgets that you can use to load other kv files in addition to the default ones.

`apply``(`*widget*`)`

Search all the rules that match the widget and apply them.

load_file(*filename*, ***kwargs*)
Insert a file into the language builder and return the root widget (if defined) of the kv file.

Parameters

***rulesonly*: bool, defaults to False**If True, the Builder will raise an exception if you have a root widget inside the definition.

load_string(*string*, ***kwargs*)
Insert a string into the Language Builder and return the root widget (if defined) of the kv string.

Parameters

***rulesonly*: bool, defaults to False**If True, the Builder will raise an exception if you have a root widget inside the definition.

match(*widget*)
Return a list of `ParserRule` objects matching the widget.

sync()
Execute all the waiting operations, such as the execution of all the expressions related to the canvas.

New in version 1.7.0.

template(**args*, ***ctx*)
Create a specialized template using a specific context. .. versionadded:: 1.0.5

With templates, you can construct custom widgets from a kv lang definition by giving them a context. Check *Template usage*.

unbind_widget(*uid*)
(internal) Unbind all the handlers created by the rules of the widget. The `kivy.uix.widget.Widget.uid` is passed here instead of the widget itself, because we are using it in the widget destructor.

New in version 1.7.2.

unload_file(*filename*)
Unload all rules associated with a previously imported file.

New in version 1.0.8.

Warning: This will not remove rules or templates already applied/used on current widgets. It will only effect the next widgets creation or template invocation.

class `kivy.lang.`**BuilderException**(*context*, *line*, *message*, *cause=None*)
Bases: `kivy.lang.ParserException`

Exception raised when the Builder failed to apply a rule on a widget.

class `kivy.lang.`**Parser**(***kwargs*)
Bases: `object`

Create a Parser object to parse a Kivy language file or Kivy content.

parse(*content*)
Parse the contents of a Parser file and return a list of root objects.

parse_level(*level*, *lines*, *spaces=0*)
Parse the current level (level * spaces) indentation.

strip_comments(*lines*)
Remove all comments from all lines in-place. Comments need to be on a single line and not at the end of a line. i.e. a comment line's first non-whitespace character must be a #.

class `kivy.lang.`**`ParserException`**(*context*, *line*, *message*, *cause=None*)
Bases: `exceptions.Exception`

Exception raised when something wrong happened in a kv file.

21.17 Logger object

Differents logging levels are available : trace, debug, info, warning, error and critical.

Examples of usage:

```
from kivy.logger import Logger

Logger.info('title: This is a info message.')
Logger.debug('title: This is a debug message.')

try:
    raise Exception('bleh')
except Exception:
    Logger.exception('Something happened!')
```

The message passed to the logger is split into two parts, separated by a colon (:). The first part is used as a title, and the second part is used as the message. This way, you can "categorize" your message easily.:

```
Logger.info('Application: This is a test')

# will appear as

[INFO   ] [Application ] This is a test
```

21.17.1 Logger configuration

The Logger can be controlled via the Kivy configuration file:

```
[kivy]
log_level = info
log_enable = 1
log_dir = logs
log_name = kivy_%y-%m-%d_%_.txt
```

More information about the allowed values are described in the `kivy.config` module.

21.17.2 Logger history

Even if the logger is not enabled, you still have access to the last 100 messages:

```
from kivy.logger import LoggerHistory

print(LoggerHistory.history)
```

`kivy.logger.`**`Logger`** **= <logging.Logger object at 0x8f0240c>**
Kivy default logger instance

class `kivy.logger.`**`LoggerHistory`**(*level=0*)
Bases: `logging.Handler`

Kivy history handler

21.18 Metrics

New in version 1.5.0.

A screen is defined by its physical size, density and resolution. These factors are essential for creating UI's with correct size everywhere.

In Kivy, all the graphics pipelines work with pixels. But using pixels as a measurement unit is problematic because sizes change according to the screen.

21.18.1 Dimensions

If you want to design your UI for different screen sizes, you will want better measurement units to work with. Kivy provides some more scalable alternatives.

Units

pt Points - 1/72 of an inch based on the physical size of the screen. Prefer to use sp instead of pt.

mm Millimeters - Based on the physical size of the screen.

cm Centimeters - Based on the physical size of the screen.

in Inches - Based on the physical size of the screen.

dp Density-independent Pixels - An abstract unit that is based on the physical density of the screen. With a `density` of 1, 1dp is equal to 1px. When running on a higher density screen, the number of pixels used to draw 1dp is scaled up a factor appropriate to the screen's dpi, and the inverse for a lower dpi. The ratio of dp-to-pixels will change with the screen density, but not necessarily in direct proportion. Using the dp unit is a simple solution to making the view dimensions in your layout resize properly for different screen densities. In others words, it provides consistency for the real-world size of your UI across different devices.

sp Scale-independent Pixels - This is like the dp unit, but it is also scaled by the user's font size preference. We recommend you use this unit when specifying font sizes, so the font size will be adjusted to both the screen density and the user's preference.

21.18.2 Examples

Here is an example of creating a label with a sp font_size and setting the height manually with a 10dp margin:

```
#:kivy 1.5.0
<MyWidget>:
    Label:
        text: 'Hello world'
        font_size: '15sp'
        size_hint_y: None
        height: self.texture_size[1] + dp(10)
```

21.18.3 Manual control of metrics

The metrics cannot be changed at runtime. Once a value has been converted to pixels, you can't retrieve the original value anymore. This stems from the fact that the DPI and density of a device cannot be changed at runtime.

We provide some environment variables to control metrics:

- *KIVY_METRICS_DENSITY*: if set, this value will be used for `density` instead of the systems one. On android, the value varies between 0.75, 1, 1.5 and 2.
- *KIVY_METRICS_FONTSCALE*: if set, this value will be used for `fontscale` instead of the systems one. On android, the value varies between 0.8 and 1.2.
- *KIVY_DPI*: if set, this value will be used for `dpi`. Please note that setting the DPI will not impact the dp/sp notation because these are based on the screen density.

For example, if you want to simulate a high-density screen (like the HTC One X):

```
KIVY_DPI=320 KIVY_METRICS_DENSITY=2 python main.py --size 1280x720
```

Or a medium-density (like Motorola Droid 2):

```
KIVY_DPI=240 KIVY_METRICS_DENSITY=1.5 python main.py --size 854x480
```

You can also simulate an alternative user preference for fontscale as follows:

```
KIVY_METRICS_FONTSCALE=1.2 python main.py
```

`kivy.metrics.`**`Metrics`** **= <kivy.metrics.MetricsBase object at 0x978df2c>**
Default instance of `MetricsBase`, used everywhere in the code .. versionadded:: 1.7.0

class `kivy.metrics.`**`MetricsBase`**
Bases: `object`

Class that contains the default attributes for Metrics. Don't use this class directly, but use the *Metrics* instance.

`density``()`
Return the density of the screen. This value is 1 by default on desktops but varies on android depending on the screen.

`dpi``()`
Return the DPI of the screen. Depending on the platform, the DPI can be taken from the Window provider (Desktop mainly) or from a platform-specific module (like android/ios).

`dpi_rounded``()`
Return the DPI of the screen, rounded to the nearest of 120, 160, 240 or 320.

`fontscale``()`
Return the fontscale user preference. This value is 1 by default but can vary between 0.8 and 1.2.

`kivy.metrics.`**`pt`**`(`*value*`)`
Convert from points to pixels

`kivy.metrics.`**`inch`**`(`*value*`)`
Convert from inches to pixels

`kivy.metrics.`**`cm`**`(`*value*`)`
Convert from centimeters to pixels

`kivy.metrics.`**`mm`**`(`*value*`)`
Convert from millimeters to pixels

`kivy.metrics.`**`dp`**`(`*value*`)`
Convert from density-independent pixels to pixels

`kivy.metrics.`**`sp`**`(`*value*`)`
Convert from scale-independent pixels to pixels

`kivy.metrics.`**`metrics`** **= <kivy.metrics.MetricsBase object at 0x978df2c>**
default instance of `MetricsBase`, used everywhere in the code (deprecated, use *Metrics* instead.)

21.19 Multistroke gesture recognizer

New in version 1.9.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

21.19.1 Conceptual Overview

This module implements the Protractor gesture recognition algorithm.

`Recognizer` is the search/database API similar to `GestureDatabase`. It maintains a list of `MultistrokeGesture` objects and allows you to search for a user-input gestures among them.

`ProgressTracker` tracks the progress of a `Recognizer.recognize()` call. It can be used to interact with the running recognizer task, for example forcing it to stop half-way, or analyzing results as they arrive.

`MultistrokeGesture` represents a gesture in the gesture database (`Recognizer.db`). It is a container for `UnistrokeTemplate` objects, and implements the heap permute algorithm to automatically generate all possible stroke orders (if desired).

`UnistrokeTemplate` represents a single stroke path. It's typically instantiated automatically by `MultistrokeGesture`, but sometimes you may need to create them manually.

`Candidate` represents a user-input gesture that is used to search the gesture database for matches. It is normally instantiated automatically by calling `Recognizer.recognize()`.

21.19.2 Usage examples

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

You can bind to events on `Recognizer` to track the state of all calls to `Recognizer.recognize()`. The callback function will receive an instance of `ProgressTracker` that can be used to analyze and control various aspects of the recognition process

```
from kivy.vector import Vector
from kivy.multistroke import Recognizer

gdb = Recognizer()

def search_start(gdb, pt):
    print("A search is starting with %d tasks" % (pt.tasks))

def search_stop(gdb, pt):
    # This will call max() on the result dictonary, so it's best to store
    # it instead of calling it 3 times consecutively
    best = pt.best
    print("Search ended (%s). Best is %s (score %f, distance %f)" % (
        pt.status, best['name'], best['score'], best['dist'] ))

# Bind your callbacks to track all matching operations
gdb.bind(on_search_start=search_start)
gdb.bind(on_search_complete=search_stop)

# The format below is referred to as `strokes`, a list of stroke paths.
# Note that each path shown here consists of two points, ie a straight
# line; if you plot them it looks like a T, hence the name.
gdb.add_gesture('T', [
    [Vector(30, 7), Vector(103, 7)],
    [Vector(66, 7), Vector(66, 87)]])

# Now you can search for the 'T' gesture using similar data (user input).
# This will trigger both of the callbacks bound above.
gdb.recognize([
    [Vector(45, 8), Vector(110, 12)],
    [Vector(88, 9), Vector(85, 95)]])
```

On the next `Clock` tick, the matching process starts (and, in this case, completes).

To track individual calls to `Recognizer.recognize()`, use the return value (also a `ProgressTracker` instance)

```
# Same as above, but keep track of progress using returned value
progress = gdb.recognize([
    [Vector(45, 8), Vector(110, 12)],
    [Vector(88, 9), Vector(85, 95)]])

progress.bind(on_progress=my_other_callback)
print(progress.progress) # = 0

# [ assuming a kivy.clock.Clock.tick() here ]

print(result.progress) # = 1
```

21.19.3 Algorithm details

For more information about the matching algorithm, see:

"Protractor: A fast and accurate gesture recognizer" by Yang Li http://yangl.org/pdf/protractor-chi2010.pdf

"$N-Protractor" by Lisa Anthony and Jacob O. Wobbrock http://depts.washington.edu/aimgroup/proj/dollar/ndc protractor.pdf

Some of the code is derived from the JavaScript implementation here: http://depts.washington.edu/aimgroup/proj

class `kivy.multistroke.`**`Recognizer`**(***kwargs*)

Bases: `kivy.event.EventDispatcher`

`Recognizer` provides a gesture database with matching facilities.

Events

*on_search_start*Fired when a new search is started using this Recognizer.

*on_search_complete*Fired when a running search ends, for whatever reason. (use `ProgressTracker.status` to find out)

Properties

*db*A `ListProperty` that contains the available `MultistrokeGesture` objects.

`db` is a `ListProperty` and defaults to []

`add_gesture`(*name, strokes, **kwargs*)

Add a new gesture to the database. This will instantiate a new `MultistrokeGesture` with *strokes* and append it to self.db.

Note: If you already have instantiated a `MultistrokeGesture` object and wish to add it, append it to `Recognizer.db` manually.

`export_gesture`(*filename=None*, ***kwargs*)

Export a list of `MultistrokeGesture` objects. Outputs a base64-encoded string that can be decoded to a Python list with the `parse_gesture()` function or imported directly to `self.db` using `Recognizer.import_gesture()`. If *filename* is specified, the output is written to disk, otherwise returned.

This method accepts optional `Recognizer.filter()` arguments.

`filter`(***kwargs*)

`filter()` returns a subset of objects in `self.db`, according to given criteria. This is used by many other methods of the `Recognizer`; the arguments below can for example be used when calling `Recognizer.recognize()` or `Recognizer.export_gesture()`. You normally don't need to call this directly.

Arguments

nameLimits the returned list to gestures where `MultistrokeGesture.name` matches given regular expression(s). If re.match(name, MultistrokeGesture.name) tests true, the gesture is included in the returned list. Can be a string or an array of strings

```
gdb = Recognizer()

# Will match all names that start with a captial N
# (ie Next, New, N, Nebraska etc, but not "n" or "next")
gdb.filter(name='N')

# exactly 'N'
gdb.filter(name='N$')

# Nebraska, teletubbies, France, fraggle, N, n, etc
gdb.filter(name=['[Nn]', '(?i)T', '(?i)F'])
```

priorityLimits the returned list to gestures with certain `MultistrokeGesture.priority` values. If specified as an integer, only gestures with a lower priority are returned. If specified as a list (min/max)

```
# Max priority 50
gdb.filter(priority=50)

# Max priority 50 (same result as above)
gdb.filter(priority=[0, 50])

# Min priority 50, max 100
gdb.filter(priority=[50, 100])
```

When this option is used, `Recognizer.db` is automatically sorted according to priority, incurring extra cost. You can use *force_priority_sort* to override this behavior if your gestures are already sorted according to priority.

orientation_sensitiveLimits the returned list to gestures that are orientation sensitive (True), gestures that are not orientation sensitive (False) or None (ignore template sensitivity, this is the default).

numstrokesLimits the returned list to gestures that have the specified number of strokes (in `MultistrokeGesture.strokes`). Can be a single integer or a list of integers.

numpointsLimits the returned list to gestures that have specific `MultistrokeGesture.numpoints` values. This is provided for flexibility, do not use it unless you understand what it does. Can be a single integer or a list of integers.

force_priority_sortCan be used to override the default sort behavior. Normally `MultistrokeGesture` objects are returned in priority order if the *priority* option is used. Setting this to True will return gestures sorted in priority order, False will return in the order gestures were added. None means decide automatically (the default).

Note: For improved performance, you can load your gesture database in priority order and set this to False when calling `Recognizer.recognize()`

dbCan be set if you want to filter a different list of objects than `Recognizer.db`. You probably don't want to do this; it is used internally by `import_gesture()`.

import_gesture(*data=None, filename=None, **kwargs*)
Import a list of gestures as formatted by `export_gesture()`. One of *data* or *filename* must be specified.

This method accepts optional `Recognizer.filter()` arguments, if none are specified then all gestures in specified data are imported.

parse_gesture(*data*)
Parse data formatted by export_gesture(). Returns a list of `MultistrokeGesture` objects. This is used internally by `import_gesture()`, you normally don't need to call this directly.

prepare_templates(***kwargs*)
This method is used to prepare `UnistrokeTemplate` objects within the gestures in self.db. This is useful if you want to minimize punishment of lazy resampling by preparing all vectors in advance. If you do this before a call to `Recognizer.export_gesture()`, you will have the vectors computed when you load the data later.

This method accepts optional `Recognizer.filter()` arguments.

force_numpoints, if specified, will prepare all templates to the given number of points (instead of each template's preferred n; ie `UnistrokeTemplate.numpoints`). You normally don't want to do this.

recognize(*strokes, goodscore=None, timeout=0, delay=0, **kwargs*)
Search for gestures matching *strokes*. Returns a `ProgressTracker` instance.

This method accepts optional `Recognizer.filter()` arguments.

Arguments

strokesA list of stroke paths (list of lists of `Vector` objects) that will be matched against gestures in the database. Can also be a `Candidate` instance.

Warning: If you manually supply a `Candidate` that has a skip-flag, make sure that the correct filter arguments are set. Otherwise the system will attempt to load vectors that have not been computed. For example, if you set *skip_bounded* and do not set *orientation_sensitive* to False, it will raise an exception if an orientation_sensitive `UnistrokeTemplate` is encountered.

goodscoreIf this is set (between 0.0 - 1.0) and a gesture score is equal to or higher than the specified value, the search is immediately halted and the on_search_complete event is fired (+ the on_complete event of the associated `ProgressTracker` instance). Default is None (disabled).

timeoutSpecifies a timeout (in seconds) for when the search is aborted and the results returned. This option applies only when *max_gpf* is not 0. Default value is 0, meaning all gestures in the database will be tested, no matter how long it takes.

max_gpfSpecifies the maximum number of `MultistrokeGesture` objects that can be processed per frame. When exceeded, will cause the search to halt and resume work in the next frame. Setting to 0 will complete the search immediately (and block the UI).

> **Warning:** This does not limit the number of `UnistrokeTemplate` objects matched! If a single gesture has a million templates, they will all be processed in a single frame with max_gpf=1!

delaySets an optional delay between each run of the recognizer loop. Normally, a run is scheduled for the next frame until the tasklist is exhausted. If you set this, there will be an additional delay between each run (specified in seconds). Default is 0, resume in the next frame.

force_numpointsforces all templates (and candidate) to be prepared to a certain number of points. This can be useful for example if you are evaluating templates for optimal n (do not use this unless you understand what it does).

`transfer_gesture`(*tgt*, ***kwargs*)

Transfers `MultistrokeGesture` objects from `Recognizer.db` to another `Recognizer` instance *tgt*.

This method accepts optional `Recognizer.filter()` arguments.

class `kivy.multistroke.`**`ProgressTracker`**(*candidate*, *tasks*, ***kwargs*)

Bases: `kivy.event.EventDispatcher`

Represents an ongoing (or completed) search operation. Instantiated and returned by the `Recognizer.recognize()` method when it is called. The *results* attribute is a dictionary that is updated as the recognition operation progresses.

> **Note:** You do not need to instantiate this class.

Arguments

candidate`Candidate` object to be evaluated

tasksTotal number of gestures in tasklist (to test against)

Events

on_progressFired for every gesture that is processed

on_resultFired when a new result is added, and it is the first match for the *name* so far, or a consecutive match with better score.

on_completeFired when the search is completed, for whatever reason. (use *ProgressTracker.status* to find out)

Attributes

resultsA dictionary of all results (so far). The key is the name of the gesture (ie `UnistrokeTemplate.name` usually inherited from `MultistrokeGesture`). Each item in the dictionary is a dict with the following entries:

nameName of the matched template (redundant)

scoreComputed score from 1.0 (perfect match) to 0.0

distCosine distance from candidate to template (low=closer)

gestureThe `MultistrokeGesture` object that was matched

best_templateIndex of the best matching template (in `MultistrokeGesture.templates`)

template_resultsList of distances for all templates. The list index corresponds to a `UnistrokeTemplate` index in gesture.templates.

status

searchCurrently working

stopWas stopped by the user (`stop()` called)
timeoutA timeout occured (specified as *timeout*= to recognize())
goodscoreThe search was stopped early because a gesture with a high enough score was found (specified as *goodscore*= to recognize())
completeThe search is complete (all gestures matching filters were tested)

`best`
Return the best match found by recognize() so far. It returns a dictionary with three keys, 'name', 'dist' and 'score' representing the template's name, distance (from candidate path) and the computed score value. This is a Python property.

`progress`
Returns the progress as a float, 0 is 0% done, 1 is 100%. This is a Python property.

`stop``()`
Raises a stop flag that is checked by the search process. It will be stopped on the next clock tick (if it is still running).

class `kivy.multistroke.`**`MultistrokeGesture`**`(`*name*, *strokes=None*, ***kwargs*`)`
Bases: `object`

`MultistrokeGesture` represents a gesture. It maintains a set of *strokes* and generates unistroke (ie `UnistrokeTemplate`) permutations that are used for evaluating candidates against this gesture later.

Arguments

nameIdentifies the name of the gesture - it is returned to you in the results of a `Recognizer.recognize()` search. You can have any number of MultistrokeGesture objects with the same name; many definitions of one gesture. The same name is given to all the generated unistroke permutations. Required, no default.

strokesA list of paths that represents the gesture. A path is a list of Vector objects:

```
gesture = MultistrokeGesture('my_gesture', strokes=[
  [Vector(x1, y1), Vector(x2, y2), ...... ], # stroke 1
  [Vector(), Vector(), Vector(), Vector() ]  # stroke 2
  #, [stroke 3], [stroke 4], ...
])
```

For template matching purposes, all the strokes are combined to a single list (unistroke). You should still specify the strokes individually, and set *stroke_sensitive* True (whenever possible).

Once you do this, unistroke permutations are immediately generated and stored in *self.templates* for later, unless you set the *permute* flag to False.

priorityDetermines when `Recognizer.recognize()` will attempt to match this template, lower priorities are evaluated first (only if a priority *filter* is used). You should use lower priority on gestures that are more likely to match. For example, set user templates at lower number than generic templates. Default is 100.

numpointsDetermines the number of points this gesture should be resampled to (for matching purposes). The default is 16.

stroke_sensitiveDetermines if the number of strokes (paths) in this gesture is required to be the same in the candidate (user input) gesture during matching. If this is False, candidates will always be evaluated, disregarding the number of strokes. Default is True.

orientation_sensitiveDetermines if this gesture is orientation sensitive. If True, aligns the indicative orientation with the one of eight base orientations that requires least rotation. Default is True.

angle_similarityThis is used by the `Recognizer.recognize()` function when a candidate is evaluated against this gesture. If the angles between them are too far off, the template is considered a non-match. Default is 30.0 (degrees)

permuteIf False, do not use Heap Permute algorithm to generate different stroke orders when instantiated. If you set this to False, a single UnistrokeTemplate built from *strokes* is used.

add_stroke(*stroke*, *permute=False*)

Add a stroke to the self.strokes list. If *permute* is True, the permute() method is called to generate new unistroke templates

get_distance(*cand*, *tpl*, *numpoints=None*)

Compute the distance from this Candiate to a UnistrokeTemplate. Returns the Cosine distance between the stroke paths.

numpoints will prepare both the UnistrokeTemplate and Candidate path to n points (when neccessary), you probably don't want to do this.

match_candidate(*cand*, ***kwargs*)

Match a given candidate against this MultistrokeGesture object. Will test against all templates and report results as a list of four items:

index 0Best matching template's index (in self.templates)

index 1Computed distance from the template to the candidate path

index 2List of distances for all templates. The list index corresponds to a UnistrokeTemplate index in self.templates.

index 3Counter for the number of performed matching operations, ie templates matched against the candidate

permute()

Generate all possible unistroke permutations from self.strokes and save the resulting list of UnistrokeTemplate objects in self.templates.

Quote from http://faculty.washington.edu/wobbrock/pubs/gi-10.2.pdf

```
We use Heap Permute [16] (p. 179) to generate all stroke orders
in a multistroke gesture. Then, to generate stroke directions for
each order, we treat each component stroke as a dichotomous
[0,1] variable. There are 2^N combinations for N strokes, so we
convert the decimal values 0 to 2^N-1, inclusive, to binary
representations and regard each bit as indicating forward (0) or
reverse (1). This algorithm is often used to generate truth tables
in propositional logic.
```

See section 4.1: "$N Algorithm" of the linked paper for details.

Warning: Using heap permute for gestures with more than 3 strokes can result in very large number of templates (a 9-stroke gesture = 38 million templates). If you are dealing with these types of gestures, you should manually compose all the desired stroke orders.

class kivy.multistroke.**UnistrokeTemplate**(*name*, *points=None*, ***kwargs*)

Bases: object

Represents a (uni)stroke path as a list of Vectors. Normally, this class is instantiated by MultistrokeGesture and not by the programmer directly. However, it is possible to manually compose UnistrokeTemplate objects.

Arguments

nameIdentifies the name of the gesture. This is normally inherited from the parent MultistrokeGesture object when a template is generated.

pointsA list of points that represents a unistroke path. This is normally one of the possible stroke order permutations from a MultistrokeGesture.

numpointsThe number of points this template should (ideally) be resampled to before the matching process. The default is 16, but you can use a template-specific settings if that improves results.

orientation_sensitiveDetermines if this template is orientation sensitive (True) or fully rotation invariant (False). The default is True.

Note: You will get an exception if you set a skip-flag and then attempt to retrieve those vectorsa.

`add_point`(*p*)
Add a point to the unistroke/path. This invalidates all previously computed vectors.

`prepare`(*numpoints=None*)
This function prepares the UnistrokeTemplate for matching given a target number of points (for resample). 16 is optimal.

class `kivy.multistroke.`**`Candidate`**(*strokes=None*, *numpoints=16*, ***kwargs*)
Bases: `object`

Represents a set of unistroke paths of user input, ie data to be matched against a `UnistrokeTemplate` object using the Protractor algorithm. By default, data is precomputed to match both rotation bounded and fully invariant `UnistrokeTemplate` objects.

Arguments

strokesSee `MultistrokeGesture.strokes` for format example. The Candidate strokes are simply combined to a unistroke in the order given. The idea is that this will match one of the unistroke permutations in *MultistrokeGesture.templates*.

numpointsThe Candidate's default N; this is only for a fallback, it is not normally used since n is driven by the UnistrokeTemplate we are being compared to.

skip_boundedIf True, do not generate/store rotation bounded vectors

skip_invariantIf True, do not generate/store rotation invariant vectors

Note that you WILL get errors if you set a skip-flag and then attempt to retrieve the data.

`add_stroke`(*stroke*)
Add a stroke to the candidate; this will invalidate all previously computed vectors

`get_angle_similarity`(*tpl*, ***kwargs*)
(Internal use only) Compute the angle similarity between this Candidate and a UnistrokeTemplate object. Returns a number that represents the angle similarity (lower is more similar).

`get_protractor_vector`(*numpoints*, *orientation_sens*)
(Internal use only) Return vector for comparing to a UnistrokeTemplate with Protractor

`get_start_unit_vector`(*numpoints*, *orientation_sens*)
(Internal use only) Get the start vector for this Candidate, with the path resampled to *numpoints* points. This is the first step in the matching process. It is compared to a UnistrokeTemplate object's start vector to determine angle similarity.

`prepare`(*numpoints=None*)
Prepare the Candidate vectors. self.strokes is combined to a single unistroke (connected end-to-end), resampled to `numpoints` points, and then the vectors are calculated and stored in self.db (for use by *get_distance* and *get_angle_similarity*)

21.20 Parser utilities

Helper functions used for CSS parsing.

`kivy.parser.`**`parse_color`**(*text*)
Parse a string to a kivy color. Supported formats:

- rgb(r, g, b)
- rgba(r, g, b, a)
- aaa
- rrggbb

For hexadecimal values, you case also use:

- #aaa
- #rrggbb

`kivy.parser.`**`parse_int`**
alias of `int`

`kivy.parser.`**`parse_float`**
alias of `float`

`kivy.parser.`**`parse_string`**`(`*text*`)`
Parse a string to a string (removing single and double quotes)

`kivy.parser.`**`parse_bool`**`(`*text*`)`
Parse a string to a boolean, ignoring case. "true"/"1" is True, "false"/"0" is False. Anything else throws an exception.

`kivy.parser.`**`parse_int2`**`(`*text*`)`
Parse a string to a list of exactly 2 integers.

```
>>> print(parse_int2("12 54"))
12, 54
```

`kivy.parser.`**`parse_float4`**`(`*text*`)`
Parse a string to a list of exactly 4 floats.

```
>>> parse_float4('54 87. 35 0')
54, 87., 35, 0
```

`kivy.parser.`**`parse_filename`**`(`*filename*`)`
Parse a filename and search for it using *resource_find()*. If found, the resource path is returned, otherwise return the unmodified filename (as specified by the caller).

21.21 Properties

The *Properties* classes are used when you create an `EventDispatcher`.

Warning: Kivy's Properties are **not to be confused** with Python's properties (i.e. the `@property` decorator and the <property> type).

Kivy's property classes support:

Value Checking / Validation When you assign a new value to a property, the value is checked against validation constraints. For example, validation for an `OptionProperty` will make sure that the value is in a predefined list of possibilities. Validation for a `NumericProperty` will check that your value is a numeric type. This prevents many errors early on.

Observer Pattern You can specify what should happen when a property's value changes. You can bind your own function as a callback to changes of a `Property`. If, for example, you want a piece of code to be called when a widget's `pos` property changes, you can `bind` a function to it.

Better Memory Management The same instance of a property is shared across multiple widget instances.

21.21.1 Comparison Python vs. Kivy

Basic example

Let's compare Python and Kivy properties by creating a Python class with 'a' as a float property:

```
class MyClass(object):
    def __init__(self, a=1.0):
        super(MyClass, self).__init__()
        self.a = a
```

With Kivy, you can do:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1.0)
```

Value checking

If you wanted to add a check for a minimum / maximum value allowed for a property, here is a possible implementation in Python:

```
class MyClass(object):
    def __init__(self, a=1):
        super(MyClass, self).__init__()
        self.a_min = 0
        self.a_max = 100
        self.a = a

    def _get_a(self):
        return self._a
    def _set_a(self, value):
        if value < self.a_min or value > self.a_max:
            raise ValueError('a out of bounds')
        self._a = value
    a = property(_get_a, _set_a)
```

The disadvantage is you have to do that work yourself. And it becomes laborious and complex if you have many properties. With Kivy, you can simplify the process:

```
class MyClass(EventDispatcher):
    a = BoundedNumericProperty(1, min=0, max=100)
```

That's all!

Error Handling

If setting a value would otherwise raise a ValueError, you have two options to handle the error gracefully within the property. An errorvalue is a substitute for the invalid value. An errorhandler is a callable (single argument function or lambda) which can return a valid substitute.

errorvalue parameter:

```
# simply returns 0 if the value exceeds the bounds
bnp = BoundedNumericProperty(0, min=-500, max=500, errorvalue=0)
```

errorhandler parameter:

```
# returns the boundary value when exceeded
bnp = BoundedNumericProperty(0, min=-500, max=500,
    errorhandler=lambda x: 500 if x > 500 else -500)
```

Conclusion

Kivy properties are easier to use than the standard ones. See the next chapter for examples of how to use them :)

21.21.2 Observe Properties changes

As we said in the beginning, Kivy's Properties implement the Observer pattern. That means you can `bind()` to a property and have your own function called when the value changes.

There are multiple ways to observe the changes.

Observe using bind()

You can observe a property change by using the bind() method outside of the class:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1)

def callback(instance, value):
    print('My callback is call from', instance)
    print('and the a value changed to', value)

ins = MyClass()
ins.bind(a=callback)

# At this point, any change to the a property will call your callback.
ins.a = 5    # callback called
ins.a = 5    # callback not called, because the value did not change
ins.a = -1   # callback called
```

Note: Property objects live at the class level and manage the values attached to instances. Re-assigning at class level will remove the Property. For example, continuing with the code above, *MyClass.a = 5* replaces the property object with a simple int.

Observe using 'on_<propname>'

If you created the class yourself, you can use the 'on_<propname>' callback:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1)

    def on_a(self, instance, value):
        print('My property a changed to', value)
```

Warning: Be careful with 'on_<propname>'. If you are creating such a callback on a property you are inheriting, you must not forget to call the superclass function too.

21.21.3 Binding to properties of properties.

When binding to a property of a property, for example binding to a numeric property of an object saved in a object property, updating the object property to point to a new object will not re-bind the numeric property to the new object. For example:

```
<MyWidget>:
    Label:
        id: first
        text: 'First label'
    Label:
        id: second
        text: 'Second label'
    Button:
        label: first
        text: self.label.text
        on_press: self.label = second
```

When clicking on the button, although the label object property has changed to the second widget, the button text will not change because it is bound to the text property of the first label directly.

In *1.9.0*, the `rebind` option has been introduced that will allow the automatic updating of the `text` when `label` is changed, provided it was enabled. See `ObjectProperty`.

class `kivy.properties.`**`Property`**

Bases: `object`

Base class for building more complex properties.

This class handles all the basic setters and getters, None type handling, the observer list and storage initialisation. This class should not be directly instantiated.

By default, a `Property` always takes a default value:

```
class MyObject(Widget):

    hello = Property('Hello world')
```

The default value must be a value that agrees with the Property type. For example, you can't set a list to a `StringProperty` because the StringProperty will check the default value.

None is a special case: you can set the default value of a Property to None, but you can't set None to a property afterward. If you really want to do that, you must declare the Property with *allownone=True*:

```
class MyObject(Widget):

    hello = ObjectProperty(None, allownone=True)

# then later
a = MyObject()
a.hello = 'bleh' # working
a.hello = None # working too, because allownone is True.
```

Parameters

default:Specifies the default value for the property.

*****kwargs***:If the parameters include *errorhandler*, this should be a callable which must take a single argument and return a valid substitute value.

If the parameters include *errorvalue*, this should be an object. If set, it will replace an invalid property value (overrides errorhandler).

Changed in version 1.4.2: Parameters errorhandler and errorvalue added

bind()
Add a new observer to be called only when the value is changed.

dispatch()
Dispatch the value change to all observers.

Changed in version 1.1.0: The method is now accessible from Python.

This can be used to force the dispatch of the property, even if the value didn't change:

```
button = Button()
# get the Property class instance
prop = button.property('text')
# dispatch this property on the button instance
prop.dispatch(button)
```

fast_bind()
Similar to bind, except it doesn't check if the observer already exists. It also expands and forwards largs and kwargs to the callback. fast_unbind should be called when unbinding.

fast_unbind()
Remove the observer from our widget observer list bound with fast_bind. It removes the first match it finds, as opposed to unbind which searches for all matches.

get()
Return the value of the property.

link()
Link the instance with its real name.

Warning: Internal usage only.

When a widget is defined and uses a `Property` class, the creation of the property object happens, but the instance doesn't know anything about its name in the widget class:

```
class MyWidget(Widget):
    uid = NumericProperty(0)
```

In this example, the uid will be a NumericProperty() instance, but the property instance doesn't know its name. That's why `link()` is used in *Widget.__new__*. The link function is also used to create the storage space of the property for this specific widget instance.

set()
Set a new value for the property.

unbind()
Remove the observer from our widget observer list.

class kivy.properties.**NumericProperty**
Bases: `kivy.properties.Property`

Property that represents a numeric value.

Parameters
default: **int or float, defaults to 0**Specifies the default value of the property.

```
>>> wid = Widget()
>>> wid.x = 42
>>> print(wid.x)
42
>>> wid.x = "plop"
```

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "properties.pyx", line 93, in kivy.properties.Property.__set__
  File "properties.pyx", line 111, in kivy.properties.Property.set
  File "properties.pyx", line 159, in kivy.properties.NumericProperty.check
ValueError: NumericProperty accept only int/float
```

Changed in version 1.4.1: NumericProperty can now accept custom text and tuple value to indicate a type, like "in", "pt", "px", "cm", "mm", in the format: '10pt' or (10, 'pt').

get_format()

Return the format used for Numeric calculation. Default is px (mean the value have not been changed at all). Otherwise, it can be one of 'in', 'pt', 'cm', 'mm'.

class kivy.properties.**StringProperty**

Bases: kivy.properties.Property

Property that represents a string value.

Parameters

default: **string, defaults to ''**Specifies the default value of the property.

class kivy.properties.**ListProperty**

Bases: kivy.properties.Property

Property that represents a list.

Parameters

default: **list, defaults to []**Specifies the default value of the property.

Warning: When assigning a list to a ListProperty, the list stored in the property is a copy of the list and not the original list. This can be demonstrated with the following example:

```
>>> class MyWidget(Widget):
>>>     my_list = ListProperty([])

>>> widget = MyWidget()
>>> my_list = widget.my_list = [1, 5, 7]
>>> print my_list is widget.my_list
False
>>> my_list.append(10)
>>> print(my_list, widget.my_list)
[1, 5, 7, 10], [1, 5, 7]
```

class kivy.properties.**ObjectProperty**

Bases: kivy.properties.Property

Property that represents a Python object.

Parameters

default: **object type**Specifies the default value of the property.

rebind: **bool, defaults to False**Whether kv rules using this object as an intermediate attribute in a kv rule, will update the bound property when this object changes.

That is the standard behavior is that if there's a kv rule `text: self.a.b.c.d`, where `a`, `b`, and `c` are properties with `rebind False` and `d` is a StringProperty. Then when the rule is applied, `text` becomes bound only to `d`. If `a`, `b`, or `c` change, `text` still remains bound to `d`. Furthermore, if any of them were `None` when the rule was initially evaluated, e.g. `b` was `None`; then `text` is bound to `b` and will not become bound to `d` even when `b` is changed to not be `None`.

By setting `rebind` to `True`, however, the rule will be re-evaluated and all the properties rebound when that intermediate property changes. E.g. in the example above, whenever `b` changes or becomes not `None` if it was `None` before, `text` is evaluated again and becomes rebound to `d`. The overall result is that `text` is now bound to all the properties among `a`, `b`, or `c` that have `rebind` set to `True`.

***kwargs*: **a list of keyword arguments**

baseclassIf kwargs includes a *baseclass* argument, this value will be used for validation: *isinstance(value, kwargs['baseclass'])*.

Warning: To mark the property as changed, you must reassign a new python object.

Changed in version 1.9.0: *rebind* has been introduced.

Changed in version 1.7.0: *baseclass* parameter added.

class `kivy.properties.`**`BooleanProperty`**

Bases: `kivy.properties.Property`

Property that represents only a boolean value.

Parameters

***default*: boolean**Specifies the default value of the property.

class `kivy.properties.`**`BoundedNumericProperty`**

Bases: `kivy.properties.Property`

Property that represents a numeric value within a minimum bound and/or maximum bound – within a numeric range.

Parameters

***default*: numeric**Specifies the default value of the property.

***kwargs*: **a list of keyword arguments**If a *min* parameter is included, this specifies the minimum numeric value that will be accepted. If a *max* parameter is included, this specifies the maximum numeric value that will be accepted.

`bounds`

Return min/max of the value.

New in version 1.0.9.

`get_max``()`

Return the maximum value acceptable for the BoundedNumericProperty in *obj*. Return None if no maximum value is set. Check `get_min` for a usage example.

New in version 1.1.0.

`get_min``()`

Return the minimum value acceptable for the BoundedNumericProperty in *obj*. Return None if no minimum value is set:

```
class MyWidget(Widget):
    number = BoundedNumericProperty(0, min=-5, max=5)

widget = MyWidget()
print(widget.property('number').get_min(widget))
# will output -5
```

New in version 1.1.0.

`set_max``()`

Change the maximum value acceptable for the BoundedNumericProperty, only for the *obj* instance. Set to None if you want to disable it. Check `set_min` for a usage example.

Warning: Changing the bounds doesn't revalidate the current value.

New in version 1.1.0.

set_min()

Change the minimum value acceptable for the BoundedNumericProperty, only for the *obj* instance. Set to None if you want to disable it:

```
class MyWidget(Widget):
    number = BoundedNumericProperty(0, min=-5, max=5)

widget = MyWidget()
# change the minmium to -10
widget.property('number').set_min(widget, -10)
# or disable the minimum check
widget.property('number').set_min(widget, None)
```

Warning: Changing the bounds doesn't revalidate the current value.

New in version 1.1.0.

class kivy.properties.**OptionProperty**

Bases: kivy.properties.Property

Property that represents a string from a predefined list of valid options.

If the string set in the property is not in the list of valid options (passed at property creation time), a ValueError exception will be raised.

Parameters

***default*: any valid type in the list of options**Specifies the default value of the property.

****kwargs*: a list of keyword arguments**Should include an *options* parameter specifying a list (not tuple) of valid options.

For example:

```
class MyWidget(Widget):
    state = OptionProperty("None", options=["On", "Off", "None"])
```

options

Return the options available.

New in version 1.0.9.

class kivy.properties.**ReferenceListProperty**

Bases: kivy.properties.Property

Property that allows the creation of a tuple of other properties.

For example, if *x* and *y* are NumericPropertys, we can create a ReferenceListProperty for the *pos*. If you change the value of *pos*, it will automatically change the values of *x* and *y* accordingly. If you read the value of *pos*, it will return a tuple with the values of *x* and *y*.

For example:

```
class MyWidget(EventDispatcher):
    x = NumericProperty(0)
    y = NumericProperty(0)
    pos = ReferenceListProperty(x, y)
```

class `kivy.properties.`**`AliasProperty`**
Bases: `kivy.properties.Property`

Create a property with a custom getter and setter.

If you don't find a Property class that fits to your needs, you can make your own by creating custom Python getter and setter methods.

Example from kivy/uix/widget.py:

```
def get_right(self):
    return self.x + self.width
def set_right(self, value):
    self.x = value - self.width
right = AliasProperty(get_right, set_right, bind=('x', 'width'))
```

Parameters

getter: **function**Function to use as a property getter

setter: **function**Function to use as a property setter. Properties listening to the alias property won't be updated when the property is set (e.g. *right = 10*), unless the *setter* returns *True*.

bind: **list/tuple**Properties to observe for changes, as property name strings

cache: **boolean**If True, the value will be cached, until one of the binded elements will changes

rebind: **bool, defaults to False**See `ObjectProperty` for details.

Changed in version 1.9.0: *rebind* has been introduced.

Changed in version 1.4.0: Parameter *cache* added.

class `kivy.properties.`**`DictProperty`**
Bases: `kivy.properties.Property`

Property that represents a dict.

Parameters

default: **dict, defaults to None**Specifies the default value of the property.

rebind: **bool, defaults to False**See `ObjectProperty` for details.

Changed in version 1.9.0: *rebind* has been introduced.

Warning: Similar to `ListProperty`, when assigning a dict to a `DictProperty`, the dict stored in the property is a copy of the dict and not the original dict. See `ListProperty` for details.

class `kivy.properties.`**`VariableListProperty`**
Bases: `kivy.properties.Property`

A ListProperty that allows you to work with a variable amount of list items and to expand them to the desired list size.

For example, GridLayout's padding used to just accept one numeric value which was applied equally to the left, top, right and bottom of the GridLayout. Now padding can be given one, two or four values, which are expanded into a length four list [left, top, right, bottom] and stored in the property.

Parameters

default: **a default list of values**Specifies the default values for the list.

length: **int, one of 2 or 4.**Specifies the length of the final list. The *default* list will be expanded to match a list of this length.

***kwargs*: **a list of keyword arguments**Not currently used.

Keeping in mind that the *default* list is expanded to a list of length 4, here are some examples of how VariabelListProperty's are handled.

- VariableListProperty([1]) represents [1, 1, 1, 1].
- VariableListProperty([1, 2]) represents [1, 2, 1, 2].
- VariableListProperty([‘1px’, (2, ‘px’), 3, 4.0]) represents [1, 2, 3, 4.0].
- VariableListProperty(5) represents [5, 5, 5, 5].
- VariableListProperty(3, length=2) represents [3, 3].

New in version 1.7.0.

class `kivy.properties.`**`ConfigParserProperty`**

Bases: `kivy.properties.Property`

Property that allows one to bind to changes in the configuration values of a `ConfigParser` as well as to bind the ConfigParser values to other properties.

A ConfigParser is composed of sections, where each section has a number of keys and values associated with these keys. ConfigParserProperty lets you automatically listen to and change the values of specified keys based on other kivy properties.

For example, say we want to have a TextInput automatically write its value, represented as an int, in the *info* section of a ConfigParser. Also, the textinputs should update its values from the ConfigParser’s fields. Finally, their values should be displayed in a label. In py:

```
class Info(Label):

    number = ConfigParserProperty(0, 'info', 'number', 'example',
                                  val_type=int, errorvalue=41)

    def __init__(self, **kw):
        super(Info, self).__init__(**kw)
        config = ConfigParser(name='example')
```

The above code creates a property that is connected to the *number* key in the *info* section of the ConfigParser named *example*. Initially, this ConfigParser doesn’t exist. Then, in *__init__*, a ConfigParser is created with name *example*, which is then automatically linked with this property. then in kv:

```
BoxLayout:
    TextInput:
        id: number
        text: str(info.number)
    Info:
        id: info
        number: number.text
        text: 'Number: {}'.format(self.number)
```

You’ll notice that we have to do *text: str(info.number)*, this is because the value of this property is always an int, because we specified *int* as the *val_type*. However, we can assign anything to the property, e.g. *number: number.text* which assigns a string, because it is instantly converted with the *val_type* callback.

Note: If a file has been opened for this ConfigParser using `read()`, then `write()` will be called every property change, keeping the file updated.

Warning: It is recommend that the config parser object be assigned to the property after the kv tree has been constructed (e.g. schedule on next frame from init). This is because the kv tree and its properties, when constructed, are evaluated on its own order, therefore, any initial values in the parser might be overwritten by objects it’s bound to. So in the example above, the TextInput might be initially empty, and if *number: number.text* is evaluated before *text: str(info.number)*, the config value will be overwitten with the (empty) text value.

Parameters

default: **object type**Specifies the default value for the key. If the parser associated with this property doesn't have this section or key, it'll be created with the current value, which is the default value initially.

section: **string type**The section in the ConfigParser where the key / value will be written. Must be provided. If the section doesn't exist, it'll be created.

key: **string type**The key in section *section* where the value will be written to. Must be provided. If the key doesn't exist, it'll be created and the current value written to it, otherwise its value will be used.

config: **string or `ConfigParser` instance.**The ConfigParser instance to associate with this property if not None. If it's a string, the ConfigParser instance whose `name` is the value of *config* will be used. If no such parser exists yet, whenever a ConfigParser with this name is created, it will automatically be linked to this property.

Whenever a ConfigParser becomes linked with a property, if the section or key doesn't exist, the current property value will be used to create that key, otherwise, the existing key value will be used for the property value; overwriting its current value. You can change the ConfigParser associated with this property if a string was used here, by changing the `name` of an existing or new ConfigParser instance. Or through `set_config()`.

***kwargs*: **a list of keyword arguments**

val_type: **a callable object**The key values are saved in the ConfigParser as strings. When the ConfigParser value is read internally and assigned to the property or when the user changes the property value directly, if *val_type* is not None, it will be called with the new value as input and it should return the value converted to the proper type accepted ny this property. For example, if the property represent ints, *val_type* can simply be *int*.

If the *val_type* callback raises a *ValueError*, *errorvalue* or *errorhandler* will be used if provided. Tip: the *getboolean* function of the ConfigParser might also be useful here to convert to a boolean type.

verify: **a callable object**Can be used to restrict the allowable values of the property. For every value assigned to the property, if this is specified, *verify* is called with the new value, and if it returns *True* the value is accepted, otherwise, *errorvalue* or *errorhandler* will be used if provided or a *ValueError* is raised.

New in version 1.9.0.

set_config()

Sets the ConfigParser object to be used by this property. Normally, the ConfigParser is set when initializing the Property using the *config* parameter.

Parameters

config: **A `ConfigParser` instance.**The instance to use for listening to and saving property value changes. If None, it disconnects the currently used *ConfigParser*.

```
class MyWidget(Widget):
    username = ConfigParserProperty('', 'info', 'name', None)

widget = MyWidget()
widget.property('username').set_config(ConfigParser())
```

21.22 Resources management

Resource management can be a pain if you have multiple paths and projects. Kivy offers 2 functions for searching for specific resources across a list of paths.

`kivy.resources.`**`resource_find`**`(`*filename*`)`
Search for a resource in the list of paths. Use resource_add_path to add a custom path to the search.

`kivy.resources.`**`resource_add_path`**`(`*path*`)`
Add a custom path to search in.

`kivy.resources.`**`resource_remove_path`**`(`*path*`)`
Remove a search path.

New in version 1.0.8.

21.23 Support

Activate other frameworks/toolkits inside the kivy event loop.

`kivy.support.`**`install_gobject_iteration`**`()`
Import and install gobject context iteration inside our event loop. This is used as soon as gobject is used (like gstreamer).

`kivy.support.`**`install_twisted_reactor`**`(`***kwargs*`)`
Installs a threaded twisted reactor, which will schedule one reactor iteration before the next frame only when twisted needs to do some work.

Any arguments or keyword arguments passed to this function will be passed on the the threaded-select reactors interleave function. These are the arguments one would usually pass to twisted's reactor.startRunning.

Unlike the default twisted reactor, the installed reactor will not handle any signals unless you set the 'installSignalHandlers' keyword argument to 1 explicitly. This is done to allow kivy to handle the signals as usual unless you specifically want the twisted reactor to handle the signals (e.g. SIGINT).

Note: Twisted is not included in iOS build by default. To use it on iOS, put the twisted distribution (and zope.interface dependency) in your application directory.

`kivy.support.`**`uninstall_twisted_reactor`**`()`
Uninstalls the Kivy's threaded Twisted Reactor. No more Twisted tasks will run after this got called. Use this to clean the *twisted.internet.reactor*

New in version 1.9.0.

`kivy.support.`**`install_android`**`()`
Install hooks for the android platform.

- Automatically sleep when the device is paused.
- Automatically kill the application when the return key is pressed.

21.24 Utils

Changed in version 1.6.0: The OrderedDict class has been removed. Use the collections.OrderedDict.

`kivy.utils.`**`intersection`**`(`*set1, set2*`)`
    Return the intersection of 2 lists.

`kivy.utils.`**`difference`**`(`*set1, set2*`)`
    Return the difference between 2 lists.

`kivy.utils.`**`strtotuple`**`(`*s*`)`
    Convert a tuple string into a tuple with some security checks. Designed to be used with the eval() function:

```
a = (12, 54, 68)
b = str(a)         # return '(12, 54, 68)'
c = strtotuple(b)  # return (12, 54, 68)
```

`kivy.utils.`**`get_color_from_hex`**`(`*s*`)`
    Transform a hex string color to a kivy `Color`.

`kivy.utils.`**`get_hex_from_color`**`(`*color*`)`
    Transform a kivy `Color` to a hex value:

```
>>> get_hex_from_color((0, 1, 0))
'#00ff00'
>>> get_hex_from_color((.25, .77, .90, .5))
'#3fc4e57f'
```

New in version 1.5.0.

`kivy.utils.`**`get_random_color`**`(`*alpha=1.0*`)`
    Returns a random color (4 tuple).

Parameters

alpha[float, defaults to 1.0] If alpha == 'random', a random alpha value is generated.

`kivy.utils.`**`is_color_transparent`**`(`*c*`)`
    Return True if the alpha channel is 0.

`kivy.utils.`**`boundary`**`(`*value, minvalue, maxvalue*`)`
    Limit a value between a minvalue and maxvalue.

`kivy.utils.`**`deprecated`**`(`*func*`)`
    This is a decorator which can be used to mark functions as deprecated. It will result in a warning being emitted the first time the function is used.

class `kivy.utils.`**`SafeList`**
    Bases: `list`

List with a clear() method.

Warning: Usage of the iterate() function will decrease your performance.

`kivy.utils.`**`interpolate`**`(`*value_from, value_to, step=10*`)`
    Interpolate between two values. This can be useful for smoothing some transitions. For example:

```
# instead of setting directly
self.pos = pos

# use interpolate, and you'll have a nicer transition
self.pos = interpolate(self.pos, new_pos)
```

Warning: These interpolations work only on lists/tuples/doubles with the same dimensions. No test is done to check the dimensions are the same.

class `kivy.utils.`**`QueryDict`**
Bases: `dict`

QueryDict is a dict() that can be queried with dot.
New in version 1.0.4.

```
d = QueryDict()
# create a key named toto, with the value 1
d.toto = 1
# it's the same as
d['toto'] = 1
```

`kivy.utils.`**`platform`** **= platform name: 'linux' from: <kivy.utils.Platform object at 0x8f178cc>**
New in version 1.3.0.

Deprecated since 1.8.0: Use platform as variable instaed of a function.

Calling platform() will return one of: *win*, *linux*, *android*, *macosx*, *ios* or *unknown*.

Changed in version 1.8.0.

platform also behaves like a regular variable in comparisons like so:

```
from kivy import platform
if platform == 'linux':
    do_linux_things()
if platform() == 'linux': # triggers deprecation warning
    do_more_linux_things()
foo = {'linux' : do_linux_things}
foo[platform]() # calls do_linux_things
p = platform # assigns to a module object
if p == 'android':
    do_android_things()
p += 'some string' # error!
```

`kivy.utils.`**`escape_markup`**`(`*text*`)`
Escape markup characters found in the text. Intended to be used when markup text is activated on the Label:

```
untrusted_text = escape_markup('Look at the example [1]')
text = '[color=ff0000]' + untrusted_text + '[/color]'
w = Label(text=text, markup=True)
```

New in version 1.3.0.

class `kivy.utils.`**`reify`**`(`*func*`)`
Bases: `object`

Put the result of a method which uses this (non-data) descriptor decorator in the instance dict after the first call, effectively replacing the decorator with an instance variable.

It acts like @property, except that the function is only ever called once; after that, the value is cached as a regular attribute. This gives you lazy attribute creation on objects that are meant to be immutable.

Taken from the Pyramid project.

21.25 Vector

The `Vector` represents a 2D vector (x, y). Our implementation is made on top of a Python list.

Example for constructing a Vector:

```
>>> # Construct a point at 82,34
>>> v = Vector(82, 34)
>>> v[0]
82
>>> v.x
82
>>> v[1]
34
>>> v.y
34

>>> # Construct by giving a list of 2 values
>>> pos = (93, 45)
>>> v = Vector(pos)
>>> v[0]
93
>>> v.x
93
>>> v[1]
45
>>> v.y
45
```

21.25.1 Optimized usage

Most of the time, you can use a list for arguments instead of using a Vector. For example, if you want to calculate the distance between 2 points:

```
a = (10, 10)
b = (87, 34)

# optimized method
print('distance between a and b:', Vector(a).distance(b))

# non-optimized method
va = Vector(a)
vb = Vector(b)
print('distance between a and b:', va.distance(vb))
```

21.25.2 Vector operators

The `Vector` supports some numeric operators like +, -, /:

```
>>> Vector(1, 1) + Vector(9, 5)
[10, 6]

>>> Vector(9, 5) - Vector(5, 5)
[4, 0]

>>> Vector(10, 10) / Vector(2., 4.)
```

```
[5.0, 2.5]

>>> Vector(10, 10) / 5.
[2.0, 2.0]
```

You can also do in-place operations:

```
>>> v = Vector(1, 1)
>>> v += 2
>>> v
[3, 3]
>>> v *= 5
[15, 15]
>>> v /= 2.
[7.5, 7.5]
```

class `kivy.vector.`**`Vector`**(**largs*)

Bases: `list`

Vector class. See module documentation for more information.

`angle`(*a*)

Computes the angle between a and b, and returns the angle in degrees.

```
>>> Vector(100, 0).angle((0, 100))
-90.0
>>> Vector(87, 23).angle((-77, 10))
-157.7920283010705
```

`distance`(*to*)

Returns the distance between two points.

```
>>> Vector(10, 10).distance((5, 10))
5.
>>> a = (90, 33)
>>> b = (76, 34)
>>> Vector(a).distance(b)
14.035668847618199
```

`distance2`(*to*)

Returns the distance between two points squared.

```
>>> Vector(10, 10).distance2((5, 10))
25
```

`dot`(*a*)

Computes the dot product of a and b.

```
>>> Vector(2, 4).dot((2, 2))
12
```

static **`in_bbox`**(*point*, *a*, *b*)

Return True if *point* is in the bounding box defined by *a* and *b*.

```
>>> bmin = (0, 0)
>>> bmax = (100, 100)
>>> Vector.in_bbox((50, 50), bmin, bmax)
True
```

```
>>> Vector.in_bbox((647, -10), bmin, bmax)
False
```

length()

Returns the length of a vector.

```
>>> Vector(10, 10).length()
14.142135623730951
>>> pos = (10, 10)
>>> Vector(pos).length()
14.142135623730951
```

length2()

Returns the length of a vector squared.

```
>>> Vector(10, 10).length2()
200
>>> pos = (10, 10)
>>> Vector(pos).length2()
200
```

static **line_intersection**(*v1*, *v2*, *v3*, *v4*)

Finds the intersection point between the lines (1)v1->v2 and (2)v3->v4 and returns it as a vector object.

```
>>> a = (98, 28)
>>> b = (72, 33)
>>> c = (10, -5)
>>> d = (20, 88)
>>> Vector.line_intersection(a, b, c, d)
[15.25931928687196, 43.911669367909241]
```

Warning: This is a line intersection method, not a segment intersection.

For math see: http://en.wikipedia.org/wiki/Line-line_intersection

normalize()

Returns a new vector that has the same direction as vec, but has a length of one.

```
>>> v = Vector(88, 33).normalize()
>>> v
[0.93632917756904444, 0.3511234415883917]
>>> v.length()
1.0
```

rotate(*angle*)

Rotate the vector with an angle in degrees.

```
>>> v = Vector(100, 0)
>>> v.rotate(45)
>>> v
[70.710678118654755, 70.710678118654741]
```

static **segment_intersection**(*v1*, *v2*, *v3*, *v4*)

Finds the intersection point between segments (1)v1->v2 and (2)v3->v4 and returns it as a vector object.

```
>>> a = (98, 28)
>>> b = (72, 33)
>>> c = (10, -5)
>>> d = (20, 88)
>>> Vector.segment_intersection(a, b, c, d)
None
```

```
>>> a = (0, 0)
>>> b = (10, 10)
>>> c = (0, 10)
>>> d = (10, 0)
>>> Vector.segment_intersection(a, b, c, d)
[5, 5]
```

x

x represents the first element in the list.

```
>>> v = Vector(12, 23)
>>> v[0]
12
>>> v.x
12
```

y

y represents the second element in the list.

```
>>> v = Vector(12, 23)
>>> v[1]
23
>>> v.y
23
```

21.26 Weak Method

The WeakMethod is used in the Clock class to allow a reference to a bound method that permits the associated object to be garbage collected. Check examples/core/clock_method.py for more information.

This WeakMethod class is taken from the recipe http://code.activestate.com/recipes/81253/, based on the nicodemus version. (thanks to him !)

class `kivy.weakmethod.`**`WeakMethod`**(*method*)

Bases: `object`

Implementation of a weakref for functions and bound methods.

`is_dead`()

Returns True if the referenced callable was a bound method and the instance no longer exists. Otherwise, return False.

CHAPTER

TWENTYTWO

ADAPTERS

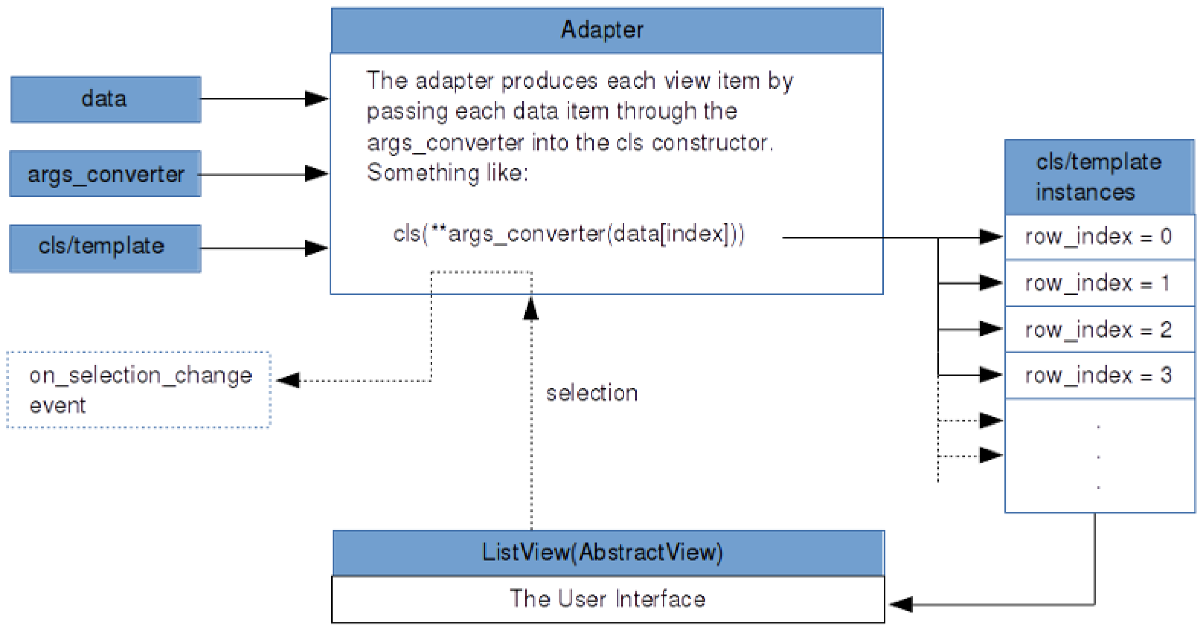
New in version 1.5.0.

An adapter is a mediating controller-type class that processes and presents data for use in views. It does this by generating models, generally lists of `SelectableView` items, that are consumed and presented by views. Views are top-level widgets, such as a `ListView`, that allow users to scroll through and (optionally) interact with your data.

22.1 The Concept

Kivy adapters are modelled on the Adapter design pattern. Conceptually, they play the role of a 'controller' between you data and views in a Model-View-Controller type architecture.

The role of an adapter can be depicted as follows:


Adapter
data
args_converter
cls/template
The adapter produces each view item by passing each data item through the args_converter into the cls constructor. Something like:
cls(**args_converter(data[index]))
cls/template instances
row_index = 0
row_index = 1
row_index = 2
row_index = 3
on_selection_change event
selection
ListView(AbstractView)
The User Interface

22.2 The Components

The components involved in this process are:

- **Adapters**: The adapter plays a mediating role between the user interface and your data. It manages the creation of the view elements for the model using the args_converter to prepare the contructor arguments for your cls/template view items.

The base `Adapter` is subclassed by the `SimpleListAdapter` and `ListAdapter`. The `DictAdapter` is a more advanced and flexible subclass of `ListAdapter`.

> *Adapter*, *SimpleListAdapter*, *ListAdapter*, *DictAdapter*.

- **Models**: The data for which an adapter serves as a bridge to views can be any sort of data. However, for convenience, model mixin classes can ease the preparation or shaping of data for use in the system. For selection operations, the `SelectableDataItem` can optionally prepare data items to provide and receive selection information (data items are not required to be "selection-aware", but in some cases it may be desired).

  > *SelectableDataItem*.

- **Args Converters**: Argument converters are made by the application programmer to do the work of converting data items to argument dictionaries suitable for instantiating views. In effect, they take each row of your data and create dictionaries that are passed into the constructors of your cls/template which are then used populate your View.

  > *List Item View Argument Converters*.

- **Views**: Models of your data are presented to the user via views. Each of your data items create a corresponding view subitem (the cls or template) presented in a list by the View. The base `AbstractView` currently has one concrete implementation: the `ListView`.

  > *Abstract View*, *List View*.

22.3 Adapter

New in version 1.5.

> **Warning:** This code is still experimental, and its API is subject to change in a future version.

An `Adapter` is a bridge between data and an `AbstractView` or one of its subclasses, such as a `ListView`.

The following arguments can be passed to the contructor to initialise the corresponding properties:

- `data`: for any sort of data to be used in a view. For an `Adapter`, data can be an object as well as a list, dict, etc. For a `ListAdapter`, data should be a list. For a `DictAdapter`, data should be a dict.
- `cls`: the class used to instantiate each list item view instance (Use this or the template argument).
- `template`: a kv template to use to instantiate each list item view instance (Use this or the cls argument).
- `args_converter`: a function used to transform the data items in preparation for either a cls instantiation or a kv template invocation. If no args_converter is provided, the data items are assumed to be simple strings.

Please refer to the `adapters` documentation for an overview of how adapters are used.

class `kivy.adapters.adapter.`**`Adapter`**`(`*`**kwargs`*`)`

  Bases: `kivy.event.EventDispatcher`

  An `Adapter` is a bridge between data and an `AbstractView` or one of its subclasses, such as a `ListView`.

  `args_converter`

    A function that prepares an args dict for the cls or kv template to build a view from a data item.

If an args_converter is not provided, a default one is set that assumes simple content in the form of a list of strings.

`args_converter` is an `ObjectProperty` and defaults to None.

`cls`

A class for instantiating a given view item (Use this or template). If this is not set and neither is the template, a `Label` is used for the view item.

`cls` is an `ObjectProperty` and defaults to None.

`data`

The data for which a view is to be constructed using either the cls or template provided, together with the args_converter provided or the default args_converter.

In this base class, data is an ObjectProperty, so it could be used for a wide variety of single-view needs.

Subclasses may override it in order to use another data type, such as a `ListProperty` or `DictProperty` as appropriate. For example, in a `ListAdapter`, data is a `ListProperty`.

`data` is an `ObjectProperty` and defaults to None.

`get_cls()`

New in version 1.9.0.

Returns the widget type specified by self.cls. If it is a string, the `Factory` is queried to retrieve the widget class with the given name, otherwise it is returned directly.

`template`

A kv template for instantiating a given view item (Use this or cls).

`template` is an `ObjectProperty` and defaults to None.

22.4 DictAdapter

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

A `DictAdapter` is an adapter around a python dictionary of records. It extends the list-like capabilities of the `ListAdapter`.

If you wish to have a bare-bones list adapter, without selection, use the `SimpleListAdapter`.

class `kivy.adapters.dictadapter.`**`DictAdapter`**`(`*`**kwargs`*`)`

Bases: `kivy.adapters.listadapter.ListAdapter`

A `DictAdapter` is an adapter around a python dictionary of records. It extends the list-like capabilities of the `ListAdapter`.

`cut_to_sel``(`*`*args`*`)`

Same as trim_to_sel, but intervening list items within the selected range are also cut, leaving only list items that are selected.

sorted_keys will be updated by update_for_new_data().

`data`

A dict that indexes records by keys that are equivalent to the keys in sorted_keys, or they are a superset of the keys in sorted_keys.

The values can be strings, class instances, dicts, etc.

`data` is a `DictProperty` and defaults to None.

sorted_keys

The sorted_keys list property contains a list of hashable objects (can be strings) that will be used directly if no args_converter function is provided. If there is an args_converter, the record received from a lookup of the data, using keys from sorted_keys, will be passed to it for instantiation of list item view class instances.

sorted_keys is a ListProperty and defaults to [].

trim_left_of_sel(**args*)

Cut list items with indices in sorted_keys that are less than the index of the first selected item, if there is a selection.

sorted_keys will be updated by update_for_new_data().

trim_right_of_sel(**args*)

Cut list items with indices in sorted_keys that are greater than the index of the last selected item, if there is a selection.

sorted_keys will be updated by update_for_new_data().

trim_to_sel(**args*)

Cut list items with indices in sorted_keys that are les than or greater than the index of the last selected item, if there is a selection. This preserves intervening list items within the selected range.

sorted_keys will be updated by update_for_new_data().

22.5 List Item View Argument Converters

New in version 1.5.

The default list item args converter for list adapters is a function (shown below) that takes a row index and a string. It returns a dict with the string as the *text* item, along with two properties suited for simple text items with a height of 25.

22.5.1 Simple Usage

Argument converters may be normal functions or, as in the case of the default args converter, lambdas:

```
list_item_args_converter = lambda row_index, x: {'text': x,
                                                 'size_hint_y': None,
                                                 'height': 25}
```

22.5.2 Advanced Usage

Typically, having the argument converter perform a simple mapping suffices. There are times, however, when more complex manipulation is required. When using a CompositeListItem, it is possible to specify a list of cls dictionaries. This allows you so compose a single view item out of multiple classes, each of which can recieve their own class constructor arguments via the *kwargs* keyword:

```
args_converter = lambda row_index, rec: \
        {'text': rec['text'],
         'size_hint_y': None,
         'height': 25,
         'cls_dicts': [{'cls': ListItemButton,
                        'kwargs': {'text': rec['text']}},
                       {'cls': ListItemLabel,
                        'kwargs': {'text': "Middle-{0}".format(rec['text']),
                                   'is_representing_cls': True}},
                       {'cls': ListItemButton,
                        'kwargs': {'text': rec['text']}}]}
```

Please see the list_composite.py for a complete example.

22.6 ListAdapter

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

A `ListAdapter` is an adapter around a python list and adds support for selection operations. If you wish to have a bare-bones list adapter, without selection, use a `SimpleListAdapter`.

From an `Adapter`, a `ListAdapter` inherits cls, template, and args_converter properties and adds others that control selection behaviour:

- `selection`: a list of selected items.
- `selection_mode`: one of 'single', 'multiple' or 'none'.
- `allow_empty_selection`: a boolean. If False, a selection is forced. If True, and only user or programmatic action will change selection, it can be empty.

A `DictAdapter` is a subclass of a `ListAdapter`. They both dispatch the `on_selection_change` event when selection changes.

Changed in version 1.6.0: Added data = ListProperty([]), which was proably inadvertently deleted at some point. This means that whenever data changes an update will fire, instead of having to reset the data object (Adapter has data defined as an ObjectProperty, so we need to reset it here to ListProperty). See also DictAdapter and its set of data = DictProperty().

class `kivy.adapters.listadapter.`**`ListAdapter`**`(`***kwargs*`)`

Bases: `kivy.adapters.adapter.Adapter`, `kivy.event.EventDispatcher`

A base class for adapters interfacing with lists, dictionaries or other collection type data, adding selection, view creation and management functonality.

`allow_empty_selection`

The allow_empty_selection may be used for cascading selection between several list views, or between a list view and an observing view. Such automatic maintenance of the selection is important for all but simple list displays. Set allow_empty_selection to False and the selection is auto-initialized and always maintained, so any observing views may likewise be updated to stay in sync.

`allow_empty_selection` is a `BooleanProperty` and defaults to True.

`cached_views`

View instances for data items are instantiated and managed by the adapter. Here we maintain a dictionary containing the view instances keyed to the indices in the data.

This dictionary works as a cache. get_view() only asks for a view from the adapter if one is not already stored for the requested index.

`cached_views` is a `DictProperty` and defaults to {}.

`create_view``(`*index*`)`

This method is more complicated than the ones in the `Adapter` and `SimpleListAdapter` classes because here we create bindings for the data items and their children back to the *self.handle_selection()* event. We also perform other selection-related tasks to keep item views in sync with the data.

cut_to_sel(**args*)

Same as trim_to_sel, but intervening list items within the selected range are also cut, leaving only list items that are selected.

data

The data list property is redefined here, overriding its definition as an ObjectProperty in the Adapter class. We bind to data so that any changes will trigger updates. See also how the `DictAdapter` redefines data as a `DictProperty`.

`data` is a `ListProperty` and defaults to [].

on_selection_change(**args*)

on_selection_change() is the default handler for the on_selection_change event. You can bind to this event to get notified of selection changes.

Parameters

adapter: `ListAdapter` or subclass The instance of the list adapter where the selection changed. Use the adapters `selection` property to see what has been selected.

propagate_selection_to_data

Normally, data items are not selected/deselected because the data items might not have an is_selected boolean property – only the item view for a given data item is selected/deselected as part of the maintained selection list. However, if the data items do have an is_selected property, or if they mix in `SelectableDataItem`, the selection machinery can propagate selection to data items. This can be useful for storing selection state in a local database or backend database for maintaining state in game play or other similar scenarios. It is a convenience function.

To propagate selection or not?

Consider a shopping list application for shopping for fruits at the market. The app allows for the selection of fruits to buy for each day of the week, presenting seven lists: one for each day of the week. Each list is loaded with all the available fruits, but the selection for each is a subset. There is only one set of fruit data shared between the lists, so it would not make sense to propagate selection to the data because selection in any of the seven lists would clash and mix with that of the others.

However, consider a game that uses the same fruits data for selecting fruits available for fruit-tossing. A given round of play could have a full fruits list, with fruits available for tossing shown selected. If the game is saved and rerun, the full fruits list, with selection marked on each item, would be reloaded correctly if selection is always propagated to the data. You could accomplish the same functionality by writing code to operate on list selection, but having selection stored in the data ListProperty might prove convenient in some cases.

Note: This setting should be set to True if you wish to initialize the view with item views already selected.

`propagate_selection_to_data` is a `BooleanProperty` and defaults to False.

select_list(*view_list*, *extend=True*)

The select call is made for the items in the provided view_list.

Arguments:

view_list: the list of item views to become the new selection, or to add to the existing selection

extend: boolean for whether or not to extend the existing list

selection
The selection list property is the container for selected items.

selection is a ListProperty and defaults to [].

selection_limit
When the selection_mode is 'multiple' and the selection_limit is non-negative, this number will limit the number of selected items. It can be set to 1, which is equivalent to single selection. If selection_limit is not set, the default value is -1, meaning that no limit will be enforced.

selection_limit is a NumericProperty and defaults to -1 (no limit).

selection_mode
The selection_mode is a string and can be set to one of the following values:

- 'none': use the list as a simple list (no select action). This option is here so that selection can be turned off, momentarily or permanently, for an existing list adapter. A ListAdapter is not meant to be used as a primary no-selection list adapter. Use a SimpleListAdapter for that.
- 'single': multi-touch/click ignored. Single item selection only.
- 'multiple': multi-touch / incremental addition to selection allowed; may be limited to a count by setting the selection_limit.

selection_mode is an OptionProperty and defaults to 'single'.

trim_left_of_sel(**args*)
Cut list items with indices in sorted_keys that are less than the index of the first selected item if there is a selection.

trim_right_of_sel(**args*)
Cut list items with indices in sorted_keys that are greater than the index of the last selected item if there is a selection.

trim_to_sel(**args*)
Cut list items with indices in sorted_keys that are less than or greater than the index of the last selected item if there is a selection. This preserves intervening list items within the selected range.

22.7 SelectableDataItem

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

22.7.1 Data Models

Kivy is open about the type of data used in applications built with the system. However, base classes are sometimes needed to ensure data conforms to the requirements of some parts of the system.

A SelectableDataItem is a basic Python data model class that can be used as a mixin to build data objects that are compatible with Kivy's Adapter and selection system and which work with views such as a ListView. A boolean *is_selected* property a requirement.

The default operation of the selection system is to not propogate selection in views such as ListView to the underlying data: selection is by default a view-only operation. However, in some cases, it is useful to propogate selection to the actual data items.

You may, of course, build your own Python data model system as the backend for a Kivy application. For instance, to use the Google App Engine Data Modeling system with Kivy, you could define your class as follows:

```
from google.appengine.ext import db

class MySelectableDataItem(db.Model):
    # ... other properties
    is_selected = db.BooleanProperty()
```

It is easy to build such a class with plain Python.

class `kivy.adapters.models.`**`SelectableDataItem`**(***kwargs*)

Bases: `object`

A mixin class containing requirements for selection operations.

`is_selected`

A boolean property indicating whether the data item is selected or not.

22.8 SimpleListAdapter

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `SimpleListAdapter` is used for basic lists. For example, it can be used for displaying a list of read-only strings that do not require user interaction.

class `kivy.adapters.simplelistadapter.`**`SimpleListAdapter`**(***kwargs*)

Bases: `kivy.adapters.adapter.Adapter`

A `SimpleListAdapter` is an adapter around a Python list.

From `Adapter`, the `ListAdapter` gets cls, template, and args_converter properties.

`data`

The data list property contains a list of objects (which can be strings) that will be used directly if no args_converter function is provided. If there is an args_converter, the data objects will be passed to it for instantiating the item view class instances.

`data` is a `ListProperty` and defaults to [].

CHAPTER

TWENTYTHREE

ADAPTER

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

An `Adapter` is a bridge between data and an `AbstractView` or one of its subclasses, such as a `ListView`.

The following arguments can be passed to the contructor to initialise the corresponding properties:

- `data`: for any sort of data to be used in a view. For an `Adapter`, data can be an object as well as a list, dict, etc. For a `ListAdapter`, data should be a list. For a `DictAdapter`, data should be a dict.
- `cls`: the class used to instantiate each list item view instance (Use this or the template argument).
- `template`: a kv template to use to instantiate each list item view instance (Use this or the cls argument).
- `args_converter`: a function used to transform the data items in preparation for either a cls instantiation or a kv template invocation. If no args_converter is provided, the data items are assumed to be simple strings.

Please refer to the `adapters` documentation for an overview of how adapters are used.

class `kivy.adapters.adapter.`**`Adapter`**(***kwargs*)

Bases: `kivy.event.EventDispatcher`

An `Adapter` is a bridge between data and an `AbstractView` or one of its subclasses, such as a `ListView`.

`args_converter`

A function that prepares an args dict for the cls or kv template to build a view from a data item.

If an args_converter is not provided, a default one is set that assumes simple content in the form of a list of strings.

`args_converter` is an `ObjectProperty` and defaults to None.

`cls`

A class for instantiating a given view item (Use this or template). If this is not set and neither is the template, a `Label` is used for the view item.

`cls` is an `ObjectProperty` and defaults to None.

`data`

The data for which a view is to be constructed using either the cls or template provided, together with the args_converter provided or the default args_converter.

In this base class, data is an ObjectProperty, so it could be used for a wide variety of single-view needs.

Subclasses may override it in order to use another data type, such as a `ListProperty` or `DictProperty` as appropriate. For example, in a `ListAdapter`, data is a `ListProperty`.

`data` is an `ObjectProperty` and defaults to None.

`get_cls``()`

New in version 1.9.0.

Returns the widget type specified by self.cls. If it is a string, the `Factory` is queried to retrieve the widget class with the given name, otherwise it is returned directly.

`template`

A kv template for instantiating a given view item (Use this or cls).

`template` is an `ObjectProperty` and defaults to None.

CHAPTER

TWENTYFOUR

LIST ITEM VIEW ARGUMENT CONVERTERS

New in version 1.5.

The default list item args converter for list adapters is a function (shown below) that takes a row index and a string. It returns a dict with the string as the *text* item, along with two properties suited for simple text items with a height of 25.

24.1 Simple Usage

Argument converters may be normal functions or, as in the case of the default args converter, lambdas:

```
list_item_args_converter = lambda row_index, x: {'text': x,
                                                 'size_hint_y': None,
                                                 'height': 25}
```

24.2 Advanced Usage

Typically, having the argument converter perform a simple mapping suffices. There are times, however, when more complex manipulation is required. When using a CompositeListItem, it is possible to specify a list of cls dictionaries. This allows you so compose a single view item out of multiple classes, each of which can recieve their own class constructor arguments via the *kwargs* keyword:

```
args_converter = lambda row_index, rec: \
        {'text': rec['text'],
         'size_hint_y': None,
         'height': 25,
         'cls_dicts': [{'cls': ListItemButton,
                         'kwargs': {'text': rec['text']}},
                        {'cls': ListItemLabel,
                         'kwargs': {'text': "Middle-{0}".format(rec['text']),
                                    'is_representing_cls': True}},
                        {'cls': ListItemButton,
                         'kwargs': {'text': rec['text']}}]}
```

Please see the list_composite.py for a complete example.

CHAPTER

TWENTYFIVE

DICTADAPTER

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

A `DictAdapter` is an adapter around a python dictionary of records. It extends the list-like capabilities of the `ListAdapter`.

If you wish to have a bare-bones list adapter, without selection, use the `SimpleListAdapter`.

class `kivy.adapters.dictadapter.`**`DictAdapter`**`(`***kwargs*`)`
Bases: `kivy.adapters.listadapter.ListAdapter`

A `DictAdapter` is an adapter around a python dictionary of records. It extends the list-like capabilities of the `ListAdapter`.

`cut_to_sel``(`**args*`)`
Same as trim_to_sel, but intervening list items within the selected range are also cut, leaving only list items that are selected.

sorted_keys will be updated by update_for_new_data().

`data`
A dict that indexes records by keys that are equivalent to the keys in sorted_keys, or they are a superset of the keys in sorted_keys.

The values can be strings, class instances, dicts, etc.

`data` is a `DictProperty` and defaults to None.

`sorted_keys`
The sorted_keys list property contains a list of hashable objects (can be strings) that will be used directly if no args_converter function is provided. If there is an args_converter, the record received from a lookup of the data, using keys from sorted_keys, will be passed to it for instantiation of list item view class instances.

`sorted_keys` is a `ListProperty` and defaults to [].

`trim_left_of_sel``(`**args*`)`
Cut list items with indices in sorted_keys that are less than the index of the first selected item, if there is a selection.

sorted_keys will be updated by update_for_new_data().

`trim_right_of_sel``(`**args*`)`
Cut list items with indices in sorted_keys that are greater than the index of the last selected item, if there is a selection.

sorted_keys will be updated by update_for_new_data().

trim_to_sel(**args*)

Cut list items with indices in sorted_keys that are les than or greater than the index of the last selected item, if there is a selection. This preserves intervening list items within the selected range.

sorted_keys will be updated by update_for_new_data().

CHAPTER

TWENTYSIX

LISTADAPTER

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

A `ListAdapter` is an adapter around a python list and adds support for selection operations. If you wish to have a bare-bones list adapter, without selection, use a `SimpleListAdapter`.

From an `Adapter`, a `ListAdapter` inherits cls, template, and args_converter properties and adds others that control selection behaviour:

- `selection`: a list of selected items.
- `selection_mode`: one of 'single', 'multiple' or 'none'.
- `allow_empty_selection`: a boolean. If False, a selection is forced. If True, and only user or programmatic action will change selection, it can be empty.

A `DictAdapter` is a subclass of a `ListAdapter`. They both dispatch the `on_selection_change` event when selection changes.

Changed in version 1.6.0: Added data = ListProperty([]), which was proably inadvertently deleted at some point. This means that whenever data changes an update will fire, instead of having to reset the data object (Adapter has data defined as an ObjectProperty, so we need to reset it here to ListProperty). See also DictAdapter and its set of data = DictProperty().

class `kivy.adapters.listadapter.`**`ListAdapter`**`(`*`**kwargs`*`)`

Bases: `kivy.adapters.adapter.Adapter`, `kivy.event.EventDispatcher`

A base class for adapters interfacing with lists, dictionaries or other collection type data, adding selection, view creation and management functonality.

`allow_empty_selection`

The allow_empty_selection may be used for cascading selection between several list views, or between a list view and an observing view. Such automatic maintenance of the selection is important for all but simple list displays. Set allow_empty_selection to False and the selection is auto-initialized and always maintained, so any observing views may likewise be updated to stay in sync.

`allow_empty_selection` is a `BooleanProperty` and defaults to True.

`cached_views`

View instances for data items are instantiated and managed by the adapter. Here we maintain a dictionary containing the view instances keyed to the indices in the data.

This dictionary works as a cache. get_view() only asks for a view from the adapter if one is not already stored for the requested index.

`cached_views` is a `DictProperty` and defaults to {}.

create_view(*index*)

This method is more complicated than the ones in the Adapter and SimpleListAdapter classes because here we create bindings for the data items and their children back to the *self.handle_selection()* event. We also perform other selection-related tasks to keep item views in sync with the data.

cut_to_sel(**args*)

Same as trim_to_sel, but intervening list items within the selected range are also cut, leaving only list items that are selected.

data

The data list property is redefined here, overriding its definition as an ObjectProperty in the Adapter class. We bind to data so that any changes will trigger updates. See also how the `DictAdapter` redefines data as a DictProperty.

data is a ListProperty and defaults to [].

on_selection_change(**args*)

on_selection_change() is the default handler for the on_selection_change event. You can bind to this event to get notified of selection changes.

Parameters

adapter: ListAdapter or subclass The instance of the list adapter where the selection changed. Use the adapters selection property to see what has been selected.

propagate_selection_to_data

Normally, data items are not selected/deselected because the data items might not have an is_selected boolean property – only the item view for a given data item is selected/deselected as part of the maintained selection list. However, if the data items do have an is_selected property, or if they mix in SelectableDataItem, the selection machinery can propagate selection to data items. This can be useful for storing selection state in a local database or backend database for maintaining state in game play or other similar scenarios. It is a convenience function.

To propagate selection or not?

Consider a shopping list application for shopping for fruits at the market. The app allows for the selection of fruits to buy for each day of the week, presenting seven lists: one for each day of the week. Each list is loaded with all the available fruits, but the selection for each is a subset. There is only one set of fruit data shared between the lists, so it would not make sense to propagate selection to the data because selection in any of the seven lists would clash and mix with that of the others.

However, consider a game that uses the same fruits data for selecting fruits available for fruit-tossing. A given round of play could have a full fruits list, with fruits available for tossing shown selected. If the game is saved and rerun, the full fruits list, with selection marked on each item, would be reloaded correctly if selection is always propagated to the data. You could accomplish the same functionality by writing code to operate on list selection, but having selection stored in the data ListProperty might prove convenient in some cases.

Note: This setting should be set to True if you wish to initialize the view with item views already selected.

---

propagate_selection_to_data is a BooleanProperty and defaults to False.

select_list(*view_list, extend=True*)

The select call is made for the items in the provided view_list.

Arguments:

view_list: the list of item views to become the new selection, or to add to the existing selection

extend: boolean for whether or not to extend the existing list

selection

The selection list property is the container for selected items.

`selection` is a `ListProperty` and defaults to [].

selection_limit

When the `selection_mode` is 'multiple' and the selection_limit is non-negative, this number will limit the number of selected items. It can be set to 1, which is equivalent to single selection. If selection_limit is not set, the default value is -1, meaning that no limit will be enforced.

`selection_limit` is a `NumericProperty` and defaults to -1 (no limit).

selection_mode

The selection_mode is a string and can be set to one of the following values:

- 'none': use the list as a simple list (no select action). This option is here so that selection can be turned off, momentarily or permanently, for an existing list adapter. A `ListAdapter` is not meant to be used as a primary no-selection list adapter. Use a `SimpleListAdapter` for that.
- 'single': multi-touch/click ignored. Single item selection only.
- 'multiple': multi-touch / incremental addition to selection allowed; may be limited to a count by setting the `selection_limit`.

`selection_mode` is an `OptionProperty` and defaults to 'single'.

trim_left_of_sel(**args*)

Cut list items with indices in sorted_keys that are less than the index of the first selected item if there is a selection.

trim_right_of_sel(**args*)

Cut list items with indices in sorted_keys that are greater than the index of the last selected item if there is a selection.

trim_to_sel(**args*)

Cut list items with indices in sorted_keys that are less than or greater than the index of the last selected item if there is a selection. This preserves intervening list items within the selected range.

CHAPTER

TWENTYSEVEN

SELECTABLEDATAITEM

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

27.1 Data Models

Kivy is open about the type of data used in applications built with the system. However, base classes are sometimes needed to ensure data conforms to the requirements of some parts of the system.

A `SelectableDataItem` is a basic Python data model class that can be used as a mixin to build data objects that are compatible with Kivy's `Adapter` and selection system and which work with views such as a `ListView`. A boolean *is_selected* property a requirement.

The default operation of the selection system is to not propogate selection in views such as ListView to the underlying data: selection is by default a view-only operation. However, in some cases, it is useful to propogate selection to the actual data items.

You may, of course, build your own Python data model system as the backend for a Kivy application. For instance, to use the Google App Engine Data Modeling system with Kivy, you could define your class as follows:

```
from google.appengine.ext import db

class MySelectableDataItem(db.Model):
    # ... other properties
    is_selected = db.BooleanProperty()
```

It is easy to build such a class with plain Python.

class `kivy.adapters.models.`**`SelectableDataItem`**(***kwargs*)
Bases: `object`

A mixin class containing requirements for selection operations.

`is_selected`
A boolean property indicating whether the data item is selected or not.

CHAPTER

TWENTYEIGHT

SIMPLELISTADAPTER

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `SimpleListAdapter` is used for basic lists. For example, it can be used for displaying a list of read-only strings that do not require user interaction.

class `kivy.adapters.simplelistadapter.`**`SimpleListAdapter`**`(`***kwargs*`)`

Bases: `kivy.adapters.adapter.Adapter`

A `SimpleListAdapter` is an adapter around a Python list.

From `Adapter`, the `ListAdapter` gets cls, template, and args_converter properties.

`data`

The data list property contains a list of objects (which can be strings) that will be used directly if no args_converter function is provided. If there is an args_converter, the data objects will be passed to it for instantiating the item view class instances.

`data` is a `ListProperty` and defaults to [].

CHAPTER

TWENTYNINE

ANIMATION

Animation and AnimationTransition are used to animate Widget properties. You must specify at least a property name and target value. To use an Animation, follow these steps:

- Setup an Animation object
- Use the Animation object on a Widget

29.1 Simple animation

To animate a Widget's x or y position, simply specify the target x/y values where you want the widget positioned at the end of the animation:

```
anim = Animation(x=100, y=100)
anim.start(widget)
```

The animation will last for 1 second unless `duration` is specified. When anim.start() is called, the Widget will move smoothly from the current x/y position to (100, 100).

29.2 Multiple properties and transitions

You can animate multiple properties and use built-in or custom transition functions using `transition` (or the *t*= shortcut). For example, to animate the position and size using the 'in_quad' transition:

```
anim = Animation(x=50, size=(80, 80), t='in_quad')
anim.start(widget)
```

Note that the *t*= parameter can be the string name of a method in the AnimationTransition class or your own animation function.

29.3 Sequential animation

To join animations sequentially, use the '+' operator. The following example will animate to x=50 over 1 second, then animate the size to (80, 80) over the next two seconds:

```
anim = Animation(x=50) + Animation(size=(80, 80), duration=2.)
anim.start(widget)
```

29.4 Parallel animation

To join animations in parallel, use the '&' operator. The following example will animate the position to (80, 10) over 1 second, whilst in parallel animating the size to (800, 800):

```
anim = Animation(pos=(80, 10))
anim &= Animation(size=(800, 800), duration=2.)
anim.start(widget)
```

Keep in mind that creating overlapping animations on the same property may have unexpected results. If you want to apply multiple animations to the same property, you should either schedule them sequentially (via the '+' operator or using the *on_complete* callback) or cancel previous animations using the `cancel_all` method.

29.5 Repeating animation

New in version 1.8.0.

Note: This is currently only implemented for 'Sequence' animations.

To set an animation to repeat, simply set the `Sequence.repeat` property to *True*:

```
anim = Animation(...) + Animation(...)
anim.repeat = True
anim.start(widget)
```

For flow control of animations such as stopping and cancelling, use the methods already in place in the animation module.

class `kivy.animation.`**`Animation`**`(`***kw*`)`

Bases: `kivy.event.EventDispatcher`

Create an animation definition that can be used to animate a Widget.

Parameters

***duration* or *d*: float, defaults to 1.**Duration of the animation, in seconds.

***transition* or *t*: str or func**Transition function for animate properties. It can be the name of a method from `AnimationTransition`.

***step* or *s*: float**Step in milliseconds of the animation. Defaults to 1 / 60.

Events

***on_start*: widget**Fired when the animation is started on a widget.

***on_complete*: widget**Fired when the animation is completed or stopped on a widget.

***on_progress*: widget, progression**Fired when the progression of the animation is changing.

Changed in version 1.4.0: Added s/step parameter.

`animated_properties`

Return the properties used to animate.

`cancel``(`*widget*`)`

Cancel the animation previously applied to a widget. Same effect as `stop`, except the *on_complete* event will *not* be triggered!

New in version 1.4.0.

static **cancel_all**(*widget*, **largs*)
Cancel all animations that concern a specific widget / list of properties. See `cancel`.

Example:

```
anim = Animation(x=50)
anim.start(widget)

# and later
Animation.cancel_all(widget, 'x')
```

New in version 1.4.0.

cancel_property(*widget*, *prop*)
Even if an animation is running, remove a property. It will not be animated further. If it was the only/last property being animated, the animation will be canceled (see `cancel`)

New in version 1.4.0.

duration
Return the duration of the animation.

have_properties_to_animate(*widget*)
Return True if a widget still has properties to animate.

New in version 1.8.0.

start(*widget*)
Start the animation on a widget.

stop(*widget*)
Stop the animation previously applied to a widget, triggering the *on_complete* event.

static **stop_all**(*widget*, **largs*)
Stop all animations that concern a specific widget / list of properties.

Example:

```
anim = Animation(x=50)
anim.start(widget)

# and later
Animation.stop_all(widget, 'x')
```

stop_property(*widget*, *prop*)
Even if an animation is running, remove a property. It will not be animated futher. If it was the only/last property being animated, the animation will be stopped (see `stop`).

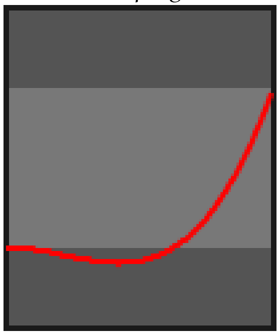
transition
Return the transition of the animation.

class `kivy.animation.`**`AnimationTransition`**
Bases: `object`

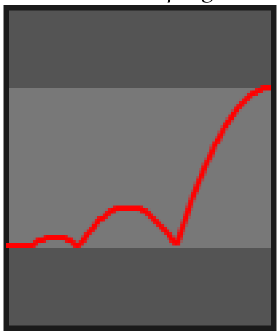
Collection of animation functions to be used with the Animation object. Easing Functions ported to Kivy from the Clutter Project http://www.clutter-project.org/docs/clutter/stable/ClutterAlpha.html

The *progress* parameter in each animation function is in the range 0-1.

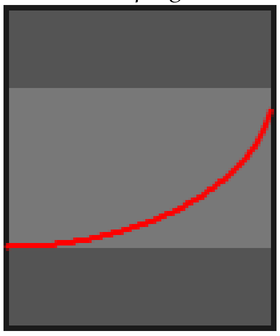
static **`in_back`**(*progress*)



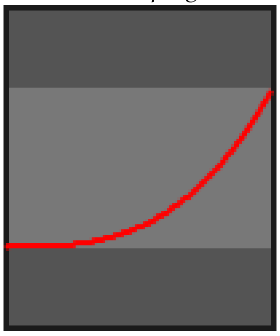
static **`in_bounce`**(*progress*)



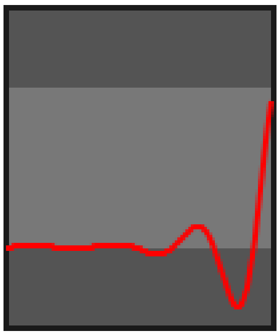
static **`in_circ`**(*progress*)



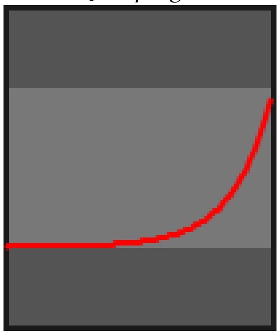
static **`in_cubic`**(*progress*)



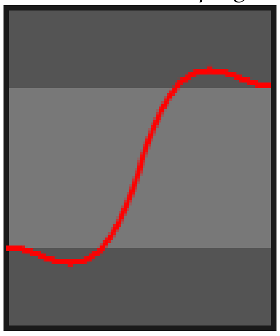
static **`in_elastic`**(*progress*)



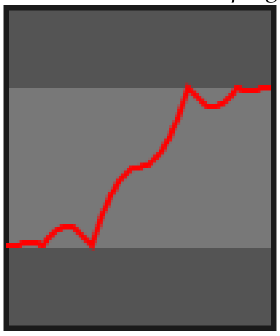
static **`in_expo`**(*progress*)



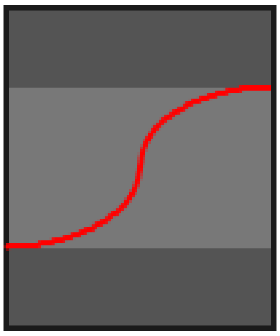
static **`in_out_back`**(*progress*)



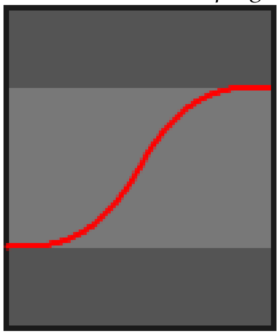
static **`in_out_bounce`**(*progress*)



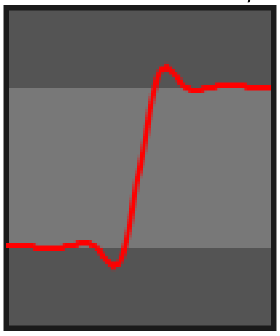
static **`in_out_circ`**(*progress*)



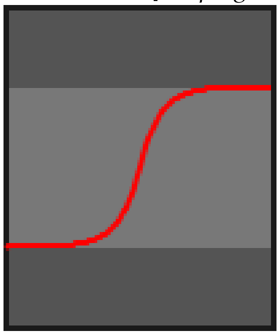
static **`in_out_cubic`**(*progress*)



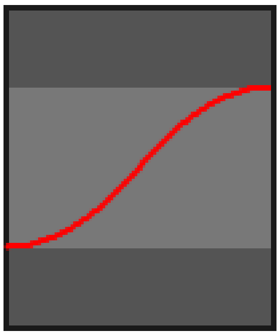
static **`in_out_elastic`**(*progress*)



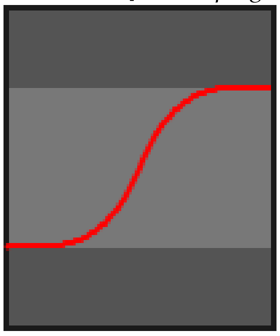
static **`in_out_expo`**(*progress*)



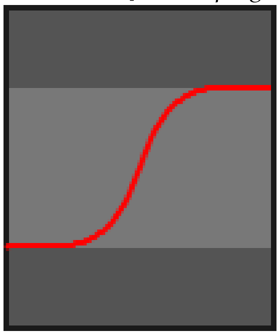
static **`in_out_quad`**(*progress*)



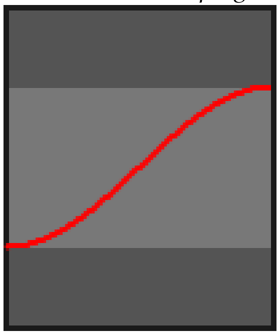
static `in_out_quart`(*progress*)



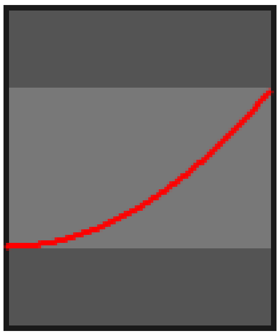
static `in_out_quint`(*progress*)



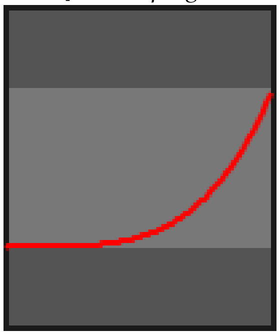
static `in_out_sine`(*progress*)



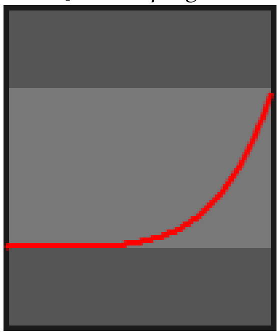
static `in_quad`(*progress*)



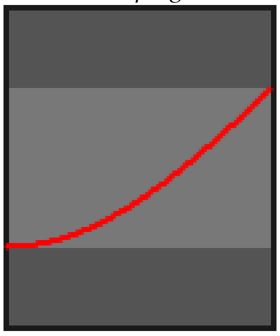
static **`in_quart`**(*progress*)



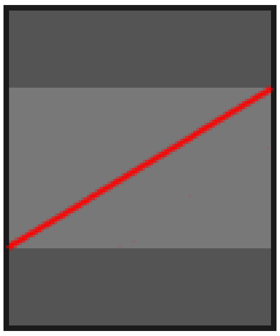
static **`in_quint`**(*progress*)



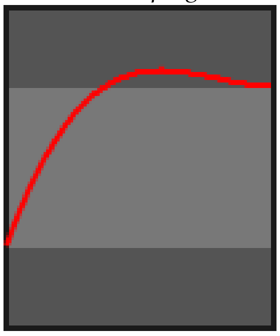
static **`in_sine`**(*progress*)



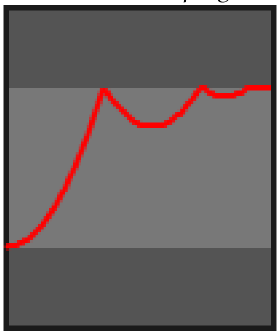
static **`linear`**(*progress*)



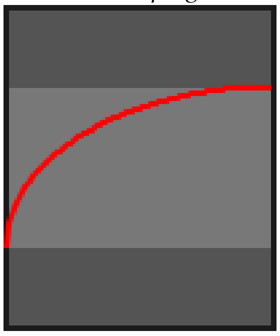
static **`out_back`**(*progress*)



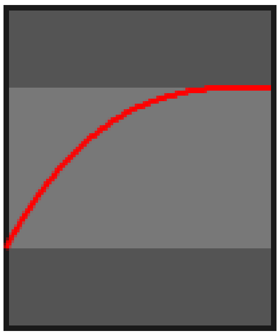
static **`out_bounce`**(*progress*)



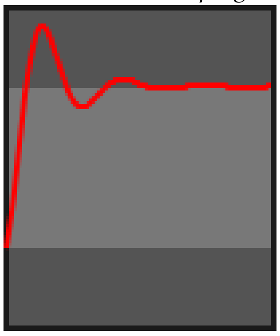
static **`out_circ`**(*progress*)



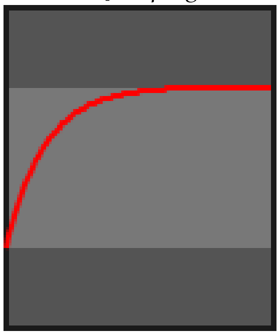
static **`out_cubic`**(*progress*)



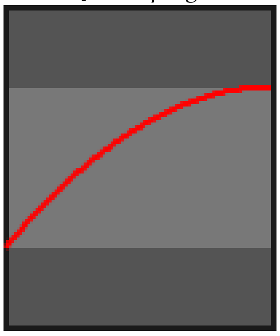
static **`out_elastic`**(*progress*)



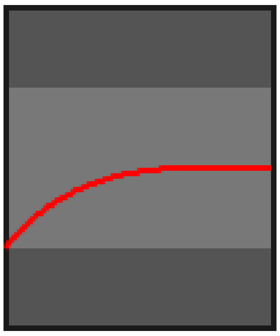
static **`out_expo`**(*progress*)



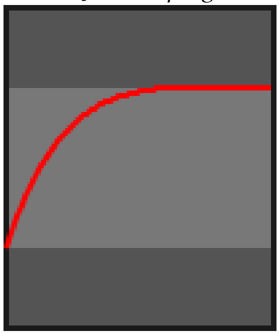
static **`out_quad`**(*progress*)



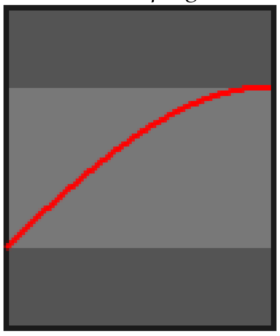
static **`out_quart`**(*progress*)



static **`out_quint`**(*progress*)



static **`out_sine`**(*progress*)



CHAPTER

THIRTY

APPLICATION

The App class is the base for creating Kivy applications. Think of it as your main entry point into the Kivy run loop. In most cases, you subclass this class and make your own app. You create an instance of your specific app class and then, when you are ready to start the application's life cycle, you call your instance's App.run() method.

30.1 Creating an Application

30.1.1 Method using build() override

To initialize your app with a widget tree, override the build() method in your app class and return the widget tree you constructed.

Here's an example of a very simple application that just shows a button:

```
'''
Application example using build() + return
==========================================

An application can be built if you return a widget on build(), or if you set
self.root.
'''

import kivy
kivy.require('1.0.7')

from kivy.app import App
from kivy.uix.button import Button


class TestApp(App):

    def build(self):
        # return a Button() as a root widget
        return Button(text='hello world')

if __name__ == '__main__':
    TestApp().run()
```

The file is also available in the examples folder at kivy/examples/application/app_with_build.py.

Here, no widget tree was constructed (or if you will, a tree with only the root node).

30.1.2 Method using kv file

You can also use the *Kivy Language* for creating applications. The .kv can contain rules and root widget definitions at the same time. Here is the same example as the Button one in a kv file.

Contents of 'test.kv':

```
#:kivy 1.0

Button:
    text: 'Hello world'
```

Contents of 'main.py':

```
'''
Application from a .kv
======================

The root application is created from the corresponding .kv. Check the test.kv
file to see what will be the root widget.
'''

import kivy
kivy.require('1.0.7')

from kivy.app import App


class TestApp(App):
    pass

if __name__ == '__main__':
    TestApp().run()
```

See `kivy/examples/application/app_with_kv.py`.

The relation between main.py and test.kv is explained in `App.load_kv()`.

30.2 Application configuration

New in version 1.0.7.

30.2.1 Use the configuration file

Your application might want to have its own configuration file. The `App` is able to handle an INI file automatically. You add your section/key/value in the `App.build_config()` method by using the *config* parameter (which is an instance of `ConfigParser`):

```
class TestApp(App):
    def build_config(self, config):
        config.setdefaults('section1', {
            'key1': 'value1',
            'key2': '42'
        })
```

As soon as you add one section in the config, a file is created on the disk and named from the mangled name of your class. "TestApp" will give a config file-name "test.ini" with the content:

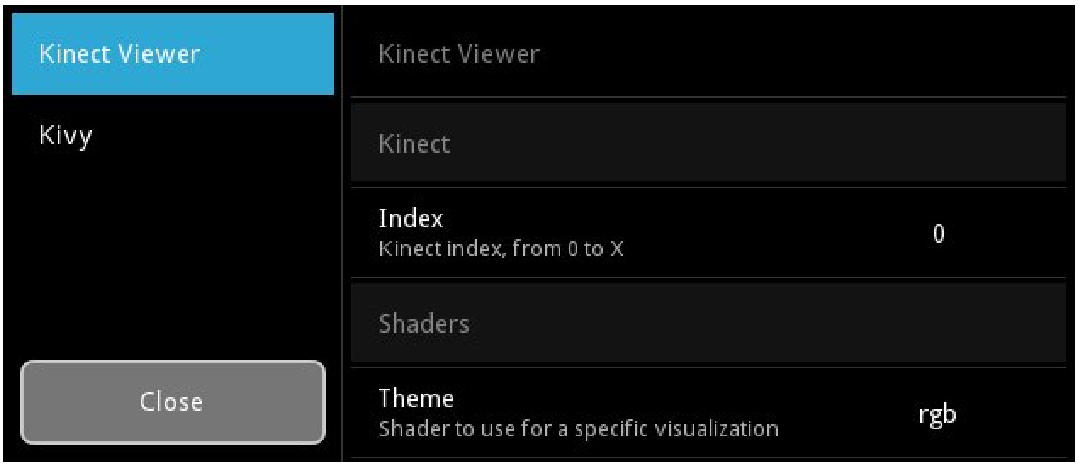
```
[section1]
key1 = value1
key2 = 42
```

The “test.ini” will be automatically loaded at runtime and you can access the configuration in your `App.build()` method:

```
class TestApp(App):
    def build_config(self, config):
        config.setdefaults('section1', {
            'key1': 'value1',
            'key2': '42'
        })

    def build(self):
        config = self.config
        return Label(text='key1 is %s and key2 is %d' % (
            config.get('section1', 'key1'),
            config.getint('section1', 'key2')))
```

30.2.2 Create a settings panel

Your application can have a settings panel to let your user configure some of your config tokens. Here is an example done in the KinectViewer example (available in the examples directory):



Index
Kinect index, from 0 to X
0

Theme
Shader to use for a specific visualization
rgb

You can add your own panels of settings by extending the `App.build_settings()` method. Check the `Settings` about how to create a panel, because you need a JSON file / data first.

Let's take as an example the previous snippet of TestApp with custom config. We could create a JSON like this:

```
[
    { "type": "title",
      "title": "Test application" },

    { "type": "options",
      "title": "My first key",
      "desc": "Description of my first key",
      "section": "section1",
      "key": "key1",
      "options": ["value1", "value2", "another value"] },
    { "type": "numeric",
      "title": "My second key",
      "desc": "Description of my second key",
      "section": "section1",
      "key": "key2" }
]
```

Then, we can create a panel using this JSON to automatically create all the options and link them to our `App.config` ConfigParser instance:

```
class TestApp(App):
    # ...
    def build_settings(self, settings):
        jsondata = """... put the json data here ..."""
        settings.add_json_panel('Test application',
            self.config, data=jsondata)
```

That's all! Now you can press F1 (default keystroke) to toggle the settings panel or press the "settings" key on your android device. You can manually call `App.open_settings()` and `App.close_settings()` if you want to handle this manually. Every change in the panel is automatically saved in the config file.

You can also use `App.build_settings()` to modify properties of the settings panel. For instance, the default panel has a sidebar for switching between json panels whose width defaults to 200dp. If you'd prefer this to be narrower, you could add:

```
settings.interface.menu.width = dp(100)
```

to your `build_settings()` method.

You might want to know when a config value has been changed by the user in order to adapt or reload your UI. You can then overload the `on_config_change()` method:

```
class TestApp(App):
    # ...
    def on_config_change(self, config, section, key, value):
        if config is self.config:
            token = (section, key)
            if token == ('section1', 'key1'):
                print('Our key1 have been changed to', value)
            elif token == ('section1', 'key2'):
                print('Our key2 have been changed to', value)
```

The Kivy configuration panel is added by default to the settings instance. If you don't want this panel, you can declare your Application as follows:

```
class TestApp(App):
    use_kivy_settings = False
    # ...
```

This only removes the Kivy panel but does not stop the settings instance from appearing. If you want to prevent the settings instance from appearing altogether, you can do this:

```
class TestApp(App):
    def open_settings(self, *largs):
        pass
```

30.3 Profiling with on_start and on_stop

It is often useful to profile python code in order to discover locations to optimise. The standard library profilers (http://docs.python.org/2/library/profile.html) provides multiple options for profiling code. For profiling the entire program, the natural approaches of using profile as a module or profile's run method does not work with Kivy. It is however, possible to use `App.on_start()` and `App.on_stop()` methods:

```
import cProfile

class MyApp(App):
    def on_start(self):
        self.profile = cProfile.Profile()
        self.profile.enable()

    def on_stop(self):
        self.profile.disable()
        self.profile.dump_stats('myapp.profile')
```

This will create a file called *myapp.profile* when you exit your app.

30.4 Customising layout

You can choose different settings widget layouts by setting `App.settings_cls`. By default, this is a `Settings` class which provides the pictured sidebar layout, but you could set it to any of the other layouts provided in `kivy.uix.settings` or create your own. See the module documentation for `kivy.uix.settings` for more information.

You can customise how the settings panel is displayed by overriding `App.display_settings()` which is called before displaying the settings panel on the screen. By default, it simply draws the panel on top of the window, but you could modify it to (for instance) show the settings in a `Popup` or add it to your app's `ScreenManager` if you are using one. If you do so, you should also modify `App.close_settings()` to exit the panel appropriately. For instance, to have the settings panel appear in a popup you can do:

```
def display_settings(self, settings):
    try:
        p = self.settings_popup
    except AttributeError:
        self.settings_popup = Popup(content=settings,
                                    title='Settings',
                                    size_hint=(0.8, 0.8))
        p = self.settings_popup
    if p.content is not settings:
        p.content = settings
    p.open()

def close_settings(self, *args):
    try:
        p = self.settings_popup
        p.dismiss()
    except AttributeError:
        pass # Settings popup doesn't exist
```

Finally, if you want to replace the current settings panel widget, you can remove the internal references to it using `App.destroy_settings()`. If you have modified `App.display_settings()`, you should be careful to detect if the settings panel has been replaced.

30.5 Pause mode

New in version 1.1.0.

Warning: This mode is experimental, and designed for phones/tablets. There are some cases where your application could crash on resume.

On tablets and phones, the user can switch at any moment to another application. By default, your application will close and the `App.on_stop()` event will be fired.

If you support Pause mode, when switching to another application, your application will wait indefinitely until the user switches back to your application. There is an issue with OpenGL on Android devices: it is not guaranteed that the OpenGL ES Context will be restored when your app resumes. The mechanism for restoring all the OpenGL data is not yet implemented in Kivy.

The currently implemented Pause mechanism is:

1. Kivy checks every frame if Pause mode is activated by the Operating System due to the user switching to another application, a phone shutdown or any other reason.
2. `App.on_pause()` is called:
3. If False is returned (default case), then `App.on_stop()` is called.
4. Otherwise the application will sleep until the OS resumes our App
5. When the app is resumed, `App.on_resume()` is called.
6. If our app memory has been reclaimed by the OS, then nothing will be called.

Here is a simple example of how on_pause() should be used:

```
class TestApp(App):

   def on_pause(self):
      # Here you can save data if needed
      return True

   def on_resume(self):
      # Here you can check if any data needs replacing (usually nothing)
      pass
```

Warning: Both *on_pause* and *on_stop* must save important data because after *on_pause* is called, *on_resume* may not be called at all.

class `kivy.app.App`(***kwargs*)
Bases: `kivy.event.EventDispatcher`

Application class, see module documentation for more information.

Events

on_start:Fired when the application is being started (before the `runTouchApp()` call.

on_stop:Fired when the application stops.

on_pause:Fired when the application is paused by the OS.

on_resume:Fired when the application is resumed from pause by the OS. Beware: you have no guarantee that this event will be fired after the *on_pause* event has been called.

Changed in version 1.7.0: Parameter *kv_file* added.

Changed in version 1.8.0: Parameters *kv_file* and *kv_directory* are now properties of App.

`build``()`

Initializes the application; it will be called only once. If this method returns a widget (tree), it will be used as the root widget and added to the window.

ReturnsNone or a root `Widget` instance if no self.root exists.

`build_config``(`*config*`)`

New in version 1.0.7.

This method is called before the application is initialized to construct your `ConfigParser` object. This is where you can put any default section / key / value for your config. If anything is set, the configuration will be automatically saved in the file returned by `get_application_config()`.

Parameters

config: **`ConfigParser`**Use this to add default section / key / value items

`build_settings``(`*settings*`)`

New in version 1.0.7.

This method is called when the user (or you) want to show the application settings. It is called once when the settings panel is first opened, after which the panel is cached. It may be called again if the cached settings panel is removed by `destroy_settings()`.

You can use this method to add settings panels and to customise the settings widget e.g. by changing the sidebar width. See the module documentation for full details.

Parameters

settings: **`Settings`**Settings instance for adding panels

`close_settings``(`**largs*`)`

Close the previously opened settings panel.

ReturnsTrue if the settings has been closed.

`config` **= None**

Returns an instance of the `ConfigParser` for the application configuration. You can use this to query some config tokens in the `build()` method.

`create_settings``()`

Create the settings panel. This method will normally be called only one time per application life-time and the result is cached internally, but it may be called again if the cached panel is removed by `destroy_settings()`.

By default, it will build a settings panel according to `settings_cls`, call `build_settings()`, add a Kivy panel if `use_kivy_settings` is True, and bind to on_close/on_config_change.

If you want to plug your own way of doing settings, without the Kivy panel or close/config change events, this is the method you want to overload.

New in version 1.8.0.

`destroy_settings``()`

New in version 1.8.0.

Dereferences the current settings panel if one exists. This means that when `App.open_settings()` is next run, a new panel will be created and displayed. It doesn't affect any of the contents of the panel, but lets you (for instance) refresh the settings panel layout if you have changed the settings widget in response to a screen size change.

If you have modified `open_settings()` or `display_settings()`, you should be careful to correctly detect if the previous settings widget has been destroyed.

`directory`

New in version 1.0.7.

Return the directory where the application lives.

`display_settings`(*settings*)

New in version 1.8.0.

Display the settings panel. By default, the panel is drawn directly on top of the window. You can define other behaviour by overriding this method, such as adding it to a ScreenManager or Popup.

You should return True if the display is successful, otherwise False.

Parameters

settings: `Settings` You can modify this object in order to modify the settings display.

`get_application_config`(*defaultpath='%(appdir)s/%(appname)s.ini'*)

New in version 1.0.7.

Changed in version 1.4.0: Customized the default path for iOS and Android platforms. Added a defaultpath parameter for desktop OS's (not applicable to iOS and Android.)

Return the filename of your application configuration. Depending on the platform, the application file will be stored in different locations:

- on iOS: <appdir>/Documents/.<appname>.ini
- on Android: /sdcard/.<appname>.ini
- otherwise: <appdir>/<appname>.ini

When you are distributing your application on Desktops, please note that if the application is meant to be installed system-wide, the user might not have write-access to the application directory. If you want to store user settings, you should overload this method and change the default behavior to save the configuration file in the user directory.:

```
class TestApp(App):
    def get_application_config(self):
        return super(TestApp, self).get_application_config(
            '~/.%(appname)s.ini')
```

Some notes:

- The tilda '~' will be expanded to the user directory.
- %(appdir)s will be replaced with the application `directory`
- %(appname)s will be replaced with the application `name`

`get_application_icon`()

Return the icon of the application.

`get_application_name`()

Return the name of the application.

static **`get_running_app`**()

Return the currently running application instance.

New in version 1.1.0.

`icon`

Icon of your application. The icon can be located in the same directory as your main file. You can set this as follows:

```
class MyApp(App):
    def build(self):
        self.icon = 'myicon.png'
```

New in version 1.0.5.

Changed in version 1.8.0: *icon* is now a `StringProperty`. Don't set the icon in the class as previously stated in the documentation.

Note: For Kivy prior to 1.8.0, you need to set this as follows:

```
class MyApp(App):
    icon = 'customicon.png'
```

---

kv_directory

Path of the directory where application kv is stored, defaults to None

New in version 1.8.0.

If a kv_directory is set, it will be used to get the initial kv file. By default, the file is assumed to be in the same directory as the current App definition file.

kv_file

Filename of the Kv file to load, defaults to None.

New in version 1.8.0.

If a kv_file is set, it will be loaded when the application starts. The loading of the "default" kv file will be prevented.

load_config()

(internal) This function is used for returning a ConfigParser with the application configuration. It's doing 3 things:

1.Creating an instance of a ConfigParser
2.Loading the default configuration by calling `build_config()`, then
3.If it exists, it loads the application configuration file, otherwise it creates one.

Returns`ConfigParser` instance

load_kv(*filename=None*)

This method is invoked the first time the app is being run if no widget tree has been constructed before for this app. This method then looks for a matching kv file in the same directory as the file that contains the application class.

For example, say you have a file named main.py that contains:

```
class ShowcaseApp(App):
    pass
```

This method will search for a file named *showcase.kv* in the directory that contains main.py. The name of the kv file has to be the lowercase name of the class, without the 'App' postfix at the end if it exists.

You can define rules and a root widget in your kv file:

```
<ClassName>: # this is a rule
    ...

ClassName: # this is a root widget
    ...
```

There must be only one root widget. See the *Kivy Language* documentation for more information on how to create kv files. If your kv file contains a root widget, it will be used as self.root, the root widget for the application.

Note: This function is called from `run()`, therefore, any widget whose styling is defined in this kv file and is created before `run()` is called (e.g. in *__init__*), won't have its styling applied. Note that `build()` is called after `load_kv` has been called.

`name`
New in version 1.0.7.

Return the name of the application based on the class name.

`on_config_change`(*config*, *section*, *key*, *value*)
Event handler fired when a configuration token has been changed by the settings page.

`on_pause`()
Event handler called when Pause mode is requested. You should return True if your app can go into Pause mode, otherwise return False and your application will be stopped (the default).

You cannot control when the application is going to go into this mode. It's determined by the Operating System and mostly used for mobile devices (android/ios) and for resizing.

The default return value is False.

New in version 1.1.0.

`on_resume`()
Event handler called when your application is resuming from the Pause mode.

New in version 1.1.0.

Warning: When resuming, the OpenGL Context might have been damaged / freed. This is where you can reconstruct some of your OpenGL state e.g. FBO content.

`on_start`()
Event handler for the *on_start* event which is fired after initialization (after build() has been called) but before the application has started running.

`on_stop`()
Event handler for the *on_stop* event which is fired when the application has finished running (i.e. the window is about to be closed).

`open_settings`(**largs*)
Open the application settings panel. It will be created the very first time, or recreated if the previously cached panel has been removed by `destroy_settings()`. The settings panel will be displayed with the `display_settings()` method, which by default adds the settings panel to the Window attached to your application. You should override that method if you want to display the settings panel differently.
ReturnsTrue if the settings has been opened.

`options` = None
Options passed to the __init__ of the App

`root` = None
The *root* widget returned by the `build()` method or by the `load_kv()` method if the kv file contains a root widget.

`root_window`
New in version 1.9.0.

Returns the root window instance used by `run()`.

`run()`
Launches the app in standalone mode.

`settings_cls`
New in version 1.8.0.

The class to used to construct the settings panel and the instance passed to `build_config()`. You should use either `Settings` or one of the provided subclasses with different layouts (`SettingsWithSidebar`, `SettingsWithSpinner`, `SettingsWithTabbedPanel`, `SettingsWithNoMenu`). You can also create your own Settings subclass. See the documentation of `Settings` for more information.

`settings_cls` is an `ObjectProperty` and defaults to `SettingsWithSpinner` which displays settings panels with a spinner to switch between them. If you set a string, the `Factory` will be used to resolve the class.

`stop`(**largs*)
Stop the application.

If you use this method, the whole application will stop by issuing a call to `stopTouchApp()`.

`title`
Title of your application. You can set this as follows:

```
class MyApp(App):
    def build(self):
        self.title = 'Hello world'
```

New in version 1.0.5.

Changed in version 1.8.0: *title* is now a `StringProperty`. Don't set the title in the class as previously stated in the documentation.

Note: For Kivy < 1.8.0, you can set this as follows:

```
class MyApp(App):
    title = 'Custom title'
```

If you want to dynamically change the title, you can do:

```
from kivy.base import EventLoop
EventLoop.window.title = 'New title'
```

`use_kivy_settings` = True
New in version 1.0.7.

If True, the application settings will also include the Kivy settings. If you don't want the user to change any kivy settings from your settings UI, change this to False.

`user_data_dir`
New in version 1.7.0.

Returns the path to the directory in the users file system which the application can use to store additional data.

Different platforms have different conventions with regards to where the user can store data such as preferences, saved games and settings. This function implements these conventions. The <app_name> directory is created when the property is called, unless it already exists.

On iOS, *~/Documents<app_name>* is returned (which is inside the app's sandbox).

On Android, */sdcard/<app_name>* is returned.

On Windows, *%APPDATA%/<app_name>* is returned.

On Mac OSX, *~/Library/Application Support/<app_name>* is returned.

On Linux, *$XDG_CONFIG_HOME/<app_name>* is returned.

CHAPTER

THIRTYONE

ATLAS

New in version 1.1.0.

Atlas is a class for managing texture atlases: packing multiple textures into one. With it, you reduce the number of images loaded and speedup the application loading.

An Atlas is composed of:

- a json file (.atlas) that contains all the information about the images contained inside the atlas.
- one or multiple atlas images associated with the atlas definition.

31.1 Definition of .atlas

A file with `<basename>.atlas` is a json file formatted like this:

```
{
    "<basename>-<index>.png": {
        "id1": [ <x>, <y>, <width>, <height> ],
        "id2": [ <x>, <y>, <width>, <height> ],
        # ...
    },
    # ...
}
```

Example of the Kivy `defaulttheme.atlas`:

```
{
    "defaulttheme-0.png": {
        "progressbar_background": [431, 224, 59, 24],
        "image-missing": [253, 344, 48, 48],
        "filechooser_selected": [1, 207, 118, 118],
        "bubble_btn": [83, 174, 32, 32],
        # ... and more ...
    }
}
```

31.2 How to create an Atlas

Warning: The atlas creation requires Imaging/PIL. This will be removed in the future when the Kivy core Image is able to support loading / blitting / saving operations.

You can directly use this module to create atlas files with this command:

```
$ python -m kivy.atlas <basename> <size> <list of images...>
```

Let's say you have a list of images that you want to put into an Atlas. The directory is named `images` with lots of png files inside:

```
$ ls
images
$ cd images
$ ls
bubble.png bubble-red.png button.png button-down.png
```

You can combine all the png's into one and generate the atlas file with:

```
$ python -m kivy.atlas myatlas 256 *.png
Atlas created at myatlas.atlas
1 image have been created
$ ls
bubble.png bubble-red.png button.png button-down.png myatlas.atlas
myatlas-0.png
```

As you can see, we get 2 new files: `myatlas.atlas` and `myatlas-0.png`.

Note: When using this script, the ids referenced in the atlas are the base names of the images without the extension. So, if you are going to name a file `../images/button.png`, the id for this image will be `button`.

If you need path information included, you should include `use_path` as follows:

```
$ python -m kivy.atlas use_path myatlas 256 *.png
```

In which case the id for `../images/button.png` will be `images_button`

31.3 How to use an Atlas

Usually, you would use the atlas as follows:

```
a = Button(background_normal='images/button.png',
           background_down='images/button_down.png')
```

In our previous example, we have created the atlas containing both images and put them in `images/myatlas.atlas`. You can use url notation to reference them:

```
atlas://path/to/myatlas/id
# will search for the ``path/to/myatlas.atlas`` and get the image ``id``
```

In our case, it would be:

```
atlas://images/myatlas/button
```

Note: In the atlas url, there is no need to add the `.atlas` extension. It will be automatically append to the filename.

31.4 Manual usage of the Atlas

```
>>> from kivy.atlas import Atlas
>>> atlas = Atlas('path/to/myatlas.atlas')
>>> print(atlas.textures.keys())
['bubble', 'bubble-red', 'button', 'button-down']
>>> print(atlas['button'])
<kivy.graphics.texture.TextureRegion object at 0x2404d10>
```

class `kivy.atlas.`**`Atlas`**(*filename*)

Bases: `kivy.event.EventDispatcher`

Manage texture atlas. See module documentation for more information.

static **`create`**(*outname, filenames, size, padding=2, use_path=False*)

This method can be used to create an atlas manually from a set of images.

Parameters

***outname*: str**Basename to use for `.atlas` creation and `-<idx>.png` associated images.

***filenames*: list**List of filenames to put in the atlas.

***size*: int or list (width, height)**Size of the atlas image.

***padding*: int, defaults to 2**Padding to put around each image.

Be careful. If you're using a padding < 2, you might have issues with the borders of the images. Because of the OpenGL linearization, it might use the pixels of the adjacent image.

If you're using a padding >= 2, we'll automatically generate a "border" of 1px around your image. If you look at the result, don't be scared if the image inside is not exactly the same as yours :).

***use_path*: bool, defaults to False**If True, the relative path of the source png file names will be included in the atlas ids rather that just in the file names. Leading dots and slashes will be excluded and all other slashes in the path will be replaced with underscores. For example, if *use_path* is False (the default) and the file name is `../data/tiles/green_grass.png`, the id will be `green_grass`. If *use_path* is True, it will be `data_tiles_green_grass`.

Changed in version 1.8.0: Parameter use_path added

`filename`

Filename of the current Atlas.

`filename` is an `AliasProperty` and defaults to None.

`textures`

List of available textures within the atlas.

`textures` is a `DictProperty` and defaults to {}.

CHAPTER

THIRTYTWO

KIVY BASE

This module contains core Kivy functionality and is not intended for end users. Feel free to look though it, but calling any of these methods directly may well result in unpredicatable behavior.

32.1 Event loop management

`kivy.base.`**`EventLoop`** **= <kivy.base.EventLoopBase object at 0x992986c>**

EventLoop instance

class `kivy.base.`**`EventLoopBase`**

Bases: `kivy.event.EventDispatcher`

Main event loop. This loop handles the updating of input and dispatching events.

`add_event_listener`(*listener*)

Add a new event listener for getting touch events.

`add_input_provider`(*provider*, *auto_remove=False*)

Add a new input provider to listen for touch events.

`add_postproc_module`(*mod*)

Add a postproc input module (DoubleTap, TripleTap, DeJitter RetainTouch are defaults).

`close`()

Exit from the main loop and stop all configured input providers.

`dispatch_input`()

Called by idle() to read events from input providers, pass events to postproc, and dispatch final events.

`ensure_window`()

Ensure that we have a window.

`exit`()

Close the main loop and close the window.

`idle`()

This function is called after every frame. By default:

- it "ticks" the clock to the next frame.
- it reads all input and dispatches events.
- it dispatches *on_update*, *on_draw* and *on_flip* events to the window.

`on_pause`()

Event handler for *on_pause* which will be fired when the event loop is paused.

`on_start`()

Event handler for *on_start* which will be fired right after all input providers have been started.

on_stop()
Event handler for *on_stop* events which will be fired right after all input providers have been stopped.

post_dispatch_input(*etype*, *me*)
This function is called by dispatch_input() when we want to dispatch an input event. The event is dispatched to all listeners and if grabbed, it's dispatched to grabbed widgets.

remove_event_listener(*listener*)
Remove an event listener from the list.

remove_input_provider(*provider*)
Remove an input provider.

remove_postproc_module(*mod*)
Remove a postproc module.

run()
Main loop

set_window(*window*)
Set the window used for the event loop.

start()
Must be called only once before run(). This starts all configured input providers.

stop()
Stop all input providers and call callbacks registered using EventLoop.add_stop_callback().

touches
Return the list of all touches currently in down or move states.

class kivy.base.**ExceptionHandler**
Bases: object

Base handler that catches exceptions in runTouchApp(). You can subclass and extend it as follows:

```
class E(ExceptionHandler):
    def handle_exception(self, inst):
        Logger.exception('Exception catched by ExceptionHandler')
        return ExceptionManager.PASS

ExceptionManager.add_handler(E())
```

All exceptions will be set to PASS, and logged to the console!

handle_exception(*exception*)
Handle one exception, defaults to returning ExceptionManager.STOP.

class kivy.base.**ExceptionManagerBase**
ExceptionManager manages exceptions handlers.

add_handler(*cls*)
Add a new exception handler to the stack.

handle_exception(*inst*)
Called when an exception occured in the runTouchApp() main loop.

remove_handler(*cls*)
Remove a exception handler from the stack.

kivy.base.**ExceptionManager** = **<kivy.base.ExceptionManagerBase instance at 0x9849b2c>**
Instance of a ExceptionManagerBase implementation.

`kivy.base.`**`runTouchApp`**`(`*widget=None*, *slave=False*`)`

Static main function that starts the application loop. You can access some magic via the following arguments:

Parameters

<empty>To make dispatching work, you need at least one input listener. If not, application will leave. (MTWindow act as an input listener)

widgetIf you pass only a widget, a MTWindow will be created and your widget will be added to the window as the root widget.

slaveNo event dispatching is done. This will be your job.

widget + slaveNo event dispatching is done. This will be your job but we try to get the window (must be created by you beforehand) and add the widget to it. Very usefull for embedding Kivy in another toolkit. (like Qt, check kivy-designed)

`kivy.base.`**`stopTouchApp`**`()`

Stop the current application by leaving the main loop

CHAPTER

THIRTYTHREE

CACHE MANAGER

The cache manager can be used to store python objects attached to a unique key. The cache can be controlled in two ways: with a object limit or a timeout.

For example, we can create a new cache with a limit of 10 objects and a timeout of 5 seconds:

```
# register a new Cache
Cache.register('mycache', limit=10, timeout=5)

# create an object + id
text = 'objectid'
instance = Label(text=text)
Cache.append('mycache', text, instance)

# retrieve the cached object
instance = Cache.get('mycache', label)
```

If the instance is NULL, the cache may have trashed it because you've not used the label for 5 seconds and you've reach the limit.

class `kivy.cache.`**`Cache`**

Bases: `object`

See module documentation for more information.

static **`append`**(*category*, *key*, *obj*, *timeout=None*)

Add a new object to the cache.

Parameters

- ***category***[str] Identifier of the category.
- ***key***[str] Unique identifier of the object to store.
- ***obj***[object] Object to store in cache.
- ***timeout***[double (optional)] Time after which to delete the object if it has not been used. If None, no timeout is applied.

static **`get`**(*category*, *key*, *default=None*)

Get a object from the cache.

Parameters

- ***category***[str] Identifier of the category.
- ***key***[str] Unique identifier of the object in the store.
- ***default***[anything, defaults to None] Default value to be returned if the key is not found.

static **`get_lastaccess`**(*category*, *key*, *default=None*)

Get the objects last access time in the cache.

Parameters

- ***category***[str] Identifier of the category.
- ***key***[str] Unique identifier of the object in the store.

default[anything, defaults to None] Default value to be returned if the key is not found.

static `get_timestamp`(*category*, *key*, *default=None*)

Get the object timestamp in the cache.

Parameters

category[str] Identifier of the category.

key[str] Unique identifier of the object in the store.

default[anything, defaults to None] Default value to be returned if the key is not found.

static `print_usage`()

Print the cache usage to the console.

static `register`(*category*, *limit=None*, *timeout=None*)

Register a new category in the cache with the specified limit.

Parameters

category[str] Identifier of the category.

limit[int (optional)] Maximum number of objects allowed in the cache. If None, no limit is applied.

timeout[double (optional)] Time after which to delete the object if it has not been used. If None, no timeout is applied.

static `remove`(*category*, *key=None*)

Purge the cache.

Parameters

category[str] Identifier of the category.

key[str (optional)] Unique identifier of the object in the store. If this arguement is not supplied, the entire category will be purged.

CHAPTER

THIRTYFOUR

CLOCK OBJECT

The `Clock` object allows you to schedule a function call in the future; once or repeatedly at specified intervals. You can get the time elapsed between the scheduling and the calling of the callback via the *dt* argument:

```
# dt means delta-time
def my_callback(dt):
    pass

# call my_callback every 0.5 seconds
Clock.schedule_interval(my_callback, 0.5)

# call my_callback in 5 seconds
Clock.schedule_once(my_callback, 5)

# call my_callback as soon as possible (usually next frame.)
Clock.schedule_once(my_callback)
```

Note: If the callback returns False, the schedule will be removed.

If you want to schedule a function to call with default arguments, you can use the functools.partial python module:

```
from functools import partial

def my_callback(value, key, *largs):
    pass

Clock.schedule_interval(partial(my_callback, 'my value', 'my key'), 0.5)
```

Conversely, if you want to schedule a function that doesn't accept the dt argument, you can use a lambda expression to write a short function that does accept dt. For Example:

```
def no_args_func():
    print("I accept no arguments, so don't schedule me in the clock")

Clock.schedule_once(lambda dt: no_args_func(), 0.5)
```

Note: You cannot unschedule an anonymous function unless you keep a reference to it. It's better to add *args to your function definition so that it can be called with an arbitrary number of parameters.

Important: The callback is weak-referenced: you are responsible for keeping a reference to your original object/callback. If you don't keep a reference, the ClockBase will never execute your callback. For example:

```
class Foo(object):
    def start(self):
        Clock.schedule_interval(self.callback, 0.5)

    def callback(self, dt):
        print('In callback')

# A Foo object is created and the method start is called.
# Because no reference is kept to the instance returned from Foo(),
# the object will be collected by the Python Garbage Collector and
# your callback will be never called.
Foo().start()

# So you should do the following and keep a reference to the instance
# of foo until you don't need it anymore!
foo = Foo()
foo.start()
```

34.1 Schedule before frame

New in version 1.0.5.

Sometimes you need to schedule a callback BEFORE the next frame. Starting from 1.0.5, you can use a timeout of -1:

```
Clock.schedule_once(my_callback, 0) # call after the next frame
Clock.schedule_once(my_callback, -1) # call before the next frame
```

The Clock will execute all the callbacks with a timeout of -1 before the next frame even if you add a new callback with -1 from a running callback. However, `Clock` has an iteration limit for these callbacks: it defaults to 10.

If you schedule a callback that schedules a callback that schedules a .. etc more than 10 times, it will leave the loop and send a warning to the console, then continue after the next frame. This is implemented to prevent bugs from hanging or crashing the application.

If you need to increase the limit, set the `max_iteration` property:

```
from kivy.clock import Clock
Clock.max_iteration = 20
```

34.2 Triggered Events

New in version 1.0.5.

A triggered event is a way to defer a callback exactly like schedule_once(), but with some added convenience. The callback will only be scheduled once per frame even if you call the trigger twice (or more). This is not the case with `Clock.schedule_once()`:

```
# will run the callback twice before the next frame
Clock.schedule_once(my_callback)
Clock.schedule_once(my_callback)

# will run the callback once before the next frame
t = Clock.create_trigger(my_callback)
t()
t()
```

Before triggered events, you may have used this approach in a widget:

```
def trigger_callback(self, *largs):
    Clock.unschedule(self.callback)
    Clock.schedule_once(self.callback)
```

As soon as you call *trigger_callback()*, it will correctly schedule the callback once in the next frame. It is more convenient to create and bind to the triggered event than using `Clock.schedule_once()` in a function:

```
from kivy.clock import Clock
from kivy.uix.widget import Widget

class Sample(Widget):
    def __init__(self, **kwargs):
        self._trigger = Clock.create_trigger(self.cb)
        super(Sample, self).__init__(**kwargs)
        self.bind(x=self._trigger, y=self._trigger)

    def cb(self, *largs):
        pass
```

Even if x and y changes within one frame, the callback is only run once.

Note: `ClockBase.create_trigger()` also has a timeout parameter that behaves exactly like `ClockBase.schedule_once()`.

34.3 Threading

New in version 1.9.0.

Often, other threads are used to schedule callbacks with kivy's main thread using `ClockBase`. Therefore, it's important to know what is thread safe and what isn't.

All the `ClockBase` and `ClockEvent` methods are safe with respect to kivy's thread. That is, it's always safe to call these methods from a single thread that is not the kivy thread. However, there are no guarantees as to the order in which these callbacks will be executed.

Calling a previously created trigger from two different threads (even if one of them is the kivy thread), or calling the trigger and its `ClockEvent.cancel()` method from two different threads at the same time is not safe. That is, although no exception will be raised, there no guarantees that calling the trigger from two different threads will not result in the callback being executed twice, or not executed at all. Similarly, such issues might arise when calling the trigger and canceling it with `ClockBase.unschedule()` or `ClockEvent.cancel()` from two threads simultaneously.

Therefore, it is safe to call `ClockBase.create_trigger()`, `ClockBase.schedule_once()`, `ClockBase.schedule_interval()`, or call or cancel a previously created trigger from an external thread. The following code, though, is not safe because it calls or cancels from two threads simultaneously without any locking mechanism:

```
event = Clock.create_trigger(func)

# in thread 1
event()
# in thread 2
event()
# now, the event may be scheduled twice or once

# the following is also unsafe
# in thread 1
event()
# in thread 2
event.cancel()
# now, the event may or may not be scheduled and a subsequent call
# may schedule it twice
```

Note, in the code above, thread 1 or thread 2 could be the kivy thread, not just an external thread.

`kivy.clock.`**`Clock`** **= None**
Instance of `ClockBase`.

class `kivy.clock.`**`ClockBase`**
Bases: `kivy.clock._ClockBase`

A clock object with event support.

`create_trigger``(`*callback*, *timeout=0*`)`
Create a Trigger event. Check module documentation for more information.

ReturnsA `ClockEvent` instance. To schedule the callback of this instance, you can call it.

New in version 1.0.5.

`frames`
Number of internal frames (not necesseraly drawed) from the start of the clock.

New in version 1.8.0.

`frames_displayed`
Number of displayed frames from the start of the clock.

`frametime`
Time spent between the last frame and the current frame (in seconds).

New in version 1.8.0.

`get_boottime``()`
Get the time in seconds from the application start.

`get_fps``()`
Get the current average FPS calculated by the clock.

`get_rfps``()`
Get the current "real" FPS calculated by the clock. This counter reflects the real framerate displayed on the screen.

In contrast to get_fps(), this function returns a counter of the number of frames, not the average of frames per second.

`get_time``()`
Get the last tick made by the clock.

max_iteration

New in version 1.0.5: When a schedule_once is used with -1, you can add a limit on how iteration will be allowed. That is here to prevent too much relayout.

schedule_interval(*callback*, *timeout*)

Schedule an event to be called every <timeout> seconds.

ReturnsA `ClockEvent` instance. As opposed to `create_trigger()` which only creates the trigger event, this method also schedules it.

schedule_once(*callback*, *timeout=0*)

Schedule an event in <timeout> seconds. If <timeout> is unspecified or 0, the callback will be called after the next frame is rendered.

ReturnsA `ClockEvent` instance. As opposed to `create_trigger()` which only creates the trigger event, this method also schedules it.

Changed in version 1.0.5: If the timeout is -1, the callback will be called before the next frame (at `tick_draw()`).

tick()

Advance the clock to the next step. Must be called every frame. The default clock has a tick() function called by the core Kivy framework.

tick_draw()

Tick the drawing counter.

unschedule(*callback*, *all=True*)

Remove a previously scheduled event.

Parameters

***callback*: `ClockEvent` or a callable.**If it's a `ClockEvent` instance, then the callback associated with this event will be canceled if it is scheduled. If it's a callable, then the callable will be unscheduled if it is scheduled.

***all*: bool**If True and if *callback* is a callable, all instances of this callable will be unscheduled (i.e. if this callable was scheduled multiple times). Defaults to *True*.

Changed in version 1.9.0: The all parameter was added. Before, it behaved as if *all* was *True*.

class kivy.clock.**ClockEvent**(*clock*, *loop*, *callback*, *timeout*, *starttime*, *cid*, *trigger=False*)

Bases: `object`

A class that describes a callback scheduled with kivy's `Clock`. This class is never created by the user; instead, kivy creates and returns an instance of this class when scheduling a callback.

Warning: Most of the methods of this class are internal and can change without notice. The only exception are the `cancel()` and `__call__()` methods.

cancel()

Cancels the callback if it was scheduled to be called.

kivy.clock.**mainthread**(*func*)

Decorator that will schedule the call of the function for the next available frame in the mainthread. It can be useful when you use `UrlRequest` or when you do Thread programming: you cannot do any OpenGL-related work in a thread.

Please note that this method will return directly and no result can be returned:

```
@mainthread
def callback(self, *args):
    print('The request succedded!',
          'This callback is called in the main thread.')
```

```
self.req = UrlRequest(url='http://...', on_success=callback)
```

New in version 1.8.0.

CHAPTER

THIRTYFIVE

COMPATIBILITY MODULE FOR PYTHON 2.7 AND > 3.3

`kivy.compat.`**`PY2`** **= True**

True if Python 2 intepreter is used

`kivy.compat.`**`string_types`**

String types that can be used for checking if a object is a string

alias of `basestring`

CHAPTER

THIRTYSIX

CONFIGURATION OBJECT

The `Config` object is an instance of a modified Python ConfigParser. See the ConfigParser documentation for more information.

Kivy has a configuration file which determines the default settings. In order to change these settings, you can alter this file manually or use the Config object. Please see the *Configure Kivy* section for more information.

Note: To avoid instances where the config settings do not work or they are not applied before window creation (like setting an initial window size), Config.set should be used before importing any modules that affect the application window (ie. importing Window). Ideally, these settings should be declared right at the start of your main.py script.

36.1 Usage of the Config object

To read a configuration token from a particular section:

```
>>> from kivy.config import Config
>>> Config.getint('kivy', 'show_fps')
0
```

Change the configuration and save it:

```
>>> Config.set('postproc', 'retain_time', '50')
>>> Config.write()
```

Changed in version 1.7.1: The ConfigParser should work correctly with utf-8 now. The values are converted from ascii to unicode only when needed. The method get() returns utf-8 strings.

36.2 Available configuration tokens

kivy

***desktop*: int, 0 or 1** This option controls desktop OS specific features, such as enabling drag-able scroll-bar in scroll views, disabling of bubbles in TextInput etc. 0 is disabled, 1 is enabled.

***exit_on_escape*: int, 0 or 1** Enables exiting kivy when escape is pressed. 0 is disabled, 1 is enabled.

***keyboard_layout*: string** Identifier of the layout to use.

keyboard_mode: **string** Specifies the keyboard mode to use. If can be one of the following:

- '' - Let Kivy choose the best option for your current platform.
- 'system' - real keyboard.
- 'dock' - one virtual keyboard docked to a screen side.
- 'multi' - one virtual keyboard for every widget request.
- 'systemanddock' - virtual docked keyboard plus input from real keyboard.
- 'systemandmulti' - analogous.

log_dir: **string** Path of log directory.

log_enable: **int, 0 or 1** Activate file logging. 0 is disabled, 1 is enabled.

log_level: **string, one of 'debug', 'info', 'warning', 'error' or 'critical'** Set the minimum log level to use.

log_name: **string** Format string to use for the filename of log file.

window_icon: **string** Path of the window icon. Use this if you want to replace the default pygame icon.

postproc

double_tap_distance: **float** Maximum distance allowed for a double tap, normalized inside the range 0 - 1000.

double_tap_time: **int** Time allowed for the detection of double tap, in milliseconds.

ignore: **list of tuples** List of regions where new touches are ignored. This configuration token can be used to resolve hotspot problems with DIY hardware. The format of the list must be:

```
ignore = [(xmin, ymin, xmax, ymax), ...]
```

All the values must be inside the range 0 - 1.

jitter_distance: **int** Maximum distance for jitter detection, normalized inside the range 0 - 1000.

jitter_ignore_devices: **string, separated with commas** List of devices to ignore from jitter detection.

retain_distance: **int** If the touch moves more than is indicated by retain_distance, it will not be retained. Argument should be an int between 0 and 1000.

retain_time: **int** Time allowed for a retain touch, in milliseconds.

triple_tap_distance: **float** Maximum distance allowed for a triple tap, normalized inside the range 0 - 1000.

triple_tap_time: **int** Time allowed for the detection of triple tap, in milliseconds.

graphics

borderless: **int , one of 0 or 1** If set to *1*, removes the window border/decoration.

fbo: **string, one of 'hardware', 'software' or 'force-hardware'** Selects the FBO backend to use.

fullscreen: **int or string, one of 0, 1, 'fake' or 'auto'** Activate fullscreen. If set to *1*, a resolution of *width* times *height* pixels will be used. If set to *auto*, your current display's resolution will be used instead. This is most likely what you want. If you want to place the window in another display, use *fake*, or set the *borderless* option from the graphics section, then adjust *width*, *height*, *top* and *left*.

***height*: int** Height of the `Window`, not used if *fullscreen* is set to *auto*.

***left*: int** Left position of the `Window`.

***maxfps*: int, defaults to 60** Maximum FPS allowed.

'multisamples': int, defaults to 2 Sets the MultiSample Anti-Aliasing (MSAA) level. Increasing this value results in smoother graphics but at the cost of processing time.

Note: This feature is limited by device hardware support and will have no effect on devices which do not support the level of MSAA requested.

***position*: string, one of 'auto' or 'custom'** Position of the window on your display. If *auto* is used, you have no control of the initial position: *top* and *left* are ignored.

***show_cursor*: int, one of 0 or 1** Show the cursor on the screen.

***top*: int** Top position of the `Window`.

***resizable*: int, one of 0 or 1** If 0, the window will have a fixed size. If 1, the window will be resizable.

***rotation*: int, one of 0, 90, 180 or 270** Rotation of the `Window`.

***width*: int** Width of the `Window`, not used if *fullscreen* is set to *auto*.

input You can create new input devices using this syntax:

```
# example of input provider instance
yourid = providerid,parameters

# example for tuio provider
default = tuio,127.0.0.1:3333
mytable = tuio,192.168.0.1:3334
```

See also:

Check the providers in kivy.input.providers for the syntax to use inside the configuration file.

widgets

***scroll_distance*: int** Default value of the `scroll_distance` property used by the `ScrollView` widget. Check the widget documentation for more information.

***scroll_friction*: float** Default value of the `scroll_friction` property used by the `ScrollView` widget. Check the widget documentation for more information.

***scroll_timeout*: int** Default value of the `scroll_timeout` property used by the `ScrollView` widget. Check the widget documentation for more information.

***scroll_stoptime*: int** Default value of the `scroll_stoptime` property used by the `ScrollView` widget. Check the widget documentation for more information.

Deprecated since version 1.7.0: Please use `effect_cls` instead.

***scroll_moves*: int** Default value of the `scroll_moves` property used by the `ScrollView` widget. Check the widget documentation for more information.

Deprecated since version 1.7.0: Please use `effect_cls` instead.

modules You can activate modules with this syntax:

```
modulename =
```

Anything after the = will be passed to the module as arguments. Check the specific module's documentation for a list of accepted arguments.

Note: These options control only the initalization of the app and a restart is required for value changes to take effect.

Changed in version 1.9.0: *borderless* has been added to the graphics section. The *fake* option of *fullscreen* in the graphics section has been deprecated, use the *borderless* option instead.

Changed in version 1.8.0: *systemanddock* and *systemandmulti* has been added as possible values for *keyboard_mode* in the kivy section. *exit_on_escape* has been added to the kivy section.

Changed in version 1.2.0: *resizable* has been added to graphics section.

Changed in version 1.1.0: tuio no longer listens by default. Window icons are not copied to user directory anymore. You can still set a new window icon by using the `window_icon` config setting.

Changed in version 1.0.8: *scroll_timeout*, *scroll_distance* and *scroll_friction* have been added. *list_friction*, *list_trigger_distance* and *list_friction_bound* have been removed. *keyboard_type* and *keyboard_layout* have been removed from the widget. *keyboard_mode* and *keyboard_layout* have been added to the kivy section.

`kivy.config.`**`Config`** = **None**

Kivy configuration object. Its `name` is *'kivy'*

class `kivy.config.`**`ConfigParser`**(*name=''*)

Bases: `ConfigParser.ConfigParser`, `object`

Enhanced ConfigParser class that supports the addition of default sections and default values.

By default, the kivy ConfigParser instance, `Config`, is given the name *'kivy'* and the ConfigParser instance used by App, `build_settings()`, is given the name *'app'*.

Parameters

***name*: string**The name of the instance. See `name`. Defaults to ''.

..versionchanged:: 1.9.0 Each ConfigParser can now be named, `name`. You can get the ConfigParser associated with a name using `get_configparser()`. In addition, you can now control the config values with `ConfigParserProperty`.

New in version 1.0.7.

`add_callback`(*callback*, *section=None*, *key=None*)

Add a callback to be called when a specific section/key changed. If you don't specify a section or a key, it will call the callback for all section/keys changes.

Callbacks will receive 3 arguments: the section, key and value.

New in version 1.4.1.

`adddefaultsection`(*section*)

Add a section if the section is missing.

static **`get_configparser`**(*name*)

Returns the `ConfigParser` instance whose name is *name*, or None if not found.

Parameters

***name*: string**The name of the `ConfigParser` instance to return.

`getdefault`(*section*, *option*, *defaultvalue*)

Get an option. If not found, it will return the default value.

getdefaultint(*section*, *option*, *defaultvalue*)
Get an option. If not found, it will return the default value. The return value will be always converted as an integer.

New in version 1.6.0.

name
The name associated with this ConfigParser instance, if not ''. Defaults to ''. It can be safely dynamically changed or set to ''.

When a ConfigParser is given a name, that config object can be retrieved using `get_configparser()`. In addition, that config instance can also be used with a `ConfigParserProperty` instance that set its *config* value to this name.

Setting more than one ConfigParser with the same name will raise a *ValueError*.

read(*filename*)
Read only one filename. In contrast to the original ConfigParser of Python, this one is able to read only one file at a time. The last read file will be used for the `write()` method.

Changed in version 1.9.0: `read()` now calls the callbacks if read changed any values.

remove_callback(*callback*, *section=None*, *key=None*)
Removes a callback added with `add_callback()`. `remove_callback()` must be called with the same parameters as `add_callback()`.

Raises a *ValueError* if not found.

New in version 1.9.0.

set(*section*, *option*, *value*)
Functions similarly to PythonConfigParser's set method, except that the value is implicitly converted to a string.

setall(*section*, *keyvalues*)
Set a lot of keys/values in one section at the same time.

setdefault(*section*, *option*, *value*)
Set the default value of a particular option.

setdefaults(*section*, *keyvalues*)
Set a lot of keys/value defaults in one section at the same time.

update_config(*filename*, *overwrite=False*)
Upgrade the configuration based on a new default config file. Overwrite any existing values if overwrite is True.

write()
Write the configuration to the last file opened using the `read()` method.
Return True if the write finished successfully.

CHAPTER

THIRTYSEVEN

CONTEXT

New in version 1.8.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

Kivy has a few "global" instances that are used directly by many pieces of the framework: *Cache*, *Builder*, *Clock*.

TODO: document this module.

`kivy.context.`**`register_context`**`(`*name, cls, *args, **kwargs*`)`
: Register a new context.

`kivy.context.`**`get_current_context`**`()`
: Return the current context.

CHAPTER

THIRTYEIGHT

CORE ABSTRACTION

This module defines the abstraction layers for our core providers and their implementations. For further information, please refer to *Architectural Overview* and the *Core Providers and Input Providers* section of the documentation.

In most cases, you shouldn't directly use a library that's already covered by the core abstraction. Always try to use our providers first. In case we are missing a feature or method, please let us know by opening a new Bug report instead of relying on your library.

Warning: These are **not** widgets! These are just abstractions of the respective functionality. For example, you cannot add a core image to your window. You have to use the image **widget** class instead. If you're really looking for widgets, please refer to `kivy.uix` instead.

38.1 Audio

Load an audio sound and play it with:

```
from kivy.core.audio import SoundLoader

sound = SoundLoader.load('mytest.wav')
if sound:
    print("Sound found at %s" % sound.source)
    print("Sound is %.3f seconds" % sound.length)
    sound.play()
```

You should not use the Sound class directly. The class returned by **SoundLoader.load** will be the best sound provider for that particular file type, so it might return different Sound classes depending the file type.

Changed in version 1.8.0: There are now 2 distinct Gstreamer implementations: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

Note: The core audio library does not support recording audio. If you require this functionality, please refer to the audiostream extension.

class `kivy.core.audio.`**`Sound`**

Bases: `kivy.event.EventDispatcher`

Represents a sound to play. This class is abstract, and cannot be used directly.

Use SoundLoader to load a sound.

Events

on_play[None] Fired when the sound is played.
on_stop[None] Fired when the sound is stopped.

filename
Deprecated since version 1.3.0: Use `source` instead.

get_pos()
Returns the current position of the audio file. Returns 0 if not playing.

New in version 1.4.1.

length
Get length of the sound (in seconds).

load()
Load the file into memory.

loop
Set to True if the sound should automatically loop when it finishes.

New in version 1.8.0.

`loop` is a `BooleanProperty` and defaults to False.

play()
Play the file.

seek(*position*)
Go to the <position> (in seconds).

source
Filename / source of your audio file.

New in version 1.3.0.

`source` is a `StringProperty` that defaults to None and is read-only. Use the `SoundLoader.load()` for loading audio.

state
State of the sound, one of 'stop' or 'play'.

New in version 1.3.0.

`state` is a read-only `OptionProperty`.

status
Deprecated since version 1.3.0: Use `state` instead.

stop()
Stop playback.

unload()
Unload the file from memory.

volume
Volume, in the range 0-1. 1 means full volume, 0 means mute.

New in version 1.3.0.

`volume` is a `NumericProperty` and defaults to 1.

class kivy.core.audio.**SoundLoader**
Load a sound, using the best loader for the given file type.

static **load**(*filename*)
Load a sound, and return a Sound() instance.

static **register**(*classobj*)
Register a new class to load the sound.

38.2 Camera

Core class for acquiring the camera and converting its input into a `Texture`.

Changed in version 1.8.0: There is now 2 distinct Gstreamer implementation: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

class `kivy.core.camera.`**`CameraBase`**`(`***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

Abstract Camera Widget class.

Concrete camera classes must implement initialization and frame capturing to a buffer that can be uploaded to the gpu.

Parameters

***index*: int**Source index of the camera.

size[tuple (int, int)] Size at which the image is drawn. If no size is specified, it defaults to the resolution of the camera image.

resolution[tuple (int, int)] Resolution to try to request from the camera. Used in the gstreamer pipeline by forcing the appsink caps to this resolution. If the camera doesnt support the resolution, a negotiation error might be thrown.

Events

on_loadFired when the camera is loaded and the texture has become available.

on_frameFired each time the camera texture is updated.

`index`

Source index of the camera

`init_camera``()`

Initialise the camera (internal)

`resolution`

Resolution of camera capture (width, height)

`start``()`

Start the camera acquire

`stop``()`

Release the camera

`texture`

Return the camera texture with the latest capture

38.3 Clipboard

Core class for accessing the Clipboard. If we are not able to access the system clipboard, a fake one will be used.

Usage example:

```
>>> from kivy.core.clipboard import Clipboard
>>> Clipboard.get_types()
['TIMESTAMP', 'TARGETS', 'MULTIPLE', 'SAVE_TARGETS', 'UTF8_STRING',
'COMPOUND_TEXT', 'TEXT', 'STRING', 'text/plain;charset=utf-8',
'text/plain']
>>> Clipboard.get('TEXT')
'Hello World'
>>> Clipboard.put('Great', 'UTF8_STRING')
>>> Clipboard.get_types()
```

```
['UTF8_STRING']
>>> Clipboard.get('UTF8_STRING')
'Great'
```

Note: The main implementation relies on Pygame and works well with text/strings. Anything else might not work the same on all platforms.

38.4 OpenGL

Select and use the best OpenGL library available. Depending on your system, the core provider can select an OpenGL ES or a 'classic' desktop OpenGL library.

38.5 Image

Core classes for loading images and converting them to a `Texture`. The raw image data can be keep in memory for further access.

class `kivy.core.image.`**`Image`**(*arg*, ***kwargs*)
Bases: `kivy.event.EventDispatcher`

Load an image and store the size and texture.

Changed in version 1.0.7: *mipmap* attribute has been added. The *texture_mipmap* and *texture_rectangle* have been deleted.

Changed in version 1.0.8: An Image widget can change its texture. A new event 'on_texture' has been introduced. New methods for handling sequenced animation have been added.

Parameters

arg[can be a string (str), Texture or Image object.] A string is interpreted as a path to the image to be loaded. You can also provide a texture object or an already existing image object. In the latter case, a real copy of the given image object will be returned.

keep_data[bool, defaults to False.] Keep the image data when the texture is created.

scale[float, defaults to 1.0] Scale of the image.

mipmap[bool, defaults to False] Create mipmap for the texture.

***anim_delay*: float, defaults to .25**Delay in seconds between each animation frame. Lower values means faster animation.

`anim_available`
Return True if this Image instance has animation available.

New in version 1.0.8.

`anim_delay`
Delay between each animation frame. A lower value means faster animation.

New in version 1.0.8.

`anim_index`
Return the index number of the image currently in the texture.

New in version 1.0.8.

`anim_reset`(*allow_anim*)
Reset an animation if available.

New in version 1.0.8.

Parameters

allow_anim: **bool**Indicate whether the animation should restart playing or not.

Usage:

```
# start/reset animation
image.anim_reset(True)

# or stop the animation
image.anim_reset(False)
```

You can change the animation speed whilst it is playing:

```
# Set to 20 FPS
image.anim_delay = 1 / 20.
```

`filename`
Get/set the filename of image

`height`
Image height

`image`
Get/set the data image object

static **`load`**(*filename*, ***kwargs*)
Load an image

Parameters

filename[str] Filename of the image.

keep_data[bool, defaults to False] Keep the image data when the texture is created.

`nocache`
Indicate whether the texture will not be stored in the cache or not.

New in version 1.6.0.

`on_texture`(**largs*)
This event is fired when the texture reference or content haschanged. It is normally used for sequenced images.
New in version 1.0.8.

`read_pixel`(x, y)
For a given local x/y position, return the pixel color at that position.

Warning: This function can only be used with images loaded with the keep_data=True keyword. For example:

```
m = Image.load('image.png', keep_data=True)
color = m.read_pixel(150, 150)
```

Parameters

x[int] Local x coordinate of the pixel in question.

y[int] Local y coordinate of the pixel in question.

`remove_from_cache`()
Remove the Image from cache. This facilitates re-loading of images from disk in case the image content has changed.

New in version 1.3.0.

Usage:

```
im = CoreImage('1.jpg')
# -- do something --
im.remove_from_cache()
im = CoreImage('1.jpg')
# this time image will be re-loaded from disk
```

save(*filename, flipped=False*)
Save image texture to file.

The filename should have the '.png' extension because the texture data read from the GPU is in the RGBA format. '.jpg' might work but has not been heavilly tested so some providers might break when using it. Any other extensions are not officially supported.

The flipped parameter flips the saved image vertically, and defaults to True.

Example:

```
# Save an core image object
from kivy.core.image import Image
img = Image('hello.png')
img.save('hello2.png')

# Save a texture
texture = Texture.create(...)
img = Image(texture)
img.save('hello3.png')
```

New in version 1.7.0.

Changed in version 1.8.0: Parameter *flipped* added to flip the image before saving, default to False.

size
Image size (width, height)

texture
Texture of the image

width
Image width

class kivy.core.image.**ImageData**(*width, height, fmt, data, source=None, flip_vertical=True, source_image=None, rowlength=0*)
Bases: object

Container for images and mipmap images. The container will always have at least the mipmap level 0.

add_mipmap(*level, width, height, data, rowlength*)
Add a image for a specific mipmap level.

New in version 1.0.7.

data
Image data. (If the image is mipmapped, it will use the level 0)

flip_vertical
Indicate if the texture will need to be vertically flipped

fmt
Decoded image format, one of a available texture format

get_mipmap(*level*)
Get the mipmap image at a specific level if it exists

New in version 1.0.7.

height
Image height in pixels. (If the image is mipmapped, it will use the level 0)

iterate_mipmaps()
Iterate over all mipmap images available.

New in version 1.0.7.

mipmaps
Data for each mipmap.

rowlength
Image rowlength. (If the image is mipmapped, it will use the level 0)

New in version 1.9.0.

size
Image (width, height) in pixels. (If the image is mipmapped, it will use the level 0)

source
Image source, if available

width
Image width in pixels. (If the image is mipmapped, it will use the level 0)

38.6 Spelling

Provides abstracted access to a range of spellchecking backends as well as word suggestions. The API is inspired by enchant but other backends can be added that implement the same API.

Spelling currently requires *python-enchant* for all platforms except OSX, where a native implementation exists.

```
>>> from kivy.core.spelling import Spelling
>>> s = Spelling()
>>> s.list_languages()
['en', 'en_CA', 'en_GB', 'en_US']
>>> s.select_language('en_US')
>>> s.suggest('helo')
[u'hole', u'help', u'helot', u'hello', u'halo', u'hero', u'hell', u'held',
 u'helm', u'he-lo']
```

class kivy.core.spelling.**SpellingBase**(*language=None*)
Bases: object

Base class for all spelling providers. Supports some abstract methods for checking words and getting suggestions.

check(*word*)
If *word* is a valid word in *self._language* (the currently active language), returns True. If the word shouldn't be checked, returns None (e.g. for ''). If it is not a valid word in *self._language*, return False.

Parameters
word[str] The word to check.

list_languages()
Return a list of all supported languages. E.g. ['en', 'en_GB', 'en_US', 'de', ...]

select_language(*language*)
From the set of registered languages, select the first language for *language*.

Parameters

language[str] Language identifier. Needs to be one of the options returned by list_languages(). Sets the language used for spell checking and word suggestions.

suggest(*fragment*)
For a given *fragment* (i.e. part of a word or a word by itself), provide corrections (*fragment* may be misspelled) or completions as a list of strings.

Parameters

fragment[str] The word fragment to get suggestions/corrections for. E.g. 'foo' might become 'of', 'food' or 'foot'.

class kivy.core.spelling.**NoSuchLangError**
Bases: exceptions.Exception

Exception to be raised when a specific language could not be found.

class kivy.core.spelling.**NoLanguageSelectedError**
Bases: exceptions.Exception

Exception to be raised when a language-using method is called but no language was selected prior to the call.

38.7 Text

An abstraction of text creation. Depending of the selected backend, the accuracy of text rendering may vary.

Changed in version 1.5.0: LabelBase.line_height added.

Changed in version 1.0.7: The LabelBase does not generate any texture if the text has a width <= 1.

This is the backend layer for getting text out of different text providers, you should only be using this directly if your needs aren't fulfilled by the Label.

Usage example:

```
from kivy.core.label import Label as CoreLabel

...
...
my_label = CoreLabel()
my_label.text = 'hello'
# the label is usually not drawn until needed, so force it to draw.
my_label.refresh()
# Now access the texture of the label and use it wherever and
# however you may please.
hello_texture = my_label.texture
```

class kivy.core.text.**LabelBase**(*text='', font_size=12, font_name='DroidSans', bold=False, italic=False, halign='left', valign='bottom', shorten=False, text_size=None, mipmap=False, color=None, line_height=1.0, strip=False, shorten_from='center', split_str=' ', **kwargs*)
Bases: object

Core text label. This is the abstract class used by different backends to render text.

Warning: The core text label can't be changed at runtime. You must recreate one.

Parameters

- ***font_size*: int, defaults to 12**Font size of the text
- ***font_name*: str, defaults to DEFAULT_FONT**Font name of the text
- ***bold*: bool, defaults to False**Activate "bold" text style
- ***italic*: bool, defaults to False**Activate "italic" text style
- ***text_size*: tuple, defaults to (None, None)**Add constraint to render the text (inside a bounding box). If no size is given, the label size will be set to the text size.
- ***padding*: float, defaults to None**If it's a float, it will set padding_x and padding_y
- ***padding_x*: float, defaults to 0.0**Left/right padding
- ***padding_y*: float, defaults to 0.0**Top/bottom padding
- ***halign*: str, defaults to "left"**Horizontal text alignment inside the bounding box
- ***valign*: str, defaults to "bottom"**Vertical text alignment inside the bounding box
- ***shorten*: bool, defaults to False**Indicate whether the label should attempt to shorten its textual contents as much as possible if a *size* is given. Setting this to True without an appropriately set size will lead to unexpected results.
- ***shorten_from*: str, defaults to *center***The side from which we should shorten the text from, can be left, right, or center. E.g. if left, the ellipsis will appear towards the left side and it will display as much text starting from the right as possible.
- ***split_str*: string, defaults to ' ' (space)**The string to use to split the words by when shortening. If empty, we can split after every character filling up the line as much as possible.
- ***max_lines*: int, defaults to 0 (unlimited)**If set, this indicate how maximum line are allowed to render the text. Works only if a limitation on text_size is set.
- ***mipmap***[bool, defaults to False] Create a mipmap for the texture
- ***strip***[bool, defaults to False] Whether each row of text has its leading and trailing spaces stripped. If *halign* is *justify* it is implicitly True.

Changed in version 1.9.0: *strip*, *shorten_from*, and *split_str* were added.

Changed in version 1.9.0: *padding_x* and *padding_y* has been fixed to work as expected. In the past, the text was padded by the negative of their values.

Changed in version 1.8.0: *max_lines* parameters has been added.

Changed in version 1.0.8: *size* have been deprecated and replaced with *text_size*.

Changed in version 1.0.7: The *valign* is now respected. This wasn't the case previously so you might have an issue in your application if you have not considered this.

`content_height`
Return the content height; i.e. the height of the text without any padding.

`content_size`
Return the content size (width, height)

`content_width`
Return the content width; i.e. the width of the text without any padding.

`fontid`
Return a unique id for all font parameters

`get_cached_extents()`
Returns a cached version of the `get_extents()` function.

```
>>> func = self._get_cached_extents()
>>> func
<built-in method size of pygame.font.Font object at 0x01E45650>
>>> func('a line')
(36, 18)
```

Warning: This method returns a size measuring function that is valid for the font settings used at the time `get_cached_extents()` was called. Any change in the font settings will render the returned function incorrect. You should only use this if you know what you're doing.

New in version 1.9.0.

get_extents(*text*)
Return a tuple (width, height) indicating the size of the specified text

label
Get/Set the text

refresh()
Force re-rendering of the text

static **register**(*name*, *fn_regular*, *fn_italic=None*, *fn_bold=None*, *fn_bolditalic=None*)
Register an alias for a Font.

New in version 1.1.0.

If you're using a ttf directly, you might not be able to use the bold/italic properties of the ttf version. If the font is delivered in multiple files (one regular, one italic and one bold), then you need to register these files and use the alias instead.

All the fn_regular/fn_italic/fn_bold parameters are resolved with `kivy.resources.resource_find()`. If fn_italic/fn_bold are None, fn_regular will be used instead.

render(*real=False*)
Return a tuple (width, height) to create the image with the user constraints. (width, height) includes the padding.

shorten(*text*, *margin=2*)
Shortens the text to fit into a single line by the width specified by `text_size` [0]. If `text_size` [0] is None, it returns text text unchanged.

`split_str` and `shorten_from` determines how the text is shortened.

Params *text* str, the text to be shortened. *margin* int, the amount of space to leave between the margins and the text. This is in addition to `padding_x`.

Retruns the text shortened to fit into a single line.

text
Get/Set the text

text_size
Get/set the (width, height) of the ' 'contrained rendering box

usersize
(deprecated) Use text_size instead.

38.7.1 Text Markup

New in version 1.1.0.

We provide a simple text-markup for inline text styling. The syntax look the same as the BBCode.

A tag is defined as `[tag]`, and might have a closed tag associated: `[/tag]`. Example of a markup text:

```
[b]Hello [color=ff0000]world[/b][/color]
```

The following tags are availables:

`[b][/b]` Activate bold text

`[i][/i]` Activate italic text

`[font=<str>][/font]` Change the font

`[size=<integer>][/size]` Change the font size

`[color=#<color>][/color]` Change the text color

`[ref=<str>][/ref]` Add an interactive zone. The reference + all the word box inside the reference will be available in `MarkupLabel.refs`

`[anchor=<str>]` Put an anchor in the text. You can get the position of your anchor within the text with `MarkupLabel.anchors`

`[sub][/sub]` Display the text at a subscript position relative to the text before it.

`[sup][/sup]` Display the text at a superscript position relative to the text before it.

If you need to escape the markup from the current text, use `kivy.utils.escape_markup()`.

class `kivy.core.text.markup.`**`MarkupLabel`**(**largs*, ***kwargs*)
Bases: `kivy.core.text.LabelBase`

Markup text label.

See module documentation for more informations.

`anchors`
Get the position of all the `[anchor=...]`:

```
    { 'anchorA': (x, y), 'anchorB': (x, y), ... }
```

`markup`
Return the text with all the markup splitted:

```
    >>> MarkupLabel('[b]Hello world[/b]').markup
    >>> ('[b]', 'Hello world', '[/b]')
```

`refs`
Get the bounding box of all the `[ref=...]`:

```
    { 'refA': ((x1, y1, x2, y2), (x1, y1, x2, y2)), ... }
```

`shorten_post`(*lines*, *w*, *h*, *margin=2*)
Shortens the text to a single line according to the label options.

This function operates on a text that has already been laid out because for markup, parts of text can have different size and options.

If `text_size` [0] is None, the lines are returned unchanged. Otherwise, the lines are converted to a single line fitting within the constrained width, `text_size` [0].

Params *lines*: list of *LayoutLine* instances describing the text. *w*: int, the width of the text in lines, including padding. *h*: int, the height of the text in lines, including padding. *margin* int, the additional space left on the sides. This is in addition to `padding_x`.

Returns3-tuple of (xw, h, lines), where w, and h is similar to the input and contains the resulting width / height of the text, including padding. lines, is a list containing a single *LayoutLine*, which contains the words for the line.

38.7.2 Text layout

An internal module for laying out text according to options and constraints. This is not part of the API and may change at any time.

`kivy.core.text.text_layout.`**`layout_text`**`()`

Lays out text into a series of `LayoutWord` and `LayoutLine` instances according to the options specified.

The function is designed to be called many times, each time new text is appended to the last line (or first line if appending upwards), unless a newline is present in the text. Each text appended is described by it's own options which can change between successive calls. If the text is constrained, we stop as soon as the constraint is reached.

Parameters

***text*: string or bytes**the text to be broken down into lines. If lines is not empty, the text is added to the last line (or first line if *append_down* is False) until a newline is reached which creates a new line in *lines*. See `LayoutLine`.

***lines*: list**a list of `LayoutLine` instances, each describing a line of the text. Calls to `layout_text()` append or create new `LayoutLine` instances in *lines*.

***size*: 2-tuple of ints**the size of the laid out text so far. Upon first call it should probably be (0, 0), afterwards it should be the (w, h) returned by this function in a previous call. When size reaches the constraining size, *text_size*, we stop adding lines and return True for the clipped parameter. size includes the x and y padding.

***text_size*: 2-tuple of ints or None.**the size constraint on the laid out text. If either element is None, the text is not constrained in that dimension. For example, (None, 200) will constrain the height, including padding to 200, while the width is unconstrained. The first line, and the first character of a line is always returned, even if it exceeds the constraint. The value be changed between different calls.

***options*: dict**the label options of this *text*. The options are saved with each word allowing different words to have different options from successive calls.

Note, *options* must include a *space_width* key with a value indicating the width of a space for that set of options.

***get_extents*: callable**a function called with a string, which returns a tuple containing the width, height of the string.

***append_down*: bool**Whether successive calls to the function appends lines before or after the existing lines. If True, they are appended to the last line and below it. If False, it's appended at the first line and above. For example, if False, everything after the last newline in *text* is appended to the first line in lines. Everything before the last newline is inserted at the start of lines in same order as text; that is we do not invert the line order.

This allows laying out from top to bottom until the constrained is reached, or from bottom to top until the constrained is reached.

***complete*: bool**whether this text complete lines. It use is that normally is strip in *options* is True, all leading and trailing spaces are removed from each line except from the last line (or first line if *append_down* is False) which only removes leading spaces. That's because further text can still be appended to the last line so we cannot strip them. If *complete* is True, it indicates no further text is coming and all lines will be stripped.

The function can also be called with *text* set to the empty string and *complete* set to True in order for the last (first) line to be stripped.

Returns3-tuple, (w, h, clipped). w and h is the width and height of the text in lines so far and includes padding. This can be larger than *text_size*, e.g. if not even a single fitted, the first line would still be returned. *clipped* is True if not all the text has been added to lines because w, h reached the constrained size.

Following is a simple example with no padding and no stripping:

```
>>> from kivy.core.text import Label
>>> from kivy.core.text.text_layout import layout_text

>>> l = Label()
>>> lines = []
>>> # layout text with width constraint by 50, but no height constraint
>>> w, h, clipped = layout_text('heres some text\nah, another line',
... lines, (0, 0), (50, None), l.options, l.get_cached_extents(), True,
... False)
>>> w, h, clipped
(46, 90, False)
# now add text from bottom up, and constrain witdh only be 100
>>> w, h, clipped = layout_text('\nyay, more text\n', lines, (w, h),
... (100, None), l.options, l.get_cached_extents(), False, True)
>>> w, h, clipped
(77, 120, 0)
>>> for line in lines:
...     print('line w: {}, line h: {}'.format(line.w, line.h))
...     for word in line.words:
...         print('w: {}, h: {}, text: {}'.format(word.lw, word.lh,
...         [word.text]))
line w: 0, line h: 15
line w: 77, line h: 15
w: 77, h: 15, text: ['yay, more text']
line w: 31, line h: 15
w: 31, h: 15, text: ['heres']
line w: 34, line h: 15
w: 34, h: 15, text: [' some']
line w: 24, line h: 15
w: 24, h: 15, text: [' text']
line w: 17, line h: 15
w: 17, h: 15, text: ['ah,']
line w: 46, line h: 15
w: 46, h: 15, text: [' another']
line w: 23, line h: 15
w: 23, h: 15, text: [' line']
```

class `kivy.core.text.text_layout.`**`LayoutWord`**

Bases: `object`

Formally describes a word contained in a line. The name word simply means a chunk of text and can be used to describe any text.

A word has some width, height and is rendered according to options saved in `options`. See `LayoutLine` for its usage.

Parameters

options: **dict**the label options dictionary for this word.
lw: **int**the width of the text in pixels.
lh: **int**the height of the text in pixels.
text: **string**the text of the word.

class `kivy.core.text.text_layout.`**`LayoutLine`**

Bases: `object`

Formally describes a line of text. A line of text is composed of many `LayoutWord` instances, each with it's own text, size and options.

A `LayoutLine` instance does not always imply that the words contained in the line ended with a newline. That is only the case if `is_last_line` is True. For example a single real line of text can be split across multiple `LayoutLine` instances if the whole line doesn't fit in the constrained width.

Parameters

x: **int**the location in a texture from where the left side of this line is began drawn.

y: **int**the location in a texture from where the bottom of this line is drawn.

w: **int**the width of the line. This is the sum of the individual widths of its `LayoutWord` instances. Does not include any padding.

h: **int**the height of the line. This is the maximum of the individual heights of its `LayoutWord` instances multiplied by the *line_height* of these instance. So this is larger then the word height.

is_last_line: **bool**whether this line was the last line in a paragraph. When True, it implies that the line was followed by a newline. Newlines should not be included in the text of words, but is implicit by setting this to True.

line_wrap: **bool**whether this line is continued from a previous line which didn't fit into a constrained width and was therefore split across multiple `LayoutLine` instances. *line_wrap* can be True or False independently of *is_last_line*.

words: **python list**a list that contains only `LayoutWord` instances describing the text of the line.

38.8 Video

Core class for reading video files and managing the `kivy.graphics.texture.Texture` video.

Changed in version 1.8.0: There is now 2 distinct Gstreamer implementation: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

Note: Recording is not supported.

class `kivy.core.video.`**`VideoBase`**`(`*`**kwargs`*`)`

Bases: `kivy.event.EventDispatcher`

VideoBase, a class used to implement a video reader.

Parameters

filename[str] Filename of the video. Can be a file or an URI.

eos[str, defaults to 'pause'] Action to take when EOS is hit. Can be one of 'pause', 'stop' or 'loop'.

Changed in version unknown: added 'pause'

async[bool, defaults to True] Load the video asynchronously (may be not supported by all providers).

autoplay[bool, defaults to False] Auto play the video on init.

Events

*on_eos*Fired when EOS is hit.

*on_load*Fired when the video is loaded and the texture is available.

*on_frame*Fired when a new frame is written to the texture.

`duration`

Get the video duration (in seconds)

filename
Get/set the filename/uri of the current video

load()
Load the video from the current filename

pause()
Pause the video

New in version 1.4.0.

play()
Play the video

position
Get/set the position in the video (in seconds)

seek(*percent*)
Move on percent position

state
Get the video playing status

stop()
Stop the video playing

texture
Get the video texture

unload()
Unload the actual video

volume
Get/set the volume in the video (1.0 = 100%)

38.9 Window

Core class for creating the default Kivy window. Kivy supports only one window per application: please don't try to create more than one.

class kivy.core.window.**Keyboard**(***kwargs*)
Bases: kivy.event.EventDispatcher

Keyboard interface that is returned by WindowBase.request_keyboard(). When you request a keyboard, you'll get an instance of this class. Whatever the keyboard input is (system or virtual keyboard), you'll receive events through this instance.

Events

on_key_down: **keycode, text, modifiers**Fired when a new key is pressed down

on_key_up: **keycode**Fired when a key is released (up)

Here is an example of how to request a Keyboard in accordance with the current configuration:

```
import kivy
kivy.require('1.0.8')

from kivy.core.window import Window
from kivy.uix.widget import Widget


class MyKeyboardListener(Widget):

    def __init__(self, **kwargs):
        super(MyKeyboardListener, self).__init__(**kwargs)
        self._keyboard = Window.request_keyboard(
            self._keyboard_closed, self, 'text')
        if self._keyboard.widget:
            # If it exists, this widget is a VKeyboard object which you can use
            # to change the keyboard layout.
            pass
        self._keyboard.bind(on_key_down=self._on_keyboard_down)

    def _keyboard_closed(self):
        print('My keyboard have been closed!')
        self._keyboard.unbind(on_key_down=self._on_keyboard_down)
        self._keyboard = None

    def _on_keyboard_down(self, keyboard, keycode, text, modifiers):
        print('The key', keycode, 'have been pressed')
        print(' - text is %r' % text)
        print(' - modifiers are %r' % modifiers)

        # Keycode is composed of an integer + a string
        # If we hit escape, release the keyboard
        if keycode[1] == 'escape':
            keyboard.release()

        # Return True to accept the key. Otherwise, it will be used by
        # the system.
        return True

if __name__ == '__main__':
    from kivy.base import runTouchApp
    runTouchApp(MyKeyboardListener())
```

callback = None
Callback that will be called when the keyboard is released

keycode_to_string(*value*)
Convert a keycode number to a string according to the `Keyboard.keycodes`. If the value is not found in the keycodes, it will return ''.

release()
Call this method to release the current keyboard. This will ensure that the keyboard is no longer attached to your callback.

string_to_keycode(*value*)
Convert a string to a keycode number according to the `Keyboard.keycodes`. If the value is not found in the keycodes, it will return -1.

target = None
Target that have requested the keyboard

widget = None
VKeyboard widget, if allowed by the configuration

window = None
Window which the keyboard is attached too

class `kivy.core.window.`**WindowBase**(***kwargs*)
Bases: `kivy.event.EventDispatcher`

WindowBase is an abstract window widget for any window implementation.
Parameters

borderless: **str, one of ('0', '1')**Set the window border state. Check the `config` documentation for a more detailed explanation on the values.

fullscreen: **str, one of ('0', '1', 'auto', 'fake')**Make the window fullscreen. Check the `config` documentation for a more detailed explanation on the values.

width: **int**Width of the window.

height: **int**Height of the window.

Events

on_motion: **etype, motionevent**Fired when a new `MotionEvent` is dispatched

on_touch_down:Fired when a new touch event is initiated.

on_touch_move:Fired when an existing touch event changes location.

on_touch_up:Fired when an existing touch event is terminated.

on_draw:Fired when the `Window` is being drawn.

on_flip:Fired when the `Window` GL surface is being flipped.

on_rotate: **rotation**Fired when the `Window` is being rotated.

on_close:Fired when the `Window` is closed.

on_request_close:Fired when the event loop wants to close the window, or if the escape key is pressed and *exit_on_escape* is *True*. If a function bound to this event returns *True*, the window will not be closed. If the the event is triggered because of the keyboard escape key, the keyword argument *source* is dispatched along with a value of *keyboard* to the bound functions.

on_keyboard: **key, scancode, codepoint, modifier**Fired when the keyboard is used for input.

Changed in version 1.3.0: The *unicode* parameter has been deprecated in favor of codepoint, and will be removed completely in future versions.

on_key_down: **key, scancode, codepoint**Fired when a key pressed.

Changed in version 1.3.0: The *unicode* parameter has been deprecated in favor of codepoint, and will be removed completely in future versions.

on_key_up: **key, scancode, codepoint**Fired when a key is released.

Changed in version 1.3.0: The *unicode* parameter has be deprecated in favor of codepoint, and will be removed completely in future versions.

on_dropfile: **str**Fired when a file is dropped on the application.

Changed in version 1.9.0: *on_request_close* has been added.

add_widget(*widget*)

Add a widget to a window

borderless

When set to True, this property removes the window border/decoration.

New in version 1.9.0.

`borderless` is a `BooleanProperty`, defaults to False.

center

Center of the rotated window.

`center` is a `AliasProperty`.

children

List of the children of this window.

`children` is a `ListProperty` instance and defaults to an empty list.

Use `add_widget()` and `remove_widget()` to manipulate the list of children. Don't manipulate the list directly unless you know what you are doing.

clear()

Clear the window with the background color

clearcolor
Color used to clear the window.

```
from kivy.core.window import Window

# red background color
Window.clearcolor = (1, 0, 0, 1)

# don't clear background at all
Window.clearcolor = None
```

Changed in version 1.7.2: The clearcolor default value is now: (0, 0, 0, 1).

close()
Close the window

create_window(**largs*)
Will create the main window and configure it.

Warning: This method is called automatically at runtime. If you call it, it will recreate a RenderContext and Canvas. This means you'll have a new graphics tree, and the old one will be unusable.
This method exist to permit the creation of a new OpenGL context AFTER closing the first one. (Like using runTouchApp() and stopTouchApp()).
This method has only been tested in a unittest environment and is not suitable for Applications.
Again, don't use this method unless you know exactly what you are doing!

dpi()
Return the DPI of the screen. If the implementation doesn't support any DPI lookup, it will just return 96.

Warning: This value is not cross-platform. Use `kivy.base.EventLoop.dpi` instead.

flip()
Flip between buffers

fullscreen
This property sets the fullscreen mode of the window. Available options are: True, False, 'auto', 'fake'. Check the `config` documentation for a more detailed explanation on the values.

New in version 1.2.0.

Note: The 'fake' option has been deprecated, use the `borderless` property instead.

height
Rotated window height.

`height` is a read-only `AliasProperty`.

hide()
Hides the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`keyboard_height`
Rerturns the height of the softkeyboard/IME on mobile platforms. Will return 0 if not on mobile platform or if IME is not active.

..versionadded:: 1.9.0

`keyboard_height` is a read-only `AliasProperty` defaults to 0.

`maximize``()`
Maximizes the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`minimize``()`
Minimizes the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`modifiers`
List of keyboard modifiers currently active.

`mouse_pos`
2d position of the mouse within the window.

New in version 1.2.0.

`on_close``(`**largs*`)`
Event called when the window is closed

`on_dropfile``(`*filename*`)`
Event called when a file is dropped on the application.

Warning: This event is currently works sdl2 window provider and on pygame window provider and MacOSX with a patched version of pygame. This event is left in place for further evolution (ios, android etc.)

New in version 1.2.0.

`on_flip``()`
Flip between buffers (event)

`on_joy_axis``(`*stickid, axisid, value*`)`
Event called when a joystick has a stick or other axis moved

New in version 1.9.0.

`on_joy_ball``(`*stickid, ballid, value*`)`
Event called when a joystick has a ball moved

New in version 1.9.0.

`on_joy_button_down`(*stickid*, *buttonid*)
Event called when a joystick has a button pressed

New in version 1.9.0.

`on_joy_button_up`(*stickid*, *buttonid*)
Event called when a joystick has a button released

New in version 1.9.0.

`on_joy_hat`(*stickid*, *hatid*, *value*)
Event called when a joystick has a hat/dpad moved

New in version 1.9.0.

`on_key_down`(*key*, *scancode=None*, *codepoint=None*, *modifier=None*, ***kwargs*)
Event called when a key is down (same arguments as on_keyboard)

`on_key_up`(*key*, *scancode=None*, *codepoint=None*, *modifier=None*, ***kwargs*)
Event called when a key is released (same arguments as on_keyboard)

`on_keyboard`(*key*, *scancode=None*, *codepoint=None*, *modifier=None*, ***kwargs*)
Event called when keyboard is used.

Warning: Some providers may omit *scancode*, *codepoint* and/or *modifier*!

`on_motion`(*etype*, *me*)
Event called when a Motion Event is received.

Parameters

etype: **str**One of 'begin', 'update', 'end'

me: `MotionEvent`The Motion Event currently dispatched.

`on_mouse_down`(*x*, *y*, *button*, *modifiers*)
Event called when the mouse is used (pressed/released)

`on_mouse_move`(*x*, *y*, *modifiers*)
Event called when the mouse is moved with buttons pressed

`on_mouse_up`(*x*, *y*, *button*, *modifiers*)
Event called when the mouse is moved with buttons pressed

`on_request_close`(**largs*, ***kwargs*)
Event called before we close the window. If a bound function returns *True*, the window will not be closed. If the the event is triggered because of the keyboard escape key, the keyword argument *source* is dispatched along with a value of *keyboard* to the bound functions.

Warning: When the bound function returns True the window will not be closed, so use with care because the user would not be able to close the program, even if the red X is clicked.

`on_resize`(*width*, *height*)
Event called when the window is resized.

`on_rotate`(*rotation*)
Event called when the screen has been rotated.

`on_touch_down`(*touch*)
Event called when a touch down event is initiated.

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

`on_touch_move`(*touch*)
Event called when a touch event moves (changes location).

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

`on_touch_up`(*touch*)
Event called when a touch event is released (terminated).

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

`parent`
Parent of this window.

`parent` is a `ObjectProperty` instance and defaults to None. When created, the parent is set to the window itself. You must take care of it if you are doing a recursive check.

`release_all_keyboards`()
New in version 1.0.8.

This will ensure that no virtual keyboard / system keyboard is requested. All instances will be closed.

`release_keyboard`(*target=None*)
New in version 1.0.4.

Internal method for the widget to release the real-keyboard. Check `request_keyboard()` to understand how it works.

`remove_widget`(*widget*)
Remove a widget from a window

`request_keyboard`(*callback, target, input_type='text'*)
New in version 1.0.4.

Internal widget method to request the keyboard. This method is rarely required by the end-user as it is handled automatically by the `TextInput`. We expose it in case you want to handle the keyboard manually for unique input scenarios.

A widget can request the keyboard, indicating a callback to call when the keyboard is released (or taken by another widget).

Parameters

***callback*: func**Callback that will be called when the keyboard is closed. This can be because somebody else requested the keyboard or the user closed it.

***target*: Widget**Attach the keyboard to the specified *target*. This should be the widget that requested the keyboard. Ensure you have a different target attached to each keyboard if you're working in a multi user mode.

New in version 1.0.8.

***input_type*: string**Choose the type of soft keyboard to request. Can be one of 'text', 'number', 'url', 'mail', 'datetime', 'tel', 'address'.

Note: *input_type* is currently only honored on mobile devices.

New in version 1.8.0.

Return An instance of `Keyboard` containing the callback, target, and if the configuration allows it, a `VKeyboard` instance attached as a *.widget* property.

Note: The behavior of this function is heavily influenced by the current *keyboard_mode*. Please see the Config's *configuration tokens* section for more information.

`restore()`

Restores the size and position of a maximized or minimized window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`rotation`

Get/set the window content rotation. Can be one of 0, 90, 180, 270 degrees.

`screenshot`(*name='screenshot{:04d}.png'*)

Save the actual displayed image in a file

`set_icon`(*filename*)

Set the icon of the window.

New in version 1.0.5.

`set_title`(*title*)

Set the window title.

New in version 1.0.5.

`set_vkeyboard_class`(*cls*)

New in version 1.0.8.

Set the VKeyboard class to use. If set to None, it will use the `kivy.uix.vkeyboard.VKeyboard`.

`show()`

Shows the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`size`

Get the rotated size of the window. If `rotation` is set, then the size will change to reflect the rotation.

`softinput_mode`

This specifies the behavior of window contents on display of soft keyboard on mobile platform. Can be one of '', 'pan', 'scale', 'resize'.

When '' The main window is left as it is allowing the user to use `keyboard_height` to manage the window contents the way they want.

when 'pan' The main window pans moving the bottom part of the window to be always on top of the keyboard.

when 'resize' The window is resized and the contents scaled to fit the remaining space.

..versionadded::1.9.0

`softinput_mode` is a `OptionProperty` defaults to None.

`system_size`
Real size of the window ignoring rotation.

`toggle_fullscreen``()`
Toggle between fullscreen and windowed mode.

Deprecated since version 1.9.0: Use `fullscreen` instead.

`width`
Rotated window width.

`width` is a read-only `AliasProperty`.

`kivy.core.window.`**`Window`** = **None**
Instance of a `WindowBase` implementation

CHAPTER

THIRTYNINE

AUDIO

Load an audio sound and play it with:

```
from kivy.core.audio import SoundLoader

sound = SoundLoader.load('mytest.wav')
if sound:
    print("Sound found at %s" % sound.source)
    print("Sound is %.3f seconds" % sound.length)
    sound.play()
```

You should not use the Sound class directly. The class returned by **SoundLoader.load** will be the best sound provider for that particular file type, so it might return different Sound classes depending the file type.

Changed in version 1.8.0: There are now 2 distinct Gstreamer implementations: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

Note: The core audio library does not support recording audio. If you require this functionality, please refer to the audiostream extension.

class `kivy.core.audio.`**`Sound`**

Bases: `kivy.event.EventDispatcher`

Represents a sound to play. This class is abstract, and cannot be used directly.

Use SoundLoader to load a sound.

Events

on_play[None] Fired when the sound is played.

on_stop[None] Fired when the sound is stopped.

`filename`

Deprecated since version 1.3.0: Use `source` instead.

`get_pos``()`

Returns the current position of the audio file. Returns 0 if not playing.

New in version 1.4.1.

`length`

Get length of the sound (in seconds).

`load``()`

Load the file into memory.

`loop`

Set to True if the sound should automatically loop when it finishes.

New in version 1.8.0.

`loop` is a `BooleanProperty` and defaults to False.

`play`()
Play the file.

`seek`(*position*)
Go to the <position> (in seconds).

`source`
Filename / source of your audio file.

New in version 1.3.0.

`source` is a `StringProperty` that defaults to None and is read-only. Use the `SoundLoader.load()` for loading audio.

`state`
State of the sound, one of 'stop' or 'play'.

New in version 1.3.0.

`state` is a read-only `OptionProperty`.

`status`
Deprecated since version 1.3.0: Use `state` instead.

`stop`()
Stop playback.

`unload`()
Unload the file from memory.

`volume`
Volume, in the range 0-1. 1 means full volume, 0 means mute.

New in version 1.3.0.

`volume` is a `NumericProperty` and defaults to 1.

class `kivy.core.audio.`**`SoundLoader`**
Load a sound, using the best loader for the given file type.

static **`load`**(*filename*)
Load a sound, and return a Sound() instance.

static **`register`**(*classobj*)
Register a new class to load the sound.

CHAPTER

FORTY

CAMERA

Core class for acquiring the camera and converting its input into a `Texture`.

Changed in version 1.8.0: There is now 2 distinct Gstreamer implementation: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

class `kivy.core.camera.`**`CameraBase`**`(`***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

Abstract Camera Widget class.

Concrete camera classes must implement initialization and frame capturing to a buffer that can be uploaded to the gpu.

Parameters

***index*: int**Source index of the camera.

size[tuple (int, int)] Size at which the image is drawn. If no size is specified, it defaults to the resolution of the camera image.

resolution[tuple (int, int)] Resolution to try to request from the camera. Used in the gstreamer pipeline by forcing the appsink caps to this resolution. If the camera doesnt support the resolution, a negotiation error might be thrown.

Events

on_loadFired when the camera is loaded and the texture has become available.

on_frameFired each time the camera texture is updated.

`index`

Source index of the camera

`init_camera``()`

Initialise the camera (internal)

`resolution`

Resolution of camera capture (width, height)

`start``()`

Start the camera acquire

`stop``()`

Release the camera

`texture`

Return the camera texture with the latest capture

CHAPTER

FORTYONE

CLIPBOARD

Core class for accessing the Clipboard. If we are not able to access the system clipboard, a fake one will be used.

Usage example:

```
>>> from kivy.core.clipboard import Clipboard
>>> Clipboard.get_types()
['TIMESTAMP', 'TARGETS', 'MULTIPLE', 'SAVE_TARGETS', 'UTF8_STRING',
'COMPOUND_TEXT', 'TEXT', 'STRING', 'text/plain;charset=utf-8',
'text/plain']
>>> Clipboard.get('TEXT')
'Hello World'
>>> Clipboard.put('Great', 'UTF8_STRING')
>>> Clipboard.get_types()
['UTF8_STRING']
>>> Clipboard.get('UTF8_STRING')
'Great'
```

Note: The main implementation relies on Pygame and works well with text/strings. Anything else might not work the same on all platforms.

CHAPTER

FORTYTWO

OPENGL

Select and use the best OpenGL library available. Depending on your system, the core provider can select an OpenGL ES or a 'classic' desktop OpenGL library.

CHAPTER

FORTYTHREE

IMAGE

Core classes for loading images and converting them to a `Texture`. The raw image data can be keep in memory for further access.

class `kivy.core.image.`**`Image`**`(`*arg*, ***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

Load an image and store the size and texture.

Changed in version 1.0.7: *mipmap* attribute has been added. The *texture_mipmap* and *texture_rectangle* have been deleted.

Changed in version 1.0.8: An Image widget can change its texture. A new event 'on_texture' has been introduced. New methods for handling sequenced animation have been added.

Parameters

arg[can be a string (str), Texture or Image object.] A string is interpreted as a path to the image to be loaded. You can also provide a texture object or an already existing image object. In the latter case, a real copy of the given image object will be returned.

keep_data[bool, defaults to False.] Keep the image data when the texture is created.

scale[float, defaults to 1.0] Scale of the image.

mipmap[bool, defaults to False] Create mipmap for the texture.

***anim_delay*: float, defaults to .25**Delay in seconds between each animation frame. Lower values means faster animation.

`anim_available`

Return True if this Image instance has animation available.

New in version 1.0.8.

`anim_delay`

Delay between each animation frame. A lower value means faster animation.

New in version 1.0.8.

`anim_index`

Return the index number of the image currently in the texture.

New in version 1.0.8.

`anim_reset``(`*allow_anim*`)`

Reset an animation if available.

New in version 1.0.8.

Parameters

***allow_anim*: bool**Indicate whether the animation should restart playing or not.

Usage:

```
# start/reset animation
image.anim_reset(True)

# or stop the animation
image.anim_reset(False)
```

You can change the animation speed whilst it is playing:

```
# Set to 20 FPS
image.anim_delay = 1 / 20.
```

`filename`
Get/set the filename of image

`height`
Image height

`image`
Get/set the data image object

static **`load`**(*filename*, ***kwargs*)
Load an image

Parameters

filename[str] Filename of the image.

keep_data[bool, defaults to False] Keep the image data when the texture is created.

`nocache`
Indicate whether the texture will not be stored in the cache or not.

New in version 1.6.0.

`on_texture`(**largs*)
This event is fired when the texture reference or content haschanged. It is normally used for sequenced images.
New in version 1.0.8.

`read_pixel`(*x*, *y*)
For a given local x/y position, return the pixel color at that position.

> **Warning:** This function can only be used with images loaded with the keep_data=True keyword. For example:
>
> ```
> m = Image.load('image.png', keep_data=True)
> color = m.read_pixel(150, 150)
> ```

Parameters

x[int] Local x coordinate of the pixel in question.

y[int] Local y coordinate of the pixel in question.

`remove_from_cache`()
Remove the Image from cache. This facilitates re-loading of images from disk in case the image content has changed.

New in version 1.3.0.

Usage:

```
im = CoreImage('1.jpg')
# -- do something --
```

```
        im.remove_from_cache()
        im = CoreImage('1.jpg')
        # this time image will be re-loaded from disk
```

save(*filename, flipped=False*)
Save image texture to file.

The filename should have the '.png' extension because the texture data read from the GPU is in the RGBA format. '.jpg' might work but has not been heavilly tested so some providers might break when using it. Any other extensions are not officially supported.

The flipped parameter flips the saved image vertically, and defaults to True.

Example:

```
        # Save an core image object
        from kivy.core.image import Image
        img = Image('hello.png')
        img.save('hello2.png')

        # Save a texture
        texture = Texture.create(...)
        img = Image(texture)
        img.save('hello3.png')
```

New in version 1.7.0.

Changed in version 1.8.0: Parameter *flipped* added to flip the image before saving, default to False.

size
Image size (width, height)

texture
Texture of the image

width
Image width

class `kivy.core.image.`**ImageData**(*width, height, fmt, data, source=None, flip_vertical=True, source_image=None, rowlength=0*)
Bases: `object`

Container for images and mipmap images. The container will always have at least the mipmap level 0.

add_mipmap(*level, width, height, data, rowlength*)
Add a image for a specific mipmap level.

New in version 1.0.7.

data
Image data. (If the image is mipmapped, it will use the level 0)

flip_vertical
Indicate if the texture will need to be vertically flipped

fmt
Decoded image format, one of a available texture format

get_mipmap(*level*)
Get the mipmap image at a specific level if it exists

New in version 1.0.7.

height
Image height in pixels. (If the image is mipmapped, it will use the level 0)

iterate_mipmaps()
Iterate over all mipmap images available.

New in version 1.0.7.

mipmaps
Data for each mipmap.

rowlength
Image rowlength. (If the image is mipmapped, it will use the level 0)

New in version 1.9.0.

size
Image (width, height) in pixels. (If the image is mipmapped, it will use the level 0)

source
Image source, if available

width
Image width in pixels. (If the image is mipmapped, it will use the level 0)

CHAPTER

FORTYFOUR

SPELLING

Provides abstracted access to a range of spellchecking backends as well as word suggestions. The API is inspired by enchant but other backends can be added that implement the same API.

Spelling currently requires *python-enchant* for all platforms except OSX, where a native implementation exists.

```
>>> from kivy.core.spelling import Spelling
>>> s = Spelling()
>>> s.list_languages()
['en', 'en_CA', 'en_GB', 'en_US']
>>> s.select_language('en_US')
>>> s.suggest('helo')
[u'hole', u'help', u'helot', u'hello', u'halo', u'hero', u'hell', u'held',
 u'helm', u'he-lo']
```

class `kivy.core.spelling.`**`SpellingBase`**`(`*language=None*`)`

Bases: `object`

Base class for all spelling providers. Supports some abstract methods for checking words and getting suggestions.

`check``(`*word*`)`

If *word* is a valid word in *self._language* (the currently active language), returns True. If the word shouldn't be checked, returns None (e.g. for ''). If it is not a valid word in *self._language*, return False.

Parameters

word[str] The word to check.

`list_languages``()`

Return a list of all supported languages. E.g. ['en', 'en_GB', 'en_US', 'de', ...]

`select_language``(`*language*`)`

From the set of registered languages, select the first language for *language*.

Parameters

language[str] Language identifier. Needs to be one of the options returned by list_languages(). Sets the language used for spell checking and word suggestions.

`suggest``(`*fragment*`)`

For a given *fragment* (i.e. part of a word or a word by itself), provide corrections (*fragment* may be misspelled) or completions as a list of strings.

Parameters

fragment[str] The word fragment to get suggestions/corrections for. E.g. 'foo' might become 'of', 'food' or 'foot'.

class `kivy.core.spelling.`**`NoSuchLangError`**
Bases: `exceptions.Exception`

Exception to be raised when a specific language could not be found.

class `kivy.core.spelling.`**`NoLanguageSelectedError`**
Bases: `exceptions.Exception`

Exception to be raised when a language-using method is called but no language was selected prior to the call.

CHAPTER

FORTYFIVE

TEXT

An abstraction of text creation. Depending of the selected backend, the accuracy of text rendering may vary.

Changed in version 1.5.0: `LabelBase.line_height` added.

Changed in version 1.0.7: The `LabelBase` does not generate any texture if the text has a width <= 1.

This is the backend layer for getting text out of different text providers, you should only be using this directly if your needs aren't fulfilled by the `Label`.

Usage example:

```
from kivy.core.label import Label as CoreLabel

...
...
my_label = CoreLabel()
my_label.text = 'hello'
# the label is usually not drawn until needed, so force it to draw.
my_label.refresh()
# Now access the texture of the label and use it wherever and
# however you may please.
hello_texture = my_label.texture
```

class `kivy.core.text.`**`LabelBase`**(*text='', font_size=12, font_name='DroidSans', bold=False, italic=False, halign='left', valign='bottom', shorten=False, text_size=None, mipmap=False, color=None, line_height=1.0, strip=False, shorten_from='center', split_str=' ', **kwargs*)

Bases: `object`

Core text label. This is the abstract class used by different backends to render text.

Warning: The core text label can't be changed at runtime. You must recreate one.

Parameters

font_size: **int, defaults to 12**Font size of the text
font_name: **str, defaults to DEFAULT_FONT**Font name of the text
bold: **bool, defaults to False**Activate "bold" text style
italic: **bool, defaults to False**Activate "italic" text style
text_size: **tuple, defaults to (None, None)**Add constraint to render the text (inside a bounding box). If no size is given, the label size will be set to the text size.
padding: **float, defaults to None**If it's a float, it will set padding_x and padding_y
padding_x: **float, defaults to 0.0**Left/right padding

***padding_y*: float, defaults to 0.0**Top/bottom padding
***halign*: str, defaults to "left"**Horizontal text alignment inside the bounding box
***valign*: str, defaults to "bottom"**Vertical text alignment inside the bounding box
***shorten*: bool, defaults to False**Indicate whether the label should attempt to shorten its textual contents as much as possible if a *size* is given. Setting this to True without an appropriately set size will lead to unexpected results.
shorten_from*: str, defaults to *centerThe side from which we should shorten the text from, can be left, right, or center. E.g. if left, the ellipsis will appear towards the left side and it will display as much text starting from the right as possible.
***split_str*: string, defaults to ' ' (space)**The string to use to split the words by when shortening. If empty, we can split after every character filling up the line as much as possible.
***max_lines*: int, defaults to 0 (unlimited)**If set, this indicate how maximum line are allowed to render the text. Works only if a limitation on text_size is set.
mipmap[bool, defaults to False] Create a mipmap for the texture
strip[bool, defaults to False] Whether each row of text has its leading and trailing spaces stripped. If *halign* is *justify* it is implicitly True.

Changed in version 1.9.0: *strip*, *shorten_from*, and *split_str* were added.

Changed in version 1.9.0: *padding_x* and *padding_y* has been fixed to work as expected. In the past, the text was padded by the negative of their values.

Changed in version 1.8.0: *max_lines* parameters has been added.

Changed in version 1.0.8: *size* have been deprecated and replaced with *text_size*.

Changed in version 1.0.7: The *valign* is now respected. This wasn't the case previously so you might have an issue in your application if you have not considered this.

content_height
Return the content height; i.e. the height of the text without any padding.

content_size
Return the content size (width, height)

content_width
Return the content width; i.e. the width of the text without any padding.

fontid
Return a unique id for all font parameters

get_cached_extents()
Returns a cached version of the get_extents() function.

```
>>> func = self._get_cached_extents()
>>> func
<built-in method size of pygame.font.Font object at 0x01E45650>
>>> func('a line')
(36, 18)
```

Warning: This method returns a size measuring function that is valid for the font settings used at the time get_cached_extents() was called. Any change in the font settings will render the returned function incorrect. You should only use this if you know what you're doing.

New in version 1.9.0.

get_extents(*text*)
Return a tuple (width, height) indicating the size of the specified text

label
: Get/Set the text

refresh()
: Force re-rendering of the text

static **register**(*name*, *fn_regular*, *fn_italic=None*, *fn_bold=None*, *fn_bolditalic=None*)
: Register an alias for a Font.

  New in version 1.1.0.

  If you're using a ttf directly, you might not be able to use the bold/italic properties of the ttf version. If the font is delivered in multiple files (one regular, one italic and one bold), then you need to register these files and use the alias instead.

  All the fn_regular/fn_italic/fn_bold parameters are resolved with `kivy.resources.resource_find()`. If fn_italic/fn_bold are None, fn_regular will be used instead.

render(*real=False*)
: Return a tuple (width, height) to create the image with the user constraints. (width, height) includes the padding.

shorten(*text*, *margin=2*)
: Shortens the text to fit into a single line by the width specified by `text_size` [0]. If `text_size` [0] is None, it returns text text unchanged.

  `split_str` and `shorten_from` determines how the text is shortened.

  Params *text* str, the text to be shortened. *margin* int, the amount of space to leave between the margins and the text. This is in addition to `padding_x`.

  Retruns the text shortened to fit into a single line.

text
: Get/Set the text

text_size
: Get/set the (width, height) of the ' 'contrained rendering box

usersize
: (deprecated) Use text_size instead.

45.1 Text Markup

New in version 1.1.0.

We provide a simple text-markup for inline text styling. The syntax look the same as the BBCode.

A tag is defined as `[tag]`, and might have a closed tag associated: `[/tag]`. Example of a markup text:

```
[b]Hello [color=ff0000]world[/b][/color]
```

The following tags are availables:

`[b][/b]` Activate bold text

`[i][/i]` Activate italic text

`[font=<str>][/font]` Change the font

`[size=<integer>][/size]` Change the font size

`[color=#<color>][/color]` Change the text color

[ref=<str>][/ref] Add an interactive zone. The reference + all the word box inside the reference will be available in `MarkupLabel.refs`

[anchor=<str>] Put an anchor in the text. You can get the position of your anchor within the text with `MarkupLabel.anchors`

[sub][/sub] Display the text at a subscript position relative to the text before it.

[sup][/sup] Display the text at a superscript position relative to the text before it.

If you need to escape the markup from the current text, use `kivy.utils.escape_markup()`.

class `kivy.core.text.markup.`**`MarkupLabel`**(**largs*, ***kwargs*)
Bases: `kivy.core.text.LabelBase`

Markup text label.

See module documentation for more informations.

`anchors`
Get the position of all the `[anchor=...]`:

```
{ 'anchorA': (x, y), 'anchorB': (x, y), ... }
```

`markup`
Return the text with all the markup splitted:

```
>>> MarkupLabel('[b]Hello world[/b]').markup
>>> ('[b]', 'Hello world', '[/b]')
```

`refs`
Get the bounding box of all the `[ref=...]`:

```
{ 'refA': ((x1, y1, x2, y2), (x1, y1, x2, y2)), ... }
```

`shorten_post`(*lines*, *w*, *h*, *margin=2*)
Shortens the text to a single line according to the label options.

This function operates on a text that has already been laid out because for markup, parts of text can have different size and options.

If `text_size` [0] is None, the lines are returned unchanged. Otherwise, the lines are converted to a single line fitting within the constrained width, `text_size` [0].

Params *lines*: list of *LayoutLine* instances describing the text. *w*: int, the width of the text in lines, including padding. *h*: int, the height of the text in lines, including padding. *margin* int, the additional space left on the sides. This is in addition to `padding_x`.

Returns3-tuple of (xw, h, lines), where w, and h is similar to the input and contains the resulting width / height of the text, including padding. lines, is a list containing a single *LayoutLine*, which contains the words for the line.

45.2 Text layout

An internal module for laying out text according to options and constraints. This is not part of the API and may change at any time.

`kivy.core.text.text_layout.`**`layout_text`**()
Lays out text into a series of `LayoutWord` and `LayoutLine` instances according to the options specified.

The function is designed to be called many times, each time new text is appended to the last line (or first line if appending upwards), unless a newline is present in the text. Each text appended is described by it's own options which can change between successive calls. If the text is constrained, we stop as soon as the constraint is reached.

Parameters

text: **string or bytes**the text to be broken down into lines. If lines is not empty, the text is added to the last line (or first line if *append_down* is False) until a newline is reached which creates a new line in *lines*. See `LayoutLine`.

lines: **list**a list of `LayoutLine` instances, each describing a line of the text. Calls to `layout_text()` append or create new `LayoutLine` instances in *lines*.

size: **2-tuple of ints**the size of the laid out text so far. Upon first call it should probably be (0, 0), afterwards it should be the (w, h) returned by this function in a previous call. When size reaches the constraining size, *text_size*, we stop adding lines and return True for the clipped parameter. size includes the x and y padding.

text_size: **2-tuple of ints or None.**the size constraint on the laid out text. If either element is None, the text is not constrained in that dimension. For example, (None, 200) will constrain the height, including padding to 200, while the width is unconstrained. The first line, and the first character of a line is always returned, even if it exceeds the constraint. The value be changed between different calls.

options: **dict**the label options of this *text*. The options are saved with each word allowing different words to have different options from successive calls.

Note, *options* must include a *space_width* key with a value indicating the width of a space for that set of options.

get_extents: **callable**a function called with a string, which returns a tuple containing the width, height of the string.

append_down: **bool**Whether successive calls to the function appends lines before or after the existing lines. If True, they are appended to the last line and below it. If False, it's appended at the first line and above. For example, if False, everything after the last newline in *text* is appended to the first line in lines. Everything before the last newline is inserted at the start of lines in same order as text; that is we do not invert the line order.

This allows laying out from top to bottom until the constrained is reached, or from bottom to top until the constrained is reached.

complete: **bool**whether this text complete lines. It use is that normally is strip in *options* is True, all leading and trailing spaces are removed from each line except from the last line (or first line if *append_down* is False) which only removes leading spaces. That's because further text can still be appended to the last line so we cannot strip them. If *complete* is True, it indicates no further text is coming and all lines will be stripped.

The function can also be called with *text* set to the empty string and *complete* set to True in order for the last (first) line to be stripped.

Returns3-tuple, (w, h, clipped). w and h is the width and height of the text in lines so far and includes padding. This can be larger than *text_size*, e.g. if not even a single fitted, the first line would still be returned. *clipped* is True if not all the text has been added to lines because w, h reached the constrained size.

Following is a simple example with no padding and no stripping:

```
>>> from kivy.core.text import Label
>>> from kivy.core.text.text_layout import layout_text

>>> l = Label()
>>> lines = []
>>> # layout text with width constraint by 50, but no height constraint
>>> w, h, clipped = layout_text('heres some text\nah, another line',
... lines, (0, 0), (50, None), l.options, l.get_cached_extents(), True,
... False)
>>> w, h, clipped
(46, 90, False)
# now add text from bottom up, and constrain witdh only be 100
>>> w, h, clipped = layout_text('\nyay, more text\n', lines, (w, h),
... (100, None), l.options, l.get_cached_extents(), False, True)
>>> w, h, clipped
(77, 120, 0)
>>> for line in lines:
...     print('line w: {}, line h: {}'.format(line.w, line.h))
...     for word in line.words:
...         print('w: {}, h: {}, text: {}'.format(word.lw, word.lh,
...         [word.text]))
line w: 0, line h: 15
line w: 77, line h: 15
w: 77, h: 15, text: ['yay, more text']
line w: 31, line h: 15
w: 31, h: 15, text: ['heres']
line w: 34, line h: 15
w: 34, h: 15, text: [' some']
line w: 24, line h: 15
w: 24, h: 15, text: [' text']
line w: 17, line h: 15
w: 17, h: 15, text: ['ah,']
line w: 46, line h: 15
w: 46, h: 15, text: [' another']
line w: 23, line h: 15
w: 23, h: 15, text: [' line']
```

class `kivy.core.text.text_layout.`**`LayoutWord`**

Bases: `object`

Formally describes a word contained in a line. The name word simply means a chunk of text and can be used to describe any text.

A word has some width, height and is rendered according to options saved in `options`. See `LayoutLine` for its usage.

Parameters

options: **dict**the label options dictionary for this word.
lw: **int**the width of the text in pixels.
lh: **int**the height of the text in pixels.
text: **string**the text of the word.

class `kivy.core.text.text_layout.`**`LayoutLine`**

Bases: `object`

Formally describes a line of text. A line of text is composed of many `LayoutWord` instances, each with it's own text, size and options.

A `LayoutLine` instance does not always imply that the words contained in the line ended with a newline. That is only the case if `is_last_line` is True. For example a single real line of text can be split across multiple `LayoutLine` instances if the whole line doesn't fit in the constrained width.

Parameters

x: **int**the location in a texture from where the left side of this line is began drawn.
y: **int**the location in a texture from where the bottom of this line is drawn.
w: **int**the width of the line. This is the sum of the individual widths of its

`LayoutWord` instances. Does not include any padding.

***h*: int**the height of the line. This is the maximum of the individual heights of its `LayoutWord` instances multiplied by the *line_height* of these instance. So this is larger then the word height.

***is_last_line*: bool**whether this line was the last line in a paragraph. When True, it implies that the line was followed by a newline. Newlines should not be included in the text of words, but is implicit by setting this to True.

***line_wrap*: bool**whether this line is continued from a previous line which didn't fit into a constrained width and was therefore split across multiple `LayoutLine` instances. *line_wrap* can be True or False independently of *is_last_line*.

***words*: python list**a list that contains only `LayoutWord` instances describing the text of the line.

CHAPTER

FORTYSIX

TEXT MARKUP

New in version 1.1.0.

We provide a simple text-markup for inline text styling. The syntax look the same as the BBCode.

A tag is defined as `[tag]`, and might have a closed tag associated: `[/tag]`. Example of a markup text:

```
[b]Hello [color=ff0000]world[/b][/color]
```

The following tags are availables:

`[b][/b]` Activate bold text

`[i][/i]` Activate italic text

`[font=<str>][/font]` Change the font

`[size=<integer>][/size]` Change the font size

`[color=#<color>][/color]` Change the text color

`[ref=<str>][/ref]` Add an interactive zone. The reference + all the word box inside the reference will be available in `MarkupLabel.refs`

`[anchor=<str>]` Put an anchor in the text. You can get the position of your anchor within the text with `MarkupLabel.anchors`

`[sub][/sub]` Display the text at a subscript position relative to the text before it.

`[sup][/sup]` Display the text at a superscript position relative to the text before it.

If you need to escape the markup from the current text, use `kivy.utils.escape_markup()`.

class `kivy.core.text.markup.`**`MarkupLabel`**(**largs*, ***kwargs*)

Bases: `kivy.core.text.LabelBase`

Markup text label.

See module documentation for more informations.

`anchors`

Get the position of all the `[anchor=...]`:

```
{ 'anchorA': (x, y), 'anchorB': (x, y), ... }
```

`markup`

Return the text with all the markup splitted:

```
>>> MarkupLabel('[b]Hello world[/b]').markup
>>> ('[b]', 'Hello world', '[/b]')
```

refs

Get the bounding box of all the `[ref=...]`:

```
{ 'refA': ((x1, y1, x2, y2), (x1, y1, x2, y2)), ... }
```

shorten_post(*lines*, *w*, *h*, *margin=2*)

Shortens the text to a single line according to the label options.

This function operates on a text that has already been laid out because for markup, parts of text can have different size and options.

If `text_size` [0] is None, the lines are returned unchanged. Otherwise, the lines are converted to a single line fitting within the constrained width, `text_size` [0].

Params *lines*: list of *LayoutLine* instances describing the text. *w*: int, the width of the text in lines, including padding. *h*: int, the height of the text in lines, including padding. *margin* int, the additional space left on the sides. This is in addition to `padding_x`.

Returns3-tuple of (xw, h, lines), where w, and h is similar to the input and contains the resulting width / height of the text, including padding. lines, is a list containing a single *LayoutLine*, which contains the words for the line.

CHAPTER

FORTYSEVEN

TEXT LAYOUT

An internal module for laying out text according to options and constraints. This is not part of the API and may change at any time.

`kivy.core.text.text_layout.`**`layout_text`**`()`

Lays out text into a series of `LayoutWord` and `LayoutLine` instances according to the options specified.

The function is designed to be called many times, each time new text is appended to the last line (or first line if appending upwards), unless a newline is present in the text. Each text appended is described by it's own options which can change between successive calls. If the text is constrained, we stop as soon as the constraint is reached.

Parameters

***text*: string or bytes**the text to be broken down into lines. If lines is not empty, the text is added to the last line (or first line if *append_down* is False) until a newline is reached which creates a new line in *lines*. See `LayoutLine`.

***lines*: list**a list of `LayoutLine` instances, each describing a line of the text. Calls to `layout_text()` append or create new `LayoutLine` instances in *lines*.

***size*: 2-tuple of ints**the size of the laid out text so far. Upon first call it should probably be (0, 0), afterwards it should be the (w, h) returned by this function in a previous call. When size reaches the constraining size, *text_size*, we stop adding lines and return True for the clipped parameter. size includes the x and y padding.

***text_size*: 2-tuple of ints or None.**the size constraint on the laid out text. If either element is None, the text is not constrained in that dimension. For example, (None, 200) will constrain the height, including padding to 200, while the width is unconstrained. The first line, and the first character of a line is always returned, even if it exceeds the constraint. The value be changed between different calls.

***options*: dict**the label options of this *text*. The options are saved with each word allowing different words to have different options from successive calls.

Note, *options* must include a *space_width* key with a value indicating the width of a space for that set of options.

***get_extents*: callable**a function called with a string, which returns a tuple containing the width, height of the string.

***append_down*: bool**Whether successive calls to the function appends lines before or after the existing lines. If True, they are appended to the last line and below it. If False, it's appended at the first line and above. For example, if False, everything after the last newline in *text* is appended to the first line in lines. Everything before the last newline is inserted at the start of lines in same order as text; that is we do not invert the line order.

This allows laying out from top to bottom until the constrained is reached, or from bottom to top until the constrained is reached.

***complete*: bool**whether this text complete lines. It use is that normally is strip in *options* is True, all leading and trailing spaces are removed from each line except from the last line (or first line if *append_down* is False) which only removes leading spaces. That's because further text can still be appended to the last line so we cannot strip them. If *complete* is True, it indicates no further text is coming and all lines will be stripped.

The function can also be called with *text* set to the empty string and *complete* set to True in order for the last (first) line to be stripped.

Returns3-tuple, (w, h, clipped). w and h is the width and height of the text in lines so far and includes padding. This can be larger than *text_size*, e.g. if not even a single fitted, the first line would still be returned. *clipped* is True if not all the text has been added to lines because w, h reached the constrained size.

Following is a simple example with no padding and no stripping:

```
>>> from kivy.core.text import Label
>>> from kivy.core.text.text_layout import layout_text

>>> l = Label()
>>> lines = []
>>> # layout text with width constraint by 50, but no height constraint
>>> w, h, clipped = layout_text('heres some text\nah, another line',
... lines, (0, 0), (50, None), l.options, l.get_cached_extents(), True,
... False)
>>> w, h, clipped
(46, 90, False)
# now add text from bottom up, and constrain witdh only be 100
>>> w, h, clipped = layout_text('\nyay, more text\n', lines, (w, h),
... (100, None), l.options, l.get_cached_extents(), False, True)
>>> w, h, clipped
(77, 120, 0)
>>> for line in lines:
...     print('line w: {}, line h: {}'.format(line.w, line.h))
...     for word in line.words:
...         print('w: {}, h: {}, text: {}'.format(word.lw, word.lh,
...         [word.text]))
line w: 0, line h: 15
line w: 77, line h: 15
w: 77, h: 15, text: ['yay, more text']
line w: 31, line h: 15
w: 31, h: 15, text: ['heres']
line w: 34, line h: 15
w: 34, h: 15, text: [' some']
line w: 24, line h: 15
w: 24, h: 15, text: [' text']
line w: 17, line h: 15
w: 17, h: 15, text: ['ah,']
line w: 46, line h: 15
w: 46, h: 15, text: [' another']
line w: 23, line h: 15
w: 23, h: 15, text: [' line']
```

class `kivy.core.text.text_layout.`**`LayoutWord`**

Bases: `object`

Formally describes a word contained in a line. The name word simply means a chunk of text and can be used to describe any text.

A word has some width, height and is rendered according to options saved in `options`. See `LayoutLine` for its usage.

Parameters

options: **dict**the label options dictionary for this word.
lw: **int**the width of the text in pixels.
lh: **int**the height of the text in pixels.
text: **string**the text of the word.

class `kivy.core.text.text_layout.`**`LayoutLine`**

Bases: `object`

Formally describes a line of text. A line of text is composed of many `LayoutWord` instances, each with it's own text, size and options.

A `LayoutLine` instance does not always imply that the words contained in the line ended with a newline. That is only the case if `is_last_line` is True. For example a single real line of text can be split across multiple `LayoutLine` instances if the whole line doesn't fit in the constrained width.

Parameters

x: **int**the location in a texture from where the left side of this line is began drawn.
y: **int**the location in a texture from where the bottom of this line is drawn.
w: **int**the width of the line. This is the sum of the individual widths of its `LayoutWord` instances. Does not include any padding.
h: **int**the height of the line. This is the maximum of the individual heights of its `LayoutWord` instances multiplied by the *line_height* of these instance. So this is larger then the word height.
is_last_line: **bool**whether this line was the last line in a paragraph. When True, it implies that the line was followed by a newline. Newlines should not be included in the text of words, but is implicit by setting this to True.
line_wrap: **bool**whether this line is continued from a previous line which didn't fit into a constrained width and was therefore split across multiple `LayoutLine` instances. *line_wrap* can be True or False independently of *is_last_line*.
words: **python list**a list that contains only `LayoutWord` instances describing the text of the line.

CHAPTER

FORTYEIGHT

VIDEO

Core class for reading video files and managing the `kivy.graphics.texture.Texture` video.

Changed in version 1.8.0: There is now 2 distinct Gstreamer implementation: one using Gi/Gst working for both Python 2+3 with Gstreamer 1.0, and one using PyGST working only for Python 2 + Gstreamer 0.10. If you have issue with GStreamer, have a look at *GStreamer compatibility*

Note: Recording is not supported.

class `kivy.core.video.`**`VideoBase`**`(`***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

VideoBase, a class used to implement a video reader.

Parameters

filename[str] Filename of the video. Can be a file or an URI.

eos[str, defaults to 'pause'] Action to take when EOS is hit. Can be one of 'pause', 'stop' or 'loop'.

Changed in version unknown: added 'pause'

async[bool, defaults to True] Load the video asynchronously (may be not supported by all providers).

autoplay[bool, defaults to False] Auto play the video on init.

Events

on_eosFired when EOS is hit.

on_loadFired when the video is loaded and the texture is available.

on_frameFired when a new frame is written to the texture.

`duration`

Get the video duration (in seconds)

`filename`

Get/set the filename/uri of the current video

`load``()`

Load the video from the current filename

`pause``()`

Pause the video

New in version 1.4.0.

`play``()`

Play the video

`position`

Get/set the position in the video (in seconds)

`seek``(`*percent*`)`

Move on percent position

state
: Get the video playing status

stop()
: Stop the video playing

texture
: Get the video texture

unload()
: Unload the actual video

volume
: Get/set the volume in the video (1.0 = 100%)

CHAPTER

FORTYNINE

WINDOW

Core class for creating the default Kivy window. Kivy supports only one window per application: please don't try to create more than one.

class `kivy.core.window.`**`Keyboard`**`(**kwargs)`

Bases: `kivy.event.EventDispatcher`

Keyboard interface that is returned by `WindowBase.request_keyboard()`. When you request a keyboard, you'll get an instance of this class. Whatever the keyboard input is (system or virtual keyboard), you'll receive events through this instance.

Events

on_key_down: **keycode, text, modifiers**Fired when a new key is pressed down

on_key_up: **keycode**Fired when a key is released (up)

Here is an example of how to request a Keyboard in accordance with the current configuration:

```
import kivy
kivy.require('1.0.8')

from kivy.core.window import Window
from kivy.uix.widget import Widget


class MyKeyboardListener(Widget):

    def __init__(self, **kwargs):
        super(MyKeyboardListener, self).__init__(**kwargs)
        self._keyboard = Window.request_keyboard(
            self._keyboard_closed, self, 'text')
        if self._keyboard.widget:
            # If it exists, this widget is a VKeyboard object which you can use
            # to change the keyboard layout.
            pass
        self._keyboard.bind(on_key_down=self._on_keyboard_down)

    def _keyboard_closed(self):
        print('My keyboard have been closed!')
        self._keyboard.unbind(on_key_down=self._on_keyboard_down)
        self._keyboard = None

    def _on_keyboard_down(self, keyboard, keycode, text, modifiers):
        print('The key', keycode, 'have been pressed')
        print(' - text is %r' % text)
        print(' - modifiers are %r' % modifiers)

        # Keycode is composed of an integer + a string
        # If we hit escape, release the keyboard
```

```
            if keycode[1] == 'escape':
                keyboard.release()

            # Return True to accept the key. Otherwise, it will be used by
            # the system.
            return True

    if __name__ == '__main__':
        from kivy.base import runTouchApp
        runTouchApp(MyKeyboardListener())
```

`callback` = None
    Callback that will be called when the keyboard is released

`keycode_to_string`(*value*)
    Convert a keycode number to a string according to the `Keyboard.keycodes`. If the value is not found in the keycodes, it will return ''.

`release`()
    Call this method to release the current keyboard. This will ensure that the keyboard is no longer attached to your callback.

`string_to_keycode`(*value*)
    Convert a string to a keycode number according to the `Keyboard.keycodes`. If the value is not found in the keycodes, it will return -1.

`target` = None
    Target that have requested the keyboard

`widget` = None
    VKeyboard widget, if allowed by the configuration

`window` = None
    Window which the keyboard is attached too

class `kivy.core.window.`**`WindowBase`**(***kwargs*)
    Bases: `kivy.event.EventDispatcher`

WindowBase is an abstract window widget for any window implementation.

Parameters

borderless: **str, one of ('0', '1')**Set the window border state. Check the `config` documentation for a more detailed explanation on the values.

fullscreen: **str, one of ('0', '1', 'auto', 'fake')**Make the window fullscreen. Check the `config` documentation for a more detailed explanation on the values.

width: **int**Width of the window.

height: **int**Height of the window.

Events

on_motion: **etype, motionevent**Fired when a new `MotionEvent` is dispatched

on_touch_down:Fired when a new touch event is initiated.

on_touch_move:Fired when an existing touch event changes location.

on_touch_up:Fired when an existing touch event is terminated.

on_draw:Fired when the `Window` is being drawn.

on_flip:Fired when the `Window` GL surface is being flipped.

on_rotate: **rotation**Fired when the `Window` is being rotated.

on_close:Fired when the `Window` is closed.

on_request_close:Fired when the event loop wants to close the window, or if the escape key is pressed and *exit_on_escape* is *True*. If a function bound to this event returns *True*, the window will not be closed. If the the event is triggered because of the keyboard escape key, the keyword argument *source* is dispatched along with a value of *keyboard* to the bound functions.

on_keyboard: **key, scancode, codepoint, modifier**Fired when the keyboard is used for input.

Changed in version 1.3.0: The *unicode* parameter has been deprecated in favor of codepoint, and will be removed completely in future versions.

on_key_down: **key, scancode, codepoint**Fired when a key pressed.

Changed in version 1.3.0: The *unicode* parameter has been deprecated in favor of codepoint, and will be removed completely in future versions.

on_key_up: **key, scancode, codepoint**Fired when a key is released.

Changed in version 1.3.0: The *unicode* parameter has be deprecated in favor of codepoint, and will be removed completely in future versions.

on_dropfile: **str**Fired when a file is dropped on the application.

Changed in version 1.9.0: *on_request_close* has been added.

add_widget(*widget*)
Add a widget to a window

borderless
When set to True, this property removes the window border/decoration.

New in version 1.9.0.

`borderless` is a `BooleanProperty`, defaults to False.

center
Center of the rotated window.

`center` is a `AliasProperty`.

children
List of the children of this window.

`children` is a `ListProperty` instance and defaults to an empty list.

Use `add_widget()` and `remove_widget()` to manipulate the list of children. Don't manipulate the list directly unless you know what you are doing.

clear()
Clear the window with the background color

clearcolor
Color used to clear the window.

```
from kivy.core.window import Window

# red background color
Window.clearcolor = (1, 0, 0, 1)

# don't clear background at all
Window.clearcolor = None
```

Changed in version 1.7.2: The clearcolor default value is now: (0, 0, 0, 1).

close()
Close the window

create_window(**largs*)
Will create the main window and configure it.

Warning: This method is called automatically at runtime. If you call it, it will recreate a RenderContext and Canvas. This means you'll have a new graphics tree, and the old one will be unusable.
This method exist to permit the creation of a new OpenGL context AFTER closing the first one. (Like using runTouchApp() and stopTouchApp()).
This method has only been tested in a unittest environment and is not suitable for Applications.
Again, don't use this method unless you know exactly what you are doing!

`dpi()`
Return the DPI of the screen. If the implementation doesn't support any DPI lookup, it will just return 96.

Warning: This value is not cross-platform. Use `kivy.base.EventLoop.dpi` instead.

`flip()`
Flip between buffers

`fullscreen`
This property sets the fullscreen mode of the window. Available options are: True, False, 'auto', 'fake'. Check the `config` documentation for a more detailed explanation on the values.

New in version 1.2.0.

Note: The 'fake' option has been deprecated, use the `borderless` property instead.

`height`
Rotated window height.

`height` is a read-only `AliasProperty`.

`hide()`
Hides the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`keyboard_height`
Rerturns the height of the softkeyboard/IME on mobile platforms. Will return 0 if not on mobile platform or if IME is not active.

..versionadded:: 1.9.0

`keyboard_height` is a read-only `AliasProperty` defaults to 0.

`maximize()`
Maximizes the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`minimize`()
Minimizes the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

`modifiers`
List of keyboard modifiers currently active.

`mouse_pos`
2d position of the mouse within the window.

New in version 1.2.0.

`on_close`(**largs*)
Event called when the window is closed

`on_dropfile`(*filename*)
Event called when a file is dropped on the application.

Warning: This event is currently works sdl2 window provider and on pygame window provider and MacOSX with a patched version of pygame. This event is left in place for further evolution (ios, android etc.)

New in version 1.2.0.

`on_flip`()
Flip between buffers (event)

`on_joy_axis`(*stickid, axisid, value*)
Event called when a joystick has a stick or other axis moved

New in version 1.9.0.

`on_joy_ball`(*stickid, ballid, value*)
Event called when a joystick has a ball moved

New in version 1.9.0.

`on_joy_button_down`(*stickid, buttonid*)
Event called when a joystick has a button pressed

New in version 1.9.0.

`on_joy_button_up`(*stickid, buttonid*)
Event called when a joystick has a button released

New in version 1.9.0.

`on_joy_hat`(*stickid, hatid, value*)
Event called when a joystick has a hat/dpad moved

New in version 1.9.0.

`on_key_down`(*key, scancode=None, codepoint=None, modifier=None, **kwargs*)
Event called when a key is down (same arguments as on_keyboard)

on_key_up(*key, scancode=None, codepoint=None, modifier=None, **kwargs*)
Event called when a key is released (same arguments as on_keyboard)

on_keyboard(*key, scancode=None, codepoint=None, modifier=None, **kwargs*)
Event called when keyboard is used.

> **Warning:** Some providers may omit *scancode*, *codepoint* and/or *modifier*!

on_motion(*etype, me*)
Event called when a Motion Event is received.

Parameters

etype: **str**One of 'begin', 'update', 'end'
me: **MotionEvent**The Motion Event currently dispatched.

on_mouse_down(*x, y, button, modifiers*)
Event called when the mouse is used (pressed/released)

on_mouse_move(*x, y, modifiers*)
Event called when the mouse is moved with buttons pressed

on_mouse_up(*x, y, button, modifiers*)
Event called when the mouse is moved with buttons pressed

on_request_close(**largs, **kwargs*)
Event called before we close the window. If a bound function returns *True*, the window will not be closed. If the the event is triggered because of the keyboard escape key, the keyword argument *source* is dispatched along with a value of *keyboard* to the bound functions.

> **Warning:** When the bound function returns True the window will not be closed, so use with care because the user would not be able to close the program, even if the red X is clicked.

on_resize(*width, height*)
Event called when the window is resized.

on_rotate(*rotation*)
Event called when the screen has been rotated.

on_touch_down(*touch*)
Event called when a touch down event is initiated.

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

on_touch_move(*touch*)
Event called when a touch event moves (changes location).

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

on_touch_up(*touch*)
Event called when a touch event is released (terminated).

Changed in version 1.9.0: The touch *pos* is now transformed to window coordinates before this method is called. Before, the touch *pos* coordinate would be *(0, 0)* when this method was called.

parent
Parent of this window.

`parent` is a `ObjectProperty` instance and defaults to None. When created, the parent is set to the window itself. You must take care of it if you are doing a recursive check.

`release_all_keyboards()`

New in version 1.0.8.

This will ensure that no virtual keyboard / system keyboard is requested. All instances will be closed.

`release_keyboard`(*target=None*)

New in version 1.0.4.

Internal method for the widget to release the real-keyboard. Check `request_keyboard()` to understand how it works.

`remove_widget`(*widget*)

Remove a widget from a window

`request_keyboard`(*callback, target, input_type='text'*)

New in version 1.0.4.

Internal widget method to request the keyboard. This method is rarely required by the end-user as it is handled automatically by the `TextInput`. We expose it in case you want to handle the keyboard manually for unique input scenarios.

A widget can request the keyboard, indicating a callback to call when the keyboard is released (or taken by another widget).

Parameters

callback: **func**Callback that will be called when the keyboard is closed. This can be because somebody else requested the keyboard or the user closed it.

target: **Widget**Attach the keyboard to the specified *target*. This should be the widget that requested the keyboard. Ensure you have a different target attached to each keyboard if you're working in a multi user mode.

New in version 1.0.8.

input_type: **string**Choose the type of soft keyboard to request. Can be one of 'text', 'number', 'url', 'mail', 'datetime', 'tel', 'address'.

Note: *input_type* is currently only honored on mobile devices.

New in version 1.8.0.

Return An instance of `Keyboard` containing the callback, target, and if the configuration allows it, a `VKeyboard` instance attached as a *.widget* property.

Note: The behavior of this function is heavily influenced by the current *keyboard_mode*. Please see the Config's *configuration tokens* section for more information.

`restore()`

Restores the size and position of a maximized or minimized window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

rotation
Get/set the window content rotation. Can be one of 0, 90, 180, 270 degrees.

screenshot(*name='screenshot{:04d}.png'*)
Save the actual displayed image in a file

set_icon(*filename*)
Set the icon of the window.

New in version 1.0.5.

set_title(*title*)
Set the window title.

New in version 1.0.5.

set_vkeyboard_class(*cls*)
New in version 1.0.8.

Set the VKeyboard class to use. If set to None, it will use the `kivy.uix.vkeyboard.VKeyboard`.

show()
Shows the window. This method should be used on desktop platforms only.

New in version 1.9.0.

Note: This feature works with the SDL2 window provider only.

Warning: This code is still experimental, and its API may be subject to change in a future version.

size
Get the rotated size of the window. If `rotation` is set, then the size will change to reflect the rotation.

softinput_mode
This specifies the behavior of window contents on display of soft keyboard on mobile platform. Can be one of '', 'pan', 'scale', 'resize'.

When '' The main window is left as it is allowing the user to use `keyboard_height` to manage the window contents the way they want.

when 'pan' The main window pans moving the bottom part of the window to be always on top of the keyboard.

when 'resize' The window is resized and the contents scaled to fit the remaining space.

..versionadded::1.9.0

`softinput_mode` is a `OptionProperty` defaults to None.

system_size
Real size of the window ignoring rotation.

toggle_fullscreen()
Toggle between fullscreen and windowed mode.

Deprecated since version 1.9.0: Use `fullscreen` instead.

width
Rotated window width.

`width` is a read-only `AliasProperty`.

`kivy.core.window.`**`Window`** **= None**

Instance of a `WindowBase` implementation

CHAPTER

FIFTY

EFFECTS

New in version 1.7.0.

Everything starts with the `KineticEffect`, the base class for computing velocity out of a movement.

This base class is used to implement the `ScrollEffect`, a base class used for our `ScrollView` widget effect. We have multiple implementations:

- `ScrollEffect`: base class used for implementing an effect. It only calculates the scrolling and the overscroll.
- `DampedScrollEffect`: uses the overscroll information to allow the user to drag more than expected. Once the user stops the drag, the position is returned to one of the bounds.
- `OpacityScrollEffect`: uses the overscroll information to reduce the opacity of the scrollview widget. When the user stops the drag, the opacity is set back to 1.

50.1 Damped scroll effect

New in version 1.7.0.

This damped scroll effect will use the `overscroll` to calculate the scroll value, and slows going back to the upper or lower limit.

class `kivy.effects.dampedscroll.`**`DampedScrollEffect`**(***kwargs*)

Bases: `kivy.effects.scroll.ScrollEffect`

DampedScrollEffect class. See the module documentation for more information.

`edge_damping`

Edge damping.

`edge_damping` is a `NumericProperty` and defaults to 0.25

`min_overscroll`

An overscroll less than this amount will be normalized to 0.

New in version 1.8.0.

`min_overscroll` is a `NumericProperty` and defaults to .5.

`round_value`

If True, when the motion stops, `value` is rounded to the nearest integer.

New in version 1.8.0.

`round_value` is a `BooleanProperty` and defaults to True.

spring_constant
Spring constant.

spring_constant is a NumericProperty and defaults to 2.0

50.2 Kinetic effect

New in version 1.7.0.

The KineticEffect is the base class that is used to compute the velocity out of a movement. When the movement is finished, the effect will compute the position of the movement according to the velocity, and reduce the velocity with a friction. The movement stop until the velocity is 0.

Conceptually, the usage could be:

```
>>> effect = KineticEffect()
>>> effect.start(10)
>>> effect.update(15)
>>> effect.update(30)
>>> effect.stop(48)
```

Over the time, you will start a movement of a value, update it, and stop the movement. At this time, you'll get the movement value into KineticEffect.value. On the example i've typed manually, the computed velocity will be:

```
>>> effect.velocity
3.1619100231163046
```

After multiple clock interaction, the velocity will decrease according to KineticEffect.friction. The computed value will be stored in KineticEffect.value. The output of this *value* could be:

```
46.30038145219605
54.58302451968686
61.9229016256196
# ...
```

class kivy.effects.kinetic.**KineticEffect**(***kwargs*)
Bases: kivy.event.EventDispatcher

Kinetic effect class. See module documentation for more information.

cancel()
Cancel a movement. This can be used in case stop() cannot be called. It will reset is_manual to False, and compute the movement if the velocity is > 0.

friction
Friction to apply on the velocity

velocity is a NumericProperty and defaults to 0.05.

is_manual
Indicate if a movement is in progress (True) or not (False).

velocity is a BooleanProperty and defaults to False.

max_history
Save up to *max_history* movement value into the history. This is used for correctly calculating the velocity according to the movement.

max_history is a NumericProperty and defaults to 5.

min_distance
The minimal distance for a movement to have nonzero velocity.

New in version 1.8.0.

min_distance is NumericProperty and defaults to 0.1.

min_velocity
Velocity below this quantity is normalized to 0. In other words, any motion whose velocity falls below this number is stopped.

min_velocity is a NumericProperty and defaults to 0.5.

start(*val*, *t=None*)
Start the movement.

Parameters

***val*: float or int**Value of the movement

***t*: float, defaults to None**Time when the movement happen. If no time is set, it will use time.time()

stop(*val*, *t=None*)
Stop the movement.

See start() for the arguments.

update(*val*, *t=None*)
Update the movement.

See start() for the arguments.

update_velocity(*dt*)
(internal) Update the velocity according to the frametime and friction.

value
Value (during the movement and computed) of the effect.

velocity is a NumericProperty and defaults to 0.

velocity
Velocity of the movement.

velocity is a NumericProperty and defaults to 0.

50.3 Opacity scroll effect

Based on the DampedScrollEffect, this one will also decrease the opacity of the target widget during the overscroll.

class kivy.effects.opacityscroll.**OpacityScrollEffect**(***kwargs*)
Bases: kivy.effects.dampedscroll.DampedScrollEffect

OpacityScrollEffect class. Uses the overscroll information to reduce the opacity of the scrollview widget. When the user stops the drag, the opacity is set back to 1.

50.4 Scroll effect

New in version 1.7.0.

Based on the kinetic effect, the ScrollEffect will limit the movement to bounds determined by its min and max properties. If the movement exceeds these bounds, it will calculate the amount of overscroll and try to return to the value of one of the bounds.

This is very useful for implementing a scrolling list. We actually use this class as a base effect for our `ScrollView` widget.

class `kivy.effects.scroll.`**`ScrollEffect`**`(`***kwargs*`)`

Bases: `kivy.effects.kinetic.KineticEffect`

ScrollEffect class. See the module documentation for more informations.

`displacement`

Cumulative distance of the movement during the interaction. This is used to determine if the movemenent is a drag (more than `drag_threshold`) or not.

`displacement` is a `NumericProperty` and defaults to 0.

`drag_threshold`

Minimum distance to travel before the movement is considered as a drag.

`velocity` is a `NumericProperty` and defaults to 20sp.

`max`

Maximum boundary to use for scrolling.

`max` is a `NumericProperty` and defaults to 0.

`min`

Minimum boundary to use for scrolling.

`min` is a `NumericProperty` and defaults to 0.

`overscroll`

Computed value when the user over-scrolls i.e. goes out of the bounds.

`overscroll` is a `NumericProperty` and defaults to 0.

`reset``(`*pos*`)`

(internal) Reset the value and the velocity to the *pos*. Mostly used when the bounds are checked.

`scroll`

Computed value for scrolling. This value is different from `kivy.effects.kinetic.KineticEffect.value` in that it will return to one of the min/max bounds.

`scroll` is a `NumericProperty` and defaults to 0.

`target_widget`

Widget to attach to this effect. Even if this class doesn't make changes to the *target_widget* by default, subclasses can use it to change the graphics or apply custom transformations.

`target_widget` is a `ObjectProperty` and defaults to None.

CHAPTER

FIFTYONE

DAMPED SCROLL EFFECT

New in version 1.7.0.

This damped scroll effect will use the `overscroll` to calculate the scroll value, and slows going back to the upper or lower limit.

class `kivy.effects.dampedscroll.`**`DampedScrollEffect`**`(`***kwargs*`)`

Bases: `kivy.effects.scroll.ScrollEffect`

DampedScrollEffect class. See the module documentation for more information.

`edge_damping`

Edge damping.

`edge_damping` is a `NumericProperty` and defaults to 0.25

`min_overscroll`

An overscroll less than this amount will be normalized to 0.

New in version 1.8.0.

`min_overscroll` is a `NumericProperty` and defaults to .5.

`round_value`

If True, when the motion stops, `value` is rounded to the nearest integer.

New in version 1.8.0.

`round_value` is a `BooleanProperty` and defaults to True.

`spring_constant`

Spring constant.

`spring_constant` is a `NumericProperty` and defaults to 2.0

CHAPTER

FIFTYTWO

KINETIC EFFECT

New in version 1.7.0.

The KineticEffect is the base class that is used to compute the velocity out of a movement. When the movement is finished, the effect will compute the position of the movement according to the velocity, and reduce the velocity with a friction. The movement stop until the velocity is 0.

Conceptually, the usage could be:

```
>>> effect = KineticEffect()
>>> effect.start(10)
>>> effect.update(15)
>>> effect.update(30)
>>> effect.stop(48)
```

Over the time, you will start a movement of a value, update it, and stop the movement. At this time, you'll get the movement value into KineticEffect.value. On the example i've typed manually, the computed velocity will be:

```
>>> effect.velocity
3.1619100231163046
```

After multiple clock interaction, the velocity will decrease according to KineticEffect.friction. The computed value will be stored in KineticEffect.value. The output of this *value* could be:

```
46.30038145219605
54.58302451968686
61.9229016256196
# ...
```

class kivy.effects.kinetic.**KineticEffect**(***kwargs*)

Bases: kivy.event.EventDispatcher

Kinetic effect class. See module documentation for more information.

cancel()

Cancel a movement. This can be used in case stop() cannot be called. It will reset is_manual to False, and compute the movement if the velocity is > 0.

friction

Friction to apply on the velocity

velocity is a NumericProperty and defaults to 0.05.

is_manual

Indicate if a movement is in progress (True) or not (False).

velocity is a BooleanProperty and defaults to False.

max_history

Save up to *max_history* movement value into the history. This is used for correctly calculating the velocity according to the movement.

`max_history` is a `NumericProperty` and defaults to 5.

min_distance

The minimal distance for a movement to have nonzero velocity.

New in version 1.8.0.

`min_distance` is `NumericProperty` and defaults to 0.1.

min_velocity

Velocity below this quantity is normalized to 0. In other words, any motion whose velocity falls below this number is stopped.

`min_velocity` is a `NumericProperty` and defaults to 0.5.

start(*val*, *t=None*)

Start the movement.

Parameters

val: **float or int**Value of the movement

t: **float, defaults to None**Time when the movement happen. If no time is set, it will use time.time()

stop(*val*, *t=None*)

Stop the movement.

See `start()` for the arguments.

update(*val*, *t=None*)

Update the movement.

See `start()` for the arguments.

update_velocity(*dt*)

(internal) Update the velocity according to the frametime and friction.

value

Value (during the movement and computed) of the effect.

`velocity` is a `NumericProperty` and defaults to 0.

velocity

Velocity of the movement.

`velocity` is a `NumericProperty` and defaults to 0.

CHAPTER

FIFTYTHREE

OPACITY SCROLL EFFECT

Based on the `DampedScrollEffect`, this one will also decrease the opacity of the target widget during the overscroll.

class `kivy.effects.opacityscroll.`**`OpacityScrollEffect`**`(`***kwargs*`)`

Bases: `kivy.effects.dampedscroll.DampedScrollEffect`

OpacityScrollEffect class. Uses the overscroll information to reduce the opacity of the scrollview widget. When the user stops the drag, the opacity is set back to 1.

CHAPTER

FIFTYFOUR

SCROLL EFFECT

New in version 1.7.0.

Based on the `kinetic` effect, the `ScrollEffect` will limit the movement to bounds determined by its `min` and `max` properties. If the movement exceeds these bounds, it will calculate the amount of `overscroll` and try to return to the value of one of the bounds.

This is very useful for implementing a scrolling list. We actually use this class as a base effect for our `ScrollView` widget.

class `kivy.effects.scroll.`**`ScrollEffect`**`(`***kwargs*`)`

Bases: `kivy.effects.kinetic.KineticEffect`

ScrollEffect class. See the module documentation for more informations.

`displacement`

Cumulative distance of the movement during the interaction. This is used to determine if the movemenent is a drag (more than `drag_threshold`) or not.

`displacement` is a `NumericProperty` and defaults to 0.

`drag_threshold`

Minimum distance to travel before the movement is considered as a drag.

`velocity` is a `NumericProperty` and defaults to 20sp.

`max`

Maximum boundary to use for scrolling.

`max` is a `NumericProperty` and defaults to 0.

`min`

Minimum boundary to use for scrolling.

`min` is a `NumericProperty` and defaults to 0.

`overscroll`

Computed value when the user over-scrolls i.e. goes out of the bounds.

`overscroll` is a `NumericProperty` and defaults to 0.

`reset``(`*pos*`)`

(internal) Reset the value and the velocity to the *pos*. Mostly used when the bounds are checked.

`scroll`

Computed value for scrolling. This value is different from `kivy.effects.kinetic.KineticEffect.value` in that it will return to one of the min/max bounds.

`scroll` is a `NumericProperty` and defaults to 0.

`target_widget`

Widget to attach to this effect. Even if this class doesn't make changes to the *target_widget* by default, subclasses can use it to change the graphics or apply custom transformations.

`target_widget` is a `ObjectProperty` and defaults to None.

CHAPTER

FIFTYFIVE

EVENT DISPATCHER

All objects that produce events in Kivy implement the `EventDispatcher` which provides a consistent interface for registering and manipulating event handlers.

Changed in version 1.0.9: Property discovery and methods have been moved from the `Widget` to the `EventDispatcher`.

class `kivy.event.`**`EventDispatcher`**

Bases: `kivy.event.ObjectWithUid`

Generic event dispatcher interface.

See the module docstring for usage.

`bind``()`

Bind an event type or a property to a callback.

Usage:

```
# With properties
def my_x_callback(obj, value):
    print('on object', obj, 'x changed to', value)
def my_width_callback(obj, value):
    print('on object', obj, 'width changed to', value)
self.bind(x=my_x_callback, width=my_width_callback)

# With event
def my_press_callback(obj):
    print('event on object', obj)
self.bind(on_press=my_press_callback)
```

In general, property callbacks are called with 2 arguments (the object and the property's new value) and event callbacks with one argument (the object). The example above illustrates this.

The following example demonstrates various ways of using the bind function in a complete application:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.app import App
from kivy.uix.button import Button
from functools import partial


class DemoBox(BoxLayout):
    """
    This class demonstrates various techniques that can be used for binding to
    events. Although parts could me made more optimal, advanced Python concepts
    are avoided for the sake of readability and clarity.
    """
    def __init__(self, **kwargs):
        super(DemoBox, self).__init__(**kwargs)
        self.orientation = "vertical"

        # We start with binding to a normal event. The only argument
        # passed to the callback is the object which we have bound to.
        btn = Button(text="Normal binding to event")
        btn.bind(on_press=self.on_event)

        # Next, we bind to a standard property change event. This typically
        # passes 2 arguments: the object and the value
        btn2 = Button(text="Normal binding to a property change")
        btn2.bind(state=self.on_property)

        # Here we use anonymous functions (a.k.a lambdas) to perform binding.
        # Their advantage is that you can avoid declaring new functions i.e.
        # they offer a concise way to "redirect" callbacks.
        btn3 = Button(text="Using anonymous functions.")
        btn3.bind(on_press=lambda x: self.on_event(None))

        # You can also declare a function that accepts a variable number of
        # positional and keyword arguments and use introspection to determine
        # what is being passed in. This is very handy for debugging as well
        # as function re-use. Here, we use standard event binding to a function
        # that accepts optional positional and keyword arguments.
        btn4 = Button(text="Use a flexible function")
        btn4.bind(on_press=self.on_anything)

        # Lastly, we show how to use partial functions. They are sometimes
        # difficult to grasp, but provide a very flexible and powerful way to
        # reuse functions.
        btn5 = Button(text="Using partial functions. For hardcores.")
        btn5.bind(on_press=partial(self.on_anything, "1", "2", monthy="python"))

        for but in [btn, btn2, btn3, btn4, btn5]:
            self.add_widget(but)

    def on_event(self, obj):
        print("Typical event from", obj)

    def on_property(self, obj, value):
        print("Typical property change from", obj, "to", value)

    def on_anything(self, *args, **kwargs):
        print('The flexible function has *args of', str(args),
            "and **kwargs of", str(kwargs))


class DemoApp(App):
    def build(self):
        return DemoBox()

if __name__ == "__main__":
    DemoApp().run()
```

When binding a function to an event, a `kivy.weakmethod.WeakMethod` of the callback is saved, and when dispatching the callback is removed if the callback reference becomes invalid. For properties, the actual callback is saved.

Another difference between binding to an event vs a property; when binding to a property, if this callback has already been bound to this property, it won't be added again. For events, we don't do this check.

create_property()

Create a new property at runtime.

New in version 1.0.9.

Changed in version 1.8.0: *value* parameter added, can be used to set the default value of the property. Also, the type of the value is used to specialize the created property.

Changed in version 1.9.0: In the past, if *value* was of type *bool*, a *NumericProperty* would be created, now a *BooleanProperty* is created.

Warning: This function is designed for the Kivy language, don't use it in your code. You should declare the property in your class instead of using this method.

Parameters

name: **string**Name of the property

value: **object, optional**Default value of the property. Type is also used for creating more appropriate property types. Defaults to None.

```
>>> mywidget = Widget()
>>> mywidget.create_property('custom')
>>> mywidget.custom = True
>>> print(mywidget.custom)
True
```

dispatch()

Dispatch an event across all the handlers added in bind/fast_bind(). As soon as a handler returns True, the dispatching stops.

The function collects all the positional and keyword arguments and passes them on to the handlers.

Note: The handlers are called in reverse order than they were registered with `bind()`.

Parameters

event_type: **str**the event name to dispatch.

Changed in version 1.9.0: Keyword arguments collection and forwarding was added. Before, only positional arguments would be collected and forwarded.

events()

Return all the events in the class. Can be used for introspection.

New in version 1.8.0.

fast_bind()

A method for faster binding. This method is somewhat different than `bind()` and is meant for more advanced users and internal usage. It can be used as long as the following points are heeded.

- As opposed to `bind()`, it does not check that this function and largs/kwargs has not been bound before to this name. So binding the same callback multiple times will just keep adding it.
- Although `bind()` creates a `WeakMethod` when binding to an event, this method stores the callback directly.
- This method returns True if *name* was found and bound, and *False*, otherwise. It does not raise an exception, like `bind()`, would if the property *name* is not found.

When binding a callback with largs and/or kwargs, `fast_unbind()` must be used for unbinding. If no largs and kwargs are provided, `unbind()` may be used as well.

This method passes on any caught positional and/or keyword arguments to the callback, removing the need to call partial. When calling the callback the expended largs are passed on followed by instance/value (just instance for kwargs) followed by expended kwargs.

Following is an example of usage similar to the example in `bind()`:

```
class DemoBox(BoxLayout):

    def __init__(self, **kwargs):
        super(DemoBox, self).__init__(**kwargs)
        self.orientation = "vertical"

        btn = Button(text="Normal binding to event")
        btn.fast_bind(’on_press’, self.on_event)

        btn2 = Button(text="Normal binding to a property change")
        btn2.fast_bind(’state’, self.on_property)

        btn3 = Button(text="A: Using function with args.")
        btn3.fast_bind(’on_press’, self.on_event_with_args, ’right’,
                       tree=’birch’, food=’apple’)

        btn4 = Button(text="Unbind A.")
        btn4.fast_bind(’on_press’, self.unbind_a, btn3)

        btn5 = Button(text="Use a flexible function")
        btn5.fast_bind(’on_press’, self.on_anything)

        btn6 = Button(text="B: Using flexible functions with args. For hardcores.")
        btn6.fast_bind(’on_press’, self.on_anything, "1", "2", monthy="python")

        btn7 = Button(text="Force dispatch B with different params")
        btn7.fast_bind(’on_press’, btn6.dispatch, ’on_press’, 6, 7, monthy="other pytho

        for but in [btn, btn2, btn3, btn4, btn5, btn6, btn7]:
            self.add_widget(but)

    def on_event(self, obj):
        print("Typical event from", obj)

    def on_event_with_args(self, side, obj, tree=None, food=None):
        print("Event with args", obj, side, tree, food)

    def on_property(self, obj, value):
        print("Typical property change from", obj, "to", value)

    def on_anything(self, *args, **kwargs):
        print(’The flexible function has *args of’, str(args),
            "and **kwargs of", str(kwargs))
        return True

    def unbind_a(self, btn, event):
        btn.fast_unbind(’on_press’, self.on_event_with_args, ’right’,
                        tree=’birch’, food=’apple’)
```

Note: Since the kv lang uses this method to bind, one has to implement this method, instead of `bind()` when creating a non `EventDispatcher` based class used with the kv lang. See

`Observable` for an example.

New in version 1.9.0.

`fast_unbind()`
Similar to `fast_bind()`.

When unbinding from a property `unbind()` will unbind all callbacks that match the callback, while this method will only unbind the first (as it is assumed that the combination of func and largs/kwargs are uniquely bound).

To unbind, the same positional and keyword arguments passed to `fast_bind()` must be passed on to fast_unbind.

New in version 1.9.0.

`get_property_observers()`
Returns a list of methods that are bound to the property/event passed as the *name* argument:

```
widget_instance.get_property_observers('on_release')
```

New in version 1.8.0.

Changed in version 1.9.0: To keep compatibility, callbacks bound with `fast_bind()` will also only return the callback function and not their provided args.

`getter()`
Return the getter of a property.

New in version 1.0.9.

`is_event_type()`
Return True if the event_type is already registered.

New in version 1.0.4.

`properties()`
Return all the properties in the class in a dictionary of key/property class. Can be used for introspection.

New in version 1.0.9.

`property()`
Get a property instance from the property name. If quiet is True, None is returned instead of raising an exception when *name* is not a property. Defaults to *False*.

New in version 1.0.9.
ReturnsA `Property` derived instance corresponding to the name.
Changed in version 1.9.0: quiet was added.

`proxy_ref`
Default implementation of proxy_ref, returns self. ..versionadded:: 1.9.0

`register_event_type()`
Register an event type with the dispatcher.

Registering event types allows the dispatcher to validate event handler names as they are attached and to search attached objects for suitable handlers. Each event type declaration must:
1.start with the prefix *on_*.
2.have a default handler in the class.
Example of creating a custom event:

```
class MyWidget(Widget):
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        self.register_event_type('on_swipe')

    def on_swipe(self):
        pass

def on_swipe_callback(*largs):
    print('my swipe is called', largs)
w = MyWidget()
w.dispatch('on_swipe')
```

setter()

Return the setter of a property. Use: instance.setter('name'). The setter is a convenient callback function useful if you want to directly bind one property to another. It returns a partial function that will accept (obj, value) args and results in the property 'name' of instance being set to value.

New in version 1.0.9.

For example, to bind number2 to number1 in python you would do:

```
class ExampleWidget(Widget):
    number1 = NumericProperty(None)
    number2 = NumericProperty(None)

    def __init__(self, **kwargs):
        super(ExampleWidget, self).__init__(**kwargs)
        self.bind(number1=self.setter('number2'))
```

This is equivalent to kv binding:

```
<ExampleWidget>:
    number2: self.number1
```

unbind()

Unbind properties from callback functions with similar usage as `bind()`.

One difference between unbinding from an event vs. property, is that when unbinding from an event, we stop after the first callback match. For properties, we remove all matching callbacks.

Note, a callback bound with `fast_bind()` without any largs or kwargs is equivalent to one bound with `bind()` so either `unbind()` or `fast_unbind()` will unbind it.

unregister_event_types()

Unregister an event type in the dispatcher.

class `kivy.event.`**ObjectWithUid**

Bases: `object`

(internal) This class assists in providing unique identifiers for class instances. It it not intended for direct usage.

class `kivy.event.`**Observable**

Bases: `kivy.event.ObjectWithUid`

`Observable` is a stub class defining the methods required for binding. `EventDispatcher` is (the) one example of a class that implements the binding interface. See `EventDispatcher` for details.

New in version 1.9.0.

fast_bind()
See EventDispatcher.fast_bind().

Note: To keep backward compatibility with derived classes which may have inherited from Observable before, the fast_bind() method was added. The default implementation of fast_bind() and fast_unbind() is to create a partial function that it passes to bind. However, fast_unbind() is fairly inefficient since we have to lookup this partial function before we can call unbind(). It is recommended to overwrite these methods in derived classes to bind directly for better performance.

fast_unbind()
See fast_bind().

CHAPTER

FIFTYSIX

EXTENSION SUPPORT

Sometimes your application requires functionality that is beyond the scope of what Kivy can deliver. In those cases it is necessary to resort to external software libraries. Given the richness of the Python ecosystem, there is already a great number of software libraries that you can simply import and use right away.

For some third-party libraries, it's not as easy as that though. Some libraries require special *wrappers* to be written for them in order to be compatible with Kivy. Some libraries might even need to be patched so that they can be used (e.g. if they open their own OpenGL context to draw in and don't support proper offscreen rendering). On those occasions it is often possible to patch the library in question and to provide a Python wrapper around it that is compatible with Kivy. Sticking with this example, you can't just use the wrapper with a 'normal' installation of the library because the patch would be missing.

That is where Kivy extensions come in handy. A Kivy extension represents a single third-party library that is provided in a way so that it can simply be downloaded as a single file, put in a special directory and then offers the functionality of the wrapped library to Kivy applications. These extensions will not pollute the global Python environment (as they might be unusable on their own after potential patches have been applied) because they reside in special directories for Kivy that are not accessed by Python by default.

Kivy extensions are provided as `*.kex` files. They are really just zip files, but you must not unzip them yourself. Kivy will do that for you as soon as it's appropriate to do so.

Warning: Again, do not try to unzip `*.kex` files on your own. While unzipping will work, Kivy will not be able to load the extension and will simply ignore it.

With Kivy's extension system, your application can use specially packaged third-party libraries in a backwards compatible way (by specifying the version that you require) even if the actual third-party library does not guarantee backwards-compatibility. There will be no breakage if newer versions are installed (as a properly suited old version will still be used). For more information about that behaviour, consider the documentation of the `load()` function.

If you want to provide an extension on your own, there is a helper script that sets up the initial extension folder structure that Kivy requires for extensions. It can be found at kivy/tools/extensions/make-kivyext.py

`kivy.ext.`**`load`**`(`*extname, version*`)`

Use this function to tell Kivy to load a specific version of the given Extension. This is different from kivy's require() in that it will always use the exact same major version you specify even if a newer (major) version is available. This is because we cannot make the same backwards-compatibility guarantee that we make with Kivy for third-party extensions. You will still get fixes and optimizations that don't break backwards compatibility via minor version upgrades of the extension.

The function will then return the loaded module as a Python module object and you can bind it to a name of your choosing. This prevents clashes with modules with the same name that might be installed in a system directory.

Usage example for this function:

```
from kivy.ext import load
myextension = load('myextension', (2, 1))
# You can now use myextension as if you had done ``import myextension``,
# but with the added benefit of using the proper version.
```

Parameters

extname: **str**The exact name of the extension that you want to use.

version: **two-tuple of ints**A tuple of the form (major, minor), where major and minor are ints that specify the major and minor version number for the extension, e.g. (1, 2) would be akin to 1.2. It is important to note that between minor versions, backwards compatibility is guaranteed, but between major versions it is not. I.e. if you change your extension in a backwards incompatible way, increase the major version number (and reset the minor to 0). If you just do a bug fix or add an optional, backwards-compatible feature, you can just increase the minor version number. If the application then requires version (1, 2), every version starting with that version number will be ok and by default the latest version will be choosen. The two ints major and minor can both be in range(0, infinity).

`kivy.ext.`**`unzip_extensions`**`()`

Unzips Kivy extensions. Internal usage only: don't use it yourself unless you know what you're doing and really want to trigger installation of new extensions.

For your file to be recognized as an extension, it has to fulfil a few requirements:

- We require that the file has the `*.kex` extension to make the distinction between a Kivy extension and an ordinary zip file clear.
- We require that the `*.kex` extension files be put into any of the directories listed in EXTENSION_PATHS which is normally ~/.kivy/extensions and extensions/ inside kivy's base directory. We do not look for extensions on sys.path or elsewhere in the system.
- We require that the Kivy extension is zipped in a way so that Python's zipfile module can extract it properly.
- We require that the extension internally obeys the common Kivy extension format, which looks like this:

```
|-- myextension/
    |-- __init__.py
    |-- data/
```

  The `__init__.py` file is the main entrypoint to the extension. All names that should be usable when the extension is loaded need to be exported (i.e. made available) in the namespace of that file.

  How the extension accesses the code of the library that it wraps (be it pure Python or binary code) is up to the extension. For example there could be another Python module adjacent to the `__init__.py` file from which the `__init__.py` file imports the usable names that it wants to expose.
- We require that the version of the extension be specified in the `setup.py` file that is created by the Kivy extension wizard and that the version specification format as explained in `load()` be used.

CHAPTER

FIFTYSEVEN

FACTORY OBJECT

The factory can be used to automatically register any class or module and instantiate classes from it anywhere in your project. It is an implementation of the Factory Pattern.

The class list and available modules are automatically generated by setup.py.

Example for registering a class/module:

```
>>> from kivy.factory import Factory
>>> Factory.register('Widget', module='kivy.uix.widget')
>>> Factory.register('Vector', module='kivy.vector')
```

Example of using the Factory:

```
>>> from kivy.factory import Factory
>>> widget = Factory.Widget(pos=(456,456))
>>> vector = Factory.Vector(9, 2)
```

Example using a class name:

```
>>> from kivy.factory import Factory
>>> Factory.register('MyWidget', cls=MyWidget)
```

By default, the first classname you register via the factory is permanent. If you wish to change the registered class, you need to unregister the classname before you re-assign it:

```
>>> from kivy.factory import Factory
>>> Factory.register('MyWidget', cls=MyWidget)
>>> widget = Factory.MyWidget()
>>> Factory.unregister('MyWidget')
>>> Factory.register('MyWidget', cls=CustomWidget)
>>> customWidget = Factory.MyWidget()
```

`kivy.factory.`**`Factory`** **= <kivy.factory.FactoryBase object at 0x963d10c>**

Factory instance to use for getting new classes

CHAPTER

FIFTYEIGHT

GARDEN

New in version 1.7.0.

Changed in version 1.8.0.

Garden is a project to centralize addons for Kivy maintained by users. You can find more information at Kivy Garden. All the garden packages are centralized on the kivy-garden Github repository.

Garden is now distributed as a separate Python module, kivy-garden. You can install it with pip:

```
pip install kivy-garden
```

The garden module does not initially include any packages. You can download them with the garden tool installed by the pip package:

```
# Installing a garden package
garden install graph

# Upgrade a garden package
garden install --upgrade graph

# Uninstall a garden package
garden uninstall graph

# List all the garden packages installed
garden list

# Search new packages
garden search

# Search all the packages that contain "graph"
garden search graph

# Show the help
garden --help
```

All the garden packages are installed by default in *~/.kivy/garden*.

Note: In previous versions of Kivy, garden was a tool at kivy/tools/garden. This no longer exists, but the kivy-garden module provides exactly the same functionality.

58.1 Packaging

If you want to include garden packages in your application, you can add *–app* to the *install* command. This will create a *libs/garden* directory in your current directory which will be used by *kivy.garden*.

For example:

```
cd myapp
garden install --app graph
```

kivy.garden.**garden_system_dir = 'garden'**
system path where garden modules can be installed

CHAPTER

FIFTYNINE

GEOMETRY UTILITIES

This module contains some helper functions for geometric calculations.

`kivy.geometry.`**`circumcircle`**`(`*a, b, c*`)`

Computes the circumcircle of a triangle defined by a, b, c. See: http://en.wikipedia.org/wiki/Circumscribed_circle

Parameters

a[iterable containing at least 2 values (for x and y)] The 1st point of the triangle.

b[iterable containing at least 2 values (for x and y)] The 2nd point of the triangle.

c[iterable containing at least 2 values (for x and y)] The 3rd point of the triangle.

Return

A tuple that defines the circle :

- The first element in the returned tuple is the center as (x, y)
- The second is the radius (float)

`kivy.geometry.`**`minimum_bounding_circle`**`(`*points*`)`

Returns the minimum bounding circle for a set of points.

For a description of the problem being solved, see the Smallest Circle Problem.

The function uses Applet's Algorithm, the runtime is O(h^3, *n), where h is the number of points in the convex hull of the set of points. **But** it runs in linear time in almost all real world cases. See: http://tinyurl.com/6e4n5yb

Parameters

points[iterable] A list of points (2 tuple with x,y coordinates)

Return

A tuple that defines the circle:

- The first element in the returned tuple is the center (x, y)
- The second the radius (float)

CHAPTER

SIXTY

GESTURE RECOGNITION

This class allows you to easily create new gestures and compare them:

```
from kivy.gesture import Gesture, GestureDatabase

# Create a gesture
g = Gesture()
g.add_stroke(point_list=[(1,1), (3,4), (2,1)])
g.normalize()

# Add it to the database
gdb = GestureDatabase()
gdb.add_gesture(g)

# And for the next gesture, try to find it!
g2 = Gesture()
# ...
gdb.find(g2)
```

Warning: You don't really want to do this: it's more of an example of how to construct gestures dynamically. Typically, you would need a lot more points, so it's better to record gestures in a file and reload them to compare later. Look in the examples/gestures directory for an example of how to do that.

class `kivy.gesture.`**`Gesture`**(*tolerance=None*)

A python implementation of a gesture recognition algorithm by Oleg Dopertchouk: http://www.gamedev.net/reference/articles/article2039.asp

Implemented by Jeiel Aranal (chemikhazi@gmail.com), released into the public domain.

`add_stroke`(*point_list=None*)

Adds a stroke to the gesture and returns the Stroke instance. Optional point_list argument is a list of the mouse points for the stroke.

`dot_product`(*comparison_gesture*)

Calculates the dot product of the gesture with another gesture.

`get_rigid_rotation`(*dstpts*)

Extract the rotation to apply to a group of points to minimize the distance to a second group of points. The two groups of points are assumed to be centered. This is a simple version that just picks an angle based on the first point of the gesture.

`get_score`(*comparison_gesture, rotation_invariant=True*)

Returns the matching score of the gesture against another gesture.

`normalize`(*stroke_samples=32*)

Runs the gesture normalization algorithm and calculates the dot product with self.

class `kivy.gesture.`**`GestureDatabase`**
Bases: `object`

Class to handle a gesture database.

`add_gesture`(*gesture*)
Add a new gesture to the database.

`find`(*gesture*, *minscore=0.9*, *rotation_invariant=True*)
Find a matching gesture in the database.

`gesture_to_str`(*gesture*)
Convert a gesture into a unique string.

`str_to_gesture`(*data*)
Convert a unique string to a gesture.

class `kivy.gesture.`**`GestureStroke`**
Gestures can be made up of multiple strokes.

`add_point`(*x=x_pos*, *y=y_pos*)
Adds a point to the stroke.

`center_stroke`(*offset_x*, *offset_y*)
Centers the stroke by offseting the points.

`normalize_stroke`(*sample_points=32*)
Normalizes strokes so that every stroke has a standard number of points. Returns True if stroke is normalized, False if it can't be normalized. sample_points controls the resolution of the stroke.

`points_distance`(*point1=GesturePoint*, *point2=GesturePoint*)
Returns the distance between two GesturePoints.

`scale_stroke`(*scale_factor=float*)
Scales the stroke down by scale_factor.

`stroke_length`(*point_list=None*)
Finds the length of the stroke. If a point list is given, finds the length of that list.

CHAPTER

SIXTYONE

GRAPHICS

This package assembles many low level functions used for drawing. The whole graphics package is compatible with OpenGL ES 2.0 and has many rendering optimizations.

61.1 The basics

For drawing on a screen, you will need :

1. a `Canvas` object.
2. `Instruction` objects.

Each `Widget` in Kivy already has a `Canvas` by default. When you create a widget, you can create all the instructions needed for drawing. If *self* is your current widget, you can do:

```
from kivy.graphics import *
with self.canvas:
    # Add a red color
    Color(1., 0, 0)

    # Add a rectangle
    Rectangle(pos=(10, 10), size=(500, 500))
```

The instructions `Color` and `Rectangle` are automaticly added to the canvas object and will be used when the window is drawn.

Note: Kivy drawing instructions are not automatically relative to the widgets position or size. You therefore you need to consider these factors when drawing. In order to make your drawing instructions relative to the widget, the instructions need either to be declared in the `KvLang` or bound to pos and size changes. Please see *Adding a Background to a Layout* for more detail.

61.2 GL Reloading mechanism

New in version 1.2.0.

During the lifetime of the application, the OpenGL context might be lost. This happens:

- when the window is resized on MacOSX or the Windows platform and you're using pygame as a window provider. This is due to SDL 1.2. In the SDL 1.2 design, it needs to recreate a GL context everytime the window is resized. This was fixed in SDL 1.3 but pygame is not yet available on it by default.

- when Android releases the app resources: when your application goes to the background, Android might reclaim your opengl context to give the resource to another app. When the user switches back to your application, a newly created gl context is given to your app.

Starting from 1.2.0, we have introduced a mechanism for reloading all the graphics resources using the GPU: Canvas, FBO, Shader, Texture, VBO, and VertexBatch:

- VBO and VertexBatch are constructed by our graphics instructions. We have all the data needed to reconstruct when reloading.
- Shader: same as VBO, we store the source and values used in the shader so we are able to recreate the vertex/fragment/program.
- Texture: if the texture has a source (an image file or atlas), the image is reloaded from the source and reuploaded to the GPU.

You should cover theses cases yourself:

- Textures without a source: if you manually created a texture and manually blit data / a buffer to it, you must handle the reloading yourself. Check the *Texture* to learn how to manage that case. (The text rendering already generates the texture and handles the reloading. You don't need to reload text yourself.)
- FBO: if you added / removed / drew things multiple times on the FBO, we can't reload it. We don't keep a history of the instructions put on it. As for textures without a source, check the *Framebuffer* to learn how to manage that case.

class `kivy.graphics.`**`Bezier`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d Bezier curve.

New in version 1.0.8.

Parameters

***points*: list**List of points in the format (x1, y1, x2, y2...)

***segments*: int, defaults to 180**Define how many segments are needed for drawing the curve. The drawing will be smoother if you have many segments.

***loop*: bool, defaults to False**Set the bezier curve to join the last point to the first.

***dash_length*: int**Length of a segment (if dashed), defaults to 1.

***dash_offset*: int**Distance between the end of a segment and the start of the next one, defaults to 0. Changing this makes it dashed.

`dash_length`

Property for getting/setting the length of the dashes in the curve.

`dash_offset`

Property for getting/setting the offset between the dashes in the curve.

`points`

Property for getting/settings the points of the triangle.

Warning: This will always reconstruct the whole graphic from the new points list. It can be very CPU intensive.

`segments`

Property for getting/setting the number of segments of the curve.

class `kivy.graphics.`**`BindTexture`**

Bases: `kivy.graphics.instructions.ContextInstruction`

BindTexture Graphic instruction. The BindTexture Instruction will bind a texture and enable GL_TEXTURE_2D for subsequent drawing.

Parameters

texture: **Texture**Specifies the texture to bind to the given index.

`source`

Set/get the source (filename) to load for the texture.

class `kivy.graphics.`**`BorderImage`**

Bases: `kivy.graphics.vertex_instructions.Rectangle`

A 2d border image. The behavior of the border image is similar to the concept of a CSS3 border-image.

Parameters

border: **list**Border information in the format (top, right, bottom, left). Each value is in pixels.

`border`

Property for getting/setting the border of the class.

class `kivy.graphics.`**`Callback`**

Bases: `kivy.graphics.instructions.Instruction`

New in version 1.0.4.

A Callback is an instruction that will be called when the drawing operation is performed. When adding instructions to a canvas, you can do this:

```
with self.canvas:
    Color(1, 1, 1)
    Rectangle(pos=self.pos, size=self.size)
    Callback(self.my_callback)
```

The definition of the callback must be:

```
def my_callback(self, instr):
    print('I have been called!')
```

Warning: Note that if you perform many and/or costly calls to callbacks, you might potentially slow down the rendering performance significantly.

The updating of your canvas does not occur until something new happens. From your callback, you can ask for an update:

```
with self.canvas:
    self.cb = Callback(self.my_callback)
# then later in the code
self.cb.ask_update()
```

If you use the Callback class to call rendering methods of another toolkit, you will have issues with the OpenGL context. The OpenGL state may have been manipulated by the other toolkit, and as soon as program flow returns to Kivy, it will just break. You can have glitches, crashes, black holes might occur, etc. To avoid that, you can activate the `reset_context` option. It will reset the OpenGL context state to make Kivy's rendering correct after the call to your callback.

Warning: The `reset_context` is not a full OpenGL reset. If you have issues regarding that, please contact us.

`ask_update``()`

Inform the parent canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

New in version 1.0.4.

reset_context

Set this to True if you want to reset the OpenGL context for Kivy after the callback has been called.

class kivy.graphics.**Canvas**

Bases: `kivy.graphics.instructions.CanvasBase`

The important Canvas class. Use this class to add graphics or context instructions that you want to be used for drawing.

Note: The Canvas supports Python's `with` statement and its enter & exit semantics.

Usage of a canvas without the `with` statement:

```
self.canvas.add(Color(1., 1., 0))
self.canvas.add(Rectangle(size=(50, 50)))
```

Usage of a canvas with Python's `with` statement:

```
with self.canvas:
    Color(1., 1., 0)
    Rectangle(size=(50, 50))
```

after

Property for getting the 'after' group.

ask_update()

Inform the canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

before

Property for getting the 'before' group.

clear()

Clears every `Instruction` in the canvas, leaving it clean.

draw()

Apply the instruction to our window.

has_after

Property to see if the `after` group has already been created.

New in version 1.7.0.

has_before

Property to see if the `before` group has already been created.

New in version 1.7.0.

opacity

Property to get/set the opacity value of the canvas.

New in version 1.4.1.

The opacity attribute controls the opacity of the canvas and its children. Be careful, it's a cumulative attribute: the value is multiplied to the current global opacity and the result is applied to the current context color.

For example: if your parent has an opacity of 0.5 and a child has an opacity of 0.2, the real opacity of the child will be 0.5 * 0.2 = 0.1.

Then, the opacity is applied on the shader as:

```
    frag_color = color * vec4(1.0, 1.0, 1.0, opacity);
```

class kivy.graphics.**CanvasBase**
Bases: kivy.graphics.instructions.InstructionGroup

CanvasBase provides the context manager methods for the Canvas.

class kivy.graphics.**Color**
Bases: kivy.graphics.instructions.ContextInstruction

Instruction to set the color state for any vertices being drawn after it. All the values passed are between 0 and 1, not 0 and 255.

In Python, you can do:

```
from kivy.graphics import Color

# create red v
c = Color(1, 0, 0)
# create blue color
c = Color(0, 1, 0)
# create blue color with 50% alpha
c = Color(0, 1, 0, .5)

# using hsv mode
c = Color(0, 1, 1, mode='hsv')
# using hsv mode + alpha
c = Color(0, 1, 1, .2, mode='hsv')
```

In kv lang:

```
<Rule>:
    canvas:
        # red color
        Color:
            rgb: 1, 0, 0
        # blue color
        Color:
            rgb: 0, 1, 0
        # blue color with 50% alpha
        Color:
            rgba: 0, 1, 0, .5

        # using hsv mode
        Color:
            hsv: 0, 1, 1
        # using hsv mode + alpha
        Color:
            hsv: 0, 1, 1
            a: .5
```

a
Alpha component, between 0 and 1.

b
Blue component, between 0 and 1.

g
Green component, between 0 and 1.

h
: Hue component, between 0 and 1.

hsv
: HSV color, list of 3 values in 0-1 range, alpha will be 1.

r
: Red component, between 0 and 1.

rgb
: RGB color, list of 3 values in 0-1 range. The alpha will be 1.

rgba
: RGBA color, list of 4 values in 0-1 range.

s
: Saturation component, between 0 and 1.

v
: Value component, between 0 and 1.

class `kivy.graphics.`**`ContextInstruction`**

Bases: `kivy.graphics.instructions.Instruction`

The ContextInstruction class is the base for the creation of instructions that don't have a direct visual representation, but instead modify the current Canvas' state, e.g. texture binding, setting color parameters, matrix manipulation and so on.

class `kivy.graphics.`**`Ellipse`**

Bases: `kivy.graphics.vertex_instructions.Rectangle`

A 2D ellipse.

Changed in version 1.0.7: Added angle_start and angle_end.

Parameters

- ***segments*: int, defaults to 180**Define how many segments are needed for drawing the ellipse. The drawing will be smoother if you have many segments.
- ***angle_start*: int, defaults to 0**Specifies the starting angle, in degrees, of the disk portion.
- ***angle_end*: int, defaults to 360**Specifies the ending angle, in degrees, of the disk portion.

angle_end
: End angle of the ellipse in degrees, defaults to 360.

angle_start
: Start angle of the ellipse in degrees, defaults to 0.

segments
: Property for getting/setting the number of segments of the ellipse.

class `kivy.graphics.`**`Fbo`**

Bases: `kivy.graphics.instructions.RenderContext`

Fbo class for wrapping the OpenGL Framebuffer extension. The Fbo support "with" statement.

Parameters

- ***clear_color*: tuple, defaults to (0, 0, 0, 0)**Define the default color for clearing the framebuffer
- ***size*: tuple, defaults to (1024, 1024)**Default size of the framebuffer
- ***push_viewport*: bool, defaults to True**If True, the OpenGL viewport will be set to the framebuffer size, and will be automatically restored when the framebuffer released.
- ***with_depthbuffer*: bool, defaults to False**If True, the framebuffer will be allocated with a Z buffer.

with_stencilbuffer: **bool, defaults to False**New in version 1.9.0.

If True, the framebuffer will be allocated with a stencil buffer.

texture: **`Texture`, defaults to None**If None, a default texture will be created.

Note: Using both of `with_stencilbuffer` and `with_depthbuffer` is not supported in kivy 1.9.0

`add_reload_observer()`

Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data in GPU.

New in version 1.2.0.

Parameters

callback: **func(context) -> return None**The first parameter will be the context itself

`bind()`

Bind the FBO to the current opengl context. *Bind* mean that you enable the Framebuffer, and all the drawing operations will act inside the Framebuffer, until `release()` is called.

The bind/release operations are automatically called when you add graphics objects into it. If you want to manipulate a Framebuffer yourself, you can use it like this:

```
self.fbo = FBO()
self.fbo.bind()
# do any drawing command
self.fbo.release()

# then, your fbo texture is available at
print(self.fbo.texture)
```

`clear_buffer()`

Clear the framebuffer with the `clear_color`.

You need to bind the framebuffer yourself before calling this method:

```
fbo.bind()
fbo.clear_buffer()
fbo.release()
```

`clear_color`

Clear color in (red, green, blue, alpha) format.

`get_pixel_color()`

Get the color of the pixel with specified window coordinates wx, wy. It returns result in RGBA format.

New in version 1.8.0.

`pixels`

Get the pixels texture, in RGBA format only, unsigned byte. The origin of the image is at bottom left.

New in version 1.7.0.

`release()`

Release the Framebuffer (unbind).

`remove_reload_observer()`

Remove a callback from the observer list, previously added by `add_reload_observer()`.

New in version 1.2.0.

size

Size of the framebuffer, in (width, height) format.

If you change the size, the framebuffer content will be lost.

texture

Return the framebuffer texture

class `kivy.graphics.`**`GraphicException`**

Bases: `exceptions.Exception`

Exception raised when a graphics error is fired.

class `kivy.graphics.`**`Instruction`**

Bases: `kivy.event.ObjectWithUid`

Represents the smallest instruction available. This class is for internal usage only, don't use it directly.

proxy_ref

Return a proxy reference to the Instruction i.e. without creating a reference of the widget. See weakref.proxy for more information.

New in version 1.7.2.

class `kivy.graphics.`**`InstructionGroup`**

Bases: `kivy.graphics.instructions.Instruction`

Group of `Instructions`. Allows for the adding and removing of graphics instructions. It can be used directly as follows:

```
blue = InstructionGroup()
blue.add(Color(0, 0, 1, 0.2))
blue.add(Rectangle(pos=self.pos, size=(100, 100)))

green = InstructionGroup()
green.add(Color(0, 1, 0, 0.4))
green.add(Rectangle(pos=(100, 100), size=(100, 100)))

# Here, self should be a Widget or subclass
[self.canvas.add(group) for group in [blue, green]]
```

add()

Add a new `Instruction` to our list.

clear()

Remove all the `Instructions`.

get_group()

Return an iterable for all the `Instructions` with a specific group name.

insert()

Insert a new `Instruction` into our list at index.

remove()

Remove an existing `Instruction` from our list.

remove_group()

Remove all `Instructions` with a specific group name.

class `kivy.graphics.`**`Line`**

Bases: `kivy.graphics.instructions.VertexInstruction`

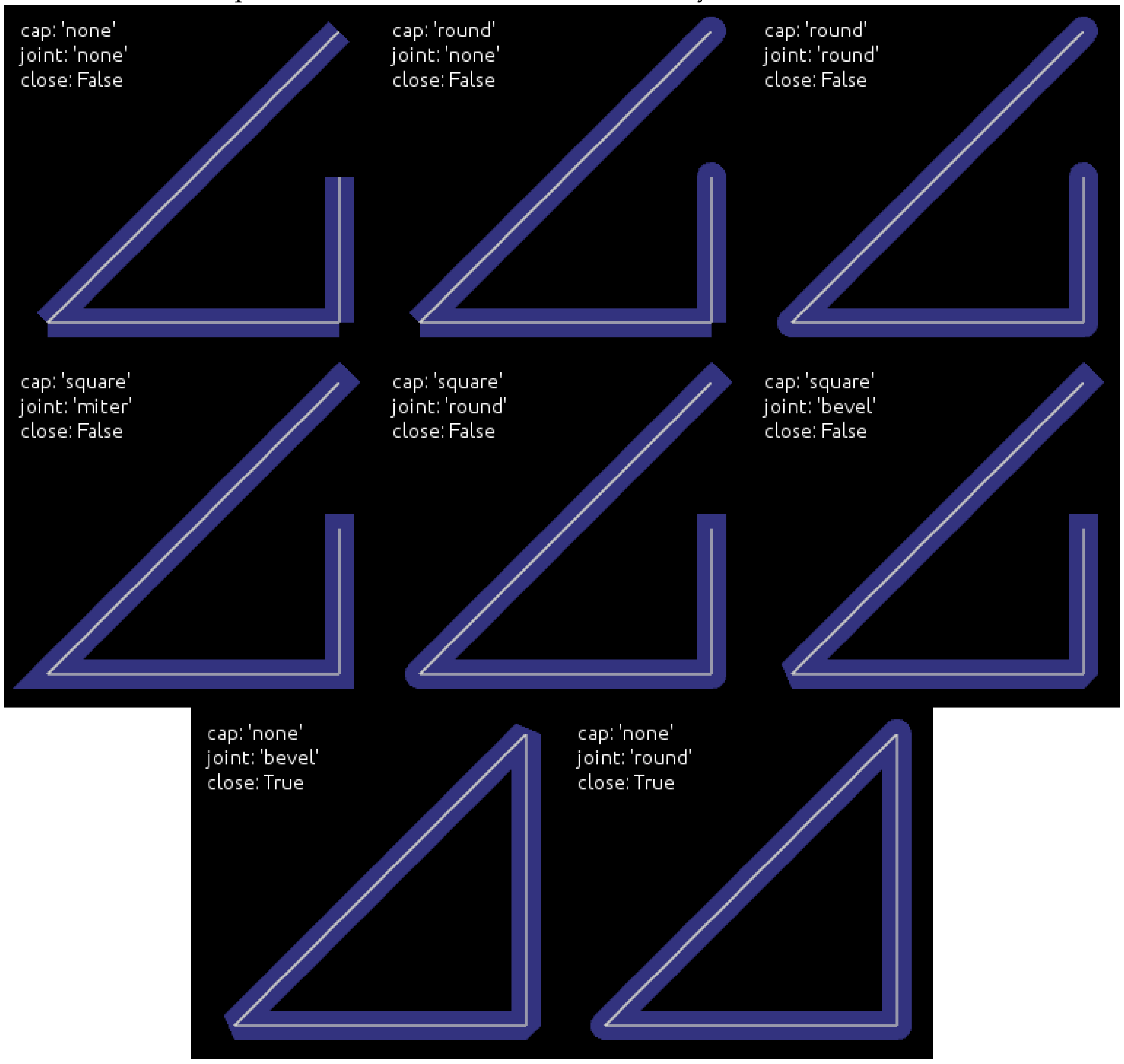
A 2d line.

Drawing a line can be done easily:

```
with self.canvas:
    Line(points=[100, 100, 200, 100, 100, 200], width=10)
```

The line has 3 internal drawing modes that you should be aware of for optimal results:

1. If the width is 1.0, then the standard GL_LINE drawing from OpenGL will be used. dash_length and dash_offset will work, while properties for cap and joint have no meaning here.
2. If the width is > 1.0, then a custom drawing method will be used, based on triangles. dash_length and dash_offset do not work in this mode. Additionally, if the current color has an alpha < 1.0, a stencil will be used internally to draw the line.



Parameters

points: **list**List of points in the format (x1, y1, x2, y2...)

dash_length: **int**Length of a segment (if dashed), defaults to 1.

dash_offset: **int**Offset between the end of a segments and the begining of the next one, defaults to 0. Changing this makes it dashed.

width: **float**Width of the line, defaults to 1.0.

cap: **str, defaults to 'round'**See cap for more information.

joint: **str, defaults to 'round'**See joint for more information.

cap_precision: **int, defaults to 10**See cap_precision for more information

joint_precision: **int, defaults to 10**See joint_precision for more information See cap_precision for more information.

joint_precision: **int, defaults to 10**See joint_precision for more information.

close: **bool, defaults to False**If True, the line will be closed.

circle: **list**If set, the `points` will be set to build a circle. Check `circle` for more information.

ellipse: **list**If set, the `points` will be set to build an ellipse. Check `ellipse` for more information.

rectangle: **list**If set, the `points` will be set to build a rectangle. Check `rectangle` for more information.

bezier: **list**If set, the `points` will be set to build a bezier line. Check `bezier` for more information.

bezier_precision: **int, defaults to 180**Precision of the Bezier drawing.

Changed in version 1.0.8: *dash_offset* and *dash_length* have been added

Changed in version 1.4.1: *width*, *cap*, *joint*, *cap_precision*, *joint_precision*, *close*, *ellipse*, *rectangle* have been added.

Changed in version 1.4.1: *bezier*, *bezier_precision* have been added.

`bezier`

Use this property to build a bezier line, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of 2n elements, n being the number of points.

Usage:

```
Line(bezier=(x1, y1, x2, y2, x3, y3)
```

New in version 1.4.2.

Note: Bezier lines calculations are inexpensive for a low number of points, but complexity is quadratic, so lines with a lot of points can be very expensive to build, use with care!

`bezier_precision`

Number of iteration for drawing the bezier between 2 segments, defaults to 180. The bezier_precision must be at least 1.

New in version 1.4.2.

`cap`

Determine the cap of the line, defaults to 'round'. Can be one of 'none', 'square' or 'round'

New in version 1.4.1.

`cap_precision`

Number of iteration for drawing the "round" cap, defaults to 10. The cap_precision must be at least 1.

New in version 1.4.1.

`circle`

Use this property to build a circle, without calculate the `points`. You can only set this property, not get it.

The argument must be a tuple of (center_x, center_y, radius, angle_start, angle_end, segments):

- center_x and center_y represent the center of the circle
- radius represent the radius of the circle
- **(optional) angle_start and angle_end are in degree. The default**value is 0 and 360.
- **(optional) segments is the precision of the ellipse. The default**value is calculated from the range between angle.

Note that it's up to you to close the circle or not.

For example, for building a simple ellipse, in python:

```
# simple circle
Line(circle=(150, 150, 50))

# only from 90 to 180 degrees
Line(circle=(150, 150, 50, 90, 180))

# only from 90 to 180 degrees, with few segments
Line(circle=(150, 150, 50, 90, 180, 20))
```

New in version 1.4.1.

close
If True, the line will be closed.

New in version 1.4.1.

dash_length
Property for getting/setting the length of the dashes in the curve

New in version 1.0.8.

dash_offset
Property for getting/setting the offset between the dashes in the curve

New in version 1.0.8.

ellipse
Use this property to build an ellipse, without calculate the points. You can only set this property, not get it.

The argument must be a tuple of (x, y, width, height, angle_start, angle_end, segments):

- x and y represent the bottom left of the ellipse
- width and height represent the size of the ellipse
- **(optional) angle_start and angle_end are in degree. The default**value is 0 and 360.
- **(optional) segments is the precision of the ellipse. The default**value is calculated from the range between angle.

Note that it's up to you to close the ellipse or not.

For example, for building a simple ellipse, in python:

```
# simple ellipse
Line(ellipse=(0, 0, 150, 150))

# only from 90 to 180 degrees
Line(ellipse=(0, 0, 150, 150, 90, 180))

# only from 90 to 180 degrees, with few segments
Line(ellipse=(0, 0, 150, 150, 90, 180, 20))
```

New in version 1.4.1.

joint
Determine the join of the line, defaults to 'round'. Can be one of 'none', 'round', 'bevel', 'miter'.

New in version 1.4.1.

joint_precision
Number of iteration for drawing the "round" joint, defaults to 10. The joint_precision must be at least 1.

New in version 1.4.1.

points

Property for getting/settings points of the line

> **Warning:** This will always reconstruct the whole graphics from the new points list. It can be very CPU expensive.

rectangle

Use this property to build a rectangle, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of (x, y, width, height) angle_end, segments):

- x and y represent the bottom-left position of the rectangle
- width and height represent the size

The line is automatically closed.

Usage:

```
Line(rectangle=(0, 0, 200, 200))
```

New in version 1.4.1.

rounded_rectangle

Use this property to build a rectangle, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of one of the following forms:

- (x, y, width, height, corner_radius)
- (x, y, width, height, corner_radius, resolution)
- (x, y, width, height, corner_radius1, corner_radius2, corner_radius3, corner_radius4)
- (x, y, width, height, corner_radius1, corner_radius2, corner_radius3, corner_radius4, resolution)
- x and y represent the bottom-left position of the rectangle
- width and height represent the size
- corner_radius is the number of pixels between two borders and the center of the circle arc joining them
- resolution is the numper of line segment that will be used to draw the circle arc at each corner (default to 30)

The line is automatically closed.

Usage:

```
Line(rounded_rectangle=(0, 0, 200, 200, 10, 20, 30, 40, 100))
```

New in version 1.9.0.

width

Determine the width of the line, defaults to 1.0.

New in version 1.4.1.

class `kivy.graphics.`**`MatrixInstruction`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Base class for Matrix Instruction on the canvas.

matrix

Matrix property. Matrix from the transformation module. Setting the matrix using this property when a change is made is important because it will notify the context about the update.

stack

Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.`**`Mesh`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d mesh.

The format for vertices is currently fixed but this might change in a future release. Right now, each vertex is described with 2D coordinates (x, y) and a 2D texture coordinate (u, v).

In OpenGL ES 2.0 and in our graphics implementation, you cannot have more than 65535 indices.

A list of vertices is described as:

```
vertices = [x1, y1, u1, v1, x2, y2, u2, v2, ...]
            |            |  |            |
            +---- i1 ----+  +---- i2 ----+
```

If you want to draw a triangle, add 3 vertices. You can then make an indices list as follows:
indices = [0, 1, 2]

New in version 1.1.0.

Parameters

***vertices*: list**List of vertices in the format (x1, y1, u1, v1, x2, y2, u2, v2...).

***indices*: list**List of indices in the format (i1, i2, i3...).

***mode*: str**Mode of the vbo. Check `mode` for more information. Defaults to 'points'.

indices

Vertex indices used to specify the order when drawing the mesh.

mode

VBO Mode used for drawing vertices/indices. Can be one of 'points', 'line_strip', 'line_loop', 'lines', 'triangles', 'triangle_strip' or 'triangle_fan'.

vertices

List of x, y, u, v coordinates used to construct the Mesh. Right now, the Mesh instruction doesn't allow you to change the format of the vertices, which means it's only x, y + one texture coordinate.

class `kivy.graphics.`**`Point`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d line.

Parameters

***points*: list**List of points in the format (x1, y1, x2, y2...).

***pointsize*: float, defaults to 1.**Size of the point (1. means the real size will be 2).

Warning: Starting from version 1.0.7, vertex instruction have a limit of 65535 vertices (indices of vertex to be accurate). 2 entries in the list (x, y) will be converted to 4 vertices. So the limit inside Point() class is 2^15-2.

add_point()

Add a point to the current `points` list.

If you intend to add multiple points, prefer to use this method instead of reassigning a new `points` list. Assigning a new `points` list will recalculate and reupload the whole buffer into the GPU. If you use add_point, it will only upload the changes.

points

Property for getting/settings points of the triangle.

pointsize
Property for getting/setting point size.

class kivy.graphics.**PopMatrix**
Bases: kivy.graphics.instructions.ContextInstruction

Pop the matrix from the context's matrix stack onto the model view.

stack
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class kivy.graphics.**PushMatrix**
Bases: kivy.graphics.instructions.ContextInstruction

Push the matrix onto the context's matrix stack.

stack
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class kivy.graphics.**Quad**
Bases: kivy.graphics.instructions.VertexInstruction

A 2d quad.

Parameters
***points*: list**List of point in the format (x1, y1, x2, y2, x3, y3, x4, y4).

points
Property for getting/settings points of the quad.

class kivy.graphics.**Rectangle**
Bases: kivy.graphics.instructions.VertexInstruction

A 2d rectangle.

Parameters
***pos*: list**Position of the rectangle, in the format (x, y).
***size*: list**Size of the rectangle, in the format (width, height).

pos
Property for getting/settings the position of the rectangle.

size
Property for getting/settings the size of the rectangle.

class kivy.graphics.**RenderContext**
Bases: kivy.graphics.instructions.Canvas

The render context stores all the necessary information for drawing, i.e.:

- The vertex shader
- The fragment shader
- The default texture
- The state stack (color, texture, matrix...)

shader
Return the shader attached to the render context.

use_parent_modelview
If True, the parent modelview matrix will be used.

New in version 1.7.0.

Before:

```
rc['modelview_mat'] = Window.render_context['modelview_mat']
```

Now:

```
rc = RenderContext(use_parent_modelview=True)
```

use_parent_projection
If True, the parent projection matrix will be used.

New in version 1.7.0.

Before:

```
rc['projection_mat'] = Window.render_context['projection_mat']
```

Now:

```
rc = RenderContext(use_parent_projection=True)
```

class `kivy.graphics.`**`Rotate`**
Bases: `kivy.graphics.context_instructions.Transform`

Rotate the coordinate space by applying a rotation transformation on the modelview matrix. You can set the properties of the instructions afterwards with e.g.:

```
rot.angle = 90
rot.axis = (0, 0, 1)
```

angle
Property for getting/setting the angle of the rotation.

axis
Property for getting/setting the axis of the rotation.

The format of the axis is (x, y, z).

origin
Origin of the rotation.

New in version 1.7.0.

The format of the origin can be either (x, y) or (x, y, z).

set()
Set the angle and axis of rotation.

```
>>> rotationobject.set(90, 0, 0, 1)
```

Deprecated since version 1.7.0: The set() method doesn't use the new `origin` property.

class `kivy.graphics.`**`Scale`**
Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a non uniform scale transformation.

Create using one or three arguments:

```
Scale(s)         # scale all three axes the same
Scale(x, y, z)   # scale the axes independently
```

Deprecated since version 1.6.0: Deprecated single scale property in favor of x, y, z, xyz axis independant scaled factors.

scale
Property for getting/setting the scale.

Deprecated since version 1.6.0: Deprecated in favor of per axis scale properties x,y,z, xyz, etc.

x
Property for getting/setting the scale on the X axis.

Changed in version 1.6.0.

xyz
3 tuple scale vector in 3D in x, y, and z axis.

Changed in version 1.6.0.

y
Property for getting/setting the scale on the Y axis.

Changed in version 1.6.0.

z
Property for getting/setting the scale on Z axis.

Changed in version 1.6.0.

class `kivy.graphics.`**`StencilPop`**
Bases: `kivy.graphics.instructions.Instruction`

Pop the stencil stack. See the module documentation for more information.

class `kivy.graphics.`**`StencilPush`**
Bases: `kivy.graphics.instructions.Instruction`

Push the stencil stack. See the module documentation for more information.

class `kivy.graphics.`**`StencilUse`**
Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer as a mask. Check the module documentation for more information.

func_op
Determine the stencil operation to use for glStencilFunc(). Can be one of 'never', 'less', 'equal', 'lequal', 'greater', 'notequal', 'gequal' or 'always'.

By default, the operator is set to 'equal'.

New in version 1.5.0.

class `kivy.graphics.`**`StencilUnUse`**
Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer to unset the mask.

class `kivy.graphics.`**`Translate`**
Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a translation of the model view coordinate space.

Construct by either:

```
Translate(x, y)         # translate in just the two axes
Translate(x, y, z)      # translate in all three axes
```

x
Property for getting/setting the translation on the X axis.

xy

2 tuple with translation vector in 2D for x and y axis.

xyz

3 tuple translation vector in 3D in x, y, and z axis.

y

Property for getting/setting the translation on the Y axis.

z

Property for getting/setting the translation on the Z axis.

class `kivy.graphics.`**`Triangle`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d triangle.

Parameters

points: **list**List of points in the format (x1, y1, x2, y2, x3, y3).

points

Property for getting/settings points of the triangle.

class `kivy.graphics.`**`VertexInstruction`**

Bases: `kivy.graphics.instructions.Instruction`

The VertexInstruction class is the base for all graphics instructions that have a direct visual representation on the canvas, such as Rectangles, Triangles, Lines, Ellipse and so on.

source

This property represents the filename to load the texture from. If you want to use an image as source, do it like this:

```
with self.canvas:
    Rectangle(source='mylogo.png', pos=self.pos, size=self.size)
```

Here's the equivalent in Kivy language:

```
<MyWidget>:
    canvas:
        Rectangle:
            source: 'mylogo.png'
            pos: self.pos
            size: self.size
```

Note: The filename will be searched for using the `kivy.resources.resource_find()` function.

tex_coords

This property represents the texture coordinates used for drawing the vertex instruction. The value must be a list of 8 values.

A texture coordinate has a position (u, v), and a size (w, h). The size can be negative, and would represent the 'flipped' texture. By default, the tex_coords are:

```
[u, v, u + w, v, u + w, y + h, u, y + h]
```

You can pass your own texture coordinates if you want to achieve fancy effects.

Warning: The default values just mentioned can be negative. Depending on the image and label providers, the coordinates are flipped vertically because of the order in which the image is internally stored. Instead of flipping the image data, we are just flipping the texture coordinates to be faster.

texture

Property that represents the texture used for drawing this Instruction. You can set a new texture like this:

```
from kivy.core.image import Image

texture = Image('logo.png').texture
with self.canvas:
    Rectangle(texture=texture, pos=self.pos, size=self.size)
```

Usually, you will use the `source` attribute instead of the texture.

class `kivy.graphics.`**`ClearColor`**

Bases: `kivy.graphics.instructions.Instruction`

ClearColor Graphics Instruction.

New in version 1.3.0.

Sets the clear color used to clear buffers with the glClear function or `ClearBuffers` graphics instructions.

a

Alpha component, between 0 and 1.

b

Blue component, between 0 and 1.

g

Green component, between 0 and 1.

r

Red component, between 0 and 1.

rgb

RGB color, a list of 3 values in 0-1 range where alpha will be 1.

rgba

RGBA color used for the clear color, a list of 4 values in the 0-1 range.

class `kivy.graphics.`**`ClearBuffers`**

Bases: `kivy.graphics.instructions.Instruction`

Clearbuffer Graphics Instruction.

New in version 1.3.0.

Clear the buffers specified by the instructions buffer mask property. By default, only the coloc buffer is cleared.

clear_color

If True, the color buffer will be cleared.

clear_depth

If True, the depth buffer will be cleared.

clear_stencil

If True, the stencil buffer will be cleared.

class `kivy.graphics.`**`PushState`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Instruction that pushes arbitrary states/uniforms onto the context state stack.

New in version 1.6.0.

class `kivy.graphics.`**`ChangeState`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Instruction that changes the values of arbitrary states/uniforms on the current render context.

New in version 1.6.0.

class `kivy.graphics.`**`PopState`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Instruction that pops arbitrary states/uniforms off the context state stack.

New in version 1.6.0.

class `kivy.graphics.`**`ApplyContextMatrix`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Pre-multiply the matrix at the top of the stack specified by *target_stack* by the matrix at the top of the 'source_stack'

New in version 1.6.0.

`source_stack`

Name of the matrix stack to use as a source. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

`target_stack`

Name of the matrix stack to use as a target. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.`**`UpdateNormalMatrix`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Update the normal matrix 'normal_mat' based on the current modelview matrix. This will compute 'normal_mat' uniform as: *inverse(transpose(mat3(mvm)))*

New in version 1.6.0.

class `kivy.graphics.`**`LoadIdentity`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Load the identity Matrix into the matrix stack specified by the instructions stack property (default='modelview_mat')

New in version 1.6.0.

`stack`

Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

61.3 Canvas

The `Canvas` is the root object used for drawing by a `Widget`. Check the class documentation for more information about the usage of Canvas.

class `kivy.graphics.instructions.`**`Instruction`**

Bases: `kivy.event.ObjectWithUid`

Represents the smallest instruction available. This class is for internal usage only, don't use it directly.

proxy_ref

Return a proxy reference to the Instruction i.e. without creating a reference of the widget. See weakref.proxy for more information.

New in version 1.7.2.

class `kivy.graphics.instructions.`**`InstructionGroup`**

Bases: `kivy.graphics.instructions.Instruction`

Group of `Instructions`. Allows for the adding and removing of graphics instructions. It can be used directly as follows:

```
blue = InstructionGroup()
blue.add(Color(0, 0, 1, 0.2))
blue.add(Rectangle(pos=self.pos, size=(100, 100)))

green = InstructionGroup()
green.add(Color(0, 1, 0, 0.4))
green.add(Rectangle(pos=(100, 100), size=(100, 100)))

# Here, self should be a Widget or subclass
[self.canvas.add(group) for group in [blue, green]]
```

add()

Add a new `Instruction` to our list.

clear()

Remove all the `Instructions`.

get_group()

Return an iterable for all the `Instructions` with a specific group name.

insert()

Insert a new `Instruction` into our list at index.

remove()

Remove an existing `Instruction` from our list.

remove_group()

Remove all `Instructions` with a specific group name.

class `kivy.graphics.instructions.`**`ContextInstruction`**

Bases: `kivy.graphics.instructions.Instruction`

The ContextInstruction class is the base for the creation of instructions that don't have a direct visual representation, but instead modify the current Canvas' state, e.g. texture binding, setting color parameters, matrix manipulation and so on.

class `kivy.graphics.instructions.`**`VertexInstruction`**

Bases: `kivy.graphics.instructions.Instruction`

The VertexInstruction class is the base for all graphics instructions that have a direct visual representation on the canvas, such as Rectangles, Triangles, Lines, Ellipse and so on.

source

This property represents the filename to load the texture from. If you want to use an image as source, do it like this:

```
with self.canvas:
    Rectangle(source='mylogo.png', pos=self.pos, size=self.size)
```

Here's the equivalent in Kivy language:

```
<MyWidget>:
    canvas:
        Rectangle:
            source: 'mylogo.png'
            pos: self.pos
            size: self.size
```

Note: The filename will be searched for using the `kivy.resources.resource_find()` function.

`tex_coords`

This property represents the texture coordinates used for drawing the vertex instruction. The value must be a list of 8 values.

A texture coordinate has a position (u, v), and a size (w, h). The size can be negative, and would represent the 'flipped' texture. By default, the tex_coords are:

```
[u, v, u + w, v, u + w, y + h, u, y + h]
```

You can pass your own texture coordinates if you want to achieve fancy effects.

Warning: The default values just mentioned can be negative. Depending on the image and label providers, the coordinates are flipped vertically because of the order in which the image is internally stored. Instead of flipping the image data, we are just flipping the texture coordinates to be faster.

`texture`

Property that represents the texture used for drawing this Instruction. You can set a new texture like this:

```
from kivy.core.image import Image

texture = Image('logo.png').texture
with self.canvas:
    Rectangle(texture=texture, pos=self.pos, size=self.size)
```

Usually, you will use the `source` attribute instead of the texture.

class `kivy.graphics.instructions.`**`Canvas`**

Bases: `kivy.graphics.instructions.CanvasBase`

The important Canvas class. Use this class to add graphics or context instructions that you want to be used for drawing.

Note: The Canvas supports Python's `with` statement and its enter & exit semantics.

Usage of a canvas without the `with` statement:

```
self.canvas.add(Color(1., 1., 0))
self.canvas.add(Rectangle(size=(50, 50)))
```

Usage of a canvas with Python's `with` statement:

```
with self.canvas:
    Color(1., 1., 0)
    Rectangle(size=(50, 50))
```

after
Property for getting the 'after' group.

ask_update()
Inform the canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

before
Property for getting the 'before' group.

clear()
Clears every `Instruction` in the canvas, leaving it clean.

draw()
Apply the instruction to our window.

has_after
Property to see if the `after` group has already been created.

New in version 1.7.0.

has_before
Property to see if the `before` group has already been created.

New in version 1.7.0.

opacity
Property to get/set the opacity value of the canvas.

New in version 1.4.1.

The opacity attribute controls the opacity of the canvas and its children. Be careful, it's a cumulative attribute: the value is multiplied to the current global opacity and the result is applied to the current context color.

For example: if your parent has an opacity of 0.5 and a child has an opacity of 0.2, the real opacity of the child will be 0.5 * 0.2 = 0.1.

Then, the opacity is applied on the shader as:

```
frag_color = color * vec4(1.0, 1.0, 1.0, opacity);
```

class `kivy.graphics.instructions.`**CanvasBase**
Bases: `kivy.graphics.instructions.InstructionGroup`

CanvasBase provides the context manager methods for the `Canvas`.

class `kivy.graphics.instructions.`**RenderContext**
Bases: `kivy.graphics.instructions.Canvas`

The render context stores all the necessary information for drawing, i.e.:

- The vertex shader
- The fragment shader
- The default texture
- The state stack (color, texture, matrix...)

shader
Return the shader attached to the render context.

use_parent_modelview
If True, the parent modelview matrix will be used.

New in version 1.7.0.

Before:

```
rc['modelview_mat'] = Window.render_context['modelview_mat']
```

Now:

```
rc = RenderContext(use_parent_modelview=True)
```

use_parent_projection

If True, the parent projection matrix will be used.

New in version 1.7.0.

Before:

```
rc['projection_mat'] = Window.render_context['projection_mat']
```

Now:

```
rc = RenderContext(use_parent_projection=True)
```

class kivy.graphics.instructions.**Callback**

Bases: kivy.graphics.instructions.Instruction

New in version 1.0.4.

A Callback is an instruction that will be called when the drawing operation is performed. When adding instructions to a canvas, you can do this:

```
with self.canvas:
    Color(1, 1, 1)
    Rectangle(pos=self.pos, size=self.size)
    Callback(self.my_callback)
```

The definition of the callback must be:

```
def my_callback(self, instr):
    print('I have been called!')
```

Warning: Note that if you perform many and/or costly calls to callbacks, you might potentially slow down the rendering performance significantly.

The updating of your canvas does not occur until something new happens. From your callback, you can ask for an update:

```
with self.canvas:
    self.cb = Callback(self.my_callback)
# then later in the code
self.cb.ask_update()
```

If you use the Callback class to call rendering methods of another toolkit, you will have issues with the OpenGL context. The OpenGL state may have been manipulated by the other toolkit, and as soon as program flow returns to Kivy, it will just break. You can have glitches, crashes, black holes might occur, etc. To avoid that, you can activate the reset_context option. It will reset the OpenGL context state to make Kivy's rendering correct after the call to your callback.

Warning: The `reset_context` is not a full OpenGL reset. If you have issues regarding that, please contact us.

ask_update()

Inform the parent canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

New in version 1.0.4.

reset_context

Set this to True if you want to reset the OpenGL context for Kivy after the callback has been called.

61.4 Context instructions

The context instructions represent non graphics elements such as:

- Matrix manipulations (PushMatrix, PopMatrix, Rotate, Translate, Scale, MatrixInstruction)
- Color manipulations (Color)
- Texture bindings (BindTexture)

Changed in version 1.0.8: The LineWidth instruction has been removed. It wasn't working before and we actually have no working implementation. We need to do more experimentation to get it right. Check the bug #207 for more information.

class `kivy.graphics.context_instructions.`**`Color`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Instruction to set the color state for any vertices being drawn after it. All the values passed are between 0 and 1, not 0 and 255.

In Python, you can do:

```python
from kivy.graphics import Color

# create red v
c = Color(1, 0, 0)
# create blue color
c = Color(0, 1, 0)
# create blue color with 50% alpha
c = Color(0, 1, 0, .5)

# using hsv mode
c = Color(0, 1, 1, mode='hsv')
# using hsv mode + alpha
c = Color(0, 1, 1, .2, mode='hsv')
```

In kv lang:

```
<Rule>:
    canvas:
        # red color
        Color:
            rgb: 1, 0, 0
        # blue color
        Color:
            rgb: 0, 1, 0
        # blue color with 50% alpha
        Color:
            rgba: 0, 1, 0, .5

        # using hsv mode
        Color:
            hsv: 0, 1, 1
        # using hsv mode + alpha
        Color:
            hsv: 0, 1, 1
            a: .5
```

`a`
Alpha component, between 0 and 1.

`b`
Blue component, between 0 and 1.

`g`
Green component, between 0 and 1.

`h`
Hue component, between 0 and 1.

`hsv`
HSV color, list of 3 values in 0-1 range, alpha will be 1.

`r`
Red component, between 0 and 1.

`rgb`
RGB color, list of 3 values in 0-1 range. The alpha will be 1.

`rgba`
RGBA color, list of 4 values in 0-1 range.

`s`
Saturation component, between 0 and 1.

`v`
Value component, between 0 and 1.

class `kivy.graphics.context_instructions.`**`BindTexture`**
Bases: `kivy.graphics.instructions.ContextInstruction`

BindTexture Graphic instruction. The BindTexture Instruction will bind a texture and enable GL_TEXTURE_2D for subsequent drawing.

Parameters
texture: **Texture**Specifies the texture to bind to the given index.

`source`
Set/get the source (filename) to load for the texture.

class `kivy.graphics.context_instructions.`**`PushMatrix`**
Bases: `kivy.graphics.instructions.ContextInstruction`

Push the matrix onto the context's matrix stack.

`stack`
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.context_instructions.`**`PopMatrix`**
Bases: `kivy.graphics.instructions.ContextInstruction`

Pop the matrix from the context's matrix stack onto the model view.

stack
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.context_instructions.`**`Rotate`**
Bases: `kivy.graphics.context_instructions.Transform`

Rotate the coordinate space by applying a rotation transformation on the modelview matrix. You can set the properties of the instructions afterwards with e.g.:

```
rot.angle = 90
rot.axis = (0, 0, 1)
```

angle
Property for getting/setting the angle of the rotation.

axis
Property for getting/setting the axis of the rotation.

The format of the axis is (x, y, z).

origin
Origin of the rotation.

New in version 1.7.0.

The format of the origin can be either (x, y) or (x, y, z).

set()
Set the angle and axis of rotation.

```
>>> rotationobject.set(90, 0, 0, 1)
```

Deprecated since version 1.7.0: The set() method doesn't use the new `origin` property.

class `kivy.graphics.context_instructions.`**`Scale`**
Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a non uniform scale transformation.

Create using one or three arguments:

```
Scale(s)         # scale all three axes the same
Scale(x, y, z)   # scale the axes independently
```

Deprecated since version 1.6.0: Deprecated single scale property in favor of x, y, z, xyz axis independant scaled factors.

scale
Property for getting/setting the scale.

Deprecated since version 1.6.0: Deprecated in favor of per axis scale properties x,y,z, xyz, etc.

x
Property for getting/setting the scale on the X axis.

Changed in version 1.6.0.

xyz
3 tuple scale vector in 3D in x, y, and z axis.

Changed in version 1.6.0.

y

Property for getting/setting the scale on the Y axis.

Changed in version 1.6.0.

z

Property for getting/setting the scale on Z axis.

Changed in version 1.6.0.

class `kivy.graphics.context_instructions.`**`Translate`**

Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a translation of the model view coordinate space.

Construct by either:

```
Translate(x, y)         # translate in just the two axes
Translate(x, y, z)      # translate in all three axes
```

x

Property for getting/setting the translation on the X axis.

xy

2 tuple with translation vector in 2D for x and y axis.

xyz

3 tuple translation vector in 3D in x, y, and z axis.

y

Property for getting/setting the translation on the Y axis.

z

Property for getting/setting the translation on the Z axis.

class `kivy.graphics.context_instructions.`**`MatrixInstruction`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Base class for Matrix Instruction on the canvas.

matrix

Matrix property. Matrix from the transformation module. Setting the matrix using this property when a change is made is important because it will notify the context about the update.

stack

Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

61.5 Context management

New in version 1.2.0.

This class manages a registry of all created graphics instructions. It has the ability to flush and delete them.

You can read more about Kivy graphics contexts in the *Graphics* module documentation. These are based on OpenGL graphics contexts.

class `kivy.graphics.context.`**`Context`**

Bases: `object`

The Context class manages groups of graphics instructions. It can also be used to manage observer callbacks. See `add_reload_observer()` and `remove_reload_observer()` for more information.

`add_reload_observer()`

(internal) Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data into the GPU.

Parameters

callback: **func(context) -> return None**The first parameter will be the context itself

before: **boolean, defaults to False**If True, the callback will be executed before all the reloading processes. Use it if you want to clear your cache for example.

Changed in version 1.4.0: *before* parameter added.

`remove_reload_observer()`

(internal) Remove a callback from the observer list previously added by `add_reload_observer()`.

61.6 Framebuffer

The Fbo is like an offscreen window. You can activate the fbo for rendering into a texture and use your fbo as a texture for other drawing.

The Fbo acts as a `kivy.graphics.instructions.Canvas`.

Here is an example of using an fbo for some colored rectangles:

```python
from kivy.graphics import Fbo, Color, Rectangle

class FboTest(Widget):
    def __init__(self, **kwargs):
        super(FboTest, self).__init__(**kwargs)

        # first step is to create the fbo and use the fbo texture on other
        # rectangle

        with self.canvas:
            # create the fbo
            self.fbo = Fbo(size=(256, 256))

            # show our fbo on the widget in different size
            Color(1, 1, 1)
            Rectangle(size=(32, 32), texture=self.fbo.texture)
            Rectangle(pos=(32, 0), size=(64, 64), texture=self.fbo.texture)
            Rectangle(pos=(96, 0), size=(128, 128), texture=self.fbo.texture)

        # in the second step, you can draw whatever you want on the fbo
        with self.fbo:
            Color(1, 0, 0, .8)
            Rectangle(size=(256, 64))
            Color(0, 1, 0, .8)
            Rectangle(size=(64, 256))
```

If you change anything in the *self.fbo* object, it will be automatically updated. The canvas where the fbo is put will be automatically updated as well.

61.6.1 Reloading the FBO content

New in version 1.2.0.

If the OpenGL context is lost, then the FBO is lost too. You need to reupload data on it yourself. Use the `Fbo.add_reload_observer()` to add a reloading function that will be automatically called when needed:

```
def __init__(self, **kwargs):
    super(...).__init__(**kwargs)
    self.fbo = Fbo(size=(512, 512))
    self.fbo.add_reload_observer(self.populate_fbo)

    # and load the data now.
    self.populate_fbo(self.fbo)


def populate_fbo(self, fbo):
    with fbo:
        # .. put your Color / Rectangle / ... here
```

This way, you could use the same method for initialization and for reloading. But it's up to you.

class `kivy.graphics.fbo.`**`Fbo`**

Bases: `kivy.graphics.instructions.RenderContext`

Fbo class for wrapping the OpenGL Framebuffer extension. The Fbo support "with" statement.

Parameters

clear_color: **tuple, defaults to (0, 0, 0, 0)**Define the default color for clearing the framebuffer

size: **tuple, defaults to (1024, 1024)**Default size of the framebuffer

push_viewport: **bool, defaults to True**If True, the OpenGL viewport will be set to the framebuffer size, and will be automatically restored when the framebuffer released.

with_depthbuffer: **bool, defaults to False**If True, the framebuffer will be allocated with a Z buffer.

with_stencilbuffer: **bool, defaults to False**New in version 1.9.0.

If True, the framebuffer will be allocated with a stencil buffer.

texture: **`Texture`, defaults to None**If None, a default texture will be created.

Note: Using both of `with_stencilbuffer` and `with_depthbuffer` is not supported in kivy 1.9.0

`add_reload_observer``()`

Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data in GPU.

New in version 1.2.0.

Parameters

callback: **func(context) -> return None**The first parameter will be the context itself

`bind``()`

Bind the FBO to the current opengl context. *Bind* mean that you enable the Framebuffer, and all the drawing operations will act inside the Framebuffer, until `release()` is called.

The bind/release operations are automatically called when you add graphics objects into it. If you want to manipulate a Framebuffer yourself, you can use it like this:

```
        self.fbo = FBO()
        self.fbo.bind()
        # do any drawing command
        self.fbo.release()

        # then, your fbo texture is available at
        print(self.fbo.texture)
```

clear_buffer()
Clear the framebuffer with the `clear_color`.

You need to bind the framebuffer yourself before calling this method:

```
fbo.bind()
fbo.clear_buffer()
fbo.release()
```

clear_color
Clear color in (red, green, blue, alpha) format.

get_pixel_color()
Get the color of the pixel with specified window coordinates wx, wy. It returns result in RGBA format.

New in version 1.8.0.

pixels
Get the pixels texture, in RGBA format only, unsigned byte. The origin of the image is at bottom left.

New in version 1.7.0.

release()
Release the Framebuffer (unbind).

remove_reload_observer()
Remove a callback from the observer list, previously added by `add_reload_observer()`.

New in version 1.2.0.

size
Size of the framebuffer, in (width, height) format.

If you change the size, the framebuffer content will be lost.

texture
Return the framebuffer texture

61.7 GL instructions

New in version 1.3.0.

61.7.1 Clearing an FBO

To clear an FBO, you can use `ClearColor` and `ClearBuffers` instructions like this example:

```
self.fbo = Fbo(size=self.size)
with self.fbo:
    ClearColor(0, 0, 0, 0)
    ClearBuffers()
```

class `kivy.graphics.gl_instructions.`**`ClearColor`**

Bases: `kivy.graphics.instructions.Instruction`

ClearColor Graphics Instruction.

New in version 1.3.0.

Sets the clear color used to clear buffers with the glClear function or `ClearBuffers` graphics instructions.

`a`
Alpha component, between 0 and 1.

`b`
Blue component, between 0 and 1.

`g`
Green component, between 0 and 1.

`r`
Red component, between 0 and 1.

`rgb`
RGB color, a list of 3 values in 0-1 range where alpha will be 1.

`rgba`
RGBA color used for the clear color, a list of 4 values in the 0-1 range.

class `kivy.graphics.gl_instructions.`**`ClearBuffers`**

Bases: `kivy.graphics.instructions.Instruction`

Clearbuffer Graphics Instruction.

New in version 1.3.0.

Clear the buffers specified by the instructions buffer mask property. By default, only the coloc buffer is cleared.

`clear_color`
If True, the color buffer will be cleared.

`clear_depth`
If True, the depth buffer will be cleared.

`clear_stencil`
If True, the stencil buffer will be cleared.

61.8 Graphics compiler

Before rendering an `InstructionGroup`, we compile the group in order to reduce the number of instructions executed at rendering time.

61.8.1 Reducing the context instructions

Imagine that you have a scheme like this:

```
Color(1, 1, 1)
Rectangle(source='button.png', pos=(0, 0), size=(20, 20))
Color(1, 1, 1)
Rectangle(source='button.png', pos=(10, 10), size=(20, 20))
Color(1, 1, 1)
Rectangle(source='button.png', pos=(10, 20), size=(20, 20))
```

The real instructions seen by the graphics canvas would be:

```
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
```

Only the first `Color` and `BindTexture` are useful and really change the context. We can reduce them to:

```
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Rectangle: push vertices (x1, y1...) to vbo & draw
Rectangle: push vertices (x1, y1...) to vbo & draw
```

This is what the compiler does in the first place, by flagging all the unused instruction with GI_IGNORE flag. As soon as a Color content changes, the whole InstructionGroup will be recompiled and a previously unused Color might be used for the next compilation.

Note to any Kivy contributor / internal developer:

- All context instructions are checked to see if they change anything in the cache.
- We must ensure that a context instruction is needed for our current Canvas.
- We must ensure that we don't depend of any other canvas.
- We must reset our cache if one of our children is another instruction group because we don't know whether it might do weird things or not.

61.9 OpenGL

This module is a Python wrapper for OpenGL commands.

Warning: Not every OpenGL command has been wrapped and because we are using the C binding for higher performance, and you should rather stick to the Kivy Graphics API. By using OpenGL commands directly, you might change the OpenGL context and introduce inconsistency between the Kivy state and the OpenGL state.

`kivy.graphics.opengl.`**`glActiveTexture`**`()`

See: glActiveTexture() on Kronos website

`kivy.graphics.opengl.`**`glAttachShader`**`()`

See: glAttachShader() on Kronos website

kivy.graphics.opengl.**glBindAttribLocation**()
See: glBindAttribLocation() on Kronos website

kivy.graphics.opengl.**glBindBuffer**()
See: glBindBuffer() on Kronos website

kivy.graphics.opengl.**glBindFramebuffer**()
See: glBindFramebuffer() on Kronos website

kivy.graphics.opengl.**glBindRenderbuffer**()
See: glBindRenderbuffer() on Kronos website

kivy.graphics.opengl.**glBindTexture**()
See: glBindTexture() on Kronos website

kivy.graphics.opengl.**glBlendColor**()
See: glBlendColor() on Kronos website

kivy.graphics.opengl.**glBlendEquation**()
See: glBlendEquation() on Kronos website

kivy.graphics.opengl.**glBlendEquationSeparate**()
See: glBlendEquationSeparate() on Kronos website

kivy.graphics.opengl.**glBlendFunc**()
See: glBlendFunc() on Kronos website

kivy.graphics.opengl.**glBlendFuncSeparate**()
See: glBlendFuncSeparate() on Kronos website

kivy.graphics.opengl.**glBufferData**()
See: glBufferData() on Kronos website

kivy.graphics.opengl.**glBufferSubData**()
See: glBufferSubData() on Kronos website

kivy.graphics.opengl.**glCheckFramebufferStatus**()
See: glCheckFramebufferStatus() on Kronos website

kivy.graphics.opengl.**glClear**()
See: glClear() on Kronos website

kivy.graphics.opengl.**glClearColor**()
See: glClearColor() on Kronos website

kivy.graphics.opengl.**glClearStencil**()
See: glClearStencil() on Kronos website

kivy.graphics.opengl.**glColorMask**()
See: glColorMask() on Kronos website

kivy.graphics.opengl.**glCompileShader**()
See: glCompileShader() on Kronos website

kivy.graphics.opengl.**glCompressedTexImage2D**()
See: glCompressedTexImage2D() on Kronos website

kivy.graphics.opengl.**glCompressedTexSubImage2D**()
See: glCompressedTexSubImage2D() on Kronos website

kivy.graphics.opengl.**glCopyTexImage2D**()
See: glCopyTexImage2D() on Kronos website

kivy.graphics.opengl.**glCopyTexSubImage2D**()
See: glCopyTexSubImage2D() on Kronos website

`kivy.graphics.opengl.`**`glCreateProgram`**`()`
See: glCreateProgram() on Kronos website

`kivy.graphics.opengl.`**`glCreateShader`**`()`
See: glCreateShader() on Kronos website

`kivy.graphics.opengl.`**`glCullFace`**`()`
See: glCullFace() on Kronos website

`kivy.graphics.opengl.`**`glDeleteBuffers`**`()`
See: glDeleteBuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteFramebuffers`**`()`
See: glDeleteFramebuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteProgram`**`()`
See: glDeleteProgram() on Kronos website

`kivy.graphics.opengl.`**`glDeleteRenderbuffers`**`()`
See: glDeleteRenderbuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteShader`**`()`
See: glDeleteShader() on Kronos website

`kivy.graphics.opengl.`**`glDeleteTextures`**`()`
See: glDeleteTextures() on Kronos website

`kivy.graphics.opengl.`**`glDepthFunc`**`()`
See: glDepthFunc() on Kronos website

`kivy.graphics.opengl.`**`glDepthMask`**`()`
See: glDepthMask() on Kronos website

`kivy.graphics.opengl.`**`glDetachShader`**`()`
See: glDetachShader() on Kronos website

`kivy.graphics.opengl.`**`glDisable`**`()`
See: glDisable() on Kronos website

`kivy.graphics.opengl.`**`glDisableVertexAttribArray`**`()`
See: glDisableVertexAttribArray() on Kronos website

`kivy.graphics.opengl.`**`glDrawArrays`**`()`
See: glDrawArrays() on Kronos website

`kivy.graphics.opengl.`**`glDrawElements`**`()`
See: glDrawElements() on Kronos website

`kivy.graphics.opengl.`**`glEnable`**`()`
See: glEnable() on Kronos website

`kivy.graphics.opengl.`**`glEnableVertexAttribArray`**`()`
See: glEnableVertexAttribArray() on Kronos website

`kivy.graphics.opengl.`**`glFinish`**`()`
See: glFinish() on Kronos website

`kivy.graphics.opengl.`**`glFlush`**`()`
See: glFlush() on Kronos website

`kivy.graphics.opengl.`**`glFramebufferRenderbuffer`**`()`
See: glFramebufferRenderbuffer() on Kronos website

`kivy.graphics.opengl.`**`glFramebufferTexture2D`**`()`
See: glFramebufferTexture2D() on Kronos website

`kivy.graphics.opengl.`**`glFrontFace`**`()`
See: glFrontFace() on Kronos website

`kivy.graphics.opengl.`**`glGenBuffers`**`()`
See: glGenBuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGenFramebuffers`**`()`
See: glGenFramebuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGenRenderbuffers`**`()`
See: glGenRenderbuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGenTextures`**`()`
See: glGenTextures() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGenerateMipmap`**`()`
See: glGenerateMipmap() on Kronos website

`kivy.graphics.opengl.`**`glGetActiveAttrib`**`()`
See: glGetActiveAttrib() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetActiveUniform`**`()`
See: glGetActiveUniform() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetAttachedShaders`**`()`
See: glGetAttachedShaders() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetAttribLocation`**`()`
See: glGetAttribLocation() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetBooleanv`**`()`
See: glGetBooleanv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetBufferParameteriv`**`()`
See: glGetBufferParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetError`**`()`
See: glGetError() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetFloatv`**`()`
See: glGetFloatv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetFramebufferAttachmentParameteriv`**`()`
See: glGetFramebufferAttachmentParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetIntegerv`**`()`
See: glGetIntegerv() on Kronos website

Unlike the C specification, the value(s) will be the result of the call

`kivy.graphics.opengl.`**`glGetProgramInfoLog`**`()`
See: glGetProgramInfoLog() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetProgramiv`**`()`
See: glGetProgramiv() on Kronos website

Unlike the C specification, the value(s) will be the result of the call

`kivy.graphics.opengl.`**`glGetRenderbufferParameteriv`**`()`
See: glGetRenderbufferParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetShaderInfoLog`**`()`
See: glGetShaderInfoLog() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetShaderPrecisionFormat`**`()`
See: glGetShaderPrecisionFormat() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glGetShaderSource`**`()`
See: glGetShaderSource() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetShaderiv`**`()`
See: glGetShaderiv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetString`**`()`
See: glGetString() on Kronos website

Unlike the C specification, the value will be returned as a string.

`kivy.graphics.opengl.`**`glGetTexParameterfv`**`()`
See: glGetTexParameterfv() on Kronos website

`kivy.graphics.opengl.`**`glGetTexParameteriv`**`()`
See: glGetTexParameteriv() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformLocation`**`()`
See: glGetUniformLocation() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformfv`**`()`
See: glGetUniformfv() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformiv`**`()`
See: glGetUniformiv() on Kronos website

`kivy.graphics.opengl.`**`glGetVertexAttribPointerv`**`()`
See: glGetVertexAttribPointerv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glGetVertexAttribfv`**`()`
See: glGetVertexAttribfv() on Kronos website

`kivy.graphics.opengl.`**`glGetVertexAttribiv`**`()`
See: glGetVertexAttribiv() on Kronos website

`kivy.graphics.opengl.`**`glHint`**`()`
See: glHint() on Kronos website

`kivy.graphics.opengl.`**`glIsBuffer`**`()`
See: glIsBuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsEnabled`**`()`
See: glIsEnabled() on Kronos website

`kivy.graphics.opengl.`**`glIsFramebuffer`**`()`
See: glIsFramebuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsProgram`**`()`
See: glIsProgram() on Kronos website

`kivy.graphics.opengl.`**`glIsRenderbuffer`**`()`
See: glIsRenderbuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsShader`**`()`
See: glIsShader() on Kronos website

`kivy.graphics.opengl.`**`glIsTexture`**`()`
See: glIsTexture() on Kronos website

`kivy.graphics.opengl.`**`glLineWidth`**`()`
See: glLineWidth() on Kronos website

`kivy.graphics.opengl.`**`glLinkProgram`**`()`
See: glLinkProgram() on Kronos website

`kivy.graphics.opengl.`**`glPixelStorei`**`()`
See: glPixelStorei() on Kronos website

`kivy.graphics.opengl.`**`glPolygonOffset`**`()`
See: glPolygonOffset() on Kronos website

`kivy.graphics.opengl.`**`glReadPixels`**`()`
See: glReadPixels() on Kronos website

We support only GL_RGB/GL_RGBA as a format and GL_UNSIGNED_BYTE as a type.

`kivy.graphics.opengl.`**`glReleaseShaderCompiler`**`()`
See: glReleaseShaderCompiler() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glRenderbufferStorage`**`()`
See: glRenderbufferStorage() on Kronos website

`kivy.graphics.opengl.`**`glSampleCoverage`**`()`
See: glSampleCoverage() on Kronos website

`kivy.graphics.opengl.`**`glScissor`**`()`
See: glScissor() on Kronos website

kivy.graphics.opengl.**glShaderBinary**()
See: glShaderBinary() on Kronos website

Warning: Not implemented yet.

kivy.graphics.opengl.**glShaderSource**()
See: glShaderSource() on Kronos website

kivy.graphics.opengl.**glStencilFunc**()
See: glStencilFunc() on Kronos website

kivy.graphics.opengl.**glStencilFuncSeparate**()
See: glStencilFuncSeparate() on Kronos website

kivy.graphics.opengl.**glStencilMask**()
See: glStencilMask() on Kronos website

kivy.graphics.opengl.**glStencilMaskSeparate**()
See: glStencilMaskSeparate() on Kronos website

kivy.graphics.opengl.**glStencilOp**()
See: glStencilOp() on Kronos website

kivy.graphics.opengl.**glStencilOpSeparate**()
See: glStencilOpSeparate() on Kronos website

kivy.graphics.opengl.**glTexImage2D**()
See: glTexImage2D() on Kronos website

kivy.graphics.opengl.**glTexParameterf**()
See: glTexParameterf() on Kronos website

kivy.graphics.opengl.**glTexParameterfv**()
See: glTexParameterfv() on Kronos website

Warning: Not implemented yet.

kivy.graphics.opengl.**glTexParameteri**()
See: glTexParameteri() on Kronos website

kivy.graphics.opengl.**glTexParameteriv**()
See: glTexParameteriv() on Kronos website

Warning: Not implemented yet.

kivy.graphics.opengl.**glTexSubImage2D**()
See: glTexSubImage2D() on Kronos website

kivy.graphics.opengl.**glUniform1f**()
See: glUniform1f() on Kronos website

kivy.graphics.opengl.**glUniform1fv**()
See: glUniform1fv() on Kronos website

Warning: Not implemented yet.

kivy.graphics.opengl.**glUniform1i**()
See: glUniform1i() on Kronos website

`kivy.graphics.opengl.`**`glUniform1iv`**`()`
See: glUniform1iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform2f`**`()`
See: glUniform2f() on Kronos website

`kivy.graphics.opengl.`**`glUniform2fv`**`()`
See: glUniform2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform2i`**`()`
See: glUniform2i() on Kronos website

`kivy.graphics.opengl.`**`glUniform2iv`**`()`
See: glUniform2iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform3f`**`()`
See: glUniform3f() on Kronos website

`kivy.graphics.opengl.`**`glUniform3fv`**`()`
See: glUniform3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform3i`**`()`
See: glUniform3i() on Kronos website

`kivy.graphics.opengl.`**`glUniform3iv`**`()`
See: glUniform3iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4f`**`()`
See: glUniform4f() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4fv`**`()`
See: glUniform4fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4i`**`()`
See: glUniform4i() on Kronos website

`kivy.graphics.opengl.`**`glUniform4iv`**`()`
See: glUniform4iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix2fv`**`()`
See: glUniformMatrix2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix3fv`**`()`
See: glUniformMatrix3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix4fv`**`()`
See: glUniformMatrix4fv() on Kronos website

`kivy.graphics.opengl.`**`glUseProgram`**`()`
See: glUseProgram() on Kronos website

`kivy.graphics.opengl.`**`glValidateProgram`**`()`
See: glValidateProgram() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib1f`**`()`
See: glVertexAttrib1f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib1fv`**`()`
See: glVertexAttrib1fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib2f`**`()`
See: glVertexAttrib2f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib2fv`**`()`
See: glVertexAttrib2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib3f`**`()`
See: glVertexAttrib3f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib3fv`**`()`
See: glVertexAttrib3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib4f`**`()`
See: glVertexAttrib4f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib4fv`**`()`
See: glVertexAttrib4fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttribPointer`**`()`
See: glVertexAttribPointer() on Kronos website

`kivy.graphics.opengl.`**`glViewport`**`()`
See: glViewport() on Kronos website

61.10 OpenGL utilities

New in version 1.0.7.

`kivy.graphics.opengl_utils.`**`gl_get_extensions`**`()`

Return a list of OpenGL extensions available. All the names in the list have the *GL_* stripped at the start (if it exists) and are in lowercase.

```
>>> print(gl_get_extensions())
['arb_blend_func_extended', 'arb_color_buffer_float', 'arb_compatibility',
 'arb_copy_buffer'... ]
```

`kivy.graphics.opengl_utils.`**`gl_has_extension`**`()`

Check if an OpenGL extension is available. If the name starts with *GL_*, it will be stripped for the test and converted to lowercase.

```
>>> gl_has_extension('NV_get_tex_image')
False
>>> gl_has_extension('OES_texture_npot')
True
```

`kivy.graphics.opengl_utils.`**`gl_has_capability`**`()`

Return the status of a OpenGL Capability. This is a wrapper that auto-discovers all the capabilities that Kivy might need. The current capabilites tested are:

- GLCAP_BGRA: Test the support of BGRA texture format
- GLCAP_NPOT: Test the support of Non Power of Two texture
- GLCAP_S3TC: Test the support of S3TC texture (DXT1, DXT3, DXT5)
- GLCAP_DXT1: Test the support of DXT texture (subset of S3TC)
- GLCAP_ETC1: Test the support of ETC1 texture

`kivy.graphics.opengl_utils.`**`gl_register_get_size`**`()`

Register an association between an OpenGL Const used in glGet* to a number of elements.

By example, the GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX is a special pname that will return the integer 1 (nvidia only).

```
>>> GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX = 0x9047
>>> gl_register_get_size(GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX, 1)
>>> glGetIntegerv(GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX)[0]
524288
```

`kivy.graphics.opengl_utils.`**`gl_has_texture_format`**`()`

Return whether a texture format is supported by your system, natively or by conversion. For example, if your card doesn't support 'bgra', we are able to convert to 'rgba' but only in software mode.

`kivy.graphics.opengl_utils.`**`gl_has_texture_conversion`**`()`

Return 1 if the texture can be converted to a native format.

`kivy.graphics.opengl_utils.`**`gl_has_texture_native_format`**`()`

Return 1 if the texture format is handled natively.

```
>>> gl_has_texture_format('azdmok')
0
>>> gl_has_texture_format('rgba')
1
>>> gl_has_texture_format('s3tc_dxt1')
[INFO   ] [GL          ] S3TC texture support is available
```

```
[INFO   ] [GL          ] DXT1 texture support is available
1
```

kivy.graphics.opengl_utils.**gl_get_texture_formats**()
Return a list of texture formats recognized by kivy. The texture list is informative but might not been supported by your hardware. If you want a list of supported textures, you must filter that list as follows:

```
supported_fmts = [gl_has_texture_format(x) for x in gl_get_texture_formats()]
```

kivy.graphics.opengl_utils.**gl_get_version**()
Return the (major, minor) OpenGL version, parsed from the GL_VERSION.

New in version 1.2.0.

kivy.graphics.opengl_utils.**gl_get_version_minor**()
Return the minor component of the OpenGL version.

New in version 1.2.0.

kivy.graphics.opengl_utils.**gl_get_version_major**()
Return the major component of the OpenGL version.

New in version 1.2.0.

61.11 SVG

New in version 1.9.0.

Warning: This is highly experimental and subject to change. Don't use it in production.

Load an SVG as a graphics instruction:

```
from kivy.graphics.svg import Svg
with widget.canvas:
    svg = Svg("image.svg")
```

There is no widget that can display Svg directly, you have to make your own for now. Check the *examples/svg* for more informations.

class kivy.graphics.svg.**Svg**
Bases: kivy.graphics.instructions.RenderContext

Svg class. See module for more informations about the usage.

anchor_x
Horizontal anchor position for scaling and rotations. Defaults to 0. The symbolic values 'left', 'center' and 'right' are also accepted.

anchor_y
Vertical anchor position for scaling and rotations. Defaults to 0. The symbolic values 'bottom', 'center' and 'top' are also accepted.

filename
Filename to load.

The parsing and rendering is done as soon as you set the filename.

61.12 Shader

The Shader class handles the compilation of the vertex and fragment shader as well as the creation of the program in OpenGL.

Todo

Include more complete documentation about the shader.

61.12.1 Header inclusion

New in version 1.0.7.

When you are creating a Shader, Kivy will always include default parameters. If you don't want to rewrite this each time you want to customize / write a new shader, you can add the "$HEADER$" token and it will be replaced by the corresponding shader header.

Here is the header for the fragment Shader:

```
#ifdef GL_ES
    precision highp float;
#endif

/* Outputs from the vertex shader */
varying vec4 frag_color;
varying vec2 tex_coord0;

/* uniform texture samplers */
uniform sampler2D texture0;
```

And the header for vertex Shader:

```
#ifdef GL_ES
    precision highp float;
#endif

/* Outputs to the fragment shader */
varying vec4 frag_color;
varying vec2 tex_coord0;

/* vertex attributes */
attribute vec2     vPosition;
attribute vec2     vTexCoords0;

/* uniform variables */
uniform mat4       modelview_mat;
uniform mat4       projection_mat;
uniform vec4       color;
uniform float      opacity;
```

61.12.2 Single file glsl shader programs

New in version 1.6.0.

To simplify shader management, the vertex and fragment shaders can be loaded automatically from a single glsl source file (plain text). The file should contain sections identified by a line starting with '—vertex' and '—fragment' respectively (case insensitive), e.g.:

```
// anything before a meaningful section such as this comment are ignored

---VERTEX SHADER--- // vertex shader starts here
void main(){
    ...
}

---FRAGMENT SHADER--- // fragment shader starts here
void main(){
    ...
}
```

The source property of the Shader should be set to the filename of a glsl shader file (of the above format), e.g. *phong.glsl*

class `kivy.graphics.shader.`**`Shader`**

Bases: `object`

Create a vertex or fragment shader.

Parameters

vs: **string, defaults to None**Source code for vertex shader

fs: **string, defaults to None**Source code for fragment shader

`fs`

Fragment shader source code.

If you set a new fragment shader code source, it will be automatically compiled and will replace the current fragment shader.

`source`

glsl source code.

source should be the filename of a glsl shader that contains both the vertex and fragment shader sourcecode, each designated by a section header consisting of one line starting with either "–VERTEX" or "–FRAGMENT" (case insensitive).

New in version 1.6.0.

`success`

Indicate whether the shader loaded successfully and is ready for usage or not.

`vs`

Vertex shader source code.

If you set a new vertex shader code source, it will be automatically compiled and will replace the current vertex shader.

61.13 Stencil instructions

New in version 1.0.4.

Changed in version 1.3.0: The stencil operation has been updated to resolve some issues that appeared when nested. You **must** now have a StencilUnUse and repeat the same operation as you did after StencilPush.

Stencil instructions permit you to draw and use the current drawing as a mask. They don't give as much control as pure OpenGL, but you can still do fancy things!

The stencil buffer can be controlled using these 3 instructions:

- `StencilPush`: push a new stencil layer. Any drawing that happens after this will be used as a mask.

- StencilUse : now draw the next instructions and use the stencil for masking them.
- StencilUnUse : stop using the stencil i.e. remove the mask and draw normally.
- StencilPop : pop the current stencil layer.

You should always respect this scheme:

```
StencilPush

# PHASE 1: put any drawing instructions to use as a mask here.

StencilUse

# PHASE 2: all the drawing here will be automatically clipped by the
# mask created in PHASE 1.

StencilUnUse

# PHASE 3: drawing instructions wil now be drawn without clipping but the
# mask will still be on the stack. You can return to PHASE 2 at any
# time by issuing another *StencilUse* command.

StencilPop

# PHASE 4: the stencil is now removed from the stack and unloaded.
```

61.13.1 Limitations

- Drawing in PHASE 1 and PHASE 3 must not collide or you will get unexpected results
- The stencil is activated as soon as you perform a StencilPush
- The stencil is deactivated as soon as you've correctly popped all the stencil layers
- You must not play with stencils yourself between a StencilPush / StencilPop
- You can push another stencil after a StencilUse / before the StencilPop
- You can push up to 128 layers of stencils (8 for kivy < 1.3.0)

61.13.2 Example of stencil usage

Here is an example, in kv style:

```
StencilPush

# create a rectangular mask with a pos of (100, 100) and a (100, 100) size.
Rectangle:
    pos: 100, 100
    size: 100, 100

StencilUse

# we want to show a big green rectangle, however, the previous stencil
# mask will crop us :)
Color:
    rgb: 0, 1, 0
Rectangle:
    size: 900, 900
```

```
StencilUnUse:
    # new in kivy 1.3.0, remove the mask previously added
    Rectangle:
        pos: 100, 100
        size: 100, 100

StencilPop
```

class `kivy.graphics.stencil_instructions.`**`StencilPush`**
Bases: `kivy.graphics.instructions.Instruction`

Push the stencil stack. See the module documentation for more information.

class `kivy.graphics.stencil_instructions.`**`StencilPop`**
Bases: `kivy.graphics.instructions.Instruction`

Pop the stencil stack. See the module documentation for more information.

class `kivy.graphics.stencil_instructions.`**`StencilUse`**
Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer as a mask. Check the module documentation for more information.

`func_op`
Determine the stencil operation to use for glStencilFunc(). Can be one of 'never', 'less', 'equal', 'lequal', 'greater', 'notequal', 'gequal' or 'always'.

By default, the operator is set to 'equal'.

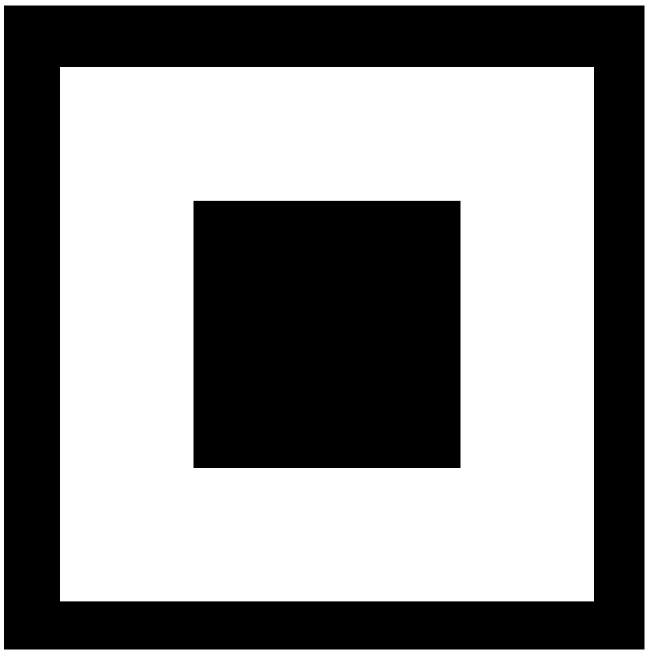
New in version 1.5.0.

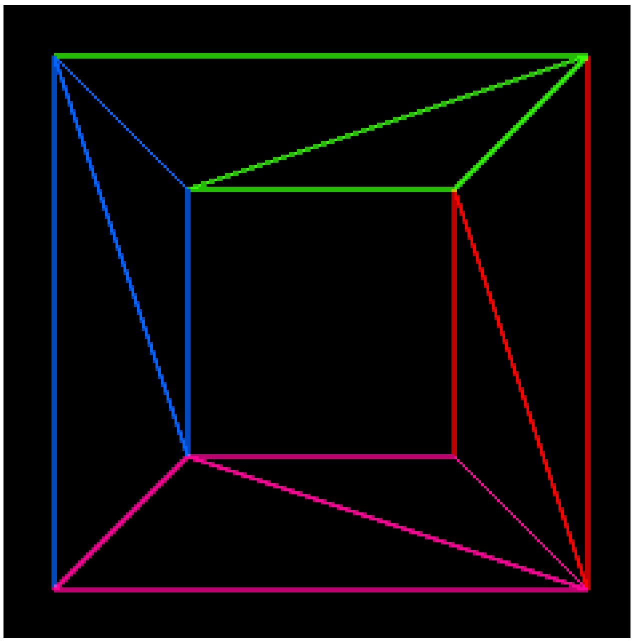
class `kivy.graphics.stencil_instructions.`**`StencilUnUse`**
Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer to unset the mask.

61.14 Tesselator

New in version 1.9.0.





Warning: This is experimental and subject to change as long as this warning notice is present. Only TYPE_POLYGONS is currently supported.

Tesselator is a library for tesselating polygons, based on libtess2. It renders concave filled polygons by first tesselating them into convex polygons. It also supports holes.

61.14.1 Usage

First, you need to create a `Tesselator` object and add contours. The first one is the external contour of your shape and all of the following ones should be holes:

```
from kivy.graphics.tesselator import Tesselator

tess = Tesselator()
tess.add_contour([0, 0, 200, 0, 200, 200, 0, 200])
tess.add_contour([50, 50, 150, 50, 150, 150, 50, 150])
```

Second, call the `Tesselator.tesselate()` method to compute the points. It is possible that the tesselator won't work. In that case, it can return False:

```
if not tess.tesselate():
    print "Tesselator didn't work :("
    return
```

After the tesselation, you have multiple ways to iterate over the result. The best approach is using `Tesselator.meshes` to get a format directly usable for a `Mesh`:

```
for vertices, indices in tess.meshes:
    self.canvas.add(Mesh(
        vertices=vertices,
        indices=indices,
        mode="triangle_fan"
    ))
```

Or, you can get the "raw" result, with just polygons and x/y coordinates with `Tesselator.vertices()`:

```
for vertices in tess.vertices:
    print "got polygon", vertices
```

class `kivy.graphics.tesselator.`**`Tesselator`**

Bases: `object`

Tesselator class. See module for more informations about the usage.

`add_contour``()`

Add a contour to the tesselator. It can be:

- a list of *[x, y, x2, y2, ...]* coordinates
- a float array: *array("f", [x, y, x2, y2, ...])*
- any buffer with floats in it.

`element_count`

Returns the number of convex polygon.

`meshes`

Iterate through the result of the `tesselate()` to give a result that can be easily pushed into Kivy's Mesh object.

It's a list of: *[[vertices, indices], [vertices, indices], ...]*. The vertices in the format *[x, y, u, v, x2, y2, u2, v2]*.

Careful, u/v coordinates are the same as x/y. You are responsible to change them for texture mapping if you need to.

You can create Mesh objects like that:

```
        tess = Tesselator()
        # add contours here
        tess.tesselate()
        for vertices, indices in self.meshes:
            self.canvas.add(Mesh(
                vertices=vertices,
                indices=indices,
                mode="triangle_fan"))
```

`tesselate``()`

Compute all the contours added with `add_contour()`, and generate polygons.

Parameters

- **winding_rule** (*enum*) – The winding rule classifies a region as inside if its winding number belongs to the chosen category. Can be one of WINDING_ODD, WINDING_NONZERO, WINDING_POSITIVE, WINDING_NEGATIVE, WINDING_ABS_GEQ_TWO. Defaults to WINDING_ODD.
- **element_type** (*enum*) – The result type, you can generate the polygons with TYPE_POLYGONS, or the contours with TYPE_BOUNDARY_CONTOURS. Defaults to TYPE_POLYGONS.

Returns1 if the tesselation happenned, 0 otherwise.

Return typeint

`vertex_count`

Returns the number of vertex generated.

This is the raw result, however, because the Tesselator format the result for you with `meshes` or `vertices` per polygon, you'll have more vertices in the result

`vertices`

Iterate through the result of the `tesselate()` in order to give only a list of *[x, y, x2, y2, ...]* polygons.

61.15 Texture

Changed in version 1.6.0: Added support for paletted texture on OES: 'palette4_rgb8', 'palette4_rgba8', 'palette4_r5_g6_b5', 'palette4_rgba4', 'palette4_rgb5_a1', 'palette8_rgb8', 'palette8_rgba8', 'palette8_r5_g6_b5', 'palette8_rgba4' and 'palette8_rgb5_a1'.

`Texture` is a class that handles OpenGL textures. Depending on the hardware, some OpenGL capabilities might not be available (BGRA support, NPOT support, etc.)

You cannot instanciate this class yourself. You must use the function `Texture.create()` to create a new texture:

```
texture = Texture.create(size=(640, 480))
```

When you create a texture, you should be aware of the default color and buffer format:

- the color/pixel format (`Texture.colorfmt`) that can be one of 'rgb', 'rgba', 'luminance', 'luminance_alpha', 'bgr' or 'bgra'. The default value is 'rgb'
- the buffer format determines how a color component is stored into memory. This can be one of 'ubyte', 'ushort', 'uint', 'byte', 'short', 'int' or 'float'. The default value and the most commonly used is 'ubyte'.

So, if you want to create an RGBA texture:

```
texture = Texture.create(size=(640, 480), colorfmt='rgba')
```

You can use your texture in almost all vertex instructions with the `kivy.graphics.VertexIntruction.texture` parameter. If you want to use your texture in kv lang, you can save it in an `ObjectProperty` inside your widget.

61.15.1 Blitting custom data

You can create your own data and blit it to the texture using `Texture.blit_buffer()`.

For example, to blit immutable bytes data:

```
# create a 64x64 texture, defaults to rgb / ubyte
texture = Texture.create(size=(64, 64))

# create 64x64 rgb tab, and fill with values from 0 to 255
# we'll have a gradient from black to white
size = 64 * 64 * 3
buf = [int(x * 255 / size) for x in range(size)]

# then, convert the array to a ubyte string
buf = b''.join(map(chr, buf))

# then blit the buffer
texture.blit_buffer(buf, colorfmt='rgb', bufferfmt='ubyte')

# that's all ! you can use it in your graphics now :)
# if self is a widget, you can do this
with self.canvas:
    Rectangle(texture=texture, pos=self.pos, size=(64, 64))
```

Since 1.9.0, you can blit data stored in a instance that implements the python buffer interface, or a memoryview thereof, such as numpy arrays, python *array.array*, a *bytearray*, or a cython array. This is beneficial if you expect to blit similar data, with perhaps a few changes in the data.

When using a bytes representation of the data, for every change you have to regenerate the bytes instance, from perhaps a list, which is very inefficient. When using a buffer object, you can simply edit parts of the original data. Similarly, unless starting with a bytes object, converting to bytes requires a full copy, however, when using a buffer instance, no memory is copied, except to upload it to the GPU.

Continuing with the example above:

```
from array import array

size = 64 * 64 * 3
buf = [int(x * 255 / size) for x in range(size)]
# initialize the array with the buffer values
arr = array('B', buf)
# now blit the array
texture.blit_buffer(arr, colorfmt='rgb', bufferfmt='ubyte')

# now change some elements in the original array
arr[24] = arr[50] = 99
# blit again the buffer
texture.blit_buffer(arr, colorfmt='rgb', bufferfmt='ubyte')
```

61.15.2 BGR/BGRA support

The first time you try to create a BGR or BGRA texture, we check whether your hardware supports BGR / BGRA textures by checking the extension 'GL_EXT_bgra'.

If the extension is not found, the conversion to RGB / RGBA will be done in software.

61.15.3 NPOT texture

Changed in version 1.0.7: If your hardware supports NPOT, no POT is created.

As the OpenGL documentation says, a texture must be power-of-two sized. That means your width and height can be one of 64, 32, 256... but not 3, 68, 42. NPOT means non-power-of-two. OpenGL ES 2 supports NPOT textures natively but with some drawbacks. Another type of NPOT texture is called a rectangle texture. POT, NPOT and textures all have their own pro/cons.

Features	POT	NPOT	Rectangle
OpenGL Target	GL_TEXTURE_2D	GL_TEXTURE_2D	GL_TEXTURE_RECTANGLE_(NV|ARB|EXT)
Texture coords	0-1 range	0-1 range	width-height range
Mipmapping	Supported	Partially	No
Wrap mode	Supported	Supported	No

If you create a NPOT texture, we first check whether your hardware supports it by checking the extensions GL_ARB_texture_non_power_of_two or OES_texture_npot. If none of theses are available, we create the nearest POT texture that can contain your NPOT texture. The `Texture.create()` will return a `TextureRegion` instead.

61.15.4 Texture atlas

A texture atlas is a single texture that contains many images. If you want to seperate the original texture into many single ones, you don't need to. You can get a region of the original texture. That will return the original texture with custom texture coordinates:

```
# for example, load a 128x128 image that contain 4 64x64 images
from kivy.core.image import Image
texture = Image('mycombinedimage.png').texture

bottomleft = texture.get_region(0, 0, 64, 64)
bottomright = texture.get_region(0, 64, 64, 64)
topleft = texture.get_region(0, 64, 64, 64)
topright = texture.get_region(64, 64, 64, 64)
```

61.15.5 Mipmapping

New in version 1.0.7.

Mipmapping is an OpenGL technique for enhancing the rendering of large textures to small surfaces. Without mipmapping, you might see pixelation when you render to small surfaces. The idea is to precalculate the subtexture and apply some image filter as a linear filter. Then, when you render a small surface, instead of using the biggest texture, it will use a lower filtered texture. The result can look better this way.

To make that happen, you need to specify mipmap=True when you create a texture. Some widgets already give you the ability to create mipmapped textures, such as the `Label` and `Image`.

From the OpenGL Wiki : "So a 64x16 2D texture can have 5 mip-maps: 32x8, 16x4, 8x2, 4x1, 2x1, and 1x1". Check http://www.opengl.org/wiki/Texture for more information.

Note: As the table in previous section said, if your texture is NPOT, we create the nearest POT texture and generate a mipmap from it. This might change in the future.

61.15.6 Reloading the Texture

New in version 1.2.0.

If the OpenGL context is lost, the Texture must be reloaded. Textures that have a source are automatically reloaded but generated textures must be reloaded by the user.

Use the `Texture.add_reload_observer()` to add a reloading function that will be automatically called when needed:

```
def __init__(self, **kwargs):
    super(...).__init__(**kwargs)
    self.texture = Texture.create(size=(512, 512), colorfmt='RGB',
        bufferfmt='ubyte')
    self.texture.add_reload_observer(self.populate_texture)

    # and load the data now.
    self.cbuffer = '\x00\xf0\xff' * 512 * 512
    self.populate_texture(self.texture)

def populate_texture(self, texture):
    texture.blit_buffer(self.cbuffer)
```

This way, you can use the same method for initialization and reloading.

Note: For all text rendering with our core text renderer, the texture is generated but we already bind a method to redo the text rendering and reupload the text to the texture. You don't have to do anything.

---

class `kivy.graphics.texture.`**`Texture`**

Bases: `object`

Handle an OpenGL texture. This class can be used to create simple textures or complex textures based on ImageData.

`add_reload_observer``()`

Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data into the GPU.

New in version 1.2.0.

Parameters

callback: **func(context) -> return None**The first parameter will be the context itself.

`ask_update``()`

Indicate that the content of the texture should be updated and the callback function needs to be called when the texture will be used.

`bind``()`

Bind the texture to the current opengl state.

`blit_buffer``()`

Blit a buffer into the texture.

Note: Unless the canvas will be updated due to other changes, `ask_update()` should be called in order to update the texture.

Parameters

pbuffer[bytes, or a class that implements the buffer interface (including memoryview).] A buffer containing the image data. It can be either a bytes object or a instance of a class that implements the python buffer interface, e.g. *array.array*, *bytearray*, numpy arrays etc. If it's not a bytes object, the underlying buffer must be contiguous, have only one dimension and must not be readonly, even though the data is not modified, due to a cython limitation. See module description for usage details.

size[tuple, defaults to texture size] Size of the image (width, height)

colorfmt[str, defaults to 'rgb'] Image format, can be one of 'rgb', 'rgba', 'bgr', 'bgra', 'luminance' or 'luminance_alpha'.

pos[tuple, defaults to (0, 0)] Position to blit in the texture.

bufferfmt[str, defaults to 'ubyte'] Type of the data buffer, can be one of 'ubyte', 'ushort', 'uint', 'byte', 'short', 'int' or 'float'.

mipmap_level: **int, defaults to 0**Indicate which mipmap level we are going to update.

mipmap_generation: **bool, defaults to True**Indicate if we need to regenerate the mipmap from level 0.

Changed in version 1.0.7: added *mipmap_level* and *mipmap_generation*

Changed in version 1.9.0: *pbuffer* can now be any class instance that implements the python buffer interface and / or memoryviews thereof.

`blit_data``()`

Replace a whole texture with image data.

`bufferfmt`

Return the buffer format used in this texture (readonly).

New in version 1.2.0.

`colorfmt`
Return the color format used in this texture (readonly).

New in version 1.0.7.

`create``()`
Create a texture based on size.

Parameters

size: **tuple, defaults to (128, 128)**Size of the texture.

colorfmt: **str, defaults to 'rgba'**Color format of the texture. Can be 'rgba' or 'rgb', 'luminance' or 'luminance_alpha'. On desktop, additionnal values are available: 'red', 'rg'.

icolorfmt: **str, default to the value of *colorfmt***Internal format storage of the texture. Can be 'rgba' or 'rgb', 'luminance' or 'luminance_alpha'. On desktop, additionnal values are available: 'r8', 'rg8', 'rgba8'.

bufferfmt: **str, defaults to 'ubyte'**Internal buffer format of the texture. Can be 'ubyte', 'ushort', 'uint', 'bute', 'short', 'int' or 'float'.

mipmap: **bool, defaults to False**If True, it will automatically generate the mipmap texture.

callback: **callable(), defaults to False**If a function is provided, it will be called when data is needed in the texture.

Changed in version 1.7.0: `callback` has been added

`create_from_data``()`
Create a texture from an ImageData class.

`flip_horizontal``()`
Flip tex_coords for horizontal display.

New in version 1.9.0.

`flip_vertical``()`
Flip tex_coords for vertical display.

`get_region``()`
Return a part of the texture defined by the rectangular arguments (x, y, width, height). Returns a `TextureRegion` instance.

`height`
Return the height of the texture (readonly).

`id`
Return the OpenGL ID of the texture (readonly).

`mag_filter`
Get/set the mag filter texture. Available values:

- linear
- nearest

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

`min_filter`
Get/set the min filter texture. Available values:

- linear
- nearest
- linear_mipmap_linear
- linear_mipmap_nearest
- nearest_mipmap_nearest
- nearest_mipmap_linear

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

`mipmap`
Return True if the texture has mipmap enabled (readonly).

`pixels`
Get the pixels texture, in RGBA format only, unsigned byte. The origin of the image is at bottom left.

New in version 1.7.0.

`remove_reload_observer()`
Remove a callback from the observer list, previously added by `add_reload_observer()`.

New in version 1.2.0.

`save()`
Save the texture content to a file. Check `kivy.core.image.Image.save()` for more information.

The flipped parameter flips the saved image vertically, and defaults to True.

New in version 1.7.0.

Changed in version 1.8.0: Parameter *flipped* added, default to True. All the OpenGL Texture are readed from bottom / left, it need to be flipped before saving. If you don't want to flip the image, set flipped to False.

`size`
Return the (width, height) of the texture (readonly).

`target`
Return the OpenGL target of the texture (readonly).

`tex_coords`
Return the list of tex_coords (opengl).

`uvpos`
Get/set the UV position inside the texture.

`uvsize`
Get/set the UV size inside the texture.

Warning: The size can be negative if the texture is flipped.

`width`
Return the width of the texture (readonly).

`wrap`
Get/set the wrap texture. Available values:
- repeat
- mirrored_repeat
- clamp_to_edge

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

class `kivy.graphics.texture.`**`TextureRegion`**
Bases: `kivy.graphics.texture.Texture`

Handle a region of a Texture class. Useful for non power-of-2 texture handling.

61.16 Transformation

This module contains a Matrix class used for our Graphics calculations. We currently support:

- rotation, translation and scaling matrices
- multiplication matrix
- clip matrix (with or without perspective)
- transformation matrix for 3d touch

For more information on transformation matrices, please see the OpenGL Matrices Tutorial.

Changed in version 1.6.0: Added `Matrix.perspective()`, `Matrix.look_at()` and `Matrix.transpose()`.

class `kivy.graphics.transformation.`**`Matrix`**

Bases: `object`

Optimized matrix class for OpenGL:

```
>>> from kivy.graphics.transformation import Matrix
>>> m = Matrix()
>>> print(m)
[[ 1.000000 0.000000 0.000000 0.000000 ]
[ 0.000000 1.000000 0.000000 0.000000 ]
[ 0.000000 0.000000 1.000000 0.000000 ]
[ 0.000000 0.000000 0.000000 1.000000 ]]

[ 0   1   2   3]
[ 4   5   6   7]
[ 8   9  10  11]
[ 12  13  14  15]
```

`identity``()`

Reset the matrix to the identity matrix (inplace).

`inverse``()`

Return the inverse of the matrix as a new Matrix.

`look_at``()`

Returns a new lookat Matrix (similar to gluLookAt).

Parameters

eyex: **float**Eyes X co-ordinate
eyey: **float**Eyes Y co-ordinate
eyez: **float**Eyes Z co-ordinate
centerx: **float**The X position of the reference point
centery: **float**The Y position of the reference point
centerz: **float**The Z position of the reference point
upx: **float**The X value up vector.
upy: **float**The Y value up vector.
upz: **float**The Z value up vector.

New in version 1.6.0.

`multiply``()`

Multiply the given matrix with self (from the left) i.e. we premultiply the given matrix by the current matrix and return the result (not inplace):

```
m.multiply(n) -> n * m
```

Parameters

ma: **Matrix**The matrix to multiply by

normal_matrix()

Computes the normal matrix, which is the inverse transpose of the top left 3x3 modelview matrix used to transform normals into eye/camera space.

New in version 1.6.0.

perspective()

Creates a perspective matrix (inplace).

Parameters

fovy: **float**"Field Of View" angle
aspect: **float**Aspect ratio
zNear: **float**Near clipping plane
zFar: **float**Far clippin plane

New in version 1.6.0.

project()

Project a point from 3d space into a 2d viewport.

Parameters

objx: **float**Points X co-ordinate
objy: **float**Points Y co-ordinate
objz: **float**Points Z co-ordinate
model: **Matrix**The model matrix
proj: **Matrix**The projection matrix
vx: **float**Viewports X co-ordinate
vy: **float**Viewports y co-ordinate
vw: **float**Viewports width
vh: **float**Viewports height

New in version 1.7.0.

rotate()

Rotate the matrix through the angle around the axis (x, y, z) (inplace).

Parameters

angle: **float**The angle through which to rotate the matrix
x: **float**X position of the point
y: **float**Y position of the point
z: **float**Z position of the point

scale()

Scale the current matrix by the specified factors over each dimension (inplace).

Parameters

x: **float**The scale factor along the X axis
y: **float**The scale factor along the Y axis
z: **float**The scale factor along the Z axis

translate()

Translate the matrix.

Parameters

x: **float**The translation factor along the X axis
y: **float**The translation factor along the Y axis
z: **float**The translation factor along the Z axis

transpose()

Return the transposed matrix as a new Matrix.

New in version 1.6.0.

view_clip()

Create a clip matrix (inplace).

Parameters

left: **float**Co-ordinate

right: **float**Co-ordinate
bottom: **float**Co-ordinate
top: **float**Co-ordinate
near: **float**Co-ordinate
far: **float**Co-ordinate
perpective: **int**Co-ordinate

Changed in version 1.6.0: Enable support for perspective parameter.

61.17 Vertex Instructions

This module includes all the classes for drawing simple vertex objects.

Note: The list attributes of the graphics instruction classes (e.g. `Triangle.points`, `Mesh.indices` etc.) are not Kivy properties but Python properties. As a consequence, the graphics will only be updated when the list object itself is changed and not when list values are modified.

For example in python:

```
class MyWidget(Button):

    triangle = ObjectProperty(None)
    def __init__(self, **kwargs):
        super(MyWidget, self).__init__(**kwargs)
        with self.canvas:
            self.triangle = Triangle(points=[0,0, 100,100, 200,0])
```

and in kv:

```
<MyWidget>:
    text: 'Update'
    on_press:
        self.triangle.points[3] = 400
```

Although when the button is pressed the triangle coordinates will be changed, the graphics will not be updated because the list itself has not been changed. Similarly, no updates will occur using any syntax that changes only elements of the list e.g. self.triangle.points[0:2] = [10,10] or self.triangle.points.insert(10) etc. To force an update after a change, the list variable itself must be changed, which in this case can be achieved with:

```
<MyWidget>:
    text: 'Update'
    on_press:
        self.triangle.points[3] = 400
        self.triangle.points = self.triangle.points
```

class `kivy.graphics.vertex_instructions.`**`Triangle`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d triangle.

Parameters

points: **list**List of points in the format (x1, y1, x2, y2, x3, y3).

`points`

Property for getting/settings points of the triangle.

class `kivy.graphics.vertex_instructions.`**`Quad`**
Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d quad.

Parameters

points: **list**List of point in the format (x1, y1, x2, y2, x3, y3, x4, y4).

`points`
Property for getting/settings points of the quad.

class `kivy.graphics.vertex_instructions.`**`Rectangle`**
Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d rectangle.

Parameters

pos: **list**Position of the rectangle, in the format (x, y).
size: **list**Size of the rectangle, in the format (width, height).

`pos`
Property for getting/settings the position of the rectangle.

`size`
Property for getting/settings the size of the rectangle.

class `kivy.graphics.vertex_instructions.`**`BorderImage`**
Bases: `kivy.graphics.vertex_instructions.Rectangle`

A 2d border image. The behavior of the border image is similar to the concept of a CSS3 border-image.

Parameters

border: **list**Border information in the format (top, right, bottom, left). Each value is in pixels.

`border`
Property for getting/setting the border of the class.

class `kivy.graphics.vertex_instructions.`**`Ellipse`**
Bases: `kivy.graphics.vertex_instructions.Rectangle`

A 2D ellipse.

Changed in version 1.0.7: Added angle_start and angle_end.

Parameters

segments: **int, defaults to 180**Define how many segments are needed for drawing the ellipse. The drawing will be smoother if you have many segments.
angle_start: **int, defaults to 0**Specifies the starting angle, in degrees, of the disk portion.
angle_end: **int, defaults to 360**Specifies the ending angle, in degrees, of the disk portion.

`angle_end`
End angle of the ellipse in degrees, defaults to 360.

`angle_start`
Start angle of the ellipse in degrees, defaults to 0.

`segments`
Property for getting/setting the number of segments of the ellipse.

class `kivy.graphics.vertex_instructions.`**`Line`**
Bases: `kivy.graphics.instructions.VertexInstruction`

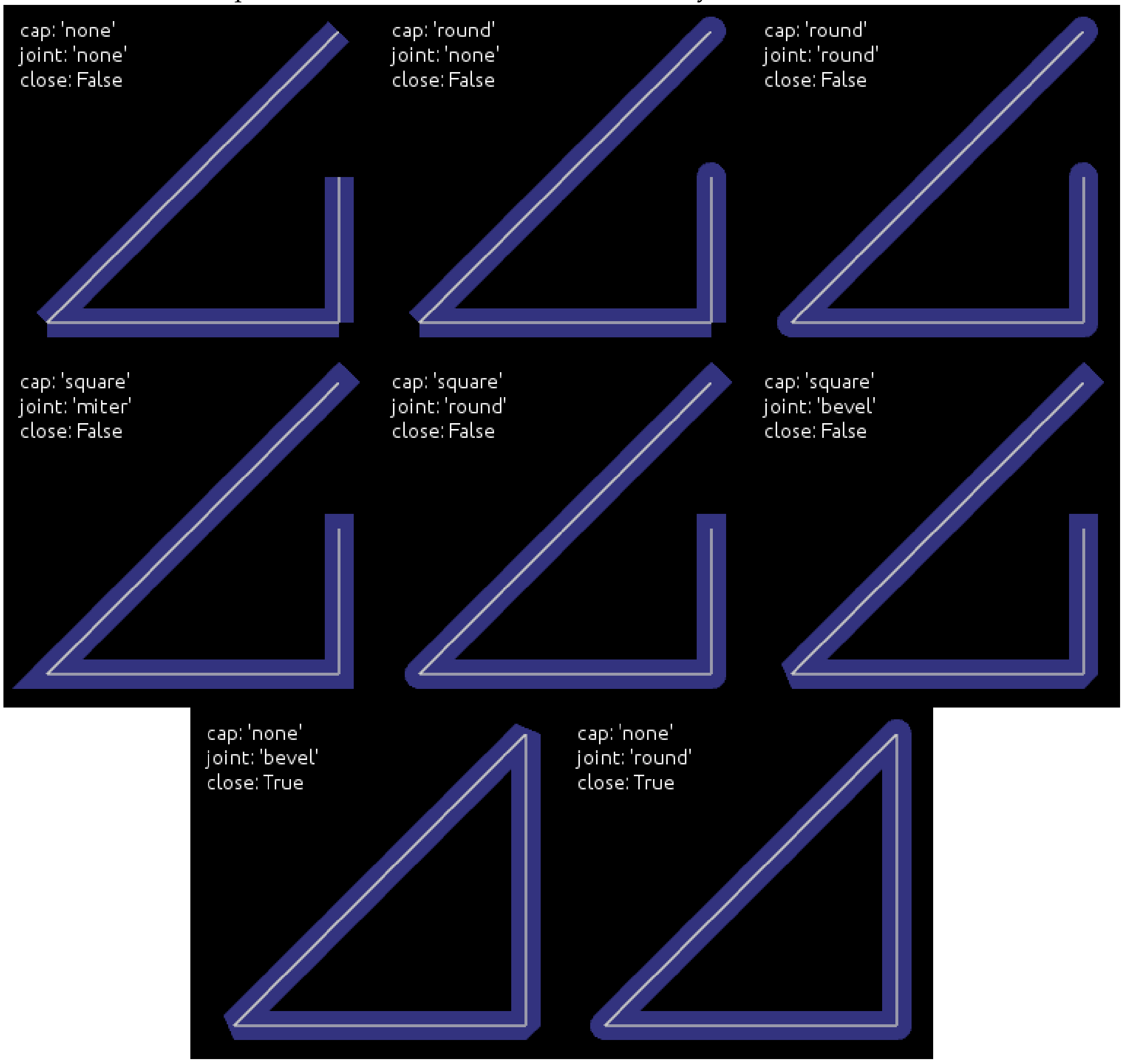
A 2d line.

Drawing a line can be done easily:

```
with self.canvas:
    Line(points=[100, 100, 200, 100, 100, 200], width=10)
```

The line has 3 internal drawing modes that you should be aware of for optimal results:

1. If the width is 1.0, then the standard GL_LINE drawing from OpenGL will be used. dash_length and dash_offset will work, while properties for cap and joint have no meaning here.
2. If the width is > 1.0, then a custom drawing method will be used, based on triangles. dash_length and dash_offset do not work in this mode. Additionally, if the current color has an alpha < 1.0, a stencil will be used internally to draw the line.



Parameters

points: **list**List of points in the format (x1, y1, x2, y2...)
dash_length: **int**Length of a segment (if dashed), defaults to 1.
dash_offset: **int**Offset between the end of a segments and the begining of the next one, defaults to 0. Changing this makes it dashed.
width: **float**Width of the line, defaults to 1.0.
cap: **str, defaults to 'round'**See cap for more information.
joint: **str, defaults to 'round'**See joint for more information.
cap_precision: **int, defaults to 10**See cap_precision for more information
joint_precision: **int, defaults to 10**See joint_precision for more information
See cap_precision for more information.
joint_precision: **int, defaults to 10**See joint_precision for more informa-

tion.

close: **bool, defaults to False**If True, the line will be closed.

circle: **list**If set, the `points` will be set to build a circle. Check `circle` for more information.

ellipse: **list**If set, the `points` will be set to build an ellipse. Check `ellipse` for more information.

rectangle: **list**If set, the `points` will be set to build a rectangle. Check `rectangle` for more information.

bezier: **list**If set, the `points` will be set to build a bezier line. Check `bezier` for more information.

bezier_precision: **int, defaults to 180**Precision of the Bezier drawing.

Changed in version 1.0.8: *dash_offset* and *dash_length* have been added

Changed in version 1.4.1: *width*, *cap*, *joint*, *cap_precision*, *joint_precision*, *close*, *ellipse*, *rectangle* have been added.

Changed in version 1.4.1: *bezier*, *bezier_precision* have been added.

`bezier`

Use this property to build a bezier line, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of 2n elements, n being the number of points.

Usage:

```
Line(bezier=(x1, y1, x2, y2, x3, y3)
```

New in version 1.4.2.

Note: Bezier lines calculations are inexpensive for a low number of points, but complexity is quadratic, so lines with a lot of points can be very expensive to build, use with care!

`bezier_precision`

Number of iteration for drawing the bezier between 2 segments, defaults to 180. The bezier_precision must be at least 1.

New in version 1.4.2.

`cap`

Determine the cap of the line, defaults to 'round'. Can be one of 'none', 'square' or 'round'

New in version 1.4.1.

`cap_precision`

Number of iteration for drawing the "round" cap, defaults to 10. The cap_precision must be at least 1.

New in version 1.4.1.

`circle`

Use this property to build a circle, without calculate the `points`. You can only set this property, not get it.

The argument must be a tuple of (center_x, center_y, radius, angle_start, angle_end, segments):

- center_x and center_y represent the center of the circle
- radius represent the radius of the circle
- **(optional) angle_start and angle_end are in degree. The default**value is 0 and 360.
- **(optional) segments is the precision of the ellipse. The default**value is calculated from the range between angle.

Note that it's up to you to `close` the circle or not.

For example, for building a simple ellipse, in python:

```
# simple circle
Line(circle=(150, 150, 50))

# only from 90 to 180 degrees
Line(circle=(150, 150, 50, 90, 180))

# only from 90 to 180 degrees, with few segments
Line(circle=(150, 150, 50, 90, 180, 20))
```

New in version 1.4.1.

`close`
If True, the line will be closed.

New in version 1.4.1.

`dash_length`
Property for getting/setting the length of the dashes in the curve

New in version 1.0.8.

`dash_offset`
Property for getting/setting the offset between the dashes in the curve

New in version 1.0.8.

`ellipse`
Use this property to build an ellipse, without calculate the `points`. You can only set this property, not get it.

The argument must be a tuple of (x, y, width, height, angle_start, angle_end, segments):

- x and y represent the bottom left of the ellipse
- width and height represent the size of the ellipse
- **(optional) angle_start and angle_end are in degree. The default**value is 0 and 360.
- **(optional) segments is the precision of the ellipse. The default**value is calculated from the range between angle.

Note that it's up to you to `close` the ellipse or not.

For example, for building a simple ellipse, in python:

```
# simple ellipse
Line(ellipse=(0, 0, 150, 150))

# only from 90 to 180 degrees
Line(ellipse=(0, 0, 150, 150, 90, 180))

# only from 90 to 180 degrees, with few segments
Line(ellipse=(0, 0, 150, 150, 90, 180, 20))
```

New in version 1.4.1.

`joint`
Determine the join of the line, defaults to 'round'. Can be one of 'none', 'round', 'bevel', 'miter'.

New in version 1.4.1.

`joint_precision`
Number of iteration for drawing the "round" joint, defaults to 10. The joint_precision must be at least 1.

New in version 1.4.1.

points

Property for getting/settings points of the line

Warning: This will always reconstruct the whole graphics from the new points list. It can be very CPU expensive.

rectangle

Use this property to build a rectangle, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of (x, y, width, height) angle_end, segments):

- x and y represent the bottom-left position of the rectangle
- width and height represent the size

The line is automatically closed.

Usage:

```
Line(rectangle=(0, 0, 200, 200))
```

New in version 1.4.1.

rounded_rectangle

Use this property to build a rectangle, without calculating the `points`. You can only set this property, not get it.

The argument must be a tuple of one of the following forms:

- (x, y, width, height, corner_radius)
- (x, y, width, height, corner_radius, resolution)
- (x, y, width, height, corner_radius1, corner_radius2, corner_radius3, corner_radius4)
- (x, y, width, height, corner_radius1, corner_radius2, corner_radius3, corner_radius4, resolution)
- x and y represent the bottom-left position of the rectangle
- width and height represent the size
- corner_radius is the number of pixels between two borders and the center of the circle arc joining them
- resolution is the numper of line segment that will be used to draw the circle arc at each corner (default to 30)

The line is automatically closed.

Usage:

```
Line(rounded_rectangle=(0, 0, 200, 200, 10, 20, 30, 40, 100))
```

New in version 1.9.0.

width

Determine the width of the line, defaults to 1.0.

New in version 1.4.1.

class `kivy.graphics.vertex_instructions.`**`Point`**

Bases: `kivy.graphics.instructions.VertexInstruction`

A 2d line.

Parameters

points: **list**List of points in the format (x1, y1, x2, y2...).

pointsize: **float, defaults to 1.**Size of the point (1. means the real size will be 2).

Warning: Starting from version 1.0.7, vertex instruction have a limit of 65535 vertices (indices of vertex to be accurate). 2 entries in the list (x, y) will be converted to 4 vertices. So the limit inside Point() class is 2^15-2.

add_point()

Add a point to the current points list.

If you intend to add multiple points, prefer to use this method instead of reassigning a new points list. Assigning a new points list will recalculate and reupload the whole buffer into the GPU. If you use add_point, it will only upload the changes.

points

Property for getting/settings points of the triangle.

pointsize

Property for getting/setting point size.

class kivy.graphics.vertex_instructions.**Mesh**

Bases: kivy.graphics.instructions.VertexInstruction

A 2d mesh.

The format for vertices is currently fixed but this might change in a future release. Right now, each vertex is described with 2D coordinates (x, y) and a 2D texture coordinate (u, v).

In OpenGL ES 2.0 and in our graphics implementation, you cannot have more than 65535 indices.

A list of vertices is described as:

```
vertices = [x1, y1, u1, v1, x2, y2, u2, v2, ...]
            |            |  |            |
            +---- i1 ----+  +---- i2 ----+
```

If you want to draw a triangle, add 3 vertices. You can then make an indices list as follows:

indices = [0, 1, 2]

New in version 1.1.0.

Parameters

vertices: **list**List of vertices in the format (x1, y1, u1, v1, x2, y2, u2, v2...).

indices: **list**List of indices in the format (i1, i2, i3...).

mode: **str**Mode of the vbo. Check mode for more information. Defaults to 'points'.

indices

Vertex indices used to specify the order when drawing the mesh.

mode

VBO Mode used for drawing vertices/indices. Can be one of 'points', 'line_strip', 'line_loop', 'lines', 'triangles', 'triangle_strip' or 'triangle_fan'.

vertices

List of x, y, u, v coordinates used to construct the Mesh. Right now, the Mesh instruction doesn't allow you to change the format of the vertices, which means it's only x, y + one texture coordinate.

class kivy.graphics.vertex_instructions.**GraphicException**

Bases: exceptions.Exception

Exception raised when a graphics error is fired.

class kivy.graphics.vertex_instructions.**Bezier**

Bases: kivy.graphics.instructions.VertexInstruction

A 2d Bezier curve.

New in version 1.0.8.

Parameters

points: **list**List of points in the format (x1, y1, x2, y2...)

segments: **int, defaults to 180**Define how many segments are needed for drawing the curve. The drawing will be smoother if you have many segments.

loop: **bool, defaults to False**Set the bezier curve to join the last point to the first.

dash_length: **int**Length of a segment (if dashed), defaults to 1.

dash_offset: **int**Distance between the end of a segment and the start of the next one, defaults to 0. Changing this makes it dashed.

`dash_length`

Property for getting/setting the length of the dashes in the curve.

`dash_offset`

Property for getting/setting the offset between the dashes in the curve.

`points`

Property for getting/settings the points of the triangle.

> **Warning:** This will always reconstruct the whole graphic from the new points list. It can be very CPU intensive.

`segments`

Property for getting/setting the number of segments of the curve.

class `kivy.graphics.vertex_instructions.`**`SmoothLine`**

Bases: `kivy.graphics.vertex_instructions.Line`

Experimental line using over-draw method to get better antialiasing results. It has few drawbacks:

- drawing line with alpha will unlikely doesn't give the intended result if the line cross itself
- no cap or joint are supported
- it use a custom texture with premultiplied alpha
- dash is not supported
- line under 1px width are not supported, it will look the same

> **Warning:** This is an unfinished work, experimental, subject to crash.

New in version 1.9.0.

`overdraw_width`

Determine the overdraw width of the line, defaults to 1.2

CHAPTER

SIXTYTWO

GRAPHICS COMPILER

Before rendering an InstructionGroup, we compile the group in order to reduce the number of instructions executed at rendering time.

62.1 Reducing the context instructions

Imagine that you have a scheme like this:

```
Color(1, 1, 1)
Rectangle(source='button.png', pos=(0, 0), size=(20, 20))
Color(1, 1, 1)
Rectangle(source='button.png', pos=(10, 10), size=(20, 20))
Color(1, 1, 1)
Rectangle(source='button.png', pos=(10, 20), size=(20, 20))
```

The real instructions seen by the graphics canvas would be:

```
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
```

Only the first Color and BindTexture are useful and really change the context. We can reduce them to:

```
Color: change 'color' context to 1, 1, 1
BindTexture: change 'texture0' to `button.png texture`
Rectangle: push vertices (x1, y1...) to vbo & draw
Rectangle: push vertices (x1, y1...) to vbo & draw
Rectangle: push vertices (x1, y1...) to vbo & draw
```

This is what the compiler does in the first place, by flagging all the unused instruction with GI_IGNORE flag. As soon as a Color content changes, the whole InstructionGroup will be recompiled and a previously unused Color might be used for the next compilation.

Note to any Kivy contributor / internal developer:

- All context instructions are checked to see if they change anything in the cache.

- We must ensure that a context instruction is needed for our current Canvas.
- We must ensure that we don't depend of any other canvas.
- We must reset our cache if one of our children is another instruction group because we don't know whether it might do weird things or not.

CHAPTER

SIXTYTHREE

CONTEXT MANAGEMENT

New in version 1.2.0.

This class manages a registry of all created graphics instructions. It has the ability to flush and delete them.

You can read more about Kivy graphics contexts in the *Graphics* module documentation. These are based on OpenGL graphics contexts.

class `kivy.graphics.context.`**`Context`**

Bases: `object`

The Context class manages groups of graphics instructions. It can also be used to manage observer callbacks. See `add_reload_observer()` and `remove_reload_observer()` for more information.

`add_reload_observer``()`

(internal) Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data into the GPU.

Parameters

***callback*: func(context) -> return None**The first parameter will be the context itself

***before*: boolean, defaults to False**If True, the callback will be executed before all the reloading processes. Use it if you want to clear your cache for example.

Changed in version 1.4.0: *before* parameter added.

`remove_reload_observer``()`

(internal) Remove a callback from the observer list previously added by `add_reload_observer()`.

CHAPTER

SIXTYFOUR

CONTEXT INSTRUCTIONS

The context instructions represent non graphics elements such as:

- Matrix manipulations (PushMatrix, PopMatrix, Rotate, Translate, Scale, MatrixInstruction)
- Color manipulations (Color)
- Texture bindings (BindTexture)

Changed in version 1.0.8: The LineWidth instruction has been removed. It wasn't working before and we actually have no working implementation. We need to do more experimentation to get it right. Check the bug #207 for more information.

class `kivy.graphics.context_instructions.`**`Color`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Instruction to set the color state for any vertices being drawn after it. All the values passed are between 0 and 1, not 0 and 255.

In Python, you can do:

```
from kivy.graphics import Color

# create red v
c = Color(1, 0, 0)
# create blue color
c = Color(0, 1, 0)
# create blue color with 50% alpha
c = Color(0, 1, 0, .5)

# using hsv mode
c = Color(0, 1, 1, mode='hsv')
# using hsv mode + alpha
c = Color(0, 1, 1, .2, mode='hsv')
```

In kv lang:

```
<Rule>:
    canvas:
        # red color
        Color:
            rgb: 1, 0, 0
        # blue color
        Color:
            rgb: 0, 1, 0
        # blue color with 50% alpha
        Color:
            rgba: 0, 1, 0, .5
        # using hsv mode
        Color:
            hsv: 0, 1, 1
        # using hsv mode + alpha
        Color:
            hsv: 0, 1, 1
            a: .5
```

a
Alpha component, between 0 and 1.

b
Blue component, between 0 and 1.

g
Green component, between 0 and 1.

h
Hue component, between 0 and 1.

hsv
HSV color, list of 3 values in 0-1 range, alpha will be 1.

r
Red component, between 0 and 1.

rgb
RGB color, list of 3 values in 0-1 range. The alpha will be 1.

rgba
RGBA color, list of 4 values in 0-1 range.

s
Saturation component, between 0 and 1.

v
Value component, between 0 and 1.

class `kivy.graphics.context_instructions.`**`BindTexture`**
Bases: `kivy.graphics.instructions.ContextInstruction`

BindTexture Graphic instruction. The BindTexture Instruction will bind a texture and enable GL_TEXTURE_2D for subsequent drawing.

Parameters
texture: **Texture**Specifies the texture to bind to the given index.

source
Set/get the source (filename) to load for the texture.

class `kivy.graphics.context_instructions.`**`PushMatrix`**
Bases: `kivy.graphics.instructions.ContextInstruction`

Push the matrix onto the context's matrix stack.

stack
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.context_instructions.`**`PopMatrix`**
Bases: `kivy.graphics.instructions.ContextInstruction`

Pop the matrix from the context's matrix stack onto the model view.

stack
Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

class `kivy.graphics.context_instructions.`**`Rotate`**
Bases: `kivy.graphics.context_instructions.Transform`

Rotate the coordinate space by applying a rotation transformation on the modelview matrix. You can set the properties of the instructions afterwards with e.g.:

```
rot.angle = 90
rot.axis = (0, 0, 1)
```

`angle`
Property for getting/setting the angle of the rotation.

`axis`
Property for getting/setting the axis of the rotation.

The format of the axis is (x, y, z).

`origin`
Origin of the rotation.

New in version 1.7.0.

The format of the origin can be either (x, y) or (x, y, z).

`set``()`
Set the angle and axis of rotation.

```
>>> rotationobject.set(90, 0, 0, 1)
```

Deprecated since version 1.7.0: The set() method doesn't use the new `origin` property.

class `kivy.graphics.context_instructions.`**`Scale`**
Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a non uniform scale transformation.

Create using one or three arguments:

```
Scale(s)          # scale all three axes the same
Scale(x, y, z)    # scale the axes independently
```

Deprecated since version 1.6.0: Deprecated single scale property in favor of x, y, z, xyz axis independant scaled factors.

`scale`
Property for getting/setting the scale.

Deprecated since version 1.6.0: Deprecated in favor of per axis scale properties x,y,z, xyz, etc.

`x`
Property for getting/setting the scale on the X axis.

Changed in version 1.6.0.

`xyz`
3 tuple scale vector in 3D in x, y, and z axis.

Changed in version 1.6.0.

`y`
Property for getting/setting the scale on the Y axis.

Changed in version 1.6.0.

z

Property for getting/setting the scale on Z axis.

Changed in version 1.6.0.

class `kivy.graphics.context_instructions.`**`Translate`**

Bases: `kivy.graphics.context_instructions.Transform`

Instruction to create a translation of the model view coordinate space.

Construct by either:

```
Translate(x, y)         # translate in just the two axes
Translate(x, y, z)      # translate in all three axes
```

x

Property for getting/setting the translation on the X axis.

xy

2 tuple with translation vector in 2D for x and y axis.

xyz

3 tuple translation vector in 3D in x, y, and z axis.

y

Property for getting/setting the translation on the Y axis.

z

Property for getting/setting the translation on the Z axis.

class `kivy.graphics.context_instructions.`**`MatrixInstruction`**

Bases: `kivy.graphics.instructions.ContextInstruction`

Base class for Matrix Instruction on the canvas.

matrix

Matrix property. Matrix from the transformation module. Setting the matrix using this property when a change is made is important because it will notify the context about the update.

stack

Name of the matrix stack to use. Can be 'modelview_mat' or 'projection_mat'.

New in version 1.6.0.

CHAPTER

SIXTYFIVE

FRAMEBUFFER

The Fbo is like an offscreen window. You can activate the fbo for rendering into a texture and use your fbo as a texture for other drawing.

The Fbo acts as a `kivy.graphics.instructions.Canvas`.

Here is an example of using an fbo for some colored rectangles:

```
from kivy.graphics import Fbo, Color, Rectangle

class FboTest(Widget):
    def __init__(self, **kwargs):
        super(FboTest, self).__init__(**kwargs)

        # first step is to create the fbo and use the fbo texture on other
        # rectangle

        with self.canvas:
            # create the fbo
            self.fbo = Fbo(size=(256, 256))

            # show our fbo on the widget in different size
            Color(1, 1, 1)
            Rectangle(size=(32, 32), texture=self.fbo.texture)
            Rectangle(pos=(32, 0), size=(64, 64), texture=self.fbo.texture)
            Rectangle(pos=(96, 0), size=(128, 128), texture=self.fbo.texture)

        # in the second step, you can draw whatever you want on the fbo
        with self.fbo:
            Color(1, 0, 0, .8)
            Rectangle(size=(256, 64))
            Color(0, 1, 0, .8)
            Rectangle(size=(64, 256))
```

If you change anything in the *self.fbo* object, it will be automatically updated. The canvas where the fbo is put will be automatically updated as well.

65.1 Reloading the FBO content

New in version 1.2.0.

If the OpenGL context is lost, then the FBO is lost too. You need to reupload data on it yourself. Use the `Fbo.add_reload_observer()` to add a reloading function that will be automatically called when needed:

```
def __init__(self, **kwargs):
    super(...).__init__(**kwargs)
    self.fbo = Fbo(size=(512, 512))
    self.fbo.add_reload_observer(self.populate_fbo)

    # and load the data now.
    self.populate_fbo(self.fbo)


def populate_fbo(self, fbo):
    with fbo:
        # .. put your Color / Rectangle / ... here
```

This way, you could use the same method for initialization and for reloading. But it's up to you.

class `kivy.graphics.fbo.`**`Fbo`**

Bases: `kivy.graphics.instructions.RenderContext`

Fbo class for wrapping the OpenGL Framebuffer extension. The Fbo support "with" statement.

Parameters

clear_color: **tuple, defaults to (0, 0, 0, 0)**Define the default color for clearing the framebuffer

size: **tuple, defaults to (1024, 1024)**Default size of the framebuffer

push_viewport: **bool, defaults to True**If True, the OpenGL viewport will be set to the framebuffer size, and will be automatically restored when the framebuffer released.

with_depthbuffer: **bool, defaults to False**If True, the framebuffer will be allocated with a Z buffer.

with_stencilbuffer: **bool, defaults to False**New in version 1.9.0.

If True, the framebuffer will be allocated with a stencil buffer.

texture: **`Texture`, defaults to None**If None, a default texture will be created.

Note: Using both of `with_stencilbuffer` and `with_depthbuffer` is not supported in kivy 1.9.0

`add_reload_observer``()`

Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data in GPU.

New in version 1.2.0.

Parameters

callback: **func(context) -> return None**The first parameter will be the context itself

`bind``()`

Bind the FBO to the current opengl context. *Bind* mean that you enable the Framebuffer, and all the drawing operations will act inside the Framebuffer, until `release()` is called.

The bind/release operations are automatically called when you add graphics objects into it. If you want to manipulate a Framebuffer yourself, you can use it like this:

```
self.fbo = FBO()
self.fbo.bind()
# do any drawing command
self.fbo.release()

# then, your fbo texture is available at
print(self.fbo.texture)
```

clear_buffer()

Clear the framebuffer with the clear_color.

You need to bind the framebuffer yourself before calling this method:

```
fbo.bind()
fbo.clear_buffer()
fbo.release()
```

clear_color

Clear color in (red, green, blue, alpha) format.

get_pixel_color()

Get the color of the pixel with specified window coordinates wx, wy. It returns result in RGBA format.

New in version 1.8.0.

pixels

Get the pixels texture, in RGBA format only, unsigned byte. The origin of the image is at bottom left.

New in version 1.7.0.

release()

Release the Framebuffer (unbind).

remove_reload_observer()

Remove a callback from the observer list, previously added by add_reload_observer().

New in version 1.2.0.

size

Size of the framebuffer, in (width, height) format.

If you change the size, the framebuffer content will be lost.

texture

Return the framebuffer texture

CHAPTER

SIXTYSIX

GL INSTRUCTIONS

New in version 1.3.0.

66.1 Clearing an FBO

To clear an FBO, you can use `ClearColor` and `ClearBuffers` instructions like this example:

```
self.fbo = Fbo(size=self.size)
with self.fbo:
    ClearColor(0, 0, 0, 0)
    ClearBuffers()
```

class `kivy.graphics.gl_instructions.`**`ClearColor`**

Bases: `kivy.graphics.instructions.Instruction`

ClearColor Graphics Instruction.

New in version 1.3.0.

Sets the clear color used to clear buffers with the glClear function or `ClearBuffers` graphics instructions.

`a`

Alpha component, between 0 and 1.

`b`

Blue component, between 0 and 1.

`g`

Green component, between 0 and 1.

`r`

Red component, between 0 and 1.

`rgb`

RGB color, a list of 3 values in 0-1 range where alpha will be 1.

`rgba`

RGBA color used for the clear color, a list of 4 values in the 0-1 range.

class `kivy.graphics.gl_instructions.`**`ClearBuffers`**

Bases: `kivy.graphics.instructions.Instruction`

Clearbuffer Graphics Instruction.

New in version 1.3.0.

Clear the buffers specified by the instructions buffer mask property. By default, only the coloc buffer is cleared.

`clear_color`
: If True, the color buffer will be cleared.

`clear_depth`
: If True, the depth buffer will be cleared.

`clear_stencil`
: If True, the stencil buffer will be cleared.

CHAPTER

SIXTYSEVEN

CANVAS

The Canvas is the root object used for drawing by a Widget. Check the class documentation for more information about the usage of Canvas.

class kivy.graphics.instructions.**Instruction**

Bases: kivy.event.ObjectWithUid

Represents the smallest instruction available. This class is for internal usage only, don't use it directly.

proxy_ref

Return a proxy reference to the Instruction i.e. without creating a reference of the widget. See weakref.proxy for more information.

New in version 1.7.2.

class kivy.graphics.instructions.**InstructionGroup**

Bases: kivy.graphics.instructions.Instruction

Group of Instructions. Allows for the adding and removing of graphics instructions. It can be used directly as follows:

```
blue = InstructionGroup()
blue.add(Color(0, 0, 1, 0.2))
blue.add(Rectangle(pos=self.pos, size=(100, 100)))

green = InstructionGroup()
green.add(Color(0, 1, 0, 0.4))
green.add(Rectangle(pos=(100, 100), size=(100, 100)))

# Here, self should be a Widget or subclass
[self.canvas.add(group) for group in [blue, green]]
```

add()

Add a new Instruction to our list.

clear()

Remove all the Instructions.

get_group()

Return an iterable for all the Instructions with a specific group name.

insert()

Insert a new Instruction into our list at index.

remove()

Remove an existing Instruction from our list.

remove_group()

Remove all Instructions with a specific group name.

class kivy.graphics.instructions.**ContextInstruction**

Bases: kivy.graphics.instructions.Instruction

The ContextInstruction class is the base for the creation of instructions that don't have a direct visual representation, but instead modify the current Canvas' state, e.g. texture binding, setting color parameters, matrix manipulation and so on.

class kivy.graphics.instructions.**VertexInstruction**

Bases: kivy.graphics.instructions.Instruction

The VertexInstruction class is the base for all graphics instructions that have a direct visual representation on the canvas, such as Rectangles, Triangles, Lines, Ellipse and so on.

source

This property represents the filename to load the texture from. If you want to use an image as source, do it like this:

```
with self.canvas:
    Rectangle(source='mylogo.png', pos=self.pos, size=self.size)
```

Here's the equivalent in Kivy language:

```
<MyWidget>:
    canvas:
        Rectangle:
            source: 'mylogo.png'
            pos: self.pos
            size: self.size
```

Note: The filename will be searched for using the kivy.resources.resource_find() function.

tex_coords

This property represents the texture coordinates used for drawing the vertex instruction. The value must be a list of 8 values.

A texture coordinate has a position (u, v), and a size (w, h). The size can be negative, and would represent the 'flipped' texture. By default, the tex_coords are:

```
[u, v, u + w, v, u + w, y + h, u, y + h]
```

You can pass your own texture coordinates if you want to achieve fancy effects.

Warning: The default values just mentioned can be negative. Depending on the image and label providers, the coordinates are flipped vertically because of the order in which the image is internally stored. Instead of flipping the image data, we are just flipping the texture coordinates to be faster.

texture

Property that represents the texture used for drawing this Instruction. You can set a new texture like this:

```
from kivy.core.image import Image

texture = Image('logo.png').texture
```

```
        with self.canvas:
            Rectangle(texture=texture, pos=self.pos, size=self.size)
```

Usually, you will use the `source` attribute instead of the texture.

class `kivy.graphics.instructions.`**`Canvas`**
Bases: `kivy.graphics.instructions.CanvasBase`

The important Canvas class. Use this class to add graphics or context instructions that you want to be used for drawing.

Note: The Canvas supports Python's `with` statement and its enter & exit semantics.

Usage of a canvas without the `with` statement:

```
self.canvas.add(Color(1., 1., 0))
self.canvas.add(Rectangle(size=(50, 50)))
```

Usage of a canvas with Python's `with` statement:

```
with self.canvas:
    Color(1., 1., 0)
    Rectangle(size=(50, 50))
```

`after`
Property for getting the 'after' group.

`ask_update``()`
Inform the canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

`before`
Property for getting the 'before' group.

`clear``()`
Clears every `Instruction` in the canvas, leaving it clean.

`draw``()`
Apply the instruction to our window.

`has_after`
Property to see if the `after` group has already been created.

New in version 1.7.0.

`has_before`
Property to see if the `before` group has already been created.

New in version 1.7.0.

`opacity`
Property to get/set the opacity value of the canvas.

New in version 1.4.1.

The opacity attribute controls the opacity of the canvas and its children. Be careful, it's a cumulative attribute: the value is multiplied to the current global opacity and the result is applied to the current context color.

For example: if your parent has an opacity of 0.5 and a child has an opacity of 0.2, the real opacity of the child will be 0.5 * 0.2 = 0.1.

Then, the opacity is applied on the shader as:

```
        frag_color = color * vec4(1.0, 1.0, 1.0, opacity);
```

class kivy.graphics.instructions.**CanvasBase**
Bases: kivy.graphics.instructions.InstructionGroup

CanvasBase provides the context manager methods for the Canvas.

class kivy.graphics.instructions.**RenderContext**
Bases: kivy.graphics.instructions.Canvas

The render context stores all the necessary information for drawing, i.e.:

- The vertex shader
- The fragment shader
- The default texture
- The state stack (color, texture, matrix...)

shader
Return the shader attached to the render context.

use_parent_modelview
If True, the parent modelview matrix will be used.

New in version 1.7.0.

Before:

```
rc['modelview_mat'] = Window.render_context['modelview_mat']
```

Now:

```
rc = RenderContext(use_parent_modelview=True)
```

use_parent_projection
If True, the parent projection matrix will be used.

New in version 1.7.0.

Before:

```
rc['projection_mat'] = Window.render_context['projection_mat']
```

Now:

```
rc = RenderContext(use_parent_projection=True)
```

class kivy.graphics.instructions.**Callback**
Bases: kivy.graphics.instructions.Instruction

New in version 1.0.4.

A Callback is an instruction that will be called when the drawing operation is performed. When adding instructions to a canvas, you can do this:

```
with self.canvas:
    Color(1, 1, 1)
    Rectangle(pos=self.pos, size=self.size)
    Callback(self.my_callback)
```

The definition of the callback must be:

```
def my_callback(self, instr):
    print('I have been called!')
```

Warning: Note that if you perform many and/or costly calls to callbacks, you might potentially slow down the rendering performance significantly.

The updating of your canvas does not occur until something new happens. From your callback, you can ask for an update:

```
with self.canvas:
    self.cb = Callback(self.my_callback)
# then later in the code
self.cb.ask_update()
```

If you use the Callback class to call rendering methods of another toolkit, you will have issues with the OpenGL context. The OpenGL state may have been manipulated by the other toolkit, and as soon as program flow returns to Kivy, it will just break. You can have glitches, crashes, black holes might occur, etc. To avoid that, you can activate the `reset_context` option. It will reset the OpenGL context state to make Kivy's rendering correct after the call to your callback.

Warning: The `reset_context` is not a full OpenGL reset. If you have issues regarding that, please contact us.

`ask_update()`

Inform the parent canvas that we'd like it to update on the next frame. This is useful when you need to trigger a redraw due to some value having changed for example.

New in version 1.0.4.

`reset_context`

Set this to True if you want to reset the OpenGL context for Kivy after the callback has been called.

CHAPTER

SIXTYEIGHT

OPENGL

This module is a Python wrapper for OpenGL commands.

Warning: Not every OpenGL command has been wrapped and because we are using the C binding for higher performance, and you should rather stick to the Kivy Graphics API. By using OpenGL commands directly, you might change the OpenGL context and introduce inconsistency between the Kivy state and the OpenGL state.

`kivy.graphics.opengl.`**`glActiveTexture`**`()`
: See: glActiveTexture() on Kronos website

`kivy.graphics.opengl.`**`glAttachShader`**`()`
: See: glAttachShader() on Kronos website

`kivy.graphics.opengl.`**`glBindAttribLocation`**`()`
: See: glBindAttribLocation() on Kronos website

`kivy.graphics.opengl.`**`glBindBuffer`**`()`
: See: glBindBuffer() on Kronos website

`kivy.graphics.opengl.`**`glBindFramebuffer`**`()`
: See: glBindFramebuffer() on Kronos website

`kivy.graphics.opengl.`**`glBindRenderbuffer`**`()`
: See: glBindRenderbuffer() on Kronos website

`kivy.graphics.opengl.`**`glBindTexture`**`()`
: See: glBindTexture() on Kronos website

`kivy.graphics.opengl.`**`glBlendColor`**`()`
: See: glBlendColor() on Kronos website

`kivy.graphics.opengl.`**`glBlendEquation`**`()`
: See: glBlendEquation() on Kronos website

`kivy.graphics.opengl.`**`glBlendEquationSeparate`**`()`
: See: glBlendEquationSeparate() on Kronos website

`kivy.graphics.opengl.`**`glBlendFunc`**`()`
: See: glBlendFunc() on Kronos website

`kivy.graphics.opengl.`**`glBlendFuncSeparate`**`()`
: See: glBlendFuncSeparate() on Kronos website

`kivy.graphics.opengl.`**`glBufferData`**`()`
: See: glBufferData() on Kronos website

`kivy.graphics.opengl.`**`glBufferSubData`**`()`
: See: glBufferSubData() on Kronos website

`kivy.graphics.opengl.`**`glCheckFramebufferStatus`**`()`
See: glCheckFramebufferStatus() on Kronos website

`kivy.graphics.opengl.`**`glClear`**`()`
See: glClear() on Kronos website

`kivy.graphics.opengl.`**`glClearColor`**`()`
See: glClearColor() on Kronos website

`kivy.graphics.opengl.`**`glClearStencil`**`()`
See: glClearStencil() on Kronos website

`kivy.graphics.opengl.`**`glColorMask`**`()`
See: glColorMask() on Kronos website

`kivy.graphics.opengl.`**`glCompileShader`**`()`
See: glCompileShader() on Kronos website

`kivy.graphics.opengl.`**`glCompressedTexImage2D`**`()`
See: glCompressedTexImage2D() on Kronos website

`kivy.graphics.opengl.`**`glCompressedTexSubImage2D`**`()`
See: glCompressedTexSubImage2D() on Kronos website

`kivy.graphics.opengl.`**`glCopyTexImage2D`**`()`
See: glCopyTexImage2D() on Kronos website

`kivy.graphics.opengl.`**`glCopyTexSubImage2D`**`()`
See: glCopyTexSubImage2D() on Kronos website

`kivy.graphics.opengl.`**`glCreateProgram`**`()`
See: glCreateProgram() on Kronos website

`kivy.graphics.opengl.`**`glCreateShader`**`()`
See: glCreateShader() on Kronos website

`kivy.graphics.opengl.`**`glCullFace`**`()`
See: glCullFace() on Kronos website

`kivy.graphics.opengl.`**`glDeleteBuffers`**`()`
See: glDeleteBuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteFramebuffers`**`()`
See: glDeleteFramebuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteProgram`**`()`
See: glDeleteProgram() on Kronos website

`kivy.graphics.opengl.`**`glDeleteRenderbuffers`**`()`
See: glDeleteRenderbuffers() on Kronos website

`kivy.graphics.opengl.`**`glDeleteShader`**`()`
See: glDeleteShader() on Kronos website

`kivy.graphics.opengl.`**`glDeleteTextures`**`()`
See: glDeleteTextures() on Kronos website

`kivy.graphics.opengl.`**`glDepthFunc`**`()`
See: glDepthFunc() on Kronos website

`kivy.graphics.opengl.`**`glDepthMask`**`()`
See: glDepthMask() on Kronos website

`kivy.graphics.opengl.`**`glDetachShader`**`()`
See: glDetachShader() on Kronos website

kivy.graphics.opengl.**glDisable**()
See: glDisable() on Kronos website

kivy.graphics.opengl.**glDisableVertexAttribArray**()
See: glDisableVertexAttribArray() on Kronos website

kivy.graphics.opengl.**glDrawArrays**()
See: glDrawArrays() on Kronos website

kivy.graphics.opengl.**glDrawElements**()
See: glDrawElements() on Kronos website

kivy.graphics.opengl.**glEnable**()
See: glEnable() on Kronos website

kivy.graphics.opengl.**glEnableVertexAttribArray**()
See: glEnableVertexAttribArray() on Kronos website

kivy.graphics.opengl.**glFinish**()
See: glFinish() on Kronos website

kivy.graphics.opengl.**glFlush**()
See: glFlush() on Kronos website

kivy.graphics.opengl.**glFramebufferRenderbuffer**()
See: glFramebufferRenderbuffer() on Kronos website

kivy.graphics.opengl.**glFramebufferTexture2D**()
See: glFramebufferTexture2D() on Kronos website

kivy.graphics.opengl.**glFrontFace**()
See: glFrontFace() on Kronos website

kivy.graphics.opengl.**glGenBuffers**()
See: glGenBuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

kivy.graphics.opengl.**glGenFramebuffers**()
See: glGenFramebuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

kivy.graphics.opengl.**glGenRenderbuffers**()
See: glGenRenderbuffers() on Kronos website

Unlike the C specification, the value will be the result of call.

kivy.graphics.opengl.**glGenTextures**()
See: glGenTextures() on Kronos website

Unlike the C specification, the value will be the result of call.

kivy.graphics.opengl.**glGenerateMipmap**()
See: glGenerateMipmap() on Kronos website

kivy.graphics.opengl.**glGetActiveAttrib**()
See: glGetActiveAttrib() on Kronos website

Unlike the C specification, the value will be the result of call.

kivy.graphics.opengl.**glGetActiveUniform**()
See: glGetActiveUniform() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetAttachedShaders`**`()`
See: glGetAttachedShaders() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetAttribLocation`**`()`
See: glGetAttribLocation() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetBooleanv`**`()`
See: glGetBooleanv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetBufferParameteriv`**`()`
See: glGetBufferParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetError`**`()`
See: glGetError() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetFloatv`**`()`
See: glGetFloatv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetFramebufferAttachmentParameteriv`**`()`
See: glGetFramebufferAttachmentParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetIntegerv`**`()`
See: glGetIntegerv() on Kronos website

Unlike the C specification, the value(s) will be the result of the call

`kivy.graphics.opengl.`**`glGetProgramInfoLog`**`()`
See: glGetProgramInfoLog() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetProgramiv`**`()`
See: glGetProgramiv() on Kronos website

Unlike the C specification, the value(s) will be the result of the call

`kivy.graphics.opengl.`**`glGetRenderbufferParameteriv`**`()`
See: glGetRenderbufferParameteriv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetShaderInfoLog`**`()`
See: glGetShaderInfoLog() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetShaderPrecisionFormat`**`()`
See: glGetShaderPrecisionFormat() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glGetShaderSource`**`()`
See: glGetShaderSource() on Kronos website

Unlike the C specification, the source code will be returned as a string.

`kivy.graphics.opengl.`**`glGetShaderiv`**`()`
See: glGetShaderiv() on Kronos website

Unlike the C specification, the value will be the result of call.

`kivy.graphics.opengl.`**`glGetString`**`()`
See: glGetString() on Kronos website

Unlike the C specification, the value will be returned as a string.

`kivy.graphics.opengl.`**`glGetTexParameterfv`**`()`
See: glGetTexParameterfv() on Kronos website

`kivy.graphics.opengl.`**`glGetTexParameteriv`**`()`
See: glGetTexParameteriv() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformLocation`**`()`
See: glGetUniformLocation() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformfv`**`()`
See: glGetUniformfv() on Kronos website

`kivy.graphics.opengl.`**`glGetUniformiv`**`()`
See: glGetUniformiv() on Kronos website

`kivy.graphics.opengl.`**`glGetVertexAttribPointerv`**`()`
See: glGetVertexAttribPointerv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glGetVertexAttribfv`**`()`
See: glGetVertexAttribfv() on Kronos website

`kivy.graphics.opengl.`**`glGetVertexAttribiv`**`()`
See: glGetVertexAttribiv() on Kronos website

`kivy.graphics.opengl.`**`glHint`**`()`
See: glHint() on Kronos website

`kivy.graphics.opengl.`**`glIsBuffer`**`()`
See: glIsBuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsEnabled`**`()`
See: glIsEnabled() on Kronos website

`kivy.graphics.opengl.`**`glIsFramebuffer`**`()`
See: glIsFramebuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsProgram`**`()`
See: glIsProgram() on Kronos website

`kivy.graphics.opengl.`**`glIsRenderbuffer`**`()`
See: glIsRenderbuffer() on Kronos website

`kivy.graphics.opengl.`**`glIsShader`**`()`
See: glIsShader() on Kronos website

`kivy.graphics.opengl.`**`glIsTexture`**`()`
See: glIsTexture() on Kronos website

`kivy.graphics.opengl.`**`glLineWidth`**`()`
See: glLineWidth() on Kronos website

`kivy.graphics.opengl.`**`glLinkProgram`**`()`
See: glLinkProgram() on Kronos website

`kivy.graphics.opengl.`**`glPixelStorei`**`()`
See: glPixelStorei() on Kronos website

`kivy.graphics.opengl.`**`glPolygonOffset`**`()`
See: glPolygonOffset() on Kronos website

`kivy.graphics.opengl.`**`glReadPixels`**`()`
See: glReadPixels() on Kronos website

We support only GL_RGB/GL_RGBA as a format and GL_UNSIGNED_BYTE as a type.

`kivy.graphics.opengl.`**`glReleaseShaderCompiler`**`()`
See: glReleaseShaderCompiler() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glRenderbufferStorage`**`()`
See: glRenderbufferStorage() on Kronos website

`kivy.graphics.opengl.`**`glSampleCoverage`**`()`
See: glSampleCoverage() on Kronos website

`kivy.graphics.opengl.`**`glScissor`**`()`
See: glScissor() on Kronos website

`kivy.graphics.opengl.`**`glShaderBinary`**`()`
See: glShaderBinary() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glShaderSource`**`()`
See: glShaderSource() on Kronos website

`kivy.graphics.opengl.`**`glStencilFunc`**`()`
See: glStencilFunc() on Kronos website

`kivy.graphics.opengl.`**`glStencilFuncSeparate`**`()`
See: glStencilFuncSeparate() on Kronos website

`kivy.graphics.opengl.`**`glStencilMask`**`()`
See: glStencilMask() on Kronos website

`kivy.graphics.opengl.`**`glStencilMaskSeparate`**`()`
See: glStencilMaskSeparate() on Kronos website

`kivy.graphics.opengl.`**`glStencilOp`**`()`
See: glStencilOp() on Kronos website

`kivy.graphics.opengl.`**`glStencilOpSeparate`**`()`
See: glStencilOpSeparate() on Kronos website

`kivy.graphics.opengl.`**`glTexImage2D`**`()`
See: glTexImage2D() on Kronos website

`kivy.graphics.opengl.`**`glTexParameterf`**`()`
See: glTexParameterf() on Kronos website

`kivy.graphics.opengl.`**`glTexParameterfv`**`()`
See: glTexParameterfv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glTexParameteri`**`()`
See: glTexParameteri() on Kronos website

`kivy.graphics.opengl.`**`glTexParameteriv`**`()`
See: glTexParameteriv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glTexSubImage2D`**`()`
See: glTexSubImage2D() on Kronos website

`kivy.graphics.opengl.`**`glUniform1f`**`()`
See: glUniform1f() on Kronos website

`kivy.graphics.opengl.`**`glUniform1fv`**`()`
See: glUniform1fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform1i`**`()`
See: glUniform1i() on Kronos website

`kivy.graphics.opengl.`**`glUniform1iv`**`()`
See: glUniform1iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform2f`**`()`
See: glUniform2f() on Kronos website

`kivy.graphics.opengl.`**`glUniform2fv`**`()`
See: glUniform2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform2i`**`()`
See: glUniform2i() on Kronos website

`kivy.graphics.opengl.`**`glUniform2iv`**`()`
See: glUniform2iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform3f`**`()`
See: glUniform3f() on Kronos website

`kivy.graphics.opengl.`**`glUniform3fv`**`()`
See: glUniform3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform3i`**`()`
See: glUniform3i() on Kronos website

`kivy.graphics.opengl.`**`glUniform3iv`**`()`
See: glUniform3iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4f`**`()`
See: glUniform4f() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4fv`**`()`
See: glUniform4fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniform4i`**`()`
See: glUniform4i() on Kronos website

`kivy.graphics.opengl.`**`glUniform4iv`**`()`
See: glUniform4iv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix2fv`**`()`
See: glUniformMatrix2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix3fv`**`()`
See: glUniformMatrix3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glUniformMatrix4fv`**`()`
See: glUniformMatrix4fv() on Kronos website

`kivy.graphics.opengl.`**`glUseProgram`**`()`
See: glUseProgram() on Kronos website

`kivy.graphics.opengl.`**`glValidateProgram`**`()`
See: glValidateProgram() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib1f`**`()`
See: glVertexAttrib1f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib1fv`**`()`
See: glVertexAttrib1fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib2f`**`()`
See: glVertexAttrib2f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib2fv`**`()`
See: glVertexAttrib2fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib3f`**`()`
See: glVertexAttrib3f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib3fv`**`()`
See: glVertexAttrib3fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttrib4f`**`()`
See: glVertexAttrib4f() on Kronos website

`kivy.graphics.opengl.`**`glVertexAttrib4fv`**`()`
See: glVertexAttrib4fv() on Kronos website

Warning: Not implemented yet.

`kivy.graphics.opengl.`**`glVertexAttribPointer`**`()`
See: glVertexAttribPointer() on Kronos website

`kivy.graphics.opengl.`**`glViewport`**`()`
See: glViewport() on Kronos website

CHAPTER

SIXTYNINE

OPENGL UTILITIES

New in version 1.0.7.

`kivy.graphics.opengl_utils.`**`gl_get_extensions`**`()`

Return a list of OpenGL extensions available. All the names in the list have the *GL_* stripped at the start (if it exists) and are in lowercase.

```
>>> print(gl_get_extensions())
['arb_blend_func_extended', 'arb_color_buffer_float', 'arb_compatibility',
 'arb_copy_buffer'... ]
```

`kivy.graphics.opengl_utils.`**`gl_has_extension`**`()`

Check if an OpenGL extension is available. If the name starts with *GL_*, it will be stripped for the test and converted to lowercase.

```
>>> gl_has_extension('NV_get_tex_image')
False
>>> gl_has_extension('OES_texture_npot')
True
```

`kivy.graphics.opengl_utils.`**`gl_has_capability`**`()`

Return the status of a OpenGL Capability. This is a wrapper that auto-discovers all the capabilities that Kivy might need. The current capabilites tested are:

- GLCAP_BGRA: Test the support of BGRA texture format
- GLCAP_NPOT: Test the support of Non Power of Two texture
- GLCAP_S3TC: Test the support of S3TC texture (DXT1, DXT3, DXT5)
- GLCAP_DXT1: Test the support of DXT texture (subset of S3TC)
- GLCAP_ETC1: Test the support of ETC1 texture

`kivy.graphics.opengl_utils.`**`gl_register_get_size`**`()`

Register an association between an OpenGL Const used in glGet* to a number of elements.

By example, the GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX is a special pname that will return the integer 1 (nvidia only).

```
>>> GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX = 0x9047
>>> gl_register_get_size(GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX, 1)
>>> glGetIntegerv(GPU_MEMORY_INFO_DEDICATED_VIDMEM_NVX)[0]
524288
```

`kivy.graphics.opengl_utils.`**`gl_has_texture_format`**`()`

Return whether a texture format is supported by your system, natively or by conversion. For example, if your card doesn't support 'bgra', we are able to convert to 'rgba' but only in software mode.

kivy.graphics.opengl_utils.**gl_has_texture_conversion**()
Return 1 if the texture can be converted to a native format.

kivy.graphics.opengl_utils.**gl_has_texture_native_format**()
Return 1 if the texture format is handled natively.

```
>>> gl_has_texture_format('azdmok')
0
>>> gl_has_texture_format('rgba')
1
>>> gl_has_texture_format('s3tc_dxt1')
[INFO   ] [GL          ] S3TC texture support is available
[INFO   ] [GL          ] DXT1 texture support is available
1
```

kivy.graphics.opengl_utils.**gl_get_texture_formats**()
Return a list of texture formats recognized by kivy. The texture list is informative but might not been supported by your hardware. If you want a list of supported textures, you must filter that list as follows:

```
supported_fmts = [gl_has_texture_format(x) for x in gl_get_texture_formats()]
```

kivy.graphics.opengl_utils.**gl_get_version**()
Return the (major, minor) OpenGL version, parsed from the GL_VERSION.

New in version 1.2.0.

kivy.graphics.opengl_utils.**gl_get_version_minor**()
Return the minor component of the OpenGL version.

New in version 1.2.0.

kivy.graphics.opengl_utils.**gl_get_version_major**()
Return the major component of the OpenGL version.

New in version 1.2.0.

CHAPTER

SEVENTY

SHADER

The Shader class handles the compilation of the vertex and fragment shader as well as the creation of the program in OpenGL.

Todo

Include more complete documentation about the shader.

70.1 Header inclusion

New in version 1.0.7.

When you are creating a Shader, Kivy will always include default parameters. If you don't want to rewrite this each time you want to customize / write a new shader, you can add the "$HEADER$" token and it will be replaced by the corresponding shader header.

Here is the header for the fragment Shader:

```
#ifdef GL_ES
    precision highp float;
#endif

/* Outputs from the vertex shader */
varying vec4 frag_color;
varying vec2 tex_coord0;

/* uniform texture samplers */
uniform sampler2D texture0;
```

And the header for vertex Shader:

```
#ifdef GL_ES
    precision highp float;
#endif

/* Outputs to the fragment shader */
varying vec4 frag_color;
varying vec2 tex_coord0;

/* vertex attributes */
attribute vec2     vPosition;
attribute vec2     vTexCoords0;

/* uniform variables */
```

```
uniform mat4       modelview_mat;
uniform mat4       projection_mat;
uniform vec4       color;
uniform float      opacity;
```

70.2 Single file glsl shader programs

New in version 1.6.0.

To simplify shader management, the vertex and fragment shaders can be loaded automatically from a single glsl source file (plain text). The file should contain sections identified by a line starting with '—vertex' and '—fragment' respectively (case insensitive), e.g.:

```
// anything before a meaningful section such as this comment are ignored

---VERTEX SHADER--- // vertex shader starts here
void main(){
    ...
}

---FRAGMENT SHADER--- // fragment shader starts here
void main(){
    ...
}
```

The source property of the Shader should be set to the filename of a glsl shader file (of the above format), e.g. *phong.glsl*

class `kivy.graphics.shader.`**`Shader`**
Bases: `object`

Create a vertex or fragment shader.

Parameters

vs: **string, defaults to None**Source code for vertex shader

fs: **string, defaults to None**Source code for fragment shader

`fs`

Fragment shader source code.

If you set a new fragment shader code source, it will be automatically compiled and will replace the current fragment shader.

`source`

glsl source code.

source should be the filename of a glsl shader that contains both the vertex and fragment shader sourcecode, each designated by a section header consisting of one line starting with either "–VERTEX" or "–FRAGMENT" (case insensitive).

New in version 1.6.0.

`success`

Indicate whether the shader loaded successfully and is ready for usage or not.

`vs`

Vertex shader source code.

If you set a new vertex shader code source, it will be automatically compiled and will replace the current vertex shader.

CHAPTER

SEVENTYONE

STENCIL INSTRUCTIONS

New in version 1.0.4.

Changed in version 1.3.0: The stencil operation has been updated to resolve some issues that appeared when nested. You **must** now have a StencilUnUse and repeat the same operation as you did after StencilPush.

Stencil instructions permit you to draw and use the current drawing as a mask. They don't give as much control as pure OpenGL, but you can still do fancy things!

The stencil buffer can be controlled using these 3 instructions:

- `StencilPush`: push a new stencil layer. Any drawing that happens after this will be used as a mask.
- `StencilUse` : now draw the next instructions and use the stencil for masking them.
- `StencilUnUse` : stop using the stencil i.e. remove the mask and draw normally.
- `StencilPop` : pop the current stencil layer.

You should always respect this scheme:

```
StencilPush

# PHASE 1: put any drawing instructions to use as a mask here.

StencilUse

# PHASE 2: all the drawing here will be automatically clipped by the
# mask created in PHASE 1.

StencilUnUse

# PHASE 3: drawing instructions wil now be drawn without clipping but the
# mask will still be on the stack. You can return to PHASE 2 at any
# time by issuing another *StencilUse* command.

StencilPop

# PHASE 4: the stencil is now removed from the stack and unloaded.
```

71.1 Limitations

- Drawing in PHASE 1 and PHASE 3 must not collide or you will get unexpected results
- The stencil is activated as soon as you perform a StencilPush

- The stencil is deactivated as soon as you've correctly popped all the stencil layers
- You must not play with stencils yourself between a StencilPush / StencilPop
- You can push another stencil after a StencilUse / before the StencilPop
- You can push up to 128 layers of stencils (8 for kivy < 1.3.0)

71.2 Example of stencil usage

Here is an example, in kv style:

```
StencilPush

# create a rectangular mask with a pos of (100, 100) and a (100, 100) size.
Rectangle:
    pos: 100, 100
    size: 100, 100

StencilUse

# we want to show a big green rectangle, however, the previous stencil
# mask will crop us :)
Color:
    rgb: 0, 1, 0
Rectangle:
    size: 900, 900

StencilUnUse:
    # new in kivy 1.3.0, remove the mask previously added
    Rectangle:
        pos: 100, 100
        size: 100, 100

StencilPop
```

class `kivy.graphics.stencil_instructions.`**`StencilPush`**

Bases: `kivy.graphics.instructions.Instruction`

Push the stencil stack. See the module documentation for more information.

class `kivy.graphics.stencil_instructions.`**`StencilPop`**

Bases: `kivy.graphics.instructions.Instruction`

Pop the stencil stack. See the module documentation for more information.

class `kivy.graphics.stencil_instructions.`**`StencilUse`**

Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer as a mask. Check the module documentation for more information.

`func_op`

Determine the stencil operation to use for glStencilFunc(). Can be one of 'never', 'less', 'equal', 'lequal', 'greater', 'notequal', 'gequal' or 'always'.

By default, the operator is set to 'equal'.

New in version 1.5.0.

class `kivy.graphics.stencil_instructions.`**`StencilUnUse`**

Bases: `kivy.graphics.instructions.Instruction`

Use current stencil buffer to unset the mask.

CHAPTER

SEVENTYTWO

SVG

New in version 1.9.0.

Warning: This is highly experimental and subject to change. Don't use it in production.

Load an SVG as a graphics instruction:

```
from kivy.graphics.svg import Svg
with widget.canvas:
    svg = Svg("image.svg")
```

There is no widget that can display Svg directly, you have to make your own for now. Check the *examples/svg* for more informations.

class `kivy.graphics.svg.`**`Svg`**

Bases: `kivy.graphics.instructions.RenderContext`

Svg class. See module for more informations about the usage.

`anchor_x`

Horizontal anchor position for scaling and rotations. Defaults to 0. The symbolic values 'left', 'center' and 'right' are also accepted.

`anchor_y`

Vertical anchor position for scaling and rotations. Defaults to 0. The symbolic values 'bottom', 'center' and 'top' are also accepted.

`filename`

Filename to load.

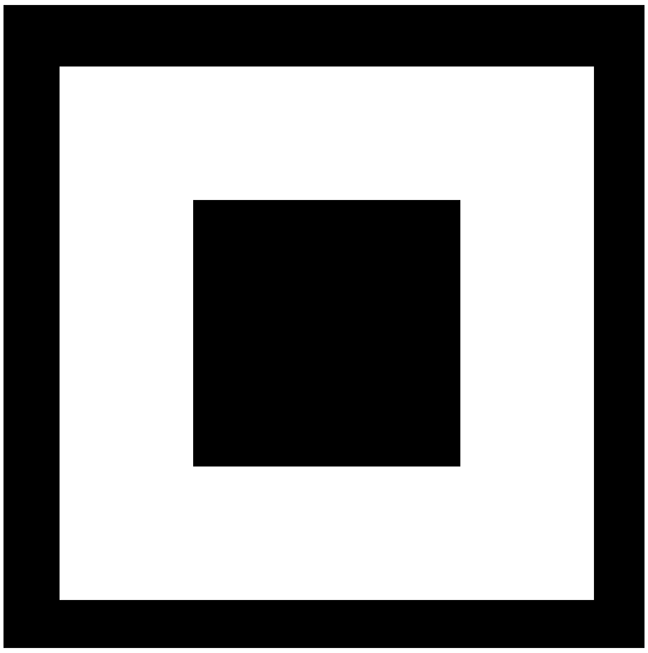
The parsing and rendering is done as soon as you set the filename.

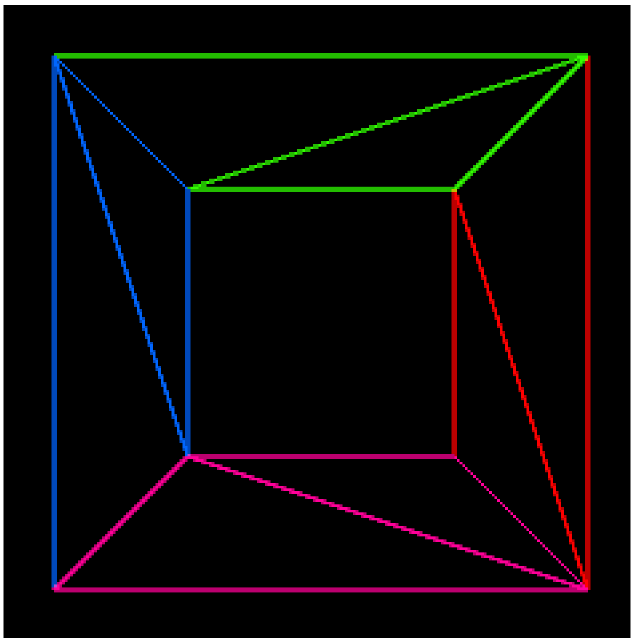
CHAPTER

SEVENTYTHREE

TESSELATOR

New in version 1.9.0.





Warning: This is experimental and subject to change as long as this warning notice is present. Only TYPE_POLYGONS is currently supported.

Tesselator is a library for tesselating polygons, based on libtess2. It renders concave filled polygons by first tesselating them into convex polygons. It also supports holes.

73.1 Usage

First, you need to create a `Tesselator` object and add contours. The first one is the external contour of your shape and all of the following ones should be holes:

```
from kivy.graphics.tesselator import Tesselator

tess = Tesselator()
tess.add_contour([0, 0, 200, 0, 200, 200, 0, 200])
tess.add_contour([50, 50, 150, 50, 150, 150, 50, 150])
```

Second, call the `Tesselator.tesselate()` method to compute the points. It is possible that the tesselator won't work. In that case, it can return False:

```
if not tess.tesselate():
    print "Tesselator didn't work :("
    return
```

After the tesselation, you have multiple ways to iterate over the result. The best approach is using `Tesselator.meshes` to get a format directly usable for a `Mesh`:

```
for vertices, indices in tess.meshes:
    self.canvas.add(Mesh(
        vertices=vertices,
        indices=indices,
        mode="triangle_fan"
    ))
```

Or, you can get the "raw" result, with just polygons and x/y coordinates with `Tesselator.vertices()`:

```
for vertices in tess.vertices:
    print "got polygon", vertices
```

class `kivy.graphics.tesselator.`**`Tesselator`**

Bases: `object`

Tesselator class. See module for more informations about the usage.

`add_contour``()`

Add a contour to the tesselator. It can be:

- a list of *[x, y, x2, y2, ...]* coordinates
- a float array: *array("f", [x, y, x2, y2, ...])*
- any buffer with floats in it.

`element_count`

Returns the number of convex polygon.

meshes

Iterate through the result of the `tesselate()` to give a result that can be easily pushed into Kivy's Mesh object.

It's a list of: *[[vertices, indices], [vertices, indices], ...]*. The vertices in the format *[x, y, u, v, x2, y2, u2, v2]*.

Careful, u/v coordinates are the same as x/y. You are responsible to change them for texture mapping if you need to.

You can create Mesh objects like that:

```
tess = Tesselator()
# add contours here
tess.tesselate()
for vertices, indices in self.meshes:
    self.canvas.add(Mesh(
        vertices=vertices,
        indices=indices,
        mode="triangle_fan"))
```

tesselate()

Compute all the contours added with `add_contour()`, and generate polygons.

Parameters

- **winding_rule** (*enum*) – The winding rule classifies a region as inside if its winding number belongs to the chosen category. Can be one of WINDING_ODD, WINDING_NONZERO, WINDING_POSITIVE, WINDING_NEGATIVE, WINDING_ABS_GEQ_TWO. Defaults to WINDING_ODD.
- **element_type** (*enum*) – The result type, you can generate the polygons with TYPE_POLYGONS, or the contours with TYPE_BOUNDARY_CONTOURS. Defaults to TYPE_POLYGONS.

Returns1 if the tesselation happenned, 0 otherwise.

Return typeint

vertex_count

Returns the number of vertex generated.

This is the raw result, however, because the Tesselator format the result for you with `meshes` or `vertices` per polygon, you'll have more vertices in the result

vertices

Iterate through the result of the `tesselate()` in order to give only a list of *[x, y, x2, y2, ...]* polygons.

CHAPTER

SEVENTYFOUR

TEXTURE

Changed in version 1.6.0: Added support for paletted texture on OES: 'palette4_rgb8', 'palette4_rgba8', 'palette4_r5_g6_b5', 'palette4_rgba4', 'palette4_rgb5_a1', 'palette8_rgb8', 'palette8_rgba8', 'palette8_r5_g6_b5', 'palette8_rgba4' and 'palette8_rgb5_a1'.

`Texture` is a class that handles OpenGL textures. Depending on the hardware, some OpenGL capabilities might not be available (BGRA support, NPOT support, etc.)

You cannot instanciate this class yourself. You must use the function `Texture.create()` to create a new texture:

```
texture = Texture.create(size=(640, 480))
```

When you create a texture, you should be aware of the default color and buffer format:

- the color/pixel format (`Texture.colorfmt`) that can be one of 'rgb', 'rgba', 'luminance', 'luminance_alpha', 'bgr' or 'bgra'. The default value is 'rgb'
- the buffer format determines how a color component is stored into memory. This can be one of 'ubyte', 'ushort', 'uint', 'byte', 'short', 'int' or 'float'. The default value and the most commonly used is 'ubyte'.

So, if you want to create an RGBA texture:

```
texture = Texture.create(size=(640, 480), colorfmt='rgba')
```

You can use your texture in almost all vertex instructions with the `kivy.graphics.VertexIntruction.texture` parameter. If you want to use your texture in kv lang, you can save it in an `ObjectProperty` inside your widget.

74.1 Blitting custom data

You can create your own data and blit it to the texture using `Texture.blit_buffer()`.

For example, to blit immutable bytes data:

```
# create a 64x64 texture, defaults to rgb / ubyte
texture = Texture.create(size=(64, 64))

# create 64x64 rgb tab, and fill with values from 0 to 255
# we'll have a gradient from black to white
size = 64 * 64 * 3
buf = [int(x * 255 / size) for x in range(size)]

# then, convert the array to a ubyte string
```

```
buf = b''.join(map(chr, buf))

# then blit the buffer
texture.blit_buffer(buf, colorfmt='rgb', bufferfmt='ubyte')

# that's all ! you can use it in your graphics now :)
# if self is a widget, you can do this
with self.canvas:
    Rectangle(texture=texture, pos=self.pos, size=(64, 64))
```

Since 1.9.0, you can blit data stored in a instance that implements the python buffer interface, or a memoryview thereof, such as numpy arrays, python *array.array*, a *bytearray*, or a cython array. This is beneficial if you expect to blit similar data, with perhaps a few changes in the data.

When using a bytes representation of the data, for every change you have to regenerate the bytes instance, from perhaps a list, which is very inefficient. When using a buffer object, you can simply edit parts of the original data. Similarly, unless starting with a bytes object, converting to bytes requires a full copy, however, when using a buffer instance, no memory is copied, except to upload it to the GPU.

Continuing with the example above:

```
from array import array

size = 64 * 64 * 3
buf = [int(x * 255 / size) for x in range(size)]
# initialize the array with the buffer values
arr = array('B', buf)
# now blit the array
texture.blit_buffer(arr, colorfmt='rgb', bufferfmt='ubyte')

# now change some elements in the original array
arr[24] = arr[50] = 99
# blit again the buffer
texture.blit_buffer(arr, colorfmt='rgb', bufferfmt='ubyte')
```

74.2 BGR/BGRA support

The first time you try to create a BGR or BGRA texture, we check whether your hardware supports BGR / BGRA textures by checking the extension 'GL_EXT_bgra'.

If the extension is not found, the conversion to RGB / RGBA will be done in software.

74.3 NPOT texture

Changed in version 1.0.7: If your hardware supports NPOT, no POT is created.

As the OpenGL documentation says, a texture must be power-of-two sized. That means your width and height can be one of 64, 32, 256... but not 3, 68, 42. NPOT means non-power-of-two. OpenGL ES 2 supports NPOT textures natively but with some drawbacks. Another type of NPOT texture is called a rectangle texture. POT, NPOT and textures all have their own pro/cons.

Features	POT	NPOT	Rectangle
OpenGL Target	GL_TEXTURE_2D	GL_TEXTURE_2D	GL_TEXTURE_RECTANGLE_(NV|ARB|EXT)
Texture coords	0-1 range	0-1 range	width-height range
Mipmapping	Supported	Partially	No
Wrap mode	Supported	Supported	No

If you create a NPOT texture, we first check whether your hardware supports it by checking the extensions GL_ARB_texture_non_power_of_two or OES_texture_npot. If none of theses are available, we create the nearest POT texture that can contain your NPOT texture. The `Texture.create()` will return a `TextureRegion` instead.

74.4 Texture atlas

A texture atlas is a single texture that contains many images. If you want to seperate the original texture into many single ones, you don't need to. You can get a region of the original texture. That will return the original texture with custom texture coordinates:

```
# for example, load a 128x128 image that contain 4 64x64 images
from kivy.core.image import Image
texture = Image('mycombinedimage.png').texture

bottomleft = texture.get_region(0, 0, 64, 64)
bottomright = texture.get_region(0, 64, 64, 64)
topleft = texture.get_region(0, 64, 64, 64)
topright = texture.get_region(64, 64, 64, 64)
```

74.5 Mipmapping

New in version 1.0.7.

Mipmapping is an OpenGL technique for enhancing the rendering of large textures to small surfaces. Without mipmapping, you might see pixelation when you render to small surfaces. The idea is to precalculate the subtexture and apply some image filter as a linear filter. Then, when you render a small surface, instead of using the biggest texture, it will use a lower filtered texture. The result can look better this way.

To make that happen, you need to specify mipmap=True when you create a texture. Some widgets already give you the ability to create mipmapped textures, such as the `Label` and `Image`.

From the OpenGL Wiki : "So a 64x16 2D texture can have 5 mip-maps: 32x8, 16x4, 8x2, 4x1, 2x1, and 1x1". Check http://www.opengl.org/wiki/Texture for more information.

Note: As the table in previous section said, if your texture is NPOT, we create the nearest POT texture and generate a mipmap from it. This might change in the future.

74.6 Reloading the Texture

New in version 1.2.0.

If the OpenGL context is lost, the Texture must be reloaded. Textures that have a source are automatically reloaded but generated textures must be reloaded by the user.

Use the `Texture.add_reload_observer()` to add a reloading function that will be automatically called when needed:

```
def __init__(self, **kwargs):
    super(...).__init__(**kwargs)
    self.texture = Texture.create(size=(512, 512), colorfmt='RGB',
        bufferfmt='ubyte')
    self.texture.add_reload_observer(self.populate_texture)

    # and load the data now.
    self.cbuffer = '\x00\xf0\xff' * 512 * 512
    self.populate_texture(self.texture)

def populate_texture(self, texture):
    texture.blit_buffer(self.cbuffer)
```

This way, you can use the same method for initialization and reloading.

Note: For all text rendering with our core text renderer, the texture is generated but we already bind a method to redo the text rendering and reupload the text to the texture. You don't have to do anything.

class `kivy.graphics.texture.`**`Texture`**

Bases: `object`

Handle an OpenGL texture. This class can be used to create simple textures or complex textures based on ImageData.

`add_reload_observer``()`

Add a callback to be called after the whole graphics context has been reloaded. This is where you can reupload your custom data into the GPU.

New in version 1.2.0.

Parameters

***callback*: func(context) -> return None**The first parameter will be the context itself.

`ask_update``()`

Indicate that the content of the texture should be updated and the callback function needs to be called when the texture will be used.

`bind``()`

Bind the texture to the current opengl state.

`blit_buffer``()`

Blit a buffer into the texture.

Note: Unless the canvas will be updated due to other changes, `ask_update()` should be called in order to update the texture.

Parameters

pbuffer[bytes, or a class that implements the buffer interface (including memoryview).] A buffer containing the image data. It can be either a bytes object or a instance of a class that implements the python buffer interface, e.g. *array.array*, *bytearray*, numpy arrays etc. If it's not a bytes object, the underlying buffer must be contiguous, have only one dimension and must not be readonly, even though the data is not modified, due to a cython limitation. See module description for usage details.

size[tuple, defaults to texture size] Size of the image (width, height)

colorfmt[str, defaults to 'rgb'] Image format, can be one of 'rgb', 'rgba', 'bgr', 'bgra', 'luminance' or 'luminance_alpha'.

pos[tuple, defaults to (0, 0)] Position to blit in the texture.

bufferfmt[str, defaults to 'ubyte'] Type of the data buffer, can be one of 'ubyte', 'ushort', 'uint', 'byte', 'short', 'int' or 'float'.

***mipmap_level*: int, defaults to 0**Indicate which mipmap level we are going to update.

mipmap_generation: **bool, defaults to True**Indicate if we need to regenerate the mipmap from level 0.

Changed in version 1.0.7: added *mipmap_level* and *mipmap_generation*

Changed in version 1.9.0: *pbuffer* can now be any class instance that implements the python buffer interface and / or memoryviews thereof.

`blit_data()`
Replace a whole texture with image data.

`bufferfmt`
Return the buffer format used in this texture (readonly).

New in version 1.2.0.

`colorfmt`
Return the color format used in this texture (readonly).

New in version 1.0.7.

`create()`
Create a texture based on size.

Parameters

size: **tuple, defaults to (128, 128)**Size of the texture.

colorfmt: **str, defaults to 'rgba'**Color format of the texture. Can be 'rgba' or 'rgb', 'luminance' or 'luminance_alpha'. On desktop, additionnal values are available: 'red', 'rg'.

icolorfmt: **str, default to the value of *colorfmt***Internal format storage of the texture. Can be 'rgba' or 'rgb', 'luminance' or 'luminance_alpha'. On desktop, additionnal values are available: 'r8', 'rg8', 'rgba8'.

bufferfmt: **str, defaults to 'ubyte'**Internal buffer format of the texture. Can be 'ubyte', 'ushort', 'uint', 'bute', 'short', 'int' or 'float'.

mipmap: **bool, defaults to False**If True, it will automatically generate the mipmap texture.

callback: **callable(), defaults to False**If a function is provided, it will be called when data is needed in the texture.

Changed in version 1.7.0: `callback` has been added

`create_from_data()`
Create a texture from an ImageData class.

`flip_horizontal()`
Flip tex_coords for horizontal display.

New in version 1.9.0.

`flip_vertical()`
Flip tex_coords for vertical display.

`get_region()`
Return a part of the texture defined by the rectangular arguments (x, y, width, height). Returns a `TextureRegion` instance.

`height`
Return the height of the texture (readonly).

`id`
Return the OpenGL ID of the texture (readonly).

`mag_filter`
Get/set the mag filter texture. Available values:

- linear
- nearest

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

min_filter
Get/set the min filter texture. Available values:
- linear
- nearest
- linear_mipmap_linear
- linear_mipmap_nearest
- nearest_mipmap_nearest
- nearest_mipmap_linear

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

mipmap
Return True if the texture has mipmap enabled (readonly).

pixels
Get the pixels texture, in RGBA format only, unsigned byte. The origin of the image is at bottom left.

New in version 1.7.0.

remove_reload_observer()
Remove a callback from the observer list, previously added by `add_reload_observer()`.

New in version 1.2.0.

save()
Save the texture content to a file. Check `kivy.core.image.Image.save()` for more information.

The flipped parameter flips the saved image vertically, and defaults to True.

New in version 1.7.0.

Changed in version 1.8.0: Parameter *flipped* added, default to True. All the OpenGL Texture are readed from bottom / left, it need to be flipped before saving. If you don't want to flip the image, set flipped to False.

size
Return the (width, height) of the texture (readonly).

target
Return the OpenGL target of the texture (readonly).

tex_coords
Return the list of tex_coords (opengl).

uvpos
Get/set the UV position inside the texture.

uvsize
Get/set the UV size inside the texture.

Warning: The size can be negative if the texture is flipped.

width
Return the width of the texture (readonly).

wrap
Get/set the wrap texture. Available values:
- repeat

- mirrored_repeat
- clamp_to_edge

Check the opengl documentation for more information about the behavior of these values : http://www.khronos.org/opengles/sdk/docs/man/xhtml/glTexParameter.xml.

class `kivy.graphics.texture.`**`TextureRegion`**

Bases: `kivy.graphics.texture.Texture`

Handle a region of a Texture class. Useful for non power-of-2 texture handling.

CHAPTER

SEVENTYFIVE

TRANSFORMATION

This module contains a Matrix class used for our Graphics calculations. We currently support:

- rotation, translation and scaling matrices
- multiplication matrix
- clip matrix (with or without perspective)
- transformation matrix for 3d touch

For more information on transformation matrices, please see the OpenGL Matrices Tutorial.

Changed in version 1.6.0: Added `Matrix.perspective()`, `Matrix.look_at()` and `Matrix.transpose()`.

class `kivy.graphics.transformation.`**`Matrix`**

Bases: `object`

Optimized matrix class for OpenGL:

```
>>> from kivy.graphics.transformation import Matrix
>>> m = Matrix()
>>> print(m)
[[ 1.000000 0.000000 0.000000 0.000000 ]
[ 0.000000 1.000000 0.000000 0.000000 ]
[ 0.000000 0.000000 1.000000 0.000000 ]
[ 0.000000 0.000000 0.000000 1.000000 ]]

[ 0   1   2   3]
[ 4   5   6   7]
[ 8   9  10  11]
[ 12  13  14  15]
```

`identity``()`

Reset the matrix to the identity matrix (inplace).

`inverse``()`

Return the inverse of the matrix as a new Matrix.

`look_at``()`

Returns a new lookat Matrix (similar to gluLookAt).

Parameters

eyex: **float**Eyes X co-ordinate
eyey: **float**Eyes Y co-ordinate
eyez: **float**Eyes Z co-ordinate
centerx: **float**The X position of the reference point
centery: **float**The Y position of the reference point
centerz: **float**The Z position of the reference point

upx: **float**The X value up vector.
upy: **float**The Y value up vector.
upz: **float**The Z value up vector.

New in version 1.6.0.

multiply()

Multiply the given matrix with self (from the left) i.e. we premultiply the given matrix by the current matrix and return the result (not inplace):

```
m.multiply(n) -> n * m
```

Parameters

ma: **Matrix**The matrix to multiply by

normal_matrix()

Computes the normal matrix, which is the inverse transpose of the top left 3x3 modelview matrix used to transform normals into eye/camera space.

New in version 1.6.0.

perspective()

Creates a perspective matrix (inplace).

Parameters

fovy: **float**"Field Of View" angle
aspect: **float**Aspect ratio
zNear: **float**Near clipping plane
zFar: **float**Far clippin plane

New in version 1.6.0.

project()

Project a point from 3d space into a 2d viewport.

Parameters

objx: **float**Points X co-ordinate
objy: **float**Points Y co-ordinate
objz: **float**Points Z co-ordinate
model: **Matrix**The model matrix
proj: **Matrix**The projection matrix
vx: **float**Viewports X co-ordinate
vy: **float**Viewports y co-ordinate
vw: **float**Viewports width
vh: **float**Viewports height

New in version 1.7.0.

rotate()

Rotate the matrix through the angle around the axis (x, y, z) (inplace).

Parameters

angle: **float**The angle through which to rotate the matrix
x: **float**X position of the point
y: **float**Y position of the point
z: **float**Z position of the point

scale()

Scale the current matrix by the specified factors over each dimension (inplace).

Parameters

x: **float**The scale factor along the X axis
y: **float**The scale factor along the Y axis
z: **float**The scale factor along the Z axis

translate()

Translate the matrix.

Parameters

x: **float**The translation factor along the X axis

y: **float**The translation factor along the Y axis

z: **float**The translation factor along the Z axis

`transpose``()`

Return the transposed matrix as a new Matrix.

New in version 1.6.0.

`view_clip``()`

Create a clip matrix (inplace).

Parameters

left: **float**Co-ordinate

right: **float**Co-ordinate

bottom: **float**Co-ordinate

top: **float**Co-ordinate

near: **float**Co-ordinate

far: **float**Co-ordinate

perpective: **int**Co-ordinate

Changed in version 1.6.0: Enable support for perspective parameter.

CHAPTER

SEVENTYSIX

INPUT MANAGEMENT

Our input system is wide and simple at the same time. We are currently able to natively support :

- Windows multitouch events (pencil and finger)
- MacOSX touchpads
- Linux multitouch events (kernel and mtdev)
- Linux wacom drivers (pencil and finger)
- TUIO

All the input management is configurable in the Kivy `config`. You can easily use many multitouch devices in one Kivy application.

When the events have been read from the devices, they are dispatched through a post processing module before being sent to your application. We also have several default modules for :

- Double tap detection
- Decreasing jittering
- Decreasing the inaccuracy of touch on "bad" DIY hardware
- Ignoring regions

class `kivy.input.`**`MotionEvent`**(*device, id, args*)

Bases: `kivy.input.motionevent.MotionEvent`

Abstract class to represent a touch and non-touch object.

Parameters

id[str] unique ID of the MotionEvent

args[list] list of parameters, passed to the depack() function

`apply_transform_2d`(*transform*)

Apply a transformation on x, y, z, px, py, pz, ox, oy, oz, dx, dy, dz

`copy_to`(*to*)

Copy some attribute to another touch object.

`depack`(*args*)

Depack *args* into attributes of the class

`distance`(*other_touch*)

Return the distance between the current touch and another touch.

`dpos`

Return delta between last position and current position, in the screen coordinate system (self.dx, self.dy)

grab(*class_instance*, *exclusive=False*)
Grab this motion event. You can grab a touch if you absolutly want to receive on_touch_move() and on_touch_up(), even if the touch is not dispatched by your parent:

```
def on_touch_down(self, touch):
    touch.grab(self)

def on_touch_move(self, touch):
    if touch.grab_current is self:
        # I received my grabbed touch
    else:
        # it’s a normal touch

def on_touch_up(self, touch):
    if touch.grab_current is self:
        # I receive my grabbed touch, I must ungrab it!
        touch.ungrab(self)
    else:
        # it’s a normal touch
        pass
```

is_mouse_scrolling
Returns True if the touch is a mousewheel scrolling

New in version 1.6.0.

move(*args*)
Move the touch to another position

opos
Return the initial position of the touch in the screen coordinate system (self.ox, self.oy)

pop()
Pop attributes values from the stack

ppos
Return the previous position of the touch in the screen coordinate system (self.px, self.py)

push(*attrs=None*)
Push attribute values in *attrs* onto the stack

scale_for_screen(*w*, *h*, *p=None*, *rotation=0*, *smode='None'*, *kheight=0*)
Scale position for the screen

spos
Return the position in the 0-1 coordinate system (self.sx, self.sy)

ungrab(*class_instance*)
Ungrab a previously grabbed touch

class kivy.input.**MotionEventProvider**(*device*, *args*)
Bases: `object`

Base class for a provider.

start()
Start the provider. This method is automatically called when the application is started and if the configuration uses the current provider.

stop()
Stop the provider.

update(*dispatch_fn*)
Update the provider and dispatch all the new touch events though the *dispatch_fn* argument.

class `kivy.input.`**`MotionEventFactory`**

MotionEvent factory is a class that registers all availables input factories. If you create a new input factory, you need to register it here:

```
MotionEventFactory.register('myproviderid', MyInputProvider)
```

static **`get`**(*name*)

Get a provider class from the provider id

static **`list`**()

Get a list of all available providers

static **`register`**(*name*, *classname*)

Register a input provider in the database

76.1 Input Postprocessing

76.1.1 Calibration

New in version 1.9.0.

Recalibrate input device to a specific range / offset.

Let's say you have 3 1080p displays, the 2 firsts are multitouch. By default, both will have mixed touch, the range will conflict with each others: the 0-1 range will goes to 0-5760 px (remember, 3 * 1920 = 5760.)

To fix it, you need to manually reference them. For example:

```
[input]
left = mtdev,/dev/input/event17
middle = mtdev,/dev/input/event15
# the right screen is just a display.
```

Then, you can use the calibration postproc module:

```
[postproc:calibration]
left = xratio=0.3333
middle = xratio=0.3333,xoffset=0.3333
```

Now, the touches from the left screen will be within 0-0.3333 range, and the touches from the middle screen will be within 0.3333-0.6666 range.

class `kivy.input.postproc.calibration.`**`InputPostprocCalibration`**

Bases: `object`

Recalibrate the inputs.

The configuration must go within a section named *postproc:calibration*. Within the section, you must have line like:

```
devicename = param=value,param=value
```

Parameters

xratio: **float**Value to multiply X
yratio: **float**Value to multiply Y
xoffset: **float**Value to add to X
yoffset: **float**Value to add to Y

76.1.2 Dejitter

Prevent blob jittering.

A problem that is often faced (esp. in optical MT setups) is that of jitterish BLOBs caused by bad camera characteristics. With this module you can get rid of that jitter. You just define a threshold *jitter_distance* in your config, and all touch movements that move the touch by less than the jitter distance are considered 'bad' movements caused by jitter and will be discarded.

class `kivy.input.postproc.dejitter.`**`InputPostprocDejitter`**

Bases: `object`

Get rid of jitterish BLOBs. Example:

```
[postproc]
jitter_distance = 0.004
jitter_ignore_devices = mouse,mactouch
```

Configuration

jitter_distance: **float**A float in range 0-1.

jitter_ignore_devices: **string**A comma-seperated list of device identifiers that should not be processed by dejitter (because they're very precise already).

76.1.3 Double Tap

Search touch for a double tap

class `kivy.input.postproc.doubletap.`**`InputPostprocDoubleTap`**

Bases: `object`

InputPostProcDoubleTap is a post-processor to check if a touch is a double tap or not. Double tap can be configured in the Kivy config file:

```
[postproc]
double_tap_time = 250
double_tap_distance = 20
```

Distance parameter is in the range 0-1000 and time is in milliseconds.

`find_double_tap`(*ref*)

Find a double tap touch within self.touches. The touch must be not a previous double tap and the distance must be within the specified threshold. Additionally, the touch profiles must be the same kind of touch.

76.1.4 Ignore list

Ignore touch on some areas of the screen

class `kivy.input.postproc.ignorelist.`**`InputPostprocIgnoreList`**

Bases: `object`

InputPostprocIgnoreList is a post-processor which removes touches in the Ignore list. The Ignore list can be configured in the Kivy config file:

```
[postproc]
# Format: [(xmin, ymin, xmax, ymax), ...]
ignore = [(0.1, 0.1, 0.15, 0.15)]
```

The Ignore list coordinates are in the range 0-1, not in screen pixels.

76.1.5 Retain Touch

Reuse touch to counter lost finger behavior

class `kivy.input.postproc.retaintouch.`**`InputPostprocRetainTouch`**
Bases: `object`

InputPostprocRetainTouch is a post-processor to delay the 'up' event of a touch, to reuse it under certains conditions. This module is designed to prevent lost finger touches on some hardware/setups.

Retain touch can be configured in the Kivy config file:

```
[postproc]
    retain_time = 100
    retain_distance = 50
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

76.1.6 Triple Tap

New in version 1.7.0.

Search touch for a triple tap

class `kivy.input.postproc.tripletap.`**`InputPostprocTripleTap`**
Bases: `object`

InputPostProcTripleTap is a post-processor to check if a touch is a triple tap or not. Triple tap can be configured in the Kivy config file:

```
[postproc]
triple_tap_time = 250
triple_tap_distance = 20
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

`find_triple_tap`(*ref*)
Find a triple tap touch within *self.touches*. The touch must be not be a previous triple tap and the distance must be be within the bounds specified. Additionally, the touch profile must be the same kind of touch.

76.2 Providers

76.2.1 Android Joystick Input Provider

This module is based on the PyGame JoyStick Input Provider. For more information, please refer to http://www.pygame.org/docs/ref/joystick.html

76.2.2 Auto Create Input Provider Config Entry for Available MT Hardware (linux only).

Thanks to Marc Tardif for the probing code, taken from scan-for-mt-device.

The device discovery is done by this provider. However, the reading of input can be performed by other providers like: hidinput, mtdev and linuxwacom. mtdev is used prior to other providers. For more information about mtdev, check `mtdev`.

Here is an example of auto creation:

```
[input]
# using mtdev
device_%(name)s = probesysfs,provider=mtdev
# using hidinput
device_%(name)s = probesysfs,provider=hidinput
# using mtdev with a match on name
device_%(name)s = probesysfs,provider=mtdev,match=acer

# using hidinput with custom parameters to hidinput (all on one line)
%(name)s = probesysfs,
    provider=hidinput,param=min_pressure=1,param=max_pressure=99

# you can also match your wacom touchscreen
touch = probesysfs,match=E3 Finger,provider=linuxwacom,
    select_all=1,param=mode=touch
# and your wacom pen
pen = probesysfs,match=E3 Pen,provider=linuxwacom,
    select_all=1,param=mode=pen
```

By default, ProbeSysfs module will enumerate hardware from the /sys/class/input device, and configure hardware with ABS_MT_POSITION_X capability. But for example, the wacom screen doesn't support this capability. You can prevent this behavior by putting select_all=1 in your config line.

76.2.3 Common definitions for a Windows provider

This file provides common definitions for constants used by WM_Touch / WM_Pen.

76.2.4 Leap Motion - finger only

76.2.5 Mouse provider implementation

On linux systems, the mouse provider can be annoying when used with another multitouch provider (hidinput or mtdev). The Mouse can conflict with them: a single touch can generate one event from the mouse provider and another from the multitouch provider.

To avoid this behavior, you can activate the "disable_on_activity" token in the mouse configuration. Then, if there are any touches activated by another provider, the mouse event will be discarded. Add this to your configuration:

```
[input]
mouse = mouse,disable_on_activity
```

Using multitouch interaction with the mouse

New in version 1.3.0.

By default, the middle and right mouse buttons, as well as a combination of ctrl + left mouse button are used for multitouch emulation. If you want to use them for other purposes, you can disable this behavior by activating the "disable_multitouch" token:

```
[input]
mouse = mouse,disable_multitouch
```

Changed in version 1.9.0.

You can now selectively control whether a click initiated as described above will emulate multi-touch. If the touch has been initiated in the above manner (e.g. right mouse button), multitouch_sim will be added to touch's profile, and property *multitouch_sim* to the touch. By default *multitouch_sim* is True and multitouch will be emulated for that touch. However, if *multitouch_on_demand* is added to the config:

```
[input]
mouse = mouse,multitouch_on_demand
```

then *multitouch_sim* defaults to *False*. In that case, if before mouse release (e.g. in on_touch_down/move) *multitouch_sim* is set to True, the touch will simulate multi-touch. For example:

```
if 'multitouch_sim' in touch.profile:
    touch.multitouch_sim = True
```

Following is a list of the supported profiles for `MouseMotionEvent`.

Profile name	Description
button	Mouse button (left, right, middle, scrollup, scrolldown) Use property *button*
pos	2D position. Use properties *x*, *y* or *pos'*
multitouch_sim	If multitouch is simulated. Use property *multitouch_sim*. See documatation above.

76.2.6 Native support for HID input from the linux kernel

Support starts from 2.6.32-ubuntu, or 2.6.34.

To configure HIDInput, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
# example with Stantum MTP4.3" screen
stantum = hidinput,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. For some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

For example, on the Asus T101M, the touchscreen reports a range from 0-4095 for the X and Y values, but the real values are in a range from 0-32768. To correct this, you can add the following to the configuration:

```
[input]
t101m = hidinput,/dev/input/event7,max_position_x=32768,max_position_y=32768
```

76.2.7 Native support for Multitouch devices on Linux, using libmtdev.

The Mtdev project is a part of the Ubuntu Maverick multitouch architecture. You can read more on http://wiki.ubuntu.com/Multitouch

To configure MTDev, it's preferable to use probesysfs providers. Check `probesysfs` for more information.

Otherwise, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
acert230h = mtdev,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum
- min_touch_major : width shape minimum
- max_touch_major : width shape maximum
- min_touch_minor : width shape minimum
- max_touch_minor : height shape maximum

76.2.8 Native support of MultitouchSupport framework for MacBook (MaxOSX platform)

76.2.9 Native support of Wacom tablet from linuxwacom driver

To configure LinuxWacom, add this to your configuration:

```
[input]
pen = linuxwacom,/dev/input/event2,mode=pen
finger = linuxwacom,/dev/input/event3,mode=touch
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

76.2.10 Support for WM_PEN messages (Windows platform)

class `kivy.input.providers.wm_pen.`**`WM_Pen`**`(`*device, id, args*`)`

Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_Pen event. Supports the pos profile.

76.2.11 Support for WM_TOUCH messages (Windows platform)

class `kivy.input.providers.wm_touch.`**`WM_MotionEvent`**`(`*device, id, args*`)`

Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_MotionEvent event. Supports pos, shape and size profiles.

76.2.12 TUIO Input Provider

TUIO is the de facto standard network protocol for the transmission of touch and fiducial information between a server and a client. To learn more about TUIO (which is itself based on the OSC protocol), please refer to http://tuio.org – The specification should be of special interest.

Configure a TUIO provider in the config.ini

The TUIO provider can be configured in the configuration file in the `[input]` section:

```
[input]
# name = tuio,<ip>:<port>
multitouchtable = tuio,192.168.0.1:3333
```

Configure a TUIO provider in the App

You must add the provider before your application is run, like this:

```
from kivy.app import App
from kivy.config import Config

class TestApp(App):
    def build(self):
        Config.set('input', 'multitouchscreen1', 'tuio,0.0.0.0:3333')
        # You can also add a second TUIO listener
        # Config.set('input', 'source2', 'tuio,0.0.0.0:3334')
        # Then do the usual things
        # ...
        return
```

class kivy.input.providers.tuio.**TuioMotionEventProvider**(*device*, *args*)
Bases: `kivy.input.provider.MotionEventProvider`

The TUIO provider listens to a socket and handles some of the incoming OSC messages:

- /tuio/2Dcur
- /tuio/2Dobj

You can easily extend the provider to handle new TUIO paths like so:

```
    # Create a class to handle the new TUIO type/path
    # Replace NEWPATH with the pathname you want to handle
    class TuioNEWPATHMotionEvent(MotionEvent):
        def __init__(self, id, args):
            super(TuioNEWPATHMotionEvent, self).__init__(id, args)

        def depack(self, args):
            # In this method, implement 'unpacking' for the received
            # arguments. you basically translate from TUIO args to Kivy
            # MotionEvent variables. If all you receive are x and y
            # values, you can do it like this:
            if len(args) == 2:
                self.sx, self.sy = args
                self.profile = ('pos', )
            self.sy = 1 - self.sy
            super(TuioNEWPATHMotionEvent, self).depack(args)

    # Register it with the TUIO MotionEvent provider.
    # You obviously need to replace the PATH placeholders appropriately.
    TuioMotionEventProvider.register('/tuio/PATH', TuioNEWPATHMotionEvent)
```

Note: The class name is of no technical importance. Your class will be associated with the path that you pass to the `register()` function. To keep things simple, you should name your class after the path that it handles, though.

static **create**(*oscpath*, ***kwargs*)
Create a touch event from a TUIO path

static **register**(*oscpath*, *classname*)
Register a new path to handle in TUIO provider

start()
Start the TUIO provider

stop()
Stop the TUIO provider

static **unregister**(*oscpath*, *classname*)
Unregister a path to stop handling it in the TUIO provider

update(*dispatch_fn*)
Update the TUIO provider (pop events from the queue)

class `kivy.input.providers.tuio.`**`Tuio2dCurMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dCur TUIO touch.

class `kivy.input.providers.tuio.`**`Tuio2dObjMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dObj TUIO object.

76.3 Input recorder

New in version 1.1.0.

Warning: This part of Kivy is still experimental and this API is subject to change in a future version.

This is a class that can record and replay some input events. This can be used for test cases, screen savers etc.

Once activated, the recorder will listen for any input event and save its properties in a file with the delta time. Later, you can play the input file: it will generate fake touch events with the saved properties and dispatch it to the event loop.

By default, only the position is saved ('pos' profile and 'sx', 'sy', attributes). Change it only if you understand how input handling works.

76.3.1 Recording events

The best way is to use the "recorder" module. Check the *Modules* documentation to see how to activate a module.

Once activated, you can press F8 to start the recording. By default, events will be written to *<current-path>/recorder.kvi*. When you want to stop recording, press F8 again.

You can replay the file by pressing F7.

Check the *Recorder module* module for more information.

76.3.2 Manual play

You can manually open a recorder file, and play it by doing:

```
from kivy.input.recorder import Recorder

rec = Recorder(filename='myrecorder.kvi')
rec.play = True
```

If you want to loop over that file, you can do:

```
from kivy.input.recorder import Recorder

def recorder_loop(instance, value):
    if value is False:
        instance.play = True
```

```
rec = Recorder(filename='myrecorder.kvi')
rec.bind(play=recorder_loop)
rec.play = True
```

76.3.3 Recording more attributes

You can extend the attributes to save on one condition: attributes values must be simple values, not instances of complex classes.

Let's say you want to save the angle and pressure of the touch, if available:

```
from kivy.input.recorder import Recorder

rec = Recorder(filename='myrecorder.kvi',
    record_attrs=['is_touch', 'sx', 'sy', 'angle', 'pressure'],
    record_profile_mask=['pos', 'angle', 'pressure'])
rec.record = True
```

Or with modules variables:

```
$ python main.py -m recorder,attrs=is_touch:sx:sy:angle:pressure,          profile_mask=pos:ang
```

76.3.4 Known limitations

- Unable to save attributes with instances of complex classes.
- Values that represent time will not be adjusted.
- Can replay only complete records. If a begin/update/end event is missing, this could lead to ghost touches.
- Stopping the replay before the end can lead to ghost touches.

class `kivy.input.recorder.`**`Recorder`**`(`***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

Recorder class. Please check module documentation for more information.

`counter`

Number of events recorded in the last session.

`counter` is a `NumericProperty` and defaults to 0, read-only.

`filename`

Filename to save the output of the recorder.

`filename` is a `StringProperty` and defaults to 'recorder.kvi'.

`play`

Boolean to start/stop the replay of the current file (if it exists).

`play` is a `BooleanProperty` and defaults to False.

`record`

Boolean to start/stop the recording of input events.

`record` is a `BooleanProperty` and defaults to False.

`record_attrs`

Attributes to record from the motion event.

`record_attrs` is a `ListProperty` and defaults to ['is_touch', 'sx', 'sy'].

record_profile_mask
Profile to save in the fake motion event when replayed.

record_profile_mask is a ListProperty and defaults to ['pos'].

window
Window instance to attach the recorder. If None, it will use the default instance.

window is a ObjectProperty and defaults to None.

76.4 Motion Event

The MotionEvent is the base class used for every touch and non-touch event. This class defines all the properties and methods needed to handle 2D and 3D movements but has many more capabilities.

Note: You never create the MotionEvent yourself: this is the role of the providers.

76.4.1 Motion Event and Touch

We differentiate between a Motion Event and Touch event. A Touch event is a MotionEvent with the *pos* profile. Only theses events are dispatched throughout the widget tree.

1. The MotionEvent 's are gathered from input providers.
2. **All the MotionEvent 's are dispatched from** on_motion().
3. **If a MotionEvent has a *pos* profile, we dispatch it through** on_touch_down(), on_touch_move() and on_touch_up().

76.4.2 Listening to a Motion Event

If you want to receive all MotionEvents, Touch or not, you can bind the MotionEvent from the Window to your own callback:

```
def on_motion(self, etype, motionevent):
    # will receive all motion events.
    pass

Window.bind(on_motion=on_motion)
```

You can also listen to changes of the mouse position by watching mouse_pos.

76.4.3 Profiles

A capability is the ability of a MotionEvent to store new information or a way to indicate what is supported by the MotionEvent. For example, you can receive a MotionEvent that has an angle, a fiducial ID, or even a shape. You can check the profile attribute to check what is currently supported by the MotionEvent and how to access it.

This is a tiny list of the supported profiles by default. Check other input providers to see if there are other profiles available.

Profile name	Description
angle	2D angle. Use property *a*
button	Mouse button (left, right, middle, scrollup, scrolldown) Use property *button*
markerid	Marker or Fiducial ID. Use property *fid*
pos	2D position. Use properties *x*, *y* or *pos'*
pos3d	3D position. Use properties *x*, *y*, *z*
pressure	Pressure of the contact. Use property *pressure*
shape	Contact shape. Use property *shape*

If you want to know whether the current `MotionEvent` has an angle:

```
def on_touch_move(self, touch):
    if 'angle' in touch.profile:
        print('The touch angle is', touch.a)
```

If you want to select only the fiducials:

```
def on_touch_move(self, touch):
    if 'markerid' not in touch.profile:
        return
```

class `kivy.input.motionevent.`**`MotionEvent`**(*device*, *id*, *args*)

Bases: `kivy.input.motionevent.MotionEvent`

Abstract class to represent a touch and non-touch object.

Parameters

id[str] unique ID of the MotionEvent

args[list] list of parameters, passed to the depack() function

`apply_transform_2d`(*transform*)

Apply a transformation on x, y, z, px, py, pz, ox, oy, oz, dx, dy, dz

`copy_to`(*to*)

Copy some attribute to another touch object.

`depack`(*args*)

Depack *args* into attributes of the class

`device` = None

Device used for creating this touch

`distance`(*other_touch*)

Return the distance between the current touch and another touch.

`double_tap_time` = None

If the touch is a `is_double_tap`, this is the time between the previous tap and the current touch.

`dpos`

Return delta between last position and current position, in the screen coordinate system (self.dx, self.dy)

`dsx` = None

Delta between self.sx and self.psx, in 0-1 range.

`dsy` = None

Delta between self.sy and self.psy, in 0-1 range.

`dsz` = None

Delta between self.sz and self.psz, in 0-1 range.

`dx` = None

Delta between self.x and self.px, in window range

dy = None
Delta between self.y and self.py, in window range

dz = None
Delta between self.z and self.pz, in window range

grab(*class_instance*, *exclusive=False*)
Grab this motion event. You can grab a touch if you absolutly want to receive on_touch_move() and on_touch_up(), even if the touch is not dispatched by your parent:

```
def on_touch_down(self, touch):
    touch.grab(self)

def on_touch_move(self, touch):
    if touch.grab_current is self:
        # I received my grabbed touch
    else:
        # it's a normal touch

def on_touch_up(self, touch):
    if touch.grab_current is self:
        # I receive my grabbed touch, I must ungrab it!
        touch.ungrab(self)
    else:
        # it's a normal touch
        pass
```

grab_current = None
Used to determine which widget the touch is being dispatched to. Check the `grab()` function for more information.

id = None
Id of the touch, not uniq. This is generally the Id set by the input provider, like ID in TUIO. If you have multiple TUIO source, the same id can be used. Prefer to use `uid` attribute instead.

is_double_tap = None
Indicate if the touch is a double tap or not

is_mouse_scrolling
Returns True if the touch is a mousewheel scrolling

New in version 1.6.0.

is_touch = None
True if the Motion Event is a Touch. Can be also verified is *pos* is `profile`.

is_triple_tap = None
Indicate if the touch is a triple tap or not

New in version 1.7.0.

move(*args*)
Move the touch to another position

opos
Return the initial position of the touch in the screen coordinate system (self.ox, self.oy)

osx = None
Origin X position, in 0-1 range.

osy = None
Origin Y position, in 0-1 range.

osz = None
: Origin Z position, in 0-1 range.

ox = None
: Origin X position, in window range

oy = None
: Origin Y position, in window range

oz = None
: Origin Z position, in window range

pop()
: Pop attributes values from the stack

pos = None
: Position (X, Y), in window range

ppos
: Return the previous position of the touch in the screen coordinate system (self.px, self.py)

profile = None
: Profiles currently used in the touch

psx = None
: Previous X position, in 0-1 range.

psy = None
: Previous Y position, in 0-1 range.

psz = None
: Previous Z position, in 0-1 range.

push(*attrs=None*)
: Push attribute values in *attrs* onto the stack

push_attrs_stack = None
: Attributes to push by default, when we use `push()` : x, y, z, dx, dy, dz, ox, oy, oz, px, py, pz.

px = None
: Previous X position, in window range

py = None
: Previous Y position, in window range

pz = None
: Previous Z position, in window range

scale_for_screen(*w, h, p=None, rotation=0, smode='None', kheight=0*)
: Scale position for the screen

shape = None
: Shape of the touch, subclass of `Shape`. By default, the property is set to None

spos
: Return the position in the 0-1 coordinate system (self.sx, self.sy)

sx = None
: X position, in 0-1 range

sy = None
: Y position, in 0-1 range

sz = None
: Z position, in 0-1 range

time_end = None
Time of the end event (last touch usage)

time_start = None
Initial time of the touch creation

time_update = None
Time of the last update

triple_tap_time = None
If the touch is a `is_triple_tap`, this is the time between the first tap and the current touch.

New in version 1.7.0.

ud = None
User data dictionary. Use this dictionary to save your own data on the touch.

uid = None
Uniq ID of the touch. You can safely use this property, it will be never the same accross all existing touches.

ungrab(*class_instance*)
Ungrab a previously grabbed touch

x = None
X position, in window range

y = None
Y position, in window range

z = None
Z position, in window range

76.5 Motion Event Factory

Factory of `MotionEvent` providers.

class `kivy.input.factory.`**`MotionEventFactory`**
MotionEvent factory is a class that registers all availables input factories. If you create a new input factory, you need to register it here:

```
MotionEventFactory.register('myproviderid', MyInputProvider)
```

static **get**(*name*)
Get a provider class from the provider id

static **list**()
Get a list of all available providers

static **register**(*name, classname*)
Register a input provider in the database

76.6 Motion Event Provider

Abstract class for the implemention of a `MotionEvent` provider. The implementation must support the `start()`, `stop()` and `update()` methods.

class `kivy.input.provider.`**`MotionEventProvider`**(*device, args*)
Bases: `object`

Base class for a provider.

start()
    Start the provider. This method is automatically called when the application is started and if the configuration uses the current provider.

stop()
    Stop the provider.

update(*dispatch_fn*)
    Update the provider and dispatch all the new touch events though the *dispatch_fn* argument.

76.7 Motion Event Shape

Represent the shape of the `MotionEvent`

class `kivy.input.shape.`**`Shape`**
    Bases: `object`

    Abstract class for all implementations of a shape

class `kivy.input.shape.`**`ShapeRect`**
    Bases: `kivy.input.shape.Shape`

    Class for the representation of a rectangle.

height
    Height of the rect

width
    Width fo the rect

CHAPTER

SEVENTYSEVEN

MOTION EVENT FACTORY

Factory of `MotionEvent` providers.

class `kivy.input.factory.`**`MotionEventFactory`**

MotionEvent factory is a class that registers all availables input factories. If you create a new input factory, you need to register it here:

```
MotionEventFactory.register('myproviderid', MyInputProvider)
```

static **`get`**(*name*)

Get a provider class from the provider id

static **`list`**()

Get a list of all available providers

static **`register`**(*name, classname*)

Register a input provider in the database

CHAPTER

SEVENTYEIGHT

MOTION EVENT

The MotionEvent is the base class used for every touch and non-touch event. This class defines all the properties and methods needed to handle 2D and 3D movements but has many more capabilities.

Note: You never create the MotionEvent yourself: this is the role of the providers.

78.1 Motion Event and Touch

We differentiate between a Motion Event and Touch event. A Touch event is a MotionEvent with the *pos* profile. Only theses events are dispatched throughout the widget tree.

1. The MotionEvent 's are gathered from input providers.
2. **All the MotionEvent 's are dispatched from** on_motion().
3. **If a MotionEvent has a *pos* profile, we dispatch it through** on_touch_down(), on_touch_move() and on_touch_up().

78.2 Listening to a Motion Event

If you want to receive all MotionEvents, Touch or not, you can bind the MotionEvent from the Window to your own callback:

```
def on_motion(self, etype, motionevent):
    # will receive all motion events.
    pass

Window.bind(on_motion=on_motion)
```

You can also listen to changes of the mouse position by watching mouse_pos.

78.3 Profiles

A capability is the ability of a MotionEvent to store new information or a way to indicate what is supported by the MotionEvent. For example, you can receive a MotionEvent that has an angle, a fiducial ID, or even a shape. You can check the profile attribute to check what is currently supported by the MotionEvent and how to access it.

This is a tiny list of the supported profiles by default. Check other input providers to see if there are other profiles available.

Profile name	Description
angle	2D angle. Use property *a*
button	Mouse button (left, right, middle, scrollup, scrolldown) Use property *button*
markerid	Marker or Fiducial ID. Use property *fid*
pos	2D position. Use properties *x*, *y* or *pos'*
pos3d	3D position. Use properties *x*, *y*, *z*
pressure	Pressure of the contact. Use property *pressure*
shape	Contact shape. Use property *shape*

If you want to know whether the current `MotionEvent` has an angle:

```
def on_touch_move(self, touch):
    if 'angle' in touch.profile:
        print('The touch angle is', touch.a)
```

If you want to select only the fiducials:

```
def on_touch_move(self, touch):
    if 'markerid' not in touch.profile:
        return
```

class `kivy.input.motionevent.`**`MotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.motionevent.MotionEvent`

Abstract class to represent a touch and non-touch object.

Parameters

id[str] unique ID of the MotionEvent

args[list] list of parameters, passed to the depack() function

`apply_transform_2d`(*transform*)
Apply a transformation on x, y, z, px, py, pz, ox, oy, oz, dx, dy, dz

`copy_to`(*to*)
Copy some attribute to another touch object.

`depack`(*args*)
Depack *args* into attributes of the class

`device` = None
Device used for creating this touch

`distance`(*other_touch*)
Return the distance between the current touch and another touch.

`double_tap_time` = None
If the touch is a `is_double_tap`, this is the time between the previous tap and the current touch.

`dpos`
Return delta between last position and current position, in the screen coordinate system (self.dx, self.dy)

`dsx` = None
Delta between self.sx and self.psx, in 0-1 range.

`dsy` = None
Delta between self.sy and self.psy, in 0-1 range.

`dsz` = None
Delta between self.sz and self.psz, in 0-1 range.

`dx` = None
Delta between self.x and self.px, in window range

dy = None
: Delta between self.y and self.py, in window range

dz = None
: Delta between self.z and self.pz, in window range

grab(*class_instance*, *exclusive=False*)
: Grab this motion event. You can grab a touch if you absolutly want to receive on_touch_move() and on_touch_up(), even if the touch is not dispatched by your parent:

```
def on_touch_down(self, touch):
    touch.grab(self)

def on_touch_move(self, touch):
    if touch.grab_current is self:
        # I received my grabbed touch
    else:
        # it's a normal touch

def on_touch_up(self, touch):
    if touch.grab_current is self:
        # I receive my grabbed touch, I must ungrab it!
        touch.ungrab(self)
    else:
        # it's a normal touch
        pass
```

grab_current = None
: Used to determine which widget the touch is being dispatched to. Check the `grab()` function for more information.

id = None
: Id of the touch, not uniq. This is generally the Id set by the input provider, like ID in TUIO. If you have multiple TUIO source, the same id can be used. Prefer to use `uid` attribute instead.

is_double_tap = None
: Indicate if the touch is a double tap or not

is_mouse_scrolling
: Returns True if the touch is a mousewheel scrolling

  New in version 1.6.0.

is_touch = None
: True if the Motion Event is a Touch. Can be also verified is *pos* is `profile`.

is_triple_tap = None
: Indicate if the touch is a triple tap or not

  New in version 1.7.0.

move(*args*)
: Move the touch to another position

opos
: Return the initial position of the touch in the screen coordinate system (self.ox, self.oy)

osx = None
: Origin X position, in 0-1 range.

osy = None
: Origin Y position, in 0-1 range.

osz = None
: Origin Z position, in 0-1 range.

ox = None
: Origin X position, in window range

oy = None
: Origin Y position, in window range

oz = None
: Origin Z position, in window range

pop()
: Pop attributes values from the stack

pos = None
: Position (X, Y), in window range

ppos
: Return the previous position of the touch in the screen coordinate system (self.px, self.py)

profile = None
: Profiles currently used in the touch

psx = None
: Previous X position, in 0-1 range.

psy = None
: Previous Y position, in 0-1 range.

psz = None
: Previous Z position, in 0-1 range.

push(*attrs=None*)
: Push attribute values in *attrs* onto the stack

push_attrs_stack = None
: Attributes to push by default, when we use `push()` : x, y, z, dx, dy, dz, ox, oy, oz, px, py, pz.

px = None
: Previous X position, in window range

py = None
: Previous Y position, in window range

pz = None
: Previous Z position, in window range

scale_for_screen(*w, h, p=None, rotation=0, smode='None', kheight=0*)
: Scale position for the screen

shape = None
: Shape of the touch, subclass of `Shape`. By default, the property is set to None

spos
: Return the position in the 0-1 coordinate system (self.sx, self.sy)

sx = None
: X position, in 0-1 range

sy = None
: Y position, in 0-1 range

sz = None
: Z position, in 0-1 range

`time_end` = None
: Time of the end event (last touch usage)

`time_start` = None
: Initial time of the touch creation

`time_update` = None
: Time of the last update

`triple_tap_time` = None
: If the touch is a `is_triple_tap`, this is the time between the first tap and the current touch.

  New in version 1.7.0.

`ud` = None
: User data dictionary. Use this dictionary to save your own data on the touch.

`uid` = None
: Uniq ID of the touch. You can safely use this property, it will be never the same accross all existing touches.

`ungrab`(*class_instance*)
: Ungrab a previously grabbed touch

`x` = None
: X position, in window range

`y` = None
: Y position, in window range

`z` = None
: Z position, in window range

CHAPTER

SEVENTYNINE

INPUT POSTPROCESSING

79.1 Calibration

New in version 1.9.0.

Recalibrate input device to a specific range / offset.

Let's say you have 3 1080p displays, the 2 firsts are multitouch. By default, both will have mixed touch, the range will conflict with each others: the 0-1 range will goes to 0-5760 px (remember, 3 * 1920 = 5760.)

To fix it, you need to manually reference them. For example:

```
[input]
left = mtdev,/dev/input/event17
middle = mtdev,/dev/input/event15
# the right screen is just a display.
```

Then, you can use the calibration postproc module:

```
[postproc:calibration]
left = xratio=0.3333
middle = xratio=0.3333,xoffset=0.3333
```

Now, the touches from the left screen will be within 0-0.3333 range, and the touches from the middle screen will be within 0.3333-0.6666 range.

class `kivy.input.postproc.calibration.`**`InputPostprocCalibration`**

Bases: `object`

Recalibrate the inputs.

The configuration must go within a section named *postproc:calibration*. Within the section, you must have line like:

```
devicename = param=value,param=value
```

Parameters

xratio: **float**Value to multiply X
yratio: **float**Value to multiply Y
xoffset: **float**Value to add to X
yoffset: **float**Value to add to Y

79.2 Dejitter

Prevent blob jittering.

A problem that is often faced (esp. in optical MT setups) is that of jitterish BLOBs caused by bad camera characteristics. With this module you can get rid of that jitter. You just define a threshold *jitter_distance* in your config, and all touch movements that move the touch by less than the jitter distance are considered 'bad' movements caused by jitter and will be discarded.

class `kivy.input.postproc.dejitter.`**`InputPostprocDejitter`**

Bases: `object`

Get rid of jitterish BLOBs. Example:

```
[postproc]
jitter_distance = 0.004
jitter_ignore_devices = mouse,mactouch
```

Configuration

jitter_distance: **float**A float in range 0-1.

jitter_ignore_devices: **string**A comma-seperated list of device identifiers that should not be processed by dejitter (because they're very precise already).

79.3 Double Tap

Search touch for a double tap

class `kivy.input.postproc.doubletap.`**`InputPostprocDoubleTap`**

Bases: `object`

InputPostProcDoubleTap is a post-processor to check if a touch is a double tap or not. Double tap can be configured in the Kivy config file:

```
[postproc]
double_tap_time = 250
double_tap_distance = 20
```

Distance parameter is in the range 0-1000 and time is in milliseconds.

`find_double_tap`(*ref*)

Find a double tap touch within self.touches. The touch must be not a previous double tap and the distance must be within the specified threshold. Additionally, the touch profiles must be the same kind of touch.

79.4 Ignore list

Ignore touch on some areas of the screen

class `kivy.input.postproc.ignorelist.`**`InputPostprocIgnoreList`**

Bases: `object`

InputPostprocIgnoreList is a post-processor which removes touches in the Ignore list. The Ignore list can be configured in the Kivy config file:

```
[postproc]
# Format: [(xmin, ymin, xmax, ymax), ...]
ignore = [(0.1, 0.1, 0.15, 0.15)]
```

The Ignore list coordinates are in the range 0-1, not in screen pixels.

79.5 Retain Touch

Reuse touch to counter lost finger behavior

class `kivy.input.postproc.retaintouch.`**`InputPostprocRetainTouch`**

Bases: `object`

InputPostprocRetainTouch is a post-processor to delay the 'up' event of a touch, to reuse it under certains conditions. This module is designed to prevent lost finger touches on some hardware/setups.

Retain touch can be configured in the Kivy config file:

```
[postproc]
    retain_time = 100
    retain_distance = 50
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

79.6 Triple Tap

New in version 1.7.0.

Search touch for a triple tap

class `kivy.input.postproc.tripletap.`**`InputPostprocTripleTap`**

Bases: `object`

InputPostProcTripleTap is a post-processor to check if a touch is a triple tap or not. Triple tap can be configured in the Kivy config file:

```
[postproc]
triple_tap_time = 250
triple_tap_distance = 20
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

`find_triple_tap`(*ref*)

Find a triple tap touch within *self.touches*. The touch must be not be a previous triple tap and the distance must be be within the bounds specified. Additionally, the touch profile must be the same kind of touch.

CHAPTER

EIGHTY

CALIBRATION

New in version 1.9.0.

Recalibrate input device to a specific range / offset.

Let's say you have 3 1080p displays, the 2 firsts are multitouch. By default, both will have mixed touch, the range will conflict with each others: the 0-1 range will goes to 0-5760 px (remember, 3 * 1920 = 5760.)

To fix it, you need to manually reference them. For example:

```
[input]
left = mtdev,/dev/input/event17
middle = mtdev,/dev/input/event15
# the right screen is just a display.
```

Then, you can use the calibration postproc module:

```
[postproc:calibration]
left = xratio=0.3333
middle = xratio=0.3333,xoffset=0.3333
```

Now, the touches from the left screen will be within 0-0.3333 range, and the touches from the middle screen will be within 0.3333-0.6666 range.

class `kivy.input.postproc.calibration.`**`InputPostprocCalibration`**

Bases: `object`

Recalibrate the inputs.

The configuration must go within a section named *postproc:calibration*. Within the section, you must have line like:

```
devicename = param=value,param=value
```

Parameters

xratio: **float**Value to multiply X
yratio: **float**Value to multiply Y
xoffset: **float**Value to add to X
yoffset: **float**Value to add to Y

CHAPTER

EIGHTYONE

DEJITTER

Prevent blob jittering.

A problem that is often faced (esp. in optical MT setups) is that of jitterish BLOBs caused by bad camera characteristics. With this module you can get rid of that jitter. You just define a threshold *jitter_distance* in your config, and all touch movements that move the touch by less than the jitter distance are considered 'bad' movements caused by jitter and will be discarded.

class `kivy.input.postproc.dejitter.`**`InputPostprocDejitter`**

Bases: `object`

Get rid of jitterish BLOBs. Example:

```
[postproc]
jitter_distance = 0.004
jitter_ignore_devices = mouse,mactouch
```

Configuration

jitter_distance: **float**A float in range 0-1.

jitter_ignore_devices: **string**A comma-seperated list of device identifiers that should not be processed by dejitter (because they're very precise already).

CHAPTER

EIGHTYTWO

DOUBLE TAP

Search touch for a double tap

class `kivy.input.postproc.doubletap.`**`InputPostprocDoubleTap`**

Bases: `object`

InputPostProcDoubleTap is a post-processor to check if a touch is a double tap or not. Double tap can be configured in the Kivy config file:

```
[postproc]
double_tap_time = 250
double_tap_distance = 20
```

Distance parameter is in the range 0-1000 and time is in milliseconds.

`find_double_tap`(*ref*)

Find a double tap touch within self.touches. The touch must be not a previous double tap and the distance must be within the specified threshold. Additionally, the touch profiles must be the same kind of touch.

CHAPTER

EIGHTYTHREE

IGNORE LIST

Ignore touch on some areas of the screen

class `kivy.input.postproc.ignorelist.`**`InputPostprocIgnoreList`**

Bases: `object`

InputPostprocIgnoreList is a post-processor which removes touches in the Ignore list. The Ignore list can be configured in the Kivy config file:

```
[postproc]
# Format: [(xmin, ymin, xmax, ymax), ...]
ignore = [(0.1, 0.1, 0.15, 0.15)]
```

The Ignore list coordinates are in the range 0-1, not in screen pixels.

CHAPTER

EIGHTYFOUR

RETAIN TOUCH

Reuse touch to counter lost finger behavior

class `kivy.input.postproc.retaintouch.`**`InputPostprocRetainTouch`**

Bases: `object`

InputPostprocRetainTouch is a post-processor to delay the 'up' event of a touch, to reuse it under certains conditions. This module is designed to prevent lost finger touches on some hardware/setups.

Retain touch can be configured in the Kivy config file:

```
[postproc]
    retain_time = 100
    retain_distance = 50
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

CHAPTER

EIGHTYFIVE

TRIPLE TAP

New in version 1.7.0.

Search touch for a triple tap

class `kivy.input.postproc.tripletap.`**`InputPostprocTripleTap`**

Bases: `object`

InputPostProcTripleTap is a post-processor to check if a touch is a triple tap or not. Triple tap can be configured in the Kivy config file:

```
[postproc]
triple_tap_time = 250
triple_tap_distance = 20
```

The distance parameter is in the range 0-1000 and time is in milliseconds.

`find_triple_tap`(*ref*)

Find a triple tap touch within *self.touches*. The touch must be not be a previous triple tap and the distance must be be within the bounds specified. Additionally, the touch profile must be the same kind of touch.

CHAPTER

EIGHTYSIX

MOTION EVENT PROVIDER

Abstract class for the implemention of a `MotionEvent` provider. The implementation must support the `start()`, `stop()` and `update()` methods.

class `kivy.input.provider.`**`MotionEventProvider`**`(`*device*, *args*`)`

Bases: `object`

Base class for a provider.

`start``()`

Start the provider. This method is automatically called when the application is started and if the configuration uses the current provider.

`stop``()`

Stop the provider.

`update``(`*dispatch_fn*`)`

Update the provider and dispatch all the new touch events though the *dispatch_fn* argument.

CHAPTER

EIGHTYSEVEN

PROVIDERS

87.1 Android Joystick Input Provider

This module is based on the PyGame JoyStick Input Provider. For more information, please refer to http://www.pygame.org/docs/ref/joystick.html

87.2 Auto Create Input Provider Config Entry for Available MT Hardware (linux only).

Thanks to Marc Tardif for the probing code, taken from scan-for-mt-device.

The device discovery is done by this provider. However, the reading of input can be performed by other providers like: hidinput, mtdev and linuxwacom. mtdev is used prior to other providers. For more information about mtdev, check `mtdev`.

Here is an example of auto creation:

```
[input]
# using mtdev
device_%(name)s = probesysfs,provider=mtdev
# using hidinput
device_%(name)s = probesysfs,provider=hidinput
# using mtdev with a match on name
device_%(name)s = probesysfs,provider=mtdev,match=acer

# using hidinput with custom parameters to hidinput (all on one line)
%(name)s = probesysfs,
    provider=hidinput,param=min_pressure=1,param=max_pressure=99

# you can also match your wacom touchscreen
touch = probesysfs,match=E3 Finger,provider=linuxwacom,
    select_all=1,param=mode=touch
# and your wacom pen
pen = probesysfs,match=E3 Pen,provider=linuxwacom,
    select_all=1,param=mode=pen
```

By default, ProbeSysfs module will enumerate hardware from the /sys/class/input device, and configure hardware with ABS_MT_POSITION_X capability. But for example, the wacom screen doesn't support this capability. You can prevent this behavior by putting select_all=1 in your config line.

87.3 Common definitions for a Windows provider

This file provides common definitions for constants used by WM_Touch / WM_Pen.

87.4 Leap Motion - finger only

87.5 Mouse provider implementation

On linux systems, the mouse provider can be annoying when used with another multitouch provider (hidinput or mtdev). The Mouse can conflict with them: a single touch can generate one event from the mouse provider and another from the multitouch provider.

To avoid this behavior, you can activate the "disable_on_activity" token in the mouse configuration. Then, if there are any touches activated by another provider, the mouse event will be discarded. Add this to your configuration:

```
[input]
mouse = mouse,disable_on_activity
```

87.5.1 Using multitouch interaction with the mouse

New in version 1.3.0.

By default, the middle and right mouse buttons, as well as a combination of ctrl + left mouse button are used for multitouch emulation. If you want to use them for other purposes, you can disable this behavior by activating the "disable_multitouch" token:

```
[input]
mouse = mouse,disable_multitouch
```

Changed in version 1.9.0.

You can now selectively control whether a click initiated as described above will emulate multi-touch. If the touch has been initiated in the above manner (e.g. right mouse button), multitouch_sim will be added to touch's profile, and property *multitouch_sim* to the touch. By default *multitouch_sim* is True and multitouch will be emulated for that touch. However, if *multitouch_on_demand* is added to the config:

```
[input]
mouse = mouse,multitouch_on_demand
```

then *multitouch_sim* defaults to *False*. In that case, if before mouse release (e.g. in on_touch_down/move) *multitouch_sim* is set to True, the touch will simulate multi-touch. For example:

```
if 'multitouch_sim' in touch.profile:
    touch.multitouch_sim = True
```

Following is a list of the supported profiles for `MouseMotionEvent`.

Profile name	Description
button	Mouse button (left, right, middle, scrollup, scrolldown) Use property *button*
pos	2D position. Use properties *x*, *y* or *pos'*
multitouch_sim	If multitouch is simulated. Use property *multitouch_sim*. See documatation above.

87.6 Native support for HID input from the linux kernel

Support starts from 2.6.32-ubuntu, or 2.6.34.

To configure HIDInput, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
# example with Stantum MTP4.3" screen
stantum = hidinput,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. For some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

For example, on the Asus T101M, the touchscreen reports a range from 0-4095 for the X and Y values, but the real values are in a range from 0-32768. To correct this, you can add the following to the configuration:

```
[input]
t101m = hidinput,/dev/input/event7,max_position_x=32768,max_position_y=32768
```

87.7 Native support for Multitouch devices on Linux, using libmtdev.

The Mtdev project is a part of the Ubuntu Maverick multitouch architecture. You can read more on http://wiki.ubuntu.com/Multitouch

To configure MTDev, it's preferable to use probesysfs providers. Check `probesysfs` for more information.

Otherwise, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
acert230h = mtdev,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis

- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum
- min_touch_major : width shape minimum
- max_touch_major : width shape maximum
- min_touch_minor : width shape minimum
- max_touch_minor : height shape maximum

87.8 Native support of MultitouchSupport framework for MacBook (MaxOSX platform)

87.9 Native support of Wacom tablet from linuxwacom driver

To configure LinuxWacom, add this to your configuration:

```
[input]
pen = linuxwacom,/dev/input/event2,mode=pen
finger = linuxwacom,/dev/input/event3,mode=touch
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

87.10 Support for WM_PEN messages (Windows platform)

class `kivy.input.providers.wm_pen.`**`WM_Pen`**`(`*device, id, args*`)`

Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_Pen event. Supports the pos profile.

87.11 Support for WM_TOUCH messages (Windows platform)

class `kivy.input.providers.wm_touch.`**`WM_MotionEvent`**(*device, id, args*)
Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_MotionEvent event. Supports pos, shape and size profiles.

87.12 TUIO Input Provider

TUIO is the de facto standard network protocol for the transmission of touch and fiducial information between a server and a client. To learn more about TUIO (which is itself based on the OSC protocol), please refer to http://tuio.org – The specification should be of special interest.

87.12.1 Configure a TUIO provider in the config.ini

The TUIO provider can be configured in the configuration file in the `[input]` section:

```
[input]
# name = tuio,<ip>:<port>
multitouchtable = tuio,192.168.0.1:3333
```

87.12.2 Configure a TUIO provider in the App

You must add the provider before your application is run, like this:

```
from kivy.app import App
from kivy.config import Config

class TestApp(App):
    def build(self):
        Config.set('input', 'multitouchscreen1', 'tuio,0.0.0.0:3333')
        # You can also add a second TUIO listener
        # Config.set('input', 'source2', 'tuio,0.0.0.0:3334')
        # Then do the usual things
        # ...
        return
```

class `kivy.input.providers.tuio.`**`TuioMotionEventProvider`**(*device, args*)
Bases: `kivy.input.provider.MotionEventProvider`

The TUIO provider listens to a socket and handles some of the incoming OSC messages:

- /tuio/2Dcur
- /tuio/2Dobj

You can easily extend the provider to handle new TUIO paths like so:

```
    # Create a class to handle the new TUIO type/path
    # Replace NEWPATH with the pathname you want to handle
    class TuioNEWPATHMotionEvent(MotionEvent):
        def __init__(self, id, args):
            super(TuioNEWPATHMotionEvent, self).__init__(id, args)

        def depack(self, args):
            # In this method, implement 'unpacking' for the received
            # arguments. you basically translate from TUIO args to Kivy
            # MotionEvent variables. If all you receive are x and y
            # values, you can do it like this:
            if len(args) == 2:
                self.sx, self.sy = args
                self.profile = ('pos', )
            self.sy = 1 - self.sy
            super(TuioNEWPATHMotionEvent, self).depack(args)

    # Register it with the TUIO MotionEvent provider.
    # You obviously need to replace the PATH placeholders appropriately.
    TuioMotionEventProvider.register('/tuio/PATH', TuioNEWPATHMotionEvent)
```

Note: The class name is of no technical importance. Your class will be associated with the path that you pass to the `register()` function. To keep things simple, you should name your class after the path that it handles, though.

static **`create`**(*oscpath*, ***kwargs*)
Create a touch event from a TUIO path

static **`register`**(*oscpath*, *classname*)
Register a new path to handle in TUIO provider

`start`()
Start the TUIO provider

`stop`()
Stop the TUIO provider

static **`unregister`**(*oscpath*, *classname*)
Unregister a path to stop handling it in the TUIO provider

`update`(*dispatch_fn*)
Update the TUIO provider (pop events from the queue)

class `kivy.input.providers.tuio.`**`Tuio2dCurMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dCur TUIO touch.

class `kivy.input.providers.tuio.`**`Tuio2dObjMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dObj TUIO object.

CHAPTER

EIGHTYEIGHT

ANDROID JOYSTICK INPUT PROVIDER

This module is based on the PyGame JoyStick Input Provider. For more information, please refer to http://www.pygame.org/docs/ref/joystick.html

CHAPTER

EIGHTYNINE

NATIVE SUPPORT FOR HID INPUT FROM THE LINUX KERNEL

Support starts from 2.6.32-ubuntu, or 2.6.34.

To configure HIDInput, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
# example with Stantum MTP4.3" screen
stantum = hidinput,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. For some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

For example, on the Asus T101M, the touchscreen reports a range from 0-4095 for the X and Y values, but the real values are in a range from 0-32768. To correct this, you can add the following to the configuration:

```
[input]
t101m = hidinput,/dev/input/event7,max_position_x=32768,max_position_y=32768
```

CHAPTER

NINETY

LEAP MOTION - FINGER ONLY

CHAPTER

NINETYONE

NATIVE SUPPORT OF WACOM TABLET FROM LINUXWACOM DRIVER

To configure LinuxWacom, add this to your configuration:

```
[input]
pen = linuxwacom,/dev/input/event2,mode=pen
finger = linuxwacom,/dev/input/event3,mode=touch
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum

CHAPTER

NINETYTWO

NATIVE SUPPORT OF MULTITOUCHSUPPORT FRAMEWORK FOR MACBOOK (MAXOSX PLATFORM)

CHAPTER

NINETYTHREE

MOUSE PROVIDER IMPLEMENTATION

On linux systems, the mouse provider can be annoying when used with another multitouch provider (hidinput or mtdev). The Mouse can conflict with them: a single touch can generate one event from the mouse provider and another from the multitouch provider.

To avoid this behavior, you can activate the "disable_on_activity" token in the mouse configuration. Then, if there are any touches activated by another provider, the mouse event will be discarded. Add this to your configuration:

```
[input]
mouse = mouse,disable_on_activity
```

93.1 Using multitouch interaction with the mouse

New in version 1.3.0.

By default, the middle and right mouse buttons, as well as a combination of ctrl + left mouse button are used for multitouch emulation. If you want to use them for other purposes, you can disable this behavior by activating the "disable_multitouch" token:

```
[input]
mouse = mouse,disable_multitouch
```

Changed in version 1.9.0.

You can now selectively control whether a click initiated as described above will emulate multi-touch. If the touch has been initiated in the above manner (e.g. right mouse button), multitouch_sim will be added to touch's profile, and property *multitouch_sim* to the touch. By default *multitouch_sim* is True and multitouch will be emulated for that touch. However, if *multitouch_on_demand* is added to the config:

```
[input]
mouse = mouse,multitouch_on_demand
```

then *multitouch_sim* defaults to *False*. In that case, if before mouse release (e.g. in on_touch_down/move) *multitouch_sim* is set to True, the touch will simulate multi-touch. For example:

```
if 'multitouch_sim' in touch.profile:
    touch.multitouch_sim = True
```

Following is a list of the supported profiles for `MouseMotionEvent`.

Profile name	Description
button	Mouse button (left, right, middle, scrollup, scrolldown) Use property *button*
pos	2D position. Use properties *x*, *y* or *pos‘*
multitouch_sim	If multitouch is simulated. Use property *multitouch_sim*. See documatation above.

CHAPTER

NINETYFOUR

NATIVE SUPPORT FOR MULTITOUCH DEVICES ON LINUX, USING LIBMTDEV.

The Mtdev project is a part of the Ubuntu Maverick multitouch architecture. You can read more on http://wiki.ubuntu.com/Multitouch

To configure MTDev, it's preferable to use probesysfs providers. Check `probesysfs` for more information.

Otherwise, add this to your configuration:

```
[input]
# devicename = hidinput,/dev/input/eventXX
acert230h = mtdev,/dev/input/event2
```

Note: You must have read access to the input event.

You can use a custom range for the X, Y and pressure values. On some drivers, the range reported is invalid. To fix that, you can add these options to the argument line:

- invert_x : 1 to invert X axis
- invert_y : 1 to invert Y axis
- min_position_x : X minimum
- max_position_x : X maximum
- min_position_y : Y minimum
- max_position_y : Y maximum
- min_pressure : pressure minimum
- max_pressure : pressure maximum
- min_touch_major : width shape minimum
- max_touch_major : width shape maximum
- min_touch_minor : width shape minimum
- max_touch_minor : height shape maximum

CHAPTER

NINETYFIVE

AUTO CREATE INPUT PROVIDER CONFIG ENTRY FOR AVAILABLE MT HARDWARE (LINUX ONLY).

Thanks to Marc Tardif for the probing code, taken from scan-for-mt-device.

The device discovery is done by this provider. However, the reading of input can be performed by other providers like: hidinput, mtdev and linuxwacom. mtdev is used prior to other providers. For more information about mtdev, check `mtdev`.

Here is an example of auto creation:

```
[input]
# using mtdev
device_%(name)s = probesysfs,provider=mtdev
# using hidinput
device_%(name)s = probesysfs,provider=hidinput
# using mtdev with a match on name
device_%(name)s = probesysfs,provider=mtdev,match=acer

# using hidinput with custom parameters to hidinput (all on one line)
%(name)s = probesysfs,
    provider=hidinput,param=min_pressure=1,param=max_pressure=99

# you can also match your wacom touchscreen
touch = probesysfs,match=E3 Finger,provider=linuxwacom,
    select_all=1,param=mode=touch
# and your wacom pen
pen = probesysfs,match=E3 Pen,provider=linuxwacom,
    select_all=1,param=mode=pen
```

By default, ProbeSysfs module will enumerate hardware from the /sys/class/input device, and configure hardware with ABS_MT_POSITION_X capability. But for example, the wacom screen doesn't support this capability. You can prevent this behavior by putting select_all=1 in your config line.

CHAPTER

NINETYSIX

TUIO INPUT PROVIDER

TUIO is the de facto standard network protocol for the transmission of touch and fiducial information between a server and a client. To learn more about TUIO (which is itself based on the OSC protocol), please refer to http://tuio.org – The specification should be of special interest.

96.1 Configure a TUIO provider in the config.ini

The TUIO provider can be configured in the configuration file in the `[input]` section:

```
[input]
# name = tuio,<ip>:<port>
multitouchtable = tuio,192.168.0.1:3333
```

96.2 Configure a TUIO provider in the App

You must add the provider before your application is run, like this:

```
from kivy.app import App
from kivy.config import Config

class TestApp(App):
    def build(self):
        Config.set('input', 'multitouchscreen1', 'tuio,0.0.0.0:3333')
        # You can also add a second TUIO listener
        # Config.set('input', 'source2', 'tuio,0.0.0.0:3334')
        # Then do the usual things
        # ...
        return
```

class `kivy.input.providers.tuio.`**`TuioMotionEventProvider`**`(`*device, args*`)`

Bases: `kivy.input.provider.MotionEventProvider`

The TUIO provider listens to a socket and handles some of the incoming OSC messages:

- /tuio/2Dcur
- /tuio/2Dobj

You can easily extend the provider to handle new TUIO paths like so:

```
# Create a class to handle the new TUIO type/path
# Replace NEWPATH with the pathname you want to handle
class TuioNEWPATHMotionEvent(MotionEvent):
    def __init__(self, id, args):
        super(TuioNEWPATHMotionEvent, self).__init__(id, args)

    def depack(self, args):
        # In this method, implement 'unpacking' for the received
        # arguments. you basically translate from TUIO args to Kivy
        # MotionEvent variables. If all you receive are x and y
        # values, you can do it like this:
        if len(args) == 2:
            self.sx, self.sy = args
            self.profile = ('pos', )
        self.sy = 1 - self.sy
        super(TuioNEWPATHMotionEvent, self).depack(args)

# Register it with the TUIO MotionEvent provider.
# You obviously need to replace the PATH placeholders appropriately.
TuioMotionEventProvider.register('/tuio/PATH', TuioNEWPATHMotionEvent)
```

Note: The class name is of no technical importance. Your class will be associated with the path that you pass to the `register()` function. To keep things simple, you should name your class after the path that it handles, though.

static **`create`**(*oscpath*, ***kwargs*)
Create a touch event from a TUIO path

static **`register`**(*oscpath*, *classname*)
Register a new path to handle in TUIO provider

`start`()
Start the TUIO provider

`stop`()
Stop the TUIO provider

static **`unregister`**(*oscpath*, *classname*)
Unregister a path to stop handling it in the TUIO provider

`update`(*dispatch_fn*)
Update the TUIO provider (pop events from the queue)

class `kivy.input.providers.tuio.`**`Tuio2dCurMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dCur TUIO touch.

class `kivy.input.providers.tuio.`**`Tuio2dObjMotionEvent`**(*device*, *id*, *args*)
Bases: `kivy.input.providers.tuio.TuioMotionEvent`

A 2dObj TUIO object.

CHAPTER

NINETYSEVEN

COMMON DEFINITIONS FOR A WINDOWS PROVIDER

This file provides common definitions for constants used by WM_Touch / WM_Pen.

CHAPTER

NINETYEIGHT

SUPPORT FOR WM_PEN MESSAGES (WINDOWS PLATFORM)

class `kivy.input.providers.wm_pen.`**`WM_Pen`**(*device, id, args*)

Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_Pen event. Supports the pos profile.

CHAPTER

NINETYNINE

SUPPORT FOR WM_TOUCH MESSAGES (WINDOWS PLATFORM)

class `kivy.input.providers.wm_touch.`**`WM_MotionEvent`**(*device, id, args*)

Bases: `kivy.input.motionevent.MotionEvent`

MotionEvent representing the WM_MotionEvent event. Supports pos, shape and size profiles.

INPUT RECORDER

New in version 1.1.0.

Warning: This part of Kivy is still experimental and this API is subject to change in a future version.

This is a class that can record and replay some input events. This can be used for test cases, screen savers etc.

Once activated, the recorder will listen for any input event and save its properties in a file with the delta time. Later, you can play the input file: it will generate fake touch events with the saved properties and dispatch it to the event loop.

By default, only the position is saved ('pos' profile and 'sx', 'sy', attributes). Change it only if you understand how input handling works.

100.1 Recording events

The best way is to use the "recorder" module. Check the *Modules* documentation to see how to activate a module.

Once activated, you can press F8 to start the recording. By default, events will be written to *<current-path>/recorder.kvi*. When you want to stop recording, press F8 again.

You can replay the file by pressing F7.

Check the *Recorder module* module for more information.

100.2 Manual play

You can manually open a recorder file, and play it by doing:

```
from kivy.input.recorder import Recorder

rec = Recorder(filename='myrecorder.kvi')
rec.play = True
```

If you want to loop over that file, you can do:

```
from kivy.input.recorder import Recorder

def recorder_loop(instance, value):
    if value is False:
        instance.play = True

rec = Recorder(filename='myrecorder.kvi')
```

```
rec.bind(play=recorder_loop)
rec.play = True
```

100.3 Recording more attributes

You can extend the attributes to save on one condition: attributes values must be simple values, not instances of complex classes.

Let's say you want to save the angle and pressure of the touch, if available:

```
from kivy.input.recorder import Recorder

rec = Recorder(filename='myrecorder.kvi',
    record_attrs=['is_touch', 'sx', 'sy', 'angle', 'pressure'],
    record_profile_mask=['pos', 'angle', 'pressure'])
rec.record = True
```

Or with modules variables:

```
$ python main.py -m recorder,attrs=is_touch:sx:sy:angle:pressure,           profile_mask=pos:ang
```

100.4 Known limitations

- Unable to save attributes with instances of complex classes.
- Values that represent time will not be adjusted.
- Can replay only complete records. If a begin/update/end event is missing, this could lead to ghost touches.
- Stopping the replay before the end can lead to ghost touches.

class `kivy.input.recorder.`**`Recorder`**`(`***kwargs*`)`

Bases: `kivy.event.EventDispatcher`

Recorder class. Please check module documentation for more information.

`counter`

Number of events recorded in the last session.

`counter` is a `NumericProperty` and defaults to 0, read-only.

`filename`

Filename to save the output of the recorder.

`filename` is a `StringProperty` and defaults to 'recorder.kvi'.

`play`

Boolean to start/stop the replay of the current file (if it exists).

`play` is a `BooleanProperty` and defaults to False.

`record`

Boolean to start/stop the recording of input events.

`record` is a `BooleanProperty` and defaults to False.

`record_attrs`
Attributes to record from the motion event.

`record_attrs` is a `ListProperty` and defaults to ['is_touch', 'sx', 'sy'].

`record_profile_mask`
Profile to save in the fake motion event when replayed.

`record_profile_mask` is a `ListProperty` and defaults to ['pos'].

`window`
Window instance to attach the recorder. If None, it will use the default instance.

`window` is a `ObjectProperty` and defaults to None.

CHAPTER

ONE

MOTION EVENT SHAPE

Represent the shape of the `MotionEvent`

class `kivy.input.shape.`**`Shape`**

Bases: `object`

Abstract class for all implementations of a shape

class `kivy.input.shape.`**`ShapeRect`**

Bases: `kivy.input.shape.Shape`

Class for the representation of a rectangle.

`height`

Height of the rect

`width`

Width fo the rect

CHAPTER

TWO

INTERACTIVE LAUNCHER

New in version 1.3.0.

The InteractiveLauncher provides a user-friendly python shell interface to an App so that it can be prototyped and debugged interactively.

Note: The Kivy API intends for some functions to only be run once or before the main EventLoop has started. Methods that can normally be called during the course of an application will work as intended, but specifically overriding methods such as on_touch() dynamically leads to trouble.

102.1 Creating an InteractiveLauncher

Take your existing subclass of App (this can be production code) and pass an instance to the InteractiveLauncher constructor.:

```
from kivy.interactive import InteractiveLauncher
from kivy.app import App
from kivy.uix.button import Button

class MyApp(App):
    def build(self):
        return Button(test='Hello Shell')

launcher = InteractiveLauncher(MyApp())
launcher.run()
```

After pressing *enter*, the script will return. This allows the interpreter to continue running. Inspection or modification of the App can be done safely through the InteractiveLauncher instance or the provided SafeMembrane class instances.

Note: If you want to test this example, start Python without any file to have already an interpreter, and copy/paste all the lines. You'll still have the interpreter at the end + the kivy application running.

102.2 Interactive Development

IPython provides a fast way to learn the Kivy API. The App instance and all of it's attributes, including methods and the entire widget tree, can be quickly listed by using the '.' operator and pressing 'tab'. Try this code in an Ipython shell.:

```
from kivy.interactive import InteractiveLauncher
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.graphics import Color, Ellipse

class MyPaintWidget(Widget):
    def on_touch_down(self, touch):
        with self.canvas:
            Color(1, 1, 0)
            d = 30.
            Ellipse(pos=(touch.x - d/2, touch.y - d/2), size=(d, d))


class TestApp(App):
    def build(self):
        return Widget()


i = InteractiveLauncher(TestApp())
i.run()
i.       # press 'tab' to list attributes of the app
i.root.  # press 'tab' to list attributes of the root widget

# App is boring.  Attach a new widget!
i.root.add_widget(MyPaintWidget())

i.safeIn()
# The application is now blocked.
# Click on the screen several times.
i.safeOut()
# The clicks will show up now

# Erase artwork and start over
i.root.canvas.clear()
```

Note: All of the proxies used in the module store their referent in the `_ref` attribute, which can be accessed directly if needed, such as for getting doc strings. `help()` and `type()` will access the proxy, not its referent.

102.3 Directly Pausing the Application

Both the `InteractiveLauncher` and `SafeMembrane` hold internal references to the `EventLoop`'s 'safe' and 'confirmed' `threading.Event` objects. You can use their safing methods to control the application manually.

`SafeMembrane.safeIn()` will cause the application to pause and `SafeMembrane.safeOut()` will allow a paused application to continue running. This is potentially useful for scripting actions into functions that need the screen to update etc.

Note: The pausing is implemented via the `Clocks' schedule_once()` method and occurs before the start of each frame.

102.4 Adding Attributes Dynamically

Note: This module uses threading and object proxies to encapsulate the running `App`. Deadlocks and memory corruption can occur if making direct references inside the thread without going through the provided proxy(s).

The `InteractiveLauncher` can have attributes added to it exactly like a normal object and if these were created from outside the membrane, they will not be threadsafe because the external references to them in the python interpreter do not go through InteractiveLauncher's membrane behavior, inherited from `SafeMembrane`.

To threadsafe these external references, simply assign them to `SafeMembrane` instances of themselves like so:

```python
from kivy.interactive import SafeMembrane

interactiveLauncher.attribute = myNewObject
# myNewObject is unsafe
myNewObject = SafeMembrane(myNewObject)
# myNewObject is now safe.  Call at will.
myNewObject.method()
```

102.4.1 TODO

Unit tests, examples, and a better explanation of which methods are safe in a running application would be nice. All three would be excellent.

Could be re-written with a context-manager style i.e.:

```python
with safe:
    foo()
```

Any use cases besides compacting code?

class `kivy.interactive.`**`SafeMembrane`**(*ob*, **args*, ***kwargs*)

Bases: `object`

This help is for a proxy object. Did you want help on the proxy's referent instead? Try using help(<instance>._ref)

The SafeMembrane is a threadsafe proxy that also returns attributes as new thread-safe objects and makes thread-safe method calls, preventing thread-unsafe objects from leaking into the user's environment.

`safeIn`()

Provides a thread-safe entry point for interactive launching.

`safeOut`()

Provides a thread-safe exit point for interactive launching.

class `kivy.interactive.`**`InteractiveLauncher`**(*app=None*, **args*, ***kwargs*)

Bases: `kivy.interactive.SafeMembrane`

Proxy to an application instance that launches it in a thread and then returns and acts as a proxy to the application in the thread.

CHAPTER

THREE

KIVY LANGUAGE

The Kivy language is a language dedicated to describing user interface and interactions. You could compare this language to Qt's QML (http://qt.nokia.com), but we included new concepts such as rule definitions (which are somewhat akin to what you may know from CSS), templating and so on.

Changed in version 1.7.0: The Builder doesn't execute canvas expressions in realtime anymore. It will pack all the expressions that need to be executed first and execute them after dispatching input, just before drawing the frame. If you want to force the execution of canvas drawing, just call `Builder.sync`.

An experimental profiling tool for the kv lang is also included. You can activate it by setting the environment variable *KIVY_PROFILE_LANG=1*. It will then generate an html file named *builder_stats.html*.

103.1 Overview

The language consists of several constructs that you can use:

Rules A rule is similar to a CSS rule. A rule applies to specific widgets (or classes thereof) in your widget tree and modifies them in a certain way. You can use rules to specify interactive behaviour or use them to add graphical representations of the widgets they apply to. You can target a specific class of widgets (similar to the CSS concept of a *class*) by using the `cls` attribute (e.g. `cls=MyTestWidget`).

A Root Widget You can use the language to create your entire user interface. A kv file must contain only one root widget at most.

Dynamic Classes *(introduced in version 1.7.0)* Dynamic classes let you create new widgets and rules on-the-fly, without any Python declaration.

Templates (deprecated) *(introduced in version 1.0.5, deprecated from version 1.7.0)* Templates were used to populate parts of an application, such as styling the content of a list (e.g. icon on the left, text on the right). They are now deprecated by dynamic classes.

103.2 Syntax of a kv File

A Kivy language file must have `.kv` as filename extension.

The content of the file should always start with the Kivy header, where *version* must be replaced with the Kivy language version you're using. For now, use 1.0:

```
#:kivy '1.0'

# content here
```

The *content* can contain rule definitions, a root widget, dynamic class definitions and templates:

```
# Syntax of a rule definition. Note that several Rules can share the same
# definition (as in CSS). Note the braces: they are part of the definition.
<Rule1,Rule2>:
    # .. definitions ..

<Rule3>:
    # .. definitions ..

# Syntax for creating a root widget
RootClassName:
    # .. definitions ..

# Syntax for creating a dynamic class
<NewWidget@BaseClass>:
    # .. definitions ..

# Syntax for create a template
[TemplateName@BaseClass1,BaseClass2]:
    # .. definitions ..
```

Regardless of whether it's a rule, root widget, dynamic class or template you're defining, the definition should look like this:

```
# With the braces it's a rule. Without them, it's a root widget.
<ClassName>:
    prop1: value1
    prop2: value2

    canvas:
        CanvasInstruction1:
            canvasprop1: value1
        CanvasInstruction2:
            canvasprop2: value2

    AnotherClass:
        prop3: value1
```

Here *prop1* and *prop2* are the properties of *ClassName* and *prop3* is the property of *AnotherClass*. If the widget doesn't have a property with the given name, an `ObjectProperty` will be automatically created and added to the instance.

AnotherClass will be created and added as a child of the *ClassName* instance.

- The indentation is important and must be consistent. The spacing must be a multiple of the number of spaces used on the first indented line. Spaces are encouraged: mixing tabs and spaces is not recommended.
- The value of a property must be given on a single line (for now at least).
- The *canvas* property is special: you can put graphics instructions in it to create a graphical representation of the current class.

Here is a simple example of a kv file that contains a root widget:

```
#:kivy 1.0

Button:
    text: 'Hello world'
```

Changed in version 1.7.0: The indentation is not limited to 4 spaces anymore. The spacing must be a multiple of the number of spaces used on the first indented line.

Both the `load_file()` and the `load_string()` methods return the root widget defined in your kv file/string. They will also add any class and template definitions to the `Factory` for later usage.

103.3 Value Expressions, on_property Expressions, ids and Reserved Keywords

When you specify a property's value, the value is evaluated as a Python expression. This expression can be static or dynamic, which means that the value can use the values of other properties using reserved keywords.

self The keyword self references the "current widget instance":

```
Button:
    text: 'My state is %s' % self.state
```

root This keyword is available only in rule definitions and represents the root widget of the rule (the first instance of the rule):

```
<MyWidget>:
    custom: 'Hello world'
    Button:
        text: root.custom
```

app This keyword always refers to your app instance. It's equivalent to a call to `kivy.app.App.get_running_app()` in Python.:

```
Label:
    text: app.name
```

args This keyword is available in on_<action> callbacks. It refers to the arguments passed to the callback.:

```
TextInput:
    on_focus: self.insert_text("Focus" if args[1] else "No focus")
```

103.3.1 ids

Class definitions may contain ids which can be used as a keywords::

```
<MyWidget>:
    Button:
        id: btn1
    Button:
        text: 'The state of the other button is %s' % btn1.state
```

Please note that the *id* will not be available in the widget instance: it is used exclusively for external references. *id* is a weakref to the widget, and not the widget itself. The widget itself can be accessed with *id.__self__* (*btn1.__self__* in this case).

When the kv file is processed, weakrefs to all the widgets tagged with ids are added to the root widgets *ids* dictionary. In other words, following on from the example above, the buttons state could also be accessed as follows:

```
widget = MyWidget()
state = widget.ids["btn1"].state

# Or, as an alternative syntax,
state = widget.ids.btn1.state
```

Note that the outermost widget applies the kv rules to all its inner widgets before any other rules are applied. This means if an inner widget contains ids, these ids may not be available during the inner widget's *__init__* function.

103.3.2 Valid expressons

There are two places that accept python statments in a kv file: after a property, which assigns to the property the result of the expression (such as the text of a button as shown above) and after a on_property, which executes the statement when the property is updated (such as on_state).

In the former case, the expression can only span a single line, cannot be extended to multiple lines using newline escaping, and must return a value. An example of a valid expression is `text: self.state and ('up' if self.state == 'normal' else 'down')`.

In the latter case, multiple single line statements are valid including multi-line statements that escape their newline, as long as they don't add an indentation level.

Examples of valid statements are:

```
on_press: if self.state == 'normal': print('normal')
on_state:
    if self.state == 'normal': print('normal')
    else: print('down')
    if self.state == 'normal': \
    print('multiline normal')
    for i in range(10): print(i)
    print([1,2,3,4,
    5,6,7])
```

An example of a invalid statement:

```
on_state:
    if self.state == 'normal':
        print('normal')
```

103.4 Relation Between Values and Properties

When you use the Kivy language, you might notice that we do some work behind the scenes to automatically make things work properly. You should know that *Properties* implement the Observer Design Pattern. That means that you can bind your own function to be called when the value of a property changes (i.e. you passively *observe* the property for potential changes).

The Kivy language detects properties in your *value* expression and will create create callbacks to automatically update the property via your expression when changes occur.

Here's a simple example that demonstrates this behaviour:

```
Button:
    text: str(self.state)
```

In this example, the parser detects that *self.state* is a dynamic value (a property). The `state` property of the button can change at any moment (when the user touches it). We now want this button to display its own state as text, even as the state changes. To do this, we use the state property of the Button and use it in the value expression for the button's *text* property, which controls what text is displayed on the button (We also convert the state to a string representation). Now, whenever the button state changes, the text property will be updated automatically.

Remember: The value is a python expression! That means that you can do something more interesting like:

```
Button:
    text: 'Plop world' if self.state == 'normal' else 'Release me!'
```

The Button text changes with the state of the button. By default, the button text will be 'Plop world', but when the button is being pressed, the text will change to 'Release me!'.

103.5 Graphical Instructions

The graphical instructions are a special part of the Kivy language. They are handled by the 'canvas' property definition:

```
Widget:
    canvas:
        Color:
            rgb: (1, 1, 1)
        Rectangle:
            size: self.size
            pos: self.pos
```

All the classes added inside the canvas property must be derived from the `Instruction` class. You cannot put any Widget class inside the canvas property (as that would not make sense because a widget is not a graphics instruction).

If you want to do theming, you'll have the same question as in CSS: which rules have been executed first? In our case, the rules are executed in processing order (i.e. top-down).

If you want to change how Buttons are rendered, you can create your own kv file and add something like this:

```
<Button>:
    canvas:
        Color:
            rgb: (1, 0, 0)
        Rectangle:
            pos: self.pos
            size: self.size
        Rectangle:
            pos: self.pos
            size: self.texture_size
            texture: self.texture
```

This will result in buttons having a red background with the label in the bottom left, in addition to all the preceding rules. You can clear all the previous instructions by using the *Clear* command:

```
<Button>:
    canvas:
        Clear
        Color:
            rgb: (1, 0, 0)
        Rectangle:
            pos: self.pos
            size: self.size
        Rectangle:
            pos: self.pos
            size: self.texture_size
            texture: self.texture
```

Then, only your rules that follow the *Clear* command will be taken into consideration.

103.6 Dynamic classes

Dynamic classes allow you to create new widgets on-the-fly, without any python declaration in the first place. The syntax of the dynamic classes is similar to the Rules, but you need to specify the base classes you want to subclass.

The syntax looks like:

```
# Simple inheritance
<NewWidget@Button>:
    # kv code here ...

# Multiple inheritance
<NewWidget@ButtonBehavior+Label>:
    # kv code here ...
```

The @ character is used to seperate your class name from the classes you want to subclass. The Python equivalent would have been:

```
# Simple inheritance
class NewWidget(Button):
    pass

# Multiple inheritance
class NewWidget(ButtonBehavior, Label):
    pass
```

Any new properties, usually added in python code, should be declared first. If the property doesn't exist in the dynamic class, it will be automatically created as an `ObjectProperty` (pre 1.8.0) or as an appropriate typed property (from version 1.8.0).

Changed in version 1.8.0: If the property value is an expression that can be evaluated right away (no external binding), then the value will be used as default value of the property, and the type of the value will be used for the specialization of the Property class. In other terms: if you declare *hello: "world"*, a new `StringProperty` will be instantiated, with the default value *"world"*. Lists, tuples, dictionaries and strings are supported.

Let's illustrate the usage of theses dynamic classes with an implementation of a basic Image button. We could derive our classes from the Button and just add a property for the image filename:

```
<ImageButton@Button>:
    source: None

    Image:
        source: root.source
        pos: root.pos
        size: root.size

# let’s use the new classes in another rule:
<MainUI>:
    BoxLayout:
        ImageButton:
            source: 'hello.png'
            on_press: root.do_something()
        ImageButton:
            source: 'world.png'
            on_press: root.do_something_else()
```

In Python, you can create an instance of the dynamic class as follows:

```
from kivy.factory import Factory
button_inst = Factory.ImageButton()
```

Note: Using dynamic classes, a child class can be declared before it's parent. This however, leads to the unintuitive situation where the parent properties/methods override those of the child. Be careful if you choose to do this.

103.7 Templates

Changed in version 1.7.0: Template usage is now deprecated. Please use Dynamic classes instead.

103.7.1 Syntax of templates

Using a template in Kivy requires 2 things :

1. a context to pass for the context (will be ctx inside template).
2. a kv definition of the template.

Syntax of a template:

```
# With only one base class
[ClassName@BaseClass]:
    # .. definitions ..

# With more than one base class
[ClassName@BaseClass1,BaseClass2]:
    # .. definitions ..
```

For example, for a list, you'll need to create a entry with a image on the left, and a label on the right. You can create a template for making that definition easier to use. So, we'll create a template that uses 2 entries in the context: an image filename and a title:

```
[IconItem@BoxLayout]:
    Image:
        source: ctx.image
    Label:
        text: ctx.title
```

Then in Python, you can instantiate the template using:

```
from kivy.lang import Builder

# create a template with hello world + an image
# the context values should be passed as kwargs to the Builder.template
# function
icon1 = Builder.template('IconItem', title='Hello world',
    image='myimage.png')

# create a second template with other information
ctx = {'title': 'Another hello world',
       'image': 'myimage2.png'}
icon2 = Builder.template('IconItem', **ctx)
# and use icon1 and icon2 as other widget.
```

103.7.2 Template example

Most of time, when you are creating a screen in the kv lang, you use a lot of redefinitions. In our example, we'll create a Toolbar, based on a BoxLayout, and put in a few Image widgets that will react to the *on_touch_down* event.:

```
<MyToolbar>:
    BoxLayout:
        Image:
            source: 'data/text.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_text()

        Image:
            source: 'data/image.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_image()

        Image:
            source: 'data/video.png'
            size: self.texture_size
            size_hint: None, None
            on_touch_down: self.collide_point(*args[1].pos) and root.create_video()
```

We can see that the size and size_hint attribute are exactly the same. More than that, the callback in on_touch_down and the image are changing. Theses can be the variable part of the template that we can put into a context. Let's try to create a template for the Image:

```
[ToolbarButton@Image]:

    # This is the same as before
    size: self.texture_size
    size_hint: None, None

    # Now, we are using the ctx for the variable part of the template
    source: 'data/%s.png' % ctx.image
    on_touch_down: self.collide_point(*args[1].pos) and ctx.callback()
```

The template can be used directly in the MyToolbar rule:

```
<MyToolbar>:
    BoxLayout:
        ToolbarButton:
            image: 'text'
            callback: root.create_text
        ToolbarButton:
            image: 'image'
            callback: root.create_image
        ToolbarButton:
            image: 'video'
            callback: root.create_video
```

That's all :)

103.7.3 Template limitations

When you are creating a context:

1. you cannot use references other than "root":

```
        <MyRule>:
            Widget:
                id: mywidget
                value: 'bleh'
            Template:
                ctxkey: mywidget.value # << fail, this references the id
                # mywidget
```

2. not all of the dynamic parts will be understood:

```
        <MyRule>:
            Template:
                ctxkey: 'value 1' if root.prop1 else 'value2' # << even if
                # root.prop1 is a property, if it changes value, ctxkey
                # will not be updated
```

103.8 Redefining a widget's style

Sometimes we would like to inherit from a widget in order to use its Python properties without also using its .kv defined style. For example, we would like to inherit from a Label, but we would also like to define our own canvas instructions instead of automatically using the canvas instructions inherited from the Label. We can achieve this by prepending a dash (-) before the class name in the .kv style definition.

In myapp.py:

```
class MyWidget(Label):
    pass
```

and in my.kv:

```
<-MyWidget>:
    canvas:
        Color:
            rgb: 1, 1, 1
        Rectangle:
            size: (32, 32)
```

MyWidget will now have a Color and Rectangle instruction in its canvas without any of the instructions inherited from the Label.

103.9 Lang Directives

You can use directives to add declarative commands, such as imports or constant definitions, to the lang files. Directives are added as comments in the following format:

```
#:<directivename> <options>
```

103.9.1 import <package>

New in version 1.0.5.

Syntax:

```
#:import <alias> <package>
```

You can import a package by writing:

```
#:import os os

<Rule>:
    Button:
        text: os.getcwd()
```

Or more complex:

```
#:import ut kivy.utils

<Rule>:
    canvas:
        Color:
            rgba: ut.get_random_color()
```

New in version 1.0.7.

You can directly import classes from a module:

```
#: import Animation kivy.animation.Animation
<Rule>:
    on_prop: Animation(x=.5).start(self)
```

103.9.2 set <key> <expr>

New in version 1.0.6.

Syntax:

```
#:set <key> <expr>
```

Set a key that will be available anywhere in the kv. For example:

```
#:set my_color (.4, .3, .4)
#:set my_color_hl (.5, .4, .5)

<Rule>:
    state: 'normal'
    canvas:
        Color:
            rgb: my_color if self.state == 'normal' else my_color_hl
```

103.9.3 include <file>

New in version 1.9.0.

Syntax:

```
#:include [force] <file>
```

Includes an external kivy file. This allows you to split complex widgets into their own files. If the include is forced, the file will first be unloaded and then reloaded again. For example:

```
# Test.kv
#:include mycomponent.kv
#:include force mybutton.kv

<Rule>:
    state: 'normal'
    MyButton:
    MyComponent:
```

```
# mycomponent.kv
#:include mybutton.kv

<MyComponent>:
    MyButton:
```

```
# mybutton.kv

<MyButton>:
    canvas:
        Color:
            rgb: (1.0, 0.0, 0.0)
        Rectangle:
            pos: self.pos
            size: (self.size[0]/4, self.size[1]/4)
```

class `kivy.lang.`**`Observable`**

Bases: `kivy.event.ObjectWithUid`

`Observable` is a stub class defining the methods required for binding. `EventDispatcher` is (the) one example of a class that implements the binding interface. See `EventDispatcher` for details.

New in version 1.9.0.

`fast_bind``()`

See `EventDispatcher.fast_bind()`.

Note: To keep backward compatibility with derived classes which may have inherited from `Observable` before, the `fast_bind()` method was added. The default implementation of `fast_bind()` and `fast_unbind()` is to create a partial function that it passes to bind. However, `fast_unbind()` is fairly inefficient since we have to lookup this partial function before we can call `unbind()`. It is recommended to overwrite these methods in derived classes to bind directly for better performance.

`fast_unbind``()`

See `fast_bind()`.

`kivy.lang.`**`Builder`** **= <kivy.lang.BuilderBase object at 0x96654cc>**

Main instance of a `BuilderBase`.

class `kivy.lang.`**`BuilderBase`**

Bases: `object`

The Builder is responsible for creating a `Parser` for parsing a kv file, merging the results into its internal rules, templates, etc.

By default, `Builder` is a global Kivy instance used in widgets that you can use to load other kv files in addition to the default ones.

`apply``(`*widget*`)`

Search all the rules that match the widget and apply them.

`load_file``(`*filename, **kwargs*`)`

Insert a file into the language builder and return the root widget (if defined) of the kv file.

Parameters

***rulesonly*: bool, defaults to False**If True, the Builder will raise an exception if you have a root widget inside the definition.

`load_string``(`*string, **kwargs*`)`

Insert a string into the Language Builder and return the root widget (if defined) of the kv string.

Parameters

***rulesonly*: bool, defaults to False**If True, the Builder will raise an exception if you have a root widget inside the definition.

`match``(`*widget*`)`

Return a list of `ParserRule` objects matching the widget.

`sync``()`

Execute all the waiting operations, such as the execution of all the expressions related to the canvas.

New in version 1.7.0.

`template``(`**args, **ctx*`)`

Create a specialized template using a specific context. .. versionadded:: 1.0.5

With templates, you can construct custom widgets from a kv lang definition by giving them a context. Check *Template usage*.

`unbind_widget``(`*uid*`)`

(internal) Unbind all the handlers created by the rules of the widget. The `kivy.uix.widget.Widget.uid` is passed here instead of the widget itself, because we are using it in the widget destructor.

New in version 1.7.2.

unload_file(*filename*)

Unload all rules associated with a previously imported file.

New in version 1.0.8.

Warning: This will not remove rules or templates already applied/used on current widgets. It will only effect the next widgets creation or template invocation.

class `kivy.lang.`**BuilderException**(*context, line, message, cause=None*)

Bases: `kivy.lang.ParserException`

Exception raised when the Builder failed to apply a rule on a widget.

class `kivy.lang.`**Parser**(***kwargs*)

Bases: `object`

Create a Parser object to parse a Kivy language file or Kivy content.

parse(*content*)

Parse the contents of a Parser file and return a list of root objects.

parse_level(*level, lines, spaces=0*)

Parse the current level (level * spaces) indentation.

strip_comments(*lines*)

Remove all comments from all lines in-place. Comments need to be on a single line and not at the end of a line. i.e. a comment line's first non-whitespace character must be a #.

class `kivy.lang.`**ParserException**(*context, line, message, cause=None*)

Bases: `exceptions.Exception`

Exception raised when something wrong happened in a kv file.

CHAPTER

FOUR

EXTERNAL LIBRARIES

Kivy comes with other python/C libraries :

- ddslib
- oscAPI (modified / optimized)
- mtdev

Warning: Even though Kivy comes with these external libraries, we do not provide any support for them and they might change in the future. Don't rely on them in your code.

104.1 GstPlayer

New in version 1.8.0.

GstPlayer is a media player implemented specifically for Kivy with Gstreamer 1.0. It doesn't use Gi at all and is focused on what we want: the ability to read video and stream the image in a callback, or read an audio file. Don't use it directly but use our Core providers instead.

This player is automatically compiled if you have *pkg-config –libs –cflags gstreamer-1.0* working.

CHAPTER

FIVE

GSTPLAYER

New in version 1.8.0.

GstPlayer is a media player implemented specifically for Kivy with Gstreamer 1.0. It doesn't use Gi at all and is focused on what we want: the ability to read video and stream the image in a callback, or read an audio file. Don't use it directly but use our Core providers instead.

This player is automatically compiled if you have *pkg-config –libs –cflags gstreamer-1.0* working.

CHAPTER

SIX

ASYNCHRONOUS DATA LOADER

This is the Asynchronous Loader. You can use it to load an image and use it, even if data are not yet available. You must specify a default loading image when using the loader:

```
from kivy.loader import Loader
image = Loader.image('mysprite.png')
```

You can also load an image from a url:

```
image = Loader.image('http://mysite.com/test.png')
```

If you want to change the default loading image, you can do:

```
Loader.loading_image = Image('another_loading.png')
```

106.1 Tweaking the asynchronous loader

New in version 1.6.0.

You can tweak the loader to provide a better user experience or more performance, depending of the images you are going to load. Take a look at the parameters:

- `Loader.num_workers` - define the number of threads to start for loading images.
- `Loader.max_upload_per_frame` - define the maximum image uploads in GPU to do per frame.

class `kivy.loader.`**`LoaderBase`**

Bases: `object`

Common base for the Loader and specific implementations. By default, the Loader will be the best available loader implementation.

The _update() function is called every 1 / 25.s or each frame if we have less than 25 FPS.

`error_image`

Image used for error. You can change it by doing:

```
Loader.error_image = 'error.png'
```

Changed in version 1.6.0: Not readonly anymore.

`image`(*filename*, *load_callback=None*, *post_callback=None*, ***kwargs*)

Load a image using the Loader. A ProxyImage is returned with a loading image. You can use it as follows:

```
from kivy.app import App
from kivy.uix.image import Image
from kivy.loader import Loader

class TestApp(App):
    def _image_loaded(self, proxyImage):
        if proxyImage.image.texture:
            self.image.texture = proxyImage.image.texture

    def build(self):
        proxyImage = Loader.image("myPic.jpg")
        proxyImage.bind(on_load=self._image_loaded)
        self.image = Image()
        return self.image

TestApp().run()
```

In order to cancel all background loading, call *Loader.stop()*.

loading_image

Image used for loading. You can change it by doing:

```
Loader.loading_image = 'loading.png'
```

Changed in version 1.6.0: Not readonly anymore.

max_upload_per_frame

The number of images to upload per frame. By default, we'll upload only 2 images to the GPU per frame. If you are uploading many small images, you can easily increase this parameter to 10 or more. If you are loading multiple full HD images, the upload time may have consequences and block the application. If you want a smooth experience, use the default.

As a matter of fact, a Full-HD RGB image will take ~6MB in memory, so it may take time. If you have activated mipmap=True too, then the GPU must calculate the mipmap of these big images too, in real time. Then it may be best to reduce the `max_upload_per_frame` to 1 or 2. If you want to get rid of that (or reduce it a lot), take a look at the DDS format.

New in version 1.6.0.

num_workers

Number of workers to use while loading (used only if the loader implementation supports it). This setting impacts the loader only on initialization. Once the loader is started, the setting has no impact:

```
from kivy.loader import Loader
Loader.num_workers = 4
```

The default value is 2 for giving a smooth user experience. You could increase the number of workers, then all the images will be loaded faster, but the user will not been able to use the application while loading. Prior to 1.6.0, the default number was 20, and loading many full-hd images was completly blocking the application.

New in version 1.6.0.

pause()

Pause the loader, can be useful during interactions.

New in version 1.6.0.

resume()

Resume the loader, after a `pause()`.

New in version 1.6.0.

run(**largs*)
Main loop for the loader.

start()
Start the loader thread/process.

stop()
Stop the loader thread/process.

class kivy.loader.**ProxyImage**(*arg*, ***kwargs*)
Bases: kivy.core.image.Image

Image returned by the Loader.image() function.

Properties

loaded: **bool, defaults to False**This value may be True if the image is already cached.

Events

*on_load*Fired when the image is loaded or changed.

CHAPTER

SEVEN

LOGGER OBJECT

Differents logging levels are available : trace, debug, info, warning, error and critical.

Examples of usage:

```
from kivy.logger import Logger

Logger.info('title: This is a info message.')
Logger.debug('title: This is a debug message.')

try:
    raise Exception('bleh')
except Exception:
    Logger.exception('Something happened!')
```

The message passed to the logger is split into two parts, separated by a colon (:). The first part is used as a title, and the second part is used as the message. This way, you can "categorize" your message easily.:

```
Logger.info('Application: This is a test')

# will appear as

[INFO   ] [Application ] This is a test
```

107.1 Logger configuration

The Logger can be controlled via the Kivy configuration file:

```
[kivy]
log_level = info
log_enable = 1
log_dir = logs
log_name = kivy_%y-%m-%d_%_.txt
```

More information about the allowed values are described in the `kivy.config` module.

107.2 Logger history

Even if the logger is not enabled, you still have access to the last 100 messages:

```
from kivy.logger import LoggerHistory

print(LoggerHistory.history)
```

`kivy.logger.`**`Logger`** **= <logging.Logger object at 0x8f0240c>**

Kivy default logger instance

class `kivy.logger.`**`LoggerHistory`**(*level=0*)

Bases: `logging.Handler`

Kivy history handler

CHAPTER

EIGHT

METRICS

New in version 1.5.0.

A screen is defined by its physical size, density and resolution. These factors are essential for creating UI's with correct size everywhere.

In Kivy, all the graphics pipelines work with pixels. But using pixels as a measurement unit is problematic because sizes change according to the screen.

108.1 Dimensions

If you want to design your UI for different screen sizes, you will want better measurement units to work with. Kivy provides some more scalable alternatives.

Units

pt Points - 1/72 of an inch based on the physical size of the screen. Prefer to use sp instead of pt.

mm Millimeters - Based on the physical size of the screen.

cm Centimeters - Based on the physical size of the screen.

in Inches - Based on the physical size of the screen.

dp Density-independent Pixels - An abstract unit that is based on the physical density of the screen. With a `density` of 1, 1dp is equal to 1px. When running on a higher density screen, the number of pixels used to draw 1dp is scaled up a factor appropriate to the screen's dpi, and the inverse for a lower dpi. The ratio of dp-to-pixels will change with the screen density, but not necessarily in direct proportion. Using the dp unit is a simple solution to making the view dimensions in your layout resize properly for different screen densities. In others words, it provides consistency for the real-world size of your UI across different devices.

sp Scale-independent Pixels - This is like the dp unit, but it is also scaled by the user's font size preference. We recommend you use this unit when specifying font sizes, so the font size will be adjusted to both the screen density and the user's preference.

108.2 Examples

Here is an example of creating a label with a sp font_size and setting the height manually with a 10dp margin:

```
#:kivy 1.5.0
<MyWidget>:
    Label:
        text: 'Hello world'
        font_size: '15sp'
        size_hint_y: None
        height: self.texture_size[1] + dp(10)
```

108.3 Manual control of metrics

The metrics cannot be changed at runtime. Once a value has been converted to pixels, you can't retrieve the original value anymore. This stems from the fact that the DPI and density of a device cannot be changed at runtime.

We provide some environment variables to control metrics:

- *KIVY_METRICS_DENSITY*: if set, this value will be used for `density` instead of the systems one. On android, the value varies between 0.75, 1, 1.5 and 2.
- *KIVY_METRICS_FONTSCALE*: if set, this value will be used for `fontscale` instead of the systems one. On android, the value varies between 0.8 and 1.2.
- *KIVY_DPI*: if set, this value will be used for `dpi`. Please note that setting the DPI will not impact the dp/sp notation because these are based on the screen density.

For example, if you want to simulate a high-density screen (like the HTC One X):

```
KIVY_DPI=320 KIVY_METRICS_DENSITY=2 python main.py --size 1280x720
```

Or a medium-density (like Motorola Droid 2):

```
KIVY_DPI=240 KIVY_METRICS_DENSITY=1.5 python main.py --size 854x480
```

You can also simulate an alternative user preference for fontscale as follows:

```
KIVY_METRICS_FONTSCALE=1.2 python main.py
```

`kivy.metrics.`**`Metrics`** = **<kivy.metrics.MetricsBase object at 0x978df2c>**
Default instance of `MetricsBase`, used everywhere in the code .. versionadded:: 1.7.0

class `kivy.metrics.`**`MetricsBase`**
Bases: `object`

Class that contains the default attributes for Metrics. Don't use this class directly, but use the *Metrics* instance.

`density``()`
Return the density of the screen. This value is 1 by default on desktops but varies on android depending on the screen.

`dpi``()`
Return the DPI of the screen. Depending on the platform, the DPI can be taken from the Window provider (Desktop mainly) or from a platform-specific module (like android/ios).

`dpi_rounded``()`
Return the DPI of the screen, rounded to the nearest of 120, 160, 240 or 320.

`fontscale``()`

Return the fontscale user preference. This value is 1 by default but can vary between 0.8 and 1.2.

`kivy.metrics.`**`pt`**`(`*value*`)`

Convert from points to pixels

`kivy.metrics.`**`inch`**`(`*value*`)`

Convert from inches to pixels

`kivy.metrics.`**`cm`**`(`*value*`)`

Convert from centimeters to pixels

`kivy.metrics.`**`mm`**`(`*value*`)`

Convert from millimeters to pixels

`kivy.metrics.`**`dp`**`(`*value*`)`

Convert from density-independent pixels to pixels

`kivy.metrics.`**`sp`**`(`*value*`)`

Convert from scale-independent pixels to pixels

`kivy.metrics.`**`metrics`** **= <kivy.metrics.MetricsBase object at 0x978df2c>**

default instance of `MetricsBase`, used everywhere in the code (deprecated, use *Metrics* instead.)

CHAPTER

NINE

MODULES

Modules are classes that can be loaded when a Kivy application is starting. The loading of modules is managed by the config file. Currently, we include:

- `touchring`: Draw a circle around each touch.
- `monitor`: Add a red topbar that indicates the FPS and a small graph indicating input activity.
- `keybinding`: Bind some keys to actions, such as a screenshot.
- `recorder`: Record and playback a sequence of events.
- `screen`: Emulate the characteristics (dpi/density/ resolution) of different screens.
- `inspector`: Examines your widget heirarchy and widget properties.
- `webdebugger`: Realtime examination of your app internals via a web browser.

Modules are automatically loaded from the Kivy path and User path:

- *PATH_TO_KIVY/kivy/modules*
- *HOME/.kivy/mods*

109.1 Activating a module

There are various ways in which you can activate a kivy module.

109.1.1 Activate a module in the config

To activate a module this way, you can edit your configuration file (in your *HOME/.kivy/config.ini*):

```
[modules]
# uncomment to activate
touchring =
# monitor =
# keybinding =
```

Only the name of the module followed by "=" is sufficient to activate the module.

109.1.2 Activate a module in Python

Before starting your application, preferably at the start of your import, you can do something like this:

```
import kivy
kivy.require('1.0.8')

# Activate the touchring module
from kivy.config import Config
Config.set('modules', 'touchring', '')
```

109.1.3 Activate a module via the commandline

When starting your application from the commandline, you can add a *-m <modulename>* to the arguments. For example:

```
python main.py -m webdebugger
```

Note: Some modules, such as the screen, may require additional parameters. They will, however, print these parameters to the console when launched without them.

109.2 Create your own module

Create a file in your *HOME/.kivy/mods*, and create 2 functions:

```
def start(win, ctx):
    pass

def stop(win, ctx):
    pass
```

Start/stop are functions that will be called for every window opened in Kivy. When you are starting a module, you can use these to store and manage the module state. Use the *ctx* variable as a dictionary. This context is unique for each instance/start() call of the module, and will be passed to stop() too.

109.3 Inspector

New in version 1.0.9.

Warning: This module is highly experimental, use it with care.

The Inspector is a tool for finding a widget in the widget tree by clicking or tapping on it. Some keyboard shortcuts are activated:

- "Ctrl + e": activate / deactivate the inspector view
- "Escape": cancel widget lookup first, then hide the inspector view

Available inspector interactions:

- tap once on a widget to select it without leaving inspect mode
- double tap on a widget to select and leave inspect mode (then you can manipulate the widget again)

Some properties can be edited live. However, due to the delayed usage of some properties, it might crash if you don't handle all the cases.

109.3.1 Usage

For normal module usage, please see the `modules` documentation.

The Inspector, however, can also be imported and used just like a normal python module. This has the added advantage of being able to activate and deactivate the module programmatically:

```
from kivy.core.window import Window
from kivy.app import App
from kivy.uix.button import Button
from kivy.modules import inspector

class Demo(App):
    def build(self):
        button = Button(text="Test")
        inspector.create_inspector(Window, button)
        return button

Demo().run()
```

To remove the Inspector, you can do the following:

```
inspector.stop(Window, button)
```

`kivy.modules.inspector.`**`stop`**(*win*, *ctx*)
Stop and unload any active Inspectors for the given *ctx*.

`kivy.modules.inspector.`**`create_inspector`**(*win*, *ctx*, **l*)
Create an Inspector instance attached to the *ctx* and bound to the Windows `on_keyboard()` event for capturing the keyboard shortcut.

Parameters
win: **A `Window`**The application Window to bind to.
ctx: **A `Widget` or subclass**The Widget to be inspected.

109.4 Keybinding

This module forces the mapping of some keys to functions:

- F11: Rotate the Window through 0, 90, 180 and 270 degrees
- Shift + F11: Switches between portrait and landscape on desktops
- F12: Take a screenshot

Note: this does't work if the application requests the keyboard beforehand.

109.4.1 Usage

For normal module usage, please see the `modules` documentation.

The Keybinding module, however, can also be imported and used just like a normal python module. This has the added advantage of being able to activate and deactivate the module programmatically:

```
from kivy.app import App
from kivy.uix.button import Button
from kivy.modules import keybinding
from kivy.core.window import Window
```

```
class Demo(App):

    def build(self):
        button = Button(text="Hello")
        keybinding.start(Window, button)
        return button

Demo().run()
```

To remove the Keybinding, you can do the following:

```
Keybinding.stop(Window, button)
```

109.5 Monitor module

The Monitor module is a toolbar that shows the activity of your current application :

- FPS
- Graph of input events

109.5.1 Usage

For normal module usage, please see the `modules` documentation.

109.6 Recorder module

New in version 1.1.0.

Create an instance of `Recorder`, attach to the class, and bind some keys to record / play sequences:

- F6: play the last record in a loop
- F7: read the latest recording
- F8: record input events

109.6.1 Configuration

Parameters *attrs*: str, defaults to `record_attrs` value.

Attributes to record from the motion event

profile_mask: str, defaults to `record_profile_mask` value.

Mask for motion event profile. Used to filter which profile will appear in the fake motion event when replayed.

filename: str, defaults to 'recorder.kvi'

Name of the file to record / play with

109.6.2 Usage

For normal module usage, please see the `modules` documentation.

109.7 Screen

This module changes some environement and configuration variables to match the density / dpi / screensize of a specific device.

To see a list of the available screenid's, just run:

```
python main.py -m screen
```

To simulate a medium-density screen such as the Motolora Droid 2:

```
python main.py -m screen:droid2
```

To simulate a high-density screen such as HTC One X, in portrait:

```
python main.py -m screen:onex,portrait
```

To simulate the iPad 2 screen:

```
python main.py -m screen:ipad
```

If the generated window is too large, you can specify a scale:

```
python main.py -m screen:note2,portrait,scale=.75
```

Note that to display your contents correctly on a scaled window you must consistently use units 'dp' and 'sp' throughout your app. See `metrics` for more details.

109.8 Touchring

Shows rings around every touch on the surface / screen. You can use this module to check that you don't have any calibration issues with touches.

109.8.1 Configuration

Parameters

image: **str, defaults to '<kivy>/data/images/ring.png'** Filename of the image to use.

scale: **float, defaults to 1.** Scale of the image.

alpha: **float, defaults to 1.** Opacity of the image.

show_cursor: **boolean, default to False** New in version 1.8.0.

cursor_image: **str, defaults to 'atlas://data/images/defaulttheme/slider_cursor'** Image used to represent the cursor if displayed .. versionadded:: 1.8.0

cursor_size: **tuple, defaults to (None, None)** Apparent size of the mouse cursor, if displayed, default value will keep its real size. .. versionadded:: 1.8.0

cursor_offset: **tuple, defaults to (None, None)** Offset of the texture image, default value , will align the top-left corner of the image to the mouse pos. .. versionadded:: 1.8.0

109.8.2 Example

In your configuration (*~/.kivy/config.ini*), you can add something like this:

```
[modules]
touchring = image=mypointer.png,scale=.3,alpha=.7
```

109.9 Web Debugger

New in version 1.2.0.

Warning: This module is highly experimental, use it with care.

This module will start a webserver and run in the background. You can see how your application evolves during runtime, examine the internal cache etc.

Run with:

```
python main.py -m webdebugger
```

Then open your webbrowser on http://localhost:5000/

INSPECTOR

New in version 1.0.9.

Warning: This module is highly experimental, use it with care.

The Inspector is a tool for finding a widget in the widget tree by clicking or tapping on it. Some keyboard shortcuts are activated:

- "Ctrl + e": activate / deactivate the inspector view
- "Escape": cancel widget lookup first, then hide the inspector view

Available inspector interactions:

- tap once on a widget to select it without leaving inspect mode
- double tap on a widget to select and leave inspect mode (then you can manipulate the widget again)

Some properties can be edited live. However, due to the delayed usage of some properties, it might crash if you don't handle all the cases.

110.1 Usage

For normal module usage, please see the modules documentation.

The Inspector, however, can also be imported and used just like a normal python module. This has the added advantage of being able to activate and deactivate the module programmatically:

```
from kivy.core.window import Window
from kivy.app import App
from kivy.uix.button import Button
from kivy.modules import inspector

class Demo(App):
    def build(self):
        button = Button(text="Test")
        inspector.create_inspector(Window, button)
        return button

Demo().run()
```

To remove the Inspector, you can do the following:

```
inspector.stop(Window, button)
```

`kivy.modules.inspector.`**`stop`**`(`*win*, *ctx*`)`
Stop and unload any active Inspectors for the given *ctx*.

`kivy.modules.inspector.`**`create_inspector`**`(`*win, ctx, *l*`)`

Create an Inspector instance attached to the *ctx* and bound to the Windows `on_keyboard()` event for capturing the keyboard shortcut.

Parameters

***win*: A `Window`**The application Window to bind to.

***ctx*: A `Widget` or subclass**The Widget to be inspected.

CHAPTER

ONE

KEYBINDING

This module forces the mapping of some keys to functions:

- F11: Rotate the Window through 0, 90, 180 and 270 degrees
- Shift + F11: Switches between portrait and landscape on desktops
- F12: Take a screenshot

Note: this does't work if the application requests the keyboard beforehand.

111.1 Usage

For normal module usage, please see the `modules` documentation.

The Keybinding module, however, can also be imported and used just like a normal python module. This has the added advantage of being able to activate and deactivate the module programmatically:

```
from kivy.app import App
from kivy.uix.button import Button
from kivy.modules import keybinding
from kivy.core.window import Window

class Demo(App):

    def build(self):
        button = Button(text="Hello")
        keybinding.start(Window, button)
        return button

Demo().run()
```

To remove the Keybinding, you can do the following:

```
Keybinding.stop(Window, button)
```

CHAPTER

TWO

MONITOR MODULE

The Monitor module is a toolbar that shows the activity of your current application :

- FPS
- Graph of input events

112.1 Usage

For normal module usage, please see the `modules` documentation.

CHAPTER

THREE

RECORDER MODULE

New in version 1.1.0.

Create an instance of `Recorder`, attach to the class, and bind some keys to record / play sequences:

- F6: play the last record in a loop
- F7: read the latest recording
- F8: record input events

113.1 Configuration

Parameters *attrs*: str, defaults to `record_attrs` value.

Attributes to record from the motion event

profile_mask: str, defaults to `record_profile_mask` value.

Mask for motion event profile. Used to filter which profile will appear in the fake motion event when replayed.

filename: str, defaults to 'recorder.kvi'

Name of the file to record / play with

113.2 Usage

For normal module usage, please see the `modules` documentation.

CHAPTER

FOUR

SCREEN

This module changes some environement and configuration variables to match the density / dpi / screensize of a specific device.

To see a list of the available screenid's, just run:

```
python main.py -m screen
```

To simulate a medium-density screen such as the Motolora Droid 2:

```
python main.py -m screen:droid2
```

To simulate a high-density screen such as HTC One X, in portrait:

```
python main.py -m screen:onex,portrait
```

To simulate the iPad 2 screen:

```
python main.py -m screen:ipad
```

If the generated window is too large, you can specify a scale:

```
python main.py -m screen:note2,portrait,scale=.75
```

Note that to display your contents correctly on a scaled window you must consistently use units 'dp' and 'sp' throughout your app. See `metrics` for more details.

CHAPTER

FIVE

TOUCHRING

Shows rings around every touch on the surface / screen. You can use this module to check that you don't have any calibration issues with touches.

115.1 Configuration

Parameters

image: **str, defaults to '<kivy>/data/images/ring.png'** Filename of the image to use.

scale: **float, defaults to 1.** Scale of the image.

alpha: **float, defaults to 1.** Opacity of the image.

show_cursor: **boolean, default to False** New in version 1.8.0.

cursor_image: **str, defaults to 'atlas://data/images/defaulttheme/slider_cursor'** Image used to represent the cursor if displayed .. versionadded:: 1.8.0

cursor_size: **tuple, defaults to (None, None)** Apparent size of the mouse cursor, if displayed, default value will keep its real size. .. versionadded:: 1.8.0

cursor_offset: **tuple, defaults to (None, None)** Offset of the texture image, default value , will align the top-left corner of the image to the mouse pos. .. versionadded:: 1.8.0

115.2 Example

In your configuration (*~/.kivy/config.ini*), you can add something like this:

```
[modules]
touchring = image=mypointer.png,scale=.3,alpha=.7
```

CHAPTER

SIX

WEB DEBUGGER

New in version 1.2.0.

Warning: This module is highly experimental, use it with care.

This module will start a webserver and run in the background. You can see how your application evolves during runtime, examine the internal cache etc.

Run with:

```
python main.py -m webdebugger
```

Then open your webbrowser on http://localhost:5000/

CHAPTER

SEVEN

MULTISTROKE GESTURE RECOGNIZER

New in version 1.9.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

117.1 Conceptual Overview

This module implements the Protractor gesture recognition algorithm.

`Recognizer` is the search/database API similar to `GestureDatabase`. It maintains a list of `MultistrokeGesture` objects and allows you to search for a user-input gestures among them.

`ProgressTracker` tracks the progress of a `Recognizer.recognize()` call. It can be used to interact with the running recognizer task, for example forcing it to stop half-way, or analyzing results as they arrive.

`MultistrokeGesture` represents a gesture in the gesture database (`Recognizer.db`). It is a container for `UnistrokeTemplate` objects, and implements the heap permute algorithm to automatically generate all possible stroke orders (if desired).

`UnistrokeTemplate` represents a single stroke path. It's typically instantiated automatically by `MultistrokeGesture`, but sometimes you may need to create them manually.

`Candidate` represents a user-input gesture that is used to search the gesture database for matches. It is normally instantiated automatically by calling `Recognizer.recognize()`.

117.2 Usage examples

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

You can bind to events on `Recognizer` to track the state of all calls to `Recognizer.recognize()`. The callback function will receive an instance of `ProgressTracker` that can be used to analyze and control various aspects of the recognition process

```
from kivy.vector import Vector
from kivy.multistroke import Recognizer

gdb = Recognizer()
```

```
def search_start(gdb, pt):
    print("A search is starting with %d tasks" % (pt.tasks))

def search_stop(gdb, pt):
    # This will call max() on the result dictonary, so it's best to store
    # it instead of calling it 3 times consecutively
    best = pt.best
    print("Search ended (%s). Best is %s (score %f, distance %f)" % (
        pt.status, best['name'], best['score'], best['dist'] ))

# Bind your callbacks to track all matching operations
gdb.bind(on_search_start=search_start)
gdb.bind(on_search_complete=search_stop)

# The format below is referred to as ‘strokes‘, a list of stroke paths.
# Note that each path shown here consists of two points, ie a straight
# line; if you plot them it looks like a T, hence the name.
gdb.add_gesture('T', [
    [Vector(30, 7), Vector(103, 7)],
    [Vector(66, 7), Vector(66, 87)]])

# Now you can search for the 'T' gesture using similar data (user input).
# This will trigger both of the callbacks bound above.
gdb.recognize([
    [Vector(45, 8), Vector(110, 12)],
    [Vector(88, 9), Vector(85, 95)]])
```

On the next `Clock` tick, the matching process starts (and, in this case, completes).

To track individual calls to `Recognizer.recognize()`, use the return value (also a `ProgressTracker` instance)

```
# Same as above, but keep track of progress using returned value
progress = gdb.recognize([
    [Vector(45, 8), Vector(110, 12)],
    [Vector(88, 9), Vector(85, 95)]])

progress.bind(on_progress=my_other_callback)
print(progress.progress) # = 0

# [ assuming a kivy.clock.Clock.tick() here ]

print(result.progress) # = 1
```

117.3 Algorithm details

For more information about the matching algorithm, see:

"Protractor: A fast and accurate gesture recognizer" by Yang Li http://yangl.org/pdf/protractor-chi2010.pdf

"$N-Protractor" by Lisa Anthony and Jacob O. Wobbrock http://depts.washington.edu/aimgroup/proj/dollar/ndc protractor.pdf

Some of the code is derived from the JavaScript implementation here: http://depts.washington.edu/aimgroup/proj

class `kivy.multistroke.`**`Recognizer`**(***kwargs*)

Bases: `kivy.event.EventDispatcher`

Recognizer provides a gesture database with matching facilities.

Events

*on_search_start*Fired when a new search is started using this Recognizer.

*on_search_complete*Fired when a running search ends, for whatever reason. (use `ProgressTracker.status` to find out)

Properties

*db*A `ListProperty` that contains the available MultistrokeGesture objects.

`db` is a ListProperty and defaults to []

add_gesture(*name, strokes, **kwargs*)

Add a new gesture to the database. This will instantiate a new MultistrokeGesture with *strokes* and append it to self.db.

Note: If you already have instantiated a MultistrokeGesture object and wish to add it, append it to `Recognizer.db` manually.

export_gesture(*filename=None, **kwargs*)

Export a list of MultistrokeGesture objects. Outputs a base64-encoded string that can be decoded to a Python list with the parse_gesture() function or imported directly to `self.db` using Recognizer.import_gesture(). If *filename* is specified, the output is written to disk, otherwise returned.

This method accepts optional Recognizer.filter() arguments.

filter(***kwargs*)

filter() returns a subset of objects in `self.db`, according to given criteria. This is used by many other methods of the Recognizer; the arguments below can for example be used when calling Recognizer.recognize() or Recognizer.export_gesture(). You normally don't need to call this directly.

Arguments

*name*Limits the returned list to gestures where `MultistrokeGesture.name` matches given regular expression(s). If re.match(name, MultistrokeGesture.name) tests true, the gesture is included in the returned list. Can be a string or an array of strings

```
gdb = Recognizer()

# Will match all names that start with a captial N
# (ie Next, New, N, Nebraska etc, but not "n" or "next")
gdb.filter(name='N')

# exactly 'N'
gdb.filter(name='N$')

# Nebraska, teletubbies, France, fraggle, N, n, etc
gdb.filter(name=['[Nn]', '(?i)T', '(?i)F'])
```

*priority*Limits the returned list to gestures with certain `MultistrokeGesture.priority` values. If specified as an integer, only gestures with a lower priority are returned. If specified as a list (min/max)

```
# Max priority 50
gdb.filter(priority=50)

# Max priority 50 (same result as above)
```

```
gdb.filter(priority=[0, 50])

# Min priority 50, max 100
gdb.filter(priority=[50, 100])
```

When this option is used, `Recognizer.db` is automatically sorted according to priority, incurring extra cost. You can use *force_priority_sort* to override this behavior if your gestures are already sorted according to priority.

orientation_sensitiveLimits the returned list to gestures that are orientation sensitive (True), gestures that are not orientation sensitive (False) or None (ignore template sensitivity, this is the default).

numstrokesLimits the returned list to gestures that have the specified number of strokes (in `MultistrokeGesture.strokes`). Can be a single integer or a list of integers.

numpointsLimits the returned list to gestures that have specific `MultistrokeGesture.numpoints` values. This is provided for flexibility, do not use it unless you understand what it does. Can be a single integer or a list of integers.

force_priority_sortCan be used to override the default sort behavior. Normally `MultistrokeGesture` objects are returned in priority order if the *priority* option is used. Setting this to True will return gestures sorted in priority order, False will return in the order gestures were added. None means decide automatically (the default).

Note: For improved performance, you can load your gesture database in priority order and set this to False when calling `Recognizer.recognize()`

dbCan be set if you want to filter a different list of objects than `Recognizer.db`. You probably don't want to do this; it is used internally by `import_gesture()`.

`import_gesture`(*data=None, filename=None, **kwargs*)
Import a list of gestures as formatted by `export_gesture()`. One of *data* or *filename* must be specified.

This method accepts optional `Recognizer.filter()` arguments, if none are specified then all gestures in specified data are imported.

`parse_gesture`(*data*)
Parse data formatted by export_gesture(). Returns a list of `MultistrokeGesture` objects. This is used internally by `import_gesture()`, you normally don't need to call this directly.

`prepare_templates`(***kwargs*)
This method is used to prepare `UnistrokeTemplate` objects within the gestures in self.db. This is useful if you want to minimize punishment of lazy resampling by preparing all vectors in advance. If you do this before a call to `Recognizer.export_gesture()`, you will have the vectors computed when you load the data later.

This method accepts optional `Recognizer.filter()` arguments.

force_numpoints, if specified, will prepare all templates to the given number of points (instead of each template's preferred n; ie `UnistrokeTemplate.numpoints`). You normally don't want to do this.

`recognize`(*strokes, goodscore=None, timeout=0, delay=0, **kwargs*)
Search for gestures matching *strokes*. Returns a `ProgressTracker` instance.

This method accepts optional `Recognizer.filter()` arguments.

Arguments

strokesA list of stroke paths (list of lists of `Vector` objects) that will be matched against gestures in the database. Can also be a `Candidate` instance.

> **Warning:** If you manually supply a `Candidate` that has a skip-flag, make sure that the correct filter arguments are set. Otherwise the system will attempt to load vectors that have not been computed. For example, if you set *skip_bounded* and do not set *orientation_sensitive* to False, it will raise an exception if an orientation_sensitive `UnistrokeTemplate` is encountered.

goodscoreIf this is set (between 0.0 - 1.0) and a gesture score is equal to or higher than the specified value, the search is immediately halted and the on_search_complete event is fired (+ the on_complete event of the associated `ProgressTracker` instance). Default is None (disabled).

timeoutSpecifies a timeout (in seconds) for when the search is aborted and the results returned. This option applies only when *max_gpf* is not 0. Default value is 0, meaning all gestures in the database will be tested, no matter how long it takes.

max_gpfSpecifies the maximum number of `MultistrokeGesture` objects that can be processed per frame. When exceeded, will cause the search to halt and resume work in the next frame. Setting to 0 will complete the search immediately (and block the UI).

> **Warning:** This does not limit the number of `UnistrokeTemplate` objects matched! If a single gesture has a million templates, they will all be processed in a single frame with max_gpf=1!

delaySets an optional delay between each run of the recognizer loop. Normally, a run is scheduled for the next frame until the tasklist is exhausted. If you set this, there will be an additional delay between each run (specified in seconds). Default is 0, resume in the next frame.

force_numpointsforces all templates (and candidate) to be prepared to a certain number of points. This can be useful for example if you are evaluating templates for optimal n (do not use this unless you understand what it does).

`transfer_gesture`(*tgt*, ***kwargs*)

Transfers `MultistrokeGesture` objects from `Recognizer.db` to another `Recognizer` instance *tgt*.

This method accepts optional `Recognizer.filter()` arguments.

class `kivy.multistroke.`**`ProgressTracker`**(*candidate*, *tasks*, ***kwargs*)

Bases: `kivy.event.EventDispatcher`

Represents an ongoing (or completed) search operation. Instantiated and returned by the `Recognizer.recognize()` method when it is called. The *results* attribute is a dictionary that is updated as the recognition operation progresses.

> **Note:** You do not need to instantiate this class.

Arguments

candidate`Candidate` object to be evaluated

tasksTotal number of gestures in tasklist (to test against)

Events

on_progressFired for every gesture that is processed

on_resultFired when a new result is added, and it is the first match for the *name* so far, or a consecutive match with better score.

on_completeFired when the search is completed, for whatever reason. (use *ProgressTracker.status* to find out)

Attributes

resultsA dictionary of all results (so far). The key is the name of the gesture (ie `UnistrokeTemplate.name` usually inherited from `MultistrokeGesture`). Each item in the dictionary is a dict with the following entries:

- ***name***Name of the matched template (redundant)
- ***score***Computed score from 1.0 (perfect match) to 0.0
- ***dist***Cosine distance from candidate to template (low=closer)
- ***gesture***The `MultistrokeGesture` object that was matched
- ***best_template***Index of the best matching template (in `MultistrokeGesture.templates`)
- ***template_results***List of distances for all templates. The list index corresponds to a `UnistrokeTemplate` index in gesture.templates.

status

- ***search***Currently working
- ***stop***Was stopped by the user (`stop()` called)
- ***timeout***A timeout occured (specified as *timeout*= to recognize())
- ***goodscore***The search was stopped early because a gesture with a high enough score was found (specified as *goodscore*= to recognize())
- ***complete***The search is complete (all gestures matching filters were tested)

`best`

Return the best match found by recognize() so far. It returns a dictionary with three keys, 'name', 'dist' and 'score' representing the template's name, distance (from candidate path) and the computed score value. This is a Python property.

`progress`

Returns the progress as a float, 0 is 0% done, 1 is 100%. This is a Python property.

`stop``()`

Raises a stop flag that is checked by the search process. It will be stopped on the next clock tick (if it is still running).

class `kivy.multistroke.`**`MultistrokeGesture`**`(`*name*, *strokes=None*, ***kwargs*`)`

Bases: `object`

`MultistrokeGesture` represents a gesture. It maintains a set of *strokes* and generates unistroke (ie `UnistrokeTemplate`) permutations that are used for evaluating candidates against this gesture later.

Arguments

nameIdentifies the name of the gesture - it is returned to you in the results of a `Recognizer.recognize()` search. You can have any number of MultistrokeGesture objects with the same name; many definitions of one gesture. The same name is given to all the generated unistroke permutations. Required, no default.

strokesA list of paths that represents the gesture. A path is a list of Vector objects:

```
gesture = MultistrokeGesture('my_gesture', strokes=[
  [Vector(x1, y1), Vector(x2, y2), ...... ], # stroke 1
  [Vector(), Vector(), Vector(), Vector() ]  # stroke 2
  #, [stroke 3], [stroke 4], ...
])
```

For template matching purposes, all the strokes are combined to a single list (unistroke). You should still specify the strokes individually, and set *stroke_sensitive* True (whenever possible).

Once you do this, unistroke permutations are immediately generated and stored in *self.templates* for later, unless you set the *permute* flag to False.

priorityDetermines when `Recognizer.recognize()` will attempt to match this template, lower priorities are evaluated first (only if a priority *filter* is used). You should use lower priority on gestures that are more likely to match. For example, set user templates at lower number than generic templates. Default is 100.

numpointsDetermines the number of points this gesture should be resampled to (for matching purposes). The default is 16.

stroke_sensitiveDetermines if the number of strokes (paths) in this gesture is required to be the same in the candidate (user input) gesture during matching. If this is False, candidates will always be evaluated, disregarding the number of strokes. Default is True.

orientation_sensitiveDetermines if this gesture is orientation sensitive. If True, aligns the indicative orientation with the one of eight base orientations that requires least rotation. Default is True.

angle_similarityThis is used by the `Recognizer.recognize()` function when a candidate is evaluated against this gesture. If the angles between them are too far off, the template is considered a non-match. Default is 30.0 (degrees)

permuteIf False, do not use Heap Permute algorithm to generate different stroke orders when instantiated. If you set this to False, a single UnistrokeTemplate built from *strokes* is used.

add_stroke(*stroke*, *permute=False*)

Add a stroke to the self.strokes list. If *permute* is True, the `permute()` method is called to generate new unistroke templates

get_distance(*cand*, *tpl*, *numpoints=None*)

Compute the distance from this Candiate to a UnistrokeTemplate. Returns the Cosine distance between the stroke paths.

numpoints will prepare both the UnistrokeTemplate and Candidate path to n points (when neccessary), you probably don't want to do this.

match_candidate(*cand*, ***kwargs*)

Match a given candidate against this MultistrokeGesture object. Will test against all templates and report results as a list of four items:

index 0Best matching template's index (in self.templates)

index 1Computed distance from the template to the candidate path

index 2List of distances for all templates. The list index corresponds to a `UnistrokeTemplate` index in self.templates.

index 3Counter for the number of performed matching operations, ie templates matched against the candidate

permute()

Generate all possible unistroke permutations from self.strokes and save the resulting list of UnistrokeTemplate objects in self.templates.

Quote from http://faculty.washington.edu/wobbrock/pubs/gi-10.2.pdf

```
We use Heap Permute [16] (p. 179) to generate all stroke orders
in a multistroke gesture. Then, to generate stroke directions for
each order, we treat each component stroke as a dichotomous
[0,1] variable. There are 2^N combinations for N strokes, so we
convert the decimal values 0 to 2^N-1, inclusive, to binary
```

```
    representations and regard each bit as indicating forward (0) or
    reverse (1). This algorithm is often used to generate truth tables
    in propositional logic.
```

See section 4.1: "$N Algorithm" of the linked paper for details.

Warning: Using heap permute for gestures with more than 3 strokes can result in very large number of templates (a 9-stroke gesture = 38 million templates). If you are dealing with these types of gestures, you should manually compose all the desired stroke orders.

class `kivy.multistroke.`**`UnistrokeTemplate`**(*name*, *points=None*, ***kwargs*)
Bases: `object`

Represents a (uni)stroke path as a list of Vectors. Normally, this class is instantiated by MultistrokeGesture and not by the programmer directly. However, it is possible to manually compose UnistrokeTemplate objects.

Arguments

nameIdentifies the name of the gesture. This is normally inherited from the parent MultistrokeGesture object when a template is generated.

pointsA list of points that represents a unistroke path. This is normally one of the possible stroke order permutations from a MultistrokeGesture.

numpointsThe number of points this template should (ideally) be resampled to before the matching process. The default is 16, but you can use a template-specific settings if that improves results.

orientation_sensitiveDetermines if this template is orientation sensitive (True) or fully rotation invariant (False). The default is True.

Note: You will get an exception if you set a skip-flag and then attempt to retrieve those vectorsa.

`add_point`(*p*)
Add a point to the unistroke/path. This invalidates all previously computed vectors.

`prepare`(*numpoints=None*)
This function prepares the UnistrokeTemplate for matching given a target number of points (for resample). 16 is optimal.

class `kivy.multistroke.`**`Candidate`**(*strokes=None*, *numpoints=16*, ***kwargs*)
Bases: `object`

Represents a set of unistroke paths of user input, ie data to be matched against a `UnistrokeTemplate` object using the Protractor algorithm. By default, data is precomputed to match both rotation bounded and fully invariant `UnistrokeTemplate` objects.

Arguments

strokesSee `MultistrokeGesture.strokes` for format example. The Candidate strokes are simply combined to a unistroke in the order given. The idea is that this will match one of the unistroke permutations in *MultistrokeGesture.templates*.

numpointsThe Candidate's default N; this is only for a fallback, it is not normally used since n is driven by the UnistrokeTemplate we are being compared to.

skip_boundedIf True, do not generate/store rotation bounded vectors

skip_invariantIf True, do not generate/store rotation invariant vectors

Note that you WILL get errors if you set a skip-flag and then attempt to retrieve the data.

`add_stroke`(*stroke*)
Add a stroke to the candidate; this will invalidate all previously computed vectors

`get_angle_similarity`(*tpl*, ***kwargs*)
(Internal use only) Compute the angle similarity between this Candidate and a

UnistrokeTemplate object. Returns a number that represents the angle similarity (lower is more similar).

get_protractor_vector(*numpoints*, *orientation_sens*)
(Internal use only) Return vector for comparing to a UnistrokeTemplate with Protractor

get_start_unit_vector(*numpoints*, *orientation_sens*)
(Internal use only) Get the start vector for this Candidate, with the path resampled to *numpoints* points. This is the first step in the matching process. It is compared to a UnistrokeTemplate object's start vector to determine angle similarity.

prepare(*numpoints=None*)
Prepare the Candidate vectors. self.strokes is combined to a single unistroke (connected end-to-end), resampled to `numpoints` points, and then the vectors are calculated and stored in self.db (for use by *get_distance* and *get_angle_similarity*)

CHAPTER

EIGHT

NETWORK SUPPORT

Kivy currently supports basic, asynchronous network requests. Please refer to `kivy.network.urlrequest.UrlRequest`.

118.1 Url Request

New in version 1.0.8.

You can use the `UrlRequest` to make asynchronous requests on the web and get the result when the request is completed. The spirit is the same as the XHR object in Javascript.

The content is also decoded if the Content-Type is application/json and the result automatically passed through json.loads.

The syntax to create a request:

```
from kivy.network.urlrequest import UrlRequest
req = UrlRequest(url, on_success, on_redirect, on_failure, on_error,
                 on_progress, req_body, req_headers, chunk_size,
                 timeout, method, decode, debug, file_path)
```

Only the first argument is mandatory: the rest are optional. By default, a "GET" request will be sent. If the `UrlRequest.req_body` is not None, a "POST" request will be sent. It's up to you to adjust `UrlRequest.req_headers` to suit your requirements and the response to the request will be accessible as the parameter called "result" on the callback function of the on_success event.

Example of fetching weather in Paris:

```
def got_weather(req, results):
    for key, value in results['weather'][0].items():
        print(key, ': ', value)

req = UrlRequest(
    'http://api.openweathermap.org/data/2.5/weather?q=Paris,fr',
    got_weather)
```

Example of Posting data (adapted from httplib example):

```
import urllib

def bug_posted(req, result):
    print('Our bug is posted !')
    print(result)
```

```
params = urllib.urlencode({'@number': 12524, '@type': 'issue',
    '@action': 'show'})
headers = {'Content-type': 'application/x-www-form-urlencoded',
          'Accept': 'text/plain'}
req = UrlRequest('bugs.python.org', on_success=bug_posted, req_body=params,
        req_headers=headers)
```

If you want a synchronous request, you can call the wait() method.

class `kivy.network.urlrequest.`**`UrlRequest`**(*url*, *on_success=None*, *on_redirect=None*, *on_failure=None*, *on_error=None*, *on_progress=None*, *req_body=None*, *req_headers=None*, *chunk_size=8192*, *timeout=None*, *method=None*, *decode=True*, *debug=False*, *file_path=None*)

Bases: `threading.Thread`

A UrlRequest. See module documentation for usage.

Changed in version 1.5.1: Add *debug* parameter

Changed in version 1.0.10: Add *method* parameter

Parameters

- ***url***: **str**Complete url string to call.
- ***on_success***: **callback(request, result)**Callback function to call when the result has been fetched.
- ***on_redirect***: **callback(request, result)**Callback function to call if the server returns a Redirect.
- ***on_failure***: **callback(request, result)**Callback function to call if the server returns a Client or Server Error.
- ***on_error***: **callback(request, error)**Callback function to call if an error occurs.
- ***on_progress***: **callback(request, current_size, total_size)**Callback function that will be called to report progression of the download. *total_size* might be -1 if no Content-Length has been reported in the http response. This callback will be called after each *chunk_size* is read.
- ***req_body***: **str, defaults to None**Data to sent in the request. If it's not None, a POST will be done instead of a GET.
- ***req_headers***: **dict, defaults to None**Custom headers to add to the request.
- ***chunk_size***: **int, defaults to 8192**Size of each chunk to read, used only when *on_progress* callback has been set. If you decrease it too much, a lot of on_progress callbacks will be fired and will slow down your download. If you want to have the maximum download speed, increase the chunk_size or don't use `on_progress`.
- ***timeout***: **int, defaults to None**If set, blocking operations will timeout after this many seconds.
- ***method***: **str, defaults to 'GET' (or 'POST' if `body` is specified)**The HTTP method to use.
- ***decode***: **bool, defaults to True**If False, skip decoding of the response.
- ***debug***: **bool, defaults to False**If True, it will use the Logger.debug to print information about url access/progression/errors.
- ***file_path***: **str, defaults to None**If set, the result of the UrlRequest will be written to this path instead of in memory.

Changed in version 1.8.0: Parameter *decode* added. Parameter *file_path* added. Parameter *on_redirect* added. Parameter *on_failure* added.

`chunk_size`

Return the size of a chunk, used only in "progress" mode (when on_progress callback is set.)

`decode_result`(*result*, *resp*)

Decode the result fetched from url according to his Content-Type. Currently supports only application/json.

`error`
Return the error of the request. This value is not determined until the request is completed.

`get_connection_for_scheme`(*scheme*)
Return the Connection class for a particular scheme. This is an internal function that can be expanded to support custom schemes.

Actual supported schemes: http, https.

`is_finished`
Return True if the request has finished, whether it's a success or a failure.

`req_body` = **None**
Request body passed in __init__

`req_headers` = **None**
Request headers passed in __init__

`resp_headers`
If the request has been completed, return a dictionary containing the headers of the response. Otherwise, it will return None.

`resp_status`
Return the status code of the response if the request is complete, otherwise return None.

`result`
Return the result of the request. This value is not determined until the request is finished.

`url` = **None**
Url of the request

`wait`(*delay=0.5*)
Wait for the request to finish (until `resp_status` is not None)

Note: This method is intended to be used in the main thread, and the callback will be dispatched from the same thread from which you're calling.

New in version 1.1.0.

CHAPTER

NINE

URL REQUEST

New in version 1.0.8.

You can use the UrlRequest to make asynchronous requests on the web and get the result when the request is completed. The spirit is the same as the XHR object in Javascript.

The content is also decoded if the Content-Type is application/json and the result automatically passed through json.loads.

The syntax to create a request:

```
from kivy.network.urlrequest import UrlRequest
req = UrlRequest(url, on_success, on_redirect, on_failure, on_error,
                 on_progress, req_body, req_headers, chunk_size,
                 timeout, method, decode, debug, file_path)
```

Only the first argument is mandatory: the rest are optional. By default, a "GET" request will be sent. If the UrlRequest.req_body is not None, a "POST" request will be sent. It's up to you to adjust UrlRequest.req_headers to suit your requirements and the response to the request will be accessible as the parameter called "result" on the callback function of the on_success event.

Example of fetching weather in Paris:

```
def got_weather(req, results):
    for key, value in results['weather'][0].items():
        print(key, ': ', value)

req = UrlRequest(
    'http://api.openweathermap.org/data/2.5/weather?q=Paris,fr',
    got_weather)
```

Example of Posting data (adapted from httplib example):

```
import urllib

def bug_posted(req, result):
    print('Our bug is posted !')
    print(result)

params = urllib.urlencode({'@number': 12524, '@type': 'issue',
    '@action': 'show'})
headers = {'Content-type': 'application/x-www-form-urlencoded',
          'Accept': 'text/plain'}
req = UrlRequest('bugs.python.org', on_success=bug_posted, req_body=params,
        req_headers=headers)
```

If you want a synchronous request, you can call the wait() method.

class `kivy.network.urlrequest.`**`UrlRequest`**(*url, on_success=None, on_redirect=None, on_failure=None, on_error=None, on_progress=None, req_body=None, req_headers=None, chunk_size=8192, timeout=None, method=None, decode=True, debug=False, file_path=None*)

Bases: `threading.Thread`

A UrlRequest. See module documentation for usage.

Changed in version 1.5.1: Add *debug* parameter

Changed in version 1.0.10: Add *method* parameter

Parameters

- ***url*: str**Complete url string to call.
- ***on_success*: callback(request, result)**Callback function to call when the result has been fetched.
- ***on_redirect*: callback(request, result)**Callback function to call if the server returns a Redirect.
- ***on_failure*: callback(request, result)**Callback function to call if the server returns a Client or Server Error.
- ***on_error*: callback(request, error)**Callback function to call if an error occurs.
- ***on_progress*: callback(request, current_size, total_size)**Callback function that will be called to report progression of the download. *total_size* might be -1 if no Content-Length has been reported in the http response. This callback will be called after each *chunk_size* is read.
- ***req_body*: str, defaults to None**Data to sent in the request. If it's not None, a POST will be done instead of a GET.
- ***req_headers*: dict, defaults to None**Custom headers to add to the request.
- ***chunk_size*: int, defaults to 8192**Size of each chunk to read, used only when *on_progress* callback has been set. If you decrease it too much, a lot of on_progress callbacks will be fired and will slow down your download. If you want to have the maximum download speed, increase the chunk_size or don't use `on_progress`.
- ***timeout*: int, defaults to None**If set, blocking operations will timeout after this many seconds.
- ***method*: str, defaults to 'GET' (or 'POST' if `body` is specified)**The HTTP method to use.
- ***decode*: bool, defaults to True**If False, skip decoding of the response.
- ***debug*: bool, defaults to False**If True, it will use the Logger.debug to print information about url access/progression/errors.
- ***file_path*: str, defaults to None**If set, the result of the UrlRequest will be written to this path instead of in memory.

Changed in version 1.8.0: Parameter *decode* added. Parameter *file_path* added. Parameter *on_redirect* added. Parameter *on_failure* added.

`chunk_size`

Return the size of a chunk, used only in "progress" mode (when on_progress callback is set.)

`decode_result`(*result, resp*)

Decode the result fetched from url according to his Content-Type. Currently supports only application/json.

`error`

Return the error of the request. This value is not determined until the request is completed.

`get_connection_for_scheme`(*scheme*)

Return the Connection class for a particular scheme. This is an internal function that can be expanded to support custom schemes.

Actual supported schemes: http, https.

is_finished
Return True if the request has finished, whether it's a success or a failure.

req_body = **None**
Request body passed in __init__

req_headers = **None**
Request headers passed in __init__

resp_headers
If the request has been completed, return a dictionary containing the headers of the response. Otherwise, it will return None.

resp_status
Return the status code of the response if the request is complete, otherwise return None.

result
Return the result of the request. This value is not determined until the request is finished.

url = **None**
Url of the request

wait(*delay=0.5*)
Wait for the request to finish (until `resp_status` is not None)

Note: This method is intended to be used in the main thread, and the callback will be dispatched from the same thread from which you're calling.

New in version 1.1.0.

CHAPTER

PARSER UTILITIES

Helper functions used for CSS parsing.

`kivy.parser.`**`parse_color`**`(`*text*`)`

Parse a string to a kivy color. Supported formats:

- rgb(r, g, b)
- rgba(r, g, b, a)
- aaa
- rrggbb

For hexadecimal values, you case also use:

- #aaa
- #rrggbb

`kivy.parser.`**`parse_int`**

alias of `int`

`kivy.parser.`**`parse_float`**

alias of `float`

`kivy.parser.`**`parse_string`**`(`*text*`)`

Parse a string to a string (removing single and double quotes)

`kivy.parser.`**`parse_bool`**`(`*text*`)`

Parse a string to a boolean, ignoring case. “true”/”1” is True, “false”/”0” is False. Anything else throws an exception.

`kivy.parser.`**`parse_int2`**`(`*text*`)`

Parse a string to a list of exactly 2 integers.

```
>>> print(parse_int2("12 54"))
12, 54
```

`kivy.parser.`**`parse_float4`**`(`*text*`)`

Parse a string to a list of exactly 4 floats.

```
>>> parse_float4('54 87. 35 0')
54, 87., 35, 0
```

`kivy.parser.`**`parse_filename`**`(`*filename*`)`

Parse a filename and search for it using *resource_find()*. If found, the resource path is returned, otherwise return the unmodified filename (as specified by the caller).

CHAPTER

ONE

PROPERTIES

The *Properties* classes are used when you create an `EventDispatcher`.

Warning: Kivy's Properties are **not to be confused** with Python's properties (i.e. the `@property` decorator and the <property> type).

Kivy's property classes support:

Value Checking / Validation When you assign a new value to a property, the value is checked against validation constraints. For example, validation for an `OptionProperty` will make sure that the value is in a predefined list of possibilities. Validation for a `NumericProperty` will check that your value is a numeric type. This prevents many errors early on.

Observer Pattern You can specify what should happen when a property's value changes. You can bind your own function as a callback to changes of a `Property`. If, for example, you want a piece of code to be called when a widget's `pos` property changes, you can `bind` a function to it.

Better Memory Management The same instance of a property is shared across multiple widget instances.

121.1 Comparison Python vs. Kivy

121.1.1 Basic example

Let's compare Python and Kivy properties by creating a Python class with 'a' as a float property:

```
class MyClass(object):
    def __init__(self, a=1.0):
        super(MyClass, self).__init__()
        self.a = a
```

With Kivy, you can do:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1.0)
```

121.1.2 Value checking

If you wanted to add a check for a minimum / maximum value allowed for a property, here is a possible implementation in Python:

```
class MyClass(object):
    def __init__(self, a=1):
        super(MyClass, self).__init__()
        self.a_min = 0
        self.a_max = 100
        self.a = a

    def _get_a(self):
        return self._a
    def _set_a(self, value):
        if value < self.a_min or value > self.a_max:
            raise ValueError('a out of bounds')
        self._a = value
    a = property(_get_a, _set_a)
```

The disadvantage is you have to do that work yourself. And it becomes laborious and complex if you have many properties. With Kivy, you can simplify the process:

```
class MyClass(EventDispatcher):
    a = BoundedNumericProperty(1, min=0, max=100)
```

That's all!

121.1.3 Error Handling

If setting a value would otherwise raise a ValueError, you have two options to handle the error gracefully within the property. An errorvalue is a substitute for the invalid value. An errorhandler is a callable (single argument function or lambda) which can return a valid substitute.

errorvalue parameter:

```
# simply returns 0 if the value exceeds the bounds
bnp = BoundedNumericProperty(0, min=-500, max=500, errorvalue=0)
```

errorhandler parameter:

```
# returns the boundary value when exceeded
bnp = BoundedNumericProperty(0, min=-500, max=500,
    errorhandler=lambda x: 500 if x > 500 else -500)
```

121.1.4 Conclusion

Kivy properties are easier to use than the standard ones. See the next chapter for examples of how to use them :)

121.2 Observe Properties changes

As we said in the beginning, Kivy's Properties implement the Observer pattern. That means you can `bind()` to a property and have your own function called when the value changes.

There are multiple ways to observe the changes.

121.2.1 Observe using bind()

You can observe a property change by using the bind() method outside of the class:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1)

def callback(instance, value):
    print('My callback is call from', instance)
    print('and the a value changed to', value)

ins = MyClass()
ins.bind(a=callback)

# At this point, any change to the a property will call your callback.
ins.a = 5    # callback called
ins.a = 5    # callback not called, because the value did not change
ins.a = -1   # callback called
```

Note: Property objects live at the class level and manage the values attached to instances. Re-assigning at class level will remove the Property. For example, continuing with the code above, *MyClass.a = 5* replaces the property object with a simple int.

121.2.2 Observe using 'on_<propname>'

If you created the class yourself, you can use the 'on_<propname>' callback:

```
class MyClass(EventDispatcher):
    a = NumericProperty(1)

    def on_a(self, instance, value):
        print('My property a changed to', value)
```

Warning: Be careful with 'on_<propname>'. If you are creating such a callback on a property you are inheriting, you must not forget to call the superclass function too.

121.3 Binding to properties of properties.

When binding to a property of a property, for example binding to a numeric property of an object saved in a object property, updating the object property to point to a new object will not re-bind the numeric property to the new object. For example:

```
<MyWidget>:
    Label:
        id: first
        text: 'First label'
    Label:
        id: second
        text: 'Second label'
    Button:
        label: first
        text: self.label.text
        on_press: self.label = second
```

When clicking on the button, although the label object property has changed to the second widget, the button text will not change because it is bound to the text property of the first label directly.

In *1.9.0*, the `rebind` option has been introduced that will allow the automatic updating of the `text` when `label` is changed, provided it was enabled. See `ObjectProperty`.

class `kivy.properties.`**`Property`**

Bases: `object`

Base class for building more complex properties.

This class handles all the basic setters and getters, None type handling, the observer list and storage initialisation. This class should not be directly instantiated.

By default, a `Property` always takes a default value:

```
class MyObject(Widget):

    hello = Property('Hello world')
```

The default value must be a value that agrees with the Property type. For example, you can't set a list to a `StringProperty` because the StringProperty will check the default value.

None is a special case: you can set the default value of a Property to None, but you can't set None to a property afterward. If you really want to do that, you must declare the Property with *allownone=True*:

```
class MyObject(Widget):

    hello = ObjectProperty(None, allownone=True)

# then later
a = MyObject()
a.hello = 'bleh' # working
a.hello = None # working too, because allownone is True.
```

Parameters

default:Specifies the default value for the property.

*****kwargs***:If the parameters include *errorhandler*, this should be a callable which must take a single argument and return a valid substitute value.

If the parameters include *errorvalue*, this should be an object. If set, it will replace an invalid property value (overrides errorhandler).

Changed in version 1.4.2: Parameters errorhandler and errorvalue added

`bind``()`

Add a new observer to be called only when the value is changed.

`dispatch``()`

Dispatch the value change to all observers.

Changed in version 1.1.0: The method is now accessible from Python.

This can be used to force the dispatch of the property, even if the value didn't change:

```
button = Button()
# get the Property class instance
prop = button.property('text')
# dispatch this property on the button instance
prop.dispatch(button)
```

fast_bind()

Similar to bind, except it doesn't check if the observer already exists. It also expands and forwards largs and kwargs to the callback. fast_unbind should be called when unbinding.

fast_unbind()

Remove the observer from our widget observer list bound with fast_bind. It removes the first match it finds, as opposed to unbind which searches for all matches.

get()

Return the value of the property.

link()

Link the instance with its real name.

> **Warning:** Internal usage only.

When a widget is defined and uses a `Property` class, the creation of the property object happens, but the instance doesn't know anything about its name in the widget class:

```
class MyWidget(Widget):
    uid = NumericProperty(0)
```

In this example, the uid will be a NumericProperty() instance, but the property instance doesn't know its name. That's why `link()` is used in *Widget.__new__*. The link function is also used to create the storage space of the property for this specific widget instance.

set()

Set a new value for the property.

unbind()

Remove the observer from our widget observer list.

class `kivy.properties.`**`NumericProperty`**

Bases: `kivy.properties.Property`

Property that represents a numeric value.

Parameters

default: **int or float, defaults to 0**Specifies the default value of the property.

```
>>> wid = Widget()
>>> wid.x = 42
>>> print(wid.x)
42
>>> wid.x = "plop"
 Traceback (most recent call last):
   File "<stdin>", line 1, in <module>
   File "properties.pyx", line 93, in kivy.properties.Property.__set__
   File "properties.pyx", line 111, in kivy.properties.Property.set
   File "properties.pyx", line 159, in kivy.properties.NumericProperty.check
 ValueError: NumericProperty accept only int/float
```

Changed in version 1.4.1: NumericProperty can now accept custom text and tuple value to indicate a type, like "in", "pt", "px", "cm", "mm", in the format: '10pt' or (10, 'pt').

get_format()

Return the format used for Numeric calculation. Default is px (mean the value have not been changed at all). Otherwise, it can be one of 'in', 'pt', 'cm', 'mm'.

class `kivy.properties.`**`StringProperty`**

Bases: `kivy.properties.Property`

Property that represents a string value.

Parameters

default: **string, defaults to ''**Specifies the default value of the property.

class `kivy.properties.`**`ListProperty`**

Bases: `kivy.properties.Property`

Property that represents a list.

Parameters

default: **list, defaults to []**Specifies the default value of the property.

Warning: When assigning a list to a `ListProperty`, the list stored in the property is a copy of the list and not the original list. This can be demonstrated with the following example:

```
>>> class MyWidget(Widget):
>>>     my_list = ListProperty([])

>>> widget = MyWidget()
>>> my_list = widget.my_list = [1, 5, 7]
>>> print my_list is widget.my_list
False
>>> my_list.append(10)
>>> print(my_list, widget.my_list)
[1, 5, 7, 10], [1, 5, 7]
```

class `kivy.properties.`**`ObjectProperty`**

Bases: `kivy.properties.Property`

Property that represents a Python object.

Parameters

default: **object type**Specifies the default value of the property.

rebind: **bool, defaults to False**Whether kv rules using this object as an intermediate attribute in a kv rule, will update the bound property when this object changes.

That is the standard behavior is that if there's a kv rule `text: self.a.b.c.d`, where `a`, `b`, and `c` are properties with `rebind False` and `d` is a `StringProperty`. Then when the rule is applied, `text` becomes bound only to `d`. If `a`, `b`, or `c` change, `text` still remains bound to `d`. Furthermore, if any of them were `None` when the rule was initially evaluated, e.g. `b` was `None`; then `text` is bound to `b` and will not become bound to `d` even when `b` is changed to not be `None`.

By setting `rebind` to `True`, however, the rule will be re-evaluated and all the properties rebound when that intermediate property changes. E.g. in the example above, whenever `b` changes or becomes not `None` if it was `None` before, `text` is evaluated again and becomes rebound to `d`. The overall result is that `text` is now bound to all the properties among `a`, `b`, or `c` that have `rebind` set to `True`.

***kwargs*: **a list of keyword arguments**

baseclassIf kwargs includes a *baseclass* argument, this value will be used for validation: *isinstance(value, kwargs['baseclass'])*.

Warning: To mark the property as changed, you must reassign a new python object.

Changed in version 1.9.0: *rebind* has been introduced.

Changed in version 1.7.0: *baseclass* parameter added.

class `kivy.properties.`**`BooleanProperty`**

Bases: `kivy.properties.Property`

Property that represents only a boolean value.

Parameters

default: **boolean**Specifies the default value of the property.

class `kivy.properties.`**`BoundedNumericProperty`**

Bases: `kivy.properties.Property`

Property that represents a numeric value within a minimum bound and/or maximum bound – within a numeric range.

Parameters

default: **numeric**Specifies the default value of the property.

****kwargs*: **a list of keyword arguments**If a *min* parameter is included, this specifies the minimum numeric value that will be accepted. If a *max* parameter is included, this specifies the maximum numeric value that will be accepted.

`bounds`

Return min/max of the value.

New in version 1.0.9.

`get_max``()`

Return the maximum value acceptable for the BoundedNumericProperty in *obj*. Return None if no maximum value is set. Check `get_min` for a usage example.

New in version 1.1.0.

`get_min``()`

Return the minimum value acceptable for the BoundedNumericProperty in *obj*. Return None if no minimum value is set:

```
class MyWidget(Widget):
    number = BoundedNumericProperty(0, min=-5, max=5)

widget = MyWidget()
print(widget.property('number').get_min(widget))
# will output -5
```

New in version 1.1.0.

`set_max``()`

Change the maximum value acceptable for the BoundedNumericProperty, only for the *obj* instance. Set to None if you want to disable it. Check `set_min` for a usage example.

Warning: Changing the bounds doesn't revalidate the current value.

New in version 1.1.0.

`set_min``()`

Change the minimum value acceptable for the BoundedNumericProperty, only for the *obj* instance. Set to None if you want to disable it:

```
class MyWidget(Widget):
    number = BoundedNumericProperty(0, min=-5, max=5)

widget = MyWidget()
# change the minmium to -10
widget.property('number').set_min(widget, -10)
# or disable the minimum check
widget.property('number').set_min(widget, None)
```

Warning: Changing the bounds doesn't revalidate the current value.

New in version 1.1.0.

class `kivy.properties.`**`OptionProperty`**

Bases: `kivy.properties.Property`

Property that represents a string from a predefined list of valid options.

If the string set in the property is not in the list of valid options (passed at property creation time), a ValueError exception will be raised.

Parameters

***default*: any valid type in the list of options**Specifies the default value of the property.

*******kwargs***: a list of keyword arguments**Should include an *options* parameter specifying a list (not tuple) of valid options.

For example:

```
class MyWidget(Widget):
    state = OptionProperty("None", options=["On", "Off", "None"])
```

`options`

Return the options available.

New in version 1.0.9.

class `kivy.properties.`**`ReferenceListProperty`**

Bases: `kivy.properties.Property`

Property that allows the creation of a tuple of other properties.

For example, if *x* and *y* are `NumericProperty`s, we can create a `ReferenceListProperty` for the *pos*. If you change the value of *pos*, it will automatically change the values of *x* and *y* accordingly. If you read the value of *pos*, it will return a tuple with the values of *x* and *y*.

For example:

```
class MyWidget(EventDispatcher):
    x = NumericProperty(0)
    y = NumericProperty(0)
    pos = ReferenceListProperty(x, y)
```

class `kivy.properties.`**`AliasProperty`**

Bases: `kivy.properties.Property`

Create a property with a custom getter and setter.

If you don't find a Property class that fits to your needs, you can make your own by creating custom Python getter and setter methods.

Example from kivy/uix/widget.py:

```
def get_right(self):
    return self.x + self.width
def set_right(self, value):
    self.x = value - self.width
right = AliasProperty(get_right, set_right, bind=('x', 'width'))
```

Parameters

***getter*: function**Function to use as a property getter *setter*: **function**Function to use as a property setter. Properties listening to the alias property won't be updated when the property is set (e.g. *right = 10*), unless the *setter* returns *True*.

bind: **list/tuple**Properties to observe for changes, as property name strings

cache: **boolean**If True, the value will be cached, until one of the binded elements will changes

rebind: **bool, defaults to False**See `ObjectProperty` for details.

Changed in version 1.9.0: *rebind* has been introduced.

Changed in version 1.4.0: Parameter *cache* added.

class `kivy.properties.`**`DictProperty`**

Bases: `kivy.properties.Property`

Property that represents a dict.

Parameters

default: **dict, defaults to None**Specifies the default value of the property.

rebind: **bool, defaults to False**See `ObjectProperty` for details.

Changed in version 1.9.0: *rebind* has been introduced.

Warning: Similar to `ListProperty`, when assigning a dict to a `DictProperty`, the dict stored in the property is a copy of the dict and not the original dict. See `ListProperty` for details.

class `kivy.properties.`**`VariableListProperty`**

Bases: `kivy.properties.Property`

A ListProperty that allows you to work with a variable amount of list items and to expand them to the desired list size.

For example, GridLayout's padding used to just accept one numeric value which was applied equally to the left, top, right and bottom of the GridLayout. Now padding can be given one, two or four values, which are expanded into a length four list [left, top, right, bottom] and stored in the property.

Parameters

default: **a default list of values**Specifies the default values for the list.

length: **int, one of 2 or 4.**Specifies the length of the final list. The *default* list will be expanded to match a list of this length.

*****kwargs*: a list of keyword arguments**Not currently used.

Keeping in mind that the *default* list is expanded to a list of length 4, here are some examples of how VariabelListProperty's are handled.

- VariableListProperty([1]) represents [1, 1, 1, 1].
- VariableListProperty([1, 2]) represents [1, 2, 1, 2].
- VariableListProperty(['1px', (2, 'px'), 3, 4.0]) represents [1, 2, 3, 4.0].
- VariableListProperty(5) represents [5, 5, 5, 5].
- VariableListProperty(3, length=2) represents [3, 3].

New in version 1.7.0.

class `kivy.properties.`**`ConfigParserProperty`**

Bases: `kivy.properties.Property`

Property that allows one to bind to changes in the configuration values of a `ConfigParser` as well as to bind the ConfigParser values to other properties.

A ConfigParser is composed of sections, where each section has a number of keys and values associated with these keys. ConfigParserProperty lets you automatically listen to and change the values of specified keys based on other kivy properties.

For example, say we want to have a TextInput automatically write its value, represented as an int, in the *info* section of a ConfigParser. Also, the textinputs should update its values from the ConfigParser's fields. Finally, their values should be displayed in a label. In py:

```
class Info(Label):

    number = ConfigParserProperty(0, 'info', 'number', 'example',
                                  val_type=int, errorvalue=41)

    def __init__(self, **kw):
        super(Info, self).__init__(**kw)
        config = ConfigParser(name='example')
```

The above code creates a property that is connected to the *number* key in the *info* section of the ConfigParser named *example*. Initially, this ConfigParser doesn't exist. Then, in *__init__*, a ConfigParser is created with name *example*, which is then automatically linked with this property. then in kv:

```
BoxLayout:
    TextInput:
        id: number
        text: str(info.number)
    Info:
        id: info
        number: number.text
        text: 'Number: {}'.format(self.number)
```

You'll notice that we have to do *text: str(info.number)*, this is because the value of this property is always an int, because we specified *int* as the *val_type*. However, we can assign anything to the property, e.g. *number: number.text* which assigns a string, because it is instantly converted with the *val_type* callback.

Note: If a file has been opened for this ConfigParser using `read()`, then `write()` will be called every property change, keeping the file updated.

Warning: It is recommend that the config parser object be assigned to the property after the kv tree has been constructed (e.g. schedule on next frame from init). This is because the kv tree and its properties, when constructed, are evaluated on its own order, therefore, any initial values in the parser might be overwritten by objects it's bound to. So in the example above, the TextInput might be initially empty, and if *number: number.text* is evaluated before *text: str(info.number)*, the config value will be overwritten with the (empty) text value.

Parameters

***default*: object type**Specifies the default value for the key. If the parser associated with this property doesn't have this section or key, it'll be created with the current value, which is the default value initially.

***section*: string type**The section in the ConfigParser where the key / value will be written. Must be provided. If the section doesn't exist, it'll be created.

***key*: string type**The key in section *section* where the value will be written to. Must be provided. If the key doesn't exist, it'll be created and the current value written to it, otherwise its value will be used.

***config*: string or `ConfigParser` instance.**The ConfigParser instance to associate with this property if not None. If it's a string, the ConfigParser instance whose `name` is the value of *config* will be used. If no such parser exists yet, whenever a ConfigParser with this name is created, it will automatically be linked to this property.

Whenever a ConfigParser becomes linked with a property, if the section or key doesn't exist, the current property value will be used to create that key, otherwise, the existing key value will be used for the property value; overwriting its current value. You can change the ConfigParser associated with this property if a string was used here, by changing the `name` of an existing or new ConfigParser instance. Or through `set_config()`.

***kwargs*: a list of keyword arguments**

val_type: **a callable object**The key values are saved in the ConfigParser as strings. When the ConfigParser value is read internally and assigned to the property or when the user changes the property value directly, if *val_type* is not None, it will be called with the new value as input and it should return the value converted to the proper type accepted ny this property. For example, if the property represent ints, *val_type* can simply be *int*.

If the *val_type* callback raises a *ValueError*, *errorvalue* or *errorhandler* will be used if provided. Tip: the *getboolean* function of the ConfigParser might also be useful here to convert to a boolean type.

verify: **a callable object**Can be used to restrict the allowable values of the property. For every value assigned to the property, if this is specified, *verify* is called with the new value, and if it returns *True* the value is accepted, otherwise, *errorvalue* or *errorhandler* will be used if provided or a *ValueError* is raised.

New in version 1.9.0.

set_config()

Sets the ConfigParser object to be used by this property. Normally, the ConfigParser is set when initializing the Property using the *config* parameter.

Parameters

config: **A `ConfigParser` instance.**The instance to use for listening to and saving property value changes. If None, it disconnects the currently used *ConfigParser*.

```
class MyWidget(Widget):
    username = ConfigParserProperty('', 'info', 'name', None)

widget = MyWidget()
widget.property('username').set_config(ConfigParser())
```

CHAPTER

TWO

RESOURCES MANAGEMENT

Resource management can be a pain if you have multiple paths and projects. Kivy offers 2 functions for searching for specific resources across a list of paths.

`kivy.resources.`**`resource_find`**`(`*filename*`)`
    Search for a resource in the list of paths. Use resource_add_path to add a custom path to the search.

`kivy.resources.`**`resource_add_path`**`(`*path*`)`
    Add a custom path to search in.

`kivy.resources.`**`resource_remove_path`**`(`*path*`)`
    Remove a search path.

    New in version 1.0.8.

CHAPTER

THREE

STORAGE

New in version 1.7.0.

Warning: This module is still experimental, and the API is subject to change in a future version.

123.1 Usage

The idea behind the Storage module is to be able to load/store any number of key/value pairs via an indexed key. The default model is abstract so you cannot use it directly. We provide some implementations such as:

- `kivy.storage.dictstore.DictStore`: use a python dict as a store
- `kivy.storage.jsonstore.JsonStore`: use a JSON file as a store
- `kivy.storage.redistore.RedisStore`: use a Redis database with redis-py

123.2 Examples

For example, let's use a JsonStore:

```
from kivy.storage.jsonstore import JsonStore

store = JsonStore('hello.json')

# put some values
store.put('tito', name='Mathieu', org='kivy')
store.put('tshirtman', name='Gabriel', age=27)

# using the same index key erases all previously added key/value pairs
store.put('tito', name='Mathieu', age=30)

# get a value using a index key and key
print('tito is', store.get('tito')['age'])

# or guess the key/entry for a part of the key
for item in store.find(name='Gabriel'):
    print('tshirtmans index key is', item[0])
    print('his key value pairs are', str(item[1]))
```

Because the data is persistant, you can check later to see if the key exists:

```
from kivy.storage.jsonstore import JsonStore

store = JsonStore('hello.json')
if store.exists('tito'):
    print('tite exists:', store.get('tito'))
    store.delete('tito')
```

123.3 Synchronous / Asynchronous API

All the standard methods (`get()`, `put()` , `exists()`, `delete()`, `find()`) have an asynchronous version.

For example, the *get* method has a *callback* parameter. If set, the *callback* will be used to return the result to the user when available: the request will be asynchronous. If the *callback* is None, then the request will be synchronous and the result will be returned directly.

Without callback (Synchronous API):

```
entry = mystore.get('tito')
print('tito =', entry)
```

With callback (Asynchronous API):

```
def my_callback(store, key, entry):
    print('the key', key, 'have', entry)
mystore.get('plop', callback=my_callback)
```

The callback signature is (for almost all methods) *callback(store, key, result)*:

```
#. 'store' is the 'Store' instance currently used.
#. 'key' is the key to search for.
#. 'entry' is the result of the lookup for the 'key'.
```

123.4 Synchronous container type

The storage API emulates the container type for the synchronous API:

```
store = JsonStore('hello.json')

# original: store.get('tito')
store['tito']

# original: store.put('tito', name='Mathieu')
store['tito'] = {'name': 'Mathieu'}

# original: store.delete('tito')
del store['tito']

# original: store.count()
len(store)

# original: store.exists('tito')
'tito' in store
```

```
# original: for key in store.keys()
for key in store:
    pass
```

class `kivy.storage.AbstractStore`(***kwargs*)
Bases: `kivy.event.EventDispatcher`

Abstract class used to implement a Store

`async_clear`(*callback*)
Asynchronous version of `clear()`.

`async_count`(*callback*)
Asynchronously return the number of entries in the storage.

`async_delete`(*callback, key*)
Asynchronous version of `delete()`.

Callback arguments

store: **`AbstractStore` instance**Store instance
key: **string**Name of the key to search for
result: **bool**Indicate True if the storage has been updated, or False if nothing has been done (no changes). None if any error.

`async_exists`(*callback, key*)
Asynchronous version of `exists()`.

Callback arguments

store: **`AbstractStore` instance**Store instance
key: **string**Name of the key to search for
result: **boo**Result of the query, None if any error

`async_find`(*callback, **filters*)
Asynchronous version of `find()`.

The callback will be called for each entry in the result.

Callback arguments

store: **`AbstractStore` instance**Store instance
key: **string**Name of the key to search for, or None if we reach the end of the results
result: **bool**Indicate True if the storage has been updated, or False if nothing has been done (no changes). None if any error.

`async_get`(*callback, key*)
Asynchronous version of `get()`.

Callback arguments

store: **`AbstractStore` instance**Store instance
key: **string**Name of the key to search for
result: **dict**Result of the query, None if any error

`async_keys`(*callback*)
Asynchronously return all the keys in the storage.

`async_put`(*callback, key, **values*)
Asynchronous version of `put()`.

Callback arguments

store: **`AbstractStore` instance**Store instance
key: **string**Name of the key to search for
result: **bool**Indicate True if the storage has been updated, or False if nothing has been done (no changes). None if any error.

`clear`()
Wipe the whole storage.

count()
: Return the number of entries in the storage.

delete(*key*)
: Delete a key from the storage. If the key is not found, a *KeyError* exception will be thrown.

exists(*key*)
: Check if a key exists in the store.

find(***filters*)
: Return all the entries matching the filters. The entries are returned through a generator as a list of (key, entry) pairs where *entry* is a dict of key/value pairs

```
for key, entry in store.find(name='Mathieu'):
    print('key:', key, ', entry:', entry)
```

Because it's a generator, you cannot directly use it as a list. You can do:

```
# get all the (key, entry) availables
entries = list(store.find(name='Mathieu'))
# get only the entry from (key, entry)
entries = list((x[1] for x in store.find(name='Mathieu')))
```

get(*key*)
: Get the key/value pairs stored at *key*. If the key is not found, a *KeyError* exception will be thrown.

keys()
: Return a list of all the keys in the storage.

put(*key*, ***values*)
: Put new key/value pairs (given in *values*) into the storage. Any existing key/value pairs will be removed.

123.5 Dictionary store

Use a Python dictionary as a store.

class `kivy.storage.dictstore.`**`DictStore`**(*filename*, *data=None*, ***kwargs*)
Bases: `kivy.storage.AbstractStore`

Store implementation using a pickled *dict*. See the `kivy.storage` module documentation for more information.

123.6 JSON store

Can be used to save/load key-value pairs from a json file.

class `kivy.storage.jsonstore.`**`JsonStore`**(*filename*, ***kwargs*)
Bases: `kivy.storage.AbstractStore`

Store implementation using a json file for storing the keys-value pairs. See the `kivy.storage` module documentation for more information.

123.7 Redis Store

Store implementation using Redis. You must have redis-py installed.

Usage example:

```
from kivy.storage.redisstore import RedisStore

params = dict(host='localhost', port=6379, db=14)
store = RedisStore(params)
```

All the key-value pairs will be stored with a prefix 'store' by default. You can instanciate the storage with another prefix like this:

```
from kivy.storage.redisstore import RedisStore

params = dict(host='localhost', port=6379, db=14)
store = RedisStore(params, prefix='mystore2')
```

The params dictionary will be passed to the redis.StrictRedis class.

See redis-py.

class `kivy.storage.redisstore.`**`RedisStore`**(*redis_params*, ***kwargs*)

Bases: `kivy.storage.AbstractStore`

Store implementation using a Redis database. See the `kivy.storage` module documentation for more informations.

CHAPTER

FOUR

DICTIONARY STORE

Use a Python dictionary as a store.

class `kivy.storage.dictstore.`**`DictStore`**(*filename*, *data=None*, ***kwargs*)

Bases: `kivy.storage.AbstractStore`

Store implementation using a pickled *dict*. See the `kivy.storage` module documentation for more information.

CHAPTER

FIVE

JSON STORE

Can be used to save/load key-value pairs from a json file.

class `kivy.storage.jsonstore.`**`JsonStore`**(*filename*, ***kwargs*)

Bases: `kivy.storage.AbstractStore`

Store implementation using a json file for storing the keys-value pairs. See the `kivy.storage` module documentation for more information.

CHAPTER

SIX

REDIS STORE

Store implementation using Redis. You must have redis-py installed.

Usage example:

```
from kivy.storage.redisstore import RedisStore

params = dict(host='localhost', port=6379, db=14)
store = RedisStore(params)
```

All the key-value pairs will be stored with a prefix 'store' by default. You can instanciate the storage with another prefix like this:

```
from kivy.storage.redisstore import RedisStore

params = dict(host='localhost', port=6379, db=14)
store = RedisStore(params, prefix='mystore2')
```

The params dictionary will be passed to the redis.StrictRedis class.

See redis-py.

class `kivy.storage.redisstore.`**`RedisStore`**(*redis_params*, ***kwargs*)

Bases: `kivy.storage.AbstractStore`

Store implementation using a Redis database. See the `kivy.storage` module documentation for more informations.

CHAPTER

SEVEN

SUPPORT

Activate other frameworks/toolkits inside the kivy event loop.

`kivy.support.`**`install_gobject_iteration`**`()`

Import and install gobject context iteration inside our event loop. This is used as soon as gobject is used (like gstreamer).

`kivy.support.`**`install_twisted_reactor`**`(`***kwargs*`)`

Installs a threaded twisted reactor, which will schedule one reactor iteration before the next frame only when twisted needs to do some work.

Any arguments or keyword arguments passed to this function will be passed on the the threaded-select reactors interleave function. These are the arguments one would usually pass to twisted's reactor.startRunning.

Unlike the default twisted reactor, the installed reactor will not handle any signals unless you set the 'installSignalHandlers' keyword argument to 1 explicitly. This is done to allow kivy to handle the signals as usual unless you specifically want the twisted reactor to handle the signals (e.g. SIGINT).

Note: Twisted is not included in iOS build by default. To use it on iOS, put the twisted distribution (and zope.interface dependency) in your application directory.

`kivy.support.`**`uninstall_twisted_reactor`**`()`

Uninstalls the Kivy's threaded Twisted Reactor. No more Twisted tasks will run after this got called. Use this to clean the *twisted.internet.reactor*

New in version 1.9.0.

`kivy.support.`**`install_android`**`()`

Install hooks for the android platform.

- Automatically sleep when the device is paused.
- Automatically kill the application when the return key is pressed.

CHAPTER

EIGHT

WIDGETS

A widget is an element of a graphical user interface. The *kivy.uix* module contains classes for creating and managing Widgets.

First read: *Widget class*

- **UX widgets**: Classical user interface widgets, ready to be assembled to create more complex widgets.

  Label, *Button*, *CheckBox*, *Image*, *Slider*, *Progress Bar*, *Text Input*, *Toggle button*, *Switch*, *Video*

- **Layouts**: A layout widget does no rendering but just acts as a trigger that arranges its children in a specific way. Read more on *Layout*.

  Grid Layout, *Box Layout*, *Anchor Layout*, *Stack Layout*

- **Complex UX widgets**: Non-atomic widgets that are the result of combining multiple classic widgets. We call them complex because their assembly and usage are not as generic as the classical widgets.

  Bubble, *Drop-Down List*, *FileChooser*, *Popup*, *Spinner*, *List View*, *TabbedPanel*, *Video player*, *VKeyboard*,

- **Behaviors widgets**: Theses widgets do no rendering but act on the graphics instructions or interaction (touch) behavior.

  Scatter, *Stencil View*

- **Screen manager**: Manages screens and transitions when switching from one to another.

  Screen Manager

128.1 Abstract View

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `AbstractView` widget has an adapter property for an adapter that mediates to data. The adapter manages an item_view_instance dict property that holds views for each data item, operating as a cache.

class `kivy.uix.abstractview.`**`AbstractView`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

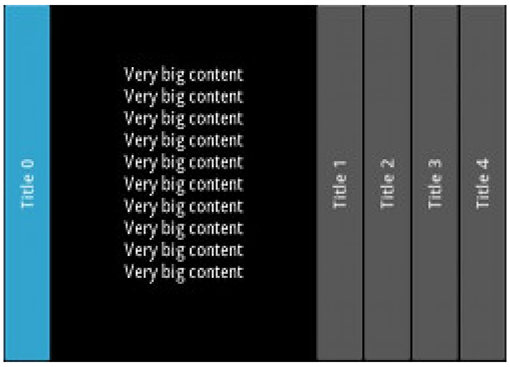
View using an `Adapter` as a data provider.

adapter

The adapter can be one of several kinds of `adapters`. The most common example is the `ListAdapter` used for managing data items in a list.

128.2 Accordion

New in version 1.0.8.



The Accordion widget is a form of menu where the options are stacked either vertically or horizontally and the item in focus (when touched) opens up to display its content.

The `Accordion` should contain one or many `AccordionItem` instances, each of which should contain one root content widget. You'll end up with a Tree something like this:

- Accordion
  - AccordionItem
    - YourContent
  - AccordionItem
    - BoxLayout
      - Another user content 1
      - Another user content 2
  - AccordionItem
    - Another user content

The current implementation divides the `AccordionItem` into two parts:

1. One container for the title bar
2. One container for the content

The title bar is made from a Kv template. We'll see how to create a new template to customize the design of the title bar.

Warning: If you see message like:

```
[WARNING] [Accordion] not have enough space for displaying all children
[WARNING] [Accordion] need 440px, got 100px
[WARNING] [Accordion] layout aborted.
```

That means you have too many children and there is no more space to display the content. This is "normal" and nothing will be done. Try to increase the space for the accordion or reduce the number of children. You can also reduce the `Accordion.min_space`.

128.2.1 Simple example

```
from kivy.uix.accordion import Accordion, AccordionItem
from kivy.uix.label import Label
from kivy.app import App

class AccordionApp(App):
    def build(self):
        root = Accordion()
        for x in range(5):
            item = AccordionItem(title='Title %d' % x)
            item.add_widget(Label(text='Very big content\n' * 10))
            root.add_widget(item)
        return root

if __name__ == '__main__':
    AccordionApp().run()
```

128.2.2 Customize the accordion

You can increase the default size of the title bar:

```
root = Accordion(min_space=60)
```

Or change the orientation to vertical:

```
root = Accordion(orientation='vertical')
```

The AccordionItem is more configurable and you can set your own title background when the item is collapsed or opened:

```
item = AccordionItem(background_normal='image_when_collapsed.png',
    background_selected='image_when_selected.png')
```

class `kivy.uix.accordion.`**`Accordion`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Accordion class. See module documentation for more information.

`anim_duration`

Duration of the animation in seconds when a new accordion item is selected.

`anim_duration` is a `NumericProperty` and defaults to .25 (250ms).

`anim_func`

Easing function to use for the animation. Check `kivy.animation.AnimationTransition` for more information about available animation functions.

`anim_func` is an `ObjectProperty` and defaults to 'out_expo'. You can set a string or a function to use as an easing function.

`min_space`

Minimum space to use for the title of each item. This value is automatically set for each child every time the layout event occurs.

`min_space` is a `NumericProperty` and defaults to 44 (px).

orientation

Orientation of the layout.

orientation is an OptionProperty and defaults to 'horizontal'. Can take a value of 'vertical' or 'horizontal'.

class kivy.uix.accordion.**AccordionItem**(***kwargs*)

Bases: kivy.uix.floatlayout.FloatLayout

AccordionItem class that must be used in conjunction with the Accordion class. See the module documentation for more information.

accordion

Instance of the Accordion that the item belongs to.

accordion is an ObjectProperty and defaults to None.

background_disabled_normal

Background image of the accordion item used for the default graphical representation when the item is collapsed and disabled.

New in version 1.8.0.

background__disabled_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_disabled'.

background_disabled_selected

Background image of the accordion item used for the default graphical representation when the item is selected (not collapsed) and disabled.

New in version 1.8.0.

background_disabled_selected is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_disabled_pressed'.

background_normal

Background image of the accordion item used for the default graphical representation when the item is collapsed.

background_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button'.

background_selected

Background image of the accordion item used for the default graphical representation when the item is selected (not collapsed).

background_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_pressed'.

collapse

Boolean to indicate if the current item is collapsed or not.

collapse is a BooleanProperty and defaults to True.

collapse_alpha

Value between 0 and 1 to indicate how much the item is collasped (1) or whether it is selected (0). It's mostly used for animation.

collapse_alpha is a NumericProperty and defaults to 1.

container

(internal) Property that will be set to the container of children inside the AccordionItem representation.

container_title
(internal) Property that will be set to the container of title inside the AccordionItem representation.

content_size
(internal) Set by the Accordion to the size allocated for the content.

min_space
Link to the Accordion.min_space property.

orientation
Link to the Accordion.orientation property.

title
Title string of the item. The title might be used in conjuction with the *AccordionItemTitle* template. If you are using a custom template, you can use that property as a text entry, or not. By default, it's used for the title text. See title_template and the example below.

title is a StringProperty and defaults to ''.

title_args
Default arguments that will be passed to the kivy.lang.Builder.template() method.

title_args is a DictProperty and defaults to {}.

title_template
Template to use for creating the title part of the accordion item. The default template is a simple Label, not customizable (except the text) that supports vertical and horizontal orientation and different backgrounds for collapse and selected mode.

It's better to create and use your own template if the default template does not suffice.

title is a StringProperty and defaults to 'AccordionItemTitle'. The current default template lives in the *kivy/data/style.kv* file.

Here is the code if you want to build your own template:

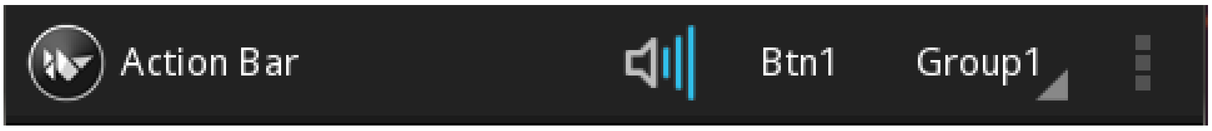
```
[AccordionItemTitle@Label]:
    text: ctx.title
    canvas.before:
        Color:
            rgb: 1, 1, 1
        BorderImage:
            source:
                ctx.item.background_normal \
                if ctx.item.collapse \
                else ctx.item.background_selected
            pos: self.pos
            size: self.size
        PushMatrix
        Translate:
            xy: self.center_x, self.center_y
        Rotate:
            angle: 90 if ctx.item.orientation == 'horizontal' else 0
            axis: 0, 0, 1
        Translate:
            xy: -self.center_x, -self.center_y
    canvas.after:
        PopMatrix
```

class kivy.uix.accordion.**AccordionException**
Bases: exceptions.Exception

AccordionException class.

128.3 Action Bar

New in version 1.8.0.



The ActionBar widget is like Android's ActionBar, where items are stacked horizontally.

The ActionBar will contain one ActionView and many ContextualActionViews. An ActionView will contain an ActionPrevious having title, app_icon and previous_icon properties. An ActionView will contain subclasses of ActionItems. Some predefined ones inlcude an ActionButton, an ActionToggleButton, an ActionCheck, an ActionSeparator and an ActionGroup.

An ActionGroup is used to display ActionItems in a group. An ActionView will always display an ActionGroup after other ActionItems. An ActionView will contain an ActionOverflow. A ContextualActionView is a subclass of an ActionView.

class `kivy.uix.actionbar.`**`ActionBarException`**

Bases: `exceptions.Exception`

ActionBarException class

class `kivy.uix.actionbar.`**`ActionItem`**

Bases: `object`

ActionItem class, an abstract class for all ActionBar widgets. To create a custom widget for an ActionBar, inherit from this class. See module documentation for more information.

`background_down`

Background image of the ActionItem used for default graphical representation when an ActionItem is pressed.

`background_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_item_down'.

`background_normal`

Background image of the ActionItem used for the default graphical representation when the ActionItem is not pressed.

`background_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_item'.

`important`

Determines if an ActionItem is important or not.

`important` is a `BooleanProperty` and defaults to False.

`inside_group`

(internal) Determines if an ActionItem is displayed inside an ActionGroup or not.

`inside_group` is a `BooleanProperty` and defaults to False.

`minimum_width`

Minimum Width required by an ActionItem.

`minimum_width` is a `NumericProperty` and defaults to '90sp'.

mipmap

Defines whether the image/icon dispayed on top of the button uses a mipmap or not.

mipmap is a BooleanProperty and defaults to *True*.

class kivy.uix.actionbar.**ActionButton**(***kwargs*)

Bases: kivy.uix.button.Button, kivy.uix.actionbar.ActionItem

ActionButton class, see module documentation for more information.

The text color, width and size_hint_x are set manually via the Kv language file. It covers a lot of cases: with/without an icon, with/without a group and takes care of the padding between elements.

You don't have much control over these properties, so if you want to customize it's appearance, we suggest you create you own button representation. You can do this by creating a class that subclasses an existing widget and an ActionItem:

```
class MyOwnActionButton(Button, ActionItem):
    pass
```

You can then create your own style using the Kv language.

icon

Source image to use when the Button is part of the ActionBar. If the Button is in a group, the text will be preferred.

class kivy.uix.actionbar.**ActionToggleButton**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.togglebutton.ToggleButton

ActionToggleButton class, see module documentation for more information.

icon

Source image to use when the Button is part of the ActionBar. If the Button is in a group, the text will be preferred.

class kivy.uix.actionbar.**ActionCheck**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.checkbox.CheckBox

ActionCheck class, see module documentation for more information.

class kivy.uix.actionbar.**ActionSeparator**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.widget.Widget

ActionSeparator class, see module documentation for more information.

background_image

Background image for the separators default graphical representation.

background_image is a StringProperty and defaults to 'atlas://data/images/defaulttheme/separator'.

class kivy.uix.actionbar.**ActionDropDown**(***kwargs*)

Bases: kivy.uix.dropdown.DropDown

ActionDropDown class, see module documentation for more information.

class kivy.uix.actionbar.**ActionGroup**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.spinner.Spinner

ActionGroup class, see module documentation for more information.

mode

Sets the current mode of an ActionGroup. If mode is 'normal', the ActionGroups children will be displayed normally if there is enough space, otherwise they will be displayed in a spinner. If mode is 'spinner', then the children will always be displayed in a spinner.

`mode` is a `OptionProperty` and defaults to 'normal'.

`separator_image`
Background Image for an ActionSeparator in an ActionView.

`separator_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/separator'.

`separator_width`
Width of the ActionSeparator in an ActionView.

`separator_width` is a `NumericProperty` and defaults to 0.

`use_separator`
Specifies whether to use a separator after/before this group or not.

`use_separator` is a `BooleanProperty` and defaults to False.

class `kivy.uix.actionbar.`**`ActionOverflow`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.actionbar.ActionGroup`

ActionOverflow class, see module documentation for more information.

`overflow_image`
Image to be used as an Overflow Image.
`overflow_image` is an `ObjectProperty` anddefaults to 'atlas://data/images/defaulttheme/overflow'.

class `kivy.uix.actionbar.`**`ActionView`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.boxlayout.BoxLayout`

ActionView class, see module documentation for more information.

`action_previous`
Previous button for an ActionView.
`action_previous` is an `ObjectProperty`and defaults to None.

`background_color`
Background color in the format (r, g, b, a).
`background_color` is a `ListProperty` anddefaults to [1, 1, 1, 1].

`background_image`
Background image of an ActionViews default graphical representation.

`background_image` is an `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_view'.

`overflow_group`
Widget to be used for the overflow.

`overflow_group` is an `ObjectProperty` and defaults to an instance of `ActionOverflow`.

`use_separator`
Specify whether to use a separator before every ActionGroup or not.

`use_separator` is a `BooleanProperty` and defaults to False.

class `kivy.uix.actionbar.`**`ContextualActionView`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.actionbar.ActionView`

ContextualActionView class, see the module documentation for more information.

class `kivy.uix.actionbar.`**`ActionPrevious`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.actionbar.ActionButton`

ActionPrevious class, see module documentation for more information.

app_icon
Application icon for the ActionView.

app_icon is a StringProperty and defaults to the window icon if set, otherwise 'data/logo/kivy-icon-32.png'.

previous_image
Image for the 'previous' ActionButtons default graphical representation.

previous_image is a StringProperty and defaults to 'atlas://data/images/defaulttheme/previous_normal'.

title
Title for ActionView.

title is a StringProperty and defaults to ''.

with_previous
Specifies whether clicking on ActionPrevious will load the previous screen or not. If True, the previous_icon will be shown otherwise it will not.

with_previous is a BooleanProperty and defaults to True.

class kivy.uix.actionbar.**ActionBar**(***kwargs*)
Bases: kivy.uix.boxlayout.BoxLayout

ActionBar, see the module documentation for more information.

Events

*on_previous*Fired when action_previous of action_view is pressed.

action_view
action_view of ActionBar.

action_view is an ObjectProperty and defaults to an instance of ActionView.

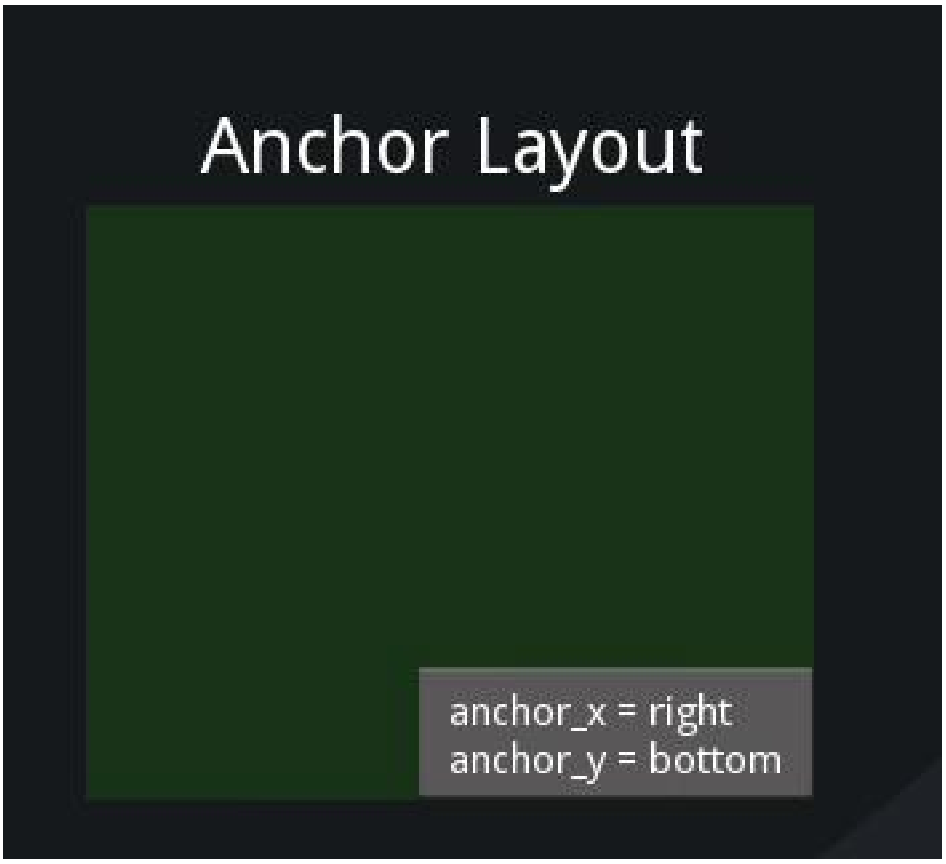
background_color
Background color, in the format (r, g, b, a).
background_color is a ListProperty anddefaults to [1, 1, 1, 1].

background_image
Background image of the ActionBars default graphical representation.

background_image is an StringProperty and defaults to 'atlas://data/images/defaulttheme/action_bar'.

border
border to be applied to the background_image.

128.4 Anchor Layout



The AnchorLayout aligns its children to a border (top, bottom, left, right) or center.

To draw a button in the lower-right corner:

```
layout = AnchorLayout(
    anchor_x='right', anchor_y='bottom')
btn = Button(text='Hello World')
layout.add_widget(btn)
```

class kivy.uix.anchorlayout.**AnchorLayout**(***kwargs*)

Bases: kivy.uix.layout.Layout

Anchor layout class. See the module documentation for more information.

anchor_x

Horizontal anchor.

anchor_x is an OptionProperty and defaults to 'center'. It accepts values of 'left', 'center' or 'right'.

anchor_y

Vertical anchor.

anchor_y is an OptionProperty and defaults to 'center'. It accepts values of 'top', 'center' or 'bottom'.

padding

Padding between the widget box and its children, in pixels: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

128.5 Behaviors

New in version 1.8.0.

This module implements behaviors that can be mixed with existing base widgets. For example, if you want to add a "button" capability to an *Image*, you could do:

```
class IconButton(ButtonBehavior, Image):
    pass
```

Note: The behavior class must always be _before_ the widget class. If you don't specify the inheritance in this order, the behavior will not work.

class `kivy.uix.behaviors.`**`ButtonBehavior`**`(`***kwargs*`)`

Bases: `object`

Button behavior.

Events

on_pressFired when the button is pressed.

on_releaseFired when the button is released (i.e. the touch/click that pressed the button goes away).

`MIN_STATE_TIME` = 0.035

The minimum period of time which the widget must remain in the *'down'* state.

`MIN_STATE_TIME` is a float.

`last_touch`

Contains the last relevant touch received by the Button. This can be used in *on_press* or *on_release* in order to know which touch dispatched the event.

New in version 1.8.0.

`last_touch` is a `ObjectProperty`, defaults to None.

`state`

State of the button, must be one of 'normal' or 'down'. The state is 'down' only when the button is currently touched/clicked, otherwise 'normal'.

`state` is an `OptionProperty`.

`trigger_action``(`*duration=0.1*`)`

Trigger whatever action(s) have been bound to the button by calling both the on_press and on_release callbacks.

This simulates a quick button press without using any touch events.

Duration is the length of the press in seconds. Pass 0 if you want the action to happen instantly.

New in version 1.8.0.

class `kivy.uix.behaviors.`**`ToggleButtonBehavior`**`(`***kwargs*`)`

Bases: `kivy.uix.behaviors.ButtonBehavior`

ToggleButton behavior, see ToggleButton module documentation for more information.

New in version 1.8.0.

allow_no_selection

This specifies whether the checkbox in group allows everything to be deselected.

..versionadded::1.9.0

allow_no_selection is a BooleanProperty defaults to *True*

static **get_widgets**(*groupname*)

Return the widgets contained in a specific group. If the group doesn't exist, an empty list will be returned.

Important: Always release the result of this method! In doubt, do:

```
l = ToggleButtonBehavior.get_widgets('mygroup')
# do your job
del l
```

Warning: It's possible that some widgets that you have previously deleted are still in the list. Garbage collector might need more elements before flushing it. The return of this method is informative, you've been warned!

group

Group of the button. If None, no group will be used (button is independent). If specified, group must be a hashable object, like a string. Only one button in a group can be in 'down' state.

group is a ObjectProperty

class kivy.uix.behaviors.**DragBehavior**(***kwargs*)

Bases: object

Drag behavior. When combined with a widget, dragging in the rectangle defined by drag_rectangle will drag the widget.

For example, to make a popup which is draggable by its title do:

```
from kivy.uix.behaviors import DragBehavior
from kivy.uix.popup import Popup

class DragPopup(DragBehavior, Popup):
    pass
```

And in .kv do::

<DragPopup>:drag_rectangle: self.x, self.y+self._container.height, self.width, self.height - self._container.height drag_timeout: 10000000 drag_distance: 0

New in version 1.8.0.

drag_distance

Distance to move before dragging the DragBehavior, in pixels. As soon as the distance has been traveled, the DragBehavior will start to drag, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

drag_distance is a NumericProperty, defaults to 20 (pixels), according to the default value of scroll_distance in user configuration.

drag_rect_height

Height of the axis aligned bounding rectangle where dragging is allowed.

drag_rect_height is a NumericProperty, defaults to 100.

drag_rect_width

Width of the axis aligned bounding rectangle where dragging is allowed.

drag_rect_width is a NumericProperty, defaults to 100.

drag_rect_x

X position of the axis aligned bounding rectangle where dragging is allowed. In window coordinates.

drag_rect_x is a NumericProperty, defaults to 0.

drag_rect_y

Y position of the axis aligned bounding rectangle where dragging is allowed. In window coordinates.

drag_rect_Y is a NumericProperty, defaults to 0.

drag_rectangle

Position and size of the axis aligned bounding rectangle where dragging is allowed.

drag_rectangle is a ReferenceListProperty of (drag_rect_x, drag_rect_y, drag_rect_width, drag_rect_height) properties.

drag_timeout

Timeout allowed to trigger the drag_distance, in milliseconds. If the user has not moved drag_distance within the timeout, dragging will be disabled, and the touch event will go to the children.

drag_timeout is a NumericProperty, defaults to 55 (milliseconds), according to the default value of scroll_timeout in user configuration.

class kivy.uix.behaviors.**FocusBehavior**(***kwargs*)

Bases: object

Implements keyboard focus behavior. When combined with other FocusBehavior widgets it allows one to cycle focus among them by pressing tab. In addition, upon gaining focus the instance will automatically receive keyboard input.

Focus, very different then selection, is intimately tied with the keyboard; each keyboard can focus on zero or one widgets, and each widget can only have the focus of one keyboard. However, multiple keyboards can focus simultaneously on different widgets. When escape is hit, the widget having the focus of that keyboard will de-focus.

In essence, focus is implemented as a doubly linked list, where each node holds a (weak) reference to the instance before it and after it, as visualized when cycling through the nodes using tab (forward) or shift+tab (backward). If previous or next widget is not specified, focus_next and focus_previous default to *None*, which means that the children list and parents are walked to find the next focusable widget, unless focus_next or focus_previous is set to the *StopIteration* class, in which case focus stops there.

For example, to cycle focus between Button elements of a GridLayout:

```
class FocusButton(FocusBehavior, Button):
    pass

grid = GridLayout(cols=4)
for i in range(40):
    grid.add_widget(FocusButton(text=str(i)))
# clicking on a widget will activate focus, and tab can now be used
# to cycle through
```

New in version 1.9.0.

Warning: This code is still experimental, and its API is subject to change in a future version.

`focus_next`

The `FocusBehavior` instance to acquire focus when tab is pressed when this instance has focus, if not *None* or *'StopIteration'*.

When tab is pressed, focus cycles through all the `FocusBehavior` widgets that are linked through `focus_next` and are focusable. If `focus_next` is *None*, it instead walks the children lists to find the next focusable widget. Finally, if `focus_next` is the *StopIteration* class, focus won't move forward, but end here.

`focus_next` is a `ObjectProperty`, defaults to *None*.

`focus_previous`

The `FocusBehavior` instance to acquire focus when shift+tab is pressed on this instance, if not None or *StopIteration*.

When shift+tab is pressed, focus cycles through all the `FocusBehavior` widgets that are linked through `focus_previous` and are focusable. If `focus_previous` is *None', it instead walks the children tree to find the previous focusable widget. Finally, if :attr:'focus_previous* is the *StopIteration* class, focus won't move backward, but end here.

`focus_previous` is a `ObjectProperty`, defaults to *None*.

`focused`

Whether the instance currently has focus.

Setting it to True, will bind to and/or request the keyboard, and input will be forwarded to the instance. Setting it to False, will unbind and/or release the keyboard. For a given keyboard, only one widget can have its focus, so focusing one will automatically unfocus the other instance holding its focus.

`focused` is a `BooleanProperty`, defaults to False.

`is_focusable`

Whether the instance can become focused. If focused, it'll lose focus when set to False.

`is_focusable` is a `BooleanProperty`, defaults to True on a desktop (i.e. desktop is True in `config`), False otherwise.

`keyboard`

The keyboard to bind, or bound to the widget when focused.

When None, a keyboard is requested and released whenever the widget comes into and out of focus. If not None, it must be a keyboard, which gets bound and unbound from the widget whenever it's in or out of focus. It is useful only when more than one keyboard is available, so it is recommended to be set to None when only one keyboard is available

If more than one keyboard is available, whenever an instance get focused a new keyboard will be requested if None. Unless, the other instances lose focus (e.g. if tab was used), a new keyboard will appear. When this is undesired, the keyboard property can be used. For example, if there are two users with two keyboards, then each keyboard can be assigned to different groups of instances of FocusBehavior, ensuring that within each group, only one FocusBehavior will have focus, and will receive input from the correct keyboard. see *keyboard_mode* in `config` for information on the keyboard modes.

`keyboard` is a `AliasProperty`, defaults to None.

`keyboard_on_key_down`(*window*, *keycode*, *text*, *modifiers*)

The method bound to the keyboard when the instance has focus.

When the instance becomes focused, this method is bound to the keyboard and will be called for every input press. The parameters are the same as `kivy.core.window.WindowBase.on_key_down()`.

When overwriting the method in the derived widget, super should be called to enable tab cycling. If the derived widget wishes to use tab for its own purposes, it can call super at the end after it is done if it didn't consume tab.

Similar to other keyboard functions, it should return True if the key was consumed.

keyboard_on_key_up(*window*, *keycode*)
The method bound to the keyboard when the instance has focus.

When the instance becomes focused, this method is bound to the keyboard and will be called for every input release. The parameters are the same as `kivy.core.window.WindowBase.on_key_up()`.

When overwriting the method in the derived widget, super should be called to enable defocusing on escape. If the derived widget wishes to use escape for its own purposes, it can call super at the end after it is done if it didn't consume escape.

See `on_key_down()`

class `kivy.uix.behaviors.`**CompoundSelectionBehavior**(***kwargs*)
Bases: `object`

Selection behavior implements the logic behind keyboard and touch selection of selectable widgets managed by the derived widget. For example, it could be combined with a `GridLayout` to add selection to the layout.

At its core, it keeps a dynamic list of widgets that can be selected. Then, as the touches and keyboard input are passed in, it selects one or more of the widgets based on these inputs. For example, it uses the mouse scroll and keyboard up/down buttons to scroll through the list of widgets. Multiselection can also be achieved using the keyboard shift and ctrl keys. Finally, in addition to the up/down type keyboard inputs, it can also accepts letters from the kayboard to be used to select nodes with associated strings that start with those letters, similar to how files are selected by a file browser.

When the controller needs to select a node it calls `select_node()` and `deselect_node()`. Therefore, they must be overwritten in order affect the selected nodes. By default, the class doesn't listen to keyboard and touch events, therefore, the derived widget must call `select_with_touch()`, `select_with_key_down()`, and `select_with_key_up()` on events that it wants to pass on for selection purposes.

For example, to add selection to a grid layout which will contain `Button` widgets:

```
class SelectableGrid(CompoundSelectionBehavior, GridLayout):

    def __init__(self, **kwargs):
        super(CompoundSelectionBehavior, self).__init__(**kwargs)
        keyboard = Window.request_keyboard(None, self)
        keyboard.bind(on_key_down=self.select_with_key_down,
        on_key_up=self.select_with_key_up)

    def select_node(self, node):
        node.background_color = (1, 0, 0, 1)
        return super(CompoundSelectionBehavior, self).select_node(node)

    def deselect_node(self, node):
        node.background_color = (1, 1, 1, 1)
        super(CompoundSelectionBehavior, self).deselect_node(node)
```

Then, for each button added to the layout, bind on_touch_down of the button to `select_with_touch()` to pass on the touch events.

New in version 1.9.0.

Warning: This code is still experimental, and its API is subject to change in a future version.

`clear_selection``()`
Deselects all the currently selected nodes.

`deselect_node``(`*node*`)`
Deselects a possibly selected node.

It is called by the controller when it deselects a node and can also be called from the outside to deselect a node directly. The derived widget should overwrite this method and change the node to its unselected state when this is called

Parameters

nodeThe node to be deselected.

Warning: This method must be called by the derived widget using super if it is overwritten.

`get_selectable_nodes``()`
(internal) Returns a list of the nodes that can be selected. It can be overwritten by the derived widget to return the correct list.

This list is used to determine which nodes to select with group selection. E.g. the last element in the list will be selected when home is pressed, pagedown will move (or add to, if shift is held) the selection from the current position by negative `page_count` nodes starting from the position of the currently selected node in this list and so on. Still, nodes can be selected even if they are not in this list.

Note: It is safe to dynamically change this list including removing, adding, or re-arranging its elements. Nodes can be selected even if they are not on this list. And selected nodes removed from the list will remain selected until `deselect_node()` is called.

Warning: Layouts display their children in the reverse order. That is, the contents of `children` is displayed form right to left, bottom to top. Therefore, internally, the indices of the elements returned by this function is reversed to make it work by default for most layouts so that the final result is that e.g. home, although it will select the last element on this list, visually it'll select the first element when counting from top to bottom and left to right. If this behavior is not desired, a reversed list should be returned instead.

Defaults to returning `children`.

`goto_node``(`*key*, *last_node*, *last_node_idx*`)`
(internal) Used by the controller to get the node at the position indicated by key. The key can be keyboard inputs, e.g. pageup, or scroll inputs from the mouse scroll wheel, e.g. scrollup. Last node is the last node selected and is used to find the resulting node. For example, if the key is up, the returned node is one node up from the last node.

It can be overwritten by the derived widget.

Parameters

keystr, the string used to find the desired node. It can be any of the keyboard keys, as well as the mouse scrollup, scrolldown, scrollright, and scrollleft strings. If letters are typed in quick succession, the letters will be combined before it's passed in as key and can be used to find nodes that have an associated string that starts with those letters.

*last_node*The last node that was selected.

*last_node_idx*The cached index of the last node selected in the `get_selectable_nodes()` list. If the list hasn't changed it saves having to look up the index of *last_node* in that list.

Returns tuple, the node targeted by key and its index in the `get_selectable_nodes()` list. Returning *(last_node, last_node_idx)* indicates a node wasn't found.

`keyboard_select`

Whether the keybaord can be used for selection. If False, keyboard inputs will be ignored.

`keyboard_select` is a `BooleanProperty` , defaults to True.

`multiselect`

Determines whether multiple nodes can be selected. If enabled, keyboard shift and ctrl selection, optionally combined with touch, for example, will be able to select multiple widgets in the normally expected manner. This dominates `touch_multiselect` when False.

`multiselect` is a `BooleanProperty` , defaults to False.

`page_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when pageup (or pagedown) is pressed.

`page_count` is a `NumericProperty`, defaults to 10.

`right_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the right (or left) arrow on the keyboard is pressed.

`right_count` is a `NumericProperty`, defaults to 1.

`scroll_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the mouse scroll wheel is scrolled.

`right_count` is a `NumericProperty`, defaults to 0.

`select_node`(*node*)

Selects a node.

It is called by the controller when it selects a node and can be called from the outside to select a node directly. The derived widget should overwrite this method and change the node to its selected state when this is called

Parameters

*node*The node to be selected.

Returns bool, True if the node was selected, False otherwise.

Warning: This method must be called by the derived widget using super if it is overwritten.

`select_with_key_down`(*keyboard*, *scancode*, *codepoint*, *modifiers*, ***kwargs*)

Processes a key press. This is called when a key press is to be used for selection. Depending on the keyboard keys pressed and the configuration, it could select or deslect nodes or node ranges from the selectable nodes list, `get_selectable_nodes()`.

The parameters are such that it could be bound directly to the on_key_down event of a keyboard. Therefore, it is safe to be called repeatedly when the key is held down as is done by the keyboard.

Returns bool, True if the keypress was used, False otherwise.

`select_with_key_up`(*keyboard*, *scancode*, ***kwargs*)

(internal) Processes a key release. This must be called by the derived widget when a key that `select_with_key_down()` returned True is released.

The parameters are such that it could be bound directly to the on_key_up event of a keyboard.

Returns bool, True if the key release was used, False otherwise.

`select_with_touch`(*node*, *touch=None*)

(internal) Processes a touch on the node. This should be called by the derived widget when a node is touched and is to be used for selection. Depending on the keyboard keys pressed and the configuration, it could select or deslect this and other nodes in the selectable nodes list, `get_selectable_nodes()`.

Parameters

nodeThe node that recieved the touch. Can be None for a scroll type touch.

touchOptionally, the touch. Defaults to None.

Returns bool, True if the touch was used, False otherwise.

`selected_nodes`

The list of selected nodes.

`selected_nodes` is a `ListProperty` and defaults to the empty list, []. It is read-only and should not be modified.

`touch_multiselect`

A special touch mode which determines whether touch events, as processed with `select_with_touch()`, will add to the selection the currently touched node, or if it will clear the selection before adding the node. This allows the selection of multiple nodes by simply touching them. This is different than `multiselect`, because when this is True simply touching an unselected node will select it, even if e.g. ctrl is not pressed. If this is False, however, ctrl is required to be held in order to add to selection when `multiselect` is True.

Note: `multiselect`, when False, will disable `touch_multiselect`.

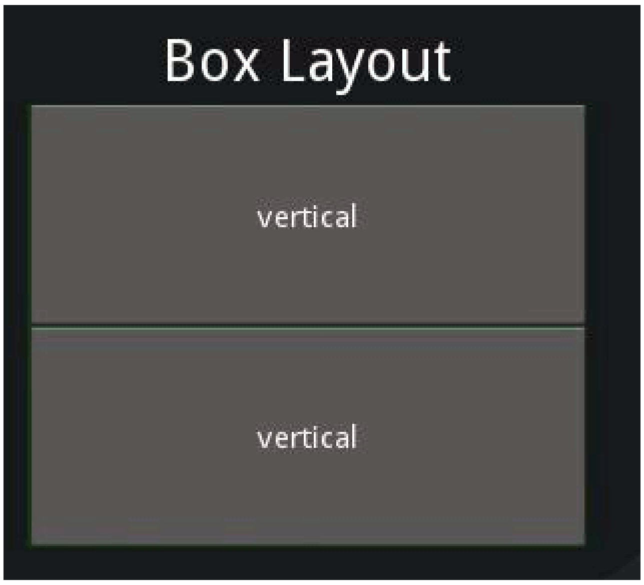
`touch_multiselect` is a `BooleanProperty`, defaults to False.

`up_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the up (or down) arrow on the keyboard is pressed.

`up_count` is a `NumericProperty`, defaults to 1.

128.6 Box Layout



BoxLayout arranges children in a vertical or horizontal box.

To position widgets above/below each other, use a vertical BoxLayout:

```
layout = BoxLayout(orientation='vertical')
btn1 = Button(text='Hello')
btn2 = Button(text='World')
layout.add_widget(btn1)
layout.add_widget(btn2)
```

To position widgets next to each other, use a horizontal BoxLayout. In this example, we use 10 pixel spacing between children; the first button covers 70% of the horizontal space, the second covers 30%:

```
layout = BoxLayout(spacing=10)
btn1 = Button(text='Hello', size_hint=(.7, 1))
btn2 = Button(text='World', size_hint=(.3, 1))
layout.add_widget(btn1)
layout.add_widget(btn2)
```

Position hints are partially working, depending on the orientation:

- If the orientation is *vertical*: *x*, *right* and *center_x* will be used.
- If the orientation is *horizontal*: *y*, *top* and *center_y* will be used.

You can check the *examples/widgets/boxlayout_poshint.py* for a live example.

Note: The *size_hint* uses the available space after subtracting all the fixed-size widgets. For example, if you have a layout that is 800px wide, and add three buttons like this:

btn1 = Button(text='Hello', size=(200, 100), size_hint=(None, None)) btn2 = Button(text='Kivy', size_hint=(.5, 1)) btn3 = Button(text='World', size_hint=(.5, 1))

The first button will be 200px wide as specified, the second and third will be 300px each, e.g. (800-200) * 0.5

Changed in version 1.4.1: Added support for *pos_hint*.

class `kivy.uix.boxlayout.`**`BoxLayout`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.layout.Layout`

Box layout class. See module documentation for more information.

`orientation`
Orientation of the layout.

`orientation` is an `OptionProperty` and defaults to 'horizontal'. Can be 'vertical' or 'horizontal'.

`padding`
Padding between layout box and children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced NumericProperty with VariableListProperty.

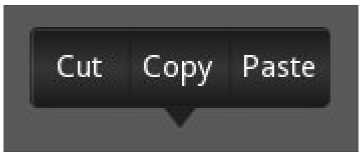
`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

`spacing`
Spacing between children, in pixels.

`spacing` is a `NumericProperty` and defaults to 0.

128.7 Bubble

New in version 1.1.0.



The Bubble widget is a form of menu or a small popup where the menu options are stacked either vertically or horizontally.

The `Bubble` contains an arrow pointing in the direction you choose.

128.7.1 Simple example

```
'''
Bubble
======

Test of the widget Bubble.
'''

from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.button import Button
from kivy.lang import Builder
from kivy.uix.bubble import Bubble

Builder.load_string('''
<cut_copy_paste>
    size_hint: (None, None)
    size: (160, 120)
    pos_hint: {'center_x': .5, 'y': .6}
    BubbleButton:
        text: 'Cut'
    BubbleButton:
        text: 'Copy'
    BubbleButton:
        text: 'Paste'
''')


class cut_copy_paste(Bubble):
    pass


class BubbleShowcase(FloatLayout):

    def __init__(self, **kwargs):
        super(BubbleShowcase, self).__init__(**kwargs)
        self.but_bubble = Button(text='Press to show bubble')
        self.but_bubble.bind(on_release=self.show_bubble)
        self.add_widget(self.but_bubble)

    def show_bubble(self, *l):
        if not hasattr(self, 'bubb'):
            self.bubb = bubb = cut_copy_paste()
            self.add_widget(bubb)
        else:
            values = ('left_top', 'left_mid', 'left_bottom', 'top_left',
                'top_mid', 'top_right', 'right_top', 'right_mid',
                'right_bottom', 'bottom_left', 'bottom_mid', 'bottom_right')
            index = values.index(self.bubb.arrow_pos)
            self.bubb.arrow_pos = values[(index + 1) % len(values)]


class TestBubbleApp(App):

    def build(self):
        return BubbleShowcase()

if __name__ == '__main__':
    TestBubbleApp().run()
```

128.7.2 Customize the Bubble

You can choose the direction in which the arrow points:

```
Bubble(arrow_pos='top_mid')
```

The widgets added to the Bubble are ordered horizontally by default, like a Boxlayout. You can change that by:

```
orientation = 'vertical'
```

To add items to the bubble:

```
bubble = Bubble(orientation = 'vertical')
bubble.add_widget(your_widget_instance)
```

To remove items:

```
bubble.remove_widget(widget)
or
bubble.clear_widgets()
```

To access the list of children, use content.children:

```
bubble.content.children
```

Warning: This is important! Do not use bubble.children

To change the appearance of the bubble:

```
bubble.background_color = (1, 0, 0, .5) #50% translucent red
bubble.border = [0, 0, 0, 0]
background_image = 'path/to/background/image'
arrow_image = 'path/to/arrow/image'
```

class `kivy.uix.bubble.`**`Bubble`**`(`***kwargs*`)`
Bases: `kivy.uix.gridlayout.GridLayout`

Bubble class. See module documentation for more information.

`arrow_image`
Image of the arrow pointing to the bubble.

`arrow_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/bubble_arrow'.

`arrow_pos`
Specifies the position of the arrow relative to the bubble. Can be one of: left_top, left_mid, left_bottom top_left, top_mid, top_right right_top, right_mid, right_bottom bottom_left, bottom_mid, bottom_right.

`arrow_pos` is a `OptionProperty` and defaults to 'bottom_mid'.

`background_color`
Background color, in the format (r, g, b, a).

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_image`
Background image of the bubble.

`background_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/bubble'.

`border`
Border used for `BorderImage` graphics instruction. Used with the `background_image`. It should be used when using custom backgrounds.

It must be a list of 4 values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16)

`content`
This is the object where the main content of the bubble is held.

`content` is a `ObjectProperty` and defaults to 'None'.

limit_to

Specifies the widget to which the bubbles position is restricted.

New in version 1.6.0.

`limit_to` is a `ObjectProperty` and defaults to 'None'.

orientation

This specifies the manner in which the children inside bubble are arranged. Can be one of 'vertical' or 'horizontal'.

`orientation` is a `OptionProperty` and defaults to 'horizontal'.

show_arrow

Indicates whether to show arrow.

New in version 1.8.0.

`show_arrow` is a `BooleanProperty` and defaults to *True*.

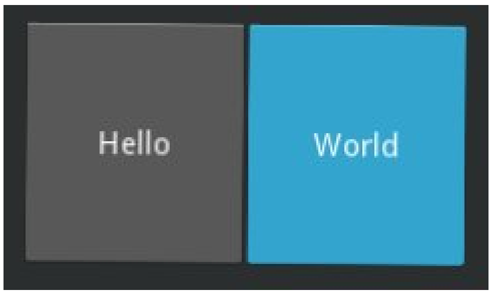
class `kivy.uix.bubble.`**`BubbleButton`**`(`***kwargs*`)`

Bases: `kivy.uix.button.Button`

A button intended for use in a Bubble widget. You can use a "normal" button class, but it will not look good unless the background is changed.

Rather use this BubbleButton widget that is already defined and provides a suitable background for you.

128.8 Button



The `Button` is a `Label` with associated actions that are triggered when the button is pressed (or released after a click/touch). To configure the button, the same properties are used as for the Label class:

```
button = Button(text='Hello world', font_size=14)
```

To attach a callback when the button is pressed (clicked/touched), use `bind`:

```
def callback(instance):
    print('The button <%s> is being pressed' % instance.text)

btn1 = Button(text='Hello world 1')
btn1.bind(on_press=callback)
btn2 = Button(text='Hello world 2')
btn2.bind(on_press=callback)
```

If you want to be notified every time the button state changes, you can bind to the `Button.state` property:

```
def callback(instance, value):
    print('My button <%s> state is <%s>' % (instance, value))
btn1 = Button(text='Hello world 1')
btn1.bind(state=callback)
```

class `kivy.uix.button.`**`Button`**`(`***kwargs*`)`

Bases: `kivy.uix.behaviors.ButtonBehavior`, `kivy.uix.label.Label`

Button class, see module documentation for more information.

Changed in version 1.8.0: The behavior / logic of the button has been moved to `ButtonBehaviors`.

`background_color`

Background color, in the format (r, g, b, a).

New in version 1.0.8.

The `background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_disabled_down`

Background image of the button used for the default graphical representation when the button is disabled and pressed.

New in version 1.8.0.

`background_disabled_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_disabled_pressed'.

`background_disabled_normal`

Background image of the button used for the default graphical representation when the button is disabled and not pressed.

New in version 1.8.0.

`background_disabled_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_disabled'.

`background_down`

Background image of the button used for the default graphical representation when the button is pressed.

New in version 1.0.4.

`background_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_pressed'.

`background_normal`

Background image of the button used for the default graphical representation when the button is not pressed.

New in version 1.0.4.

`background_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button'.

`border`

Border used for `BorderImage` graphics instruction. Used with `background_normal` and `background_down`. Can be used for custom backgrounds.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instruction for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16)

128.9 Camera

The Camera widget is used to capture and display video from a camera. Once the widget is created, the texture inside the widget will be automatically updated. Our CameraBase implementation is used under the hood:

```
cam = Camera()
```

By default, the first camera found on your system is used. To use a different camera, set the index property:

```
cam = Camera(index=1)
```

You can also select the camera resolution:

```
cam = Camera(resolution=(320, 240))
```

Warning: The camera texture is not updated as soon as you have created the object. The camera initialization is asynchronous, so there may be a delay before the requested texture is created.

class kivy.uix.camera.**Camera**(***kwargs*)
Bases: kivy.uix.image.Image

Camera class. See module documentation for more information.

index
Index of the used camera, starting from 0.

index is a NumericProperty and defaults to -1 to allow auto selection.

play
Boolean indicating whether the camera is playing or not. You can start/stop the camera by setting this property:

```
# start the camera playing at creation (default)
cam = Camera(play=True)

# create the camera, and start later
cam = Camera(play=False)
# and later
cam.play = True
```

play is a BooleanProperty and defaults to True.

resolution
Preferred resolution to use when invoking the camera. If you are using [-1, -1], the resolution will be the default one:

```
# create a camera object with the best image available
cam = Camera()

# create a camera object with an image of 320x240 if possible
cam = Camera(resolution=(320, 240))
```

Warning: Depending on the implementation, the camera may not respect this property.

resolution is a ListProperty and defaults to [-1, -1].

128.10 Carousel

New in version 1.4.0.

The Carousel widget provides the classic mobile-friendly carousel view where you can swipe between slides. You can add any content to the carousel and use it horizontally or verticaly. The carousel can display pages in loop or not.

Example:

```
class Example1(App):

    def build(self):
        carousel = Carousel(direction='right')
        for i in range(10):
            src = "http://placehold.it/480x270.png&text=slide-%d&.png" % i
            image = Factory.AsyncImage(source=src, allow_stretch=True)
            carousel.add_widget(image)
        return carousel

Example1().run()
```

Changed in version 1.5.0: The carousel now supports active children, like the ScrollView. It will detect a swipe gesture according to Carousel.scroll_timeout and Carousel.scroll_distance.

In addition, the container used for adding a slide is now hidden in the API. We made a mistake by exposing it to the user. The impacted properties are: Carousel.slides, Carousel.current_slide, Carousel.previous_slide and Carousel.next_slide.

class kivy.uix.carousel.**Carousel**(***kwargs*)
Bases: kivy.uix.stencilview.StencilView

Carousel class. See module documentation for more information.

anim_cancel_duration
Defines the duration of the animation when a swipe movement is not accepted. This is generally when the user doesnt swipe enough. See min_move.

anim_cancel_duration is a NumericProperty and defaults to 0.3.

anim_move_duration
Defines the duration of the Carousel animation between pages.

anim_move_duration is a NumericProperty and defaults to 0.5.

anim_type
Type of animation to use while animating in the next/previous slide.

New in version 1.8.0.

current_slide
The currently shown slide.

current_slide is an AliasProperty.

Changed in version 1.5.0: The property doesn't expose the container used for storing the slide. It returns widget you have added.

direction
Specifies the direction in which the slides are ordered i.e. the direction from which the user swipes to go from one slide to the next. Can be *right*, *left*, 'top', or *bottom*. For example, with the default value of *right*, the second slide is to the right of the first and the user would swipe from the right towards the left to get to the second slide.

`direction` is a `OptionProperty` and defaults to 'right'.

`index`
Get/Set the current visible slide based on the index.

`index` is a `AliasProperty` and defaults to 0 (the first item).

`load_next`(*mode='next'*)
Animate to next slide.

New in version 1.7.0.

`load_previous`()
Animate to the previous slide.

New in version 1.7.0.

`load_slide`(*slide*)
Animate to the slide that is passed as the argument.

Changed in version 1.8.0.

`loop`
Allow the Carousel to swipe infinitely. When the user reaches the last page, they will return to first page when trying to swipe to the next.

`loop` is a `BooleanProperty` and defaults to False.

`min_move`
Defines the minimal distance from the edge where the movement is considered a swipe gesture and the Carousel will change its content. This is a percentage of the Carousel width. If the movement doesn't reach this minimal value, then the movement is cancelled and the content is restored to its original position.

`min_move` is a `NumericProperty` and defaults to 0.2.

`next_slide`
The next slide in the Carousel. It is None if the current slide is the last slide in the Carousel. If `orientation` is 'horizontal', the next slide is to the right. If `orientation` is 'vertical', the next slide is towards the bottom.

`next_slide` is a `AliasProperty`.

Changed in version 1.5.0: The property doesn't expose the container used for storing the slide. It returns the widget you have added.

`previous_slide`
The previous slide in the Carousel. It is None if the current slide is the first slide in the Carousel. If `orientation` is 'horizontal', the previous slide is to the left. If `orientation` is 'vertical', the previous slide towards the bottom.

`previous_slide` is a `AliasProperty`.

Changed in version 1.5.0: This property doesn't expose the container used for storing the slide. It returns the widget you have added.

`scroll_distance`
Distance to move before scrolling the `Carousel` in pixels. As soon as the distance has been traveled, the `Carousel` will start to scroll, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

`scroll_distance` is a `NumericProperty` and defaults to 20dp.

New in version 1.5.0.

`scroll_timeout`
Timeout allowed to trigger the `scroll_distance`, in milliseconds. If the user has not

moved scroll_distance within the timeout, the scrolling will be disabled and the touch event will go to the children.

scroll_timeout is a NumericProperty and defaults to 200 (milliseconds)

New in version 1.5.0.

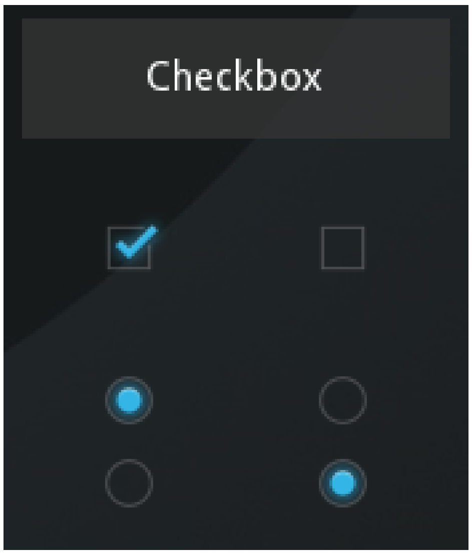
slides

List of slides inside the Carousel. The slides are added when a widget is added to Carousel using add_widget().

slides is a ListProperty and is read-only.

128.11 CheckBox

New in version 1.4.0.



CheckBox is a specific two-state button that can be either checked or unchecked. If the CheckBox is in a Group, it becomes a Radio button. As with the ToggleButton, only one Radio button at a time can be selected when the CheckBox.group is set.

An example usage:

```
from kivy.uix.checkbox import CheckBox

# ...

def on_checkbox_active(checkbox, value):
    if value:
        print('The checkbox', checkbox, 'is active')
    else:
        print('The checkbox', checkbox, 'is inactive')

checkbox = CheckBox()
checkbox.bind(active=on_checkbox_active)
```

class kivy.uix.checkbox.**CheckBox**(***kwargs*)

Bases: kivy.uix.behaviors.ToggleButtonBehavior, kivy.uix.widget.Widget

CheckBox class, see module documentation for more information.

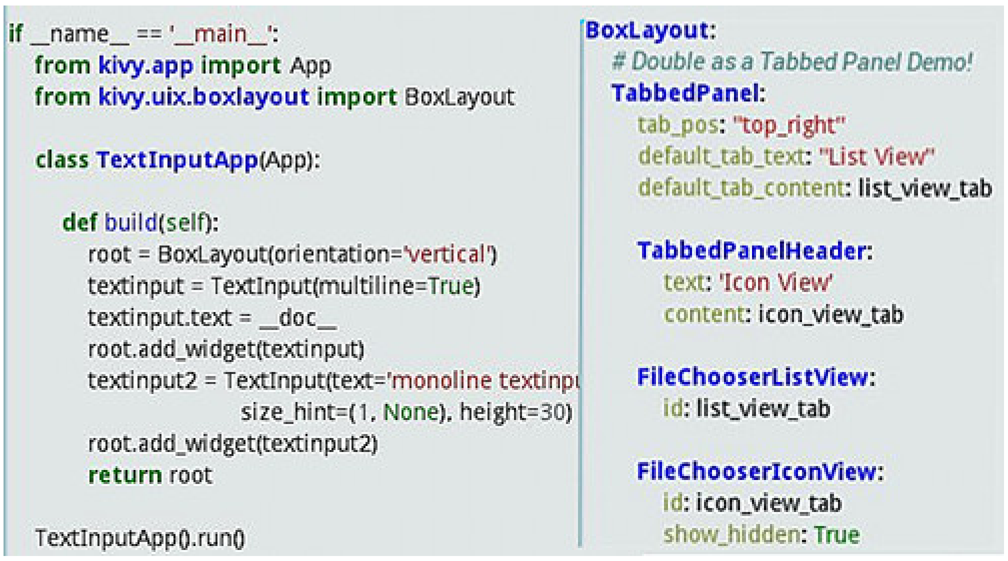
active

Indicates if the switch is active or inactive.

`active` is a `BooleanProperty` and defaults to False.

128.12 Code Input

New in version 1.5.0.



```
if __name__ == '__main__':
    from kivy.app import App
    from kivy.uix.boxlayout import BoxLayout

    class TextInputApp(App):

        def build(self):
            root = BoxLayout(orientation='vertical')
            textinput = TextInput(multiline=True)
            textinput.text = __doc__
            root.add_widget(textinput)
            textinput2 = TextInput(text='monoline textinpu
                                   size_hint=(1, None), height=30)
            root.add_widget(textinput2)
            return root

    TextInputApp().run()
```

```
BoxLayout:
    # Double as a Tabbed Panel Demo!
    TabbedPanel:
        tab_pos: "top_right"
        default_tab_text: "List View"
        default_tab_content: list_view_tab

        TabbedPanelHeader:
            text: 'Icon View'
            content: icon_view_tab

        FileChooserListView:
            id: list_view_tab

        FileChooserIconView:
            id: icon_view_tab
            show_hidden: True
```

The `CodeInput` provides a box of editable highlighted text like the one shown in the image.

It supports all the features provided by the `textinput` as well as code highlighting for languages supported by pygments along with *KivyLexer* for `kivy.lang` highlighting.

128.12.1 Usage example

To create a CodeInput with highlighting for *KV language*:

```
from kivy.uix.codeinput import CodeInput
from kivy.extras.highlight import KivyLexer
codeinput = CodeInput(lexer=KivyLexer())
```

To create a CodeInput with highlighting for *Cython*:

```
from kivy.uix.codeinput import CodeInput
from pygments.lexers import CythonLexer
codeinput = CodeInput(lexer=CythonLexer())
```

class `kivy.uix.codeinput.`**`CodeInput`**`(`***kwargs*`)`

Bases: `kivy.uix.textinput.TextInput`

CodeInput class, used for displaying highlighted code.

lexer

This holds the selected Lexer used by pygments to highlight the code.

`lexer` is an `ObjectProperty` and defaults to *PythonLexer*.

128.13 Color Picker

New in version 1.7.0.

Warning: This widget is experimental. Its use and API can change at any time until this warning is removed.

The ColorPicker widget allows a user to select a color from a chromatic wheel where pinch and zoom can be used to change the selected color. Sliders and TextInputs are also provided for entering the RGBA/HSV/HEX values directly.

Usage:

```
clr_picker = ColorPicker()
parent.add_widget(clr_picker)

# To monitor changes, we can bind to color property changes
def on_color(instance, value):
    print "RGBA = ", str(value)  #  or instance.color
    print "HSV = ", str(instance.hsv)
    print "HEX = ", str(instance.hex_color)

clr_picker.bind(color=on_color)
```

class `kivy.uix.colorpicker.`**`ColorPicker`**(***kwargs*)
Bases: `kivy.uix.relativelayout.RelativeLayout`

See module documentation.

`color`
The `color` holds the color currently selected in rgba format.

`color` is a `ListProperty` and defaults to (1, 1, 1, 1).

`font_name`
Specifies the font used on the ColorPicker.

`font_name` is a `StringProperty` and defaults to 'data/fonts/DroidSansMono.ttf'.

`hex_color`
The `hex_color` holds the currently selected color in hex.

`hex_color` is an `AliasProperty` and defaults to *#ffffffff*.

`hsv`
The `hsv` holds the color currently selected in hsv format.

`hsv` is a `ListProperty` and defaults to (1, 1, 1).

`wheel`
The `wheel` holds the color wheel.

`wheel` is an `ObjectProperty` and defaults to None.

class `kivy.uix.colorpicker.`**`ColorWheel`**(***kwargs*)
Bases: `kivy.uix.widget.Widget`

Chromatic wheel for the ColorPicker.

Changed in version 1.7.1: *font_size*, *font_name* and *foreground_color* have been removed. The sizing is now the same as others widget, based on 'sp'. Orientation is also automatically determined according to the width/height ratio.

a

The Alpha value of the color currently selected.

a is a BoundedNumericProperty and can be a value from 0 to 1.

b

The Blue value of the color currently selected.

b is a BoundedNumericProperty and can be a value from 0 to 1.

color

The holds the color currently selected.

color is a ReferenceListProperty and contains a list of *r*, *g*, *b*, *a* values.

g

The Green value of the color currently selected.

g is a BoundedNumericProperty and can be a value from 0 to 1.

r

The Red value of the color currently selected.

r is a BoundedNumericProperty and can be a value from 0 to 1. It defaults to 0.

128.14 Drop-Down List

New in version 1.4.0.

A versatile drop-down list that can be used with custom widgets. It allows you to display a list of widgets under a displayed widget. Unlike other toolkits, the list of widgets can contain any type of widget: simple buttons, images etc.

The positioning of the drop-down list is fully automatic: we will always try to place the dropdown list in a way that the user can select an item in the list.

128.14.1 Basic example

A button with a dropdown list of 10 possible values. All the buttons within the dropdown list will trigger the dropdown DropDown.select() method. After being called, the main button text will display the selection of the dropdown.

```
from kivy.uix.dropdown import DropDown
from kivy.uix.button import Button
from kivy.base import runTouchApp

# create a dropdown with 10 buttons
dropdown = DropDown()
for index in range(10):
    # when adding widgets, we need to specify the height manually (disabling
    # the size_hint_y) so the dropdown can calculate the area it needs.
    btn = Button(text='Value %d' % index, size_hint_y=None, height=44)

    # for each button, attach a callback that will call the select() method
    # on the dropdown. We'll pass the text of the button as the data of the
    # selection.
    btn.bind(on_release=lambda btn: dropdown.select(btn.text))

    # then add the button inside the dropdown
    dropdown.add_widget(btn)
```

```
# create a big main button
mainbutton = Button(text='Hello', size_hint=(None, None))

# show the dropdown menu when the main button is released
# note: all the bind() calls pass the instance of the caller (here, the
# mainbutton instance) as the first argument of the callback (here,
# dropdown.open.).
mainbutton.bind(on_release=dropdown.open)

# one last thing, listen for the selection in the dropdown list and
# assign the data to the button text.
dropdown.bind(on_select=lambda instance, x: setattr(mainbutton, 'text', x))

runTouchApp(mainbutton)
```

128.14.2 Extending dropdown in Kv

You could create a dropdown directly from your kv:

```
#:kivy 1.4.0
<CustomDropDown>:
    Button:
        text: 'My first Item'
        size_hint_y: None
        height: 44
        on_release: root.select('item1')
    Label:
        text: 'Unselectable item'
        size_hint_y: None
        height: 44
    Button:
        text: 'My second Item'
        size_hint_y: None
        height: 44
        on_release: root.select('item2')
```

And then, create the associated python class and use it:

```
class CustomDropDown(DropDown):
    pass

dropdown = CustomDropDown()
mainbutton = Button(text='Hello', size_hint=(None, None))
mainbutton.bind(on_release=dropdown.open)
dropdown.bind(on_select=lambda instance, x: setattr(mainbutton, 'text', x))
```

class `kivy.uix.dropdown.`**`DropDown`**`(`***kwargs*`)`

Bases: `kivy.uix.scrollview.ScrollView`

DropDown class. See module documentation for more information.

Events

on_select: **data**Fired when a selection is done. The data of the selection is passed in as the first argument and is what you pass in the `select()` method as the first argument.

on_dismiss:New in version 1.8.0.

Fired when the DropDown is dismissed, either on selection or on touching outside the widget.

attach_to
(internal) Property that will be set to the widget to which the drop down list is attached.

The `open()` method will automatically set this property whilst `dismiss()` will set it back to None.

auto_dismiss
By default, the dropdown will be automatically dismissed when a touch happens outside of it, this option allow to disable this feature

`auto_dismiss` is a `BooleanProperty` and defaults to True.

New in version 1.8.0.

auto_width
By default, the width of the dropdown will be the same as the width of the attached widget. Set to False if you want to provide your own width.

container
(internal) Property that will be set to the container of the dropdown list. It is a `GridLayout` by default.

dismiss(**largs*)
Remove the dropdown widget from the window and detach it from the attached widget.

dismiss_on_select
By default, the dropdown will be automatically dismissed when a selection has been done. Set to False to prevent the dismiss.

`dismiss_on_select` is a `BooleanProperty` and defaults to True.

max_height
Indicate the maximum height that the dropdown can take. If None, it will take the maximum height available until the top or bottom of the screen is reached.

`max_height` is a `NumericProperty` and defaults to None.

open(*widget*)
Open the dropdown list and attach it to a specific widget. Depending on the position of the widget within the window and the height of the dropdown, the dropdown might be above or below that widget.

select(*data*)
Call this method to trigger the *on_select* event with the *data* selection. The *data* can be anything you want.

128.15 EffectWidget

New in version 1.9.0: This code is still experimental, and its API is subject to change in a future version.

The `EffectWidget` is able to apply a variety of fancy graphical effects to its children. It works by rendering to a series of `Fbo` instances with custom opengl fragment shaders. As such, effects can freely do almost anything, from inverting the colors of the widget, to antialiasing, to emulating the appearance of a crt monitor!

The basic usage is as follows:

```
w = EffectWidget()
w.add_widget(Button(text='Hello!')
w.effects = [InvertEffect(), HorizontalBlurEffect(size=2.0)]
```

The effects can be a list of effects of any length, and they will be applied sequentially.

The module comes with a range of prebuilt effects, but the interface is designed to make it easy to create your own. Instead of writing a full glsl shader, you provide a single function that takes some inputs based on the screen (current pixel color, current widget texture etc.). See the sections below for more information.

Note: It is not efficient to resize an `EffectWidget`, as each `Fbo` is recreated every time. If you need to resize frequently, consider doing things a different way.

Note: Although some effects have adjustable parameters, it is *not* efficient to animate these, as the entire shader is reconstructed every time. You should use glsl uniform variables instead. The `AdvancedEffectBase` may make this easier.

Note: The `EffectWidget` *cannot* draw outside its own widget area (pos -> pos + size), any child widgets overlapping the boundary will be cut off at this point.

128.15.1 Provided Effects

The module comes with several pre-written effects. Some have adjustable properties (e.g. blur radius), see the individual effect documentation for more details.

- `MonochromeEffect` - makes the widget grayscale.
- `InvertEffect` - inverts the widget colors.
- `ChannelMixEffect` - swaps around color channels.
- `ScanlinesEffect` - displays flickering scanlines.
- `PixelateEffect` - pixelates the image.
- `HorizontalBlurEffect` - Gaussuan blurs horizontally.
- `VerticalBlurEffect` - Gaussuan blurs vertically.
- `FXAAEffect` - applies a very basic AA.

128.15.2 Creating Effects

Effects are designed to make it easy to create and use your own transformations. You do this by creating and using an instance of `EffectBase` with your own custom `EffectBase.glsl` property.

The glsl property is a string representing part of a glsl fragment shader. You can include as many functions as you like (the string is simply spliced into the whole shader), but it must implement a function `effect` as below:

```
vec4 effect(vec4 color, sampler2D texture, vec2 tex_coords, vec2 coords)
{
    // ... your code here
    return something;  // must be a vec4 representing the new color
}
```

The full shader will calculate the normal pixel colour at each point, then call your `effect` function to transform it. The parameters are:

- **color**: The normal colour of the current pixel (i.e. texture sampled at tex_coords).
- **texture**: The texture containing the widget's normal background.

- **tex_coords**: The normal texture_coords used to access texture.
- **coords**: The pixel indices of the current pixel.

The shader code also has access to two useful uniform variables, `time` containing the time (in seconds) since the program start, and `resolution` containing the shape (x pixels, y pixels) of the widget.

For instance, the following simple string (taken from the *InvertEffect*) would invert the input color but set alpha to 1.0:

```
vec4 effect(vec4 color, sampler2D texture, vec2 tex_coords, vec2 coords)
{
    return vec4(1.0 - color.xyz, 1.0);
}
```

You can also set the glsl by automatically loading the string from a file, simply set the `EffectBase.source` property of an effect.

class `kivy.uix.effectwidget.`**`EffectWidget`**`(`***kwargs*`)`
Bases: `kivy.uix.relativelayout.RelativeLayout`

Widget with the ability to apply a series of graphical effects to its children. See module documentation for full information on setting effects and creating your own.

`background_color`
This defines the background color to be used for the fbo in the EffectWidget.

`background_color` is a `ListProperty` defaults to (0, 0, 0, 1)

`effects`
List of all the effects to be applied. These should all be instances of `EffectBase`.

effects is a `ListProperty` and defaults to [].

`fbo_list`
(internal) list of all the fbos that are being used to apply the effects.

fbo_list is a `ListProperty` and defaults to [].

`refresh_fbo_setup``(`**args*`)`
(internal) Creates and assigns one `Fbo` per effect, and makes sure all sizes etc. are correct and consistent.

`texture`
The output texture of our final `Fbo` after all effects have been applied.

texture is an `ObjectProperty` and defaults to None.

class `kivy.uix.effectwidget.`**`EffectBase`**`(`**args, **kwargs*`)`
Bases: `kivy.event.EventDispatcher`

The base class for GLSL effects. It simply returns its input.

See module documentation for more details.

`fbo`
The fbo currently using this effect. The `EffectBase` automatically handles this.

`fbo` is a `ObjectProperty` and defaults to None.

`glsl`
The glsl string defining your effect function, see module documentation for more details.

`glsl` is a `StringProperty` and defaults to a trivial effect that returns its input.

set_fbo_shader(**args*)

Sets the Fbo's shader by splicing the glsl string into a full fragment shader.

The full shader is made up of `shader_header + shader_uniforms + self.glsl + shader_footer_effect`.

source

The (optional) filename from which to load the glsl string.

source is a StringProperty and defaults to ''.

class kivy.uix.effectwidget.**AdvancedEffectBase**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

An EffectBase with additional behavior to easily set and update uniform variables in your shader.

This class is provided for convenience if implementing your own effects, it is not used by any of those provided with Kivy.

In addition to your base glsl string that must be provided as normal, the AdvancedEffectBase has an extra property uniforms, a dictionary of name-value pairs. Whenever a value is changed, the new values for the uniform variable with the given name are uploaded to the shader.

You must still manually declare your uniform variables at the top of your glsl string.

uniforms

A dictionary of uniform variable names and their values. These are automatically uploaded to the `fbo` shader if appropriate.

uniforms is a DictProperty and defaults to {}.

class kivy.uix.effectwidget.**MonochromeEffect**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

Returns its input colours in monochrome.

class kivy.uix.effectwidget.**InvertEffect**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

Inverts the colours in the input.

class kivy.uix.effectwidget.**ChannelMixEffect**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

Mixes the color channels of the input according to the order property. Channels may be arbitrarily rearranged or repeated.

order

The new sorted order of the rgb channels.

order is a ListProperty and defaults to [1, 2, 0], corresponding to (g, b, r).

class kivy.uix.effectwidget.**ScanlinesEffect**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

Adds scanlines to the input.

class kivy.uix.effectwidget.**PixelateEffect**(**args*, ***kwargs*)

Bases: kivy.uix.effectwidget.EffectBase

Pixelates the input according to its pixel_size

pixel_size

Sets the size of a new 'pixel' in the effect, in terms of number of 'real' pixels.

pixel_size is a NumericProperty and defaults to 10.

class `kivy.uix.effectwidget.`**`HorizontalBlurEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Blurs the input horizontally, with the width given by `size`.

`size`
The blur width in pixels.

size is a `NumericProperty` and defaults to 4.0.

class `kivy.uix.effectwidget.`**`VerticalBlurEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Blurs the input vertically, with the width given by `size`.

`size`
The blur width in pixels.

size is a `NumericProperty` and defaults to 4.0.

class `kivy.uix.effectwidget.`**`FXAAEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Applies very simple antialiasing via fxaa.

128.16 FileChooser

New in version 1.0.5.

Changed in version 1.2.0: In the chooser template, the *controller* is not a direct reference anymore but a weak-reference. You must update all the notation *root.controller.xxx* to *root.controller().xxx*.

128.16.1 Simple example

main.py

```
#!/usr/bin/env python
from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.factory import Factory
from kivy.properties import ObjectProperty
from kivy.uix.popup import Popup

import os

class LoadDialog(FloatLayout):
    load = ObjectProperty(None)
    cancel = ObjectProperty(None)


class SaveDialog(FloatLayout):
    save = ObjectProperty(None)
    text_input = ObjectProperty(None)
    cancel = ObjectProperty(None)


class Root(FloatLayout):
    loadfile = ObjectProperty(None)
    savefile = ObjectProperty(None)
    text_input = ObjectProperty(None)
    def dismiss_popup(self):
        self._popup.dismiss()

    def show_load(self):
        content = LoadDialog(load=self.load, cancel=self.dismiss_popup)
        self._popup = Popup(title="Load file", content=content, size_hint=(0.9, 0.9))
        self._popup.open()

    def show_save(self):
        content = SaveDialog(save=self.save, cancel=self.dismiss_popup)
        self._popup = Popup(title="Save file", content=content, size_hint=(0.9, 0.9))
        self._popup.open()

    def load(self, path, filename):
        with open(os.path.join(path, filename[0])) as stream:
            self.text_input.text = stream.read()

        self.dismiss_popup()

    def save(self, path, filename):
        with open(os.path.join(path, filename), 'w') as stream:
            stream.write(self.text_input.text)

        self.dismiss_popup()


class Editor(App):
    pass


Factory.register('Root', cls=Root)
Factory.register('LoadDialog', cls=LoadDialog)
Factory.register('SaveDialog', cls=SaveDialog)

if __name__ == '__main__':
    Editor().run()
```

editor.kv

```
#:kivy 1.1.0

Root:
    text_input: text_input

    BoxLayout:
        orientation: 'vertical'
        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: 'Load'
                on_release: root.show_load()
            Button:
                text: 'Save'
                on_release: root.show_save()

        BoxLayout:
            TextInput:
                id: text_input
                text: ''

            RstDocument:
                text: text_input.text
                show_errors: True

<LoadDialog>:
    BoxLayout:
        size: root.size
        pos: root.pos
        orientation: "vertical"
        FileChooserListView:
            id: filechooser

        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: "Cancel"
                on_release: root.cancel()

            Button:
                text: "Load"
                on_release: root.load(filechooser.path, filechooser.selection)

<SaveDialog>:
    text_input: text_input
    BoxLayout:
        size: root.size
        pos: root.pos
        orientation: "vertical"
        FileChooserListView:
            id: filechooser
            on_selection: text_input.text = self.selection and self.selection[0] or ''

        TextInput:
            id: text_input
            size_hint_y: None
            height: 30
            multiline: False

        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: "Cancel"
                on_release: root.cancel()

            Button:
                text: "Save"
                on_release: root.save(filechooser.path, text_input.text)
```

class `kivy.uix.filechooser.`**`FileChooserListView`**(***kwargs*)

Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` using a list view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserIconView`**(***kwargs*)

Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` using an icon view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserListLayout`**`(`***kwargs*`)`
Bases: `kivy.uix.filechooser.FileChooserLayout`

File chooser layout using a list view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserIconLayout`**`(`***kwargs*`)`
Bases: `kivy.uix.filechooser.FileChooserLayout`

File chooser layout using an icon view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooser`**`(`***kwargs*`)`
Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` which supports switching between multiple, synced layout views.

New in version 1.9.0.

`manager`
Reference to the `ScreenManager` instance.

`ObjectProperty`

`view_list`
List of views added to this FileChooser.

`AliasProperty` of type `list`.

`view_mode`
Current layout view mode.

`AliasProperty` of type `str`.

class `kivy.uix.filechooser.`**`FileChooserController`**`(`***kwargs*`)`
Bases: `kivy.uix.floatlayout.FloatLayout`

Base for implementing a FileChooser. Don't use this class directly, but prefer using an implementation such as the `FileChooser`, `FileChooserListView` or `FileChooserIconView`.

Changed in version 1.9.0.

Events

on_entry_added: **entry, parent**Fired when a root-level entry is added to the file list.

*on_entries_cleared*Fired when the the entries list is cleared, usually when the root is refreshed.

on_subentry_to_entry: **entry, parent**Fired when a sub-entry is added to an existing entry.

on_remove_subentry: **entry, parent**Fired when entries are removed from an entry, usually when a node is closed.

on_submit: **selection, touch**Fired when a file has been selected with a double-tap.

`cancel``(`**largs*`)`
Cancel any background action started by filechooser, such as loading a new directory.

New in version 1.2.0.

dirselect
: BooleanProperty, defaults to False. Determines whether directories are valid selections or not.

  New in version 1.1.0.

entry_released(*entry, touch*)
: (internal) This method must be called by the template when an entry is touched by the user.

  New in version 1.1.0.

entry_touched(*entry, touch*)
: (internal) This method must be called by the template when an entry is touched by the user.

file_encodings
: Possible encodings for decoding a filename to unicode. In the case that the user has a weird filename, undecodable without knowing it's initial encoding, we have no other choice than to guess it.

  Please note that if you encounter an issue because of a missing encoding here, we'll be glad to add it to this list.

  New in version 1.3.0.

  Deprecated since version 1.8.0: This property is no longer used as the filechooser no longer decodes the file names.

  file_encodings is a ListProperty and defaults to ['utf-8', 'latin1', 'cp1252'],

file_system
: Implementation to access the file system. Must be an instance of FileSystemAbstract.

  New in version 1.8.0.

  ObjectProperty, defaults to FileSystemLocal()

files
: Read-only ListProperty. The list of files in the directory specified by path after applying the filters.

filter_dirs
: BooleanProperty, defaults to False. Indicates whether filters should also apply to directories.

filters
: ListProperty, defaults to [], equal to '*'. Specifies the filters to be applied to the files in the directory.

  The filters are not reset when the path changes. You need to do that yourself if desired.

  There are two kinds of filters: patterns and callbacks.

  1.Patterns

  e.g. ['*.png']. You can use the following patterns:

Pattern	Meaning
*	matches everything
?	matches any single character
[seq]	matches any character in seq
[!seq]	matches any character not in seq

  2.Callbacks

  You can specify a function that will be called for each file. The callback will be passed the folder and file name as the first and second parameters respectively. It should return True to indicate a match and False otherwise.

Changed in version 1.4.0: If the filter is a callable (function or method), it will be called with the path and the file name as arguments for each file in the directory. The callable should returns True to indicate a match and False overwise.

get_nice_size(*fn*)

Pass the filepath. Returns the size in the best human readable format or '' if it is a directory (Don't recursively calculate size.).

layout

Reference to the layout widget instance.

layout is an `ObjectProperty`.

New in version 1.9.0.

multiselect

`BooleanProperty`, defaults to False. Determines whether the user is able to select multiple files or not.

path

`StringProperty`, defaults to the current working directory as a unicode string. It specifies the path on the filesystem that this controller should refer to.

Warning: If a unicode path is specified, all the files returned will be in unicode allowing the display of unicode files and paths. If a bytes path is specified, only files and paths with ascii names will be displayed properly: non-ascii filenames will be displayed and listed with questions marks (?) instead of their unicode characters.

progress_cls

Class to use for displaying a progress indicator for filechooser loading.

New in version 1.2.0.

`ObjectProperty`, defaults to `FileChooserProgress`.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

rootpath

Root path to use instead of the system root path. If set, it will not show a ".." directory to go up to the root path. For example, if you set rootpath to /users/foo, the user will be unable to go to /users or to any other directory not starting with /users/foo.

New in version 1.2.0.

`StringProperty`, defaults to None.

Note: Similar to `path`, if *rootpath* is specified, whether it's a bytes or unicode string determines the type of the filenames and paths read.

selection

Read-only `ListProperty`. Contains the list of files that are currently selected.

show_hidden

`BooleanProperty`, defaults to False. Determines whether hidden files and folders should be shown.

sort_func

`ObjectProperty`. Provides a function to be called with a list of filenames, and the filesystem implementation as the second argument. Returns a list of filenames sorted for display in the view.

Changed in version 1.8.0: The signature needs now 2 arguments: first the list of files, second the filesystem class to use.

class `kivy.uix.filechooser.`**`FileChooserProgressBase`**`(`***kwargs*`)`
Bases: `kivy.uix.floatlayout.FloatLayout`

Base for implementing a progress view. This view is used when too many entries need to be created and are delayed over multiple frames.

New in version 1.2.0.

`cancel``(`**largs*`)`
Cancel any action from the FileChooserController.

`index`
Current index of `total` entries to be loaded.

`path`
Current path of the FileChooser, read-only.

`total`
Total number of entries to load.

class `kivy.uix.filechooser.`**`FileSystemAbstract`**
Bases: `object`

Class for implementing a File System view that can be used with the `FileChooser`.:attr:~*FileChooser.file_system*.

New in version 1.8.0.

`getsize``(`*fn*`)`
Return the size in bytes of a file

`is_dir``(`*fn*`)`
Return True if the argument passed to this method is a directory

`is_hidden``(`*fn*`)`
Return True if the file is hidden

`listdir``(`*fn*`)`
Return the list of files in the directory *fn*

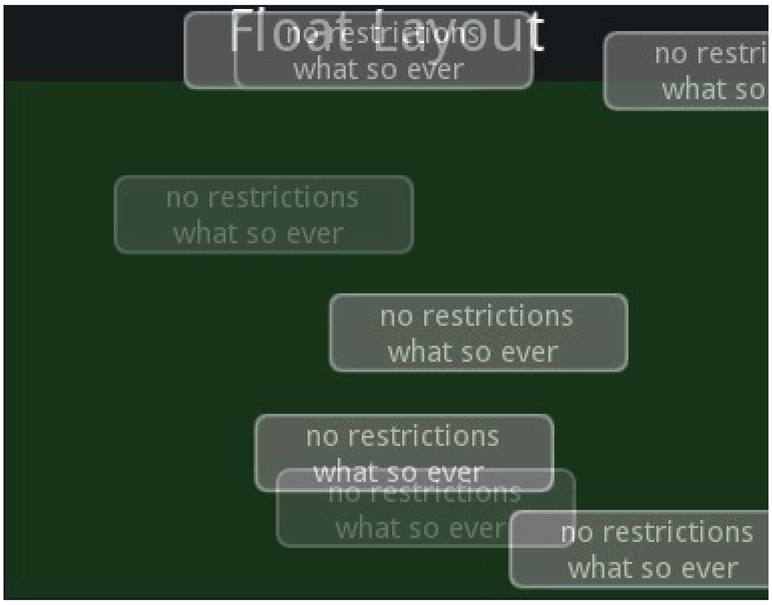
class `kivy.uix.filechooser.`**`FileSystemLocal`**
Bases: `kivy.uix.filechooser.FileSystemAbstract`

Implementation of `FileSystemAbstract` for local files

New in version 1.8.0.

128.17 Float Layout

The `FloatLayout` class honors only the `Widget.pos_hint` and `Widget.size_hint` attributes.



For example, a FloatLayout with a size of (300, 300) is created:

```
layout = FloatLayout(size=(300, 300))
```

By default, all widgets have their size_hint=(1, 1), so this button will adopt the same size as the layout:

```
button = Button(text='Hello world')
layout.add_widget(button)
```

To create a button 50% of the width and 25% of the height of the layout and positioned at (20, 20), you can do:

```
button = Button(
    text='Hello world',
    size_hint=(.5, .25),
    pos=(20, 20))
```

If you want to create a button that will always be the size of layout minus 20% on each side:

```
button = Button(text='Hello world', size_hint=(.6, .6),
                pos_hint={'x':.2, 'y':.2})
```

Note: This layout can be used for an application. Most of the time, you will use the size of Window.

Warning: If you are not using pos_hint, you must handle the positioning of the children: if the float layout is moving, you must handle moving the children too.

class `kivy.uix.floatlayout.`**`FloatLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

Float layout class. See module documentation for more information.

128.18 Gesture Surface

New in version 1.9.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

class `kivy.uix.gesturesurface.`**`GestureSurface`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

Simple gesture surface to track/draw touch movements. Typically used to gather user input suitable for `kivy.multistroke.Recognizer`.

Properties

temporal_windowTime to wait from the last touch_up event before attempting to recognize the gesture. If you set this to 0, the *on_gesture_complete* event is not fired unless the `max_strokes` condition is met.

`temporal_window` is a `NumericProperty` and defaults to 2.0

max_strokesMax number of strokes in a single gesture; if this is reached, recognition will start immediately on the final touch_up event. If this is set to 0, the *on_gesture_complete* event is not fired unless the `temporal_window` expires.

`max_strokes` is a `NumericProperty` and defaults to 2.0

bbox_marginBounding box margin for detecting gesture collisions, in pixels.

`bbox_margin` is a `NumericProperty` and defaults to 30

draw_timeoutNumber of seconds to keep lines/bbox on canvas after the *on_gesture_complete* event is fired. If this is set to 0, gestures are immediately removed from the surface when complete.

`draw_timeout` is a `NumericProperty` and defaults to 3.0

colorColor used to draw the gesture, in RGB. This option does not have an effect if `use_random_color` is True.

`draw_timeout` is a `ListProperty` and defaults to [1, 1, 1] (white)

use_random_colorSet to True to pick a random color for each gesture, if you do this then *color* is ignored. Defaults to False.

`use_random_color` is a `BooleanProperty` and defaults to False

line_widthLine width used for tracing touches on the surface. Set to 0 if you only want to detect gestures without drawing anything. If you use 1.0, OpenGL GL_LINE is used for drawing; values > 1 will use an internal drawing method based on triangles (less efficient), see `kivy.graphics`.

`line_width` is a `NumericProperty` and defaults to 2

draw_bboxSet to True if you want to draw bounding box behind gestures. This only works if *line_width* >= 1. Default is False.

`draw_bbox` is a `BooleanProperty` and defaults to True

bbox_alphaOpacity for bounding box if *draw_bbox* is True. Default 0.1

`bbox_alpha` is a `NumericProperty` and defaults to 0.1

Events

on_gesture_start **`GestureContainer`**Fired when a new gesture is initiated on the surface, ie the first on_touch_down that does not collide with an existing gesture on the surface.

on_gesture_extend **`GestureContainer`**Fired when a touch_down event occurs within an existing gesture.

on_gesture_merge **`GestureContainer`**, **`GestureContainer`**Fired when two gestures collide and get merged to one gesture. The first argument is the gesture that has been merged (no longer valid); the second is the combined (resulting) gesture.

on_gesture_complete `GestureContainer`Fired when a set of strokes is considered a complete gesture, this happens when *temporal_window* expires or *max_strokes* is reached. Typically you will bind to this event and use the provided *GestureContainer* get_vectors() method to match against your gesture database.

on_gesture_cleanup `GestureContainer`Fired *draw_timeout* seconds after *on_gesture_complete*, The gesture will be removed from the canvas (if line_width > 0 or draw_bbox is True) and the internal gesture list before this.

on_gesture_discard `GestureContainer`Fired when a gesture does not meet the minimum size requirements for recognition (width/height < 5, or consists only of single- point strokes).

`find_colliding_gesture`(*touch*)
Checks if a touch x/y collides with the bounding box of an existing gesture. If so, return it (otherwise returns None)

`get_gesture`(*touch*)
Returns GestureContainer associated with given touch

`init_gesture`(*touch*)
Create a new gesture from touch, ie it's the first on surface, or was not close enough to any existing gesture (yet)

`merge_gestures`(*g*, *other*)
Merges two gestures together, the oldest one is retained and the newer one gets the *GestureContainer.was_merged* flag raised.

`on_touch_down`(*touch*)
When a new touch is registered, the first thing we do is to test if it collides with the bounding box of another known gesture. If so, it is assumed to be part of that gesture.

`on_touch_move`(*touch*)
When a touch moves, we add a point to the line on the canvas so the path is updated. We must also check if the new point collides with the bouonding box of another gesture - if so, they should be merged.

class `kivy.uix.gesturesurface.`**`GestureContainer`**(*touch*, ***kwargs*)
Bases: `kivy.event.EventDispatcher`

Container object that stores information about a gesture. It has various properties that are updated by *GestureSurface* as drawing progresses.

Arguments

touchTouch object (as received by on_touch_down) used to initialize the gesture container. Required.

Properties

activeSet to False once the gesture is complete (meets *max_stroke* setting or *GestureSurface.temporal_window*)

`active` is a `BooleanProperty`

active_strokesNumber of strokes currently active in the gesture, ie concurrent touches associated with this gesture.

`active_strokes` is a `NumericProperty`

max_strokesMax number of strokes allowed in the gesture. This is set by *GestureSurface.max_strokes* but can be overridden for example from *on_gesture_start*.

`max_strokes` is a `NumericProperty`

was_mergedIndicates that this gesture has been merged with another gesture and should be considered discarded.

`was_merged` is a `BooleanProperty`

bboxDictionary with keys minx, miny, maxx, maxy. Represents the size of the gesture bounding box.

`bbox` is a `DictProperty`

widthRepresents the width of the gesture.

`width` is a `NumericProperty`

heightRepresents the height of the gesture.

`height` is a `NumericProperty`

`accept_stroke``(`*count=1*`)`
Returns True if this container can accept *count* new strokes

`add_stroke``(`*touch, line*`)`
Associate a list of points with a touch.uid; the line itself is created by the caller, but subsequent move/up events look it up via us. This is done to avoid problems during merge.

`complete_stroke``()`
Called on touch up events to keep track of how many strokes are active in the gesture (we only want to dispatch event when the *last* stroke in the gesture is released)

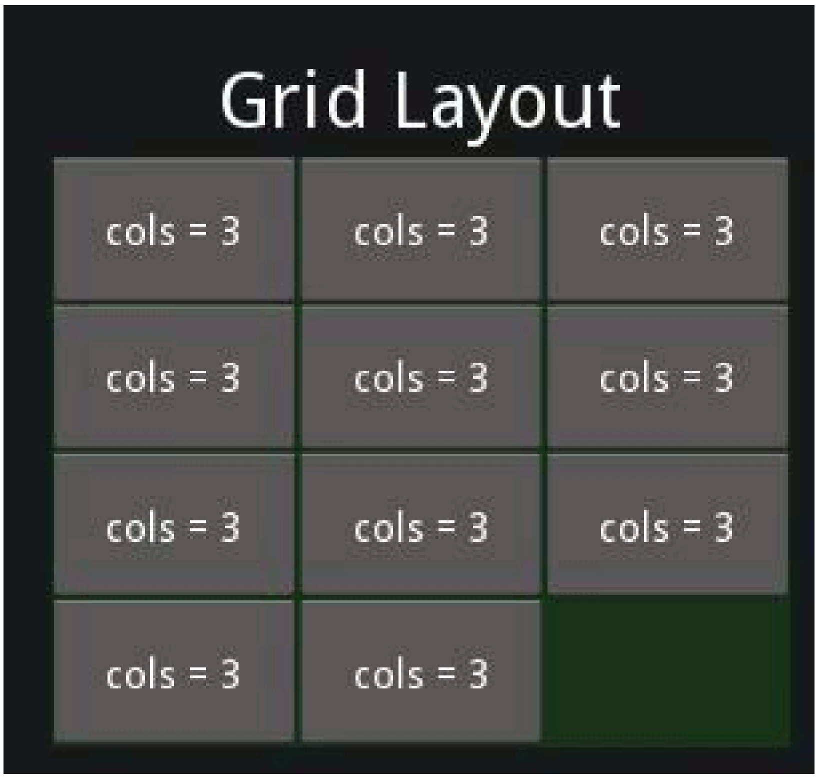
`get_vectors``(`***kwargs*`)`
Return strokes in a format that is acceptable for *kivy.multistroke.Recognizer* as a gesture candidate or template. The result is cached automatically; the cache is invalidated at the start and end of a stroke and if *update_bbox* is called. If you are going to analyze a gesture mid-stroke, you may need to set the *no_cache* argument to True.

`handles``(`*touch*`)`
Returns True if this container handles the given touch

`single_points_test``()`
Returns True if the gesture consists only of single-point strokes, we must discard it in this case, or an exception will be raised

`update_bbox``(`*touch*`)`
Update gesture bbox from a touch coordinate

128.19 Grid Layout



New in version 1.0.4.

The `GridLayout` arranges children in a matrix. It takes the available space and divides it into columns and rows, then adds widgets to the resulting "cells".

Changed in version 1.0.7: The implementation has changed to use the widget size_hint for calculating column/row sizes. *uniform_width* and *uniform_height* have been removed and other properties have added to give you more control.

128.19.1 Background

Unlike many other toolkits, you cannot explicitly place a widget in a specific column/row. Each child is automatically assigned a position determined by the layout configuration and the child's index in the children list.

A GridLayout must always have at least one input constraint: `GridLayout.cols` or `GridLayout.rows`. If you do not specify cols or rows, the Layout will throw an exception.

128.19.2 Column Width and Row Height

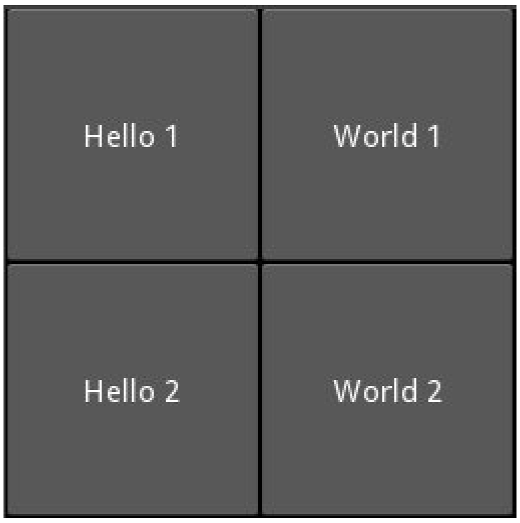
The column width/row height are determined in 3 steps:

- The initial size is given by the `col_default_width` and `row_default_height` properties. To customize the size of a single column or row, use `cols_minimum` or `rows_minimum`.
- The *size_hint_x*/*size_hint_y* of the children are taken into account. If no widgets have a size hint, the maximum size is used for all children.
- You can force the default size by setting the `col_force_default` or `row_force_default` property. This will force the layout to ignore the *width* and *size_hint* properties of children and use the default size.

128.19.3 Using a GridLayout

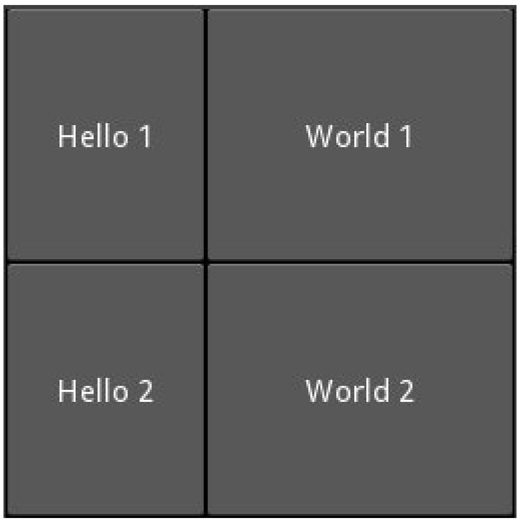
In the example below, all widgets will have an equal size. By default, the *size_hint* is (1, 1), so a Widget will take the full size of the parent:

```
layout = GridLayout(cols=2)
layout.add_widget(Button(text='Hello 1'))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2'))
layout.add_widget(Button(text='World 2'))
```



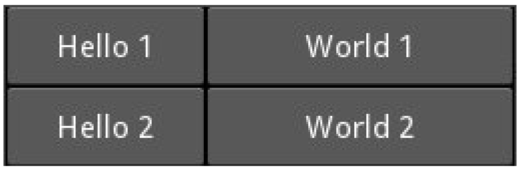
Now, let's fix the size of Hello buttons to 100px instead of using size_hint_x=1:

```
layout = GridLayout(cols=2)
layout.add_widget(Button(text='Hello 1', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 2'))
```



Next, let's fix the row height to a specific size:

```
layout = GridLayout(cols=2, row_force_default=True, row_default_height=40)
layout.add_widget(Button(text='Hello 1', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 2'))
```



class `kivy.uix.gridlayout.`**`GridLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

Grid layout class. See module documentation for more information.

`col_default_width`

Default minimum size to use for a column.

New in version 1.0.7.

`col_default_width` is a `NumericProperty` and defaults to 0.

`col_force_default`

If True, ignore the width and size_hint_x of the child and use the default column width.

New in version 1.0.7.

`col_force_default` is a `BooleanProperty` and defaults to False.

`cols`

Number of columns in the grid.

Changed in version 1.0.8: Changed from a NumericProperty to BoundedNumericProperty. You can no longer set this to a negative value.

`cols` is a `NumericProperty` and defaults to 0.

`cols_minimum`

List of minimum sizes for each column.

New in version 1.0.7.

`cols_minimum` is a `DictProperty` and defaults to {}.

`minimum_height`

Minimum height needed to contain all children.

New in version 1.0.8.

`minimum_height` is a `kivy.properties.NumericProperty` and defaults to 0.

`minimum_size`

Minimum size needed to contain all children.

New in version 1.0.8.

`minimum_size` is a `ReferenceListProperty` of (`minimum_width`, `minimum_height`) properties.

`minimum_width`

Minimum width needed to contain all children.

New in version 1.0.8.

`minimum_width` is a `kivy.properties.NumericProperty` and defaults to 0.

`padding`

Padding between the layout box and it's children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced NumericProperty with VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

`row_default_height`
Default minimum size to use for row.

New in version 1.0.7.

`row_default_height` is a `NumericProperty` and defaults to 0.

`row_force_default`
If True, ignore the height and size_hint_y of the child and use the default row height.

New in version 1.0.7.

`row_force_default` is a `BooleanProperty` and defaults to False.

`rows`
Number of rows in the grid.

Changed in version 1.0.8: Changed from a NumericProperty to a BoundedNumericProperty. You can no longer set this to a negative value.

`rows` is a `NumericProperty` and defaults to 0.

`rows_minimum`
List of minimum sizes for each row.

New in version 1.0.7.

`rows_minimum` is a `DictProperty` and defaults to {}.

`spacing`
Spacing between children: [spacing_horizontal, spacing_vertical].

spacing also accepts a one argument form [spacing].

`spacing` is a `VariableListProperty` and defaults to [0, 0].

class `kivy.uix.gridlayout.`**`GridLayoutException`**
Bases: `exceptions.Exception`

Exception for errors if the grid layout manipulation fails.

128.20 Image

The `Image` widget is used to display an image:

```
wimg = Image(source='mylogo.png')
```

128.20.1 Asynchronous Loading

To load an image asynchronously (for example from an external webserver), use the `AsyncImage` subclass:

```
aimg = AsyncImage(source='http://mywebsite.com/logo.png')
```

This can be useful as it prevents your application from waiting until the image is loaded. If you want to display large images or retrieve them from URL's, using AsyncImage will allow these resources to be retrieved on a background thread without blocking your application.

128.20.2 Alignment

By default, the image is centered and fits inside the widget bounding box. If you don't want that, you can set *allow_stretch* to True and *keep_ratio* to False.

You can also inherit from Image and create your own style.

For example, if you want your image to be greater than,the size of your widget, you could do:

```
class FullImage(Image):
    pass
```

And in your kivy language file:

```
<-FullImage>:
    canvas:
        Color:
            rgb: (1, 1, 1)
        Rectangle:
            texture: self.texture
            size: self.width + 20, self.height + 20
            pos: self.x - 10, self.y - 10
```

class `kivy.uix.image.`**`Image`**`(`***kwargs*`)`
Bases: `kivy.uix.widget.Widget`

Image class, see module documentation for more information.

`allow_stretch`
If True, the normalized image size will be maximized to fit in the image box. Otherwise, if the box is too tall, the image will not be stretched more than 1:1 pixels.

New in version 1.0.7.

`allow_stretch` is a `BooleanProperty` and defaults to False.

`anim_delay`
Delay the animation if the image is sequenced (like an animated gif). If anim_delay is set to -1, the animation will be stopped.

New in version 1.0.8.

`anim_delay` is a `NumericProperty` and defaults to 0.25 (4 FPS).

`color`
Image color, in the format (r, g, b, a). This attribute can be used to 'tint' an image. Be careful: if the source image is not gray/white, the color will not really work as expected.

New in version 1.0.6.

`color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`image_ratio`
Ratio of the image (width / float(height).

`image_ratio` is a `AliasProperty` and is read-only.

keep_data

If True, the underlaying _coreimage will store the raw image data. This is useful when performing pixel based collision detection.

New in version 1.3.0.

keep_data is a BooleanProperty and defaults to False.

keep_ratio

If False along with allow_stretch being True, the normalized image size will be maximized to fit in the image box and ignores the aspect ratio of the image. Otherwise, if the box is too tall, the image will not be stretched more than 1:1 pixels.

New in version 1.0.8.

keep_ratio is a BooleanProperty and defaults to True.

mipmap

Indicate if you want OpenGL mipmapping to be applied to the texture. Read *Mipmapping* for more information.

New in version 1.0.7.

mipmap is a BooleanProperty and defaults to False.

nocache

If this property is set True, the image will not be added to the internal cache. The cache will simply ignore any calls trying to append the core image.

New in version 1.6.0.

nocache is a BooleanProperty and defaults to False.

norm_image_size

Normalized image size within the widget box.

This size will always fit the widget size and will preserve the image ratio.

norm_image_size is a AliasProperty and is read-only.

reload()

Reload image from disk. This facilitates re-loading of images from disk in case the image content changes.

New in version 1.3.0.

Usage:

```
im = Image(source = '1.jpg')
# -- do something --
im.reload()
# image will be re-loaded from disk
```

source

Filename / source of your image.

source is a StringProperty and defaults to None.

texture

Texture object of the image.

Depending of the texture creation, the value will be a Texture or a TextureRegion object.

texture is a ObjectProperty and defaults to None.

`texture_size`

Texture size of the image.

> **Warning:** The texture size is set after the texture property. So if you listen to the change on `texture`, the property texture_size will not be up-to-date. Use self.texture.size instead.

class `kivy.uix.image.`**`AsyncImage`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.image.Image`

Asynchronous Image class. See the module documentation for more information.

> **Note:** The AsyncImage is a specialized form of the Image class. You may want to refer to the `loader` documentation and in particular, the `ProxyImage` for more detail on how to handle events around asynchronous image loading.

128.21 Label

The `Label` widget is for rendering text. It supports ascii and unicode strings:

```
# hello world text
l = Label(text='Hello world')

# unicode text; can only display glyphs that are available in the font
l = Label(text=u'Hello world ' + unichr(2764))

# multiline text
l = Label(text='Multi\nLine')

# size
l = Label(text='Hello world', font_size='20sp')
```

128.21.1 Markup text

New in version 1.1.0.

You can change the style of the text using *Text Markup*. The syntax is similar to the bbcode syntax but only the inline styling is allowed:

```
# hello world with world in bold
l = Label(text='Hello [b]World[/b]', markup=True)

# hello in red, world in blue
l = Label(text='[color=ff3333]Hello[/color][color=3333ff]World[/color]',
    markup = True)
```

If you need to escape the markup from the current text, use `kivy.utils.escape_markup()`:

```
text = 'This is an important message [1]'
l = Label(text='[b]' + escape_markup(text) + '[/b]', markup=True)
```

The following tags are available:

`[b][/b]` Activate bold text

`[i][/i]` Activate italic text

`[font=<str>][/font]` Change the font

`[size=<integer>][/size]` Change the font size

`[color=#<color>][/color]` Change the text color

`[ref=<str>][/ref]` Add an interactive zone. The reference + bounding box inside the reference will be available in `Label.refs`

`[anchor=<str>]` Put an anchor in the text. You can get the position of your anchor within the text with `Label.anchors`

`[sub][/sub]` Display the text at a subscript position relative to the text before it.

`[sup][/sup]` Display the text at a superscript position relative to the text before it.

If you want to render the markup text with a [or] or & character, you need to escape them. We created a simple syntax:

```
[   -> &bl;
]   -> &br;
&   -> &amp;
```

Then you can write:

```
"[size=24]Hello &bl;World&bt;[/size]"
```

128.21.2 Interactive Zone in Text

New in version 1.1.0.

You can now have definable "links" using text markup. The idea is to be able to detect when the user clicks on part of the text and to react. The tag `[ref=xxx]` is used for that.

In this example, we are creating a reference on the word "World". When this word is clicked, the function `print_it` will be called with the name of the reference:

```
def print_it(instance, value):
    print('User clicked on', value)
widget = Label(text='Hello [ref=world]World[/ref]', markup=True)
widget.bind(on_ref_press=print_it)
```

For prettier rendering, you could add a color for the reference. Replace the `text=` in the previous example with:

```
'Hello [ref=world][color=0000ff]World[/color][/ref]'
```

128.21.3 Usage example

The following example marks the anchors and references contained in a label:

```
from kivy.app import App
from kivy.uix.label import Label
from kivy.clock import Clock
from kivy.graphics import Color, Rectangle


class TestApp(App):
    @staticmethod
    def get_x(label, ref_x):
        """ Return the x value of the ref/anchor relative to the canvas """
        return label.center_x - label.texture_size[0] * 0.5 + ref_x

    @staticmethod
    def get_y(label, ref_y):
        """ Return the y value of the ref/anchor relative to the canvas """
        # Note the inversion of direction, as y values start at the top of
        # the texture and increase downwards
        return label.center_y + label.texture_size[1] * 0.5 - ref_y

    def show_marks(self, label):

        # Indicate the position of the anchors with a red top marker
        for name, anc in label.anchors.items():
            with label.canvas:
                Color(1, 0, 0)
                Rectangle(pos=(self.get_x(label, anc[0]),
                               self.get_y(label, anc[1])),
                          size=(3, 3))

        # Draw a green surround around the refs. Note the sizes y inversion
        for name, boxes in label.refs.items():
            for box in boxes:
                with label.canvas:
                    Color(0, 1, 0, 0.25)
                    Rectangle(pos=(self.get_x(label, box[0]),
                                   self.get_y(label, box[1])),
                              size=(box[2] - box[0],
                                    box[1] - box[3]))

    def build(self):
        label = Label(
            text='[anchor=a]a\nChars [anchor=b]b\n[ref=myref]ref[/ref]',
            markup=True)
        Clock.schedule_once(lambda dt: self.show_marks(label), 1)
        return label

TestApp().run()
```

class `kivy.uix.label.`**`Label`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Label class, see module documentation for more information.

Events

on_ref_press Fired when the user clicks on a word referenced with a `[ref]` tag in a text markup.

`anchors`

New in version 1.1.0.

Position of all the `[anchor=xxx]` markup in the text. These co-ordinates are relative to the top left corner of the text, with the y value increasing downwards. Anchors names should be unique and only the first occurence of any duplicate anchors will be recorded.

You can place anchors in your markup text as follows:

```
text = """
    [anchor=title1][size=24]This is my Big title.[/size]
    [anchor=content]Hello world
"""
```

Then, all the `[anchor=]` references will be removed and you'll get all the anchor positions in this property (only after rendering):

```
>>> widget = Label(text=text, markup=True)
>>> widget.texture_update()
>>> widget.anchors
{"content": (20, 32), "title1": (20, 16)}
```

Note: This works only with markup text. You need `markup` set to True.

`bold`

Indicates use of the bold version of your font.

Note: Depending of your font, the bold attribute may have no impact on your text rendering.

`bold` is a `BooleanProperty` and defaults to False.

`color`

Text color, in the format (r, g, b, a)

`color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`disabled_color`

Text color, in the format (r, g, b, a)

New in version 1.8.0.

`disabled_color` is a `ListProperty` and defaults to [1, 1, 1, .5].

`font_name`

Filename of the font to use. The path can be absolute or relative. Relative paths are resolved by the `resource_find()` function.

Warning: Depending of your text provider, the font file can be ignored. However, you can mostly use this without problems.
If the font used lacks the glyphs for the particular language/symbols you are using, you will see '[]' blank box characters instead of the actual glyphs. The solution is to use a font that has the glyphs you need to display. For example, to display क, use a font such as freesans.ttf that has the glyph.

`font_name` is a `StringProperty` and defaults to 'DroidSans'.

`font_size`

Font size of the text, in pixels.

`font_size` is a `NumericProperty` and defaults to 12dp.

`halign`

Horizontal alignment of the text.

`halign` is an `OptionProperty` and defaults to 'left'. Available options are : left, center, right and justify.

Warning: This doesn't change the position of the text texture of the Label (centered), only the position of the text in this texture. You probably want to bind the size of the Label to the `texture_size` or set a `text_size`.

Changed in version 1.6.0: A new option was added to `halign`, namely *justify*.

italic

Indicates use of the italic version of your font.

Note: Depending of your font, the italic attribute may have no impact on your text rendering.

`italic` is a `BooleanProperty` and defaults to False.

line_height

Line Height for the text. e.g. line_height = 2 will cause the spacing between lines to be twice the size.

`line_height` is a `NumericProperty` and defaults to 1.0.

New in version 1.5.0.

markup

New in version 1.1.0.

If True, the text will be rendered using the `MarkupLabel`: you can change the style of the text using tags. Check the *Text Markup* documentation for more information.

`markup` is a `BooleanProperty` and defaults to False.

max_lines

Maximum number of lines to use, defaults to 0, which means unlimited. Please note that `shorten` take over this property. (with shorten, the text is always one line.)

New in version 1.8.0.

`max_lines` is a `NumericProperty` and defaults to 0.

mipmap

Indicates whether OpenGL mipmapping is applied to the texture or not. Read *Mipmapping* for more information.

New in version 1.0.7.

`mipmap` is a `BooleanProperty` and defaults to False.

padding

Padding of the text in the format (padding_x, padding_y)

`padding` is a `ReferenceListProperty` of (`padding_x`, `padding_y`) properties.

padding_x

Horizontal padding of the text inside the widget box.

`padding_x` is a `NumericProperty` and defaults to 0.

Changed in version 1.9.0: *padding_x* has been fixed to work as expected. In the past, the text was padded by the negative of its values.

padding_y

Vertical padding of the text inside the widget box.

`padding_y` is a `NumericProperty` and defaults to 0.

Changed in version 1.9.0: *padding_y* has been fixed to work as expected. In the past, the text was padded by the negative of its values.

refs

New in version 1.1.0.

List of `[ref=xxx]` markup items in the text with the bounding box of all the words contained in a ref, available only after rendering.

For example, if you wrote:

```
Check out my [ref=hello]link[/ref]
```

The refs will be set with:

```
{'hello': ((64, 0, 78, 16), )}
```

The references marked "hello" have a bounding box at (x1, y1, x2, y2). These co-ordinates are relative to the top left corner of the text, with the y value increasing downwards. You can define multiple refs with the same name: each occurence will be added as another (x1, y1, x2, y2) tuple to this list.

The current Label implementation uses these references if they exist in your markup text, automatically doing the collision with the touch and dispatching an *on_ref_press* event.

You can bind a ref event like this:

```
def print_it(instance, value):
    print('User click on', value)
widget = Label(text='Hello [ref=world]World[/ref]', markup=True)
widget.on_ref_press(print_it)
```

Note: This works only with markup text. You need `markup` set to True.

shorten

Indicates whether the label should attempt to shorten its textual contents as much as possible if a `text_size` is given. Setting this to True without an appropriately set `text_size` will lead to unexpected results.

`shorten_from` and `split_str` control the direction from which the `text` is split, as well as where in the `text` we are allowed to split.

`shorten` is a `BooleanProperty` and defaults to False.

shorten_from

The side from which we should shorten the text from, can be left, right, or center.

For example, if left, the ellipsis will appear towards the left side and we will display as much text starting from the right as possible. Similar to `shorten`, this option only applies when `text_size` [0] is not None, In this case, the string is shortened to fit within the specified width.

New in version 1.9.0.

`shorten_from` is a `OptionProperty` and defaults to *center*.

split_str

The string used to split the `text` while shortening the string when `shorten` is True.

For example, if it's a space, the string will be broken into words and as many whole words that can fit into a single line will be displayed. If `shorten_from` is the empty string, '', we split on every character fitting as much text as possible into the line.

New in version 1.9.0.

`split_str` is a `StringProperty` and defaults to '' (the empty string).

strip

Whether leading and trailing spaces and newlines should be stripped from each displayed line. If True, every line will start at the right or left edge, depending on halign. If halign is *justify* it is implicitly True.

New in version 1.9.0.

strip is a BooleanProperty and defaults to False.

text

Text of the label.

Creation of a simple hello world:

```
widget = Label(text='Hello world')
```

If you want to create the widget with an unicode string, use:

```
widget = Label(text=u'My unicode string')
```

text is a StringProperty and defaults to ''.

text_size

By default, the label is not constrained to any bounding box. You can set the size constraint of the label with this property. The text will autoflow into the constrains. So although the font size will not be reduced, the text will be arranged to fit into the box as best as possible, with any text still outside the box clipped.

This sets and clips texture_size to text_size if not None.

New in version 1.0.4.

For example, whatever your current widget size is, if you want the label to be created in a box with width=200 and unlimited height:

```
Label(text='Very big big line', text_size=(200, None))
```

Note: This text_size property is the same as the usersize property in the Label class. (It is named size= in the constructor.)

text_size is a ListProperty and defaults to (None, None), meaning no size restriction by default.

texture

Texture object of the text. The text is rendered automatically when a property changes. The OpenGL texture created in this operation is stored in this property. You can use this texture for any graphics elements.

Depending on the texture creation, the value will be a Texture or TextureRegion object.

Warning: The texture update is scheduled for the next frame. If you need the texture immediately after changing a property, you have to call the texture_update() method before accessing texture:

```
l = Label(text='Hello world')
# l.texture is good
l.font_size = '50sp'
# l.texture is not updated yet
l.texture_update()
# l.texture is good now.
```

`texture` is an `ObjectProperty` and defaults to None.

`texture_size`

Texture size of the text. The size is determined by the font size and text. If `text_size` is [None, None], the texture will be the size required to fit the text, otherwise it's clipped to fit `text_size`.

When `text_size` is [None, None], one can bind to texture_size and rescale it proportionally to fit the size of the label in order to make the text fit maximally in the label.

> **Warning:** The `texture_size` is set after the `texture` property. If you listen for changes to `texture`, `texture_size` will not be up-to-date in your callback. Bind to `texture_size` instead.

`texture_update`(**largs*)

Force texture recreation with the current Label properties.

After this function call, the `texture` and `texture_size` will be updated in this order.

`valign`

Vertical alignment of the text.

`valign` is an `OptionProperty` and defaults to 'bottom'. Available options are : bottom, middle and top.

> **Warning:** This doesn't change the position of the text texture of the Label (centered), only the position of the text within this texture. You probably want to bind the size of the Label to the `texture_size` or set a `text_size` to change this behavior.

128.22 Layout

Layouts are used to calculate and assign widget positions.

The `Layout` class itself cannot be used directly. You should use one of the following layout classes:

- Anchor layout: `kivy.uix.anchorlayout.AnchorLayout`
- Box layout: `kivy.uix.boxlayout.BoxLayout`
- Float layout: `kivy.uix.floatlayout.FloatLayout`
- Grid layout: `kivy.uix.gridlayout.GridLayout`
- Page Layout: `kivy.uix.pagelayout.PageLayout`
- Relative layout: `kivy.uix.relativelayout.RelativeLayout`
- Scatter layout: `kivy.uix.scatterlayout.ScatterLayout`
- Stack layout: `kivy.uix.stacklayout.StackLayout`

128.22.1 Understanding the *size_hint* Property in *Widget*

The `size_hint` is a tuple of values used by layouts to manage the sizes of their children. It indicates the size relative to the layout's size instead of an absolute size (in pixels/points/cm/etc). The format is:

```
widget.size_hint = (width_percent, height_percent)
```

The percent is specified as a floating point number in the range 0-1. For example, 0.5 is 50%, 1 is 100%.

If you want a widget's width to be half of the parent's width and the height to be identical to the parent's height, you would do:

```
widget.size_hint = (0.5, 1.0)
```

If you don't want to use a size_hint for either the width or height, set the value to None. For example, to make a widget that is 250px wide and 30% of the parent's height, do:

```
widget.size_hint = (None, 0.3)
widget.width = 250
```

Changed in version 1.4.1: The *reposition_child* internal method (made public by mistake) has been removed.

class `kivy.uix.layout.`**`Layout`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.widget.Widget`

Layout interface class, used to implement every layout. See module documentation for more information.

`do_layout``(`*`*largs`*`)`

This function is called when a layout is needed by a trigger. If you are writing a new Layout subclass, don't call this function directly but use `_trigger_layout()` instead.

New in version 1.0.8.

128.23 List View

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `ListView` implements an `AbstractView` as a vertical, scrollable,pannable list clipped to the scrollview's bounding box and contains list item view instances.

The `AbstractView` has one property: `adapter`. The adapter can be one of the following: a `SimpleListAdapter`, a `ListAdapter` or a `DictAdapter`. The `Adapter` can make use of `args_converters` to prepare you data for passing into the constructor for each item view instantiation.

For an overview of how all these components fit together, please see the `adapters` module documentation.

128.23.1 Introduction

Lists are central parts of many software projects. Kivy's approach to lists includes providing solutions for simple lists, along with a substantial framework for building lists of moderate to advanced complexity. For a new user, it can be difficult to ramp up from simple to advanced. For this reason, Kivy provides an extensive set of examples (with the Kivy package) that you may wish to run first, to get a taste of the range of functionality offered. You can tell from the names of the examples that they illustrate the "ramping up" from simple to advanced:

- kivy/examples/widgets/lists/list_simple.py
- kivy/examples/widgets/lists/list_simple_in_kv.py

- kivy/examples/widgets/lists/list_simple_in_kv_2.py
- kivy/examples/widgets/lists/list_master_detail.py
- kivy/examples/widgets/lists/list_two_up.py
- kivy/examples/widgets/lists/list_kv.py
- kivy/examples/widgets/lists/list_composite.py
- kivy/examples/widgets/lists/list_cascade.py
- kivy/examples/widgets/lists/list_cascade_dict.py
- kivy/examples/widgets/lists/list_cascade_images.py
- kivy/examples/widgets/lists/list_ops.py

Many of the examples feature selection, some restricting selection to single selection, where only one item at at time can be selected, and others allowing multiple item selection. Many of the examples illustrate how selection in one list can be connected to actions and selections in another view or another list.

Find your own way of reading the documentation here, examining the source code for the example apps and running the examples. Some may prefer to read the documentation through first, others may want to run the examples and view their code. No matter what you do, going back and forth will likely be needed.

128.23.2 Basic Example

In its simplest form, we make a listview with 100 items:

```
from kivy.uix.listview import ListView
from kivy.base import runTouchApp


class MainView(ListView):
    def __init__(self, **kwargs):
        super(MainView, self).__init__(
            item_strings=[str(index) for index in range(100)])

if __name__ == '__main__':
    runTouchApp(MainView())
```

Or, we could declare the listview using the kv language:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.lang import Builder
from kivy.base import runTouchApp

Builder.load_string("""
<MyListView>:
    ListView:
        item_strings: [str(index) for index in range(100)]
""")


class MyListView(BoxLayout):
    pass

if __name__ == '__main__':
    runTouchApp(MyListView())
```

128.23.3 Using an Adapter

Behind the scenes, the basic example above uses the SimpleListAdapter. When the constructor for the ListView sees that only a list of strings is provided as an argument (called item_strings), it creates a SimpleListAdapter using the list of strings.

"Simple" in SimpleListAdapter means *without selection support*. It is a scrollable list of items that does not respond to touch events.

To use a SimpleListAdaper explicitly when creating a ListView instance, do:

```
simple_list_adapter = SimpleListAdapter(
        data=["Item #{0}".format(i) for i in range(100)],
        cls=Label)

list_view = ListView(adapter=simple_list_adapter)
```

The instance of SimpleListAdapter has a required data argument which contains data items to use for instantiating Label views for the list view (note the cls=Label argument). The data items are strings. Each item string is set by the SimpleListAdapter as the *text* argument for each Label instantiation.

You can declare a ListView with an adapter in a kv file with special attention given to the way longer python blocks are indented:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.base import runTouchApp
from kivy.lang import Builder

# Note the special nature of indentation in the adapter declaration, where
# the adapter: is on one line, then the value side must be given at one
# level of indentation.

Builder.load_string("""
#:import label kivy.uix.label
#:import sla kivy.adapters.simplelistadapter

<MyListView>:
    ListView:
        adapter:
            sla.SimpleListAdapter(
            data=["Item #{0}".format(i) for i in range(100)],
            cls=label.Label)
""")


class MyListView(BoxLayout):
    pass

if __name__ == '__main__':
    runTouchApp(MyListView())
```

128.23.4 ListAdapter and DictAdapter

For most use cases, your data is more complex than a simple list of strings. Selection functionality is also often needed. The ListAdapter and DictAdapter cover these more elaborate needs.

The ListAdapter is the base class for DictAdapter, so we can start with it.

Refer to the ListAdapter docs for details, but here is a synopses of its arguments:

- `data`: strings, class instances, dicts, etc. that form the base data for instantiating views.
- `cls`: a Kivy view that is to be instantiated for each list item. There are several built-in types available, including ListItemLabel and ListItemButton, or you can make your own class that mixes in the required `SelectableView`.
- `template`: the name of a Kivy language (kv) template that defines the Kivy view for each list item.

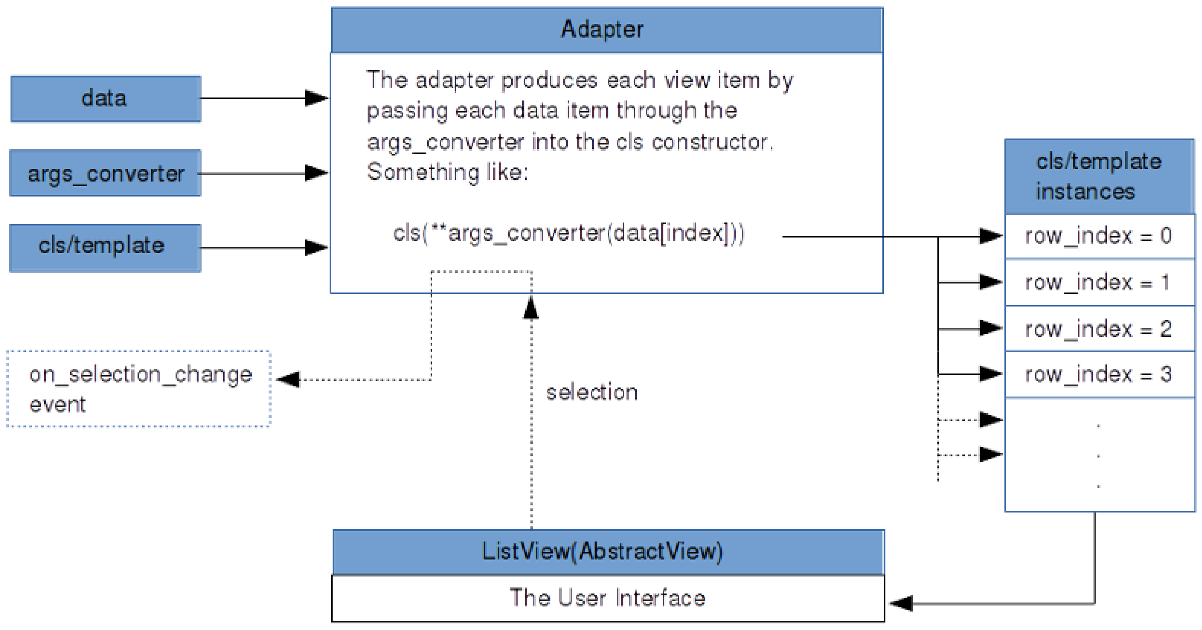
Note: Pick only one, cls or template, to provide as an argument.

- `args_converters`: a function that takes a data item object as input and uses it to build and return an args dict, ready to be used in a call to instantiate item views using the item view cls or template. In the case of cls, the args dict becomes a kwargs constructor argument. For a template, it is treated as a context (ctx) but is essentially similar in form to the kwargs usage.
- `selection_mode`: a string with the value 'single', 'multiple' or other.
- `allow_empty_selection`: a boolean, which if False (the default), forces there to always be a selection if there is data available. If True, selection happens only as a result of user action.

In narrative, we can summarize as follows:

> A listview's adapter takes data items and uses an args_converter function to transform them into arguments for creating list item view instances, using either a cls or a kv template.

In a graphic, a summary of the relationship between a listview and its components can be summarized as follows:


Adapter
The adapter produces each view item by passing each data item through the args_converter into the cls constructor. Something like:
cls(**args_converter(data[index]))
data
args_converter
cls/template
on_selection_change event
selection
cls/template instances
row_index = 0
row_index = 1
row_index = 2
row_index = 3
ListView(AbstractView)
The User Interface

Please refer to the `adapters` documentation for more details.

A `DictAdapter` has the same arguments and requirements as a `ListAdapter` except for two things:

1. There is an additional argument, sorted_keys, which must meet the requirements of normal python dictionary keys.
2. The data argument is, as you would expect, a dict. Keys in the dict must include the keys in the sorted_keys argument, but they may form a superset of the keys in sorted_keys. Values may be strings, class instances, dicts, etc. (The args_converter uses it accordingly).

128.23.5 Using an Args Converter

A ListView allows use of built-in list item views, such as ListItemButton, your own custom item view class or a custom kv template. Whichever type of list item view is used, an *args_converter* function is needed to prepare, per list data item, kwargs for the cls or the ctx for the template.

Note: Only the ListItemLabel, ListItemButton or custom classes like them (and not the simple Label or Button classes) are to be used in the listview system.

Warning: ListItemButton inherits the *background_normal* and *background_down* properties from the Button widget, so the *selected_color* and *deselected_color* are not represented faithfully by default.

Here is an args_converter for use with the built-in ListItemButton specified as a normal Python function:

```
def args_converter(row_index, an_obj):
    return {'text': an_obj.text,
            'size_hint_y': None,
            'height': 25}
```

and as a lambda:

```
args_converter = lambda row_index, an_obj: {'text': an_obj.text,
                                             'size_hint_y': None,
                                             'height': 25}
```

In the args converter example above, the data item is assumed to be an object (class instance), hence the reference an_obj.text.

Here is an example of an args converter that works with list data items that are dicts:

```
args_converter = lambda row_index, obj: {'text': obj['text'],
                                          'size_hint_y': None,
                                          'height': 25}
```

So, it is the responsibility of the developer to code the args_converter according to the data at hand. The row_index argument can be useful in some cases, such as when custom labels are needed.

128.23.6 An Example ListView

Now, to some example code:

```
from kivy.adapters.listadapter import ListAdapter
from kivy.uix.listview import ListItemButton, ListView

data = [{'text': str(i), 'is_selected': False} for i in range(100)]

args_converter = lambda row_index, rec: {'text': rec['text'],
                                          'size_hint_y': None,
                                          'height': 25}

list_adapter = ListAdapter(data=data,
                           args_converter=args_converter,
                           cls=ListItemButton,
                           selection_mode='single',
                           allow_empty_selection=False)
```

```
list_view = ListView(adapter=list_adapter)
```

This listview will show 100 buttons with text of 0 to 100. The args_converter function converts the dict items in the data and instantiates ListItemButton views by passing these converted items into it's constructor. The listview will only allow single selection and the first item will already be selected as allow_empty_selection is False. For a complete discussion on these arguments, please see the `ListAdapter` documentation.

The `ListItemLabel` works in much the same way as the `ListItemButton`.

128.23.7 Using a Custom Item View Class

The data used in an adapter can be any of the normal Python types or custom classes, as shown below. It is up to the programmer to assure that the args_converter performs the appropriate conversions.

Here we make a simple DataItem class that has the required text and is_selected properties:

```
from kivy.uix.listview import ListItemButton
from kivy.adapters.listadapter import ListAdapter


class DataItem(object):
    def __init__(self, text='', is_selected=False):
        self.text = text
        self.is_selected = is_selected

data_items = [DataItem(text='cat'),
              DataItem(text='dog'),
              DataItem(text='frog')]

list_item_args_converter = lambda row_index, obj: {'text': obj.text,
                                                   'size_hint_y': None,
                                                   'height': 25}

list_adapter = ListAdapter(data=data_items,
                           args_converter=list_item_args_converter,
                           propagate_selection_to_data=True,
                           cls=ListItemButton)

list_view = ListView(adapter=list_adapter)
```

The data is passed to the `ListAdapter` along with an args_converter function. The propagation setting means that the is_selected property for each data item will be set and kept in sync with the list item views. This setting should be set to True if you wish to initialize the view with item views already selected.

You may also use the provided `SelectableDataItem` mixin to make a custom class. Instead of the "manually-constructed" DataItem class above, we could do:

```
from kivy.adapters.models import SelectableDataItem

class DataItem(SelectableDataItem):
    # Add properties here.
    pass
```

`SelectableDataItem` is a simple mixin class that has an is_selected property.

128.23.8 Using an Item View Template

SelectableView is another simple mixin class that has required properties for a list item: text, and is_selected. To make your own template, mix it in as follows:

```
from kivy.lang import Builder

Builder.load_string("""
[CustomListItem@SelectableView+BoxLayout]:
    size_hint_y: ctx.size_hint_y
    height: ctx.height
    ListItemButton:
        text: ctx.text
        is_selected: ctx.is_selected
""")
```

A class called CustomListItem can then be instantiated for each list item. Note that it subclasses a BoxLayout and is thus a type of layout. It contains a ListItemButton instance.

Using the power of the Kivy language (kv), you can easily build composite list items: in addition to ListItemButton, you could have a ListItemLabel or a custom class you have defined and registered via the Factory.

An args_converter needs to be constructed that goes along with such a kv template. For example, to use the kv template above:

```
list_item_args_converter = \
        lambda row_index, rec: {'text': rec['text'],
                                'is_selected': rec['is_selected'],
                                'size_hint_y': None,
                                'height': 25}
integers_dict = \
    { str(i): {'text': str(i), 'is_selected': False} for i in range(100)}

dict_adapter = DictAdapter(sorted_keys=[str(i) for i in range(100)],
                           data=integers_dict,
                           args_converter=list_item_args_converter,
                           template='CustomListItem')

list_view = ListView(adapter=dict_adapter)
```

A dict adapter is created with 1..100 integer strings as sorted_keys, and an integers_dict as data. integers_dict has the integer strings as keys and dicts with text and is_selected properties. The CustomListItem defined above in the Builder.load_string() call is set as the kv template for the list item views. The list_item_args_converter lambda function will take each dict in integers_dict and will return an args dict, ready for passing as the context (ctx) for the template.

128.23.9 Using CompositeListItem

The class CompositeListItem is another option for building advanced composite list items. The kv language approach has its advantages, but here we build a composite list view using a plain Python:

```
args_converter = lambda row_index, rec: \
    {'text': rec['text'],
    'size_hint_y': None,
    'height': 25,
    'cls_dicts': [{'cls': ListItemButton,
                   'kwargs': {'text': rec['text']}},
                {'cls': ListItemLabel,
                    'kwargs': {'text': "Middle-{0}".format(rec['text']),
                            'is_representing_cls': True}},
                {'cls': ListItemButton,
                    'kwargs': {'text': rec['text']}}]}

item_strings = ["{0}".format(index) for index in range(100)]

integers_dict = \
    {str(i): {'text': str(i), 'is_selected': False} for i in range(100)}

dict_adapter = DictAdapter(sorted_keys=item_strings,
                           data=integers_dict,
                           args_converter=args_converter,
                           selection_mode='single',
                           allow_empty_selection=False,
                           cls=CompositeListItem)

list_view = ListView(adapter=dict_adapter)
```

The args_converter is somewhat complicated, so we should go through the details. Observe in the `DictAdapter` instantiation that `CompositeListItem` instance is set as the cls to be instantiated for each list item component. The args_converter will make args dicts for this cls. In the args_converter, the first three items, text, size_hint_y, and height, are arguments for the CompositeListItem itself. After that you see a cls_dicts list that contains argument sets for each of the member widgets for this composite: 2 `ListItemButtons` and a `ListItemLabel`. This is a similar approach to using a kv template described above.

For details on how `CompositeListItem` works, examine the code, looking for how parsing of the cls_dicts list and kwargs processing is done.

128.23.10 Uses for Selection

What can we do with selection? Combining selection with the system of bindings in Kivy, we can build a wide range of user interface designs.

We could make data items that contain the names of dog breeds, and connect the selection of dog breed to the display of details in another view, which would update automatically on selection. This is done via a binding to the `on_selection_change` event:

```
list_adapter.bind(on_selection_change=callback_function)
```

where callback_function() gets passed the adapter as an argument and does whatever is needed for the update. See the example called list_master_detail.py, and imagine that the list on the left could be a list of dog breeds, and the detail view on the right could show details for a selected dog breed.

In another example, we could set the selection_mode of a listview to 'multiple', and load it with a list of answers to a multiple-choice question. The question could have several correct answers. A color swatch view could be bound to selection change, as above, so that it turns green as soon as the correct choices are made, unless the number of touches exeeds a limit, then the answer session could be terminated. See the examples that feature thumbnail images to get some ideas, e.g., list_cascade_dict.py.

In a more involved example, we could chain together three listviews, where selection in the first controls the items shown in the second, and selection in the second controls the items shown in the third. If allow_empty_selection were set to False for these listviews, a dynamic system of selection "cascading" from one list to the next, would result.

There are so many ways that listviews and Kivy bindings functionality can be used, that we have only scratched the surface here. For on-disk examples, see:

```
kivy/examples/widgets/lists/list_*.py
```

Several examples show the "cascading" behavior described above. Others demonstrate the use of kv templates and composite list views.

class `kivy.uix.listview.`**`SelectableView`**`(`***kwargs*`)`

Bases: `object`

The `SelectableView` mixin is used to design list items and other classes that are to be instantiated by an adapter for use in a listview. The `ListAdapter` and `DictAdapter` adapters are selection-enabled. select() and deselect() are to be overridden with display code to mark items as selected or not, if desired.

`deselect``(`**args*`)`

The list item is responsible for updating the display for being unselected, if desired.

`index`

The index into the underlying data list or the data item this view represents.

`index` is a `NumericProperty`, default to -1.

`is_selected`

A SelectableView instance carries this property, which should be kept in sync with the equivalent property in the data item it represents.

`is_selected` is a `BooleanProperty`, default to False.

`select``(`**args*`)`

The list item is responsible for updating the display for being selected, if desired.

class `kivy.uix.listview.`**`ListItemButton`**`(`***kwargs*`)`

Bases: `kivy.uix.listview.ListItemReprMixin`, `kivy.uix.listview.SelectableView`, `kivy.uix.button.Button`

`ListItemButton` mixes `SelectableView` with `Button` to produce a button suitable for use in `ListView`.

`deselected_color`

`deselected_color` is a `ListProperty` and defaults to [0., 1., 0., 1].

`selected_color`

`selected_color` is a `ListProperty` and defaults to [1., 0., 0., 1].

class `kivy.uix.listview.`**`ListItemLabel`**`(`***kwargs*`)`

Bases: `kivy.uix.listview.ListItemReprMixin`, `kivy.uix.listview.SelectableView`, `kivy.uix.label.Label`

`ListItemLabel` mixes `SelectableView` with `Label` to produce a label suitable for use in `ListView`.

class `kivy.uix.listview.`**`CompositeListItem`**`(`***kwargs*`)`

Bases: `kivy.uix.listview.SelectableView`, `kivy.uix.boxlayout.BoxLayout`

`CompositeListItem` mixes `SelectableView` with `BoxLayout` for a generic container-style list item, to be used in `ListView`.

`background_color`

ListItem sublasses Button, which has background_color, but for a composite list item, we must add this property.

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`deselected_color`

`deselected_color` is a `ListProperty` and defaults to [.33, .33, .33, 1].

representing_cls
Which component view class, if any, should represent for the composite list item in __repr__()?

representing_cls is an ObjectProperty and defaults to None.

selected_color
selected_color is a ListProperty and defaults to [1., 0., 0., 1].

class kivy.uix.listview.**ListView**(***kwargs*)
Bases: kivy.uix.abstractview.AbstractView, kivy.event.EventDispatcher

ListView is a primary high-level widget, handling the common task of presenting items in a scrolling list. Flexibility is afforded by use of a variety of adapters to interface with data.

The adapter property comes via the mixed in AbstractView class.

ListView also subclasses EventDispatcher for scrolling. The event *on_scroll_complete* is used in refreshing the main view.

For a simple list of string items, without selection, use SimpleListAdapter. For list items that respond to selection, ranging from simple items to advanced composites, use ListAdapter. For an alternate powerful adapter, use DictAdapter, rounding out the choice for designing highly interactive lists.

Events
on_scroll_complete: **(boolean,)**Fired when scrolling completes.

container
The container is a GridLayout widget held within a ScrollView widget. (See the associated kv block in the Builder.load_string() setup). Item view instances managed and provided by the adapter are added to this container. The container is cleared with a call to clear_widgets() when the list is rebuilt by the populate() method. A padding Widget instance is also added as needed, depending on the row height calculations.

container is an ObjectProperty and defaults to None.

divider
[TODO] Not used.

divider_height
[TODO] Not used.

item_strings
If item_strings is provided, create an instance of SimpleListAdapter with this list of strings, and use it to manage a no-selection list.

item_strings is a ListProperty and defaults to [].

row_height
The row_height property is calculated on the basis of the height of the container and the count of items.

row_height is a NumericProperty and defaults to None.

scrolling
If the scroll_to() method is called while scrolling operations are happening, a call recursion error can occur. scroll_to() checks to see that scrolling is False before calling populate(). scroll_to() dispatches a scrolling_complete event, which sets scrolling back to False.

scrolling is a BooleanProperty and defaults to False.

128.24 ModalView

New in version 1.4.0.

The ModalView widget is used to create modal views. By default, the view will cover the whole "parent" window.

Remember that the default size of a Widget is size_hint=(1, 1). If you don't want your view to be fullscreen, either use size hints with values lower than 1 (for instance size_hint=(.8, .8)) or deactivate the size_hint and use fixed size attributes.

128.24.1 Examples

Example of a simple 400x400 Hello world view:

```
view = ModalView(size_hint=(None, None), size=(400, 400))
view.add_widget(Label(text='Hello world'))
```

By default, any click outside the view will dismiss it. If you don't want that, you can set ModalView.auto_dismiss to False:

```
view = ModalView(auto_dismiss=False)
view.add_widget(Label(text='Hello world'))
view.open()
```

To manually dismiss/close the view, use the ModalView.dismiss() method of the ModalView instance:

```
view.dismiss()
```

Both ModalView.open() and ModalView.dismiss() are bindable. That means you can directly bind the function to an action, e.g. to a button's on_press

```
# create content and add it to the view
content = Button(text='Close me!')
view = ModalView(auto_dismiss=False)
view.add_widget(content)

# bind the on_press event of the button to the dismiss function
content.bind(on_press=view.dismiss)

# open the view
view.open()
```

128.24.2 ModalView Events

There are two events available: *on_open* which is raised when the view is opening, and *on_dismiss* which is raised when the view is closed. For *on_dismiss*, you can prevent the view from closing by explictly returning True from your callback.

```
def my_callback(instance):
    print('ModalView', instance, 'is being dismissed, but is prevented!')
    return True
view = ModalView()
view.add_widget(Label(text='Hello world'))
view.bind(on_dismiss=my_callback)
view.open()
```

Changed in version 1.5.0: The ModalView can be closed by hitting the escape key on the keyboard if the `ModalView.auto_dismiss` property is True (the default).

class `kivy.uix.modalview.`**`ModalView`**`(`***kwargs*`)`

Bases: `kivy.uix.anchorlayout.AnchorLayout`

ModalView class. See module documentation for more information.

Events

on_open:Fired when the ModalView is opened.

on_dismiss:Fired when the ModalView is closed. If the callback returns True, the dismiss will be canceled.

`attach_to`

If a widget is set on attach_to, the view will attach to the nearest parent window of the widget. If none is found, it will attach to the main/global Window.

`attach_to` is an `ObjectProperty` and defaults to None.

`auto_dismiss`

This property determines if the view is automatically dismissed when the user clicks outside it.

`auto_dismiss` is a `BooleanProperty` and defaults to True.

`background`

Background image of the view used for the view background.

`background` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/modalview-background'.

`background_color`

Background color in the format (r, g, b, a).

`background_color` is a `ListProperty` and defaults to [0, 0, 0, .7].

`border`

Border used for `BorderImage` graphics instruction. Used for the `background_normal` and the `background_down` properties. Can be used when using custom backgrounds.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16).

`dismiss``(`**largs, **kwargs*`)`

Close the view if it is open. If you really want to close the view, whatever the on_dismiss event returns, you can use the *force* argument:

```
view = ModalView(...)
view.dismiss(force=True)
```

When the view is dismissed, it will be faded out before being removed from the parent. If you don't want animation, use:

```
view.dismiss(animation=False)
```

`open``(`**largs*`)`

Show the view window from the `attach_to` widget. If set, it will attach to the nearest window. If the widget is not attached to any window, the view will attach to the global `Window`.

128.25 PageLayout

The `PageLayout` class is used to create a simple multi-page layout, in a way that allows easy flipping of one page to another using borders.

`PageLayout` doesn't honor size_hint or pos_hint in any way currently.

New in version 1.8.0.

example:

```
PageLayout:
    Button:
        text: 'page1'

    Button:
        text: 'page2'

    Button:
        text: 'page3'
```

class `kivy.uix.pagelayout.`**`PageLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

PageLayout class. See module documentation for more information.

`border`

Width of the border used around the current page to display the previous/next page when needed.

`border` is a `NumericProperty`, defaults to 0.

`page`

Currently displayed page.

`page` is a `NumericProperty`, defaults to 0.

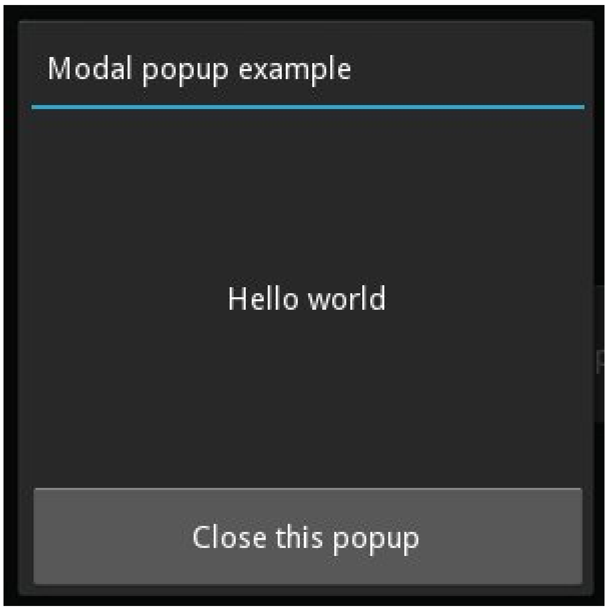
`swipe_threshold`

Thresold to the swipe action triggering, as percentage of the widget size.

`swipe_threshold` is a `NumericProperty`, defaults to .5.

128.26 Popup

New in version 1.0.7.



The Popup widget is used to create modal popups. By default, the popup will cover the whole "parent" window. When you are creating a popup, you must at least set a Popup.title and Popup.content.

Remember that the default size of a Widget is size_hint=(1, 1). If you don't want your popup to be fullscreen, either use size hints with values less than 1 (for instance size_hint=(.8, .8)) or deactivate the size_hint and use fixed size attributes.

Changed in version 1.4.0: The Popup class now inherits from ModalView. The Popup offers a default layout with a title and a separation bar.

128.26.1 Examples

Example of a simple 400x400 Hello world popup:

```
popup = Popup(title='Test popup',
    content=Label(text='Hello world'),
    size_hint=(None, None), size=(400, 400))
```

By default, any click outside the popup will dismiss/close it. If you don't want that, you can set auto_dismiss to False:

```
popup = Popup(title='Test popup', content=Label(text='Hello world'),
              auto_dismiss=False)
popup.open()
```

To manually dismiss/close the popup, use dismiss:

```
popup.dismiss()
```

Both open() and dismiss() are bindable. That means you can directly bind the function to an action, e.g. to a button's on_press:

```
# create content and add to the popup
content = Button(text='Close me!')
popup = Popup(content=content, auto_dismiss=False)

# bind the on_press event of the button to the dismiss function
content.bind(on_press=popup.dismiss)
```

```
# open the popup
popup.open()
```

128.26.2 Popup Events

There are two events available: *on_open* which is raised when the popup is opening, and *on_dismiss* which is raised when the popup is closed. For *on_dismiss*, you can prevent the popup from closing by explictly returning True from your callback:

```
def my_callback(instance):
    print('Popup', instance, 'is being dismissed but is prevented!')
    return True
popup = Popup(content=Label(text='Hello world'))
popup.bind(on_dismiss=my_callback)
popup.open()
```

class `kivy.uix.popup.`**`Popup`**`(`***kwargs*`)`

Bases: `kivy.uix.modalview.ModalView`

Popup class. See module documentation for more information.

Events

***on_open*:**Fired when the Popup is opened.

***on_dismiss*:**Fired when the Popup is closed. If the callback returns True, the dismiss will be canceled.

`content`

Content of the popup that is displayed just under the title.

`content` is an `ObjectProperty` and defaults to None.

`separator_color`

Color used by the separator between title and content.

New in version 1.1.0.

`separator_color` is a `ListProperty` and defaults to [47 / 255., 167 / 255., 212 / 255., 1.]

`separator_height`

Height of the separator.

New in version 1.1.0.

`separator_height` is a `NumericProperty` and defaults to 2dp.

`title`

String that represents the title of the popup.

`title` is a `StringProperty` and defaults to 'No title'.

`title_color`

Color used by the Title.

New in version 1.8.0.

`title_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`title_size`

Represents the font size of the popup title.

New in version 1.6.0.

`title_size` is a `NumericProperty` and defaults to '14sp'.

class `kivy.uix.popup.`**`PopupException`**

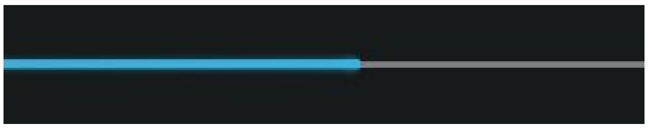
Bases: `exceptions.Exception`

Popup exception, fired when multiple content widgets are added to the popup.

New in version 1.4.0.

128.27 Progress Bar

New in version 1.0.8.



The `ProgressBar` widget is used to visualize the progress of some task. Only the horizontal mode is currently supported: the vertical mode is not yet available.

The progress bar has no interactive elements and is a display-only widget.

To use it, simply assign a value to indicate the current progress:

```
from kivy.uix.progressbar import ProgressBar
pb = ProgressBar(max=1000)

# this will update the graphics automatically (75% done)
pb.value = 750
```

class `kivy.uix.progressbar.`**`ProgressBar`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Class for creating a progress bar widget.

See module documentation for more details.

`max`

Maximum value allowed for `value`.

`max` is a `NumericProperty` and defaults to 100.

`value`

Current value used for the slider.

`value` is an `AliasProperty` that returns the value of the progress bar. If the value is < 0 or > `max`, it will be normalized to those boundaries.

Changed in version 1.6.0: The value is now limited to between 0 and `max`.

`value_normalized`

Normalized value inside the range 0-1:

```
>>> pb = ProgressBar(value=50, max=100)
>>> pb.value
50
>>> slider.value_normalized
0.5
```

`value_normalized` is an `AliasProperty`.

128.28 Relative Layout

New in version 1.4.0.

This layout allows you to set relative coordinates for children. If you want absolute positioning, use the FloatLayout.

The RelativeLayout class behaves just like the regular FloatLayout except that its child widgets are positioned relative to the layout.

When a widget with position = (0,0) is added to a RelativeLayout, the child widget will also move when the position of the RelativeLayout is changed. The child widgets coordinates remain (0,0) as they are always relative to the parent layout.

128.28.1 Coordinate Systems

Window coordinates

By default, there's only one coordinate system that defines the position of widgets and touch events dispatched to them: the window coordinate system, which places (0, 0) at the bottom left corner of the window. Although there are other coordinate systems defined, e.g. local and parent coordinates, these coordinate systems are identical to the window coordinate system as long as a relative layout type widget is not in the widget's parent stack. When widget.pos is read or a touch is received, the coordinate values are in parent coordinates, but as mentioned, these are identical to window coordinates, even in complex widget stacks.

For example:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(args[1].pos))
    BoxLayout:
        on_touch_down: print('Box: {}'.format(args[1].pos))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(args[1].pos))
```

When the middle button is clicked and the touch propagates through the different parent coordinate systems, it prints the following:

```
>>> Box: (430.0, 282.0)
>>> Right: (430.0, 282.0)
>>> Middle: (430.0, 282.0)
```

As claimed, the touch has identical coordinates to the window coordinates in every coordinate system. collide_point() for example, takes the point in window coordinates.

Parent coordinates

Other RelativeLayout type widgets are Scatter, ScatterLayout, and ScrollView. If such a special widget is in the parent stack, only then does the parent and local coordinate system diverge from the window coordinate system. For each such widget in the stack, a coordinate system with (0, 0) of that coordinate system being at the bottom left corner of that widget is created. **Position and touch coordinates received and read by a widget are in the coordinate system of the most recent special**

widget in its parent stack (not including itself) or in window coordinates if there are none (as in the first example). We call these coordinates parent coordinates.

For example:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(args[1].pos))
    RelativeLayout:
        on_touch_down: print('Relative: {}'.format(args[1].pos))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(args[1].pos))
```

Clicking on the middle button prints:

```
>>> Relative: (396.0, 298.0)
>>> Right: (-137.33, 298.0)
>>> Middle: (396.0, 298.0)
```

As the touch propagates through the widgets, for each widget, the touch is received in parent coordinates. Because both the relative and middle widgets don't have these special widgets in their parent stack, the touch is the same as window coordinates. Only the right widget, which has a RelativeLayout in its parent stack, receives the touch in coordinates relative to that RelativeLayout which is different than window coordinates.

Local and Widget coordinates

When expressed in parent coordinates, the position is expressed in the coordinates of the most recent special widget in its parent stack, not including itself. When expressed in local or widget coordinates, the widgets themselves are also included.

Changing the above example to transform the parent coordinates into local coordinates:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(self.to_local(*args[1].pos)))
    RelativeLayout:
        on_touch_down: print('Relative: {}'.format(self.to_local(*args[1].pos)))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(self.to_local(*args[1].pos)))
```

Now, clicking on the middle button prints:

```
>>> Relative: (-135.33, 301.0)
>>> Right: (-135.33, 301.0)
>>> Middle: (398.0, 301.0)
```

This is because now the relative widget also expresses the coordinates relative to itself.

Coordinate transformations

`Widget` provides 4 functions to transform coordinates between the various coordinate systems. For now, we assume that the *relative* keyword of these functions is *False*. `to_widget()` takes the coordinates expressed in window coordinates and returns them in local (widget) coordinates. `to_window()` takes the coordinates expressed in local coordinates and returns them in window coordinates. `to_parent()` takes the coordinates expressed in local coordinates and returns them in parent coordinates. `to_local()` takes the coordinates expressed in parent coordinates and returns them in local coordinates.

Each of the 4 transformation functions take a *relative* parameter. When the relative parameter is True, the coordinates are returned or originate in true relative coordinates - relative to a coordinate system with its (0, 0) at the bottom left corner of the widget in question.

Changed in version 1.7.0: Prior to version 1.7.0, the `RelativeLayout` was implemented as a `FloatLayout` inside a `Scatter`. This behaviour/widget has been renamed to *ScatterLayout*. The `RelativeLayout` now only supports relative positions (and can't be rotated, scaled or translated on a multitouch system using two or more fingers). This was done so that the implementation could be optimized and avoid the heavier calculations of `Scatter` (e.g. inverse matrix, recaculating multiple properties etc.)

class `kivy.uix.relativelayout.`**`RelativeLayout`**(***kw*)
Bases: `kivy.uix.floatlayout.FloatLayout`

RelativeLayout class, see module documentation for more information.

128.29 Sandbox

New in version 1.8.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

This is a widget that runs itself and all of its children in a Sandbox. That means if a child raises an Exception, it will be caught. The Sandbox itself runs its own Clock, Cache, etc.

The SandBox widget is still experimental and required for the Kivy designer. When the user designs their own widget, if they do something wrong (wrong size value, invalid python code), it will be caught correctly without breaking the whole application. Because it has been designed that way, we are still enhancing this widget and the `kivy.context` module. Don't use it unless you know what you are doing.

class `kivy.uix.sandbox.`**`Sandbox`**(***kwargs*)
Bases: `kivy.uix.floatlayout.FloatLayout`

Sandbox widget, used to trap all the exceptions raised by child widgets.

`on_context_created`()
Override this method in order to load your kv file or do anything else with the newly created context.

`on_exception`(*exception*, *_traceback=None*)
Override this method in order to catch all the exceptions from children.

If you return True, it will not reraise the exception. If you return False, the exception will be raised to the parent.

128.30 Scatter

`Scatter` is used to build interactive widgets that can be translated, rotated and scaled with two or more fingers on a multitouch system.

Scatter has its own matrix transformation: the modelview matrix is changed before the children are drawn and the previous matrix is restored when the drawing is finished. That makes it possible to perform rotation, scaling and translation over the entire children tree without changing any widget properties. That specific behavior makes the scatter unique, but there are some advantages / constraints that you should consider:

1. The children are positioned relative to the scatter similar to a RelativeLayout (see `relativelayout`). So when dragging the scatter, the position of the children don't change, only the position of the scatter does.
2. The scatter size has no impact on the size of it's children.
3. If you want to resize the scatter, use scale, not size (read #2). Scale transforms both the scatter and its children, but does not change size.
4. The scatter is not a layout. You must manage the size of the children yourself.

For touch events, the scatter converts from the parent matrix to the scatter matrix automatically in on_touch_down/move/up events. If you are doing things manually, you will need to use `to_parent()` and `to_local()`.

128.30.1 Usage

By default, the Scatter does not have a graphical representation: it is a container only. The idea is to combine the Scatter with another widget, for example an `Image`:

```
scatter = Scatter()
image = Image(source='sun.jpg')
scatter.add_widget(image)
```

128.30.2 Control Interactions

By default, all interactions are enabled. You can selectively disable them using the do_rotation, do_translation and do_scale properties.

Disable rotation:

```
scatter = Scatter(do_rotation=False)
```

Allow only translation:

```
scatter = Scatter(do_rotation=False, do_scale=False)
```

Allow only translation on x axis:

```
scatter = Scatter(do_rotation=False, do_scale=False,
                  do_translation_y=False)
```

128.30.3 Automatic Bring to Front

If the `Scatter.auto_bring_to_front` property is True, the scatter widget will be removed and re-added to the parent when it is touched (brought to front, above all other widgets in the parent). This is useful when you are manipulating several scatter widgets and don't want the active one to be partially hidden.

128.30.4 Scale Limitation

We are using a 32-bit matrix in double representation. That means we have a limit for scaling. You cannot do infinite scaling down/up with our implementation. Generally, you don't hit the minimum scale (because you don't see it on the screen), but the maximum scale is 9.99506983235e+19 (2^66).

You can also limit the minimum and maximum scale allowed:

```
scatter = Scatter(scale_min=.5, scale_max=3.)
```

128.30.5 Behavior

Changed in version 1.1.0: If no control interactions are enabled, then the touch handler will never return True.

class `kivy.uix.scatter.`**`Scatter`**(***kwargs*)
Bases: `kivy.uix.widget.Widget`

Scatter class. See module documentation for more information.

Events

on_transform_with_touch:Fired when the scatter has been transformed by user touch or multitouch, such as panning or zooming.

on_bring_to_front:Fired when the scatter is brought to the front.

Changed in version 1.9.0: Event *on_bring_to_front* added.

Changed in version 1.8.0: Event *on_transform_with_touch* added.

`apply_transform`(*trans*, *post_multiply=False*, *anchor=(0, 0)*)
Transforms the scatter by applying the "trans" transformation matrix (on top of its current transformation state). The resultant matrix can be found in the `transform` property.

Parameters

trans: **`Matrix`**.Transformation matix to be applied to the scatter widget.

anchor: **tuple, defaults to (0, 0).**The point to use as the origin of the transformation (uses local widget space).

post_multiply: **bool, defaults to False.**If True, the transform matrix is post multiplied (as if applied before the current transform).

Usage example:

```
from kivy.graphics.transformation import Matrix
mat = Matrix().scale(3, 3, 3)
scatter_instance.apply_transform(mat)
```

`auto_bring_to_front`
If True, the widget will be automatically pushed on the top of parent widget list for drawing.

`auto_bring_to_front` is a `BooleanProperty` and defaults to True.

`bbox`
Bounding box of the widget in parent space:

```
((x, y), (w, h))
# x, y = lower left corner
```

bbox is an AliasProperty.

do_collide_after_children

If True, the collision detection for limiting the touch inside the scatter will be done after dispaching the touch to the children. You can put children outside the bounding box of the scatter and still be able to touch them.

New in version 1.3.0.

do_rotation

Allow rotation.

do_rotation is a BooleanProperty and defaults to True.

do_scale

Allow scaling.

do_scale is a BooleanProperty and defaults to True.

do_translation

Allow translation on the X or Y axis.

do_translation is an AliasProperty of (do_translation_x + do_translation_y)

do_translation_x

Allow translation on the X axis.

do_translation_x is a BooleanProperty and defaults to True.

do_translation_y

Allow translation on Y axis.

do_translation_y is a BooleanProperty and defaults to True.

on_bring_to_front(*touch*)

Called when a touch event causes the scatter to be brought to the front of the parent (only if auto_bring_to_front is True)

Parameters *touch*: the touch object which brought the scatter to front.

New in version 1.9.0.

on_transform_with_touch(*touch*)

Called when a touch event has transformed the scatter widget. By default this does nothing, but can be overriden by derived classes that need to react to transformations caused by user input.

Parameters *touch*: the touch object which triggered the transformation.

New in version 1.8.0.

rotation

Rotation value of the scatter.

rotation is an AliasProperty and defaults to 0.0.

scale

Scale value of the scatter.

scale is an AliasProperty and defaults to 1.0.

scale_max

Maximum scaling factor allowed.

scale_max is a NumericProperty and defaults to 1e20.

scale_min
Minimum scaling factor allowed.

scale_min is a NumericProperty and defaults to 0.01.

transform
Transformation matrix.

transform is an ObjectProperty and defaults to the identity matrix.

Note: This matrix reflects the current state of the transformation matrix but setting it directly will erase previously applied transformations. To apply a transformation considering context, please use the apply_transform method.

transform_inv
Inverse of the transformation matrix.

transform_inv is an ObjectProperty and defaults to the identity matrix.

translation_touches
Determine whether translation was triggered by a single or multiple touches. This only has effect when do_translation = True.

translation_touches is a NumericProperty and defaults to 1.

New in version 1.7.0.

class kivy.uix.scatter.**ScatterPlane**(***kwargs*)
Bases: kivy.uix.scatter.Scatter

This is essentially an unbounded Scatter widget. It's a convenience class to make it easier to handle infinite planes.

128.31 Scatter Layout

New in version 1.6.0.

This layout behaves just like a RelativeLayout. When a widget is added with position = (0,0) to a ScatterLayout, the child widget will also move when you change the position of the ScatterLayout. The child widget's coordinates remain (0,0) as they are relative to the parent layout.

However, since ScatterLayout is implemented using a Scatter widget, you can also translate, rotate and scale the layout using touches or clicks, just like in the case of a normal Scatter widget, and the child widgets will behave as expected.

In contrast to a Scatter, the Layout favours 'hint' properties, such as size_hint, size_hint_x, size_hint_y and pos_hint.

Note: The ScatterLayout is implemented as a FloatLayout inside a Scatter.

Warning: Since the actual ScatterLayout is a Scatter, its add_widget and remove_widget functions are overridden to add children to the embedded FloatLayout (accessible as the *content* property of Scatter) automatically. So if you want to access the added child elements, you need self.content.children instead of self.children.

Warning: The ScatterLayout was introduced in 1.7.0 and was called RelativeLayout in prior versions. The RelativeLayout is now an optimized implementation that uses only a positional transform to avoid some of the heavier calculation involved for Scatter.

class `kivy.uix.scatterlayout.`**`ScatterLayout`**`(`***kw*`)`

Bases: `kivy.uix.scatter.Scatter`

ScatterLayout class, see module documentation for more information.

128.32 Screen Manager

New in version 1.4.0.

Warning: This widget is still experimental, and its API is subject to change in a future version.

The screen manager is a widget dedicated to managing multiple screens for your application. The default `ScreenManager` displays only one `Screen` at a time and uses a `TransitionBase` to switch from one Screen to another.

Multiple transitions are supported based on changing the screen coordinates / scale or even performing fancy animation using custom shaders.

128.32.1 Basic Usage

Let's construct a Screen Manager with 4 named screens. When you are creating a screen, **you absolutely need to give a name to it**:

```
from kivy.uix.screenmanager import ScreenManager, Screen

# Create the manager
sm = ScreenManager()

# Add few screens
for i in range(4):
    screen = Screen(name='Title %d' % i)
    sm.add_widget(screen)

# By default, the first screen added into the ScreenManager will be
# displayed. You can then change to another screen.

# Let's display the screen named 'Title 2'
# A transition will automatically be used.
sm.current = 'Title 2'
```

The default `ScreenManager.transition` is a `SlideTransition` with options `direction` and `duration`.

Please note that by default, a `Screen` displays nothing: it's just a `RelativeLayout`. You need to use that class as a root widget for your own screen, the best way being to subclass.

Here is an example with a 'Menu Screen' and a 'Settings Screen':

```
from kivy.app import App
from kivy.lang import Builder
from kivy.uix.screenmanager import ScreenManager, Screen

# Create both screens. Please note the root.manager.current: this is how
# you can control the ScreenManager from kv. Each screen has by default a
# property manager that gives you the instance of the ScreenManager used.
Builder.load_string("""
<MenuScreen>:
    BoxLayout:
        Button:
            text: 'Goto settings'
            on_press: root.manager.current = 'settings'
        Button:
            text: 'Quit'

<SettingsScreen>:
    BoxLayout:
        Button:
            text: 'My settings button'
        Button:
            text: 'Back to menu'
            on_press: root.manager.current = 'menu'
""")

# Declare both screens
class MenuScreen(Screen):
    pass

class SettingsScreen(Screen):
    pass

# Create the screen manager
sm = ScreenManager()
sm.add_widget(MenuScreen(name='menu'))
sm.add_widget(SettingsScreen(name='settings'))

class TestApp(App):

    def build(self):
        return sm

if __name__ == '__main__':
    TestApp().run()
```

128.32.2 Changing Direction

A common use case for `ScreenManager` involves using a `SlideTransition` which slides right to the next screen and slides left to the previous screen. Building on the previous example, this can be accomplished like so:

```
Builder.load_string("""
<MenuScreen>:
    BoxLayout:
        Button:
            text: 'Goto settings'
            on_press:
                root.manager.transition.direction = 'left'
                root.manager.current = 'settings'
        Button:
            text: 'Quit'

<SettingScreen>:
    BoxLayout:
        Button:
            text: 'My settings button'
        Button:
            text: 'Back to menu'
            on_press:
                root.manager.transition.direction = 'right'
                root.manager.current = 'menu'
""")
```

128.32.3 Advanced Usage

From 1.8.0, you can now switch dynamically to a new screen, change the transition options and remove the previous one by using `switch_to()`:

```
sm = ScreenManager()
screens = [Screen(name='Title {}'.format(i)) for i in range(4)]

sm.switch_to(screens[0])
# later
sm.switch_to(screens[1], direction='right')
```

Note that this method adds the screen to the `ScreenManager` instance and should not be used if your screens have already been added to this instance. To switch to a screen which is already added, you should use the `current` property.

128.32.4 Changing transitions

You have multiple transitions available by default, such as:

- `NoTransition` - switches screens instantly with no animation
- `SlideTransition` - slide the screen in/out, from any direction
- `SwapTransition` - implementation of the iOS swap transition
- `FadeTransition` - shader to fade the screen in/out
- `WipeTransition` - shader to wipe the screens from right to left
- `FallOutTransition` - shader where the old screen 'falls' and becomes transparent, revealing the new one behind it.
- `RiseInTransition` - shader where the new screen rises from the screen centre while fading from transparent to opaque.

You can easily switch transitions by changing the `ScreenManager.transition` property:

```
sm = ScreenManager(transition=FadeTransition())
```

Note: Currently, none of Shader based Transitions use anti-aliasing. This is because they use the FBO which doesn't have any logic to handle supersampling. This is a known issue and we are working on a transparent implementation that will give the same results as if it had been rendered on screen.

To be more concrete, if you see sharp edged text during the animation, it's normal.

class `kivy.uix.screenmanager.`**`Screen`**`(`***kw*`)`

Bases: `kivy.uix.relativelayout.RelativeLayout`

Screen is an element intended to be used with a `ScreenManager`. Check module documentation for more information.

Events

***on_pre_enter*: ()**Event fired when the screen is about to be used: the entering animation is started.

***on_enter*: ()**Event fired when the screen is displayed: the entering animation is complete.

***on_pre_leave*: ()**Event fired when the screen is about to be removed: the leaving animation is started.

***on_leave*: ()**Event fired when the screen is removed: the leaving animation is finished.

Changed in version 1.6.0: Events *on_pre_enter*, *on_enter*, *on_pre_leave* and *on_leave* were added.

`manager`

`ScreenManager` object, set when the screen is added to a manager.

`manager` is an `ObjectProperty` and defaults to None, read-only.

`name`

Name of the screen which must be unique within a `ScreenManager`. This is the name used for `ScreenManager.current`.

`name` is a `StringProperty` and defaults to ''.

`transition_progress`

Value that represents the completion of the current transition, if any is occuring.

If a transition is in progress, whatever the mode, the value will change from 0 to 1. If you want to know if it's an entering or leaving animation, check the `transition_state`.

`transition_progress` is a `NumericProperty` and defaults to 0.

`transition_state`

Value that represents the state of the transition:

- 'in' if the transition is going to show your screen
- 'out' if the transition is going to hide your screen

After the transition is complete, the state will retain it's last value (in or out).

`transition_state` is an `OptionProperty` and defaults to 'out'.

class `kivy.uix.screenmanager.`**`ScreenManager`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

Screen manager. This is the main class that will control your `Screen` stack and memory.

By default, the manager will show only one screen at a time.

`current`

Name of the screen currently shown, or the screen to show.

```
from kivy.uix.screenmanager import ScreenManager, Screen

sm = ScreenManager()
sm.add_widget(Screen(name='first'))
sm.add_widget(Screen(name='second'))

# By default, the first added screen will be shown. If you want to
# show another one, just set the 'current' property.
sm.current = 'second'
```

`current_screen`

Contains the currently displayed screen. You must not change this property manually, use `current` instead.

`current_screen` is an `ObjectProperty` and defaults to None, read-only.

get_screen(*name*)
Return the screen widget associated with the name or raise a `ScreenManagerException` if not found.

has_screen(*name*)
Return True if a screen with the *name* has been found.

New in version 1.6.0.

next()
Return the name of the next screen from the screen list.

previous()
Return the name of the previous screen from the screen list.

screen_names
List of the names of all the `Screen` widgets added. The list is read only.

`screens_names` is an `AliasProperty` and is read-only. It is updated if the screen list changes or the name of a screen changes.

screens
List of all the `Screen` widgets added. You must not change the list manually. Use `Screen.add_widget()` instead.

`screens` is a `ListProperty` and defaults to [], read-only.

switch_to(*screen*, ***options*)
Add a new screen to the ScreenManager and switch to it. The previous screen will be removed from the children. *options* are the `transition` options that will be changed before the animation happens.

If no previous screens are available, the screen will be used as the main one:

```
sm = ScreenManager()
sm.switch_to(screen1)
# later
sm.switch_to(screen2, direction='left')
# later
sm.switch_to(screen3, direction='right', duration=1.)
```

If any animation is in progress, it will be stopped and replaced by this one: you should avoid this because the animation will just look weird. Use either `switch_to()` or `current` but not both.

The *screen* name will be changed if there is any conflict with the current screen.

transition
Transition object to use for animating the screen that will be hidden and the screen that will be shown. By default, an instance of `SlideTransition` will be given.

For example, if you want to change to a `WipeTransition`:

```
from kivy.uix.screenmanager import ScreenManager, Screen,
WipeTransition

sm = ScreenManager(transition=WipeTransition())
sm.add_widget(Screen(name='first'))
sm.add_widget(Screen(name='second'))

# by default, the first added screen will be shown. If you want to
# show another one, just set the 'current' property.
sm.current = 'second'
```

Changed in version 1.8.0: Default transition has been changed from `SwapTransition` to `SlideTransition`.

class `kivy.uix.screenmanager.`**`ScreenManagerException`**
Bases: `exceptions.Exception`

Exception for the `ScreenManager`.

class `kivy.uix.screenmanager.`**`TransitionBase`**
Bases: `kivy.event.EventDispatcher`

TransitionBase is used to animate 2 screens within the `ScreenManager`. This class acts as a base for other implementations like the `SlideTransition` and `SwapTransition`.

Events

***on_progress*: Transition object, progression float**Fired during the animation of the transition.

***on_complete*: Transition object**Fired when the transition is fininshed.

`add_screen`(*screen*)
(internal) Used to add a screen to the `ScreenManager`.

`duration`
Duration in seconds of the transition.

`duration` is a `NumericProperty` and defaults to .4 (= 400ms).

Changed in version 1.8.0: Default duration has been changed from 700ms to 400ms.

`is_active`
Indicate whether the transition is currently active or not.

`is_active` is a `BooleanProperty` and defaults to False, read-only.

`manager`
`ScreenManager` object, set when the screen is added to a manager.

`manager` is an `ObjectProperty` and defaults to None, read-only.

`remove_screen`(*screen*)
(internal) Used to remove a screen from the `ScreenManager`.

`screen_in`
Property that contains the screen to show. Automatically set by the `ScreenManager`.

`screen_in` is an `ObjectProperty` and defaults to None.

`screen_out`
Property that contains the screen to hide. Automatically set by the `ScreenManager`.

`screen_out` is an `ObjectProperty` and defaults to None.

`start`(*manager*)
(internal) Starts the transition. This is automatically called by the `ScreenManager`.

`stop`()
(internal) Stops the transition. This is automatically called by the `ScreenManager`.

class `kivy.uix.screenmanager.`**`ShaderTransition`**
Bases: `kivy.uix.screenmanager.TransitionBase`

Transition class that uses a Shader for animating the transition between 2 screens. By default, this class doesn't assign any fragment/vertex shader. If you want to create your own fragment shader for the transition, you need to declare the header yourself and include the "t", "tex_in" and "tex_out" uniform:

```
# Create your own transition. This shader implements a "fading"
# transition.
fs = """$HEADER
    uniform float t;
    uniform sampler2D tex_in;
    uniform sampler2D tex_out;

    void main(void) {
        vec4 cin = texture2D(tex_in, tex_coord0);
        vec4 cout = texture2D(tex_out, tex_coord0);
        gl_FragColor = mix(cout, cin, t);
    }
"""

# And create your transition
tr = ShaderTransition(fs=fs)
sm = ScreenManager(transition=tr)
```

clearcolor

Sets the color of Fbo ClearColor.

New in version 1.9.0.

`clearcolor` is a `ListProperty` and defaults to [0, 0, 0, 1].

fs

Fragment shader to use.

`fs` is a `StringProperty` and defaults to None.

vs

Vertex shader to use.

`vs` is a `StringProperty` and defaults to None.

class `kivy.uix.screenmanager.`**`SlideTransition`**

Bases: `kivy.uix.screenmanager.TransitionBase`

Slide Transition, can be used to show a new screen from any direction: left, right, up or down.

direction

Direction of the transition.

`direction` is an `OptionProperty` and defaults to 'left'. Can be one of 'left', 'right', 'up' or 'down'.

class `kivy.uix.screenmanager.`**`SwapTransition`**

Bases: `kivy.uix.screenmanager.TransitionBase`

Swap transition that looks like iOS transition when a new window appears on the screen.

class `kivy.uix.screenmanager.`**`FadeTransition`**

Bases: `kivy.uix.screenmanager.ShaderTransition`

Fade transition, based on a fragment Shader.

class `kivy.uix.screenmanager.`**`WipeTransition`**

Bases: `kivy.uix.screenmanager.ShaderTransition`

Wipe transition, based on a fragment Shader.

class `kivy.uix.screenmanager.`**`FallOutTransition`**

Bases: `kivy.uix.screenmanager.ShaderTransition`

Transition where the new screen 'falls' from the screen centre, becoming smaller and more transparent until it disappears, and revealing the new screen behind it. Mimics the popular/standard Android transition.

New in version 1.8.0.

duration

Duration in seconds of the transition, replacing the default of `TransitionBase`.

`duration` is a `NumericProperty` and defaults to .15 (= 150ms).

class `kivy.uix.screenmanager.`**`RiseInTransition`**

Bases: `kivy.uix.screenmanager.ShaderTransition`

Transition where the new screen rises from the screen centre, becoming larger and changing from transparent to opaque until it fills the screen. Mimics the popular/standard Android transition.

New in version 1.8.0.

duration

Duration in seconds of the transition, replacing the default of `TransitionBase`.

`duration` is a `NumericProperty` and defaults to .2 (= 200ms).

class `kivy.uix.screenmanager.`**`NoTransition`**

Bases: `kivy.uix.screenmanager.TransitionBase`

No transition, instantly switches to the next screen with no delay or animation.

New in version 1.8.0.

128.33 Scroll View

New in version 1.0.4.

The `ScrollView` widget provides a scrollable/pannable viewport that is clipped at the scrollview's bounding box.

128.33.1 Scrolling Behavior

The ScrollView accepts only one child and applies a viewport/window to it according to the `ScrollView.scroll_x` and `ScrollView.scroll_y` properties. Touches are analyzed to determine if the user wants to scroll or control the child in some other manner - you cannot do both at the same time. To determine if interaction is a scrolling gesture, these properties are used:

- **`ScrollView.scroll_distance`: the minimum distance to travel,** defaults to 20 pixels.
- **`ScrollView.scroll_timeout`: the maximum time period, defaults** to 250 milliseconds.

If a touch travels `scroll_distance` pixels within the `scroll_timeout` period, it is recognized as a scrolling gesture and translation (scroll/pan) will begin. If the timeout occurs, the touch down event is dispatched to the child instead (no translation).

The default value for those settings can be changed in the configuration file:

```
[widgets]
scroll_timeout = 250
scroll_distance = 20
```

New in version 1.1.1: ScrollView now animates scrolling in Y when a mousewheel is used.

128.33.2 Limiting to the X or Y Axis

By default, the ScrollView allows scrolling in both the X and Y axes. You can explicitly disable scrolling on an axis by setting `ScrollView.do_scroll_x` or `ScrollView.do_scroll_y` to False.

128.33.3 Managing the Content Size and Position

ScrollView manages the position of its children similarly to a RelativeLayout (see `relativelayout`) but not the size. You must carefully specify the *size_hint* of your content to get the desired scroll/pan effect.

By default, size_hint is (1, 1), so the content size will fit your ScrollView exactly (you will have nothing to scroll). You must deactivate at least one of the size_hint instructions (x or y) of the child to enable scrolling.

To scroll a `GridLayout` on Y-axis/vertically, set the child's width identical to that of the ScrollView (size_hint_x=1, default), and set the size_hint_y property to None:

```
layout = GridLayout(cols=1, spacing=10, size_hint_y=None)
# Make sure the height is such that there is something to scroll.
layout.bind(minimum_height=layout.setter('height'))
for i in range(30):
    btn = Button(text=str(i), size_hint_y=None, height=40)
    layout.add_widget(btn)
root = ScrollView(size_hint=(None, None), size=(400, 400))
root.add_widget(layout)
```

128.33.4 Overscroll Effects

New in version 1.7.0.

When scrolling would exceed the bounds of the `ScrollView`, it uses a `ScrollEffect` to handle the overscroll. These effects can perform actions like bouncing back, changing opacity, or simply preventing scrolling beyond the normal boundaries. Note that complex effects may perform many computations, which can be slow on weaker hardware.

You can change what effect is being used by setting `ScrollView.effect_cls` to any effect class. Current options include:

- `ScrollEffect`: Does not allow scrolling beyond the `ScrollView` boundaries.
- `DampedScrollEffect`: The current default. Allows the user to scroll beyond the normal boundaries, but has the content spring back once the touch/click is released.
- `OpacityScrollEffect`: Similar to the `DampedScrollEffect`, but also reduces opacity during overscroll.

You can also create your own scroll effect by subclassing one of these, then pass it as the `effect_cls` in the same way.

Alternatively, you can set `ScrollView.effect_x` and/or `ScrollView.effect_y` to an *instance* of the effect you want to use. This will override the default effect set in `ScrollView.effect_cls`.

All the effects are located in the `kivy.effects`.

class `kivy.uix.scrollview.`**`ScrollView`**`(`***kwargs*`)`

Bases: `kivy.uix.stencilview.StencilView`

ScrollView class. See module documentation for more information.

Changed in version 1.7.0: *auto_scroll, scroll_friction, scroll_moves, scroll_stoptime' has been deprecated, use :attr:'effect_cls* instead.

bar_color
Color of horizontal / vertical scroll bar, in RGBA format.

New in version 1.2.0.

`bar_color` is a `ListProperty` and defaults to [.7, .7, .7, .9].

bar_inactive_color
Color of horizontal / vertical scroll bar (in RGBA format), when no scroll is happening.

New in version 1.9.0.

`bar_inactive_color` is a `ListProperty` and defaults to [.7, .7, .7, .2].

bar_margin
Margin between the bottom / right side of the scrollview when drawing the horizontal / vertical scroll bar.

New in version 1.2.0.

`bar_margin` is a `NumericProperty`, default to 0

bar_pos
Which side of the scroll view to place each of the bars on.

`bar_pos` is a `ReferenceListProperty` of (`bar_pos_x`, `bar_pos_y`)

bar_pos_x
Which side of the ScrollView the horizontal scroll bar should go on. Possible values are 'top' and 'bottom'.

New in version 1.8.0.

`bar_pos_x` is an `OptionProperty`, default to 'bottom'

bar_pos_y
Which side of the ScrollView the vertical scroll bar should go on. Possible values are 'left' and 'right'.

New in version 1.8.0.

`bar_pos_y` is an `OptionProperty`, default to 'right'

bar_width
Width of the horizontal / vertical scroll bar. The width is interpreted as a height for the horizontal bar.

New in version 1.2.0.

`bar_width` is a `NumericProperty` and defaults to 2.

convert_distance_to_scroll(*dx, dy*)
Convert a distance in pixels to a scroll distance, depending on the content size and the scrollview size.

The result will be a tuple of scroll distance that can be added to `scroll_x` and `scroll_y`

do_scroll
Allow scroll on X or Y axis.

`do_scroll` is a `AliasProperty` of (`do_scroll_x` + `do_scroll_y`)

do_scroll_x
Allow scroll on X axis.

`do_scroll_x` is a `BooleanProperty` and defaults to True.

do_scroll_y

Allow scroll on Y axis.

do_scroll_y is a BooleanProperty and defaults to True.

effect_cls

Class effect to instanciate for X and Y axis.

New in version 1.7.0.

effect_cls is an ObjectProperty and defaults to DampedScrollEffect.

Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

effect_x

Effect to apply for the X axis. If None is set, an instance of effect_cls will be created.

New in version 1.7.0.

effect_x is an ObjectProperty and defaults to None.

effect_y

Effect to apply for the Y axis. If None is set, an instance of effect_cls will be created.

New in version 1.7.0.

effect_y is an ObjectProperty and defaults to None, read-only.

hbar

Return a tuple of (position, size) of the horizontal scrolling bar.

New in version 1.2.0.

The position and size are normalized between 0-1, and represent a percentage of the current scrollview height. This property is used internally for drawing the little horizontal bar when you're scrolling.

vbar is a AliasProperty, readonly.

scroll_distance

Distance to move before scrolling the ScrollView, in pixels. As soon as the distance has been traveled, the ScrollView will start to scroll, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

scroll_distance is a NumericProperty and defaults to 20 (pixels), according to the default value in user configuration.

scroll_timeout

Timeout allowed to trigger the scroll_distance, in milliseconds. If the user has not moved scroll_distance within the timeout, the scrolling will be disabled, and the touch event will go to the children.

scroll_timeout is a NumericProperty and defaults to 55 (milliseconds) according to the default value in user configuration.

Changed in version 1.5.0: Default value changed from 250 to 55.

scroll_type

Sets the type of scrolling to use for the content of the scrollview. Available options are: ['content'], ['bars'], ['bars', 'content'].

New in version 1.8.0.

scroll_type is a OptionProperty, defaults to ['content'].

scroll_wheel_distance

Distance to move when scrolling with a mouse wheel. It is advisable that you base this value on the dpi of your target device's screen.

New in version 1.8.0.

`scroll_wheel_distance` is a `NumericProperty` , defaults to 20 pixels.

`scroll_x`

X scrolling value, between 0 and 1. If 0, the content's left side will touch the left side of the ScrollView. If 1, the content's right side will touch the right side.

This property is controled by `ScrollView` only if `do_scroll_x` is True.

`scroll_x` is a `NumericProperty` and defaults to 0.

`scroll_y`

Y scrolling value, between 0 and 1. If 0, the content's bottom side will touch the bottom side of the ScrollView. If 1, the content's top side will touch the top side.

This property is controled by `ScrollView` only if `do_scroll_y` is True.

`scroll_y` is a `NumericProperty` and defaults to 1.

`update_from_scroll`(**largs*)

Force the reposition of the content, according to current value of `scroll_x` and `scroll_y`.

This method is automatically called when one of the `scroll_x`, `scroll_y`, `pos` or `size` properties change, or if the size of the content changes.

`vbar`

Return a tuple of (position, size) of the vertical scrolling bar.

New in version 1.2.0.

The position and size are normalized between 0-1, and represent a percentage of the current scrollview height. This property is used internally for drawing the little vertical bar when you're scrolling.

`vbar` is a `AliasProperty`, readonly.

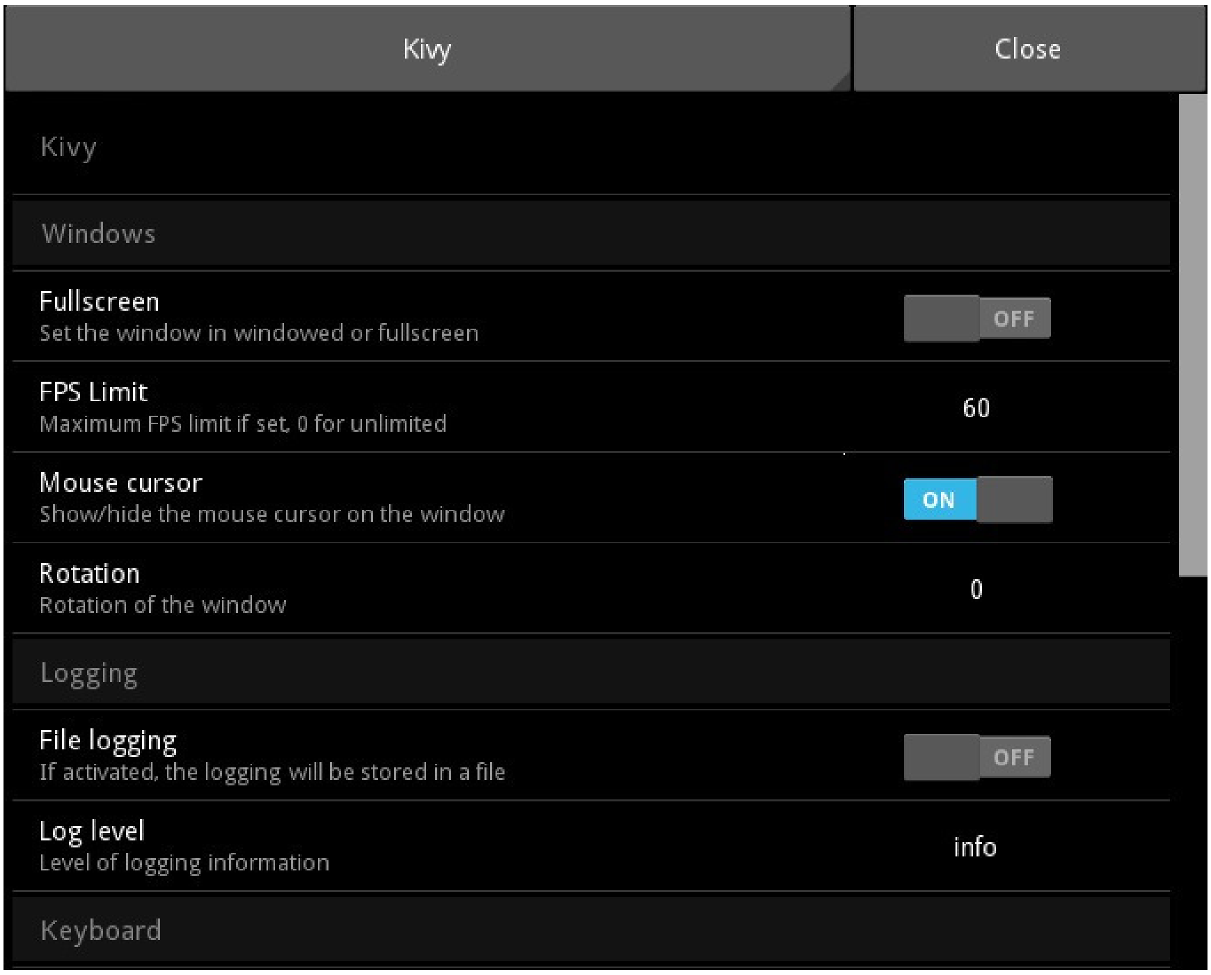
`viewport_size`

(internal) Size of the internal viewport. This is the size of your only child in the scrollview.

128.34 Settings

New in version 1.0.7.

This module is a complete and extensible framework for adding a Settings interface to your application. By default, the interface uses a `SettingsWithSpinner`, which consists of a `Spinner` (top) to switch between individual settings panels (bottom). See *Different panel layouts* for some alternatives.


Kivy

Close

Kivy

Windows

Fullscreen
Set the window in windowed or fullscreen
OFF

FPS Limit
Maximum FPS limit if set, 0 for unlimited
60

Mouse cursor
Show/hide the mouse cursor on the window
ON

Rotation
Rotation of the window
0

Logging

File logging
If activated, the logging will be stored in a file
OFF

Log level
Level of logging information
info

Keyboard

A `SettingsPanel` represents a group of configurable options. The `SettingsPanel.title` property is used by `Settings` when a panel is added - it determines the name of the sidebar button. SettingsPanel controls a `ConfigParser` instance.

The panel can be automatically constructed from a JSON definition file: you describe the settings you want and corresponding sections/keys in the ConfigParser instance... and you're done!

Settings are also integrated with the `App` class. Use `Settings.add_kivy_panel()` to configure the Kivy core settings in a panel.

128.34.1 Create a panel from JSON

To create a panel from a JSON-file, you need two things:

- a `ConfigParser` instance with default values
- a JSON file

Warning: The `kivy.config.ConfigParser` is required. You cannot use the default ConfigParser from Python libraries.

You must create and handle the `ConfigParser` object. SettingsPanel will read the values from the associated ConfigParser instance. Make sure you have default values for all sections/keys in your JSON file!

The JSON file contains structured information to describe the available settings. Here is an example:

```
[
    {
        "type": "title",
        "title": "Windows"
    },
    {
        "type": "bool",
        "title": "Fullscreen",
        "desc": "Set the window in windowed or fullscreen",
        "section": "graphics",
        "key": "fullscreen",
        "true": "auto"
    }
]
```

Each element in the root list represents a setting that the user can configure. Only the "type" key is mandatory: an instance of the associated class will be created and used for the setting - other keys are assigned to corresponding properties of that class.

Type	Associated class
title	SettingTitle
bool	SettingBoolean
numeric	SettingNumeric
options	SettingOptions
string	SettingString
path	SettingPath (new from 1.1.0)

In the JSON example above, the first element is of type "title". It will create a new instance of `SettingTitle` and apply the rest of the key/value pairs to the properties of that class, i.e. "title": "Windows" sets the `SettingTitle.title` property to "Windows".

To load the JSON example to a `Settings` instance, use the `Settings.add_json_panel()` method. It will automatically instantiate a `SettingsPanel` and add it to `Settings`:

```
from kivy.config import ConfigParser

config = ConfigParser()
config.read('myconfig.ini')

s = Settings()
s.add_json_panel('My custom panel', config, 'settings_custom.json')
s.add_json_panel('Another panel', config, 'settings_test2.json')

# then use the s as a widget...
```

128.34.2 Different panel layouts

A kivy `App` can automatically create and display a `Settings` instance. See the `settings_cls` documentation for details on how to choose which settings class to display.

Several pre-built settings widgets are available. All except `SettingsWithNoMenu` include close buttons triggering the on_close event.

- `Settings`: Displays settings with a sidebar at the left to switch between json panels.
- `SettingsWithSidebar`: A trivial subclass of `Settings`.

- `SettingsWithSpinner`: Displays settings with a spinner at the top, which can be used to switch between json panels. Uses `InterfaceWithSpinner` as the `interface_cls`. This is the default behavior from Kivy 1.8.0.
- `SettingsWithTabbedPanel`: Displays json panels as individual tabs in a `TabbedPanel`. Uses `InterfaceWithTabbedPanel` as the `interface_cls`.
- `SettingsWithNoMenu`: Displays a single json panel, with no way to switch to other panels and no close button. This makes it impossible for the user to exit unless `close_settings()` is overridden with a different close trigger! Uses `InterfaceWithNoMenu` as the `interface_cls`.

You can construct your own settings panels with any layout you choose by setting `Settings.interface_cls`. This should be a widget that displays a json settings panel with some way to switch between panels. An instance will be automatically created by `Settings`.

Interface widgets may be anything you like, but *must* have a method add_panel that recieves newly created json settings panels for the interface to display. See the documentation for `InterfaceWithSidebar` for more information. They may optionally dispatch an on_close event, for instance if a close button is clicked. This event is used by `Settings` to trigger its own on_close event.

class `kivy.uix.settings.`**`Settings`**`(`**args, **kargs*`)`
Bases: `kivy.uix.boxlayout.BoxLayout`

Settings UI. Check module documentation for more information on how to use this class.

Events

on_config_change: **ConfigParser instance, section, key, value**Fired when section/key/value of a ConfigParser changes.

*on_close*Fired by the default panel when the Close button is pressed.

`add_interface``()`
(Internal) creates an instance of `Settings.interface_cls`, and sets it to `interface`. When json panels are created, they will be added to this interface which will display them to the user.

`add_json_panel``(`*title, config, filename=None, data=None*`)`
Create and add a new `SettingsPanel` using the configuration *config* with the JSON definition *filename*.

Check the *Create a panel from JSON* section in the documentation for more information about JSON format and the usage of this function.

`add_kivy_panel``()`
Add a panel for configuring Kivy. This panel acts directly on the kivy configuration. Feel free to include or exclude it in your configuration.

See `use_kivy_settings()` for information on enabling/disabling the automatic kivy panel.

`create_json_panel``(`*title, config, filename=None, data=None*`)`
Create new `SettingsPanel`.

New in version 1.5.0.

Check the documentation of `add_json_panel()` for more information.

`interface`
(internal) Reference to the widget that will contain, organise and display the panel configuration panel widgets.

`interface` is an `ObjectProperty` and defaults to None.

`interface_cls`
The widget class that will be used to display the graphical interface for the settings panel. By default, it displays one Settings panel at a time with a sidebar to switch between them.

`interface_cls` is an `ObjectProperty` and defaults to :class'InterfaceWithSidebar'.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

`register_type`(*tp*, *cls*)
Register a new type that can be used in the JSON definition.

class `kivy.uix.settings.`**`SettingsPanel`**(***kwargs*)
Bases: `kivy.uix.gridlayout.GridLayout`

This class is used to contruct panel settings, for use with a `Settings` instance or subclass.

`config`
A `kivy.config.ConfigParser` instance. See module documentation for more information.

`get_value`(*section*, *key*)
Return the value of the section/key from the `config` ConfigParser instance. This function is used by `SettingItem` to get the value for a given section/key.

If you don't want to use a ConfigParser instance, you might want to override this function.

`settings`
A `Settings` instance that will be used to fire the *on_config_change* event.

`title`
Title of the panel. The title will be reused by the `Settings` in the sidebar.

class `kivy.uix.settings.`**`SettingItem`**(***kwargs*)
Bases: `kivy.uix.floatlayout.FloatLayout`

Base class for individual settings (within a panel). This class cannot be used directly; it is used for implementing the other setting classes. It builds a row with a title/description (left) and a setting control (right).

Look at `SettingBoolean`, `SettingNumeric` and `SettingOptions` for usage examples.

Events

on_releaseFired when the item is touched and then released.

`content`
(internal) Reference to the widget that contains the real setting. As soon as the content object is set, any further call to add_widget will call the content.add_widget. This is automatically set.

`content` is an `ObjectProperty` and defaults to None.

`desc`
Description of the setting, rendered on the line below the title.

`desc` is a `StringProperty` and defaults to None.

`disabled`
Indicate if this setting is disabled. If True, all touches on the setting item will be discarded.

`disabled` is a `BooleanProperty` and defaults to False.

`key`
Key of the token inside the `section` in the `ConfigParser` instance.

`key` is a `StringProperty` and defaults to None.

`panel`
(internal) Reference to the SettingsPanel for this setting. You don't need to use it.

`panel` is an `ObjectProperty` and defaults to None.

section

Section of the token inside the `ConfigParser` instance.

`section` is a `StringProperty` and defaults to None.

selected_alpha

(internal) Float value from 0 to 1, used to animate the background when the user touches the item.

`selected_alpha` is a `NumericProperty` and defaults to 0.

title

Title of the setting, defaults to '<No title set>'.

`title` is a `StringProperty` and defaults to '<No title set>'.

value

Value of the token according to the `ConfigParser` instance. Any change to this value will trigger a `Settings.on_config_change()` event.

`value` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`SettingString`**`(`***kwargs*`)`

Bases: `kivy.uix.settings.SettingItem`

Implementation of a string setting on top of a `SettingItem`. It is visualized with a `Label` widget that, when clicked, will open a `Popup` with a `Textinput` so the user can enter a custom value.

popup

(internal) Used to store the current popup when it's shown.

`popup` is an `ObjectProperty` and defaults to None.

textinput

(internal) Used to store the current textinput from the popup and to listen for changes.

`textinput` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`SettingPath`**`(`***kwargs*`)`

Bases: `kivy.uix.settings.SettingItem`

Implementation of a Path setting on top of a `SettingItem`. It is visualized with a `Label` widget that, when clicked, will open a `Popup` with a `FileChooserListView` so the user can enter a custom value.

New in version 1.1.0.

popup

(internal) Used to store the current popup when it is shown.

`popup` is an `ObjectProperty` and defaults to None.

textinput

(internal) Used to store the current textinput from the popup and to listen for changes.

`textinput` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`SettingBoolean`**`(`***kwargs*`)`

Bases: `kivy.uix.settings.SettingItem`

Implementation of a boolean setting on top of a `SettingItem`. It is visualized with a `Switch` widget. By default, 0 and 1 are used for values: you can change them by setting `values`.

values

Values used to represent the state of the setting. If you want to use "yes" and "no" in your ConfigParser instance:

```
SettingBoolean(..., values=['no', 'yes'])
```

> **Warning:** You need a minimum of two values, the index 0 will be used as False, and index 1 as True

`values` is a `ListProperty` and defaults to ['0', '1']

class `kivy.uix.settings.`**`SettingNumeric`**`(`***kwargs*`)`
Bases: `kivy.uix.settings.SettingString`

Implementation of a numeric setting on top of a `SettingString`. It is visualized with a `Label` widget that, when clicked, will open a `Popup` with a `Textinput` so the user can enter a custom value.

class `kivy.uix.settings.`**`SettingOptions`**`(`***kwargs*`)`
Bases: `kivy.uix.settings.SettingItem`

Implementation of an option list on top of a `SettingItem`. It is visualized with a `Label` widget that, when clicked, will open a `Popup` with a list of options from which the user can select.

`options`
List of all availables options. This must be a list of "string" items. Otherwise, it will crash. :)

`options` is a `ListProperty` and defaults to [].

`popup`
(internal) Used to store the current popup when it is shown.

`popup` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`SettingTitle`**`(`***kwargs*`)`
Bases: `kivy.uix.label.Label`

A simple title label, used to organize the settings in sections.

class `kivy.uix.settings.`**`SettingsWithSidebar`**`(`**args, **kargs*`)`
Bases: `kivy.uix.settings.Settings`

A settings widget that displays settings panels with a sidebar to switch between them. This is the default behaviour of `Settings`, and this widget is a trivial wrapper subclass.

class `kivy.uix.settings.`**`SettingsWithSpinner`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.settings.Settings`

A settings widget that displays one settings panel at a time with a spinner at the top to switch between them.

class `kivy.uix.settings.`**`SettingsWithTabbedPanel`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.settings.Settings`

A settings widget that displays settings panels as pages in a `TabbedPanel`.

class `kivy.uix.settings.`**`SettingsWithNoMenu`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.settings.Settings`

A settings widget that displays a single settings panel with *no* Close button. It will not accept more than one Settings panel. It is intended for use in programs with few enough settings that a full panel switcher is not useful.

> **Warning:** This Settings panel does *not* provide a Close button, and so it is impossible to leave the settings screen unless you also add other behaviour or override `display_settings()` and `close_settings()`.

class `kivy.uix.settings.`**`InterfaceWithSidebar`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.boxlayout.BoxLayout`

The default Settings interface class. It displays a sidebar menu with names of available settings panels, which may be used to switch which one is currently displayed.

See `add_panel()` for information on the method you must implement if creating your own interface.

This class also dispatches an event 'on_close', which is triggered when the sidebar menu's close button is released. If creating your own interface widget, it should also dispatch such an event which will automatically be caught by `Settings` and used to trigger its own 'on_close' event.

`add_panel``(`*panel, name, uid*`)`
This method is used by Settings to add new panels for possible display. Any replacement for ContentPanel *must* implement this method.

Parameters
- **panel** – A `SettingsPanel`. It should be stored and the interface should provide a way to switch between panels.
- **name** – The name of the panel as a string. It may be used to represent the panel but isn't necessarily unique.
- **uid** – A unique int identifying the panel. It should be used to identify and switch between panels.

`content`
(internal) A reference to the panel display widget (a `ContentPanel`).

`content` is an `ObjectProperty` and defaults to None.

`menu`
(internal) A reference to the sidebar menu widget.

`menu` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`ContentPanel`**`(`***kwargs*`)`
Bases: `kivy.uix.scrollview.ScrollView`

A class for displaying settings panels. It displays a single settings panel at a time, taking up the full size and shape of the ContentPanel. It is used by `InterfaceWithSidebar` and `InterfaceWithSpinner` to display settings.

`add_panel``(`*panel, name, uid*`)`
This method is used by Settings to add new panels for possible display. Any replacement for ContentPanel *must* implement this method.

Parameters
- **panel** – A `SettingsPanel`. It should be stored and displayed when requested.
- **name** – The name of the panel as a string. It may be used to represent the panel.
- **uid** – A unique int identifying the panel. It should be stored and used to identify panels when switching.

`container`
(internal) A reference to the GridLayout that contains the settings panel.

`container` is an `ObjectProperty` and defaults to None.

`current_panel`
(internal) A reference to the current settings panel.

`current_panel` is an `ObjectProperty` and defaults to None.

`current_uid`
(internal) A reference to the uid of the current settings panel.

current_uid is a NumericProperty and defaults to 0.

on_current_uid(**args*)

The uid of the currently displayed panel. Changing this will automatically change the displayed panel.

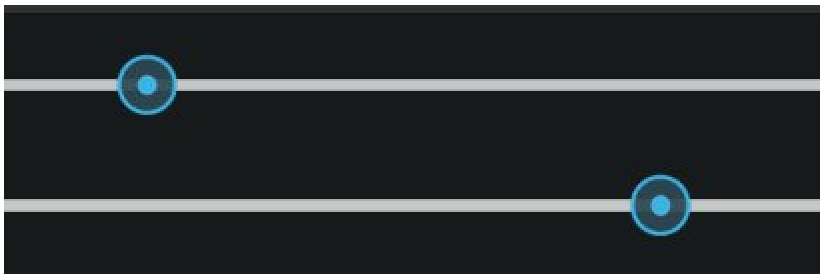
Parametersuid – A panel uid. It should be used to retrieve and display a settings panel that has previously been added with add_panel().

panels

(internal) Stores a dictionary mapping settings panels to their uids.

panels is a DictProperty and defaults to {}.

128.35 Slider



The Slider widget looks like a scrollbar. It supports horizontal and vertical orientations, min/max values and a default value.

To create a slider from -100 to 100 starting from 25:

```
from kivy.uix.slider import Slider
s = Slider(min=-100, max=100, value=25)
```

To create a vertical slider:

```
from kivy.uix.slider import Slider
s = Slider(orientation='vertical')
```

class kivy.uix.slider.**Slider**(***kwargs*)

Bases: kivy.uix.widget.Widget

Class for creating a Slider widget.

Check module documentation for more details.

max

Maximum value allowed for value.

max is a NumericProperty and defaults to 100.

min

Minimum value allowed for value.

min is a NumericProperty and defaults to 0.

orientation

Orientation of the slider.

orientation is an OptionProperty and defaults to 'horizontal'. Can take a value of 'vertical' or 'horizontal'.

padding

Padding of the slider. The padding is used for graphical representation and interaction. It prevents the cursor from going out of the bounds of the slider bounding box.

By default, padding is 10. The range of the slider is reduced from padding *2 on the screen. It allows drawing a cursor of 20px width without having the cursor go out of the widget.

`padding` is a `NumericProperty` and defaults to 10.

range

Range of the slider in the format (minimum value, maximum value):

```
>>> slider = Slider(min=10, max=80)
>>> slider.range
[10, 80]
>>> slider.range = (20, 100)
>>> slider.min
20
>>> slider.max
100
```

`range` is a `ReferenceListProperty` of (`min`, `max`) properties.

step

Step size of the slider.

New in version 1.4.0.

Determines the size of each interval or step the slider takes between min and max. If the value range can't be evenly divisible by step the last step will be capped by slider.max

`step` is a `NumericProperty` and defaults to 1.

value

Current value used for the slider.

`value` is a `NumericProperty` and defaults to 0.

value_normalized

Normalized value inside the `range` (min/max) to 0-1 range:

```
>>> slider = Slider(value=50, min=0, max=100)
>>> slider.value
50
>>> slider.value_normalized
0.5
>>> slider.value = 0
>>> slider.value_normalized
0
>>> slider.value = 100
>>> slider.value_normalized
1
```

You can also use it for setting the real value without knowing the minimum and maximum:

```
>>> slider = Slider(min=0, max=200)
>>> slider.value_normalized = .5
>>> slider.value
100
>>> slider.value_normalized = 1.
>>> slider.value
200
```

`value_normalized` is an `AliasProperty`.

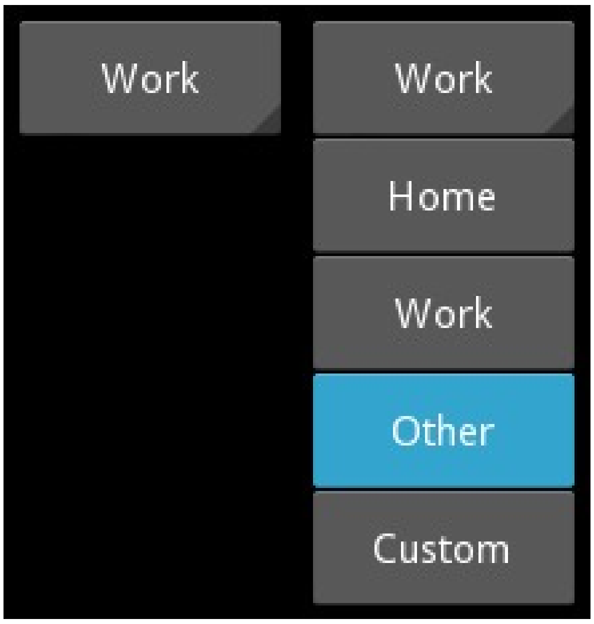
`value_pos`

Position of the internal cursor, based on the normalized value.

`value_pos` is an `AliasProperty`.

128.36 Spinner

New in version 1.4.0.



Spinner is a widget that provides a quick way to select one value from a set. In the default state, a spinner shows its currently selected value. Touching the spinner displays a dropdown menu with all the other available values from which the user can select a new one.

Example:

```
from kivy.base import runTouchApp
from kivy.uix.spinner import Spinner

spinner = Spinner(
    # default value shown
    text='Home',
    # available values
    values=('Home', 'Work', 'Other', 'Custom'),
    # just for positioning in our example
    size_hint=(None, None),
    size=(100, 44),
    pos_hint={'center_x': .5, 'center_y': .5})

def show_selected_value(spinner, text):
    print('The spinner', spinner, 'have text', text)

spinner.bind(text=show_selected_value)

runTouchApp(spinner)
```

class `kivy.uix.spinner.`**`Spinner`**(***kwargs*)

Bases: `kivy.uix.button.Button`

Spinner class, see module documentation for more information.

dropdown_cls

Class used to display the dropdown list when the Spinner is pressed.

dropdown_cls is an ObjectProperty and defaults to DropDown.

Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

is_open

By default, the spinner is not open. Set to True to open it.

is_open is a BooleanProperty and defaults to False.

New in version 1.4.0.

option_cls

Class used to display the options within the dropdown list displayed under the Spinner. The *text* property of the class will be used to represent the value.

The option class requires at least:

- a *text* property, used to display the value.
- an *on_release* event, used to trigger the option when pressed/touched.

option_cls is an ObjectProperty and defaults to SpinnerOption.

Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

values

Values that can be selected by the user. It must be a list of strings.

values is a ListProperty and defaults to [].

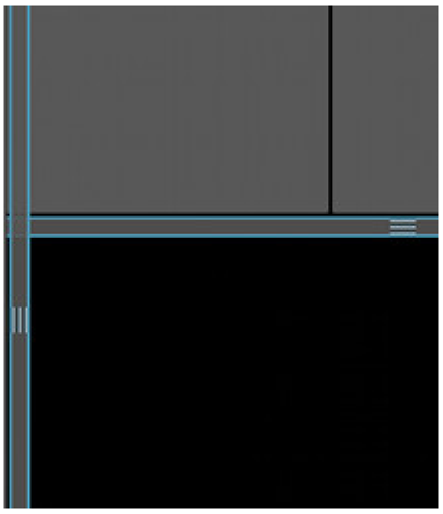
class kivy.uix.spinner.**SpinnerOption**(***kwargs*)

Bases: kivy.uix.button.Button

Special button used in the dropdown list. We just set the default size_hint_y and height.

128.37 Splitter

New in version 1.5.0.



The Splitter is a widget that helps you re-size it's child widget/layout by letting you re-size it via dragging the boundary or double tapping the boundary. This widget is similar to the ScrollView in that it allows only one child widget.

Usage:

```
splitter = Splitter(sizable_from = 'right')
splitter.add_widget(layout_or_widget_instance)
splitter.min_size = 100
splitter.max_size = 250
```

To change the size of the strip/border used for resizing:

```
splitter.strip_size = '10pt'
```

To change its appearance:

```
splitter.strip_cls = your_custom_class
```

You can also change the appearance of the *strip_cls*, which defaults to `SplitterStrip`, by overriding the *kv* rule in your app:

```
<SplitterStrip>:
    horizontal: True if self.parent and self.parent.sizable_from[0] in ('t', 'b') else False
    background_normal: 'path to normal horizontal image' if self.horizontal else 'path to vertica
    background_down: 'path to pressed horizontal image' if self.horizontal else 'path to vertical
```

class `kivy.uix.splitter.`**`Splitter`**`(`***kwargs*`)`

Bases: `kivy.uix.boxlayout.BoxLayout`

See module documentation.

Events

on_press:Fired when the splitter is pressed.

on_release:Fired when the splitter is released.

Changed in version 1.6.0: Added *on_press* and *on_release* events.

`border`

Border used for the `BorderImage` graphics instruction.

This must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (4, 4, 4, 4).

`keep_within_parent`

If True, will limit the splitter to stay within its parent widget.

`keep_within_parent` is a `BooleanProperty` and defaults to False.

New in version 1.9.0.

`max_size`

Specifies the maximum size beyond which the widget is not resizable.

`max_size` is a `NumericProperty` and defaults to *500pt*.

`min_size`

Specifies the minimum size beyond which the widget is not resizable.

`min_size` is a `NumericProperty` and defaults to *100pt*.

`rescale_with_parent`

If True, will automatically change size to take up the same proportion of the parent widget when it is resized, while staying within `min_size` and `max_size`. As long as these attributes can be satisfied, this stops the `Splitter` from exceeding the parent size during rescaling.

`rescale_with_parent` is a `BooleanProperty` and defaults to False.

New in version 1.9.0.

sizable_from

Specifies whether the widget is resizable. Options are::*left*, *right*, *top* or *bottom*
sizable_from is an OptionProperty and defaults to *left*.

strip_cls

Specifies the class of the resize Strip.

strip_cls is an kivy.properties.ObjectProperty and defaults to SplitterStrip, which is of type Button.

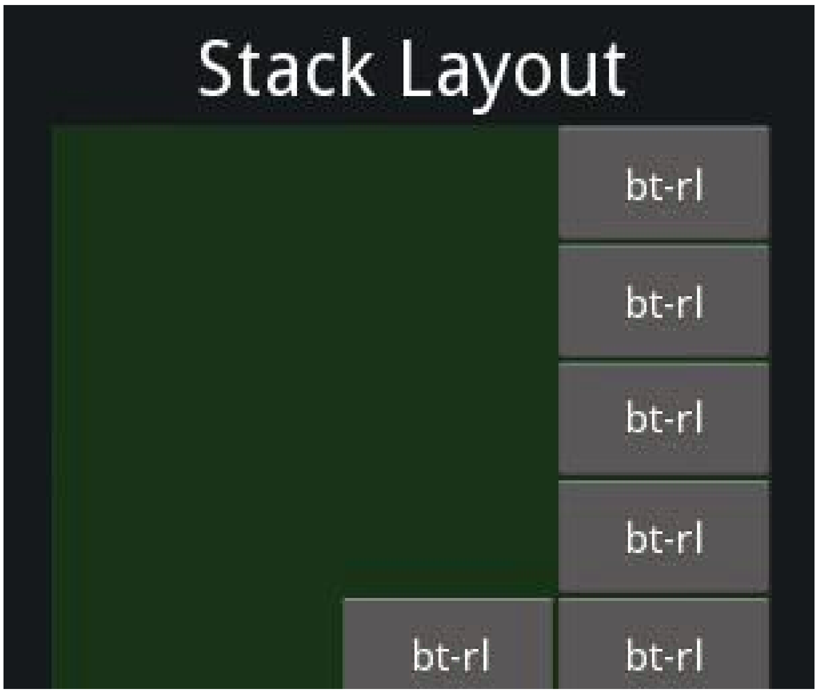
Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

strip_size

Specifies the size of resize strip

strp_size is a NumericProperty defaults to *10pt*

128.38 Stack Layout

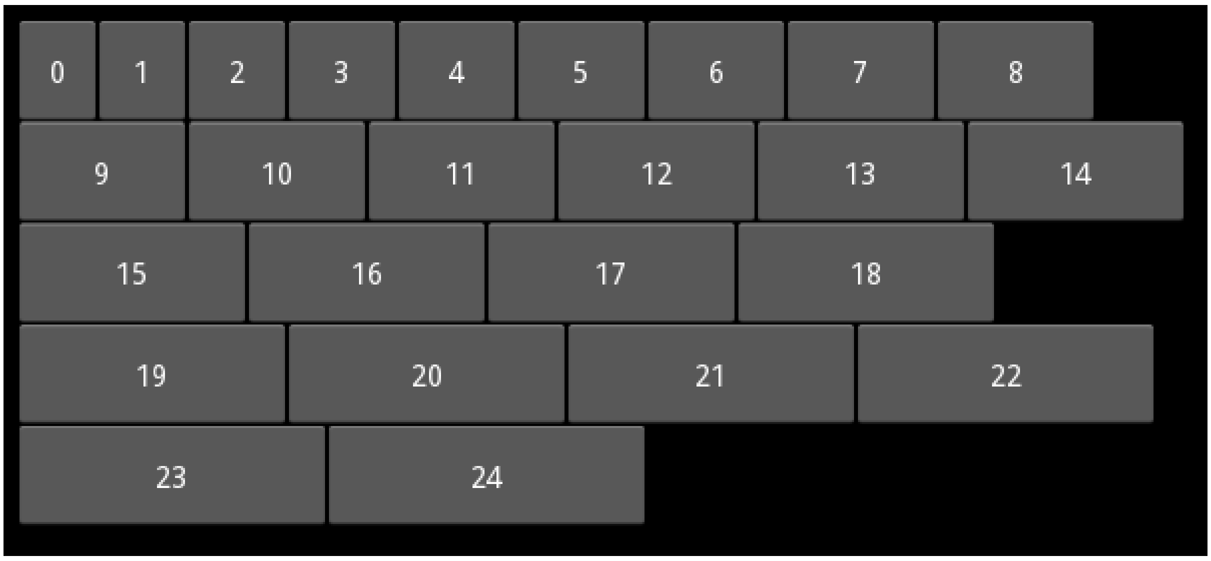


New in version 1.0.5.

The StackLayout arranges children vertically or horizontally, as many as the layout can fit. The size of the individual children widgets do not have to be uniform.

For example, to display widgets that get progressively larger in width:

```
root = StackLayout()
for i in range(25):
    btn = Button(text=str(i), width=40 + i * 5, size_hint=(None, 0.15))
    root.add_widget(btn)
```



class `kivy.uix.stacklayout.`**`StackLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

Stack layout class. See module documentation for more information.

`minimum_height`

Minimum height needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_height` is a `kivy.properties.NumericProperty` and defaults to 0.

`minimum_size`

Minimum size needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_size` is a `ReferenceListProperty` of (`minimum_width`, `minimum_height`) properties.

`minimum_width`

Minimum width needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_width` is a `kivy.properties.NumericProperty` and defaults to 0.

`orientation`

Orientation of the layout.

`orientation` is an `OptionProperty` and defaults to 'lr-tb'.

Valid orientations are 'lr-tb', 'tb-lr', 'rl-tb', 'tb-rl', 'lr-bt', 'bt-lr', 'rl-bt' and 'bt-rl'.

Changed in version 1.5.0: `orientation` now correctly handles all valid combinations of 'lr','rl','tb','bt'. Before this version only 'lr-tb' and 'tb-lr' were supported, and 'tb-lr' was misnamed and placed widgets from bottom to top and from right to left (reversed compared to what was expected).

Note: 'lr' means Left to Right. 'rl' means Right to Left. 'tb' means Top to Bottom. 'bt' means Bottom to Top.

padding

Padding between the layout box and it's children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a single argument form [padding].

Changed in version 1.7.0: Replaced the NumericProperty with a VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

spacing

Spacing between children: [spacing_horizontal, spacing_vertical].

spacing also accepts a single argument form [spacing].

`spacing` is a `VariableListProperty` and defaults to [0, 0].

128.39 Stencil View

New in version 1.0.4.

`StencilView` limits the drawing of child widgets to the StencilView's bounding box. Any drawing outside the bounding box will be clipped (trashed).

The StencilView uses the stencil graphics instructions under the hood. It provides an efficient way to clip the drawing area of children.

Note: As with the stencil graphics instructions, you cannot stack more than 8 stencil-aware widgets.

Note: StencilView is not a layout. Consequently, you have to manage the size and position of its children directly. You can combine (subclass both) a StencilView and a Layout in order to achieve a layout's behavior. For example:

```
class BoxStencil(BoxLayout, StencilView):
    pass
```

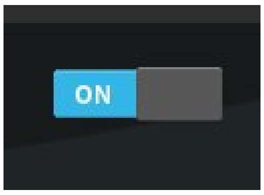
class `kivy.uix.stencilview.`**`StencilView`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

StencilView class. See module documentation for more information.

128.40 Switch

New in version 1.0.7.



The Switch widget is active or inactive, like a mechanical light switch. The user can swipe to the left/right to activate/deactivate it:

```
switch = Switch(active=True)
```

To attach a callback that listens to the activation state:

```
def callback(instance, value):
    print('the switch', instance, 'is', value)

switch = Switch()
switch.bind(active=callback)
```

By default, the representation of the widget is static. The minimum size required is 83x32 pixels (defined by the background image). The image is centered within the widget.

The entire widget is active, not just the part with graphics. As long as you swipe over the widget's bounding box, it will work.

Note: If you want to control the state with a single touch instead of a swipe, use the `ToggleButton` instead.

class `kivy.uix.switch.`**`Switch`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.widget.Widget`

Switch class. See module documentation for more information.

`active`

Indicate whether the switch is active or inactive.

`active` is a `BooleanProperty` and defaults to False.

`active_norm_pos`

(internal) Contains the normalized position of the movable element inside the switch, in the 0-1 range.

`active_norm_pos` is a `NumericProperty` and defaults to 0.

`touch_control`

(internal) Contains the touch that currently interacts with the switch.

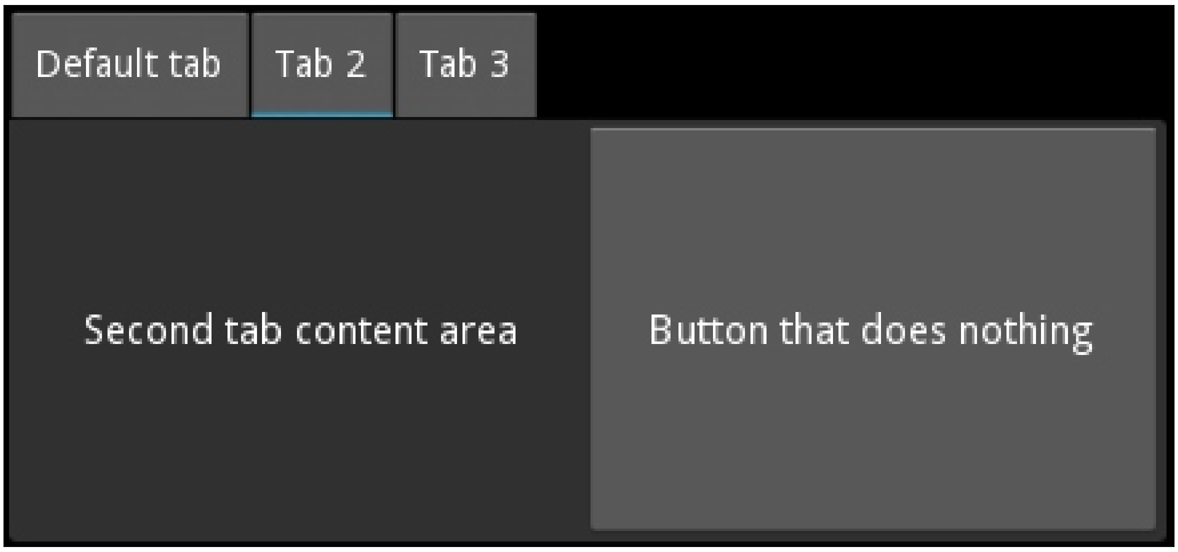
`touch_control` is an `ObjectProperty` and defaults to None.

`touch_distance`

(internal) Contains the distance between the initial position of the touch and the current position to determine if the swipe is from the left or right.

`touch_distance` is a `NumericProperty` and defaults to 0.

128.41 TabbedPanel



New in version 1.3.0.

The *TabbedPanel* widget manages different widgets in tabs, with a header area for the actual tab buttons and a content area for showing the current tab content.

The `TabbedPanel` provides one default tab.

128.41.1 Simple example

```
'''
TabbedPanel
============

Test of the widget TabbedPanel.
'''

from kivy.app import App
from kivy.uix.tabbedpanel import TabbedPanel
from kivy.uix.floatlayout import FloatLayout
from kivy.lang import Builder

Builder.load_string("""

<Test>:
    size_hint: .5, .5
    pos_hint: {'center_x': .5, 'center_y': .5}
    do_default_tab: False

    TabbedPanelItem:
        text: 'first tab'
        Label:
            text: 'First tab content area'
    TabbedPanelItem:
        text: 'tab2'
        BoxLayout:
            Label:
                text: 'Second tab content area'
            Button:
                text: 'Button that does nothing'
        TabbedPanelItem:
            text: 'tab3'
            RstDocument:
                text: '\\n'.join(("Hello world", "-----------", "You are in the third tab."))

""")

class Test(TabbedPanel):
    pass

class TabbedPanelApp(App):
    def build(self):
        return Test()

if __name__ == '__main__':
    TabbedPanelApp().run()
```

Note: A new class `TabbedPanelItem` has been introduced in 1.5.0 for convenience. So now one can simply add a `TabbedPanelItem` to a `TabbedPanel` and *content* to the `TabbedPanelItem` as in the example provided above.

128.41.2 Customize the Tabbed Panel

You can choose the position in which the tabs are displayed:

```
tab_pos = 'top_mid'
```

An individual tab is called a TabbedPanelHeader. It is a special button containing a *content* property. You add the TabbedPanelHeader first, and set its *content* property separately:

```
tp = TabbedPanel()
th = TabbedPanelHeader(text='Tab2')
tp.add_widget(th)
```

An individual tab, represented by a TabbedPanelHeader, needs its content set. This content can be any widget. It could be a layout with a deep hierarchy of widgets, or it could be an individual widget, such as a label or a button:

```
th.content = your_content_instance
```

There is one "shared" main content area active at any given time, for all the tabs. Your app is responsible for adding the content of individual tabs and for managing them, but it's not responsible for content switching. The tabbed panel handles switching of the main content object as per user action.

Note: The default_tab functionality is turned off by default since 1.5.0. To turn it back on, set *do_default_tab* = True.

There is a default tab added when the tabbed panel is instantiated. Tabs that you add individually as above, are added in addition to the default tab. Thus, depending on your needs and design, you will want to customize the default tab:

```
tp.default_tab_text = 'Something Specific To Your Use'
```

The default tab machinery requires special consideration and management. Accordingly, an *on_default_tab* event is provided for associating a callback:

```
tp.bind(default_tab = my_default_tab_callback)
```

It's important to note that by default, `default_tab_cls` is of type `TabbedPanelHeader` and thus has the same properties as other tabs.

Since 1.5.0, it is now possible to disable the creation of the `default_tab` by setting `do_default_tab` to False.

Tabs and content can be removed in several ways:

```
tp.remove_widget(widget/tabbed_panel_header)
or
tp.clear_widgets() # to clear all the widgets in the content area
or
tp.clear_tabs() # to remove the TabbedPanelHeaders
```

To access the children of the tabbed panel, use content.children:

```
tp.content.children
```

To access the list of tabs:

```
tp.tab_list
```

To change the appearance of the main tabbed panel content:

```
background_color = (1, 0, 0, .5) #50% translucent red
border = [0, 0, 0, 0]
background_image = 'path/to/background/image'
```

To change the background of a individual tab, use these two properties:

```
tab_header_instance.background_normal = 'path/to/tab_head/img'
tab_header_instance.background_down = 'path/to/tab_head/img_pressed'
```

A TabbedPanelStrip contains the individual tab headers. To change the appearance of this tab strip, override the canvas of TabbedPanelStrip. For example, in the kv language:

```
<TabbedPanelStrip>
    canvas:
        Color:
            rgba: (0, 1, 0, 1) # green
        Rectangle:
            size: self.size
            pos: self.pos
```

By default the tabbed panel strip takes its background image and color from the tabbed panel's background_image and background_color.

class `kivy.uix.tabbedpanel.`**`StripLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.gridlayout.GridLayout`

The main layout that is used to house the entire tabbedpanel strip including the blank areas in case the tabs don't cover the entire width/height.

New in version 1.8.0.

background_image

Background image to be used for the Strip layout of the TabbedPanel. **background_image is a StringProperty and**defaults to a transparent image.

border

Border property for the background_image.

border is a ListProperty and defaults to [4, 4, 4, 4]

class kivy.uix.tabbedpanel.**TabbedPanel**(***kwargs*)

Bases: kivy.uix.gridlayout.GridLayout

The TabbedPanel class. See module documentation for more information.

background_color

Background color, in the format (r, g, b, a).

background_color is a ListProperty and defaults to [1, 1, 1, 1].

background_disabled_image

Background image of the main shared content object when disabled.

New in version 1.8.0.

background_disabled_image is a StringProperty and defaults to 'atlas://data/images/defaulttheme/tab'.

background_image

Background image of the main shared content object.

background_image is a StringProperty and defaults to 'atlas://data/images/defaulttheme/tab'.

border

Border used for BorderImage graphics instruction, used itself for background_image. Can be changed for a custom background.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information.

border is a ListProperty and defaults to (16, 16, 16, 16)

content

This is the object holding (current_tab's content is added to this) the content of the current tab. To Listen to the changes in the content of the current tab, you should bind to current_tabs *content* property.

content is an ObjectProperty and defaults to 'None'.

current_tab

Links to the currently selected or active tab.

New in version 1.4.0.

current_tab is an AliasProperty, read-only.

default_tab

Holds the default tab.

Note: For convenience, the automatically provided default tab is deleted when you change default_tab to something else. As of 1.5.0, this behaviour has been extended to every *default_tab* for consistency and not just the automatically provided one.

---

default_tab is an AliasProperty.

`default_tab_cls`

Specifies the class to use for the styling of the default tab.

New in version 1.4.0.

> **Warning:** *default_tab_cls* should be subclassed from *TabbedPanelHeader*

`default_tab_cls` is an `ObjectProperty` and defaults to *TabbedPanelHeader*. If you set a string, the `Factory` will be used to resolve the class.

Changed in version 1.8.0: The `Factory` will resolve the class if a string is set.

`default_tab_content`

Holds the default tab content.

`default_tab_content` is an `AliasProperty`.

`default_tab_text`

Specifies the text displayed on the default tab header.

`default_tab_text` is a `StringProperty` and defaults to 'default tab'.

`do_default_tab`

Specifies whether a default_tab head is provided.

New in version 1.5.0.

`do_default_tab` is a `BooleanProperty` and defaults to 'True'.

`strip_border`

Border to be used on `strip_image`.

New in version 1.8.0.

`strip_border` is a `ListProperty` and defaults to [4, 4, 4, 4].

`strip_image`

Background image of the tabbed strip.

New in version 1.8.0.

`strip_image` is a `StringProperty` and defaults to a empty image.

`switch_to`(*header*)

Switch to a specific panel header.

`tab_height`

Specifies the height of the tab header.

`tab_height` is a `NumericProperty` and defaults to 40.

`tab_list`

List of all the tab headers.

`tab_list` is an `AliasProperty` and is read-only.

`tab_pos`

Specifies the position of the tabs relative to the content. Can be one of: *left_top*, *left_mid*, *left_bottom*, *top_left*, *top_mid*, *top_right*, *right_top*, *right_mid*, *right_bottom*, *bottom_left*, *bottom_mid*, *bottom_right*.

`tab_pos` is an `OptionProperty` and defaults to 'bottom_mid'.

`tab_width`

Specifies the width of the tab header.

`tab_width` is a `NumericProperty` and defaults to 100.

class `kivy.uix.tabbedpanel.`**`TabbedPanelContent`**(***kwargs*)
Bases: `kivy.uix.floatlayout.FloatLayout`

The TabbedPanelContent class.

class `kivy.uix.tabbedpanel.`**`TabbedPanelHeader`**(***kwargs*)
Bases: `kivy.uix.togglebutton.ToggleButton`

A Base for implementing a Tabbed Panel Head. A button intended to be used as a Heading/Tab for a TabbedPanel widget.

You can use this TabbedPanelHeader widget to add a new tab to a TabbedPanel.

`content`
Content to be loaded when this tab header is selected.

`content` is an `ObjectProperty` and defaults to None.

class `kivy.uix.tabbedpanel.`**`TabbedPanelItem`**(***kwargs*)
Bases: `kivy.uix.tabbedpanel.TabbedPanelHeader`

This is a convenience class that provides a header of type TabbedPanelHeader and links it with the content automatically. Thus facilitating you to simply do the following in kv language:

```
<TabbedPanel>:
    ...other settings
    TabbedPanelItem:
        BoxLayout:
            Label:
                text: 'Second tab content area'
            Button:
                text: 'Button that does nothing'
```

New in version 1.5.0.

class `kivy.uix.tabbedpanel.`**`TabbedPanelStrip`**(***kwargs*)
Bases: `kivy.uix.gridlayout.GridLayout`

A strip intended to be used as background for Heading/Tab. This does not cover the blank areas in case the tabs don't cover the entire width/height of the TabbedPanel(use StripLayout for that).

`tabbed_panel`
Link to the panel that the tab strip is a part of.

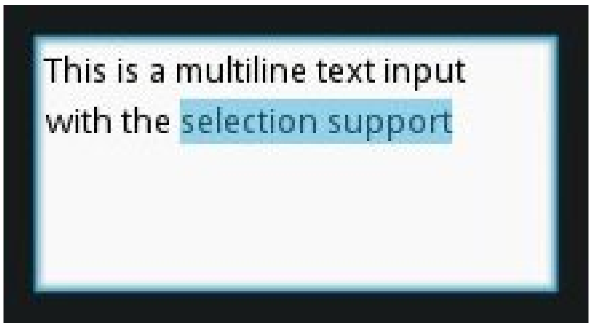
`tabbed_panel` is an `ObjectProperty` and defaults to None .

class `kivy.uix.tabbedpanel.`**`TabbedPanelException`**
Bases: `exceptions.Exception`

The TabbedPanelException class.

128.42 Text Input

New in version 1.0.4.


This is a multiline text input
with the selection support

The TextInput widget provides a box of editable plain text.

Unicode, multiline, cursor navigation, selection and clipboard features are supported.

Note: Two different coordinate systems are used with TextInput:

- (x, y) - coordinates in pixels, mostly used for rendering on screen.
- (row, col) - cursor index in characters / lines, used for selection and cursor movement.

128.42.1 Usage example

To create a multiline textinput ('enter' key adds a new line):

```
from kivy.uix.textinput import TextInput
textinput = TextInput(text='Hello world')
```

To create a singleline textinput, set the multiline property to False ('enter' key will defocus the textinput and emit on_text_validate event):

```
def on_enter(instance, value):
    print('User pressed enter in', instance)

textinput = TextInput(text='Hello world', multiline=False)
textinput.bind(on_text_validate=on_enter)
```

The textinput's text is stored on its TextInput.text property. To run a callback when the text changes:

```
def on_text(instance, value):
    print('The widget', instance, 'have:', value)

textinput = TextInput()
textinput.bind(text=on_text)
```

You can 'focus' a textinput, meaning that the input box will be highlighted and keyboard focus will be requested:

```
textinput = TextInput(focus=True)
```

The textinput is defocused if the 'escape' key is pressed, or if another widget requests the keyboard. You can bind a callback to the focus property to get notified of focus changes:

```
def on_focus(instance, value):
    if value:
        print('User focused', instance)
    else:
        print('User defocused', instance)

textinput = TextInput()
textinput.bind(focus=on_focus)
```

128.42.2 Selection

The selection is automatically updated when the cursor position changes. You can get the currently selected text from the `TextInput.selection_text` property.

128.42.3 Filtering

You can control which text can be added to the `TextInput` by overwriting `TextInput.insert_text()`.Every string that is typed, pasted or inserted by any other means to the `TextInput` is passed through this function. By overwriting it you can reject or change unwanted characters.

For example, to write only in capitalized characters:

```
class CapitalInput(TextInput):

    def insert_text(self, substring, from_undo=False):
        s = substring.upper()
        return super(CapitalInput, self).insert_text(s, from_undo=from_undo)
```

Or to only allow floats (0 - 9 and a single period):

```
class FloatInput(TextInput):

    pat = re.compile('[^0-9]')
    def insert_text(self, substring, from_undo=False):
        pat = self.pat
        if '.' in self.text:
            s = re.sub(pat, '', substring)
        else:
            s = '.'.join([re.sub(pat, '', s) for s in substring.split('.', 1)])
        return super(FloatInput, self).insert_text(s, from_undo=from_undo)
```

128.42.4 Default shortcuts

Shortcuts	Description
Left	Move cursor to left
Right	Move cursor to right
Up	Move cursor to up
Down	Move cursor to down
Home	Move cursor at the beginning of the line
End	Move cursor at the end of the line
PageUp	Move cursor to 3 lines before
PageDown	Move cursor to 3 lines after
Backspace	Delete the selection or character before the cursor
Del	Delete the selection of character after the cursor
Shift + <dir>	Start a text selection. Dir can be Up, Down, Left, Right
Control + c	Copy selection
Control + x	Cut selection
Control + p	Paste selection
Control + a	Select all the content
Control + z	undo
Control + r	redo

class `kivy.uix.textinput.`**`TextInput`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

TextInput class. See module documentation for more information.

Events

on_text_validate Fired only in multiline=False mode when the user hits 'enter'. This will also unfocus the textinput.

on_double_tap Fired when a double tap happens in the text input. The default behavior selects the text around the cursor position. More info at `on_double_tap()`.

on_triple_tap Fired when a triple tap happens in the text input. The default behavior selects the line around the cursor position. More info at `on_triple_tap()`.

on_quad_touch Fired when four fingers are touching the text input. The default behavior selects the whole text. More info at `on_quad_touch()`.

Warning: When changing a `TextInput` property that requires re-drawing, e.g. modifying the `text`, the updates occur on the next clock cycle and not instantly. This might cause any changes to the `TextInput` that occur between the modification and the next cycle to be ignored, or to use previous values. For example, after a update to the `text`, changing the cursor in the same clock frame will move it using the previous text and will likely end up in an incorrect position. The solution is to schedule any updates to occur on the next clock cycle using `schedule_once()`.

Changed in version 1.7.0: *on_double_tap*, *on_triple_tap* and *on_quad_touch* events added.

`allow_copy`

Decides whether to allow copying the text.

New in version 1.8.0.

`allow_copy` is a `BooleanProperty` and defaults to True.

`auto_indent`

Automatically indent multiline text.

New in version 1.7.0.

auto_indent is a BooleanProperty and defaults to False.

background_active
Background image of the TextInput when it's in focus.

New in version 1.4.1.

background_active is a StringProperty and defaults to 'atlas://data/images/defaulttheme/textinput_active'.

background_color
Current color of the background, in (r, g, b, a) format.

New in version 1.2.0.

background_color is a ListProperty and defaults to [1, 1, 1, 1] (white).

background_disabled_active
Background image of the TextInput when it's in focus and disabled.

New in version 1.8.0.

background_disabled_active is a StringProperty and defaults to 'atlas://data/images/defaulttheme/textinput_disabled_active'.

background_disabled_normal
Background image of the TextInput when disabled.

New in version 1.8.0.

background_disabled_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/textinput_disabled'.

background_normal
Background image of the TextInput when it's not in focus.

New in version 1.4.1.

background_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/textinput'.

border
Border used for BorderImage graphics instruction. Used with background_normal and background_active. Can be used for a custom background.

New in version 1.4.1.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instruction for more information about how to use it.

border is a ListProperty and defaults to (4, 4, 4, 4).

cancel_selection()
Cancel current selection (if any).

copy(*data=''*)
Copy the value provided in argument *data* into current clipboard. If data is not of type string it will be converted to string. If no data is provided then current selection if present is copied.

New in version 1.8.0.

cursor
Tuple of (row, col) values indicating the current cursor position. You can set a new (row, col) if you want to move the cursor. The scrolling area will be automatically updated to ensure that the cursor is visible inside the viewport.

cursor is an AliasProperty.

cursor_blink

This property is used to blink the cursor graphic. The value of `cursor_blink` is automatically computed. Setting a value on it will have no impact.

`cursor_blink` is a `BooleanProperty` and defaults to False.

cursor_col

Current column of the cursor.

`cursor_col` is an `AliasProperty` to cursor[0], read-only.

cursor_color

Current color of the cursor, in (r, g, b, a) format.

New in version 1.9.0.

`cursor_color` is a `ListProperty` and defaults to [1, 0, 0, 1].

cursor_index(*cursor=None*)

Return the cursor index in the text/value.

cursor_offset()

Get the cursor x offset on the current line.

cursor_pos

Current position of the cursor, in (x, y).

`cursor_pos` is an `AliasProperty`, read-only.

cursor_row

Current row of the cursor.

`cursor_row` is an `AliasProperty` to cursor[1], read-only.

cut()

Copy current selection to clipboard then delete it from TextInput.

New in version 1.8.0.

delete_selection(*from_undo=False*)

Delete the current text selection (if any).

disabled_foreground_color

Current color of the foreground when disabled, in (r, g, b, a) format.

New in version 1.8.0.

`disabled_foreground_color` is a `ListProperty` and defaults to [0, 0, 0, 5] (50% transparent black).

do_backspace(*from_undo=False, mode='bkspc'*)

Do backspace operation from the current cursor position. This action might do several things:

- removing the current selection if available.
- removing the previous char and move the cursor back.
- do nothing, if we are at the start.

do_cursor_movement(*action*)

Move the cursor relative to it's current position. Action can be one of :

- cursor_left: move the cursor to the left
- cursor_right: move the cursor to the right
- cursor_up: move the cursor on the previous line
- cursor_down: move the cursor on the next line
- cursor_home: move the cursor at the start of the current line
- cursor_end: move the cursor at the end of current line
- cursor_pgup: move one "page" before

- cursor_pgdown: move one "page" after

do_redo()

Do redo operation.

New in version 1.3.0.

This action re-does any command that has been un-done by do_undo/ctrl+z. This function is automatically called when *ctrl+r* keys are pressed.

do_undo()

Do undo operation.

New in version 1.3.0.

This action un-does any edits that have been made since the last call to reset_undo(). This function is automatically called when *ctrl+z* keys are pressed.

focus

If focus is True, the keyboard will be requested and you can start entering text into the textinput.

`focus` is a `BooleanProperty` and defaults to False.

Note: Selection is cancelled when TextInput is focused. If you need to show selection when TextInput is focused, you should delay (use Clock.schedule) the call to the functions for selecting text (select_all, select_text).

---

font_name

Filename of the font to use. The path can be absolute or relative. Relative paths are resolved by the `resource_find()` function.

> **Warning:** Depending on your text provider, the font file may be ignored. However, you can mostly use this without problems.
> If the font used lacks the glyphs for the particular language/symbols you are using, you will see '[]' blank box characters instead of the actual glyphs. The solution is to use a font that has the glyphs you need to display. For example, to display क, use a font like freesans.ttf that has the glyph.

`font_name` is a `StringProperty` and defaults to 'DroidSans'.

font_size

Font size of the text in pixels.

`font_size` is a `NumericProperty` and defaults to 10.

foreground_color

Current color of the foreground, in (r, g, b, a) format.

New in version 1.2.0.

`foreground_color` is a `ListProperty` and defaults to [0, 0, 0, 1] (black).

get_cursor_from_index(*index*)

Return the (row, col) of the cursor from text index.

get_cursor_from_xy(*x, y*)

Return the (row, col) of the cursor from an (x, y) position.

handle_image_left

Image used to display the Left handle on the TextInput for selection.

New in version 1.8.0.

`handle_image_left` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_left'.

`handle_image_middle`

Image used to display the middle handle on the TextInput for cursor positioning.

New in version 1.8.0.

`handle_image_middle` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_middle'.

`handle_image_right`

Image used to display the Right handle on the TextInput for selection.

New in version 1.8.0.

`handle_image_right` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_right'.

`hide_keyboard``()`

Convenience function to hide the keyboard in managed mode

`hint_text`

Hint text of the widget.

Shown if text is '' and focus is False.

New in version 1.6.0.

`hint_text` a `StringProperty` and defaults to ''.

`hint_text_color`

Current color of the hint_text text, in (r, g, b, a) format.

New in version 1.6.0.

`hint_text_color` is a `ListProperty` and defaults to [0.5, 0.5, 0.5, 1.0] (grey).

`input_filter`

Filters the input according to the specified mode, if not None. If None, no filtering is applied.

New in version 1.9.0.

`input_filter` is an `ObjectProperty` and defaults to *None*. Can be one of *None*, *'int'* (string), or *'float'* (string), or a callable. If it is *'int'*, it will only accept numbers. If it is *'float'* it will also accept a single period. Finally, if it is a callable it will be called with two parameter; the string to be added and a bool indicating whether the string is a result of undo (True). The callable should return a new substring that will be used instead.

`input_type`

The kind of input, keyboard to request

New in version 1.8.0.

`input_type` is an `OptionsProperty` and defaults to 'text'. Can be one of 'text', 'number', 'url', 'mail', 'datetime', 'tel', 'address'.

`insert_text``(`*substring*, *from_undo=False*`)`

Insert new text at the current cursor position. Override this function in order to pre-process text for input validation.

`keyboard_mode`

How the keyboard visibility should be managed (auto will have standard behaviour to show/hide on focus, managed requires setting keyboard_visible manually, or calling the helper functions `show_keyboard()` and `hide_keyboard()`.

New in version 1.8.0.

`keyboard_mode` is an `OptionsProperty` and defaults to 'auto'. Can be one of 'auto' or 'managed'.

`keyboard_suggestions`

If True provides auto suggestions on top of keyboard. This will only work if `input_type` is set to *text*.

New in version 1.8.0.

`keyboard_suggestions` is a `BooleanProperty` defaults to True.

`line_height`

Height of a line. This property is automatically computed from the `font_name`, `font_size`. Changing the line_height will have no impact.

Note: `line_height` is the height of a single line of text. Use `minimum_height`, which also includes padding, to get the height required to display the text properly.

`line_height` is a `NumericProperty`, read-only.

`line_spacing`

Space taken up between the lines.

New in version 1.8.0.

`line_spacing` is a `NumericProperty` and defaults to 0.

`minimum_height`

Minimum height of the content inside the TextInput.

New in version 1.8.0.

`minimum_height` is a readonly `AliasProperty`.

`multiline`

If True, the widget will be able show multiple lines of text. If False, the "enter" keypress will defocus the textinput instead of adding a new line.

`multiline` is a `BooleanProperty` and defaults to True.

`on_double_tap`()

This event is dispatched when a double tap happens inside TextInput. The default behavior is to select the word around the current cursor position. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

`on_quad_touch`()

This event is dispatched when four fingers are touching inside TextInput. The default behavior is to select all text. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

`on_triple_tap`()

This event is dispatched when a triple tap happens inside TextInput. The default behavior is to select the line around current cursor position. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

`padding`

Padding of the text: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced AliasProperty with VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [6, 6, 6, 6].

padding_x

Horizontal padding of the text: [padding_left, padding_right].

padding_x also accepts a one argument form [padding_horizontal].

padding_x is a VariableListProperty and defaults to [0, 0]. This might be changed by the current theme.

Deprecated since version 1.7.0: Use padding instead.

padding_y

Vertical padding of the text: [padding_top, padding_bottom].

padding_y also accepts a one argument form [padding_vertical].

padding_y is a VariableListProperty and defaults to [0, 0]. This might be changed by the current theme.

Deprecated since version 1.7.0: Use padding instead.

password

If True, the widget will display its characters as the character '*'.

New in version 1.2.0.

password is a BooleanProperty and defaults to False.

paste()

Insert text from system Clipboard into the TextInput at current cursor position.

New in version 1.8.0.

readonly

If True, the user will not be able to change the content of a textinput.

New in version 1.3.0.

readonly is a BooleanProperty and defaults to False.

reset_undo()

Reset undo and redo lists from memory.

New in version 1.3.0.

scroll_x

X scrolling value of the viewport. The scrolling is automatically updated when the cursor is moved or text changed. If there is no user input, the scroll_x and scroll_y properties may be changed.

scroll_x is a NumericProperty and defaults to 0.

scroll_y

Y scrolling value of the viewport. See scroll_x for more information.

scroll_y is a NumericProperty and defaults to 0.

select_all()

Select all of the text displayed in this TextInput.

New in version 1.4.0.

select_text(*start*, *end*)

Select a portion of text displayed in this TextInput.

New in version 1.4.0.

Parameters

startIndex of textinput.text from where to start selection

endIndex of textinput.text till which the selection should be displayed

selection_color

Current color of the selection, in (r, g, b, a) format.

Warning: The color should always have an "alpha" component less than 1 since the selection is drawn after the text.

selection_color is a ListProperty and defaults to [0.1843, 0.6549, 0.8313, .5].

selection_from

If a selection is in progress or complete, this property will represent the cursor index where the selection started.

Changed in version 1.4.0: selection_from is an AliasProperty and defaults to None, readonly.

selection_text

Current content selection.

selection_text is a StringProperty and defaults to '', readonly.

selection_to

If a selection is in progress or complete, this property will represent the cursor index where the selection started.

Changed in version 1.4.0: selection_to is an AliasProperty and defaults to None, readonly.

show_keyboard()

Convenience function to show the keyboard in managed mode

tab_width

By default, each tab will be replaced by four spaces on the text input widget. You can set a lower or higher value.

tab_width is a NumericProperty and defaults to 4.

text

Text of the widget.

Creation of a simple hello world:

```
widget = TextInput(text='Hello world')
```

If you want to create the widget with an unicode string, use:

```
widget = TextInput(text=u'My unicode string')
```

text a StringProperty.

use_bubble

Indicates whether the cut/copy/paste bubble is used.

New in version 1.7.0.

use_bubble is a BooleanProperty and defaults to True on mobile OS's, False on desktop OS's.

use_handles

Indicates whether the selection handles are displayed.

New in version 1.8.0.

use_handles is a BooleanProperty and defaults to True on mobile OS's, False on desktop OS's.

128.43 Toggle button

The ToggleButton widget acts like a checkbox. When you touch/click it, the state toggles between 'normal' and 'down' (as opposed to a Button that is only 'down' as long as it is pressed).

Toggle buttons can also be grouped to make radio buttons - only one button in a group can be in a 'down' state. The group name can be a string or any other hashable Python object:

```
btn1 = ToggleButton(text='Male', group='sex',)
btn2 = ToggleButton(text='Female', group='sex', state='down')
btn3 = ToggleButton(text='Mixed', group='sex')
```

Only one of the buttons can be 'down'/checked at the same time.

To configure the ToggleButton, you can use the same properties that you can use for a Button class.

class kivy.uix.togglebutton.**ToggleButton**(***kwargs*)
Bases: kivy.uix.behaviors.ToggleButtonBehavior, kivy.uix.button.Button

Toggle button class, see module documentation for more information.

128.44 Tree View

New in version 1.0.4.

TreeView is a widget used to represent a tree structure. It is currently very basic, supporting a minimal feature set.

128.44.1 Introduction

A TreeView is populated with TreeViewNode instances, but you cannot use a TreeViewNode directly. You must combine it with another widget, such as Label, Button or even your own widget. The TreeView always creates a default root node, based on TreeViewLabel.

TreeViewNode is a class object containing needed properties for serving as a tree node. Extend TreeViewNode to create custom node types for use with a TreeView.

For constructing your own subclass, follow the pattern of TreeViewLabel which combines a Label and a TreeViewNode, producing a TreeViewLabel for direct use in a TreeView instance.

To use the TreeViewLabel class, you could create two nodes directly attached to root:

```
tv = TreeView()
tv.add_node(TreeViewLabel(text='My first item'))
tv.add_node(TreeViewLabel(text='My second item'))
```

Or, create two nodes attached to a first:

```
tv = TreeView()
n1 = tv.add_node(TreeViewLabel(text='Item 1'))
tv.add_node(TreeViewLabel(text='SubItem 1'), n1)
tv.add_node(TreeViewLabel(text='SubItem 2'), n1)
```

If you have a large tree structure, perhaps you would need a utility function to populate the tree view:

```
def populate_tree_view(tree_view, parent, node):
    if parent is None:
        tree_node = tree_view.add_node(TreeViewLabel(text=node['node_id'],
                                                     is_open=True))
    else:
        tree_node = tree_view.add_node(TreeViewLabel(text=node['node_id'],
                                                     is_open=True), parent)

    for child_node in node['children']:
        populate_tree_view(tree_view, tree_node, child_node)


tree = {'node_id': '1',
        'children': [{'node_id': '1.1',
                      'children': [{'node_id': '1.1.1',
                                    'children': [{'node_id': '1.1.1.1',
                                                  'children': []}]},
                                   {'node_id': '1.1.2',
                                    'children': []},
                                   {'node_id': '1.1.3',
                                    'children': []}]},
                     {'node_id': '1.2',
                      'children': []}]}


class TreeWidget(FloatLayout):
    def __init__(self, **kwargs):
        super(TreeWidget, self).__init__(**kwargs)

        tv = TreeView(root_options=dict(text='Tree One'),
                      hide_root=False,
                      indent_level=4)

        populate_tree_view(tv, None, tree)

        self.add_widget(tv)
```

The root widget in the tree view is opened by default and has text set as 'Root'. If you want to change that, you can use the `TreeView.root_options` property. This will pass options to the root widget:

```
tv = TreeView(root_options=dict(text='My root label'))
```

128.44.2 Creating Your Own Node Widget

For a button node type, combine a `Button` and a `TreeViewNode` as follows:

```
class TreeViewButton(Button, TreeViewNode):
    pass
```

You must know that, for a given node, only the `size_hint_x` will be honored. The allocated width for the node will depend of the current width of the TreeView and the level of the node. For example, if a node is at level 4, the width allocated will be:

> treeview.width - treeview.indent_start - treeview.indent_level * node.level

You might have some trouble with that. It is the developer's responsibility to correctly handle adapting the graphical representation nodes, if needed.

class `kivy.uix.treeview.`**`TreeView`**`(`***kwargs*`)`
Bases: `kivy.uix.widget.Widget`

TreeView class. See module documentation for more information.

Events

on_node_expand: **(node,)**Fired when a node is being expanded

on_node_collapse: **(node,)**Fired when a node is being collapsed

`add_node``(`*node, parent=None*`)`
Add a new node to the tree.

Parameters

node: **instance of a `TreeViewNode`**Node to add into the tree

parent: **instance of a `TreeViewNode`, defaults to None**Parent node to attach the new node. If *None*, it is added to the `root` node.

Returnsthe node *node*.

`get_node_at_pos``(`*pos*`)`
Get the node at the position (x, y).

`hide_root`
Use this property to show/hide the initial root node. If True, the root node will be appear as a closed node.

`hide_root` is a `BooleanProperty` and defaults to False.

`indent_level`
Width used for the indentation of each level except the first level.

Computation of indent for each level of the tree is:

```
indent = indent_start + level * indent_level
```

`indent_level` is a `NumericProperty` and defaults to 16.

`indent_start`
Indentation width of the level 0 / root node. This is mostly the initial size to accommodate a tree icon (collapsed / expanded). See `indent_level` for more information about the computation of level indentation.

`indent_start` is a `NumericProperty` and defaults to 24.

`iterate_all_nodes``(`*node=None*`)`
Generator to iterate over all nodes from *node* and down whether expanded or not. If *node* is *None*, the generator start with `root`.

`iterate_open_nodes``(`*node=None*`)`
Generator to iterate over all the expended nodes starting from *node* and down. If *node* is *None*, the generator start with `root`.

To get all the open nodes:

```
treeview = TreeView()
# ... add nodes ...
for node in treeview.iterate_open_nodes():
    print(node)
```

`load_func`
Callback to use for asynchronous loading. If set, asynchronous loading will be automatically done. The callback must act as a Python generator function, using yield to send data back to the treeview.

The callback should be in the format:

```
        def callback(treeview, node):
            for name in ('Item 1', 'Item 2'):
                yield TreeViewLabel(text=name)
```

load_func is a ObjectProperty and defaults to None.

minimum_height

Minimum height needed to contain all children.

New in version 1.0.9.

minimum_height is a kivy.properties.NumericProperty and defaults to 0.

minimum_size

Minimum size needed to contain all children.

New in version 1.0.9.

minimum_size is a ReferenceListProperty of (minimum_width, minimum_height) properties.

minimum_width

Minimum width needed to contain all children.

New in version 1.0.9.

minimum_width is a kivy.properties.NumericProperty and defaults to 0.

remove_node(*node*)

Removes a node from the tree.

New in version 1.0.7.

Parameters

node: **instance of a TreeViewNode** Node to remove from the tree. If *node* is root, it is not removed.

root

Root node.

By default, the root node widget is a TreeViewLabel with text 'Root'. If you want to change the default options passed to the widget creation, use the root_options property:

```
        treeview = TreeView(root_options={
            'text': 'Root directory',
            'font_size': 15})
```

root_options will change the properties of the TreeViewLabel instance. However, you cannot change the class used for root node yet.

root is an AliasProperty and defaults to None. It is read-only. However, the content of the widget can be changed.

root_options

Default root options to pass for root widget. See root property for more information about the usage of root_options.

root_options is an ObjectProperty and defaults to {}.

select_node(*node*)

Select a node in the tree.

selected_node

Node selected by TreeView.select_node() or by touch.

selected_node is a AliasProperty and defaults to None. It is read-only.

toggle_node(*node*)
Toggle the state of the node (open/collapsed).

class kivy.uix.treeview.**TreeViewException**
Bases: exceptions.Exception

Exception for errors in the TreeView.

class kivy.uix.treeview.**TreeViewLabel**(***kwargs*)
Bases: kivy.uix.label.Label, kivy.uix.treeview.TreeViewNode

Combines a Label and a TreeViewNode to create a TreeViewLabel that can be used as a text node in the tree.

See module documentation for more information.

class kivy.uix.treeview.**TreeViewNode**(***kwargs*)
Bases: object

TreeViewNode class, used to build a node class for a TreeView object.

color_selected
Background color of the node when the node is selected.

color_selected is a ListProperty and defaults to [.1, .1, .1, 1].

even_color
Background color of even nodes when the node is not selected.

bg_color is a ListProperty ans defaults to [.5, .5, .5, .1].

is_leaf
Boolean to indicate whether this node is a leaf or not. Used to adjust the graphical representation.

is_leaf is a BooleanProperty and defaults to True. It is automatically set to False when child is added.

is_loaded
Boolean to indicate whether this node is already loaded or not. This property is used only if the TreeView uses asynchronous loading.

is_loaded is a BooleanProperty and defaults to False.

is_open
Boolean to indicate whether this node is opened or not, in case there are child nodes. This is used to adjust the graphical representation.

> **Warning:** This property is automatically set by the TreeView. You can read but not write it.

is_open is a BooleanProperty and defaults to False.

is_selected
Boolean to indicate whether this node is selected or not. This is used adjust the graphical representation.

> **Warning:** This property is automatically set by the TreeView. You can read but not write it.

is_selected is a BooleanProperty and defaults to False.

level
Level of the node.

level is a NumericProperty and defaults to -1.

no_selection
Boolean used to indicate whether selection of the node is allowed ornot.
no_selection is a BooleanProperty and defaults to False.

nodes
List of nodes. The nodes list is different than the children list. A node in the nodes list represents a node on the tree. An item in the children list represents the widget associated with the node.

Warning: This property is automatically set by the TreeView. You can read but not write it.

nodes is a ListProperty and defaults to [].

odd
This property is set by the TreeView widget automatically and is read-only.

odd is a BooleanProperty and defaults to False.

odd_color
Background color of odd nodes when the node is not selected.

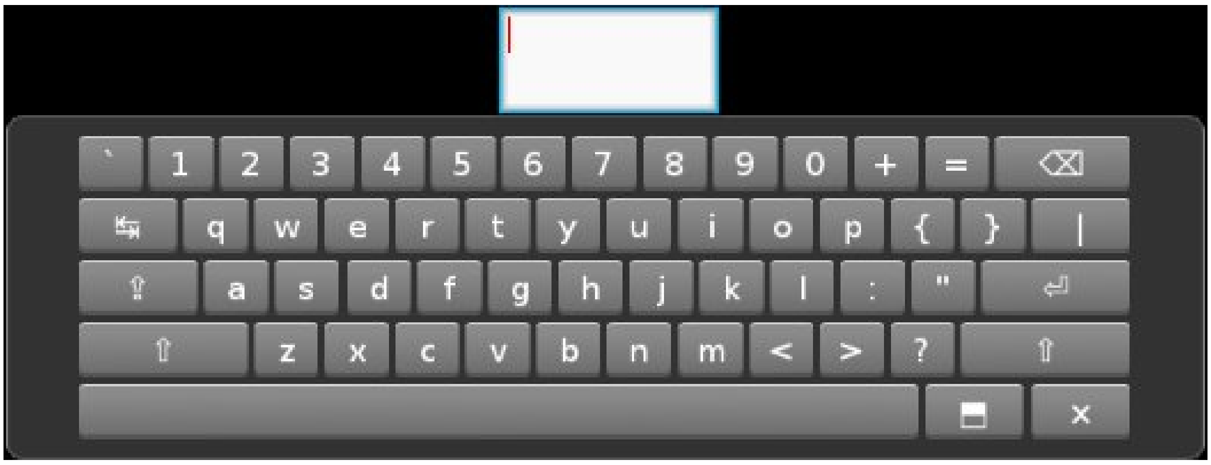
odd_color is a ListProperty and defaults to [1., 1., 1., 0.].

parent_node
Parent node. This attribute is needed because the parent can be None when the node is not displayed.

New in version 1.0.7.

parent_node is an ObjectProperty and defaults to None.

128.45 VKeyboard



New in version 1.0.8.

VKeyboard is an onscreen keyboard for Kivy. Its operation is intended to be transparent to the user. Using the widget directly is NOT recommended. Read the section Request keyboard first.

128.45.1 Modes

This virtual keyboard has a docked and free mode:

- docked mode (VKeyboard.docked = True) Generally used when only one person is using the computer, like a tablet or personal computer etc.
- free mode: (VKeyboard.docked = False) Mostly for multitouch surfaces. This mode allows multiple virtual keyboards to be used on the screen.

If the docked mode changes, you need to manually call VKeyboard.setup_mode() otherwise the change will have no impact. During that call, the VKeyboard, implemented on top of a Scatter, will change the behavior of the scatter and position the keyboard near the target (if target and docked mode is set).

128.45.2 Layouts

The virtual keyboard is able to load a custom layout. If you create a new layout and put the JSON in <kivy_data_dir>/keyboards/<layoutid>.json, you can load it by setting VKeyboard.layout to your layoutid.

The JSON must be structured like this:

```
{
    "title": "Title of your layout",
    "description": "Description of your layout",
    "cols": 15,
    "rows": 5,

    ...
}
```

Then, you need to describe the keys in each row, for either a "normal", "shift" or a "special" (added in version 1.9.0) mode. Keys for this row data must be named *normal_<row>*, *shift_<row>* and *special_<row>*. Replace *row* with the row number. Inside each row, you will describe the key. A key is a 4 element list in the format:

```
[ <text displayed on the keyboard>, <text to put when the key is pressed>,
  <text that represents the keycode>, <size of cols> ]
```

Here are example keys:

```
# f key
["f", "f", "f", 1]
# capslock
["\u21B9", "        ", "tab", 1.5]
```

Finally, complete the JSON:

```
{
    ...
    "normal_1": [
        ["‘", "‘", "‘", 1],    ["1", "1", "1", 1],    ["2", "2", "2", 1],
        ["3", "3", "3", 1],    ["4", "4", "4", 1],    ["5", "5", "5", 1],
        ["6", "6", "6", 1],    ["7", "7", "7", 1],    ["8", "8", "8", 1],
        ["9", "9", "9", 1],    ["0", "0", "0", 1],    ["+", "+", "+", 1],
        ["=", "=", "=", 1],    ["\u232b", null, "backspace", 2]
    ],

    "shift_1": [ ... ],
    "normal_2": [ ... ],
    "special_2": [ ... ],
    ...
}
```

128.45.3 Request Keyboard

The instantiation of the virtual keyboard is controlled by the configuration. Check *keyboard_mode* and *keyboard_layout* in the *Configuration object*.

If you intend to create a widget that requires a keyboard, do not use the virtual keyboard directly, but prefer to use the best method available on the platform. Check the `request_keyboard()` method in the *Window*.

If you want a specific layout when you request the keyboard, you should write something like this (from 1.8.0, numeric.json can be in the same directory as your main.py):

```
keyboard = Window.request_keyboard(
    self._keyboard_close, self)
if keyboard.widget:
    vkeyboard = self._keyboard.widget
    vkeyboard.layout = 'numeric.json'
```

class `kivy.uix.vkeyboard.`**`VKeyboard`**`(`***kwargs*`)`
Bases: `kivy.uix.scatter.Scatter`

VKeyboard is an onscreen keyboard with multitouch support. Its layout is entirely customizable and you can switch between available layouts using a button in the bottom right of the widget.

Events

on_key_down: **keycode, internal, modifiers**Fired when the keyboard received a key down event (key press).

on_key_up: **keycode, internal, modifiers**Fired when the keyboard received a key up event (key release).

`available_layouts`

Dictionary of all available layouts. Keys are the layout ID, and the value is the JSON (translated into a Python object).

`available_layouts` is a `DictProperty` and defaults to {}.

`background`

Filename of the background image.

`background` a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard`

`background_border`

Background image border. Used for controlling the `border` property of the background.

`background_border` is a `ListProperty` and defaults to [16, 16, 16, 16]

`background_color`

Background color, in the format (r, g, b, a). If a background is set, the color will be combined with the background texture.

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_disabled`

Filename of the background image when vkeyboard is disabled.

New in version 1.8.0.

`background_disabled` is a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard__disabled_background`.

callback

Callback can be set to a function that will be called if the VKeyboard is closed by the user.

target is an ObjectProperty instance and defaults to None.

collide_margin(*x*, *y*)

Do a collision test, and return True if the (x, y) is inside the vkeyboard margin.

docked

Indicate whether the VKeyboard is docked on the screen or not. If you change it, you must manually call setup_mode() otherwise it will have no impact. If the VKeyboard is created by the Window, the docked mode will be automatically set by the configuration, using the *keyboard_mode* token in *[kivy]* section.

docked is a BooleanProperty and defaults to False.

key_background_color

Key background color, in the format (r, g, b, a). If a key background is set, the color will be combined with the key background texture.

key_background_color is a ListProperty and defaults to [1, 1, 1, 1].

key_background_down

Filename of the key background image for use when a touch is active on the widget.

key_background_down a StringProperty and defaults to atlas://data/images/defaulttheme/vkeyboard_key_down.

key_background_normal

Filename of the key background image for use when no touches are active on the widget.

key_background_normal a StringProperty and defaults to atlas://data/images/defaulttheme/vkeyboard_key_normal.

key_border

Key image border. Used for controlling the border property of the key.

key_border is a ListProperty and defaults to [16, 16, 16, 16]

key_disabled_background_normal

Filename of the key background image for use when no touches are active on the widget and vkeyboard is disabled.

..versionadded:: 1.8.0

key_disabled_background_normal a StringProperty and defaults to atlas://data/images/defaulttheme/vkeyboard_disabled_key_normal.

key_margin

Key margin, used to create space between keys. The margin is composed of four values, in pixels:

```
key_margin = [top, right, bottom, left]
```

key_margin is a ListProperty and defaults to [2, 2, 2, 2]

layout

Layout to use for the VKeyboard. By default, it will be the layout set in the configuration, according to the *keyboard_layout* in *[kivy]* section.

Changed in version 1.8.0: If layout is a .json filename, it will loaded and added to the available_layouts.

layout is a StringProperty and defaults to None.

layout_path
Path from which layouts are read.

`layout` is a `StringProperty` and defaults to `<kivy_data_dir>/keyboards/`

margin_hint
Margin hint, used as spacing between keyboard background and keys content. The margin is composed of four values, between 0 and 1:

```
margin_hint = [top, right, bottom, left]
```

The margin hints will be multiplied by width and height, according to their position.

`margin_hint` is a `ListProperty` and defaults to [.05, .06, .05, .06]

refresh(*force=False*)
(internal) Recreate the entire widget and graphics according to the selected layout.

setup_mode(**largs*)
Call this method when you want to readjust the keyboard according to options: `docked` or not, with attached `target` or not:

- If `docked` is True, it will call `setup_mode_dock()`
- If `docked` is False, it will call `setup_mode_free()`

Feel free to overload these methods to create new positioning behavior.

setup_mode_dock(**largs*)
Setup the keyboard in docked mode.

Dock mode will reset the rotation, disable translation, rotation and scale. Scale and position will be automatically adjusted to attach the keyboard to the bottom of the screen.

Note: Don't call this method directly, use `setup_mode()` instead.

setup_mode_free()
Setup the keyboard in free mode.

Free mode is designed to let the user control the position and orientation of the keyboard. The only real usage is for a multiuser environment, but you might found other ways to use it. If a `target` is set, it will place the vkeyboard under the target.

Note: Don't call this method directly, use `setup_mode()` instead.

target
Target widget associated with the VKeyboard. If set, it will be used to send keyboard events. If the VKeyboard mode is "free", it will also be used to set the initial position.

`target` is an `ObjectProperty` instance and defaults to None.

128.46 Video

The `Video` widget is used to display video files and streams. Depending on your Video core provider, platform, and plugins, you will be able to play different formats. For example, the pygame video provider only supports MPEG1 on Linux and OSX. GStreamer is more versatile, and can read many video containers and codecs such as MKV, OGV, AVI, MOV, FLV (if the correct gstreamer plugins are installed). Our `VideoBase` implementation is used under the hood.

Video loading is asynchronous - many properties are not available until the video is loaded (when the texture is created):

```
def on_position_change(instance, value):
    print('The position in the video is', value)
def on_duration_change(instance, value):
    print('The duration of the video is', video)
video = Video(source='PandaSneezes.avi')
video.bind(position=on_position_change,
           duration=on_duration_change)
```

class `kivy.uix.video.`**`Video`**`(`***kwargs*`)`

Bases: `kivy.uix.image.Image`

Video class. See module documentation for more information.

`duration`

Duration of the video. The duration defaults to -1, and is set to a real duration when the video is loaded.

`duration` is a `NumericProperty` and defaults to -1.

`eos`

Boolean, indicates whether the video has finished playing or not (reached the end of the stream).

`eos` is a `BooleanProperty` and defaults to False.

`loaded`

Boolean, indicates whether the video is loaded and ready for playback or not.

New in version 1.6.0.

`loaded` is a `BooleanProperty` and defaults to False.

`options`

Options to pass at Video core object creation.

New in version 1.0.4.

`options` is an `kivy.properties.ObjectProperty` and defaults to {}.

`play`

Deprecated since version 1.4.0: Use `state` instead.

Boolean, indicates whether the video is playing or not. You can start/stop the video by setting this property:

```
# start playing the video at creation
video = Video(source='movie.mkv', play=True)

# create the video, and start later
video = Video(source='movie.mkv')
# and later
video.play = True
```

`play` is a `BooleanProperty` and defaults to False.

Deprecated since version 1.4.0: Use `state` instead.

`position`

Position of the video between 0 and `duration`. The position defaults to -1 and is set to a real position when the video is loaded.

`position` is a `NumericProperty` and defaults to -1.

seek(*percent*)
Change the position to a percentage of duration. Percentage must be a value between 0-1.

Warning: Calling seek() before the video is loaded has no impact.

New in version 1.2.0.

state
String, indicates whether to play, pause, or stop the video:

```
# start playing the video at creation
video = Video(source='movie.mkv', state='play')

# create the video, and start later
video = Video(source='movie.mkv')
# and later
video.state = 'play'
```

`state` is an `OptionProperty` and defaults to 'stop'.

unload()
Unload the video. The playback will be stopped.

New in version 1.8.0.

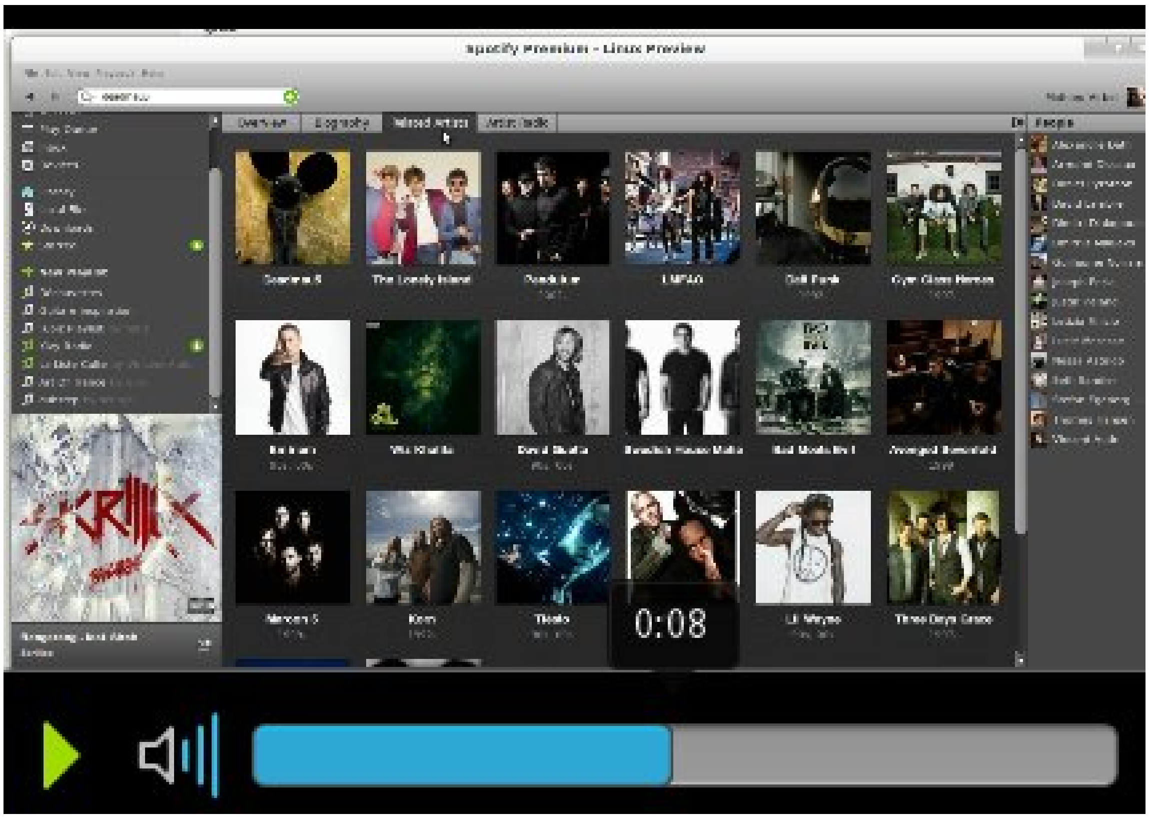
volume
Volume of the video, in the range 0-1. 1 means full volume, 0 means mute.

`volume` is a `NumericProperty` and defaults to 1.

128.47 Video player

New in version 1.2.0.

The video player widget can be used to play video and let the user control the play/pausing, volume and position. The widget cannot be customized much because of the complex assembly of numerous base widgets.



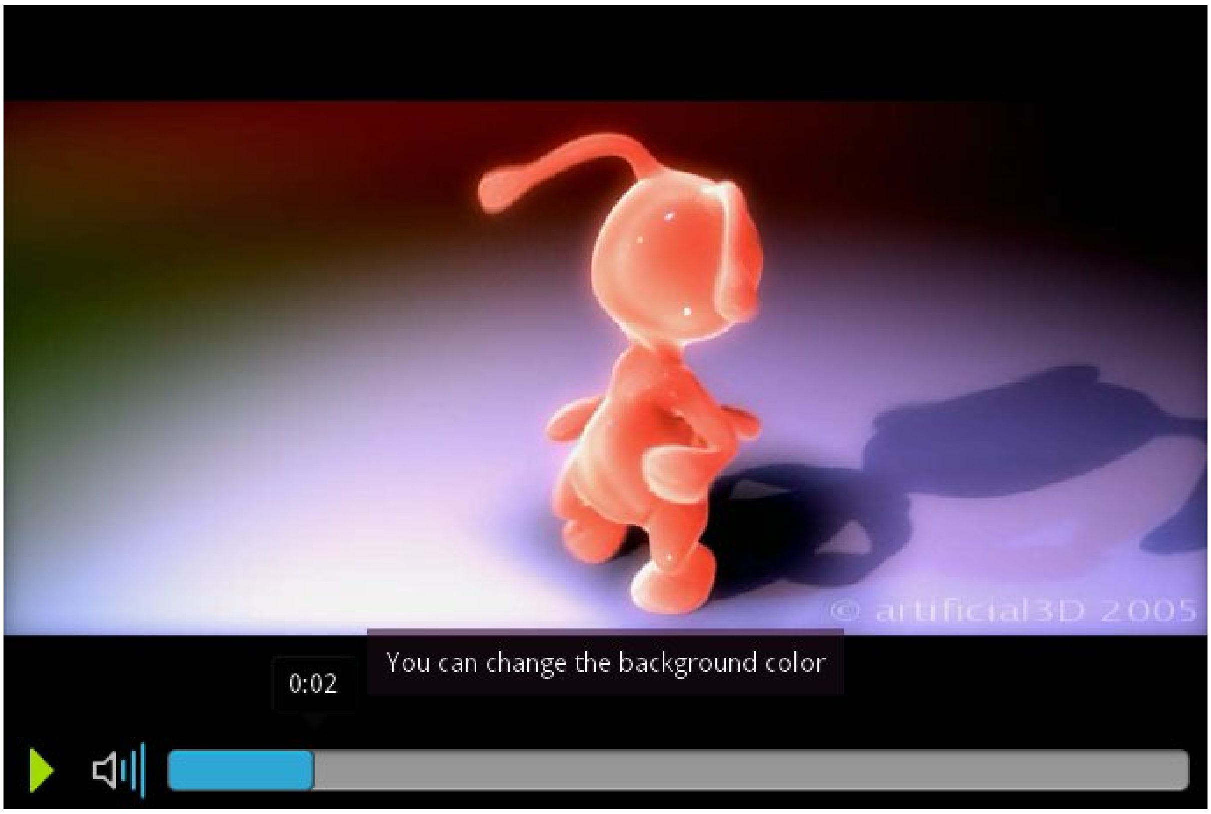
128.47.1 Annotations

If you want to display text at a specific time and for a certain duration, consider annotations. An annotation file has a ".jsa" extension. The player will automatically load the associated annotation file if it exists.

An annotation file is JSON-based, providing a list of label dictionary items. The key and value must match one of the `VideoPlayerAnnotation` items. For example, here is a short version of a jsa file that you can find in *examples/widgets/softboy.jsa*:

```
[
    {"start": 0, "duration": 2,
    "text": "This is an example of annotation"},
    {"start": 2, "duration": 2,
    "bgcolor": [0.5, 0.2, 0.4, 0.5],
    "text": "You can change the background color"}
]
```

For our softboy.avi example, the result will be:



If you want to experiment with annotation files, test with:

```
python -m kivy.uix.videoplayer examples/widgets/softboy.avi
```

128.47.2 Fullscreen

The video player can play the video in fullscreen, if VideoPlayer.allow_fullscreen is activated by a double-tap on the video. By default, if the video is smaller than the Window, it will be not stretched.

You can allow stretching by passing custom options to a VideoPlayer instance:

```
player = VideoPlayer(source='myvideo.avi', state='play',
    options={'allow_stretch': True})
```

128.47.3 End-of-stream behavior

You can specify what happens when the video has finished playing by passing an *eos* (end of stream) directive to the underlying VideoBase class. *eos* can be one of 'stop', 'pause' or 'loop' and defaults to 'stop'. For example, in order to loop the video:

```
player = VideoPlayer(source='myvideo.avi', state='play',
    options={'eos': 'loop'})
```

Note: The *eos* property of the VideoBase class is a string specifying the end-of-stream behavior. This property differs from the *eos* properties of the VideoPlayer and Video classes, whose *eos* property is simply a boolean indicating that the end of the file has been reached.

class `kivy.uix.videoplayer.`**`VideoPlayer`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.gridlayout.GridLayout`

VideoPlayer class. See module documentation for more information.

`allow_fullscreen`
By default, you can double-tap on the video to make it fullscreen. Set this property to False to prevent this behavior.

`allow_fullscreen` is a `BooleanProperty` defaults to True.

`annotations`
If set, it will be used for reading annotations box.

`annotations` is a `StringProperty` and defaults to ''.

`duration`
Duration of the video. The duration defaults to -1 and is set to the real duration when the video is loaded.

`duration` is a `NumericProperty` and defaults to -1.

`fullscreen`
Switch to fullscreen view. This should be used with care. When activated, the widget will remove itself from its parent, remove all children from the window and will add itself to it. When fullscreen is unset, all the previous children are restored and the widget is restored to its previous parent.

> **Warning:** The re-add operation doesn't care about the index position of it's children within the parent.

`fullscreen` is a `BooleanProperty` and defaults to False.

`image_loading`
Image filename used when the video is loading.

`image_loading` is a `StringProperty` and defaults to 'data/images/image-loading.gif'.

`image_overlay_play`
Image filename used to show a "play" overlay when the video has not yet started.

`image_overlay_play` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/player-play-overlay'.

`image_pause`
Image filename used for the "Pause" button.

`image_pause` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/media-playback-pause'.

`image_play`
Image filename used for the "Play" button.

`image_play` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/media-playback-start'.

`image_stop`
Image filename used for the "Stop" button.

`image_stop` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/media-playback-stop'.

`image_volumehigh`
Image filename used for the volume icon when the volume is high.

image_volumehigh is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-high'.

image_volumelow

Image filename used for the volume icon when the volume is low.

image_volumelow is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-low'.

image_volumemedium

Image filename used for the volume icon when the volume is medium.

image_volumemedium is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-medium'.

image_volumemuted

Image filename used for the volume icon when the volume is muted.

image_volumemuted is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-muted'.

options

Optional parameters can be passed to a Video instance with this property.

options a DictProperty and defaults to {}.

play

Deprecated since version 1.4.0: Use state instead.

Boolean, indicates whether the video is playing or not. You can start/stop the video by setting this property:

```
# start playing the video at creation
video = VideoPlayer(source='movie.mkv', play=True)

# create the video, and start later
video = VideoPlayer(source='movie.mkv')
# and later
video.play = True
```

play is a BooleanProperty and defaults to False.

position

Position of the video between 0 and duration. The position defaults to -1 and is set to the real position when the video is loaded.

position is a NumericProperty and defaults to -1.

seek(*percent*)

Change the position to a percentage of the duration. Percentage must be a value between 0-1.

Warning: Calling seek() before video is loaded has no effect.

source

Source of the video to read.

source is a StringProperty and defaults to ''.

Changed in version 1.4.0.

state

String, indicates whether to play, pause, or stop the video:

```
# start playing the video at creation
video = VideoPlayer(source='movie.mkv', state='play')

# create the video, and start later
video = VideoPlayer(source='movie.mkv')
# and later
video.state = 'play'
```

`state` is an `OptionProperty` and defaults to 'play'.

`thumbnail`
Thumbnail of the video to show. If None, VideoPlayer will try to find the thumbnail from the `source` + '.png'.

`thumbnail` a `StringProperty` and defaults to ''.

Changed in version 1.4.0.

`volume`
Volume of the video in the range 0-1. 1 means full volume and 0 means mute.

`volume` is a `NumericProperty` and defaults to 1.

class `kivy.uix.videoplayer.`**`VideoPlayerAnnotation`**`(`***kwargs*`)`
Bases: `kivy.uix.label.Label`

Annotation class used for creating annotation labels.

Additional keys are available:
- bgcolor: [r, g, b, a] - background color of the text box
- bgsource: 'filename' - background image used for the background text box
- border: (n, e, s, w) - border used for the background image

`duration`
Duration of the annotation.

`duration` is a `NumericProperty` and defaults to 1.

`start`
Start time of the annotation.

`start` is a `NumericProperty` and defaults to 0.

128.48 Widget class

The `Widget` class is the base class required to create a Widget. This widget class is designed with a couple of principles in mind:

Event Driven Widget interaction is built on top of events that occur. If a property changes, the widget can respond to the change in the 'on_<propname>' callback. If nothing changes, nothing will be done. That's the main goal of the `Property` class.

Separate the widget and its graphical representation Widgets don't have a *draw()* method. This is done on purpose: The idea is to allow you to create your own graphical representation outside the widget class. Obviously you can still use all the available properties to do that, so that your representation properly reflects the widget's current state. Every widget has its own `Canvas` that you can use to draw. This separation allows Kivy to run your application in a very efficient manner.

Bounding Box / Collision Often you want to know if a certain point is within the bounds of your widget. An example would be a button widget where you want to only trigger an action when the button itself is actually touched. For this, you can use the

Widget.collide_point() method, which will return True if the point you pass to it is inside the axis-aligned bounding box defined by the widget's position and size. If a simple AABB is not sufficient, you can override the method to perform the collision checks with more complex shapes, e.g. a polygon. You can also check if a widget collides with another widget with Widget.collide_widget().

We also have some default values and behaviors that you should be aware of:

- A Widget is not a Layout: it will not change the position or the size of its children. If you want control over positioning or sizing, use a Layout.
- The default size of a widget is (100, 100). This is only changed if the parent is a Layout. For example, if you add a Label inside a Button, the label will not inherit the button's size or position because the button is not a *Layout*: it's just another *Widget*.
- The default size_hint is (1, 1). If the parent is a Layout, then the widget size will be the parent layout's size.
- Widget.on_touch_down(), Widget.on_touch_move(), Widget.on_touch_up() don't do any sort of collisions. If you want to know if the touch is inside your widget, use Widget.collide_point().

128.48.1 Using Properties

When you read the documentation, all properties are described in the format:

```
<name> is a <property class> and defaults to <default value>.
```

e.g.

text is a StringProperty and defaults to ''.

If you want to be notified when the pos attribute changes, i.e. when the widget moves, you can bind your own callback function like this:

```
def callback_pos(instance, value):
    print('The widget', instance, 'moved to', value)

wid = Widget()
wid.bind(pos=callback_pos)
```

Read more about *Properties*.

128.48.2 Basic drawing

Widgets support a range of drawing instructions that you can use to customize the look of your widgets and layouts. For example, to draw a background image for your widget, you can do the following:

```
def redraw(self, args):
    self.bg_rect.size = self.size
    self.bg_rect.pos = self.pos

widget = Widget()
with widget.canvas:
    widget.bg_rect = Rectangle(source="cover.jpg", pos=self.pos, size=self.size)
widget.bind(pos=redraw, size=redraw)
```

To draw a background in kv:

```
Widget:
    canvas:
        Rectangle:
            source: "cover.jpg"
            size: self.size
            pos: self.pos
```

These examples only scratch the surface. Please see the `kivy.graphics` documentation for more information.

128.48.3 Widget touch event bubbling

When you catch touch events between multiple widgets, you often need to be aware of the order in which these events are propogated. In Kivy, events bubble up from the most recently added widget and then backwards through its children (from the most recently added back to the first child). This order is the same for the *on_touch_move* and *on_touch_up* events.

If you want to reverse this order, you can raise events in the children before the parent by using the *super* command. For example:

```
class MyWidget(Widget):
    def on_touch_down(self, touch):
        super(MyWidget, self).on_touch_down(touch)
        # Do stuff here
```

In general, this would seldom be the best approach as every event bubbles all the way through event time and there is no way of determining if it has been handled. In order to stop this event bubbling, one of these methods must return *True*. At this point, Kivy assumes the event has been handled and the propogation stops.

This means that the recommended approach is to let the event bubble naturally but swallow the event if it has been handled. For example:

```
class MyWidget(Widget):
    def on_touch_down(self, touch):
        If <some_condition>:
            # Do stuff here and kill the event
            return True
        else:
            # Continue normal event bubbling
            return super(MyWidget, self).on_touch_down(touch)
```

This approach gives you good control over exactly how events are dispatched and managed. Sometimes, however, you may wish to let the event be completely propogated before taking action. You can use the `Clock` to help you here:

```
class MyLabel(Label):
    def on_touch_down(self, touch, after=False):
        if after:
            print "Fired after the event has been dispatched!"
        else:
            Clock.schedule_once(lambda dt: self.on_touch_down(touch, True))
            return super(MyLabel, self).on_touch_down(touch)
```

class `kivy.uix.widget.`**`Widget`**`(`*****kwargs***`)`

Bases: `kivy.uix.widget.WidgetBase`

Widget class. See module documentation for more information.

Events

on_touch_down:Fired when a new touch event occurs

on_touch_move:Fired when an existing touch moves

on_touch_up:Fired when an existing touch disappears

Warning: Adding a *__del__* method to a class derived from Widget with Python prior to 3.4 will disable automatic garbage collection for instances of that class. This is because the Widget class creates reference cycles, thereby preventing garbage collection.

Changed in version 1.0.9: Everything related to event properties has been moved to the `EventDispatcher`. Event properties can now be used when contructing a simple class without subclassing `Widget`.

Changed in version 1.5.0: The constructor now accepts on_* arguments to automatically bind callbacks to properties or events, as in the Kv language.

`add_widget`(*widget*, *index=0*, *canvas=None*)

Add a new widget as a child of this widget.

Parameters

widget: **`Widget`**Widget to add to our list of children.

index: **int, defaults to 0**Index to insert the widget in the list.

New in version 1.0.5.

canvas: **str, defaults to None**Canvas to add widget's canvas to. Can be 'before', 'after' or None for the default canvas.

New in version 1.9.0.

```
>>> from kivy.uix.button import Button
>>> from kivy.uix.slider import Slider
>>> root = Widget()
>>> root.add_widget(Button())
>>> slider = Slider()
>>> root.add_widget(slider)
```

`canvas` = **None**

Canvas of the widget.

The canvas is a graphics object that contains all the drawing instructions for the graphical representation of the widget.

There are no general properties for the Widget class, such as background color, to keep the design simple and lean. Some derived classes, such as Button, do add such convenience properties but generally the developer is responsible for implementing the graphics representation for a custom widget from the ground up. See the derived widget classes for patterns to follow and extend.

See `Canvas` for more information about the usage.

`center`

Center position of the widget.

`center` is a `ReferenceListProperty` of (`center_x`, `center_y`) properties.

`center_x`

X center position of the widget.

`center_x` is an `AliasProperty` of (`x` + `width` / 2.).

`center_y`

Y center position of the widget.

`center_y` is an `AliasProperty` of (`y` + `height` / 2.).

`children`

List of children of this widget.

`children` is a `ListProperty` and defaults to an empty list.

Use `add_widget()` and `remove_widget()` for manipulating the children list. Don't manipulate the children list directly unless you know what you are doing.

`clear_widgets`(*children=None*)

Remove all widgets added to this widget.

Changed in version 1.8.0: *children* argument can be used to select the children we want to remove. It should be a list of children (or filtered list) of the current widget.

`cls`

Class of the widget, used for styling.

`collide_point`(*x, y*)

Check if a point (x, y) is inside the widget's axis aligned boundingbox.

Parameters

x: **numeric**X position of the point (in window coordinates)

y: **numeric**Y position of the point (in window coordinates)

Returnsbool, True if the point is inside the bounding box.

```
>>> Widget(pos=(10, 10), size=(50, 50)).collide_point(40, 40)
True
```

`collide_widget`(*wid*)

Check if the other widget collides with this widget. Performs an axis-aligned bounding box intersection test by default.

Parameters

wid: **`Widget`** **class**Widget to collide with.

Returnsbool, True if the other widget collides with this widget.

```
>>> wid = Widget(size=(50, 50))
>>> wid2 = Widget(size=(50, 50), pos=(25, 25))
>>> wid.collide_widget(wid2)
True
>>> wid2.pos = (55, 55)
>>> wid.collide_widget(wid2)
False
```

`disabled`

Indicates whether this widget can interact with input or not.

Note:

1.Child Widgets, when added to a disabled widget, will be disabled automatically.

2.Disabling/enabling a parent disables/enables all of its children.

New in version 1.8.0.

`disabled` is a `BooleanProperty` and defaults to False.

`export_to_png`(*filename, *args*)

Saves an image of the widget and its children in png format at the specified filename. Works by removing the widget canvas from its parent, rendering to an `Fbo`, and calling `save()`.

Note: The image includes only this widget and its children. If you want to include widgets elsewhere in the tree, you must call `export_to_png()` from their common parent, or use `screenshot()` to capture the whole window.

Note: The image will be saved in png format, you should include the extension in your filename.

New in version 1.9.0.

get_parent_window()
Return the parent window.

Returns Instance of the parent window. Can be a WindowBase or Widget.

get_root_window()
Return the root window.

Returns Instance of the root window. Can be a WindowBase or Widget.

height
Height of the widget.

height is a NumericProperty and defaults to 100.

Warning: Keep in mind that the *height* property is subject to layout logic and that this has not yet happened at the time of the widget's *__init__* method.

id
Unique identifier of the widget in the tree.

id is a StringProperty and defaults to None.

Warning: If the id is already used in the tree, an exception will be raised.

ids
This is a dictionary of ids defined in your kv language. This will only be populated if you use ids in your kv language code.

New in version 1.7.0.

ids is a DictProperty and defaults to an empty dict {}.

The ids are populated for each root level widget definition. For example:

```
# in kv
<MyWidget@Widget>:
    id: my_widget
    Label:
        id: label_widget
        Widget:
            id: inner_widget
            Label:
                id: inner_label
    TextInput:
        id: text_input
    OtherWidget:
        id: other_widget


<OtherWidget@Widget>
    id: other_widget
    Label:
        id: other_label
        TextInput:
            id: other_textinput
```

Then, in python:

```
>>> widget = MyWidget()
>>> print(widget.ids)
{'other_widget': <weakproxy at 041CFED0 to OtherWidget at 041BEC38>,
'inner_widget': <weakproxy at 04137EA0 to Widget at 04138228>,
'inner_label': <weakproxy at 04143540 to Label at 04138260>,
'label_widget': <weakproxy at 04137B70 to Label at 040F97A0>,
'text_input': <weakproxy at 041BB5D0 to TextInput at 041BEC00>}
>>> print(widget.ids['other_widget'].ids)
{'other_textinput': <weakproxy at 041DBB40 to TextInput at 041BEF48>,
'other_label': <weakproxy at 041DB570 to Label at 041BEEA0>}
>>> print(widget.ids['label_widget'].ids)
{}
```

on_touch_down(*touch*)
Receive a touch down event.

Parameters
touch: **MotionEvent class**Touch received. The touch is in parent coordinates. See relativelayout for a discussion on coordinate systems.

Returns bool. If True, the dispatching of the touch event will stop.

on_touch_move(*touch*)
Receive a touch move event. The touch is in parent coordinates.

See on_touch_down() for more information.

on_touch_up(*touch*)
Receive a touch up event. The touch is in parent coordinates.

See on_touch_down() for more information.

opacity
Opacity of the widget and all its children.

New in version 1.4.1.

The opacity attribute controls the opacity of the widget and its children. Be careful, it's a cumulative attribute: the value is multiplied by the current global opacity and the result is applied to the current context color.

For example, if the parent has an opacity of 0.5 and a child has an opacity of 0.2, the real opacity of the child will be 0.5 * 0.2 = 0.1.

Then, the opacity is applied by the shader as:

```
frag_color = color * vec4(1.0, 1.0, 1.0, opacity);
```

opacity is a NumericProperty and defaults to 1.0.

parent
Parent of this widget.

parent is an ObjectProperty and defaults to None.

The parent of a widget is set when the widget is added to another widget and unset when the widget is removed from its parent.

pos
Position of the widget.

pos is a ReferenceListProperty of (x, y) properties.

pos_hint

Position hint. This property allows you to set the position of the widget inside its parent layout, in percent (similar to size_hint).

For example, if you want to set the top of the widget to be at 90% height of its parent layout, you can write:

```
widget = Widget(pos_hint={'top': 0.9})
```

The keys 'x', 'right' and 'center_x' will use the parent width. The keys 'y', 'top' and 'center_y' will use the parent height.

See *Float Layout* for further reference.

Note: pos_hint is not used by all layouts. Check the documentation of the layout in question to see if it supports pos_hint.

---

pos_hint is an ObjectProperty containing a dict.

proxy_ref

Return a proxy reference to the widget, i.e. without creating a reference to the widget. See weakref.proxy for more information.

New in version 1.7.2.

remove_widget(*widget*)

Remove a widget from the children of this widget.

Parameters

widget: **Widget**Widget to remove from our children list.

```
>>> from kivy.uix.button import Button
>>> root = Widget()
>>> button = Button()
>>> root.add_widget(button)
>>> root.remove_widget(button)
```

right

Right position of the widget.

right is an AliasProperty of (x + width).

size

Size of the widget.

size is a ReferenceListProperty of (width, height) properties.

size_hint

Size hint.

size_hint is a ReferenceListProperty of (size_hint_x, size_hint_y) properties.

See size_hint_x for more information.

size_hint_x

X size hint. Represents how much space the widget should use in the direction of the X axis relative to its parent's width. Only the Layout and Window classes make use of the hint.

The value is in percent as a float from 0. to 1., where 1. means the full size of his parent. 0.5 represents 50%.

size_hint_x is a NumericProperty and defaults to 1.

size_hint_y

Y size hint.

size_hint_y is a NumericProperty and defaults to 1.

See size_hint_x for more information.

to_local(*x, y, relative=False*)

Transform parent coordinates to local coordinates. See relativelayout for details on the coordinate systems.

Parameters

relative: **bool, defaults to False**Change to True if you want to translate coordinates to relative widget coordinates.

to_parent(*x, y, relative=False*)

Transform local coordinates to parent coordinates. See relativelayout for details on the coordinate systems.

Parameters

relative: **bool, defaults to False**Change to True if you want to translate relative positions from a widget to its parent coordinates.

to_widget(*x, y, relative=False*)

Convert the given coordinate from window to local widget coordinates. See relativelayout for details on the coordinate systems.

to_window(*x, y, initial=True, relative=False*)

Transform local coordinates to window coordinates. See relativelayout for details on the coordinate systems.

top

Top position of the widget.

top is an AliasProperty of (y + height).

walk(*restrict=False, loopback=False*)

Iterator that walks the widget tree starting with this widget and goes forward returning widgets in the order in which layouts display them.

Parameters

restrict: **bool, defaults to False**If True, it will only iterate through the widget and its children (or children of its children etc.). Defaults to False.

loopback: **bool, defaults to False**If True, when the last widget in the tree is reached, it'll loop back to the uppermost root and start walking until we hit this widget again. Naturally, it can only loop back when *restrict* is False. Defaults to False.

ReturnsA generator that walks the tree, returning widgets in the forward layout order.

For example, given a tree with the following structure:

```
GridLayout:
    Button
    BoxLayout:
        id: box
        Widget
        Button
    Widget
```

walking this tree:

```
>>> # Call walk on box with loopback True, and restrict False
>>> [type(widget) for widget in box.walk(loopback=True)]
```

```
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>,
    <class 'Widget'>, <class 'GridLayout'>, <class 'Button'>]
>>> # Now with loopback False, and restrict False
>>> [type(widget) for widget in box.walk()]
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>,
    <class 'Widget'>]
>>> # Now with restrict True
>>> [type(widget) for widget in box.walk(restrict=True)]
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>]
```

New in version 1.9.0.

walk_reverse(*loopback=False*)

Iterator that walks the widget tree backwards starting with the widget before this, and going backwards returning widgets in the reverse order in which layouts display them.

This walks in the opposite direction of `walk()`, so a list of the tree generated with `walk()` will be in reverse order compared to the list generated with this, provided *loopback* is True.

Parameters

loopback: **bool, defaults to False**If True, when the uppermost root in the tree is reached, it'll loop back to the last widget and start walking back until after we hit widget again. Defaults to False.

ReturnsA generator that walks the tree, returning widgets in the reverse layout order.

For example, given a tree with the following structure:

```
GridLayout:
    Button
    BoxLayout:
        id: box
        Widget
        Button
    Widget
```

walking this tree:

```
>>> # Call walk on box with loopback True
>>> [type(widget) for widget in box.walk_reverse(loopback=True)]
[<class 'Button'>, <class 'GridLayout'>, <class 'Widget'>,
    <class 'Button'>, <class 'Widget'>, <class 'BoxLayout'>]
>>> # Now with loopback False
>>> [type(widget) for widget in box.walk_reverse()]
[<class 'Button'>, <class 'GridLayout'>]
>>> forward = [w for w in box.walk(loopback=True)]
>>> backward = [w for w in box.walk_reverse(loopback=True)]
>>> forward == backward[::-1]
True
```

New in version 1.9.0.

width

Width of the widget.

`width` is a `NumericProperty` and defaults to 100.

Warning: Keep in mind that the *width* property is subject to layout logic and that this has not yet happened at the time of the widget's *__init__* method.

x

X position of the widget.

x is a NumericProperty and defaults to 0.

y

Y position of the widget.

y is a NumericProperty and defaults to 0.

class kivy.uix.widget.**WidgetException**

Bases: exceptions.Exception

Fired when the widget gets an exception.

128.49 reStructuredText renderer

New in version 1.1.0.

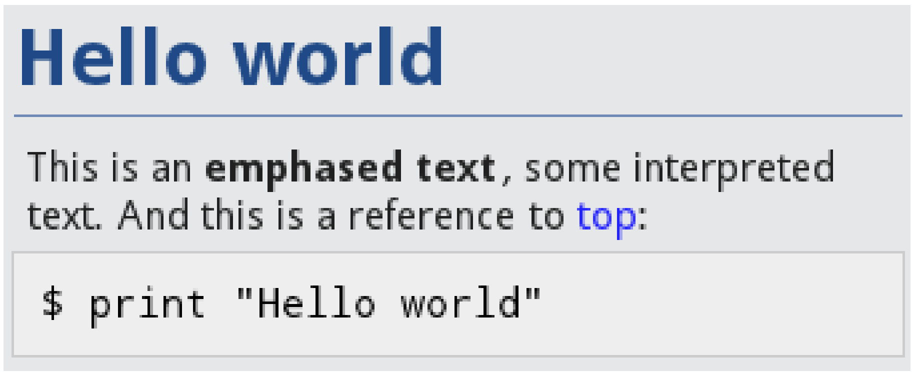
reStructuredText is an easy-to-read, what-you-see-is-what-you-get plaintext markup syntax and parser system.

Warning: This widget is highly experimental. The whole styling and implementation are not stable until this warning has been removed.

128.49.1 Usage with Text

```
text = """
.. _top:

Hello world
===========

This is an **emphased text**, some ``interpreted text``.
And this is a reference to top_::

    $ print("Hello world")

"""
document = RstDocument(text=text)
```

The rendering will output:



Hello world

This is an **emphased text**, some interpreted text. And this is a reference to top:

```
$ print "Hello world"
```

128.49.2 Usage with Source

You can also render a rst file using the `RstDocument.source` property:

```
document = RstDocument(source='index.rst')
```

You can reference other documents with the role `:doc:`. For example, in the document `index.rst` you can write:

```
Go to my next document: :doc:`moreinfo.rst`
```

It will generate a link that, when clicked, opens the `moreinfo.rst` document.

class `kivy.uix.rst.`**`RstDocument`**`(`***kwargs*`)`

Bases: `kivy.uix.scrollview.ScrollView`

Base widget used to store an Rst document. See module documentation for more information.

`background_color`

Specifies the background_color to be used for the RstDocument.

New in version 1.8.0.

`background_color` is an `AliasProperty` for colors['background'].

`base_font_size`

Font size for the biggest title, 31 by default. All other font sizes are derived from this.

New in version 1.8.0.

`colors`

Dictionary of all the colors used in the RST rendering.

> **Warning:** This dictionary is needs special handling. You also need to call `RstDocument.render()` if you change them after loading.

`colors` is a `DictProperty`.

`document_root`

Root path where :doc: will search for rst documents. If no path is given, it will use the directory of the first loaded source file.

`document_root` is a `StringProperty` and defaults to None.

`goto``(`*ref, *largs*`)`

Scroll to the reference. If it's not found, nothing will be done.

For this text:

```
.. _myref:

This is something I always wanted.
```

You can do:

```
from kivy.clock import Clock
from functools import partial

doc = RstDocument(...)
Clock.schedule_once(partial(doc.goto, 'myref'), 0.1)
```

Note: It is preferable to delay the call of the goto if you just loaded the document because the layout might not be finished or the size of the RstDocument has not yet been determined. In either case, the calculation of the scrolling would be wrong.

You can, however, do a direct call if the document is already loaded.

New in version 1.3.0.

preload(*filename*, *encoding='utf-8'*, *errors='strict'*)
Preload a rst file to get its toctree and its title.

The result will be stored in `toctrees` with the `filename` as key.

render()
Force document rendering.

resolve_path(*filename*)
Get the path for this filename. If the filename doesn't exist, it returns the document_root + filename.

show_errors
Indicate whether RST parsers errors should be shown on the screen or not.

`show_errors` is a `BooleanProperty` and defaults to False.

source
Filename of the RST document.

`source` is a `StringProperty` and defaults to None.

source_encoding
Encoding to be used for the `source` file.

`source_encoding` is a `StringProperty` and defaults to *utf-8*.

Note: It is your responsibility to ensure that the value provided is a valid codec supported by python.

source_error
Error handling to be used while encoding the `source` file.

`source_error` is an `OptionProperty` and defaults to *strict*. Can be one of 'strict', 'ignore', 'replace', 'xmlcharrefreplace' or 'backslashreplac'.

text
RST markup text of the document.

`text` is a `StringProperty` and defaults to None.

title
Title of the current document.

`title` is a `StringProperty` and defaults to ''. It is read-only.

toctrees
Toctree of all loaded or preloaded documents. This dictionary is filled when a rst document is explicitly loaded or where `preload()` has been called.

If the document has no filename, e.g. when the document is loaded from a text file, the key will be ''.

`toctrees` is a `DictProperty` and defaults to {}.

underline_color

underline color of the titles, expressed in html color notation

underline_color is a StringProperty and defaults to '204a9699'.

CHAPTER

NINE

ABSTRACT VIEW

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `AbstractView` widget has an adapter property for an adapter that mediates to data. The adapter manages an item_view_instance dict property that holds views for each data item, operating as a cache.

class `kivy.uix.abstractview.`**`AbstractView`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

View using an `Adapter` as a data provider.

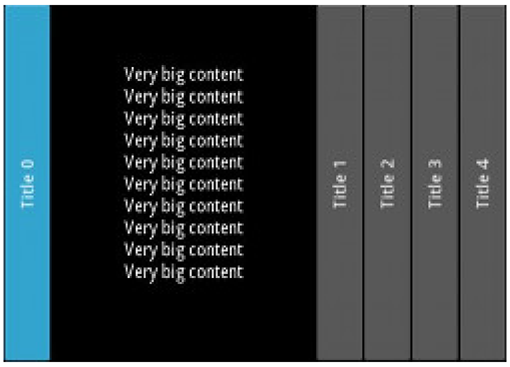
`adapter`

The adapter can be one of several kinds of `adapters`. The most common example is the `ListAdapter` used for managing data items in a list.

CHAPTER

ACCORDION

New in version 1.0.8.



The Accordion widget is a form of menu where the options are stacked either vertically or horizontally and the item in focus (when touched) opens up to display its content.

The `Accordion` should contain one or many `AccordionItem` instances, each of which should contain one root content widget. You'll end up with a Tree something like this:

- Accordion
  - AccordionItem
    - YourContent
  - AccordionItem
    - BoxLayout
      - Another user content 1
      - Another user content 2
  - AccordionItem
    - Another user content

The current implementation divides the `AccordionItem` into two parts:

1. One container for the title bar
2. One container for the content

The title bar is made from a Kv template. We'll see how to create a new template to customize the design of the title bar.

Warning: If you see message like:

```
[WARNING] [Accordion] not have enough space for displaying all children
[WARNING] [Accordion] need 440px, got 100px
[WARNING] [Accordion] layout aborted.
```

That means you have too many children and there is no more space to display the content. This is "normal" and nothing will be done. Try to increase the space for the accordion or reduce the number of children. You can also reduce the `Accordion.min_space`.

130.1 Simple example

```
from kivy.uix.accordion import Accordion, AccordionItem
from kivy.uix.label import Label
from kivy.app import App

class AccordionApp(App):
    def build(self):
        root = Accordion()
        for x in range(5):
            item = AccordionItem(title='Title %d' % x)
            item.add_widget(Label(text='Very big content\n' * 10))
            root.add_widget(item)
        return root

if __name__ == '__main__':
    AccordionApp().run()
```

130.2 Customize the accordion

You can increase the default size of the title bar:

```
root = Accordion(min_space=60)
```

Or change the orientation to vertical:

```
root = Accordion(orientation='vertical')
```

The AccordionItem is more configurable and you can set your own title background when the item is collapsed or opened:

```
item = AccordionItem(background_normal='image_when_collapsed.png',
    background_selected='image_when_selected.png')
```

class `kivy.uix.accordion.`**`Accordion`**(***kwargs*)

Bases: `kivy.uix.widget.Widget`

Accordion class. See module documentation for more information.

`anim_duration`

Duration of the animation in seconds when a new accordion item is selected.

`anim_duration` is a `NumericProperty` and defaults to .25 (250ms).

anim_func

Easing function to use for the animation. Check kivy.animation.AnimationTransition for more information about available animation functions.

anim_func is an ObjectProperty and defaults to 'out_expo'. You can set a string or a function to use as an easing function.

min_space

Minimum space to use for the title of each item. This value is automatically set for each child every time the layout event occurs.

min_space is a NumericProperty and defaults to 44 (px).

orientation

Orientation of the layout.

orientation is an OptionProperty and defaults to 'horizontal'. Can take a value of 'vertical' or 'horizontal'.

class kivy.uix.accordion.**AccordionItem**(***kwargs*)

Bases: kivy.uix.floatlayout.FloatLayout

AccordionItem class that must be used in conjunction with the Accordion class. See the module documentation for more information.

accordion

Instance of the Accordion that the item belongs to.

accordion is an ObjectProperty and defaults to None.

background_disabled_normal

Background image of the accordion item used for the default graphical representation when the item is collapsed and disabled.

New in version 1.8.0.

background__disabled_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_disabled'.

background_disabled_selected

Background image of the accordion item used for the default graphical representation when the item is selected (not collapsed) and disabled.

New in version 1.8.0.

background_disabled_selected is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_disabled_pressed'.

background_normal

Background image of the accordion item used for the default graphical representation when the item is collapsed.

background_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button'.

background_selected

Background image of the accordion item used for the default graphical representation when the item is selected (not collapsed).

background_normal is a StringProperty and defaults to 'atlas://data/images/defaulttheme/button_pressed'.

collapse

Boolean to indicate if the current item is collapsed or not.

collapse is a BooleanProperty and defaults to True.

collapse_alpha

Value between 0 and 1 to indicate how much the item is collasped (1) or whether it is selected (0). It's mostly used for animation.

collapse_alpha is a NumericProperty and defaults to 1.

container

(internal) Property that will be set to the container of children inside the AccordionItem representation.

container_title

(internal) Property that will be set to the container of title inside the AccordionItem representation.

content_size

(internal) Set by the Accordion to the size allocated for the content.

min_space

Link to the Accordion.min_space property.

orientation

Link to the Accordion.orientation property.

title

Title string of the item. The title might be used in conjuction with the *AccordionItemTitle* template. If you are using a custom template, you can use that property as a text entry, or not. By default, it's used for the title text. See title_template and the example below.

title is a StringProperty and defaults to ''.

title_args

Default arguments that will be passed to the `kivy.lang.Builder.template()` method.

title_args is a DictProperty and defaults to {}.

title_template

Template to use for creating the title part of the accordion item. The default template is a simple Label, not customizable (except the text) that supports vertical and horizontal orientation and different backgrounds for collapse and selected mode.

It's better to create and use your own template if the default template does not suffice.

title is a StringProperty and defaults to 'AccordionItemTitle'. The current default template lives in the *kivy/data/style.kv* file.

Here is the code if you want to build your own template:

```
[AccordionItemTitle@Label]:
    text: ctx.title
    canvas.before:
        Color:
            rgb: 1, 1, 1
        BorderImage:
            source:
                ctx.item.background_normal \
                if ctx.item.collapse \
                else ctx.item.background_selected
            pos: self.pos
            size: self.size
        PushMatrix
        Translate:
            xy: self.center_x, self.center_y
        Rotate:
            angle: 90 if ctx.item.orientation == 'horizontal' else 0
```

```
                    axis: 0, 0, 1
                Translate:
                    xy: -self.center_x, -self.center_y
            canvas.after:
                PopMatrix
```

class `kivy.uix.accordion.`**`AccordionException`**

Bases: `exceptions.Exception`

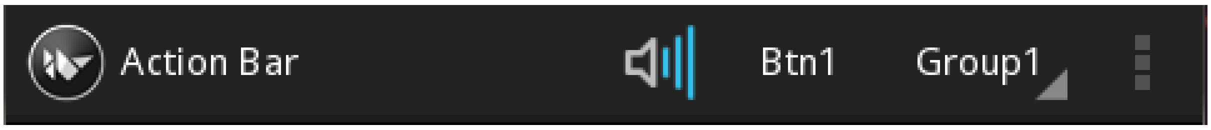
AccordionException class.

CHAPTER

ONE

ACTION BAR

New in version 1.8.0.



The ActionBar widget is like Android's ActionBar, where items are stacked horizontally.

The ActionBar will contain one ActionView and many ContextualActionViews. An ActionView will contain an ActionPrevious having title, app_icon and previous_icon properties. An ActionView will contain subclasses of ActionItems. Some predefined ones inlcude an ActionButton, an ActionToggleButton, an ActionCheck, an ActionSeparator and an ActionGroup.

An ActionGroup is used to display ActionItems in a group. An ActionView will always display an ActionGroup after other ActionItems. An ActionView will contain an ActionOverflow. A ContextualActionView is a subclass of an ActionView.

class `kivy.uix.actionbar.`**`ActionBarException`**

Bases: `exceptions.Exception`

ActionBarException class

class `kivy.uix.actionbar.`**`ActionItem`**

Bases: `object`

ActionItem class, an abstract class for all ActionBar widgets. To create a custom widget for an ActionBar, inherit from this class. See module documentation for more information.

`background_down`

Background image of the ActionItem used for default graphical representation when an ActionItem is pressed.

`background_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_item_down'.

`background_normal`

Background image of the ActionItem used for the default graphical representation when the ActionItem is not pressed.

`background_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_item'.

`important`

Determines if an ActionItem is important or not.

`important` is a `BooleanProperty` and defaults to False.

inside_group

(internal) Determines if an ActionItem is displayed inside an ActionGroup or not.

inside_group is a BooleanProperty and defaults to False.

minimum_width

Minimum Width required by an ActionItem.

minimum_width is a NumericProperty and defaults to '90sp'.

mipmap

Defines whether the image/icon dispayed on top of the button uses a mipmap or not.

mipmap is a BooleanProperty and defaults to *True*.

class kivy.uix.actionbar.**ActionButton**(***kwargs*)

Bases: kivy.uix.button.Button, kivy.uix.actionbar.ActionItem

ActionButton class, see module documentation for more information.

The text color, width and size_hint_x are set manually via the Kv language file. It covers a lot of cases: with/without an icon, with/without a group and takes care of the padding between elements.

You don't have much control over these properties, so if you want to customize it's appearance, we suggest you create you own button representation. You can do this by creating a class that subclasses an existing widget and an ActionItem:

```
class MyOwnActionButton(Button, ActionItem):
    pass
```

You can then create your own style using the Kv language.

icon

Source image to use when the Button is part of the ActionBar. If the Button is in a group, the text will be preferred.

class kivy.uix.actionbar.**ActionToggleButton**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.togglebutton.ToggleButton

ActionToggleButton class, see module documentation for more information.

icon

Source image to use when the Button is part of the ActionBar. If the Button is in a group, the text will be preferred.

class kivy.uix.actionbar.**ActionCheck**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.checkbox.CheckBox

ActionCheck class, see module documentation for more information.

class kivy.uix.actionbar.**ActionSeparator**(***kwargs*)

Bases: kivy.uix.actionbar.ActionItem, kivy.uix.widget.Widget

ActionSeparator class, see module documentation for more information.

background_image

Background image for the separators default graphical representation.

background_image is a StringProperty and defaults to 'atlas://data/images/defaulttheme/separator'.

class kivy.uix.actionbar.**ActionDropDown**(***kwargs*)

Bases: kivy.uix.dropdown.DropDown

ActionDropDown class, see module documentation for more information.

class `kivy.uix.actionbar.`**`ActionGroup`**`(`***kwargs*`)`
Bases: `kivy.uix.actionbar.ActionItem`, `kivy.uix.spinner.Spinner`

ActionGroup class, see module documentation for more information.

`mode`
Sets the current mode of an ActionGroup. If mode is 'normal', the ActionGroups children will be displayed normally if there is enough space, otherwise they will be displayed in a spinner. If mode is 'spinner', then the children will always be displayed in a spinner.

`mode` is a `OptionProperty` and defaults to 'normal'.

`separator_image`
Background Image for an ActionSeparator in an ActionView.

`separator_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/separator'.

`separator_width`
Width of the ActionSeparator in an ActionView.

`separator_width` is a `NumericProperty` and defaults to 0.

`use_separator`
Specifies whether to use a separator after/before this group or not.

`use_separator` is a `BooleanProperty` and defaults to False.

class `kivy.uix.actionbar.`**`ActionOverflow`**`(`***kwargs*`)`
Bases: `kivy.uix.actionbar.ActionGroup`

ActionOverflow class, see module documentation for more information.

`overflow_image`
Image to be used as an Overflow Image.
`overflow_image` is an `ObjectProperty` anddefaults to 'atlas://data/images/defaulttheme/overflow'.

class `kivy.uix.actionbar.`**`ActionView`**`(`***kwargs*`)`
Bases: `kivy.uix.boxlayout.BoxLayout`

ActionView class, see module documentation for more information.

`action_previous`
Previous button for an ActionView.
`action_previous` is an `ObjectProperty`and defaults to None.

`background_color`
Background color in the format (r, g, b, a).
`background_color` is a `ListProperty` anddefaults to [1, 1, 1, 1].

`background_image`
Background image of an ActionViews default graphical representation.

`background_image` is an `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_view'.

`overflow_group`
Widget to be used for the overflow.

`overflow_group` is an `ObjectProperty` and defaults to an instance of `ActionOverflow`.

`use_separator`
Specify whether to use a separator before every ActionGroup or not.

`use_separator` is a `BooleanProperty` and defaults to False.

class `kivy.uix.actionbar.`**`ContextualActionView`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.actionbar.ActionView`

ContextualActionView class, see the module documentation for more information.

class `kivy.uix.actionbar.`**`ActionPrevious`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.actionbar.ActionButton`

ActionPrevious class, see module documentation for more information.

`app_icon`
Application icon for the ActionView.

`app_icon` is a `StringProperty` and defaults to the window icon if set, otherwise 'data/logo/kivy-icon-32.png'.

`previous_image`
Image for the 'previous' ActionButtons default graphical representation.

`previous_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/previous_normal'.

`title`
Title for ActionView.

`title` is a `StringProperty` and defaults to ''.

`with_previous`
Specifies whether clicking on ActionPrevious will load the previous screen or not. If True, the previous_icon will be shown otherwise it will not.

`with_previous` is a `BooleanProperty` and defaults to True.

class `kivy.uix.actionbar.`**`ActionBar`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.boxlayout.BoxLayout`

ActionBar, see the module documentation for more information.

Events

*on_previous*Fired when action_previous of action_view is pressed.

`action_view`
action_view of ActionBar.

`action_view` is an `ObjectProperty` and defaults to an instance of ActionView.

`background_color`
Background color, in the format (r, g, b, a).
`background_color` is a `ListProperty` anddefaults to [1, 1, 1, 1].

`background_image`
Background image of the ActionBars default graphical representation.

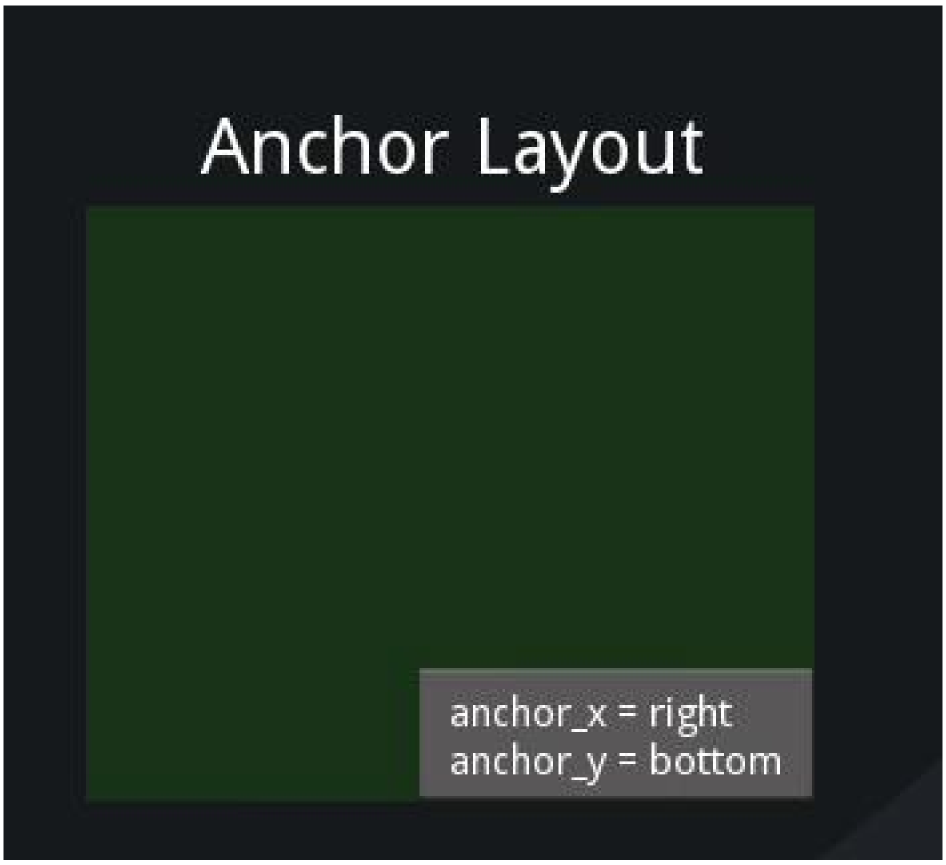
`background_image` is an `StringProperty` and defaults to 'atlas://data/images/defaulttheme/action_bar'.

`border`
`border` to be applied to the `background_image`.

CHAPTER

TWO

ANCHOR LAYOUT



The AnchorLayout aligns its children to a border (top, bottom, left, right) or center.

To draw a button in the lower-right corner:

```
layout = AnchorLayout(
    anchor_x='right', anchor_y='bottom')
btn = Button(text='Hello World')
layout.add_widget(btn)
```

class `kivy.uix.anchorlayout.`**`AnchorLayout`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.layout.Layout`

Anchor layout class. See the module documentation for more information.

`anchor_x`

Horizontal anchor.

anchor_x is an OptionProperty and defaults to 'center'. It accepts values of 'left', 'center' or 'right'.

anchor_y

Vertical anchor.

anchor_y is an OptionProperty and defaults to 'center'. It accepts values of 'top', 'center' or 'bottom'.

padding

Padding between the widget box and its children, in pixels: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

padding is a VariableListProperty and defaults to [0, 0, 0, 0].

CHAPTER

THREE

BEHAVIORS

New in version 1.8.0.

This module implements behaviors that can be mixed with existing base widgets. For example, if you want to add a "button" capability to an *Image*, you could do:

```
class IconButton(ButtonBehavior, Image):
    pass
```

Note: The behavior class must always be _before_ the widget class. If you don't specify the inheritance in this order, the behavior will not work.

class `kivy.uix.behaviors.`**`ButtonBehavior`**(***kwargs*)

Bases: `object`

Button behavior.

Events

*on_press*Fired when the button is pressed.

*on_release*Fired when the button is released (i.e. the touch/click that pressed the button goes away).

`MIN_STATE_TIME` = 0.035

The minimum period of time which the widget must remain in the *'down'* state.

`MIN_STATE_TIME` is a float.

`last_touch`

Contains the last relevant touch received by the Button. This can be used in *on_press* or *on_release* in order to know which touch dispatched the event.

New in version 1.8.0.

`last_touch` is a `ObjectProperty`, defaults to None.

`state`

State of the button, must be one of 'normal' or 'down'. The state is 'down' only when the button is currently touched/clicked, otherwise 'normal'.

`state` is an `OptionProperty`.

`trigger_action`(*duration=0.1*)

Trigger whatever action(s) have been bound to the button by calling both the on_press and on_release callbacks.

This simulates a quick button press without using any touch events.

Duration is the length of the press in seconds. Pass 0 if you want the action to happen instantly.

New in version 1.8.0.

class `kivy.uix.behaviors.`**`ToggleButtonBehavior`**`(`***kwargs*`)`
Bases: `kivy.uix.behaviors.ButtonBehavior`

ToggleButton behavior, see ToggleButton module documentation for more information.

New in version 1.8.0.

`allow_no_selection`
This specifies whether the checkbox in group allows everything to be deselected.

..versionadded::1.9.0

`allow_no_selection` is a `BooleanProperty` defaults to *True*

static **`get_widgets`**`(`*groupname*`)`
Return the widgets contained in a specific group. If the group doesn't exist, an empty list will be returned.

Important: Always release the result of this method! In doubt, do:

```
l = ToggleButtonBehavior.get_widgets('mygroup')
# do your job
del l
```

Warning: It's possible that some widgets that you have previously deleted are still in the list. Garbage collector might need more elements before flushing it. The return of this method is informative, you've been warned!

`group`
Group of the button. If None, no group will be used (button is independent). If specified, `group` must be a hashable object, like a string. Only one button in a group can be in 'down' state.

`group` is a `ObjectProperty`

class `kivy.uix.behaviors.`**`DragBehavior`**`(`***kwargs*`)`
Bases: `object`

Drag behavior. When combined with a widget, dragging in the rectangle defined by `drag_rectangle` will drag the widget.

For example, to make a popup which is draggable by its title do:

```
from kivy.uix.behaviors import DragBehavior
from kivy.uix.popup import Popup

class DragPopup(DragBehavior, Popup):
    pass
```

And in .kv do::
<DragPopup>:drag_rectangle: self.x, self.y+self._container.height, self.width, self.height - self._container.height drag_timeout: 10000000 drag_distance: 0

New in version 1.8.0.

`drag_distance`
Distance to move before dragging the `DragBehavior`, in pixels. As soon as the distance has been traveled, the `DragBehavior` will start to drag, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

`drag_distance` is a `NumericProperty`, defaults to 20 (pixels), according to the default value of scroll_distance in user configuration.

drag_rect_height

Height of the axis aligned bounding rectangle where dragging is allowed.

drag_rect_height is a NumericProperty, defaults to 100.

drag_rect_width

Width of the axis aligned bounding rectangle where dragging is allowed.

drag_rect_width is a NumericProperty, defaults to 100.

drag_rect_x

X position of the axis aligned bounding rectangle where dragging is allowed. In window coordinates.

drag_rect_x is a NumericProperty, defaults to 0.

drag_rect_y

Y position of the axis aligned bounding rectangle where dragging is allowed. In window coordinates.

drag_rect_Y is a NumericProperty, defaults to 0.

drag_rectangle

Position and size of the axis aligned bounding rectangle where dragging is allowed.

drag_rectangle is a ReferenceListProperty of (drag_rect_x, drag_rect_y, drag_rect_width, drag_rect_height) properties.

drag_timeout

Timeout allowed to trigger the drag_distance, in milliseconds. If the user has not moved drag_distance within the timeout, dragging will be disabled, and the touch event will go to the children.

drag_timeout is a NumericProperty, defaults to 55 (milliseconds), according to the default value of scroll_timeout in user configuration.

class kivy.uix.behaviors.**FocusBehavior**(***kwargs*)

Bases: object

Implements keyboard focus behavior. When combined with other FocusBehavior widgets it allows one to cycle focus among them by pressing tab. In addition, upon gaining focus the instance will automatically receive keyboard input.

Focus, very different then selection, is intimately tied with the keyboard; each keyboard can focus on zero or one widgets, and each widget can only have the focus of one keyboard. However, multiple keyboards can focus simultaneously on different widgets. When escape is hit, the widget having the focus of that keyboard will de-focus.

In essence, focus is implemented as a doubly linked list, where each node holds a (weak) reference to the instance before it and after it, as visualized when cycling through the nodes using tab (forward) or shift+tab (backward). If previous or next widget is not specified, focus_next and focus_previous default to *None*, which means that the children list and parents are walked to find the next focusable widget, unless focus_next or focus_previous is set to the *StopIteration* class, in which case focus stops there.

For example, to cycle focus between Button elements of a GridLayout:

```
class FocusButton(FocusBehavior, Button):
    pass

grid = GridLayout(cols=4)
for i in range(40):
    grid.add_widget(FocusButton(text=str(i)))
```

```
# clicking on a widget will activate focus, and tab can now be used
# to cycle through
```

New in version 1.9.0.

Warning: This code is still experimental, and its API is subject to change in a future version.

focus_next

The FocusBehavior instance to acquire focus when tab is pressed when this instance has focus, if not *None* or *'StopIteration'*.

When tab is pressed, focus cycles through all the FocusBehavior widgets that are linked through focus_next and are focusable. If focus_next is *None*, it instead walks the children lists to find the next focusable widget. Finally, if focus_next is the *StopIteration* class, focus won't move forward, but end here.

focus_next is a ObjectProperty, defaults to *None*.

focus_previous

The FocusBehavior instance to acquire focus when shift+tab is pressed on this instance, if not None or *StopIteration*.

When shift+tab is pressed, focus cycles through all the FocusBehavior widgets that are linked through focus_previous and are focusable. If focus_previous is *None', it instead walks the children tree to find the previous focusable widget. Finally, if :attr:'focus_previous* is the *StopIteration* class, focus won't move backward, but end here.

focus_previous is a ObjectProperty, defaults to *None*.

focused

Whether the instance currently has focus.

Setting it to True, will bind to and/or request the keyboard, and input will be forwarded to the instance. Setting it to False, will unbind and/or release the keyboard. For a given keyboard, only one widget can have its focus, so focusing one will automatically unfocus the other instance holding its focus.

focused is a BooleanProperty, defaults to False.

is_focusable

Whether the instance can become focused. If focused, it'll lose focus when set to False.

is_focusable is a BooleanProperty, defaults to True on a desktop (i.e. desktop is True in config), False otherwise.

keyboard

The keyboard to bind, or bound to the widget when focused.

When None, a keyboard is requested and released whenever the widget comes into and out of focus. If not None, it must be a keyboard, which gets bound and unbound from the widget whenever it's in or out of focus. It is useful only when more than one keyboard is available, so it is recommended to be set to None when only one keyboard is available

If more than one keyboard is available, whenever an instance get focused a new keyboard will be requested if None. Unless, the other instances lose focus (e.g. if tab was used), a new keyboard will appear. When this is undesired, the keyboard property can be used. For example, if there are two users with two keyboards, then each keyboard can be assigned to different groups of instances of FocusBehavior, ensuring that within each group, only one FocusBehavior will have focus, and will receive input from the correct keyboard. see *keyboard_mode* in config for information on the keyboard modes.

keyboard is a AliasProperty, defaults to None.

keyboard_on_key_down(*window*, *keycode*, *text*, *modifiers*)
The method bound to the keyboard when the instance has focus.

When the instance becomes focused, this method is bound to the keyboard and will be called for every input press. The parameters are the same as `kivy.core.window.WindowBase.on_key_down()`.

When overwriting the method in the derived widget, super should be called to enable tab cycling. If the derived widget wishes to use tab for its own purposes, it can call super at the end after it is done if it didn't consume tab.

Similar to other keyboard functions, it should return True if the key was consumed.

keyboard_on_key_up(*window*, *keycode*)
The method bound to the keyboard when the instance has focus.

When the instance becomes focused, this method is bound to the keyboard and will be called for every input release. The parameters are the same as `kivy.core.window.WindowBase.on_key_up()`.

When overwriting the method in the derived widget, super should be called to enable defocusing on escape. If the derived widget wishes to use escape for its own purposes, it can call super at the end after it is done if it didn't consume escape.

See `on_key_down()`

class `kivy.uix.behaviors.`**CompoundSelectionBehavior**(***kwargs*)
Bases: `object`

Selection behavior implements the logic behind keyboard and touch selection of selectable widgets managed by the derived widget. For example, it could be combined with a `GridLayout` to add selection to the layout.

At its core, it keeps a dynamic list of widgets that can be selected. Then, as the touches and keyboard input are passed in, it selects one or more of the widgets based on these inputs. For example, it uses the mouse scroll and keyboard up/down buttons to scroll through the list of widgets. Multiselection can also be achieved using the keyboard shift and ctrl keys. Finally, in addition to the up/down type keyboard inputs, it can also accepts letters from the kayboard to be used to select nodes with associated strings that start with those letters, similar to how files are selected by a file browser.

When the controller needs to select a node it calls `select_node()` and `deselect_node()`. Therefore, they must be overwritten in order affect the selected nodes. By default, the class doesn't listen to keyboard and touch events, therefore, the derived widget must call `select_with_touch()`, `select_with_key_down()`, and `select_with_key_up()` on events that it wants to pass on for selection purposes.

For example, to add selection to a grid layout which will contain `Button` widgets:

```
class SelectableGrid(CompoundSelectionBehavior, GridLayout):

    def __init__(self, **kwargs):
        super(CompoundSelectionBehavior, self).__init__(**kwargs)
        keyboard = Window.request_keyboard(None, self)
        keyboard.bind(on_key_down=self.select_with_key_down,
        on_key_up=self.select_with_key_up)

    def select_node(self, node):
        node.background_color = (1, 0, 0, 1)
        return super(CompoundSelectionBehavior, self).select_node(node)

    def deselect_node(self, node):
        node.background_color = (1, 1, 1, 1)
        super(CompoundSelectionBehavior, self).deselect_node(node)
```

Then, for each button added to the layout, bind on_touch_down of the button to `select_with_touch()` to pass on the touch events.

New in version 1.9.0.

Warning: This code is still experimental, and its API is subject to change in a future version.

clear_selection()
: Deselects all the currently selected nodes.

deselect_node(*node*)
: Deselects a possibly selected node.

It is called by the controller when it deselects a node and can also be called from the outside to deselect a node directly. The derived widget should overwrite this method and change the node to its unselected state when this is called

Parameters

nodeThe node to be deselected.

Warning: This method must be called by the derived widget using super if it is overwritten.

get_selectable_nodes()
: (internal) Returns a list of the nodes that can be selected. It can be overwritten by the derived widget to return the correct list.

This list is used to determine which nodes to select with group selection. E.g. the last element in the list will be selected when home is pressed, pagedown will move (or add to, if shift is held) the selection from the current position by negative `page_count` nodes starting from the position of the currently selected node in this list and so on. Still, nodes can be selected even if they are not in this list.

Note: It is safe to dynamically change this list including removing, adding, or re-arranging its elements. Nodes can be selected even if they are not on this list. And selected nodes removed from the list will remain selected until `deselect_node()` is called.

Warning: Layouts display their children in the reverse order. That is, the contents of `children` is displayed form right to left, bottom to top. Therefore, internally, the indices of the elements returned by this function is reversed to make it work by default for most layouts so that the final result is that e.g. home, although it will select the last element on this list, visually it'll select the first element when counting from top to bottom and left to right. If this behavior is not desired, a reversed list should be returned instead.

Defaults to returning `children`.

goto_node(*key*, *last_node*, *last_node_idx*)
: (internal) Used by the controller to get the node at the position indicated by key. The key can be keyboard inputs, e.g. pageup, or scroll inputs from the mouse scroll wheel, e.g. scrollup. Last node is the last node selected and is used to find the resulting node. For example, if the key is up, the returned node is one node up from the last node.

It can be overwritten by the derived widget.

Parameters

keystr, the string used to find the desired node. It can be any of the keyboard keys, as well as the mouse scrollup, scrolldown, scrollright, and scrollleft strings. If letters are typed in quick succession, the letters will be combined before it's passed in as key and can be used to find nodes that have an associated string that starts with those letters.

last_node The last node that was selected.

last_node_idx The cached index of the last node selected in the `get_selectable_nodes()` list. If the list hasn't changed it saves having to look up the index of *last_node* in that list.

Returns tuple, the node targeted by key and its index in the `get_selectable_nodes()` list. Returning *(last_node, last_node_idx)* indicates a node wasn't found.

`keyboard_select`

Whether the keybaord can be used for selection. If False, keyboard inputs will be ignored.

`keyboard_select` is a `BooleanProperty` , defaults to True.

`multiselect`

Determines whether multiple nodes can be selected. If enabled, keyboard shift and ctrl selection, optionally combined with touch, for example, will be able to select multiple widgets in the normally expected manner. This dominates `touch_multiselect` when False.

`multiselect` is a `BooleanProperty` , defaults to False.

`page_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when pageup (or pagedown) is pressed.

`page_count` is a `NumericProperty`, defaults to 10.

`right_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the right (or left) arrow on the keyboard is pressed.

`right_count` is a `NumericProperty`, defaults to 1.

`scroll_count`

Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the mouse scroll wheel is scrolled.

`right_count` is a `NumericProperty`, defaults to 0.

`select_node`(*node*)

Selects a node.

It is called by the controller when it selects a node and can be called from the outside to select a node directly. The derived widget should overwrite this method and change the node to its selected state when this is called

Parameters

node The node to be selected.

Returns bool, True if the node was selected, False otherwise.

> **Warning:** This method must be called by the derived widget using super if it is overwritten.

`select_with_key_down`(*keyboard, scancode, codepoint, modifiers, **kwargs*)

Processes a key press. This is called when a key press is to be used for selection. Depending on the keyboard keys pressed and the configuration, it could select or deslect nodes or node ranges from the selectable nodes list, `get_selectable_nodes()`.

The parameters are such that it could be bound directly to the on_key_down event of a keyboard. Therefore, it is safe to be called repeatedly when the key is held down as is done by the keyboard.

Returns bool, True if the keypress was used, False otherwise.

`select_with_key_up`(*keyboard*, *scancode*, ***kwargs*)

(internal) Processes a key release. This must be called by the derived widget when a key that `select_with_key_down()` returned True is released.

The parameters are such that it could be bound directly to the on_key_up event of a keyboard.

Returns bool, True if the key release was used, False otherwise.

`select_with_touch`(*node*, *touch=None*)

(internal) Processes a touch on the node. This should be called by the derived widget when a node is touched and is to be used for selection. Depending on the keyboard keys pressed and the configuration, it could select or deslect this and other nodes in the selectable nodes list, `get_selectable_nodes()`.

Parameters

nodeThe node that recieved the touch. Can be None for a scroll type touch.

touchOptionally, the touch. Defaults to None.

Returns bool, True if the touch was used, False otherwise.

`selected_nodes`

The list of selected nodes.

`selected_nodes` is a `ListProperty` and defaults to the empty list, []. It is read-only and should not be modified.

`touch_multiselect`

A special touch mode which determines whether touch events, as processed with `select_with_touch()`, will add to the selection the currently touched node, or if it will clear the selection before adding the node. This allows the selection of multiple nodes by simply touching them. This is different than `multiselect`, because when this is True simply touching an unselected node will select it, even if e.g. ctrl is not pressed. If this is False, however, ctrl is required to be held in order to add to selection when `multiselect` is True.

Note: `multiselect`, when False, will disable `touch_multiselect`.

`touch_multiselect` is a `BooleanProperty`, defaults to False.

`up_count`

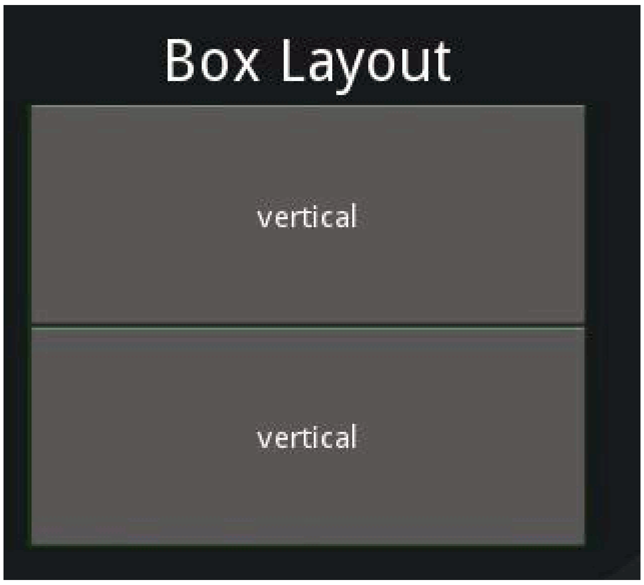
Determines by how much the selected node is moved up or down, relative to position of the last selected node, when the up (or down) arrow on the keyboard is pressed.

`up_count` is a `NumericProperty`, defaults to 1.

CHAPTER

FOUR

BOX LAYOUT



BoxLayout arranges children in a vertical or horizontal box.

To position widgets above/below each other, use a vertical BoxLayout:

```
layout = BoxLayout(orientation='vertical')
btn1 = Button(text='Hello')
btn2 = Button(text='World')
layout.add_widget(btn1)
layout.add_widget(btn2)
```

To position widgets next to each other, use a horizontal BoxLayout. In this example, we use 10 pixel spacing between children; the first button covers 70% of the horizontal space, the second covers 30%:

```
layout = BoxLayout(spacing=10)
btn1 = Button(text='Hello', size_hint=(.7, 1))
btn2 = Button(text='World', size_hint=(.3, 1))
layout.add_widget(btn1)
layout.add_widget(btn2)
```

Position hints are partially working, depending on the orientation:

- If the orientation is *vertical*: *x*, *right* and *center_x* will be used.
- If the orientation is *horizontal*: *y*, *top* and *center_y* will be used.

You can check the *examples/widgets/boxlayout_poshint.py* for a live example.

Note: The *size_hint* uses the available space after subtracting all the fixed-size widgets. For example, if you have a layout that is 800px wide, and add three buttons like this:

btn1 = Button(text='Hello', size=(200, 100), size_hint=(None, None)) btn2 = Button(text='Kivy', size_hint=(.5, 1)) btn3 = Button(text='World', size_hint=(.5, 1))

The first button will be 200px wide as specified, the second and third will be 300px each, e.g. (800-200) * 0.5

Changed in version 1.4.1: Added support for *pos_hint*.

class `kivy.uix.boxlayout.`**`BoxLayout`**(***kwargs*)

Bases: `kivy.uix.layout.Layout`

Box layout class. See module documentation for more information.

`orientation`

Orientation of the layout.

`orientation` is an `OptionProperty` and defaults to 'horizontal'. Can be 'vertical' or 'horizontal'.

`padding`

Padding between layout box and children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced NumericProperty with VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

`spacing`

Spacing between children, in pixels.

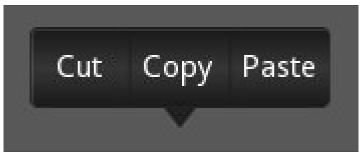
`spacing` is a `NumericProperty` and defaults to 0.

CHAPTER

FIVE

BUBBLE

New in version 1.1.0.



The Bubble widget is a form of menu or a small popup where the menu options are stacked either vertically or horizontally.

The Bubble contains an arrow pointing in the direction you choose.

135.1 Simple example

```
'''
Bubble
======

Test of the widget Bubble.
'''

from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.uix.button import Button
from kivy.lang import Builder
from kivy.uix.bubble import Bubble

Builder.load_string('''
<cut_copy_paste>
    size_hint: (None, None)
    size: (160, 120)
    pos_hint: {'center_x': .5, 'y': .6}
    BubbleButton:
        text: 'Cut'
    BubbleButton:
        text: 'Copy'
    BubbleButton:
        text: 'Paste'
''')


class cut_copy_paste(Bubble):
    pass
```

```
class BubbleShowcase(FloatLayout):

    def __init__(self, **kwargs):
        super(BubbleShowcase, self).__init__(**kwargs)
        self.but_bubble = Button(text='Press to show bubble')
        self.but_bubble.bind(on_release=self.show_bubble)
        self.add_widget(self.but_bubble)

    def show_bubble(self, *l):
        if not hasattr(self, 'bubb'):
            self.bubb = bubb = cut_copy_paste()
            self.add_widget(bubb)
        else:
            values = ('left_top', 'left_mid', 'left_bottom', 'top_left',
                'top_mid', 'top_right', 'right_top', 'right_mid',
                'right_bottom', 'bottom_left', 'bottom_mid', 'bottom_right')
            index = values.index(self.bubb.arrow_pos)
            self.bubb.arrow_pos = values[(index + 1) % len(values)]


class TestBubbleApp(App):

    def build(self):
        return BubbleShowcase()

if __name__ == '__main__':
    TestBubbleApp().run()
```

135.2 Customize the Bubble

You can choose the direction in which the arrow points:

```
Bubble(arrow_pos='top_mid')
```

The widgets added to the Bubble are ordered horizontally by default, like a Boxlayout. You can change that by:

```
orientation = 'vertical'
```

To add items to the bubble:

```
bubble = Bubble(orientation = 'vertical')
bubble.add_widget(your_widget_instance)
```

To remove items:

```
bubble.remove_widget(widget)
or
bubble.clear_widgets()
```

To access the list of children, use content.children:

```
bubble.content.children
```

Warning: This is important! Do not use bubble.children

To change the appearance of the bubble:

```
bubble.background_color = (1, 0, 0, .5) #50% translucent red
bubble.border = [0, 0, 0, 0]
background_image = 'path/to/background/image'
arrow_image = 'path/to/arrow/image'
```

class `kivy.uix.bubble.`**`Bubble`**`(`***kwargs*`)`

Bases: `kivy.uix.gridlayout.GridLayout`

Bubble class. See module documentation for more information.

`arrow_image`

Image of the arrow pointing to the bubble.

`arrow_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/bubble_arrow'.

`arrow_pos`

Specifies the position of the arrow relative to the bubble. Can be one of: left_top, left_mid, left_bottom top_left, top_mid, top_right right_top, right_mid, right_bottom bottom_left, bottom_mid, bottom_right.

`arrow_pos` is a `OptionProperty` and defaults to 'bottom_mid'.

`background_color`

Background color, in the format (r, g, b, a).

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_image`

Background image of the bubble.

`background_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/bubble'.

`border`

Border used for `BorderImage` graphics instruction. Used with the `background_image`. It should be used when using custom backgrounds.

It must be a list of 4 values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16)

`content`

This is the object where the main content of the bubble is held.

`content` is a `ObjectProperty` and defaults to 'None'.

`limit_to`

Specifies the widget to which the bubbles position is restricted.

New in version 1.6.0.

`limit_to` is a `ObjectProperty` and defaults to 'None'.

`orientation`

This specifies the manner in which the children inside bubble are arranged. Can be one of 'vertical' or 'horizontal'.

`orientation` is a `OptionProperty` and defaults to 'horizontal'.

show_arrow

Indicates whether to show arrow.

New in version 1.8.0.

`show_arrow` is a `BooleanProperty` and defaults to *True*.

class `kivy.uix.bubble.`**`BubbleButton`**`(`***kwargs*`)`

Bases: `kivy.uix.button.Button`

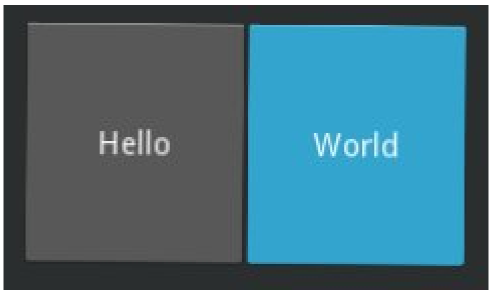
A button intended for use in a Bubble widget. You can use a "normal" button class, but it will not look good unless the background is changed.

Rather use this BubbleButton widget that is already defined and provides a suitable background for you.

CHAPTER

SIX

BUTTON



The Button is a Label with associated actions that are triggered when the button is pressed (or released after a click/touch). To configure the button, the same properties are used as for the Label class:

```
button = Button(text='Hello world', font_size=14)
```

To attach a callback when the button is pressed (clicked/touched), use bind:

```
def callback(instance):
    print('The button <%s> is being pressed' % instance.text)

btn1 = Button(text='Hello world 1')
btn1.bind(on_press=callback)
btn2 = Button(text='Hello world 2')
btn2.bind(on_press=callback)
```

If you want to be notified every time the button state changes, you can bind to the Button.state property:

```
def callback(instance, value):
    print('My button <%s> state is <%s>' % (instance, value))
btn1 = Button(text='Hello world 1')
btn1.bind(state=callback)
```

class kivy.uix.button.**Button**(***kwargs*)

Bases: kivy.uix.behaviors.ButtonBehavior, kivy.uix.label.Label

Button class, see module documentation for more information.

Changed in version 1.8.0: The behavior / logic of the button has been moved to ButtonBehaviors.

background_color

Background color, in the format (r, g, b, a).

New in version 1.0.8.

The `background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_disabled_down`

Background image of the button used for the default graphical representation when the button is disabled and pressed.

New in version 1.8.0.

`background_disabled_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_disabled_pressed'.

`background_disabled_normal`

Background image of the button used for the default graphical representation when the button is disabled and not pressed.

New in version 1.8.0.

`background_disabled_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_disabled'.

`background_down`

Background image of the button used for the default graphical representation when the button is pressed.

New in version 1.0.4.

`background_down` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button_pressed'.

`background_normal`

Background image of the button used for the default graphical representation when the button is not pressed.

New in version 1.0.4.

`background_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/button'.

`border`

Border used for `BorderImage` graphics instruction. Used with `background_normal` and `background_down`. Can be used for custom backgrounds.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instruction for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16)

CHAPTER

SEVEN

CAMERA

The Camera widget is used to capture and display video from a camera. Once the widget is created, the texture inside the widget will be automatically updated. Our CameraBase implementation is used under the hood:

```
cam = Camera()
```

By default, the first camera found on your system is used. To use a different camera, set the index property:

```
cam = Camera(index=1)
```

You can also select the camera resolution:

```
cam = Camera(resolution=(320, 240))
```

Warning: The camera texture is not updated as soon as you have created the object. The camera initialization is asynchronous, so there may be a delay before the requested texture is created.

class `kivy.uix.camera.`**`Camera`**`(**kwargs)`

Bases: `kivy.uix.image.Image`

Camera class. See module documentation for more information.

`index`

Index of the used camera, starting from 0.

`index` is a `NumericProperty` and defaults to -1 to allow auto selection.

`play`

Boolean indicating whether the camera is playing or not. You can start/stop the camera by setting this property:

```
# start the camera playing at creation (default)
cam = Camera(play=True)

# create the camera, and start later
cam = Camera(play=False)
# and later
cam.play = True
```

`play` is a `BooleanProperty` and defaults to True.

`resolution`

Preferred resolution to use when invoking the camera. If you are using [-1, -1], the resolution will be the default one:

```
# create a camera object with the best image available
cam = Camera()

# create a camera object with an image of 320x240 if possible
cam = Camera(resolution=(320, 240))
```

Warning: Depending on the implementation, the camera may not respect this property.

`resolution` is a `ListProperty` and defaults to [-1, -1].

CHAPTER

EIGHT

CAROUSEL

New in version 1.4.0.

The `Carousel` widget provides the classic mobile-friendly carousel view where you can swipe between slides. You can add any content to the carousel and use it horizontally or verticaly. The carousel can display pages in loop or not.

Example:

```
class Example1(App):

    def build(self):
        carousel = Carousel(direction='right')
        for i in range(10):
            src = "http://placehold.it/480x270.png&text=slide-%d&.png" % i
            image = Factory.AsyncImage(source=src, allow_stretch=True)
            carousel.add_widget(image)
        return carousel

Example1().run()
```

Changed in version 1.5.0: The carousel now supports active children, like the `ScrollView`. It will detect a swipe gesture according to `Carousel.scroll_timeout` and `Carousel.scroll_distance`.

In addition, the container used for adding a slide is now hidden in the API. We made a mistake by exposing it to the user. The impacted properties are: `Carousel.slides`, `Carousel.current_slide`, `Carousel.previous_slide` and `Carousel.next_slide`.

class `kivy.uix.carousel.`**`Carousel`**`(`***kwargs*`)`

Bases: `kivy.uix.stencilview.StencilView`

Carousel class. See module documentation for more information.

`anim_cancel_duration`

Defines the duration of the animation when a swipe movement is not accepted. This is generally when the user doesnt swipe enough. See `min_move`.

`anim_cancel_duration` is a `NumericProperty` and defaults to 0.3.

`anim_move_duration`

Defines the duration of the Carousel animation between pages.

`anim_move_duration` is a `NumericProperty` and defaults to 0.5.

`anim_type`

Type of animation to use while animating in the next/previous slide.

New in version 1.8.0.

current_slide

The currently shown slide.

current_slide is an AliasProperty.

Changed in version 1.5.0: The property doesn't expose the container used for storing the slide. It returns widget you have added.

direction

Specifies the direction in which the slides are ordered i.e. the direction from which the user swipes to go from one slide to the next. Can be *right*, *left*, 'top', or *bottom*. For example, with the default value of *right*, the second slide is to the right of the first and the user would swipe from the right towards the left to get to the second slide.

direction is a OptionProperty and defaults to 'right'.

index

Get/Set the current visible slide based on the index.

index is a AliasProperty and defaults to 0 (the first item).

load_next(*mode='next'*)

Animate to next slide.

New in version 1.7.0.

load_previous()

Animate to the previous slide.

New in version 1.7.0.

load_slide(*slide*)

Animate to the slide that is passed as the argument.

Changed in version 1.8.0.

loop

Allow the Carousel to swipe infinitely. When the user reaches the last page, they will return to first page when trying to swipe to the next.

loop is a BooleanProperty and defaults to False.

min_move

Defines the minimal distance from the edge where the movement is considered a swipe gesture and the Carousel will change its content. This is a percentage of the Carousel width. If the movement doesn't reach this minimal value, then the movement is cancelled and the content is restored to its original position.

min_move is a NumericProperty and defaults to 0.2.

next_slide

The next slide in the Carousel. It is None if the current slide is the last slide in the Carousel. If orientation is 'horizontal', the next slide is to the right. If orientation is 'vertical', the next slide is towards the bottom.

next_slide is a AliasProperty.

Changed in version 1.5.0: The property doesn't expose the container used for storing the slide. It returns the widget you have added.

previous_slide

The previous slide in the Carousel. It is None if the current slide is the first slide in the Carousel. If orientation is 'horizontal', the previous slide is to the left. If orientation is 'vertical', the previous slide towards the bottom.

previous_slide is a AliasProperty.

Changed in version 1.5.0: This property doesn't expose the container used for storing the slide. It returns the widget you have added.

scroll_distance

Distance to move before scrolling the `Carousel` in pixels. As soon as the distance has been traveled, the `Carousel` will start to scroll, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

`scroll_distance` is a `NumericProperty` and defaults to 20dp.

New in version 1.5.0.

scroll_timeout

Timeout allowed to trigger the `scroll_distance`, in milliseconds. If the user has not moved `scroll_distance` within the timeout, the scrolling will be disabled and the touch event will go to the children.

`scroll_timeout` is a `NumericProperty` and defaults to 200 (milliseconds)

New in version 1.5.0.

slides

List of slides inside the Carousel. The slides are added when a widget is added to Carousel using add_widget().

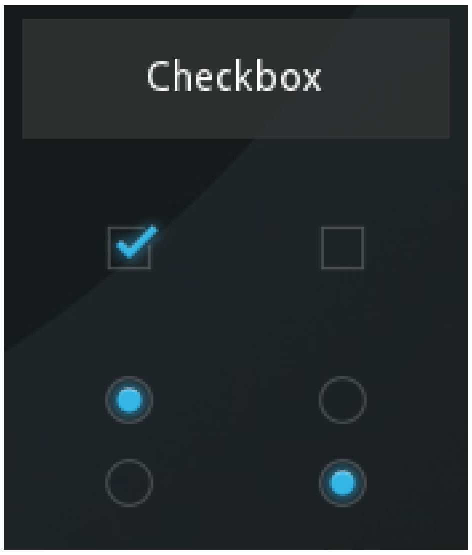
`slides` is a `ListProperty` and is read-only.

CHAPTER

NINE

CHECKBOX

New in version 1.4.0.



CheckBox is a specific two-state button that can be either checked or unchecked. If the CheckBox is in a Group, it becomes a Radio button. As with the ToggleButton, only one Radio button at a time can be selected when the CheckBox.group is set.

An example usage:

```
from kivy.uix.checkbox import CheckBox

# ...

def on_checkbox_active(checkbox, value):
    if value:
        print('The checkbox', checkbox, 'is active')
    else:
        print('The checkbox', checkbox, 'is inactive')

checkbox = CheckBox()
checkbox.bind(active=on_checkbox_active)
```

class `kivy.uix.checkbox.`**`CheckBox`**(***kwargs*)

Bases: `kivy.uix.behaviors.ToggleButtonBehavior`, `kivy.uix.widget.Widget`

CheckBox class, see module documentation for more information.

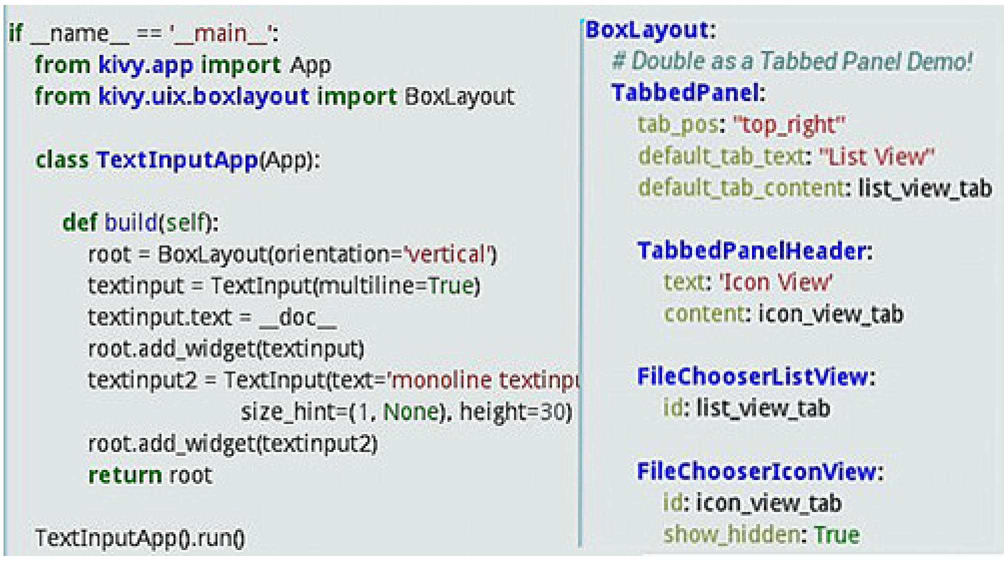
`active`

Indicates if the switch is active or inactive.

`active` is a `BooleanProperty` and defaults to False.

CODE INPUT

New in version 1.5.0.



```
if __name__ == '__main__':
    from kivy.app import App
    from kivy.uix.boxlayout import BoxLayout

    class TextInputApp(App):

        def build(self):
            root = BoxLayout(orientation='vertical')
            textinput = TextInput(multiline=True)
            textinput.text = __doc__
            root.add_widget(textinput)
            textinput2 = TextInput(text='monoline textinpu
                                   size_hint=(1, None), height=30)
            root.add_widget(textinput2)
            return root

    TextInputApp().run()
```

```
BoxLayout:
    # Double as a Tabbed Panel Demo!
    TabbedPanel:
        tab_pos: "top_right"
        default_tab_text: "List View"
        default_tab_content: list_view_tab

        TabbedPanelHeader:
            text: 'Icon View'
            content: icon_view_tab

        FileChooserListView:
            id: list_view_tab

        FileChooserIconView:
            id: icon_view_tab
            show_hidden: True
```

The `CodeInput` provides a box of editable highlighted text like the one shown in the image.

It supports all the features provided by the `textinput` as well as code highlighting for languages supported by pygments along with *KivyLexer* for `kivy.lang` highlighting.

140.1 Usage example

To create a CodeInput with highlighting for *KV language*:

```
from kivy.uix.codeinput import CodeInput
from kivy.extras.highlight import KivyLexer
codeinput = CodeInput(lexer=KivyLexer())
```

To create a CodeInput with highlighting for *Cython*:

```
from kivy.uix.codeinput import CodeInput
from pygments.lexers import CythonLexer
codeinput = CodeInput(lexer=CythonLexer())
```

class `kivy.uix.codeinput.`**`CodeInput`**`(`***kwargs*`)`

Bases: `kivy.uix.textinput.TextInput`

CodeInput class, used for displaying highlighted code.

lexer

This holds the selected Lexer used by pygments to highlight the code.

`lexer` is an `ObjectProperty` and defaults to *PythonLexer*.

CHAPTER

ONE

COLOR PICKER

New in version 1.7.0.

Warning: This widget is experimental. Its use and API can change at any time until this warning is removed.

The ColorPicker widget allows a user to select a color from a chromatic wheel where pinch and zoom can be used to change the selected color. Sliders and TextInputs are also provided for entering the RGBA/HSV/HEX values directly.

Usage:

```
clr_picker = ColorPicker()
parent.add_widget(clr_picker)

# To monitor changes, we can bind to color property changes
def on_color(instance, value):
    print "RGBA = ", str(value)  #  or instance.color
    print "HSV = ", str(instance.hsv)
    print "HEX = ", str(instance.hex_color)

clr_picker.bind(color=on_color)
```

class `kivy.uix.colorpicker.`**`ColorPicker`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.relativelayout.RelativeLayout`

See module documentation.

`color`

The `color` holds the color currently selected in rgba format.

`color` is a `ListProperty` and defaults to (1, 1, 1, 1).

`font_name`

Specifies the font used on the ColorPicker.

`font_name` is a `StringProperty` and defaults to 'data/fonts/DroidSansMono.ttf'.

`hex_color`

The `hex_color` holds the currently selected color in hex.

`hex_color` is an `AliasProperty` and defaults to *#ffffffff*.

`hsv`

The `hsv` holds the color currently selected in hsv format.

`hsv` is a `ListProperty` and defaults to (1, 1, 1).

`wheel`

The `wheel` holds the color wheel.

`wheel` is an `ObjectProperty` and defaults to None.

class `kivy.uix.colorpicker.`**`ColorWheel`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Chromatic wheel for the ColorPicker.

Changed in version 1.7.1: *font_size*, *font_name* and *foreground_color* have been removed. The sizing is now the same as others widget, based on 'sp'. Orientation is also automatically determined according to the width/height ratio.

`a`

The Alpha value of the color currently selected.

`a` is a `BoundedNumericProperty` and can be a value from 0 to 1.

`b`

The Blue value of the color currently selected.

`b` is a `BoundedNumericProperty` and can be a value from 0 to 1.

`color`

The holds the color currently selected.

`color` is a `ReferenceListProperty` and contains a list of *r*, *g*, *b*, *a* values.

`g`

The Green value of the color currently selected.

`g` is a `BoundedNumericProperty` and can be a value from 0 to 1.

`r`

The Red value of the color currently selected.

`r` is a `BoundedNumericProperty` and can be a value from 0 to 1. It defaults to 0.

CHAPTER

TWO

DROP-DOWN LIST

New in version 1.4.0.

A versatile drop-down list that can be used with custom widgets. It allows you to display a list of widgets under a displayed widget. Unlike other toolkits, the list of widgets can contain any type of widget: simple buttons, images etc.

The positioning of the drop-down list is fully automatic: we will always try to place the dropdown list in a way that the user can select an item in the list.

142.1 Basic example

A button with a dropdown list of 10 possible values. All the buttons within the dropdown list will trigger the dropdown `DropDown.select()` method. After being called, the main button text will display the selection of the dropdown.

```
from kivy.uix.dropdown import DropDown
from kivy.uix.button import Button
from kivy.base import runTouchApp

# create a dropdown with 10 buttons
dropdown = DropDown()
for index in range(10):
    # when adding widgets, we need to specify the height manually (disabling
    # the size_hint_y) so the dropdown can calculate the area it needs.
    btn = Button(text='Value %d' % index, size_hint_y=None, height=44)

    # for each button, attach a callback that will call the select() method
    # on the dropdown. We'll pass the text of the button as the data of the
    # selection.
    btn.bind(on_release=lambda btn: dropdown.select(btn.text))

    # then add the button inside the dropdown
    dropdown.add_widget(btn)

# create a big main button
mainbutton = Button(text='Hello', size_hint=(None, None))

# show the dropdown menu when the main button is released
# note: all the bind() calls pass the instance of the caller (here, the
# mainbutton instance) as the first argument of the callback (here,
# dropdown.open.).
mainbutton.bind(on_release=dropdown.open)
```

```
# one last thing, listen for the selection in the dropdown list and
# assign the data to the button text.
dropdown.bind(on_select=lambda instance, x: setattr(mainbutton, 'text', x))

runTouchApp(mainbutton)
```

142.2 Extending dropdown in Kv

You could create a dropdown directly from your kv:

```
#:kivy 1.4.0
<CustomDropDown>:
    Button:
        text: 'My first Item'
        size_hint_y: None
        height: 44
        on_release: root.select('item1')
    Label:
        text: 'Unselectable item'
        size_hint_y: None
        height: 44
    Button:
        text: 'My second Item'
        size_hint_y: None
        height: 44
        on_release: root.select('item2')
```

And then, create the associated python class and use it:

```
class CustomDropDown(DropDown):
    pass

dropdown = CustomDropDown()
mainbutton = Button(text='Hello', size_hint=(None, None))
mainbutton.bind(on_release=dropdown.open)
dropdown.bind(on_select=lambda instance, x: setattr(mainbutton, 'text', x))
```

class `kivy.uix.dropdown.`**`DropDown`**(***kwargs*)

Bases: `kivy.uix.scrollview.ScrollView`

DropDown class. See module documentation for more information.

Events

on_select: **data**Fired when a selection is done. The data of the selection is passed in as the first argument and is what you pass in the `select()` method as the first argument.

on_dismiss:New in version 1.8.0.

Fired when the DropDown is dismissed, either on selection or on touching outside the widget.

`attach_to`

(internal) Property that will be set to the widget to which the drop down list is attached.

The `open()` method will automatically set this property whilst `dismiss()` will set it back to None.

`auto_dismiss`

By default, the dropdown will be automatically dismissed when a touch happens outside of it, this option allow to disable this feature `auto_dismiss` is a `BooleanProperty` and defaults to True.

New in version 1.8.0.

`auto_width`
By default, the width of the dropdown will be the same as the width of the attached widget. Set to False if you want to provide your own width.

`container`
(internal) Property that will be set to the container of the dropdown list. It is a `GridLayout` by default.

`dismiss`(**largs*)
Remove the dropdown widget from the window and detach it from the attached widget.

`dismiss_on_select`
By default, the dropdown will be automatically dismissed when a selection has been done. Set to False to prevent the dismiss.

`dismiss_on_select` is a `BooleanProperty` and defaults to True.

`max_height`
Indicate the maximum height that the dropdown can take. If None, it will take the maximum height available until the top or bottom of the screen is reached.

`max_height` is a `NumericProperty` and defaults to None.

`open`(*widget*)
Open the dropdown list and attach it to a specific widget. Depending on the position of the widget within the window and the height of the dropdown, the dropdown might be above or below that widget.

`select`(*data*)
Call this method to trigger the *on_select* event with the *data* selection. The *data* can be anything you want.

CHAPTER

THREE

EFFECTWIDGET

New in version 1.9.0: This code is still experimental, and its API is subject to change in a future version.

The EffectWidget is able to apply a variety of fancy graphical effects to its children. It works by rendering to a series of Fbo instances with custom opengl fragment shaders. As such, effects can freely do almost anything, from inverting the colors of the widget, to antialiasing, to emulating the appearance of a crt monitor!

The basic usage is as follows:

```
w = EffectWidget()
w.add_widget(Button(text='Hello!')
w.effects = [InvertEffect(), HorizontalBlurEffect(size=2.0)]
```

The effects can be a list of effects of any length, and they will be applied sequentially.

The module comes with a range of prebuilt effects, but the interface is designed to make it easy to create your own. Instead of writing a full glsl shader, you provide a single function that takes some inputs based on the screen (current pixel color, current widget texture etc.). See the sections below for more information.

Note: It is not efficient to resize an EffectWidget, as each Fbo is recreated every time. If you need to resize frequently, consider doing things a different way.

Note: Although some effects have adjustable parameters, it is *not* efficient to animate these, as the entire shader is reconstructed every time. You should use glsl uniform variables instead. The AdvancedEffectBase may make this easier.

Note: The EffectWidget *cannot* draw outside its own widget area (pos -> pos + size), any child widgets overlapping the boundary will be cut off at this point.

143.1 Provided Effects

The module comes with several pre-written effects. Some have adjustable properties (e.g. blur radius), see the individual effect documentation for more details.

- MonochromeEffect - makes the widget grayscale.
- InvertEffect - inverts the widget colors.
- ChannelMixEffect - swaps around color channels.
- ScanlinesEffect - displays flickering scanlines.

- PixelateEffect - pixelates the image.
- HorizontalBlurEffect - Gaussuan blurs horizontally.
- VerticalBlurEffect - Gaussuan blurs vertically.
- FXAAEffect - applies a very basic AA.

143.2 Creating Effects

Effects are designed to make it easy to create and use your own transformations. You do this by creating and using an instance of EffectBase with your own custom EffectBase.glsl property.

The glsl property is a string representing part of a glsl fragment shader. You can include as many functions as you like (the string is simply spliced into the whole shader), but it must implement a function effect as below:

```
vec4 effect(vec4 color, sampler2D texture, vec2 tex_coords, vec2 coords)
{
    // ... your code here
    return something;  // must be a vec4 representing the new color
}
```

The full shader will calculate the normal pixel colour at each point, then call your effect function to transform it. The parameters are:

- **color**: The normal colour of the current pixel (i.e. texture sampled at tex_coords).
- **texture**: The texture containing the widget's normal background.
- **tex_coords**: The normal texture_coords used to access texture.
- **coords**: The pixel indices of the current pixel.

The shader code also has access to two useful uniform variables, time containing the time (in seconds) since the program start, and resolution containing the shape (x pixels, y pixels) of the widget.

For instance, the following simple string (taken from the *InvertEffect*) would invert the input color but set alpha to 1.0:

```
vec4 effect(vec4 color, sampler2D texture, vec2 tex_coords, vec2 coords)
{
    return vec4(1.0 - color.xyz, 1.0);
}
```

You can also set the glsl by automatically loading the string from a file, simply set the EffectBase.source property of an effect.

class kivy.uix.effectwidget.**EffectWidget**(***kwargs*)

Bases: kivy.uix.relativelayout.RelativeLayout

Widget with the ability to apply a series of graphical effects to its children. See module documentation for full information on setting effects and creating your own.

background_color

This defines the background color to be used for the fbo in the EffectWidget.

background_color is a ListProperty defaults to (0, 0, 0, 1)

effects

List of all the effects to be applied. These should all be instances of EffectBase.

effects is a ListProperty and defaults to [].

fbo_list

(internal) list of all the fbos that are being used to apply the effects.

fbo_list is a `ListProperty` and defaults to [].

refresh_fbo_setup(**args*)

(internal) Creates and assigns one `Fbo` per effect, and makes sure all sizes etc. are correct and consistent.

texture

The output texture of our final `Fbo` after all effects have been applied.

texture is an `ObjectProperty` and defaults to None.

class `kivy.uix.effectwidget.`**EffectBase**(**args, **kwargs*)

Bases: `kivy.event.EventDispatcher`

The base class for GLSL effects. It simply returns its input.

See module documentation for more details.

fbo

The fbo currently using this effect. The `EffectBase` automatically handles this.

`fbo` is a `ObjectProperty` and defaults to None.

glsl

The glsl string defining your effect function, see module documentation for more details.

`glsl` is a `StringProperty` and defaults to a trivial effect that returns its input.

set_fbo_shader(**args*)

Sets the `Fbo`'s shader by splicing the `glsl` string into a full fragment shader.

The full shader is made up of `shader_header + shader_uniforms + self.glsl + shader_footer_effect`.

source

The (optional) filename from which to load the `glsl` string.

`source` is a `StringProperty` and defaults to ''.

class `kivy.uix.effectwidget.`**AdvancedEffectBase**(**args, **kwargs*)

Bases: `kivy.uix.effectwidget.EffectBase`

An `EffectBase` with additional behavior to easily set and update uniform variables in your shader.

This class is provided for convenience if implementing your own effects, it is not used by any of those provided with Kivy.

In addition to your base glsl string that must be provided as normal, the `AdvancedEffectBase` has an extra property `uniforms`, a dictionary of name-value pairs. Whenever a value is changed, the new values for the uniform variable with the given name are uploaded to the shader.

You must still manually declare your uniform variables at the top of your glsl string.

uniforms

A dictionary of uniform variable names and their values. These are automatically uploaded to the `fbo` shader if appropriate.

uniforms is a `DictProperty` and defaults to {}.

class `kivy.uix.effectwidget.`**MonochromeEffect**(**args, **kwargs*)

Bases: `kivy.uix.effectwidget.EffectBase`

Returns its input colours in monochrome.

class `kivy.uix.effectwidget.`**`InvertEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Inverts the colours in the input.

class `kivy.uix.effectwidget.`**`ChannelMixEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Mixes the color channels of the input according to the order property. Channels may be arbitrarily rearranged or repeated.

`order`
The new sorted order of the rgb channels.

order is a `ListProperty` and defaults to [1, 2, 0], corresponding to (g, b, r).

class `kivy.uix.effectwidget.`**`ScanlinesEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Adds scanlines to the input.

class `kivy.uix.effectwidget.`**`PixelateEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Pixelates the input according to its `pixel_size`

`pixel_size`
Sets the size of a new 'pixel' in the effect, in terms of number of 'real' pixels.

pixel_size is a `NumericProperty` and defaults to 10.

class `kivy.uix.effectwidget.`**`HorizontalBlurEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Blurs the input horizontally, with the width given by `size`.

`size`
The blur width in pixels.

size is a `NumericProperty` and defaults to 4.0.

class `kivy.uix.effectwidget.`**`VerticalBlurEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Blurs the input vertically, with the width given by `size`.

`size`
The blur width in pixels.

size is a `NumericProperty` and defaults to 4.0.

class `kivy.uix.effectwidget.`**`FXAAEffect`**`(`**args, **kwargs*`)`
Bases: `kivy.uix.effectwidget.EffectBase`

Applies very simple antialiasing via fxaa.

CHAPTER

FOUR

FILECHOOSER

New in version 1.0.5.

Changed in version 1.2.0: In the chooser template, the *controller* is not a direct reference anymore but a weak-reference. You must update all the notation *root.controller.xxx* to *root.controller().xxx*.

144.1 Simple example

main.py

```
#!/usr/bin/env python
from kivy.app import App
from kivy.uix.floatlayout import FloatLayout
from kivy.factory import Factory
from kivy.properties import ObjectProperty
from kivy.uix.popup import Popup

import os

class LoadDialog(FloatLayout):
    load = ObjectProperty(None)
    cancel = ObjectProperty(None)


class SaveDialog(FloatLayout):
    save = ObjectProperty(None)
    text_input = ObjectProperty(None)
    cancel = ObjectProperty(None)


class Root(FloatLayout):
    loadfile = ObjectProperty(None)
    savefile = ObjectProperty(None)
    text_input = ObjectProperty(None)

    def dismiss_popup(self):
        self._popup.dismiss()

    def show_load(self):
        content = LoadDialog(load=self.load, cancel=self.dismiss_popup)
        self._popup = Popup(title="Load file", content=content, size_hint=(0.9, 0.9))
        self._popup.open()

    def show_save(self):
        content = SaveDialog(save=self.save, cancel=self.dismiss_popup)
        self._popup = Popup(title="Save file", content=content, size_hint=(0.9, 0.9))
        self._popup.open()

    def load(self, path, filename):
        with open(os.path.join(path, filename[0])) as stream:
            self.text_input.text = stream.read()

        self.dismiss_popup()

    def save(self, path, filename):
        with open(os.path.join(path, filename), 'w') as stream:
            stream.write(self.text_input.text)

        self.dismiss_popup()


class Editor(App):
    pass


Factory.register('Root', cls=Root)
Factory.register('LoadDialog', cls=LoadDialog)
Factory.register('SaveDialog', cls=SaveDialog)

if __name__ == '__main__':
    Editor().run()
```

editor.kv

```
#:kivy 1.1.0

Root:
    text_input: text_input

    BoxLayout:
        orientation: 'vertical'
        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: 'Load'
                on_release: root.show_load()
            Button:
                text: 'Save'
                on_release: root.show_save()

        BoxLayout:
            TextInput:
                id: text_input
                text: ''

            RstDocument:
                text: text_input.text
                show_errors: True

<LoadDialog>:
    BoxLayout:
        size: root.size
        pos: root.pos
        orientation: "vertical"
        FileChooserListView:
            id: filechooser

        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: "Cancel"
                on_release: root.cancel()

            Button:
                text: "Load"
                on_release: root.load(filechooser.path, filechooser.selection)

<SaveDialog>:
    text_input: text_input
    BoxLayout:
        size: root.size
        pos: root.pos
        orientation: "vertical"
        FileChooserListView:
            id: filechooser
            on_selection: text_input.text = self.selection and self.selection[0] or ''

        TextInput:
            id: text_input
            size_hint_y: None
            height: 30
            multiline: False

        BoxLayout:
            size_hint_y: None
            height: 30
            Button:
                text: "Cancel"
                on_release: root.cancel()

            Button:
                text: "Save"
                on_release: root.save(filechooser.path, text_input.text)
```

class `kivy.uix.filechooser.`**`FileChooserListView`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` using a list view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserIconView`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` using an icon view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserListLayout`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.filechooser.FileChooserLayout`

File chooser layout using a list view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooserIconLayout`**`(`***kwargs*`)`
Bases: `kivy.uix.filechooser.FileChooserLayout`

File chooser layout using an icon view.

New in version 1.9.0.

class `kivy.uix.filechooser.`**`FileChooser`**`(`***kwargs*`)`
Bases: `kivy.uix.filechooser.FileChooserController`

Implementation of `FileChooserController` which supports switching between multiple, synced layout views.

New in version 1.9.0.

`manager`
Reference to the `ScreenManager` instance.

`ObjectProperty`

`view_list`
List of views added to this FileChooser.

`AliasProperty` of type `list`.

`view_mode`
Current layout view mode.

`AliasProperty` of type `str`.

class `kivy.uix.filechooser.`**`FileChooserController`**`(`***kwargs*`)`
Bases: `kivy.uix.floatlayout.FloatLayout`

Base for implementing a FileChooser. Don't use this class directly, but prefer using an implementation such as the `FileChooser`, `FileChooserListView` or `FileChooserIconView`.

Changed in version 1.9.0.

Events

on_entry_added: **entry, parent**Fired when a root-level entry is added to the file list.

*on_entries_cleared*Fired when the the entries list is cleared, usually when the root is refreshed.

on_subentry_to_entry: **entry, parent**Fired when a sub-entry is added to an existing entry.

on_remove_subentry: **entry, parent**Fired when entries are removed from an entry, usually when a node is closed.

on_submit: **selection, touch**Fired when a file has been selected with a double-tap.

`cancel``(`**largs*`)`
Cancel any background action started by filechooser, such as loading a new directory.

New in version 1.2.0.

`dirselect`
`BooleanProperty`, defaults to False. Determines whether directories are valid selections or not.

New in version 1.1.0.

`entry_released``(`*entry, touch*`)`
(internal) This method must be called by the template when an entry is touched by the user.

New in version 1.1.0.

`entry_touched``(`*entry, touch*`)`
(internal) This method must be called by the template when an entry is touched by the user.

file_encodings

Possible encodings for decoding a filename to unicode. In the case that the user has a weird filename, undecodable without knowing it's initial encoding, we have no other choice than to guess it.

Please note that if you encounter an issue because of a missing encoding here, we'll be glad to add it to this list.

New in version 1.3.0.

Deprecated since version 1.8.0: This property is no longer used as the filechooser no longer decodes the file names.

file_encodings is a `ListProperty` and defaults to ['utf-8', 'latin1', 'cp1252'],

file_system

Implementation to access the file system. Must be an instance of FileSystemAbstract.

New in version 1.8.0.

`ObjectProperty`, defaults to `FileSystemLocal()`

files

Read-only `ListProperty`. The list of files in the directory specified by path after applying the filters.

filter_dirs

`BooleanProperty`, defaults to False. Indicates whether filters should also apply to directories.

filters

`ListProperty`, defaults to [], equal to '*'. Specifies the filters to be applied to the files in the directory.

The filters are not reset when the path changes. You need to do that yourself if desired.

There are two kinds of filters: patterns and callbacks.

1.Patterns

e.g. ['*.png']. You can use the following patterns:

Pattern	Meaning
*	matches everything
?	matches any single character
[seq]	matches any character in seq
[!seq]	matches any character not in seq

2.Callbacks

You can specify a function that will be called for each file. The callback will be passed the folder and file name as the first and second parameters respectively. It should return True to indicate a match and False otherwise.

Changed in version 1.4.0: If the filter is a callable (function or method), it will be called with the path and the file name as arguments for each file in the directory. The callable should returns True to indicate a match and False overwise.

get_nice_size(*fn*)

Pass the filepath. Returns the size in the best human readable format or '' if it is a directory (Don't recursively calculate size.).

layout

Reference to the layout widget instance.

layout is an `ObjectProperty`.

New in version 1.9.0.

multiselect
BooleanProperty, defaults to False. Determines whether the user is able to select multiple files or not.

path
StringProperty, defaults to the current working directory as a unicode string. It specifies the path on the filesystem that this controller should refer to.

Warning: If a unicode path is specified, all the files returned will be in unicode allowing the display of unicode files and paths. If a bytes path is specified, only files and paths with ascii names will be displayed properly: non-ascii filenames will be displayed and listed with questions marks (?) instead of their unicode characters.

progress_cls
Class to use for displaying a progress indicator for filechooser loading.

New in version 1.2.0.

ObjectProperty, defaults to `FileChooserProgress`.

Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

rootpath
Root path to use instead of the system root path. If set, it will not show a ".." directory to go up to the root path. For example, if you set rootpath to /users/foo, the user will be unable to go to /users or to any other directory not starting with /users/foo.

New in version 1.2.0.

StringProperty, defaults to None.

Note: Similar to path, if *rootpath* is specified, whether it's a bytes or unicode string determines the type of the filenames and paths read.

selection
Read-only ListProperty. Contains the list of files that are currently selected.

show_hidden
BooleanProperty, defaults to False. Determines whether hidden files and folders should be shown.

sort_func
ObjectProperty. Provides a function to be called with a list of filenames, and the filesystem implementation as the second argument. Returns a list of filenames sorted for display in the view.

Changed in version 1.8.0: The signature needs now 2 arguments: first the list of files, second the filesystem class to use.

class `kivy.uix.filechooser.`**`FileChooserProgressBase`**`(`***kwargs*`)`
Bases: `kivy.uix.floatlayout.FloatLayout`

Base for implementing a progress view. This view is used when too many entries need to be created and are delayed over multiple frames.

New in version 1.2.0.

cancel(**largs*)
Cancel any action from the FileChooserController.

index
Current index of total entries to be loaded.

path

Current path of the FileChooser, read-only.

total

Total number of entries to load.

class `kivy.uix.filechooser.`**`FileSystemAbstract`**

Bases: `object`

Class for implementing a File System view that can be used with the `FileChooser`.:attr:~*FileChooser.file_system*.

New in version 1.8.0.

getsize(*fn*)

Return the size in bytes of a file

is_dir(*fn*)

Return True if the argument passed to this method is a directory

is_hidden(*fn*)

Return True if the file is hidden

listdir(*fn*)

Return the list of files in the directory *fn*

class `kivy.uix.filechooser.`**`FileSystemLocal`**

Bases: `kivy.uix.filechooser.FileSystemAbstract`

Implementation of `FileSystemAbstract` for local files

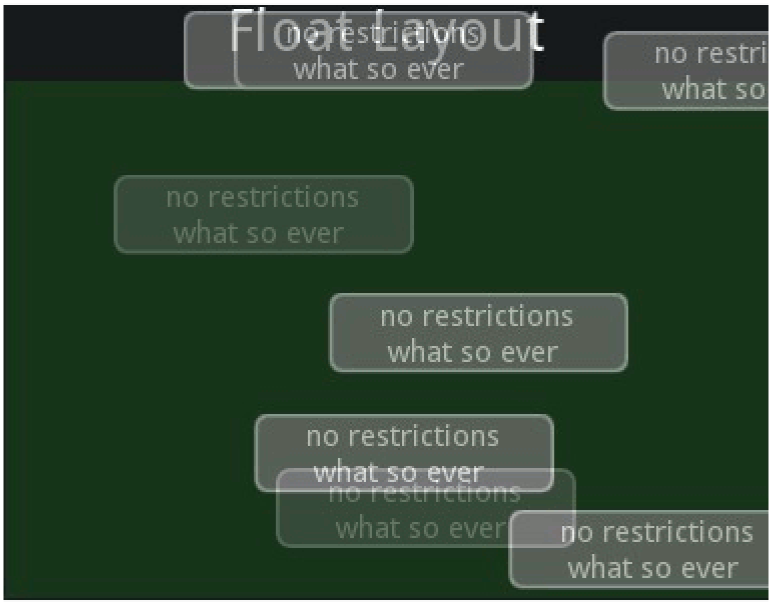
New in version 1.8.0.

CHAPTER

FIVE

FLOAT LAYOUT

The FloatLayout class honors only the `Widget.pos_hint` and `Widget.size_hint` attributes.



For example, a FloatLayout with a size of (300, 300) is created:

```
layout = FloatLayout(size=(300, 300))
```

By default, all widgets have their size_hint=(1, 1), so this button will adopt the same size as the layout:

```
button = Button(text='Hello world')
layout.add_widget(button)
```

To create a button 50% of the width and 25% of the height of the layout and positioned at (20, 20), you can do:

```
button = Button(
    text='Hello world',
    size_hint=(.5, .25),
    pos=(20, 20))
```

If you want to create a button that will always be the size of layout minus 20% on each side:

```
button = Button(text='Hello world', size_hint=(.6, .6),
                pos_hint={'x':.2, 'y':.2})
```

Note: This layout can be used for an application. Most of the time, you will use the size of Window.

Warning: If you are not using pos_hint, you must handle the positioning of the children: if the float layout is moving, you must handle moving the children too.

class `kivy.uix.floatlayout.`**`FloatLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

Float layout class. See module documentation for more information.

CHAPTER

SIX

GESTURE SURFACE

New in version 1.9.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

See `kivy/examples/demo/multistroke/main.py` for a complete application example.

class `kivy.uix.gesturesurface.`**`GestureSurface`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

Simple gesture surface to track/draw touch movements. Typically used to gather user input suitable for `kivy.multistroke.Recognizer`.

Properties

temporal_windowTime to wait from the last touch_up event before attempting to recognize the gesture. If you set this to 0, the *on_gesture_complete* event is not fired unless the `max_strokes` condition is met.

`temporal_window` is a `NumericProperty` and defaults to 2.0

max_strokesMax number of strokes in a single gesture; if this is reached, recognition will start immediately on the final touch_up event. If this is set to 0, the *on_gesture_complete* event is not fired unless the `temporal_window` expires.

`max_strokes` is a `NumericProperty` and defaults to 2.0

bbox_marginBounding box margin for detecting gesture collisions, in pixels.

`bbox_margin` is a `NumericProperty` and defaults to 30

draw_timeoutNumber of seconds to keep lines/bbox on canvas after the *on_gesture_complete* event is fired. If this is set to 0, gestures are immediately removed from the surface when complete.

`draw_timeout` is a `NumericProperty` and defaults to 3.0

colorColor used to draw the gesture, in RGB. This option does not have an effect if `use_random_color` is True.

`draw_timeout` is a `ListProperty` and defaults to [1, 1, 1] (white)

use_random_colorSet to True to pick a random color for each gesture, if you do this then *color* is ignored. Defaults to False.

`use_random_color` is a `BooleanProperty` and defaults to False

line_widthLine width used for tracing touches on the surface. Set to 0 if you only want to detect gestures without drawing anything. If you use 1.0, OpenGL GL_LINE is used for drawing; values > 1 will use an internal drawing method based on triangles (less efficient), see `kivy.graphics`.

`line_width` is a `NumericProperty` and defaults to 2 *draw_bbox*Set to True if you want to draw bounding box behind gestures. This only works if *line_width* >= 1. Default is False.

`draw_bbox` is a `BooleanProperty` and defaults to True

*bbox_alpha*Opacity for bounding box if *draw_bbox* is True. Default 0.1

`bbox_alpha` is a `NumericProperty` and defaults to 0.1

Events

on_gesture_start **`GestureContainer`**Fired when a new gesture is initiated on the surface, ie the first on_touch_down that does not collide with an existing gesture on the surface.

on_gesture_extend **`GestureContainer`**Fired when a touch_down event occurs within an existing gesture.

on_gesture_merge **`GestureContainer`**, **`GestureContainer`**Fired when two gestures collide and get merged to one gesture. The first argument is the gesture that has been merged (no longer valid); the second is the combined (resulting) gesture.

on_gesture_complete **`GestureContainer`**Fired when a set of strokes is considered a complete gesture, this happens when *temporal_window* expires or *max_strokes* is reached. Typically you will bind to this event and use the provided *GestureContainer* get_vectors() method to match against your gesture database.

on_gesture_cleanup **`GestureContainer`**Fired *draw_timeout* seconds after *on_gesture_complete*, The gesture will be removed from the canvas (if line_width > 0 or draw_bbox is True) and the internal gesture list before this.

on_gesture_discard **`GestureContainer`**Fired when a gesture does not meet the minimum size requirements for recognition (width/height < 5, or consists only of single- point strokes).

`find_colliding_gesture`(*touch*)

Checks if a touch x/y collides with the bounding box of an existing gesture. If so, return it (otherwise returns None)

`get_gesture`(*touch*)

Returns GestureContainer associated with given touch

`init_gesture`(*touch*)

Create a new gesture from touch, ie it's the first on surface, or was not close enough to any existing gesture (yet)

`merge_gestures`(*g*, *other*)

Merges two gestures together, the oldest one is retained and the newer one gets the *GestureContainer.was_merged* flag raised.

`on_touch_down`(*touch*)

When a new touch is registered, the first thing we do is to test if it collides with the bounding box of another known gesture. If so, it is assumed to be part of that gesture.

`on_touch_move`(*touch*)

When a touch moves, we add a point to the line on the canvas so the path is updated. We must also check if the new point collides with the bouonding box of another gesture - if so, they should be merged.

class `kivy.uix.gesturesurface.`**`GestureContainer`**(*touch*, ***kwargs*)

Bases: `kivy.event.EventDispatcher`

Container object that stores information about a gesture. It has various properties that are updated by *GestureSurface* as drawing progresses.

Arguments

touchTouch object (as received by on_touch_down) used to initialize the gesture container. Required.

Properties

activeSet to False once the gesture is complete (meets *max_stroke* setting or *GestureSurface.temporal_window*)

`active` is a `BooleanProperty`

active_strokesNumber of strokes currently active in the gesture, ie concurrent touches associated with this gesture.

`active_strokes` is a `NumericProperty`

max_strokesMax number of strokes allowed in the gesture. This is set by *GestureSurface.max_strokes* but can be overridden for example from *on_gesture_start*.

`max_strokes` is a `NumericProperty`

was_mergedIndicates that this gesture has been merged with another gesture and should be considered discarded.

`was_merged` is a `BooleanProperty`

bboxDictionary with keys minx, miny, maxx, maxy. Represents the size of the gesture bounding box.

`bbox` is a `DictProperty`

widthRepresents the width of the gesture.

`width` is a `NumericProperty`

heightRepresents the height of the gesture.

`height` is a `NumericProperty`

`accept_stroke`(*count=1*)

Returns True if this container can accept *count* new strokes

`add_stroke`(*touch, line*)

Associate a list of points with a touch.uid; the line itself is created by the caller, but subsequent move/up events look it up via us. This is done to avoid problems during merge.

`complete_stroke`()

Called on touch up events to keep track of how many strokes are active in the gesture (we only want to dispatch event when the *last* stroke in the gesture is released)

`get_vectors`(***kwargs*)

Return strokes in a format that is acceptable for *kivy.multistroke.Recognizer* as a gesture candidate or template. The result is cached automatically; the cache is invalidated at the start and end of a stroke and if *update_bbox* is called. If you are going to analyze a gesture mid-stroke, you may need to set the *no_cache* argument to True.

`handles`(*touch*)

Returns True if this container handles the given touch

`single_points_test`()

Returns True if the gesture consists only of single-point strokes, we must discard it in this case, or an exception will be raised

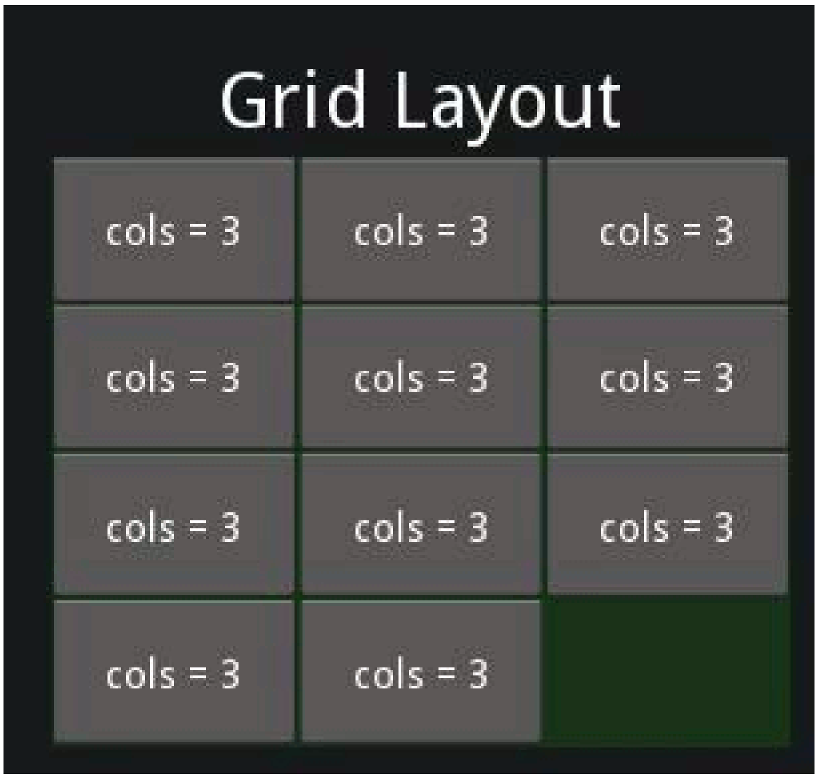
`update_bbox`(*touch*)

Update gesture bbox from a touch coordinate

CHAPTER

SEVEN

GRID LAYOUT



New in version 1.0.4.

The `GridLayout` arranges children in a matrix. It takes the available space and divides it into columns and rows, then adds widgets to the resulting "cells".

Changed in version 1.0.7: The implementation has changed to use the widget size_hint for calculating column/row sizes. *uniform_width* and *uniform_height* have been removed and other properties have added to give you more control.

147.1 Background

Unlike many other toolkits, you cannot explicitly place a widget in a specific column/row. Each child is automatically assigned a position determined by the layout configuration and the child's index in the children list.

A GridLayout must always have at least one input constraint: `GridLayout.cols` or `GridLayout.rows`. If you do not specify cols or rows, the Layout will throw an exception.

147.2 Column Width and Row Height

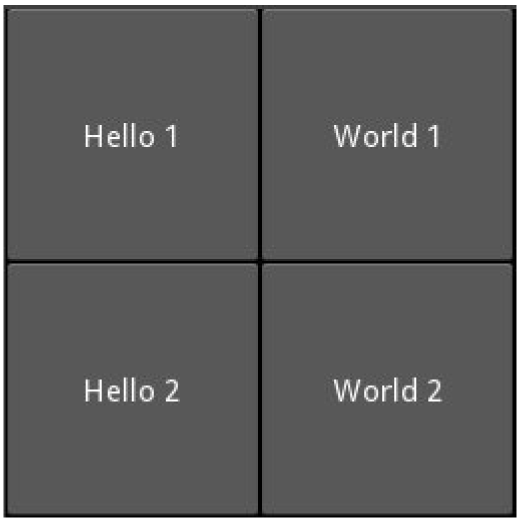
The column width/row height are determined in 3 steps:

- The initial size is given by the `col_default_width` and `row_default_height` properties. To customize the size of a single column or row, use `cols_minimum` or `rows_minimum`.
- The *size_hint_x*/*size_hint_y* of the children are taken into account. If no widgets have a size hint, the maximum size is used for all children.
- You can force the default size by setting the `col_force_default` or `row_force_default` property. This will force the layout to ignore the *width* and *size_hint* properties of children and use the default size.

147.3 Using a GridLayout

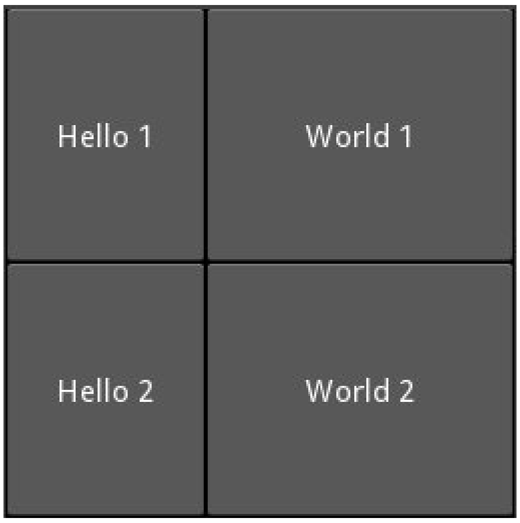
In the example below, all widgets will have an equal size. By default, the *size_hint* is (1, 1), so a Widget will take the full size of the parent:

```
layout = GridLayout(cols=2)
layout.add_widget(Button(text='Hello 1'))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2'))
layout.add_widget(Button(text='World 2'))
```



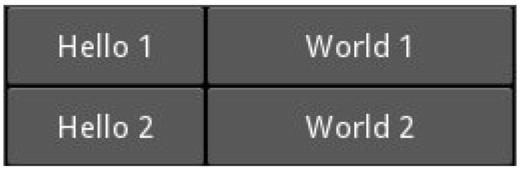
Now, let's fix the size of Hello buttons to 100px instead of using size_hint_x=1:

```
layout = GridLayout(cols=2)
layout.add_widget(Button(text='Hello 1', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 2'))
```



Next, let's fix the row height to a specific size:

```
layout = GridLayout(cols=2, row_force_default=True, row_default_height=40)
layout.add_widget(Button(text='Hello 1', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 1'))
layout.add_widget(Button(text='Hello 2', size_hint_x=None, width=100))
layout.add_widget(Button(text='World 2'))
```



class `kivy.uix.gridlayout.`**`GridLayout`**`(`***kwargs*`)`
Bases: `kivy.uix.layout.Layout`

Grid layout class. See module documentation for more information.

`col_default_width`
Default minimum size to use for a column.

New in version 1.0.7.

`col_default_width` is a `NumericProperty` and defaults to 0.

`col_force_default`
If True, ignore the width and size_hint_x of the child and use the default column width.

New in version 1.0.7.

`col_force_default` is a `BooleanProperty` and defaults to False.

`cols`
Number of columns in the grid.

Changed in version 1.0.8: Changed from a NumericProperty to BoundedNumericProperty. You can no longer set this to a negative value.

`cols` is a `NumericProperty` and defaults to 0.

`cols_minimum`
List of minimum sizes for each column.

New in version 1.0.7.

`cols_minimum` is a `DictProperty` and defaults to {}.

minimum_height

Minimum height needed to contain all children.

New in version 1.0.8.

minimum_height is a kivy.properties.NumericProperty and defaults to 0.

minimum_size

Minimum size needed to contain all children.

New in version 1.0.8.

minimum_size is a ReferenceListProperty of (minimum_width, minimum_height) properties.

minimum_width

Minimum width needed to contain all children.

New in version 1.0.8.

minimum_width is a kivy.properties.NumericProperty and defaults to 0.

padding

Padding between the layout box and it's children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced NumericProperty with VariableListProperty.

padding is a VariableListProperty and defaults to [0, 0, 0, 0].

row_default_height

Default minimum size to use for row.

New in version 1.0.7.

row_default_height is a NumericProperty and defaults to 0.

row_force_default

If True, ignore the height and size_hint_y of the child and use the default row height.

New in version 1.0.7.

row_force_default is a BooleanProperty and defaults to False.

rows

Number of rows in the grid.

Changed in version 1.0.8: Changed from a NumericProperty to a BoundedNumericProperty. You can no longer set this to a negative value.

rows is a NumericProperty and defaults to 0.

rows_minimum

List of minimum sizes for each row.

New in version 1.0.7.

rows_minimum is a DictProperty and defaults to {}.

spacing

Spacing between children: [spacing_horizontal, spacing_vertical].

spacing also accepts a one argument form [spacing].

spacing is a VariableListProperty and defaults to [0, 0].

class `kivy.uix.gridlayout.`**`GridLayoutException`**

Bases: `exceptions.Exception`

Exception for errors if the grid layout manipulation fails.

CHAPTER

EIGHT

IMAGE

The Image widget is used to display an image:

```
wimg = Image(source='mylogo.png')
```

148.1 Asynchronous Loading

To load an image asynchronously (for example from an external webserver), use the AsyncImage subclass:

```
aimg = AsyncImage(source='http://mywebsite.com/logo.png')
```

This can be useful as it prevents your application from waiting until the image is loaded. If you want to display large images or retrieve them from URL's, using AsyncImage will allow these resources to be retrieved on a background thread without blocking your application.

148.2 Alignment

By default, the image is centered and fits inside the widget bounding box. If you don't want that, you can set *allow_stretch* to True and *keep_ratio* to False.

You can also inherit from Image and create your own style.

For example, if you want your image to be greater than,the size of your widget, you could do:

```
class FullImage(Image):
    pass
```

And in your kivy language file:

```
<-FullImage>:
    canvas:
        Color:
            rgb: (1, 1, 1)
        Rectangle:
            texture: self.texture
            size: self.width + 20, self.height + 20
            pos: self.x - 10, self.y - 10
```

class `kivy.uix.image.`**`Image`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Image class, see module documentation for more information.

`allow_stretch`

If True, the normalized image size will be maximized to fit in the image box. Otherwise, if the box is too tall, the image will not be stretched more than 1:1 pixels.

New in version 1.0.7.

`allow_stretch` is a `BooleanProperty` and defaults to False.

`anim_delay`

Delay the animation if the image is sequenced (like an animated gif). If anim_delay is set to -1, the animation will be stopped.

New in version 1.0.8.

`anim_delay` is a `NumericProperty` and defaults to 0.25 (4 FPS).

`color`

Image color, in the format (r, g, b, a). This attribute can be used to 'tint' an image. Be careful: if the source image is not gray/white, the color will not really work as expected.

New in version 1.0.6.

`color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`image_ratio`

Ratio of the image (width / float(height).

`image_ratio` is a `AliasProperty` and is read-only.

`keep_data`

If True, the underlaying _coreimage will store the raw image data. This is useful when performing pixel based collision detection.

New in version 1.3.0.

`keep_data` is a `BooleanProperty` and defaults to False.

`keep_ratio`

If False along with allow_stretch being True, the normalized image size will be maximized to fit in the image box and ignores the aspect ratio of the image. Otherwise, if the box is too tall, the image will not be stretched more than 1:1 pixels.

New in version 1.0.8.

`keep_ratio` is a `BooleanProperty` and defaults to True.

`mipmap`

Indicate if you want OpenGL mipmapping to be applied to the texture. Read *Mipmapping* for more information.

New in version 1.0.7.

`mipmap` is a `BooleanProperty` and defaults to False.

`nocache`

If this property is set True, the image will not be added to the internal cache. The cache will simply ignore any calls trying to append the core image.

New in version 1.6.0.

`nocache` is a `BooleanProperty` and defaults to False.

norm_image_size

Normalized image size within the widget box.

This size will always fit the widget size and will preserve the image ratio.

`norm_image_size` is a `AliasProperty` and is read-only.

reload()

Reload image from disk. This facilitates re-loading of images from disk in case the image content changes.

New in version 1.3.0.

Usage:

```
im = Image(source = '1.jpg')
# -- do something --
im.reload()
# image will be re-loaded from disk
```

source

Filename / source of your image.

`source` is a `StringProperty` and defaults to None.

texture

Texture object of the image.

Depending of the texture creation, the value will be a `Texture` or a `TextureRegion` object.

`texture` is a `ObjectProperty` and defaults to None.

texture_size

Texture size of the image.

Warning: The texture size is set after the texture property. So if you listen to the change on `texture`, the property texture_size will not be up-to-date. Use self.texture.size instead.

class kivy.uix.image.**AsyncImage**(***kwargs*)

Bases: `kivy.uix.image.Image`

Asynchronous Image class. See the module documentation for more information.

Note: The AsyncImage is a specialized form of the Image class. You may want to refer to the `loader` documentation and in particular, the `ProxyImage` for more detail on how to handle events around asynchronous image loading.

CHAPTER

NINE

LABEL

The Label widget is for rendering text. It supports ascii and unicode strings:

```
# hello world text
l = Label(text='Hello world')

# unicode text; can only display glyphs that are available in the font
l = Label(text=u'Hello world ' + unichr(2764))

# multiline text
l = Label(text='Multi\nLine')

# size
l = Label(text='Hello world', font_size='20sp')
```

149.1 Markup text

New in version 1.1.0.

You can change the style of the text using *Text Markup*. The syntax is similar to the bbcode syntax but only the inline styling is allowed:

```
# hello world with world in bold
l = Label(text='Hello [b]World[/b]', markup=True)

# hello in red, world in blue
l = Label(text='[color=ff3333]Hello[/color][color=3333ff]World[/color]',
    markup = True)
```

If you need to escape the markup from the current text, use `kivy.utils.escape_markup()`:

```
text = 'This is an important message [1]'
l = Label(text='[b]' + escape_markup(text) + '[/b]', markup=True)
```

The following tags are available:

[b][/b] Activate bold text

[i][/i] Activate italic text

[font=<str>][/font] Change the font

[size=<integer>][/size] Change the font size

[color=#<color>][/color] Change the text color

`[ref=<str>][/ref]` Add an interactive zone. The reference + bounding box inside the reference will be available in `Label.refs`

`[anchor=<str>]` Put an anchor in the text. You can get the position of your anchor within the text with `Label.anchors`

`[sub][/sub]` Display the text at a subscript position relative to the text before it.

`[sup][/sup]` Display the text at a superscript position relative to the text before it.

If you want to render the markup text with a [or] or & character, you need to escape them. We created a simple syntax:

```
[   -> &bl;
]   -> &br;
&   -> &amp;
```

Then you can write:

```
"[size=24]Hello &bl;World&bt;[/size]"
```

149.2 Interactive Zone in Text

New in version 1.1.0.

You can now have definable "links" using text markup. The idea is to be able to detect when the user clicks on part of the text and to react. The tag `[ref=xxx]` is used for that.

In this example, we are creating a reference on the word "World". When this word is clicked, the function `print_it` will be called with the name of the reference:

```
def print_it(instance, value):
    print('User clicked on', value)
widget = Label(text='Hello [ref=world]World[/ref]', markup=True)
widget.bind(on_ref_press=print_it)
```

For prettier rendering, you could add a color for the reference. Replace the `text=` in the previous example with:

```
'Hello [ref=world][color=0000ff]World[/color][/ref]'
```

149.3 Usage example

The following example marks the anchors and references contained in a label:

```
from kivy.app import App
from kivy.uix.label import Label
from kivy.clock import Clock
from kivy.graphics import Color, Rectangle


class TestApp(App):

    @staticmethod
    def get_x(label, ref_x):
        """ Return the x value of the ref/anchor relative to the canvas """
        return label.center_x - label.texture_size[0] * 0.5 + ref_x

    @staticmethod
    def get_y(label, ref_y):
        """ Return the y value of the ref/anchor relative to the canvas """
        # Note the inversion of direction, as y values start at the top of
        # the texture and increase downwards
        return label.center_y + label.texture_size[1] * 0.5 - ref_y

    def show_marks(self, label):

        # Indicate the position of the anchors with a red top marker
        for name, anc in label.anchors.items():
            with label.canvas:
                Color(1, 0, 0)
                Rectangle(pos=(self.get_x(label, anc[0]),
                               self.get_y(label, anc[1])),
                          size=(3, 3))

        # Draw a green surround around the refs. Note the sizes y inversion
        for name, boxes in label.refs.items():
            for box in boxes:
                with label.canvas:
                    Color(0, 1, 0, 0.25)
                    Rectangle(pos=(self.get_x(label, box[0]),
                                   self.get_y(label, box[1])),
                              size=(box[2] - box[0],
                                    box[1] - box[3]))

    def build(self):
        label = Label(
            text='[anchor=a]a\nChars [anchor=b]b\n[ref=myref]ref[/ref]',
            markup=True)
        Clock.schedule_once(lambda dt: self.show_marks(label), 1)
        return label

TestApp().run()
```

class `kivy.uix.label.`**`Label`**(***kwargs*)

Bases: `kivy.uix.widget.Widget`

Label class, see module documentation for more information.

Events

on_ref_press Fired when the user clicks on a word referenced with a `[ref]` tag in a text markup.

`anchors`

New in version 1.1.0.

Position of all the `[anchor=xxx]` markup in the text. These co-ordinates are relative to the top left corner of the text, with the y value increasing downwards. Anchors names should be unique and only the first occurence of any duplicate anchors will be recorded.

You can place anchors in your markup text as follows:

```
text = """
    [anchor=title1][size=24]This is my Big title.[/size]
    [anchor=content]Hello world
"""
```

Then, all the `[anchor=]` references will be removed and you'll get all the anchor positions in this property (only after rendering):

```
>>> widget = Label(text=text, markup=True)
>>> widget.texture_update()
>>> widget.anchors
{"content": (20, 32), "title1": (20, 16)}
```

Note: This works only with markup text. You need `markup` set to True.

`bold`

Indicates use of the bold version of your font.

Note: Depending of your font, the bold attribute may have no impact on your text rendering.

`bold` is a `BooleanProperty` and defaults to False.

`color`

Text color, in the format (r, g, b, a)

`color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`disabled_color`

Text color, in the format (r, g, b, a)

New in version 1.8.0.

`disabled_color` is a `ListProperty` and defaults to [1, 1, 1, .5].

`font_name`

Filename of the font to use. The path can be absolute or relative. Relative paths are resolved by the `resource_find()` function.

Warning: Depending of your text provider, the font file can be ignored. However, you can mostly use this without problems.
If the font used lacks the glyphs for the particular language/symbols you are using, you will see '[]' blank box characters instead of the actual glyphs. The solution is to use a font that has the glyphs you need to display. For example, to display क, use a font such as freesans.ttf that has the glyph.

`font_name` is a `StringProperty` and defaults to 'DroidSans'.

`font_size`

Font size of the text, in pixels.

`font_size` is a `NumericProperty` and defaults to 12dp.

`halign`

Horizontal alignment of the text.

`halign` is an `OptionProperty` and defaults to 'left'. Available options are : left, center, right and justify.

Warning: This doesn't change the position of the text texture of the Label (centered), only the position of the text in this texture. You probably want to bind the size of the Label to the `texture_size` or set a `text_size`.

Changed in version 1.6.0: A new option was added to `halign`, namely *justify*.

`italic`

Indicates use of the italic version of your font.

Note: Depending of your font, the italic attribute may have no impact on your text rendering.

`italic` is a `BooleanProperty` and defaults to False.

`line_height`

Line Height for the text. e.g. line_height = 2 will cause the spacing between lines to be twice the size.

`line_height` is a `NumericProperty` and defaults to 1.0.

New in version 1.5.0.

`markup`

New in version 1.1.0.

If True, the text will be rendered using the `MarkupLabel`: you can change the style of the text using tags. Check the *Text Markup* documentation for more information.

`markup` is a `BooleanProperty` and defaults to False.

`max_lines`

Maximum number of lines to use, defaults to 0, which means unlimited. Please note that `shorten` take over this property. (with shorten, the text is always one line.)

New in version 1.8.0.

`max_lines` is a `NumericProperty` and defaults to 0.

`mipmap`

Indicates whether OpenGL mipmapping is applied to the texture or not. Read *Mipmapping* for more information.

New in version 1.0.7.

`mipmap` is a `BooleanProperty` and defaults to False.

`padding`

Padding of the text in the format (padding_x, padding_y)

`padding` is a `ReferenceListProperty` of (`padding_x`, `padding_y`) properties.

`padding_x`

Horizontal padding of the text inside the widget box.

`padding_x` is a `NumericProperty` and defaults to 0.

Changed in version 1.9.0: *padding_x* has been fixed to work as expected. In the past, the text was padded by the negative of its values.

`padding_y`

Vertical padding of the text inside the widget box.

`padding_y` is a `NumericProperty` and defaults to 0.

Changed in version 1.9.0: *padding_y* has been fixed to work as expected. In the past, the text was padded by the negative of its values.

`refs`

New in version 1.1.0.

List of `[ref=xxx]` markup items in the text with the bounding box of all the words contained in a ref, available only after rendering.

For example, if you wrote:

```
Check out my [ref=hello]link[/ref]
```

The refs will be set with:

```
{'hello': ((64, 0, 78, 16), )}
```

The references marked "hello" have a bounding box at (x1, y1, x2, y2). These co-ordinates are relative to the top left corner of the text, with the y value increasing downwards. You can define multiple refs with the same name: each occurence will be added as another (x1, y1, x2, y2) tuple to this list.

The current Label implementation uses these references if they exist in your markup text, automatically doing the collision with the touch and dispatching an *on_ref_press* event.

You can bind a ref event like this:

```
def print_it(instance, value):
    print('User click on', value)
widget = Label(text='Hello [ref=world]World[/ref]', markup=True)
widget.on_ref_press(print_it)
```

Note: This works only with markup text. You need `markup` set to True.

shorten

Indicates whether the label should attempt to shorten its textual contents as much as possible if a `text_size` is given. Setting this to True without an appropriately set `text_size` will lead to unexpected results.

`shorten_from` and `split_str` control the direction from which the `text` is split, as well as where in the `text` we are allowed to split.

`shorten` is a `BooleanProperty` and defaults to False.

shorten_from

The side from which we should shorten the text from, can be left, right, or center.

For example, if left, the ellipsis will appear towards the left side and we will display as much text starting from the right as possible. Similar to `shorten`, this option only applies when `text_size` [0] is not None, In this case, the string is shortened to fit within the specified width.

New in version 1.9.0.

`shorten_from` is a `OptionProperty` and defaults to *center*.

split_str

The string used to split the `text` while shortening the string when `shorten` is True.

For example, if it's a space, the string will be broken into words and as many whole words that can fit into a single line will be displayed. If `shorten_from` is the empty string, '', we split on every character fitting as much text as possible into the line.

New in version 1.9.0.

`split_str` is a `StringProperty` and defaults to '' (the empty string).

strip

Whether leading and trailing spaces and newlines should be stripped from each displayed line. If True, every line will start at the right or left edge, depending on `halign`. If `halign` is *justify* it is implicitly True.

New in version 1.9.0.

`strip` is a `BooleanProperty` and defaults to False.

`text`

Text of the label.

Creation of a simple hello world:

```
widget = Label(text='Hello world')
```

If you want to create the widget with an unicode string, use:

```
widget = Label(text=u'My unicode string')
```

`text` is a `StringProperty` and defaults to ''.

`text_size`

By default, the label is not constrained to any bounding box. You can set the size constraint of the label with this property. The text will autoflow into the constrains. So although the font size will not be reduced, the text will be arranged to fit into the box as best as possible, with any text still outside the box clipped.

This sets and clips `texture_size` to text_size if not None.

New in version 1.0.4.

For example, whatever your current widget size is, if you want the label to be created in a box with width=200 and unlimited height:

```
Label(text='Very big big line', text_size=(200, None))
```

Note: This text_size property is the same as the `usersize` property in the `Label` class. (It is named size= in the constructor.)

`text_size` is a `ListProperty` and defaults to (None, None), meaning no size restriction by default.

`texture`

Texture object of the text. The text is rendered automatically when a property changes. The OpenGL texture created in this operation is stored in this property. You can use this `texture` for any graphics elements.

Depending on the texture creation, the value will be a `Texture` or `TextureRegion` object.

Warning: The `texture` update is scheduled for the next frame. If you need the texture immediately after changing a property, you have to call the `texture_update()` method before accessing `texture`:

```
l = Label(text='Hello world')
# l.texture is good
l.font_size = '50sp'
# l.texture is not updated yet
l.texture_update()
# l.texture is good now.
```

`texture` is an `ObjectProperty` and defaults to None.

`texture_size`

Texture size of the text. The size is determined by the font size and text. If `text_size` is [None, None], the texture will be the size required to fit the text, otherwise it's clipped to fit `text_size`.

When `text_size` is [None, None], one can bind to texture_size and rescale it proportionally to fit the size of the label in order to make the text fit maximally in the label.

Warning: The `texture_size` is set after the `texture` property. If you listen for changes to `texture`, `texture_size` will not be up-to-date in your callback. Bind to `texture_size` instead.

`texture_update`(**largs*)

Force texture recreation with the current Label properties.

After this function call, the `texture` and `texture_size` will be updated in this order.

`valign`

Vertical alignment of the text.

`valign` is an `OptionProperty` and defaults to 'bottom'. Available options are : bottom, middle and top.

Warning: This doesn't change the position of the text texture of the Label (centered), only the position of the text within this texture. You probably want to bind the size of the Label to the `texture_size` or set a `text_size` to change this behavior.

LAYOUT

Layouts are used to calculate and assign widget positions.

The Layout class itself cannot be used directly. You should use one of the following layout classes:

- Anchor layout: kivy.uix.anchorlayout.AnchorLayout
- Box layout: kivy.uix.boxlayout.BoxLayout
- Float layout: kivy.uix.floatlayout.FloatLayout
- Grid layout: kivy.uix.gridlayout.GridLayout
- Page Layout: kivy.uix.pagelayout.PageLayout
- Relative layout: kivy.uix.relativelayout.RelativeLayout
- Scatter layout: kivy.uix.scatterlayout.ScatterLayout
- Stack layout: kivy.uix.stacklayout.StackLayout

150.1 Understanding the *size_hint* Property in *Widget*

The `size_hint` is a tuple of values used by layouts to manage the sizes of their children. It indicates the size relative to the layout's size instead of an absolute size (in pixels/points/cm/etc). The format is:

```
widget.size_hint = (width_percent, height_percent)
```

The percent is specified as a floating point number in the range 0-1. For example, 0.5 is 50%, 1 is 100%.

If you want a widget's width to be half of the parent's width and the height to be identical to the parent's height, you would do:

```
widget.size_hint = (0.5, 1.0)
```

If you don't want to use a size_hint for either the width or height, set the value to None. For example, to make a widget that is 250px wide and 30% of the parent's height, do:

```
widget.size_hint = (None, 0.3)
widget.width = 250
```

Changed in version 1.4.1: The *reposition_child* internal method (made public by mistake) has been removed.

class `kivy.uix.layout.`**`Layout`**`(`***kwargs*`)`

Bases: kivy.uix.widget.Widget

Layout interface class, used to implement every layout. See module documentation for more information.

`do_layout`(**largs*)

This function is called when a layout is needed by a trigger. If you are writing a new Layout subclass, don't call this function directly but use `_trigger_layout()` instead.

New in version 1.0.8.

CHAPTER

ONE

LIST VIEW

New in version 1.5.

Warning: This code is still experimental, and its API is subject to change in a future version.

The `ListView` implements an `AbstractView` as a vertical, scrollable,pannable list clipped to the scrollview's bounding box and contains list item view instances.

The `AbstractView` has one property: `adapter`. The adapter can be one of the following: a `SimpleListAdapter`, a `ListAdapter` or a `DictAdapter`. The `Adapter` can make use of `args_converters` to prepare you data for passing into the constructor for each item view instantiation.

For an overview of how all these components fit together, please see the `adapters` module documentation.

151.1 Introduction

Lists are central parts of many software projects. Kivy's approach to lists includes providing solutions for simple lists, along with a substantial framework for building lists of moderate to advanced complexity. For a new user, it can be difficult to ramp up from simple to advanced. For this reason, Kivy provides an extensive set of examples (with the Kivy package) that you may wish to run first, to get a taste of the range of functionality offered. You can tell from the names of the examples that they illustrate the "ramping up" from simple to advanced:

- kivy/examples/widgets/lists/list_simple.py
- kivy/examples/widgets/lists/list_simple_in_kv.py
- kivy/examples/widgets/lists/list_simple_in_kv_2.py
- kivy/examples/widgets/lists/list_master_detail.py
- kivy/examples/widgets/lists/list_two_up.py
- kivy/examples/widgets/lists/list_kv.py
- kivy/examples/widgets/lists/list_composite.py
- kivy/examples/widgets/lists/list_cascade.py
- kivy/examples/widgets/lists/list_cascade_dict.py
- kivy/examples/widgets/lists/list_cascade_images.py
- kivy/examples/widgets/lists/list_ops.py

Many of the examples feature selection, some restricting selection to single selection, where only one item at at time can be selected, and others allowing multiple item selection. Many of the examples illustrate how selection in one list can be connected to actions and selections in another view or another list.

Find your own way of reading the documentation here, examining the source code for the example apps and running the examples. Some may prefer to read the documentation through first, others may want to run the examples and view their code. No matter what you do, going back and forth will likely be needed.

151.2 Basic Example

In its simplest form, we make a listview with 100 items:

```
from kivy.uix.listview import ListView
from kivy.base import runTouchApp


class MainView(ListView):
    def __init__(self, **kwargs):
        super(MainView, self).__init__(
            item_strings=[str(index) for index in range(100)])

if __name__ == '__main__':
    runTouchApp(MainView())
```

Or, we could declare the listview using the kv language:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.lang import Builder
from kivy.base import runTouchApp

Builder.load_string("""
<MyListView>:
    ListView:
        item_strings: [str(index) for index in range(100)]
""")


class MyListView(BoxLayout):
    pass

if __name__ == '__main__':
    runTouchApp(MyListView())
```

151.3 Using an Adapter

Behind the scenes, the basic example above uses the `SimpleListAdapter`. When the constructor for the `ListView` sees that only a list of strings is provided as an argument (called item_strings), it creates a `SimpleListAdapter` using the list of strings.

"Simple" in `SimpleListAdapter` means *without selection support*. It is a scrollable list of items that does not respond to touch events.

To use a `SimpleListAdaper` explicitly when creating a ListView instance, do:

```
simple_list_adapter = SimpleListAdapter(
        data=["Item #{0}".format(i) for i in range(100)],
        cls=Label)

list_view = ListView(adapter=simple_list_adapter)
```

The instance of SimpleListAdapter has a required data argument which contains data items to use for instantiating Label views for the list view (note the cls=Label argument). The data items are strings. Each item string is set by the SimpleListAdapter as the *text* argument for each Label instantiation.

You can declare a ListView with an adapter in a kv file with special attention given to the way longer python blocks are indented:

```
from kivy.uix.boxlayout import BoxLayout
from kivy.base import runTouchApp
from kivy.lang import Builder

# Note the special nature of indentation in the adapter declaration, where
# the adapter: is on one line, then the value side must be given at one
# level of indentation.

Builder.load_string("""
#:import label kivy.uix.label
#:import sla kivy.adapters.simplelistadapter

<MyListView>:
    ListView:
        adapter:
            sla.SimpleListAdapter(
            data=["Item #{0}".format(i) for i in range(100)],
            cls=label.Label)
""")


class MyListView(BoxLayout):
    pass

if __name__ == '__main__':
    runTouchApp(MyListView())
```

151.4 ListAdapter and DictAdapter

For most use cases, your data is more complex than a simple list of strings. Selection functionality is also often needed. The ListAdapter and DictAdapter cover these more elaborate needs.

The ListAdapter is the base class for DictAdapter, so we can start with it.

Refer to the ListAdapter docs for details, but here is a synopses of its arguments:

- data: strings, class instances, dicts, etc. that form the base data for instantiating views.
- cls: a Kivy view that is to be instantiated for each list item. There are several built-in types available, including ListItemLabel and ListItemButton, or you can make your own class that mixes in the required SelectableView.
- template: the name of a Kivy language (kv) template that defines the Kivy view for each list item.

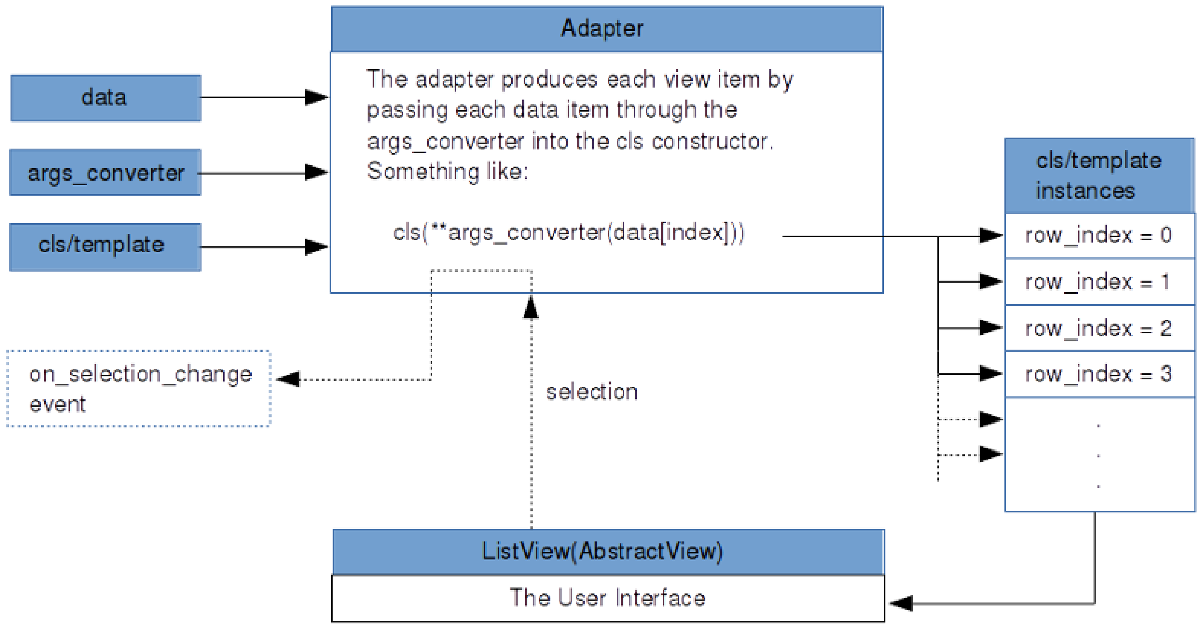
Note: Pick only one, cls or template, to provide as an argument.

- `args_converters`: a function that takes a data item object as input and uses it to build and return an args dict, ready to be used in a call to instantiate item views using the item view cls or template. In the case of cls, the args dict becomes a kwargs constructor argument. For a template, it is treated as a context (ctx) but is essentially similar in form to the kwargs usage.
- `selection_mode`: a string with the value 'single', 'multiple' or other.
- `allow_empty_selection`: a boolean, which if False (the default), forces there to always be a selection if there is data available. If True, selection happens only as a result of user action.

In narrative, we can summarize as follows:

> A listview's adapter takes data items and uses an args_converter function to transform them into arguments for creating list item view instances, using either a cls or a kv template.

In a graphic, a summary of the relationship between a listview and its components can be summarized as follows:


Adapter
The adapter produces each view item by passing each data item through the args_converter into the cls constructor. Something like:
cls(**args_converter(data[index]))
data
args_converter
cls/template
cls/template instances
row_index = 0
row_index = 1
row_index = 2
row_index = 3
on_selection_change event
selection
ListView(AbstractView)
The User Interface

Please refer to the `adapters` documentation for more details.

A `DictAdapter` has the same arguments and requirements as a `ListAdapter` except for two things:

1. There is an additional argument, sorted_keys, which must meet the requirements of normal python dictionary keys.
2. The data argument is, as you would expect, a dict. Keys in the dict must include the keys in the sorted_keys argument, but they may form a superset of the keys in sorted_keys. Values may be strings, class instances, dicts, etc. (The args_converter uses it accordingly).

151.5 Using an Args Converter

A `ListView` allows use of built-in list item views, such as `ListItemButton`, your own custom item view class or a custom kv template. Whichever type of list item view is used, an *args_converter* function is needed to prepare, per list data item, kwargs for the cls or the ctx for the template.

Note: Only the ListItemLabel, ListItemButton or custom classes like them (and not the simple Label or

Button classes) are to be used in the listview system.

Warning: ListItemButton inherits the *background_normal* and *background_down* properties from the Button widget, so the *selected_color* and *deselected_color* are not represented faithfully by default.

Here is an args_converter for use with the built-in ListItemButton specified as a normal Python function:

```
def args_converter(row_index, an_obj):
    return {'text': an_obj.text,
            'size_hint_y': None,
            'height': 25}
```

and as a lambda:

```
args_converter = lambda row_index, an_obj: {'text': an_obj.text,
                                            'size_hint_y': None,
                                            'height': 25}
```

In the args converter example above, the data item is assumed to be an object (class instance), hence the reference an_obj.text.

Here is an example of an args converter that works with list data items that are dicts:

```
args_converter = lambda row_index, obj: {'text': obj['text'],
                                         'size_hint_y': None,
                                         'height': 25}
```

So, it is the responsibility of the developer to code the args_converter according to the data at hand. The row_index argument can be useful in some cases, such as when custom labels are needed.

151.6 An Example ListView

Now, to some example code:

```
from kivy.adapters.listadapter import ListAdapter
from kivy.uix.listview import ListItemButton, ListView

data = [{'text': str(i), 'is_selected': False} for i in range(100)]

args_converter = lambda row_index, rec: {'text': rec['text'],
                                         'size_hint_y': None,
                                         'height': 25}

list_adapter = ListAdapter(data=data,
                           args_converter=args_converter,
                           cls=ListItemButton,
                           selection_mode='single',
                           allow_empty_selection=False)

list_view = ListView(adapter=list_adapter)
```

This listview will show 100 buttons with text of 0 to 100. The args_converter function converts the dict items in the data and instantiates ListItemButton views by passing these converted items into it's constructor. The listview will only allow single selection and the first item will already be selected as allow_empty_selection is False. For a complete discussion on these arguments, please see the `ListAdapter` documentation.

The `ListItemLabel` works in much the same way as the `ListItemButton`.

151.7 Using a Custom Item View Class

The data used in an adapter can be any of the normal Python types or custom classes, as shown below. It is up to the programmer to assure that the args_converter performs the appropriate conversions.

Here we make a simple DataItem class that has the required text and is_selected properties:

```
from kivy.uix.listview import ListItemButton
from kivy.adapters.listadapter import ListAdapter


class DataItem(object):
    def __init__(self, text='', is_selected=False):
        self.text = text
        self.is_selected = is_selected

data_items = [DataItem(text='cat'),
              DataItem(text='dog'),
              DataItem(text='frog')]

list_item_args_converter = lambda row_index, obj: {'text': obj.text,
                                                    'size_hint_y': None,
                                                    'height': 25}

list_adapter = ListAdapter(data=data_items,
                           args_converter=list_item_args_converter,
                           propagate_selection_to_data=True,
                           cls=ListItemButton)

list_view = ListView(adapter=list_adapter)
```

The data is passed to the `ListAdapter` along with an args_converter function. The propagation setting means that the is_selected property for each data item will be set and kept in sync with the list item views. This setting should be set to True if you wish to initialize the view with item views already selected.

You may also use the provided `SelectableDataItem` mixin to make a custom class. Instead of the "manually-constructed" DataItem class above, we could do:

```
from kivy.adapters.models import SelectableDataItem

class DataItem(SelectableDataItem):
    # Add properties here.
    pass
```

`SelectableDataItem` is a simple mixin class that has an is_selected property.

151.8 Using an Item View Template

`SelectableView` is another simple mixin class that has required properties for a list item: text, and is_selected. To make your own template, mix it in as follows:

```
from kivy.lang import Builder

Builder.load_string("""
[CustomListItem@SelectableView+BoxLayout]:
    size_hint_y: ctx.size_hint_y
    height: ctx.height
    ListItemButton:
        text: ctx.text
        is_selected: ctx.is_selected
""")
```

A class called CustomListItem can then be instantiated for each list item. Note that it subclasses a `BoxLayout` and is thus a type of `layout`. It contains a `ListItemButton` instance.

Using the power of the Kivy language (kv), you can easily build composite list items: in addition to ListItemButton, you could have a ListItemLabel or a custom class you have defined and registered via the `Factory`.

An args_converter needs to be constructed that goes along with such a kv template. For example, to use the kv template above:

```
list_item_args_converter = \
        lambda row_index, rec: {'text': rec['text'],
                                'is_selected': rec['is_selected'],
                                'size_hint_y': None,
                                'height': 25}
integers_dict = \
    { str(i): {'text': str(i), 'is_selected': False} for i in range(100)}

dict_adapter = DictAdapter(sorted_keys=[str(i) for i in range(100)],
                           data=integers_dict,
                           args_converter=list_item_args_converter,
                           template='CustomListItem')

list_view = ListView(adapter=dict_adapter)
```

A dict adapter is created with 1..100 integer strings as sorted_keys, and an integers_dict as data. integers_dict has the integer strings as keys and dicts with text and is_selected properties. The CustomListItem defined above in the Builder.load_string() call is set as the kv template for the list item views. The list_item_args_converter lambda function will take each dict in integers_dict and will return an args dict, ready for passing as the context (ctx) for the template.

151.9 Using CompositeListItem

The class `CompositeListItem` is another option for building advanced composite list items. The kv language approach has its advantages, but here we build a composite list view using a plain Python:

```
args_converter = lambda row_index, rec: \
    {'text': rec['text'],
    'size_hint_y': None,
    'height': 25,
    'cls_dicts': [{'cls': ListItemButton,
                    'kwargs': {'text': rec['text']}},
                   {'cls': ListItemLabel,
                    'kwargs': {'text': "Middle-{0}".format(rec['text']),
                              'is_representing_cls': True}},
                {'cls': ListItemButton,
                    'kwargs': {'text': rec['text']}}]}

item_strings = ["{0}".format(index) for index in range(100)]

integers_dict = \
    {str(i): {'text': str(i), 'is_selected': False} for i in range(100)}

dict_adapter = DictAdapter(sorted_keys=item_strings,
                           data=integers_dict,
                           args_converter=args_converter,
                           selection_mode='single',
                           allow_empty_selection=False,
                           cls=CompositeListItem)

list_view = ListView(adapter=dict_adapter)
```

The args_converter is somewhat complicated, so we should go through the details. Observe in the `DictAdapter` instantiation that `CompositeListItem` instance is set as the cls to be instantiated for each list item component. The args_converter will make args dicts for this cls. In the args_converter, the first three items, text, size_hint_y, and height, are arguments for the CompositeListItem itself. After that you see a cls_dicts list that contains argument sets for each of the member widgets for this composite: 2 `ListItemButtons` and a `ListItemLabel`. This is a similar approach to using a kv template described above.

For details on how `CompositeListItem` works, examine the code, looking for how parsing of the cls_dicts list and kwargs processing is done.

151.10 Uses for Selection

What can we do with selection? Combining selection with the system of bindings in Kivy, we can build a wide range of user interface designs.

We could make data items that contain the names of dog breeds, and connect the selection of dog breed to the display of details in another view, which would update automatically on selection. This is done via a binding to the `on_selection_change` event:

```
list_adapter.bind(on_selection_change=callback_function)
```

where callback_function() gets passed the adapter as an argument and does whatever is needed for the update. See the example called list_master_detail.py, and imagine that the list on the left could be a list of dog breeds, and the detail view on the right could show details for a selected dog breed.

In another example, we could set the selection_mode of a listview to 'multiple', and load it with a list of answers to a multiple-choice question. The question could have several correct answers. A color swatch view could be bound to selection change, as above, so that it turns green as soon as the correct choices are made, unless the number of touches exeeds a limit, then the answer session could be terminated. See the examples that feature thumbnail images to get some ideas, e.g., list_cascade_dict.py.

In a more involved example, we could chain together three listviews, where selection in the first controls the items shown in the second, and selection in the second controls the items shown in the third. If allow_empty_selection were set to False for these listviews, a dynamic system of selection "cascading" from one list to the next, would result.

There are so many ways that listviews and Kivy bindings functionality can be used, that we have only scratched the surface here. For on-disk examples, see:

```
kivy/examples/widgets/lists/list_*.py
```

Several examples show the "cascading" behavior described above. Others demonstrate the use of kv templates and composite list views.

class kivy.uix.listview.**SelectableView**(***kwargs*)

Bases: object

The SelectableView mixin is used to design list items and other classes that are to be instantiated by an adapter for use in a listview. The ListAdapter and DictAdapter adapters are selection-enabled. select() and deselect() are to be overridden with display code to mark items as selected or not, if desired.

deselect(**args*)

The list item is responsible for updating the display for being unselected, if desired.

index

The index into the underlying data list or the data item this view represents.

index is a NumericProperty, default to -1.

is_selected

A SelectableView instance carries this property, which should be kept in sync with the equivalent property in the data item it represents.

is_selected is a BooleanProperty, default to False.

select(**args*)

The list item is responsible for updating the display for being selected, if desired.

class kivy.uix.listview.**ListItemButton**(***kwargs*)

Bases: kivy.uix.listview.ListItemReprMixin, kivy.uix.listview.SelectableView, kivy.uix.button.Button

ListItemButton mixes SelectableView with Button to produce a button suitable for use in ListView.

deselected_color

deselected_color is a ListProperty and defaults to [0., 1., 0., 1].

selected_color

selected_color is a ListProperty and defaults to [1., 0., 0., 1].

class kivy.uix.listview.**ListItemLabel**(***kwargs*)

Bases: kivy.uix.listview.ListItemReprMixin, kivy.uix.listview.SelectableView, kivy.uix.label.Label

ListItemLabel mixes SelectableView with Label to produce a label suitable for use in ListView.

class kivy.uix.listview.**CompositeListItem**(***kwargs*)

Bases: kivy.uix.listview.SelectableView, kivy.uix.boxlayout.BoxLayout

CompositeListItem mixes SelectableView with BoxLayout for a generic container-style list item, to be used in ListView.

background_color

ListItem sublasses Button, which has background_color, but for a composite list item, we must add this property.

background_color is a ListProperty and defaults to [1, 1, 1, 1].

deselected_color

deselected_color is a ListProperty and defaults to [.33, .33, .33, 1].

representing_cls

Which component view class, if any, should represent for the composite list item in __repr__()?

representing_cls is an ObjectProperty and defaults to None.

selected_color

selected_color is a ListProperty and defaults to [1., 0., 0., 1].

class kivy.uix.listview.**ListView**(***kwargs*)

Bases: kivy.uix.abstractview.AbstractView, kivy.event.EventDispatcher

ListView is a primary high-level widget, handling the common task of presenting items in a scrolling list. Flexibility is afforded by use of a variety of adapters to interface with data.

The adapter property comes via the mixed in AbstractView class.

ListView also subclasses EventDispatcher for scrolling. The event *on_scroll_complete* is used in refreshing the main view.

For a simple list of string items, without selection, use SimpleListAdapter. For list items that respond to selection, ranging from simple items to advanced composites, use ListAdapter. For an alternate powerful adapter, use DictAdapter, rounding out the choice for designing highly interactive lists.

Events

***on_scroll_complete*: (boolean,)**Fired when scrolling completes.

container

The container is a GridLayout widget held within a ScrollView widget. (See the associated kv block in the Builder.load_string() setup). Item view instances managed and provided by the adapter are added to this container. The container is cleared with a call to clear_widgets() when the list is rebuilt by the populate() method. A padding Widget instance is also added as needed, depending on the row height calculations.

container is an ObjectProperty and defaults to None.

divider

[TODO] Not used.

divider_height

[TODO] Not used.

item_strings

If item_strings is provided, create an instance of SimpleListAdapter with this list of strings, and use it to manage a no-selection list.

item_strings is a ListProperty and defaults to [].

row_height

The row_height property is calculated on the basis of the height of the container and the count of items.

row_height is a NumericProperty and defaults to None.

scrolling

If the scroll_to() method is called while scrolling operations are happening, a call recursion error can occur. scroll_to() checks to see that scrolling is False before calling populate(). scroll_to() dispatches a scrolling_complete event, which sets scrolling back to False.

scrolling is a BooleanProperty and defaults to False.

CHAPTER

TWO

MODALVIEW

New in version 1.4.0.

The ModalView widget is used to create modal views. By default, the view will cover the whole "parent" window.

Remember that the default size of a Widget is size_hint=(1, 1). If you don't want your view to be fullscreen, either use size hints with values lower than 1 (for instance size_hint=(.8, .8)) or deactivate the size_hint and use fixed size attributes.

152.1 Examples

Example of a simple 400x400 Hello world view:

```
view = ModalView(size_hint=(None, None), size=(400, 400))
view.add_widget(Label(text='Hello world'))
```

By default, any click outside the view will dismiss it. If you don't want that, you can set ModalView.auto_dismiss to False:

```
view = ModalView(auto_dismiss=False)
view.add_widget(Label(text='Hello world'))
view.open()
```

To manually dismiss/close the view, use the ModalView.dismiss() method of the ModalView instance:

```
view.dismiss()
```

Both ModalView.open() and ModalView.dismiss() are bindable. That means you can directly bind the function to an action, e.g. to a button's on_press

```
# create content and add it to the view
content = Button(text='Close me!')
view = ModalView(auto_dismiss=False)
view.add_widget(content)

# bind the on_press event of the button to the dismiss function
content.bind(on_press=view.dismiss)

# open the view
view.open()
```

152.2 ModalView Events

There are two events available: *on_open* which is raised when the view is opening, and *on_dismiss* which is raised when the view is closed. For *on_dismiss*, you can prevent the view from closing by explictly returning True from your callback.

```
def my_callback(instance):
    print('ModalView', instance, 'is being dismissed, but is prevented!')
    return True
view = ModalView()
view.add_widget(Label(text='Hello world'))
view.bind(on_dismiss=my_callback)
view.open()
```

Changed in version 1.5.0: The ModalView can be closed by hitting the escape key on the keyboard if the `ModalView.auto_dismiss` property is True (the default).

class `kivy.uix.modalview.`**`ModalView`**`(`***kwargs*`)`

Bases: `kivy.uix.anchorlayout.AnchorLayout`

ModalView class. See module documentation for more information.

Events

on_open:Fired when the ModalView is opened.

on_dismiss:Fired when the ModalView is closed. If the callback returns True, the dismiss will be canceled.

`attach_to`

If a widget is set on attach_to, the view will attach to the nearest parent window of the widget. If none is found, it will attach to the main/global Window.

`attach_to` is an `ObjectProperty` and defaults to None.

`auto_dismiss`

This property determines if the view is automatically dismissed when the user clicks outside it.

`auto_dismiss` is a `BooleanProperty` and defaults to True.

`background`

Background image of the view used for the view background.

`background` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/modalview-background'.

`background_color`

Background color in the format (r, g, b, a).

`background_color` is a `ListProperty` and defaults to [0, 0, 0, .7].

`border`

Border used for `BorderImage` graphics instruction. Used for the `background_normal` and the `background_down` properties. Can be used when using custom backgrounds.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16).

`dismiss``(`**largs, **kwargs*`)`

Close the view if it is open. If you really want to close the view, whatever the on_dismiss event returns, you can use the *force* argument:

```
view = ModalView(...)
view.dismiss(force=True)
```

When the view is dismissed, it will be faded out before being removed from the parent. If you don't want animation, use:

```
view.dismiss(animation=False)
```

open(**largs*)
Show the view window from the `attach_to` widget. If set, it will attach to the nearest window. If the widget is not attached to any window, the view will attach to the global `Window`.

CHAPTER

THREE

PAGELAYOUT

The PageLayout class is used to create a simple multi-page layout, in a way that allows easy flipping of one page to another using borders.

PageLayout doesn't honor size_hint or pos_hint in any way currently.

New in version 1.8.0.

example:

```
PageLayout:
    Button:
        text: 'page1'

    Button:
        text: 'page2'

    Button:
        text: 'page3'
```

class `kivy.uix.pagelayout.`**`PageLayout`**`(`***kwargs*`)`

Bases: `kivy.uix.layout.Layout`

PageLayout class. See module documentation for more information.

`border`

Width of the border used around the current page to display the previous/next page when needed.

`border` is a `NumericProperty`, defaults to 0.

`page`

Currently displayed page.

`page` is a `NumericProperty`, defaults to 0.

`swipe_threshold`

Thresold to the swipe action triggering, as percentage of the widget size.

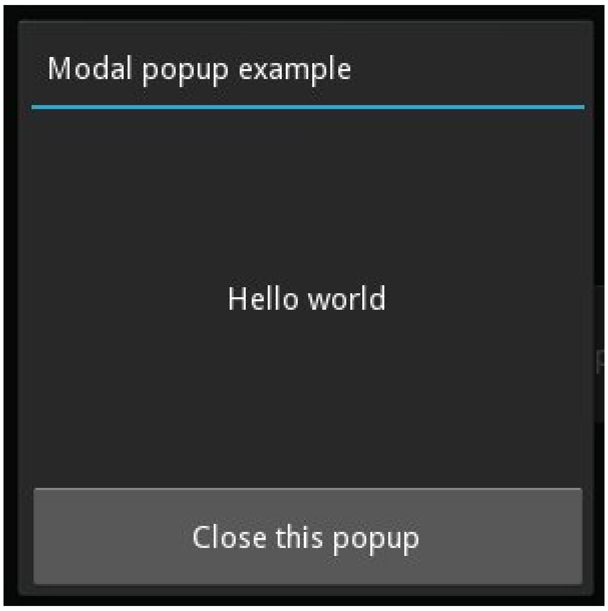
`swipe_threshold` is a `NumericProperty`, defaults to .5.

CHAPTER

FOUR

POPUP

New in version 1.0.7.



The Popup widget is used to create modal popups. By default, the popup will cover the whole "parent" window. When you are creating a popup, you must at least set a Popup.title and Popup.content.

Remember that the default size of a Widget is size_hint=(1, 1). If you don't want your popup to be fullscreen, either use size hints with values less than 1 (for instance size_hint=(.8, .8)) or deactivate the size_hint and use fixed size attributes.

Changed in version 1.4.0: The Popup class now inherits from ModalView. The Popup offers a default layout with a title and a separation bar.

154.1 Examples

Example of a simple 400x400 Hello world popup:

```
popup = Popup(title='Test popup',
    content=Label(text='Hello world'),
    size_hint=(None, None), size=(400, 400))
```

By default, any click outside the popup will dismiss/close it. If you don't want that, you can set auto_dismiss to False:

```
popup = Popup(title='Test popup', content=Label(text='Hello world'),
              auto_dismiss=False)
popup.open()
```

To manually dismiss/close the popup, use `dismiss`:

```
popup.dismiss()
```

Both `open()` and `dismiss()` are bindable. That means you can directly bind the function to an action, e.g. to a button's on_press:

```
# create content and add to the popup
content = Button(text='Close me!')
popup = Popup(content=content, auto_dismiss=False)

# bind the on_press event of the button to the dismiss function
content.bind(on_press=popup.dismiss)

# open the popup
popup.open()
```

154.2 Popup Events

There are two events available: *on_open* which is raised when the popup is opening, and *on_dismiss* which is raised when the popup is closed. For *on_dismiss*, you can prevent the popup from closing by explictly returning True from your callback:

```
def my_callback(instance):
    print('Popup', instance, 'is being dismissed but is prevented!')
    return True
popup = Popup(content=Label(text='Hello world'))
popup.bind(on_dismiss=my_callback)
popup.open()
```

class `kivy.uix.popup.`**`Popup`**`(`***kwargs*`)`
Bases: `kivy.uix.modalview.ModalView`

Popup class. See module documentation for more information.

Events

on_open:Fired when the Popup is opened.

on_dismiss:Fired when the Popup is closed. If the callback returns True, the dismiss will be canceled.

`content`
Content of the popup that is displayed just under the title.

`content` is an `ObjectProperty` and defaults to None.

`separator_color`
Color used by the separator between title and content.

New in version 1.1.0.

`separator_color` is a `ListProperty` and defaults to [47 / 255., 167 / 255., 212 / 255., 1.]

`separator_height`

Height of the separator.

New in version 1.1.0.

`separator_height` is a `NumericProperty` and defaults to 2dp.

`title`

String that represents the title of the popup.

`title` is a `StringProperty` and defaults to 'No title'.

`title_color`

Color used by the Title.

New in version 1.8.0.

`title_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`title_size`

Represents the font size of the popup title.

New in version 1.6.0.

`title_size` is a `NumericProperty` and defaults to '14sp'.

class `kivy.uix.popup.`**`PopupException`**

Bases: `exceptions.Exception`

Popup exception, fired when multiple content widgets are added to the popup.

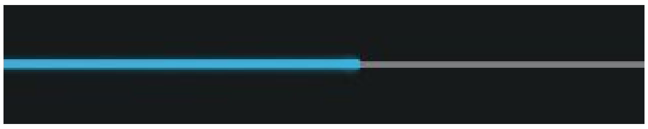
New in version 1.4.0.

CHAPTER

FIVE

PROGRESS BAR

New in version 1.0.8.



The ProgressBar widget is used to visualize the progress of some task. Only the horizontal mode is currently supported: the vertical mode is not yet available.

The progress bar has no interactive elements and is a display-only widget.

To use it, simply assign a value to indicate the current progress:

```
from kivy.uix.progressbar import ProgressBar
pb = ProgressBar(max=1000)

# this will update the graphics automatically (75% done)
pb.value = 750
```

class `kivy.uix.progressbar.`**`ProgressBar`**(***kwargs*)

Bases: `kivy.uix.widget.Widget`

Class for creating a progress bar widget.

See module documentation for more details.

`max`

Maximum value allowed for `value`.

`max` is a `NumericProperty` and defaults to 100.

`value`

Current value used for the slider.

`value` is an `AliasProperty` that returns the value of the progress bar. If the value is < 0 or > `max`, it will be normalized to those boundaries.

Changed in version 1.6.0: The value is now limited to between 0 and `max`.

`value_normalized`

Normalized value inside the range 0-1:

```
>>> pb = ProgressBar(value=50, max=100)
>>> pb.value
50
>>> slider.value_normalized
0.5
```

value_normalized is an AliasProperty.

CHAPTER

SIX

RELATIVE LAYOUT

New in version 1.4.0.

This layout allows you to set relative coordinates for children. If you want absolute positioning, use the FloatLayout.

The RelativeLayout class behaves just like the regular FloatLayout except that its child widgets are positioned relative to the layout.

When a widget with position = (0,0) is added to a RelativeLayout, the child widget will also move when the position of the RelativeLayout is changed. The child widgets coordinates remain (0,0) as they are always relative to the parent layout.

156.1 Coordinate Systems

156.1.1 Window coordinates

By default, there's only one coordinate system that defines the position of widgets and touch events dispatched to them: the window coordinate system, which places (0, 0) at the bottom left corner of the window. Although there are other coordinate systems defined, e.g. local and parent coordinates, these coordinate systems are identical to the window coordinate system as long as a relative layout type widget is not in the widget's parent stack. When widget.pos is read or a touch is received, the coordinate values are in parent coordinates, but as mentioned, these are identical to window coordinates, even in complex widget stacks.

For example:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(args[1].pos))
    BoxLayout:
        on_touch_down: print('Box: {}'.format(args[1].pos))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(args[1].pos))
```

When the middle button is clicked and the touch propagates through the different parent coordinate systems, it prints the following:

```
>>> Box: (430.0, 282.0)
>>> Right: (430.0, 282.0)
>>> Middle: (430.0, 282.0)
```

As claimed, the touch has identical coordinates to the window coordinates in every coordinate system. `collide_point()` for example, takes the point in window coordinates.

156.1.2 Parent coordinates

Other `RelativeLayout` type widgets are `Scatter`, `ScatterLayout`, and `ScrollView`. If such a special widget is in the parent stack, only then does the parent and local coordinate system diverge from the window coordinate system. For each such widget in the stack, a coordinate system with (0, 0) of that coordinate system being at the bottom left corner of that widget is created. **Position and touch coordinates received and read by a widget are in the coordinate system of the most recent special widget in its parent stack (not including itself) or in window coordinates if there are none** (as in the first example). We call these coordinates parent coordinates.

For example:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(args[1].pos))
    RelativeLayout:
        on_touch_down: print('Relative: {}'.format(args[1].pos))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(args[1].pos))
```

Clicking on the middle button prints:

```
>>> Relative: (396.0, 298.0)
>>> Right: (-137.33, 298.0)
>>> Middle: (396.0, 298.0)
```

As the touch propagates through the widgets, for each widget, the touch is received in parent coordinates. Because both the relative and middle widgets don't have these special widgets in their parent stack, the touch is the same as window coordinates. Only the right widget, which has a RelativeLayout in its parent stack, receives the touch in coordinates relative to that RelativeLayout which is different than window coordinates.

156.1.3 Local and Widget coordinates

When expressed in parent coordinates, the position is expressed in the coordinates of the most recent special widget in its parent stack, not including itself. When expressed in local or widget coordinates, the widgets themselves are also included.

Changing the above example to transform the parent coordinates into local coordinates:

```
BoxLayout:
    Label:
        text: 'Left'
    Button:
        text: 'Middle'
        on_touch_down: print('Middle: {}'.format(self.to_local(*args[1].pos)))
    RelativeLayout:
        on_touch_down: print('Relative: {}'.format(self.to_local(*args[1].pos)))
        Button:
            text: 'Right'
            on_touch_down: print('Right: {}'.format(self.to_local(*args[1].pos)))
```

Now, clicking on the middle button prints:

```
>>> Relative: (-135.33, 301.0)
>>> Right: (-135.33, 301.0)
>>> Middle: (398.0, 301.0)
```

This is because now the relative widget also expresses the coordinates relative to itself.

156.1.4 Coordinate transformations

`Widget` provides 4 functions to transform coordinates between the various coordinate systems. For now, we assume that the *relative* keyword of these functions is *False*. `to_widget()` takes the coordinates expressed in window coordinates and returns them in local (widget) coordinates. `to_window()` takes the coordinates expressed in local coordinates and returns them in window coordinates. `to_parent()` takes the coordinates expressed in local coordinates and returns them in parent coordinates. `to_local()` takes the coordinates expressed in parent coordinates and returns them in local coordinates.

Each of the 4 transformation functions take a *relative* parameter. When the relative parameter is True, the coordinates are returned or originate in true relative coordinates - relative to a coordinate system with its (0, 0) at the bottom left corner of the widget in question.

Changed in version 1.7.0: Prior to version 1.7.0, the `RelativeLayout` was implemented as a `FloatLayout` inside a `Scatter`. This behaviour/widget has been renamed to *ScatterLayout*. The `RelativeLayout` now only supports relative positions (and can't be rotated, scaled or translated on a multitouch system using two or more fingers). This was done so that the implementation could be optimized and avoid the heavier calculations of `Scatter` (e.g. inverse matrix, recaculating multiple properties etc.)

class `kivy.uix.relativelayout.`**`RelativeLayout`**(***kw*)

Bases: `kivy.uix.floatlayout.FloatLayout`

RelativeLayout class, see module documentation for more information.

CHAPTER

SEVEN

RESTRUCTUREDTEXT RENDERER

New in version 1.1.0.

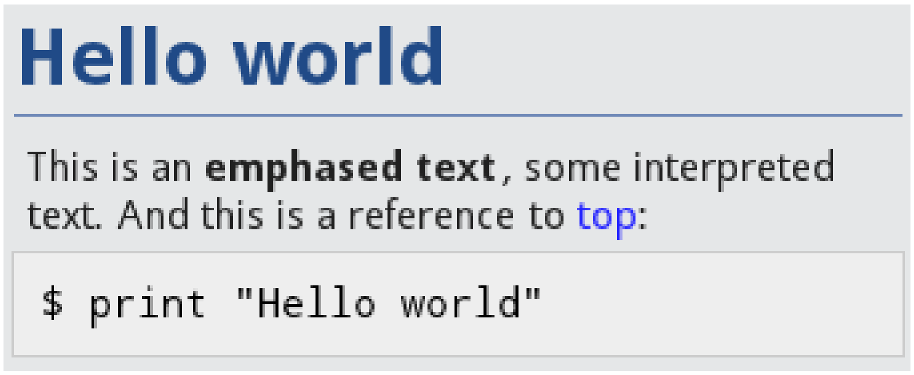
reStructuredText is an easy-to-read, what-you-see-is-what-you-get plaintext markup syntax and parser system.

Warning: This widget is highly experimental. The whole styling and implementation are not stable until this warning has been removed.

157.1 Usage with Text

```
text = """
.. _top:

Hello world
===========

This is an **emphased text**, some ``interpreted text``.
And this is a reference to top_::

    $ print("Hello world")

"""
document = RstDocument(text=text)
```

The rendering will output:



Hello world

This is an **emphased text**, some interpreted text. And this is a reference to top:

```
$ print "Hello world"
```

157.2 Usage with Source

You can also render a rst file using the `RstDocument.source` property:

```
document = RstDocument(source='index.rst')
```

You can reference other documents with the role `:doc:`. For example, in the document `index.rst` you can write:

```
Go to my next document: :doc:‘moreinfo.rst‘
```

It will generate a link that, when clicked, opens the `moreinfo.rst` document.

class `kivy.uix.rst.`**`RstDocument`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.scrollview.ScrollView`

Base widget used to store an Rst document. See module documentation for more information.

`background_color`
Specifies the background_color to be used for the RstDocument.

New in version 1.8.0.

`background_color` is an `AliasProperty` for colors['background'].

`base_font_size`
Font size for the biggest title, 31 by default. All other font sizes are derived from this.

New in version 1.8.0.

`colors`
Dictionary of all the colors used in the RST rendering.

> **Warning:** This dictionary is needs special handling. You also need to call `RstDocument.render()` if you change them after loading.

`colors` is a `DictProperty`.

`document_root`
Root path where :doc: will search for rst documents. If no path is given, it will use the directory of the first loaded source file.

`document_root` is a `StringProperty` and defaults to None.

`goto``(`*`ref, *largs`*`)`
Scroll to the reference. If it's not found, nothing will be done.

For this text:

```
.. _myref:

This is something I always wanted.
```

You can do:

```
from kivy.clock import Clock
from functools import partial

doc = RstDocument(...)
Clock.schedule_once(partial(doc.goto, 'myref'), 0.1)
```

Note: It is preferable to delay the call of the goto if you just loaded the document because the layout might not be finished or the size of the RstDocument has not yet been determined. In either case, the calculation of the scrolling would be wrong.

You can, however, do a direct call if the document is already loaded.

New in version 1.3.0.

`preload`(*filename*, *encoding='utf-8'*, *errors='strict'*)
Preload a rst file to get its toctree and its title.

The result will be stored in `toctrees` with the `filename` as key.

`render`()
Force document rendering.

`resolve_path`(*filename*)
Get the path for this filename. If the filename doesn't exist, it returns the document_root + filename.

`show_errors`
Indicate whether RST parsers errors should be shown on the screen or not.

`show_errors` is a `BooleanProperty` and defaults to False.

`source`
Filename of the RST document.

`source` is a `StringProperty` and defaults to None.

`source_encoding`
Encoding to be used for the `source` file.

`source_encoding` is a `StringProperty` and defaults to *utf-8*.

Note: It is your responsibility to ensure that the value provided is a valid codec supported by python.

`source_error`
Error handling to be used while encoding the `source` file.

`source_error` is an `OptionProperty` and defaults to *strict*. Can be one of 'strict', 'ignore', 'replace', 'xmlcharrefreplace' or 'backslashreplac'.

`text`
RST markup text of the document.

`text` is a `StringProperty` and defaults to None.

`title`
Title of the current document.

`title` is a `StringProperty` and defaults to ''. It is read-only.

`toctrees`
Toctree of all loaded or preloaded documents. This dictionary is filled when a rst document is explicitly loaded or where `preload()` has been called.

If the document has no filename, e.g. when the document is loaded from a text file, the key will be ''.

`toctrees` is a `DictProperty` and defaults to {}.

underline_color

underline color of the titles, expressed in html color notation

`underline_color` is a `StringProperty` and defaults to '204a9699'.

CHAPTER

EIGHT

SANDBOX

New in version 1.8.0.

Warning: This is experimental and subject to change as long as this warning notice is present.

This is a widget that runs itself and all of its children in a Sandbox. That means if a child raises an Exception, it will be caught. The Sandbox itself runs its own Clock, Cache, etc.

The SandBox widget is still experimental and required for the Kivy designer. When the user designs their own widget, if they do something wrong (wrong size value, invalid python code), it will be caught correctly without breaking the whole application. Because it has been designed that way, we are still enhancing this widget and the `kivy.context` module. Don't use it unless you know what you are doing.

class `kivy.uix.sandbox.`**`Sandbox`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

Sandbox widget, used to trap all the exceptions raised by child widgets.

`on_context_created``()`

Override this method in order to load your kv file or do anything else with the newly created context.

`on_exception``(`*exception*, *_traceback=None*`)`

Override this method in order to catch all the exceptions from children.

If you return True, it will not reraise the exception. If you return False, the exception will be raised to the parent.

CHAPTER

NINE

SCATTER

Scatter is used to build interactive widgets that can be translated, rotated and scaled with two or more fingers on a multitouch system.

Scatter has its own matrix transformation: the modelview matrix is changed before the children are drawn and the previous matrix is restored when the drawing is finished. That makes it possible to perform rotation, scaling and translation over the entire children tree without changing any widget properties. That specific behavior makes the scatter unique, but there are some advantages / constraints that you should consider:

1. The children are positioned relative to the scatter similar to a RelativeLayout (see relativelayout). So when dragging the scatter, the position of the children don't change, only the position of the scatter does.
2. The scatter size has no impact on the size of it's children.
3. If you want to resize the scatter, use scale, not size (read #2). Scale transforms both the scatter and its children, but does not change size.
4. The scatter is not a layout. You must manage the size of the children yourself.

For touch events, the scatter converts from the parent matrix to the scatter matrix automatically in on_touch_down/move/up events. If you are doing things manually, you will need to use `to_parent()` and `to_local()`.

159.1 Usage

By default, the Scatter does not have a graphical representation: it is a container only. The idea is to combine the Scatter with another widget, for example an Image:

```
scatter = Scatter()
image = Image(source='sun.jpg')
scatter.add_widget(image)
```

159.2 Control Interactions

By default, all interactions are enabled. You can selectively disable them using the do_rotation, do_translation and do_scale properties.

Disable rotation:

```
scatter = Scatter(do_rotation=False)
```

Allow only translation:

```
scatter = Scatter(do_rotation=False, do_scale=False)
```

Allow only translation on x axis:

```
scatter = Scatter(do_rotation=False, do_scale=False,
                  do_translation_y=False)
```

159.3 Automatic Bring to Front

If the `Scatter.auto_bring_to_front` property is True, the scatter widget will be removed and re-added to the parent when it is touched (brought to front, above all other widgets in the parent). This is useful when you are manipulating several scatter widgets and don't want the active one to be partially hidden.

159.4 Scale Limitation

We are using a 32-bit matrix in double representation. That means we have a limit for scaling. You cannot do infinite scaling down/up with our implementation. Generally, you don't hit the minimum scale (because you don't see it on the screen), but the maximum scale is 9.99506983235e+19 (2^66).

You can also limit the minimum and maximum scale allowed:

```
scatter = Scatter(scale_min=.5, scale_max=3.)
```

159.5 Behavior

Changed in version 1.1.0: If no control interactions are enabled, then the touch handler will never return True.

class `kivy.uix.scatter.`**`Scatter`**`(`***kwargs*`)`
Bases: `kivy.uix.widget.Widget`

Scatter class. See module documentation for more information.

Events

on_transform_with_touch:Fired when the scatter has been transformed by user touch or multitouch, such as panning or zooming.

on_bring_to_front:Fired when the scatter is brought to the front.

Changed in version 1.9.0: Event *on_bring_to_front* added.

Changed in version 1.8.0: Event *on_transform_with_touch* added.

`apply_transform``(`*trans, post_multiply=False, anchor=(0, 0)*`)`
Transforms the scatter by applying the "trans" transformation matrix (on top of its current transformation state). The resultant matrix can be found in the `transform` property.

Parameters

trans: **`Matrix`**.Transformation matix to be applied to the scatter widget.

anchor: **tuple, defaults to (0, 0).**The point to use as the origin of the transformation (uses local widget space).

post_multiply: **bool, defaults to False.**If True, the transform matrix is post multiplied (as if applied before the current transform).

Usage example:

```
from kivy.graphics.transformation import Matrix
mat = Matrix().scale(3, 3, 3)
scatter_instance.apply_transform(mat)
```

auto_bring_to_front

If True, the widget will be automatically pushed on the top of parent widget list for drawing.

auto_bring_to_front is a BooleanProperty and defaults to True.

bbox

Bounding box of the widget in parent space:

```
((x, y), (w, h))
# x, y = lower left corner
```

bbox is an AliasProperty.

do_collide_after_children

If True, the collision detection for limiting the touch inside the scatter will be done after dispaching the touch to the children. You can put children outside the bounding box of the scatter and still be able to touch them.

New in version 1.3.0.

do_rotation

Allow rotation.

do_rotation is a BooleanProperty and defaults to True.

do_scale

Allow scaling.

do_scale is a BooleanProperty and defaults to True.

do_translation

Allow translation on the X or Y axis.

do_translation is an AliasProperty of (do_translation_x + do_translation_y)

do_translation_x

Allow translation on the X axis.

do_translation_x is a BooleanProperty and defaults to True.

do_translation_y

Allow translation on Y axis.

do_translation_y is a BooleanProperty and defaults to True.

on_bring_to_front(*touch*)

Called when a touch event causes the scatter to be brought to the front of the parent (only if auto_bring_to_front is True)

Parameters *touch*: the touch object which brought the scatter to front.

New in version 1.9.0.

on_transform_with_touch(*touch*)

Called when a touch event has transformed the scatter widget. By default this does nothing, but can be overriden by derived classes that need to react to transformations caused by user input.

Parameters *touch*: the touch object which triggered the transformation.

New in version 1.8.0.

rotation

Rotation value of the scatter.

`rotation` is an `AliasProperty` and defaults to 0.0.

scale

Scale value of the scatter.

`scale` is an `AliasProperty` and defaults to 1.0.

scale_max

Maximum scaling factor allowed.

`scale_max` is a `NumericProperty` and defaults to 1e20.

scale_min

Minimum scaling factor allowed.

`scale_min` is a `NumericProperty` and defaults to 0.01.

transform

Transformation matrix.

`transform` is an `ObjectProperty` and defaults to the identity matrix.

Note: This matrix reflects the current state of the transformation matrix but setting it directly will erase previously applied transformations. To apply a transformation considering context, please use the `apply_transform` method.

---

transform_inv

Inverse of the transformation matrix.

`transform_inv` is an `ObjectProperty` and defaults to the identity matrix.

translation_touches

Determine whether translation was triggered by a single or multiple touches. This only has effect when `do_translation` = True.

`translation_touches` is a `NumericProperty` and defaults to 1.

New in version 1.7.0.

class kivy.uix.scatter.**ScatterPlane**(***kwargs*)

Bases: `kivy.uix.scatter.Scatter`

This is essentially an unbounded Scatter widget. It's a convenience class to make it easier to handle infinite planes.

SCATTER LAYOUT

New in version 1.6.0.

This layout behaves just like a RelativeLayout. When a widget is added with position = (0,0) to a ScatterLayout, the child widget will also move when you change the position of the ScatterLayout. The child widget's coordinates remain (0,0) as they are relative to the parent layout.

However, since ScatterLayout is implemented using a Scatter widget, you can also translate, rotate and scale the layout using touches or clicks, just like in the case of a normal Scatter widget, and the child widgets will behave as expected.

In contrast to a Scatter, the Layout favours 'hint' properties, such as size_hint, size_hint_x, size_hint_y and pos_hint.

Note: The ScatterLayout is implemented as a FloatLayout inside a Scatter.

Warning: Since the actual ScatterLayout is a Scatter, its add_widget and remove_widget functions are overridden to add children to the embedded FloatLayout (accessible as the *content* property of Scatter) automatically. So if you want to access the added child elements, you need self.content.children instead of self.children.

Warning: The ScatterLayout was introduced in 1.7.0 and was called RelativeLayout in prior versions. The RelativeLayout is now an optimized implementation that uses only a positional transform to avoid some of the heavier calculation involved for Scatter.

class `kivy.uix.scatterlayout.`**`ScatterLayout`**`(`***kw*`)`

Bases: `kivy.uix.scatter.Scatter`

ScatterLayout class, see module documentation for more information.

CHAPTER

ONE

SCREEN MANAGER

New in version 1.4.0.

Warning: This widget is still experimental, and its API is subject to change in a future version.

The screen manager is a widget dedicated to managing multiple screens for your application. The default `ScreenManager` displays only one `Screen` at a time and uses a `TransitionBase` to switch from one Screen to another.

Multiple transitions are supported based on changing the screen coordinates / scale or even performing fancy animation using custom shaders.

161.1 Basic Usage

Let's construct a Screen Manager with 4 named screens. When you are creating a screen, **you absolutely need to give a name to it**:

```
from kivy.uix.screenmanager import ScreenManager, Screen

# Create the manager
sm = ScreenManager()

# Add few screens
for i in range(4):
    screen = Screen(name='Title %d' % i)
    sm.add_widget(screen)

# By default, the first screen added into the ScreenManager will be
# displayed. You can then change to another screen.

# Let's display the screen named 'Title 2'
# A transition will automatically be used.
sm.current = 'Title 2'
```

The default `ScreenManager.transition` is a `SlideTransition` with options `direction` and `duration`.

Please note that by default, a `Screen` displays nothing: it's just a `RelativeLayout`. You need to use that class as a root widget for your own screen, the best way being to subclass.

Here is an example with a 'Menu Screen' and a 'Settings Screen':

```
from kivy.app import App
from kivy.lang import Builder
from kivy.uix.screenmanager import ScreenManager, Screen

# Create both screens. Please note the root.manager.current: this is how
# you can control the ScreenManager from kv. Each screen has by default a
# property manager that gives you the instance of the ScreenManager used.
Builder.load_string("""
<MenuScreen>:
    BoxLayout:
        Button:
            text: 'Goto settings'
            on_press: root.manager.current = 'settings'
        Button:
            text: 'Quit'

<SettingsScreen>:
    BoxLayout:
        Button:
            text: 'My settings button'
        Button:
            text: 'Back to menu'
            on_press: root.manager.current = 'menu'
""")

# Declare both screens
class MenuScreen(Screen):
    pass

class SettingsScreen(Screen):
    pass

# Create the screen manager
sm = ScreenManager()
sm.add_widget(MenuScreen(name='menu'))
sm.add_widget(SettingsScreen(name='settings'))

class TestApp(App):

    def build(self):
        return sm

if __name__ == '__main__':
    TestApp().run()
```

161.2 Changing Direction

A common use case for `ScreenManager` involves using a `SlideTransition` which slides right to the next screen and slides left to the previous screen. Building on the previous example, this can be accomplished like so:

```
Builder.load_string("""
<MenuScreen>:
    BoxLayout:
        Button:
            text: 'Goto settings'
            on_press:
                root.manager.transition.direction = 'left'
                root.manager.current = 'settings'
        Button:
            text: 'Quit'

<SettingScreen>:
    BoxLayout:
        Button:
            text: 'My settings button'
        Button:
            text: 'Back to menu'
            on_press:
                root.manager.transition.direction = 'right'
                root.manager.current = 'menu'
""")
```

161.3 Advanced Usage

From 1.8.0, you can now switch dynamically to a new screen, change the transition options and remove the previous one by using `switch_to()`:

```
sm = ScreenManager()
screens = [Screen(name='Title {}'.format(i)) for i in range(4)]

sm.switch_to(screens[0])
# later
sm.switch_to(screens[1], direction='right')
```

Note that this method adds the screen to the `ScreenManager` instance and should not be used if your screens have already been added to this instance. To switch to a screen which is already added, you should use the `current` property.

161.4 Changing transitions

You have multiple transitions available by default, such as:

- `NoTransition` - switches screens instantly with no animation
- `SlideTransition` - slide the screen in/out, from any direction
- `SwapTransition` - implementation of the iOS swap transition
- `FadeTransition` - shader to fade the screen in/out
- `WipeTransition` - shader to wipe the screens from right to left
- `FallOutTransition` - shader where the old screen 'falls' and becomes transparent, revealing the new one behind it.
- `RiseInTransition` - shader where the new screen rises from the screen centre while fading from transparent to opaque.

You can easily switch transitions by changing the `ScreenManager.transition` property:

```
sm = ScreenManager(transition=FadeTransition())
```

Note: Currently, none of Shader based Transitions use anti-aliasing. This is because they use the FBO which doesn't have any logic to handle supersampling. This is a known issue and we are working on a transparent implementation that will give the same results as if it had been rendered on screen.

To be more concrete, if you see sharp edged text during the animation, it's normal.

---

class `kivy.uix.screenmanager.`**`Screen`**`(`***kw*`)`

Bases: `kivy.uix.relativelayout.RelativeLayout`

Screen is an element intended to be used with a `ScreenManager`. Check module documentation for more information.

Events

***on_pre_enter*: ()**Event fired when the screen is about to be used: the entering animation is started.

***on_enter*: ()**Event fired when the screen is displayed: the entering animation is complete.

***on_pre_leave*: ()**Event fired when the screen is about to be removed: the leaving animation is started.

***on_leave*: ()**Event fired when the screen is removed: the leaving animation is finished.

Changed in version 1.6.0: Events *on_pre_enter*, *on_enter*, *on_pre_leave* and *on_leave* were added.

`manager`

`ScreenManager` object, set when the screen is added to a manager.

`manager` is an `ObjectProperty` and defaults to None, read-only.

`name`

Name of the screen which must be unique within a `ScreenManager`. This is the name used for `ScreenManager.current`.

`name` is a `StringProperty` and defaults to ''.

`transition_progress`

Value that represents the completion of the current transition, if any is occuring.

If a transition is in progress, whatever the mode, the value will change from 0 to 1. If you want to know if it's an entering or leaving animation, check the `transition_state`.

`transition_progress` is a `NumericProperty` and defaults to 0.

`transition_state`

Value that represents the state of the transition:

- 'in' if the transition is going to show your screen
- 'out' if the transition is going to hide your screen

After the transition is complete, the state will retain it's last value (in or out).

`transition_state` is an `OptionProperty` and defaults to 'out'.

class `kivy.uix.screenmanager.`**`ScreenManager`**`(`***kwargs*`)`

Bases: `kivy.uix.floatlayout.FloatLayout`

Screen manager. This is the main class that will control your `Screen` stack and memory.

By default, the manager will show only one screen at a time.

`current`

Name of the screen currently shown, or the screen to show.

```
from kivy.uix.screenmanager import ScreenManager, Screen

sm = ScreenManager()
```

```
sm.add_widget(Screen(name='first'))
sm.add_widget(Screen(name='second'))

# By default, the first added screen will be shown. If you want to
# show another one, just set the 'current' property.
sm.current = 'second'
```

current_screen

Contains the currently displayed screen. You must not change this property manually, use current instead.

current_screen is an ObjectProperty and defaults to None, read-only.

get_screen(*name*)

Return the screen widget associated with the name or raise a ScreenManagerException if not found.

has_screen(*name*)

Return True if a screen with the *name* has been found.

New in version 1.6.0.

next()

Return the name of the next screen from the screen list.

previous()

Return the name of the previous screen from the screen list.

screen_names

List of the names of all the Screen widgets added. The list is read only.

screens_names is an AliasProperty and is read-only. It is updated if the screen list changes or the name of a screen changes.

screens

List of all the Screen widgets added. You must not change the list manually. Use Screen.add_widget() instead.

screens is a ListProperty and defaults to [], read-only.

switch_to(*screen, **options*)

Add a new screen to the ScreenManager and switch to it. The previous screen will be removed from the children. *options* are the transition options that will be changed before the animation happens.

If no previous screens are available, the screen will be used as the main one:

```
sm = ScreenManager()
sm.switch_to(screen1)
# later
sm.switch_to(screen2, direction='left')
# later
sm.switch_to(screen3, direction='right', duration=1.)
```

If any animation is in progress, it will be stopped and replaced by this one: you should avoid this because the animation will just look weird. Use either switch_to() or current but not both.

The *screen* name will be changed if there is any conflict with the current screen.

transition

Transition object to use for animating the screen that will be hidden and the screen that will be shown. By default, an instance of SlideTransition will be given.

For example, if you want to change to a WipeTransition:

```
from kivy.uix.screenmanager import ScreenManager, Screen,
WipeTransition

sm = ScreenManager(transition=WipeTransition())
sm.add_widget(Screen(name='first'))
sm.add_widget(Screen(name='second'))

# by default, the first added screen will be shown. If you want to
# show another one, just set the 'current' property.
sm.current = 'second'
```

Changed in version 1.8.0: Default transition has been changed from SwapTransition to SlideTransition.

class kivy.uix.screenmanager.**ScreenManagerException**
Bases: exceptions.Exception

Exception for the ScreenManager.

class kivy.uix.screenmanager.**TransitionBase**
Bases: kivy.event.EventDispatcher

TransitionBase is used to animate 2 screens within the ScreenManager. This class acts as a base for other implementations like the SlideTransition and SwapTransition.

Events

on_progress: **Transition object, progression float**Fired during the animation of the transition.

on_complete: **Transition object**Fired when the transition is fininshed.

add_screen(*screen*)
(internal) Used to add a screen to the ScreenManager.

duration
Duration in seconds of the transition.

duration is a NumericProperty and defaults to .4 (= 400ms).

Changed in version 1.8.0: Default duration has been changed from 700ms to 400ms.

is_active
Indicate whether the transition is currently active or not.

is_active is a BooleanProperty and defaults to False, read-only.

manager
ScreenManager object, set when the screen is added to a manager.

manager is an ObjectProperty and defaults to None, read-only.

remove_screen(*screen*)
(internal) Used to remove a screen from the ScreenManager.

screen_in
Property that contains the screen to show. Automatically set by the ScreenManager.

screen_in is an ObjectProperty and defaults to None.

screen_out
Property that contains the screen to hide. Automatically set by the ScreenManager.

screen_out is an ObjectProperty and defaults to None.

start(*manager*)
(internal) Starts the transition. This is automatically called by the ScreenManager.

stop()

(internal) Stops the transition. This is automatically called by the ScreenManager.

class kivy.uix.screenmanager.**ShaderTransition**

Bases: kivy.uix.screenmanager.TransitionBase

Transition class that uses a Shader for animating the transition between 2 screens. By default, this class doesn't assign any fragment/vertex shader. If you want to create your own fragment shader for the transition, you need to declare the header yourself and include the "t", "tex_in" and "tex_out" uniform:

```
# Create your own transition. This shader implements a "fading"
# transition.
fs = """$HEADER
    uniform float t;
    uniform sampler2D tex_in;
    uniform sampler2D tex_out;

    void main(void) {
        vec4 cin = texture2D(tex_in, tex_coord0);
        vec4 cout = texture2D(tex_out, tex_coord0);
        gl_FragColor = mix(cout, cin, t);
    }
"""

# And create your transition
tr = ShaderTransition(fs=fs)
sm = ScreenManager(transition=tr)
```

clearcolor

Sets the color of Fbo ClearColor.

New in version 1.9.0.

clearcolor is a ListProperty and defaults to [0, 0, 0, 1].

fs

Fragment shader to use.

fs is a StringProperty and defaults to None.

vs

Vertex shader to use.

vs is a StringProperty and defaults to None.

class kivy.uix.screenmanager.**SlideTransition**

Bases: kivy.uix.screenmanager.TransitionBase

Slide Transition, can be used to show a new screen from any direction: left, right, up or down.

direction

Direction of the transition.

direction is an OptionProperty and defaults to 'left'. Can be one of 'left', 'right', 'up' or 'down'.

class kivy.uix.screenmanager.**SwapTransition**

Bases: kivy.uix.screenmanager.TransitionBase

Swap transition that looks like iOS transition when a new window appears on the screen.

class kivy.uix.screenmanager.**FadeTransition**

Bases: kivy.uix.screenmanager.ShaderTransition

Fade transition, based on a fragment Shader.

class `kivy.uix.screenmanager.`**`WipeTransition`**
Bases: `kivy.uix.screenmanager.ShaderTransition`

Wipe transition, based on a fragment Shader.

class `kivy.uix.screenmanager.`**`FallOutTransition`**
Bases: `kivy.uix.screenmanager.ShaderTransition`

Transition where the new screen 'falls' from the screen centre, becoming smaller and more transparent until it disappears, and revealing the new screen behind it. Mimics the popular/standard Android transition.

New in version 1.8.0.

`duration`
Duration in seconds of the transition, replacing the default of `TransitionBase`.

`duration` is a `NumericProperty` and defaults to .15 (= 150ms).

class `kivy.uix.screenmanager.`**`RiseInTransition`**
Bases: `kivy.uix.screenmanager.ShaderTransition`

Transition where the new screen rises from the screen centre, becoming larger and changing from transparent to opaque until it fills the screen. Mimics the popular/standard Android transition.

New in version 1.8.0.

`duration`
Duration in seconds of the transition, replacing the default of `TransitionBase`.

`duration` is a `NumericProperty` and defaults to .2 (= 200ms).

class `kivy.uix.screenmanager.`**`NoTransition`**
Bases: `kivy.uix.screenmanager.TransitionBase`

No transition, instantly switches to the next screen with no delay or animation.

New in version 1.8.0.

CHAPTER

TWO

SCROLL VIEW

New in version 1.0.4.

The ScrollView widget provides a scrollable/pannable viewport that is clipped at the scrollview's bounding box.

162.1 Scrolling Behavior

The ScrollView accepts only one child and applies a viewport/window to it according to the ScrollView.scroll_x and ScrollView.scroll_y properties. Touches are analyzed to determine if the user wants to scroll or control the child in some other manner - you cannot do both at the same time. To determine if interaction is a scrolling gesture, these properties are used:

- **ScrollView.scroll_distance: the minimum distance to travel,** defaults to 20 pixels.
- **ScrollView.scroll_timeout: the maximum time period, defaults** to 250 milliseconds.

If a touch travels scroll_distance pixels within the scroll_timeout period, it is recognized as a scrolling gesture and translation (scroll/pan) will begin. If the timeout occurs, the touch down event is dispatched to the child instead (no translation).

The default value for those settings can be changed in the configuration file:

```
[widgets]
scroll_timeout = 250
scroll_distance = 20
```

New in version 1.1.1: ScrollView now animates scrolling in Y when a mousewheel is used.

162.2 Limiting to the X or Y Axis

By default, the ScrollView allows scrolling in both the X and Y axes. You can explicitly disable scrolling on an axis by setting ScrollView.do_scroll_x or ScrollView.do_scroll_y to False.

162.3 Managing the Content Size and Position

ScrollView manages the position of its children similarly to a RelativeLayout (see relativelayout) but not the size. You must carefully specify the *size_hint* of your content to get the desired scroll/pan effect.

By default, size_hint is (1, 1), so the content size will fit your ScrollView exactly (you will have nothing to scroll). You must deactivate at least one of the size_hint instructions (x or y) of the child to enable scrolling.

To scroll a `GridLayout` on Y-axis/vertically, set the child's width identical to that of the ScrollView (size_hint_x=1, default), and set the size_hint_y property to None:

```
layout = GridLayout(cols=1, spacing=10, size_hint_y=None)
# Make sure the height is such that there is something to scroll.
layout.bind(minimum_height=layout.setter('height'))
for i in range(30):
    btn = Button(text=str(i), size_hint_y=None, height=40)
    layout.add_widget(btn)
root = ScrollView(size_hint=(None, None), size=(400, 400))
root.add_widget(layout)
```

162.4 Overscroll Effects

New in version 1.7.0.

When scrolling would exceed the bounds of the `ScrollView`, it uses a `ScrollEffect` to handle the overscroll. These effects can perform actions like bouncing back, changing opacity, or simply preventing scrolling beyond the normal boundaries. Note that complex effects may perform many computations, which can be slow on weaker hardware.

You can change what effect is being used by setting `ScrollView.effect_cls` to any effect class. Current options include:

- `ScrollEffect`: Does not allow scrolling beyond the `ScrollView` boundaries.
- `DampedScrollEffect`: The current default. Allows the user to scroll beyond the normal boundaries, but has the content spring back once the touch/click is released.
- `OpacityScrollEffect`: Similar to the `DampedScrollEffect`, but also reduces opacity during overscroll.

You can also create your own scroll effect by subclassing one of these, then pass it as the `effect_cls` in the same way.

Alternatively, you can set `ScrollView.effect_x` and/or `ScrollView.effect_y` to an *instance* of the effect you want to use. This will override the default effect set in `ScrollView.effect_cls`.

All the effects are located in the `kivy.effects`.

class `kivy.uix.scrollview.`**`ScrollView`**`(`***kwargs*`)`
Bases: `kivy.uix.stencilview.StencilView`

ScrollView class. See module documentation for more information.

Changed in version 1.7.0: *auto_scroll, scroll_friction, scroll_moves, scroll_stoptime' has been deprecated, use :attr:'effect_cls* instead.

`bar_color`
Color of horizontal / vertical scroll bar, in RGBA format.

New in version 1.2.0.

`bar_color` is a `ListProperty` and defaults to [.7, .7, .7, .9].

`bar_inactive_color`
Color of horizontal / vertical scroll bar (in RGBA format), when no scroll is happening.

New in version 1.9.0.

`bar_inactive_color` is a `ListProperty` and defaults to [.7, .7, .7, .2].

`bar_margin`
Margin between the bottom / right side of the scrollview when drawing the horizontal / vertical scroll bar.

New in version 1.2.0.

`bar_margin` is a `NumericProperty`, default to 0

`bar_pos`
Which side of the scroll view to place each of the bars on.

`bar_pos` is a `ReferenceListProperty` of (`bar_pos_x`, `bar_pos_y`)

`bar_pos_x`
Which side of the ScrollView the horizontal scroll bar should go on. Possible values are 'top' and 'bottom'.

New in version 1.8.0.

`bar_pos_x` is an `OptionProperty`, default to 'bottom'

`bar_pos_y`
Which side of the ScrollView the vertical scroll bar should go on. Possible values are 'left' and 'right'.

New in version 1.8.0.

`bar_pos_y` is an `OptionProperty`, default to 'right'

`bar_width`
Width of the horizontal / vertical scroll bar. The width is interpreted as a height for the horizontal bar.

New in version 1.2.0.

`bar_width` is a `NumericProperty` and defaults to 2.

`convert_distance_to_scroll`(*dx*, *dy*)
Convert a distance in pixels to a scroll distance, depending on the content size and the scrollview size.

The result will be a tuple of scroll distance that can be added to `scroll_x` and `scroll_y`

`do_scroll`
Allow scroll on X or Y axis.

`do_scroll` is a `AliasProperty` of (`do_scroll_x` + `do_scroll_y`)

`do_scroll_x`
Allow scroll on X axis.

`do_scroll_x` is a `BooleanProperty` and defaults to True.

`do_scroll_y`
Allow scroll on Y axis.

`do_scroll_y` is a `BooleanProperty` and defaults to True.

`effect_cls`
Class effect to instanciate for X and Y axis.

New in version 1.7.0.

`effect_cls` is an `ObjectProperty` and defaults to `DampedScrollEffect`.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

effect_x

Effect to apply for the X axis. If None is set, an instance of effect_cls will be created.

New in version 1.7.0.

effect_x is an ObjectProperty and defaults to None.

effect_y

Effect to apply for the Y axis. If None is set, an instance of effect_cls will be created.

New in version 1.7.0.

effect_y is an ObjectProperty and defaults to None, read-only.

hbar

Return a tuple of (position, size) of the horizontal scrolling bar.

New in version 1.2.0.

The position and size are normalized between 0-1, and represent a percentage of the current scrollview height. This property is used internally for drawing the little horizontal bar when you're scrolling.

vbar is a AliasProperty, readonly.

scroll_distance

Distance to move before scrolling the ScrollView, in pixels. As soon as the distance has been traveled, the ScrollView will start to scroll, and no touch event will go to children. It is advisable that you base this value on the dpi of your target device's screen.

scroll_distance is a NumericProperty and defaults to 20 (pixels), according to the default value in user configuration.

scroll_timeout

Timeout allowed to trigger the scroll_distance, in milliseconds. If the user has not moved scroll_distance within the timeout, the scrolling will be disabled, and the touch event will go to the children.

scroll_timeout is a NumericProperty and defaults to 55 (milliseconds) according to the default value in user configuration.

Changed in version 1.5.0: Default value changed from 250 to 55.

scroll_type

Sets the type of scrolling to use for the content of the scrollview. Available options are: ['content'], ['bars'], ['bars', 'content'].

New in version 1.8.0.

scroll_type is a OptionProperty, defaults to ['content'].

scroll_wheel_distance

Distance to move when scrolling with a mouse wheel. It is advisable that you base this value on the dpi of your target device's screen.

New in version 1.8.0.

scroll_wheel_distance is a NumericProperty , defaults to 20 pixels.

scroll_x

X scrolling value, between 0 and 1. If 0, the content's left side will touch the left side of the ScrollView. If 1, the content's right side will touch the right side.

This property is controled by ScrollView only if do_scroll_x is True.

scroll_x is a NumericProperty and defaults to 0.

scroll_y

Y scrolling value, between 0 and 1. If 0, the content's bottom side will touch the bottom side of the ScrollView. If 1, the content's top side will touch the top side.

This property is controled by `ScrollView` only if `do_scroll_y` is True.

`scroll_y` is a `NumericProperty` and defaults to 1.

update_from_scroll(**largs*)

Force the reposition of the content, according to current value of `scroll_x` and `scroll_y`.

This method is automatically called when one of the `scroll_x`, `scroll_y`, `pos` or `size` properties change, or if the size of the content changes.

vbar

Return a tuple of (position, size) of the vertical scrolling bar.

New in version 1.2.0.

The position and size are normalized between 0-1, and represent a percentage of the current scrollview height. This property is used internally for drawing the little vertical bar when you're scrolling.

`vbar` is a `AliasProperty`, readonly.

viewport_size

(internal) Size of the internal viewport. This is the size of your only child in the scrollview.

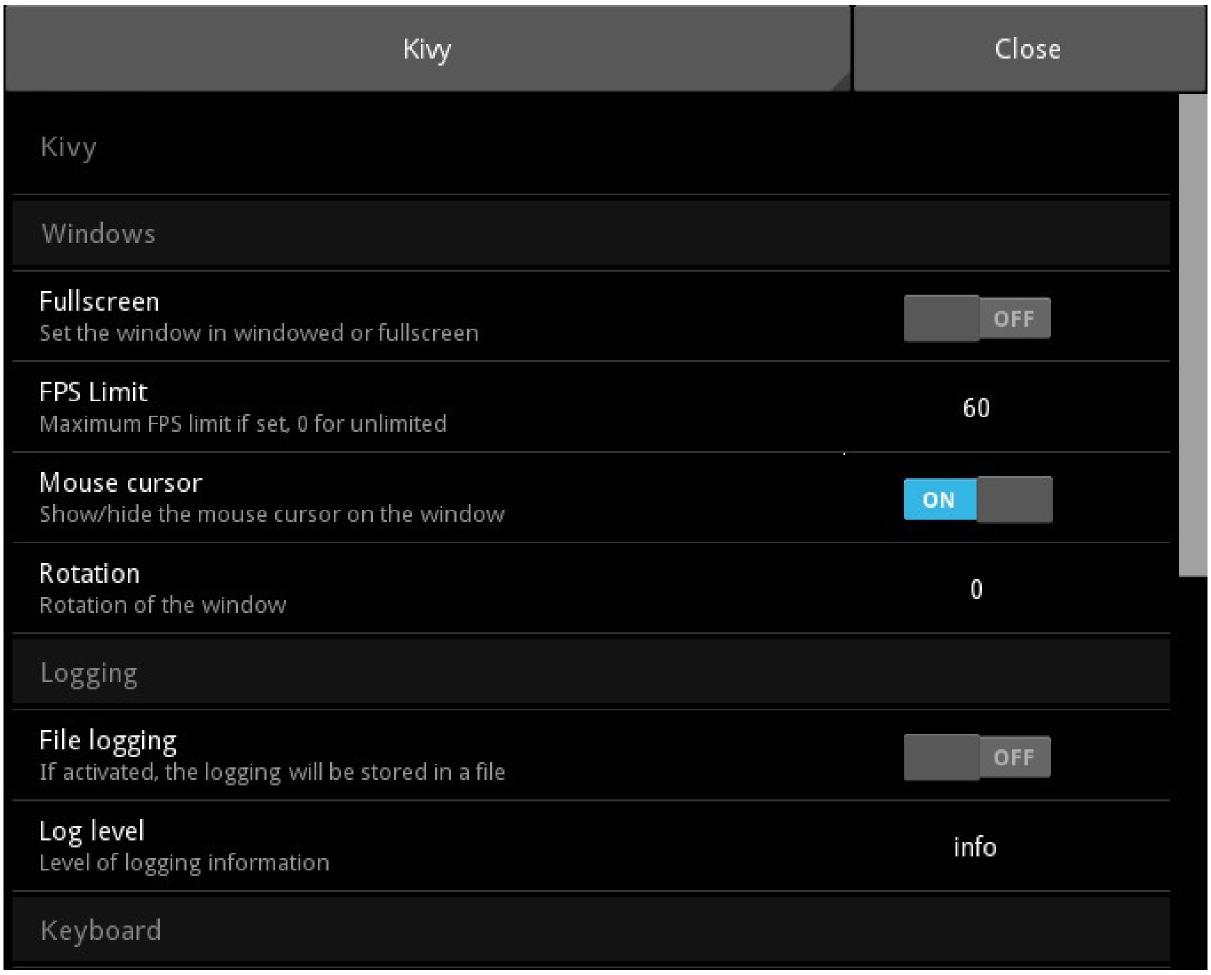
CHAPTER

THREE

SETTINGS

New in version 1.0.7.

This module is a complete and extensible framework for adding a Settings interface to your application. By default, the interface uses a SettingsWithSpinner, which consists of a Spinner (top) to switch between individual settings panels (bottom). See *Different panel layouts* for some alternatives.



Fullscreen
Set the window in windowed or fullscreen
OFF

FPS Limit
Maximum FPS limit if set, 0 for unlimited
60

Mouse cursor
Show/hide the mouse cursor on the window
ON

Rotation
Rotation of the window
0

File logging
If activated, the logging will be stored in a file
OFF

Log level
Level of logging information
info

A SettingsPanel represents a group of configurable options. The SettingsPanel.title property is used by Settings when a panel is added - it determines the name of the sidebar button. SettingsPanel controls a ConfigParser instance.

The panel can be automatically constructed from a JSON definition file: you describe the settings you want and corresponding sections/keys in the ConfigParser instance... and you're done!

Settings are also integrated with the App class. Use Settings.add_kivy_panel() to configure the

Kivy core settings in a panel.

163.1 Create a panel from JSON

To create a panel from a JSON-file, you need two things:

- a ConfigParser instance with default values
- a JSON file

> **Warning:** The kivy.config.ConfigParser is required. You cannot use the default ConfigParser from Python libraries.

You must create and handle the ConfigParser object. SettingsPanel will read the values from the associated ConfigParser instance. Make sure you have default values for all sections/keys in your JSON file!

The JSON file contains structured information to describe the available settings. Here is an example:

```
[
    {
        "type": "title",
        "title": "Windows"
    },
    {
        "type": "bool",
        "title": "Fullscreen",
        "desc": "Set the window in windowed or fullscreen",
        "section": "graphics",
        "key": "fullscreen",
        "true": "auto"
    }
]
```

Each element in the root list represents a setting that the user can configure. Only the “type” key is mandatory: an instance of the associated class will be created and used for the setting - other keys are assigned to corresponding properties of that class.

Type	Associated class
title	SettingTitle
bool	SettingBoolean
numeric	SettingNumeric
options	SettingOptions
string	SettingString
path	SettingPath (new from 1.1.0)

In the JSON example above, the first element is of type “title”. It will create a new instance of SettingTitle and apply the rest of the key/value pairs to the properties of that class, i.e. “title”: “Windows” sets the `SettingTitle.title` property to “Windows”.

To load the JSON example to a Settings instance, use the Settings.add_json_panel() method. It will automatically instantiate a SettingsPanel and add it to Settings:

```
from kivy.config import ConfigParser

config = ConfigParser()
config.read('myconfig.ini')
```

```
s = Settings()
s.add_json_panel('My custom panel', config, 'settings_custom.json')
s.add_json_panel('Another panel', config, 'settings_test2.json')

# then use the s as a widget...
```

163.2 Different panel layouts

A kivy App can automatically create and display a Settings instance. See the settings_cls documentation for details on how to choose which settings class to display.

Several pre-built settings widgets are available. All except SettingsWithNoMenu include close buttons triggering the on_close event.

- Settings: Displays settings with a sidebar at the left to switch between json panels.
- SettingsWithSidebar: A trivial subclass of Settings.
- SettingsWithSpinner: Displays settings with a spinner at the top, which can be used to switch between json panels. Uses InterfaceWithSpinner as the interface_cls. This is the default behavior from Kivy 1.8.0.
- SettingsWithTabbedPanel: Displays json panels as individual tabs in a TabbedPanel. Uses InterfaceWithTabbedPanel as the interface_cls.
- SettingsWithNoMenu: Displays a single json panel, with no way to switch to other panels and no close button. This makes it impossible for the user to exit unless close_settings() is overridden with a different close trigger! Uses InterfaceWithNoMenu as the interface_cls.

You can construct your own settings panels with any layout you choose by setting Settings.interface_cls. This should be a widget that displays a json settings panel with some way to switch between panels. An instance will be automatically created by Settings.

Interface widgets may be anything you like, but *must* have a method add_panel that recieves newly created json settings panels for the interface to display. See the documentation for InterfaceWithSidebar for more information. They may optionally dispatch an on_close event, for instance if a close button is clicked. This event is used by Settings to trigger its own on_close event.

class kivy.uix.settings.**Settings**(**args*, ***kargs*)
Bases: kivy.uix.boxlayout.BoxLayout

Settings UI. Check module documentation for more information on how to use this class.

Events

on_config_change: **ConfigParser instance, section, key, value**Fired when section/key/value of a ConfigParser changes.

*on_close*Fired by the default panel when the Close button is pressed.

add_interface()
(Internal) creates an instance of Settings.interface_cls, and sets it to interface. When json panels are created, they will be added to this interface which will display them to the user.

add_json_panel(*title*, *config*, *filename=None*, *data=None*)
Create and add a new SettingsPanel using the configuration *config* with the JSON definition *filename*.

Check the *Create a panel from JSON* section in the documentation for more information about JSON format and the usage of this function.

add_kivy_panel()

Add a panel for configuring Kivy. This panel acts directly on the kivy configuration. Feel free to include or exclude it in your configuration.

See use_kivy_settings() for information on enabling/disabling the automatic kivy panel.

create_json_panel(*title*, *config*, *filename=None*, *data=None*)

Create new SettingsPanel.

New in version 1.5.0.

Check the documentation of add_json_panel() for more information.

interface

(internal) Reference to the widget that will contain, organise and display the panel configuration panel widgets.

interface is an ObjectProperty and defaults to None.

interface_cls

The widget class that will be used to display the graphical interface for the settings panel. By default, it displays one Settings panel at a time with a sidebar to switch between them.

interface_cls is an ObjectProperty and defaults to :class'InterfaceWithSidebar'.

Changed in version 1.8.0: If you set a string, the Factory will be used to resolve the class.

register_type(*tp*, *cls*)

Register a new type that can be used in the JSON definition.

class kivy.uix.settings.**SettingsPanel**(***kwargs*)

Bases: kivy.uix.gridlayout.GridLayout

This class is used to contruct panel settings, for use with a Settings instance or subclass.

config

A kivy.config.ConfigParser instance. See module documentation for more information.

get_value(*section*, *key*)

Return the value of the section/key from the config ConfigParser instance. This function is used by SettingItem to get the value for a given section/key.

If you don't want to use a ConfigParser instance, you might want to override this function.

settings

A Settings instance that will be used to fire the *on_config_change* event.

title

Title of the panel. The title will be reused by the Settings in the sidebar.

class kivy.uix.settings.**SettingItem**(***kwargs*)

Bases: kivy.uix.floatlayout.FloatLayout

Base class for individual settings (within a panel). This class cannot be used directly; it is used for implementing the other setting classes. It builds a row with a title/description (left) and a setting control (right).

Look at SettingBoolean, SettingNumeric and SettingOptions for usage examples.

Events

on_releaseFired when the item is touched and then released.

content

(internal) Reference to the widget that contains the real setting. As soon as the content object is set, any further call to add_widget will call the content.add_widget. This is automatically set.

content is an ObjectProperty and defaults to None.

desc
Description of the setting, rendered on the line below the title.

desc is a StringProperty and defaults to None.

disabled
Indicate if this setting is disabled. If True, all touches on the setting item will be discarded.

disabled is a BooleanProperty and defaults to False.

key
Key of the token inside the section in the ConfigParser instance.

key is a StringProperty and defaults to None.

panel
(internal) Reference to the SettingsPanel for this setting. You don't need to use it.

panel is an ObjectProperty and defaults to None.

section
Section of the token inside the ConfigParser instance.

section is a StringProperty and defaults to None.

selected_alpha
(internal) Float value from 0 to 1, used to animate the background when the user touches the item.

selected_alpha is a NumericProperty and defaults to 0.

title
Title of the setting, defaults to '<No title set>'.

title is a StringProperty and defaults to '<No title set>'.

value
Value of the token according to the ConfigParser instance. Any change to this value will trigger a Settings.on_config_change() event.

value is an ObjectProperty and defaults to None.

class kivy.uix.settings.**SettingString**(***kwargs*)
Bases: kivy.uix.settings.SettingItem

Implementation of a string setting on top of a SettingItem. It is visualized with a Label widget that, when clicked, will open a Popup with a Textinput so the user can enter a custom value.

popup
(internal) Used to store the current popup when it's shown.

popup is an ObjectProperty and defaults to None.

textinput
(internal) Used to store the current textinput from the popup and to listen for changes.

textinput is an ObjectProperty and defaults to None.

class kivy.uix.settings.**SettingPath**(***kwargs*)
Bases: kivy.uix.settings.SettingItem

Implementation of a Path setting on top of a SettingItem. It is visualized with a Label widget that, when clicked, will open a Popup with a FileChooserListView so the user can enter a custom value.

New in version 1.1.0.

popup
(internal) Used to store the current popup when it is shown.

popup is an ObjectProperty and defaults to None.

textinput
(internal) Used to store the current textinput from the popup and to listen for changes.

textinput is an ObjectProperty and defaults to None.

class kivy.uix.settings.**SettingBoolean**(***kwargs*)
Bases: kivy.uix.settings.SettingItem

Implementation of a boolean setting on top of a SettingItem. It is visualized with a Switch widget. By default, 0 and 1 are used for values: you can change them by setting values.

values
Values used to represent the state of the setting. If you want to use "yes" and "no" in your ConfigParser instance:

```
SettingBoolean(..., values=['no', 'yes'])
```

Warning: You need a minimum of two values, the index 0 will be used as False, and index 1 as True

values is a ListProperty and defaults to ['0', '1']

class kivy.uix.settings.**SettingNumeric**(***kwargs*)
Bases: kivy.uix.settings.SettingString

Implementation of a numeric setting on top of a SettingString. It is visualized with a Label widget that, when clicked, will open a Popup with a Textinput so the user can enter a custom value.

class kivy.uix.settings.**SettingOptions**(***kwargs*)
Bases: kivy.uix.settings.SettingItem

Implementation of an option list on top of a SettingItem. It is visualized with a Label widget that, when clicked, will open a Popup with a list of options from which the user can select.

options
List of all availables options. This must be a list of "string" items. Otherwise, it will crash. :)

options is a ListProperty and defaults to [].

popup
(internal) Used to store the current popup when it is shown.

popup is an ObjectProperty and defaults to None.

class kivy.uix.settings.**SettingTitle**(***kwargs*)
Bases: kivy.uix.label.Label

A simple title label, used to organize the settings in sections.

class kivy.uix.settings.**SettingsWithSidebar**(**args, **kargs*)
Bases: kivy.uix.settings.Settings

A settings widget that displays settings panels with a sidebar to switch between them. This is the default behaviour of Settings, and this widget is a trivial wrapper subclass.

class kivy.uix.settings.**SettingsWithSpinner**(**args, **kwargs*)
Bases: kivy.uix.settings.Settings

A settings widget that displays one settings panel at a time with a spinner at the top to switch between them.

class `kivy.uix.settings.`**`SettingsWithTabbedPanel`**`(`**args, **kwargs*`)`

Bases: `kivy.uix.settings.Settings`

A settings widget that displays settings panels as pages in a `TabbedPanel`.

class `kivy.uix.settings.`**`SettingsWithNoMenu`**`(`**args, **kwargs*`)`

Bases: `kivy.uix.settings.Settings`

A settings widget that displays a single settings panel with *no* Close button. It will not accept more than one Settings panel. It is intended for use in programs with few enough settings that a full panel switcher is not useful.

> **Warning:** This Settings panel does *not* provide a Close button, and so it is impossible to leave the settings screen unless you also add other behaviour or override `display_settings()` and `close_settings()`.

class `kivy.uix.settings.`**`InterfaceWithSidebar`**`(`**args, **kwargs*`)`

Bases: `kivy.uix.boxlayout.BoxLayout`

The default Settings interface class. It displays a sidebar menu with names of available settings panels, which may be used to switch which one is currently displayed.

See `add_panel()` for information on the method you must implement if creating your own interface.

This class also dispatches an event 'on_close', which is triggered when the sidebar menu's close button is released. If creating your own interface widget, it should also dispatch such an event which will automatically be caught by `Settings` and used to trigger its own 'on_close' event.

`add_panel``(`*panel, name, uid*`)`

This method is used by Settings to add new panels for possible display. Any replacement for ContentPanel *must* implement this method.

Parameters

- **panel** – A `SettingsPanel`. It should be stored and the interface should provide a way to switch between panels.
- **name** – The name of the panel as a string. It may be used to represent the panel but isn't necessarily unique.
- **uid** – A unique int identifying the panel. It should be used to identify and switch between panels.

`content`

(internal) A reference to the panel display widget (a `ContentPanel`).

`content` is an `ObjectProperty` and defaults to None.

`menu`

(internal) A reference to the sidebar menu widget.

`menu` is an `ObjectProperty` and defaults to None.

class `kivy.uix.settings.`**`ContentPanel`**`(`***kwargs*`)`

Bases: `kivy.uix.scrollview.ScrollView`

A class for displaying settings panels. It displays a single settings panel at a time, taking up the full size and shape of the ContentPanel. It is used by `InterfaceWithSidebar` and `InterfaceWithSpinner` to display settings.

`add_panel``(`*panel, name, uid*`)`

This method is used by Settings to add new panels for possible display. Any replacement for ContentPanel *must* implement this method.

Parameters

- **panel** – A `SettingsPanel`. It should be stored and displayed when requested.
- **name** – The name of the panel as a string. It may be used to represent the panel.
- **uid** – A unique int identifying the panel. It should be stored and used to identify panels when switching.

`container`

(internal) A reference to the GridLayout that contains the settings panel.

`container` is an `ObjectProperty` and defaults to None.

`current_panel`

(internal) A reference to the current settings panel.

`current_panel` is an `ObjectProperty` and defaults to None.

`current_uid`

(internal) A reference to the uid of the current settings panel.

`current_uid` is a `NumericProperty` and defaults to 0.

`on_current_uid``(`**args*`)`

The uid of the currently displayed panel. Changing this will automatically change the displayed panel.

Parametersuid – A panel uid. It should be used to retrieve and display a settings panel that has previously been added with `add_panel()`.

`panels`

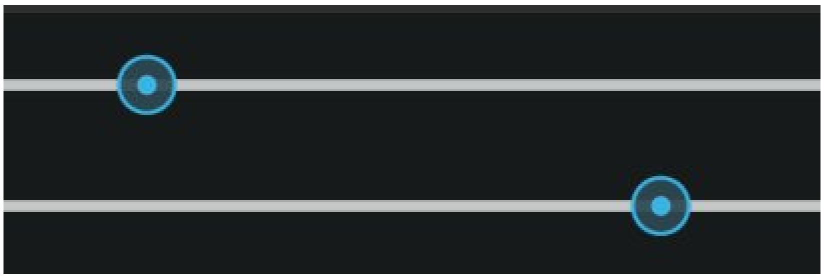
(internal) Stores a dictionary mapping settings panels to their uids.

`panels` is a `DictProperty` and defaults to {}.

CHAPTER

FOUR

SLIDER



The Slider widget looks like a scrollbar. It supports horizontal and vertical orientations, min/max values and a default value.

To create a slider from -100 to 100 starting from 25:

```
from kivy.uix.slider import Slider
s = Slider(min=-100, max=100, value=25)
```

To create a vertical slider:

```
from kivy.uix.slider import Slider
s = Slider(orientation='vertical')
```

class `kivy.uix.slider.`**`Slider`**`(`*`**kwargs`*`)`

Bases: `kivy.uix.widget.Widget`

Class for creating a Slider widget.

Check module documentation for more details.

`max`

Maximum value allowed for `value`.

`max` is a `NumericProperty` and defaults to 100.

`min`

Minimum value allowed for `value`.

`min` is a `NumericProperty` and defaults to 0.

`orientation`

Orientation of the slider.

`orientation` is an `OptionProperty` and defaults to 'horizontal'. Can take a value of 'vertical' or 'horizontal'.

`padding`

Padding of the slider. The padding is used for graphical representation and interaction. It prevents the cursor from going out of the bounds of the slider bounding box.

By default, padding is 10. The range of the slider is reduced from padding *2 on the screen. It allows drawing a cursor of 20px width without having the cursor go out of the widget.

`padding` is a `NumericProperty` and defaults to 10.

range

Range of the slider in the format (minimum value, maximum value):

```
>>> slider = Slider(min=10, max=80)
>>> slider.range
[10, 80]
>>> slider.range = (20, 100)
>>> slider.min
20
>>> slider.max
100
```

`range` is a `ReferenceListProperty` of (`min`, `max`) properties.

step

Step size of the slider.

New in version 1.4.0.

Determines the size of each interval or step the slider takes between min and max. If the value range can't be evenly divisible by step the last step will be capped by slider.max

`step` is a `NumericProperty` and defaults to 1.

value

Current value used for the slider.

`value` is a `NumericProperty` and defaults to 0.

value_normalized

Normalized value inside the `range` (min/max) to 0-1 range:

```
>>> slider = Slider(value=50, min=0, max=100)
>>> slider.value
50
>>> slider.value_normalized
0.5
>>> slider.value = 0
>>> slider.value_normalized
0
>>> slider.value = 100
>>> slider.value_normalized
1
```

You can also use it for setting the real value without knowing the minimum and maximum:

```
>>> slider = Slider(min=0, max=200)
>>> slider.value_normalized = .5
>>> slider.value
100
>>> slider.value_normalized = 1.
>>> slider.value
200
```

`value_normalized` is an `AliasProperty`.

value_pos

Position of the internal cursor, based on the normalized value.

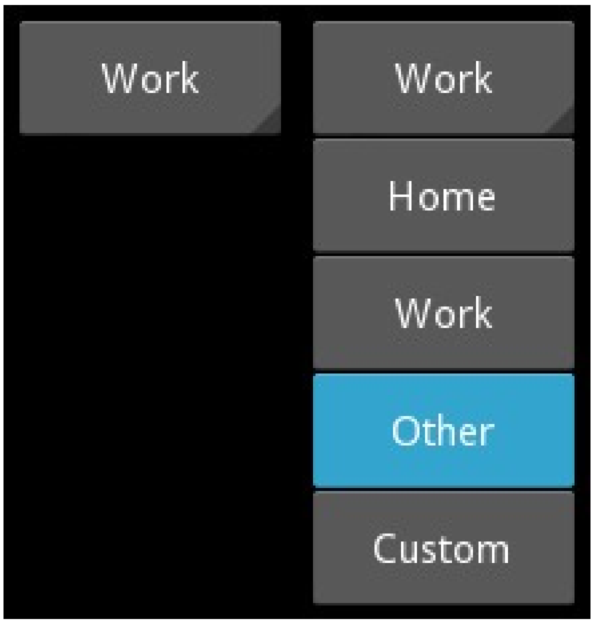
value_pos is an AliasProperty.

CHAPTER

FIVE

SPINNER

New in version 1.4.0.



Spinner is a widget that provides a quick way to select one value from a set. In the default state, a spinner shows its currently selected value. Touching the spinner displays a dropdown menu with all the other available values from which the user can select a new one.

Example:

```
from kivy.base import runTouchApp
from kivy.uix.spinner import Spinner

spinner = Spinner(
    # default value shown
    text='Home',
    # available values
    values=('Home', 'Work', 'Other', 'Custom'),
    # just for positioning in our example
    size_hint=(None, None),
    size=(100, 44),
    pos_hint={'center_x': .5, 'center_y': .5})

def show_selected_value(spinner, text):
    print('The spinner', spinner, 'have text', text)

spinner.bind(text=show_selected_value)
```

```
runTouchApp(spinner)
```

class `kivy.uix.spinner.`**`Spinner`**`(`***kwargs*`)`
Bases: `kivy.uix.button.Button`

Spinner class, see module documentation for more information.

`dropdown_cls`
Class used to display the dropdown list when the Spinner is pressed.

`dropdown_cls` is an `ObjectProperty` and defaults to `DropDown`.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

`is_open`
By default, the spinner is not open. Set to True to open it.

`is_open` is a `BooleanProperty` and defaults to False.

New in version 1.4.0.

`option_cls`
Class used to display the options within the dropdown list displayed under the Spinner. The *text* property of the class will be used to represent the value.

The option class requires at least:

- a *text* property, used to display the value.
- an *on_release* event, used to trigger the option when pressed/touched.

`option_cls` is an `ObjectProperty` and defaults to `SpinnerOption`.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

`values`
Values that can be selected by the user. It must be a list of strings.

`values` is a `ListProperty` and defaults to [].

class `kivy.uix.spinner.`**`SpinnerOption`**`(`***kwargs*`)`
Bases: `kivy.uix.button.Button`

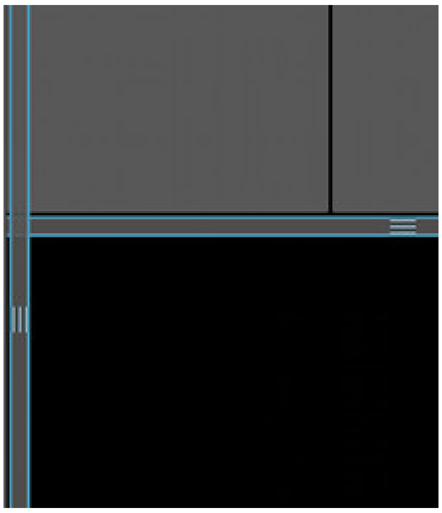
Special button used in the dropdown list. We just set the default size_hint_y and height.

CHAPTER

SIX

SPLITTER

New in version 1.5.0.



The Splitter is a widget that helps you re-size it's child widget/layout by letting you re-size it via dragging the boundary or double tapping the boundary. This widget is similar to the ScrollView in that it allows only one child widget.

Usage:

```
splitter = Splitter(sizable_from = 'right')
splitter.add_widget(layout_or_widget_instance)
splitter.min_size = 100
splitter.max_size = 250
```

To change the size of the strip/border used for resizing:

```
splitter.strip_size = '10pt'
```

To change its appearance:

```
splitter.strip_cls = your_custom_class
```

You can also change the appearance of the *strip_cls*, which defaults to SplitterStrip, by overriding the *kv* rule in your app:

```
<SplitterStrip>:
    horizontal: True if self.parent and self.parent.sizable_from[0] in ('t', 'b') else False
    background_normal: 'path to normal horizontal image' if self.horizontal else 'path to vertica
    background_down: 'path to pressed horizontal image' if self.horizontal else 'path to vertical
```

class `kivy.uix.splitter.`**`Splitter`**`(`***kwargs*`)`

Bases: `kivy.uix.boxlayout.BoxLayout`

See module documentation.

Events

on_press:Fired when the splitter is pressed.

on_release:Fired when the splitter is released.

Changed in version 1.6.0: Added *on_press* and *on_release* events.

`border`

Border used for the `BorderImage` graphics instruction.

This must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information about how to use it.

`border` is a `ListProperty` and defaults to (4, 4, 4, 4).

`keep_within_parent`

If True, will limit the splitter to stay within its parent widget.

`keep_within_parent` is a `BooleanProperty` and defaults to False.

New in version 1.9.0.

`max_size`

Specifies the maximum size beyond which the widget is not resizable.

`max_size` is a `NumericProperty` and defaults to *500pt*.

`min_size`

Specifies the minimum size beyond which the widget is not resizable.

`min_size` is a `NumericProperty` and defaults to *100pt*.

`rescale_with_parent`

If True, will automatically change size to take up the same proportion of the parent widget when it is resized, while staying within `min_size` and `max_size`. As long as these attributes can be satisfied, this stops the `Splitter` from exceeding the parent size during rescaling.

`rescale_with_parent` is a `BooleanProperty` and defaults to False.

New in version 1.9.0.

`sizable_from`

Specifies whether the widget is resizable. Options are::*left*, *right*, *top* or *bottom*
`sizable_from` is an `OptionProperty` and defaults to *left*.

`strip_cls`

Specifies the class of the resize Strip.

`strip_cls` is an `kivy.properties.ObjectProperty` and defaults to `SplitterStrip`, which is of type `Button`.

Changed in version 1.8.0: If you set a string, the `Factory` will be used to resolve the class.

`strip_size`

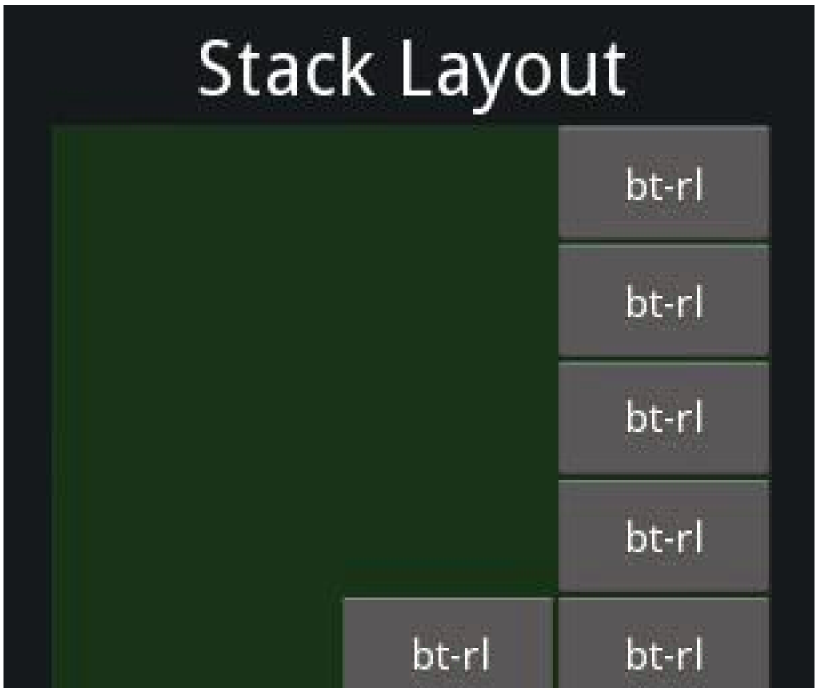
Specifies the size of resize strip

`strp_size` is a `NumericProperty` defaults to *10pt*

CHAPTER

SEVEN

STACK LAYOUT

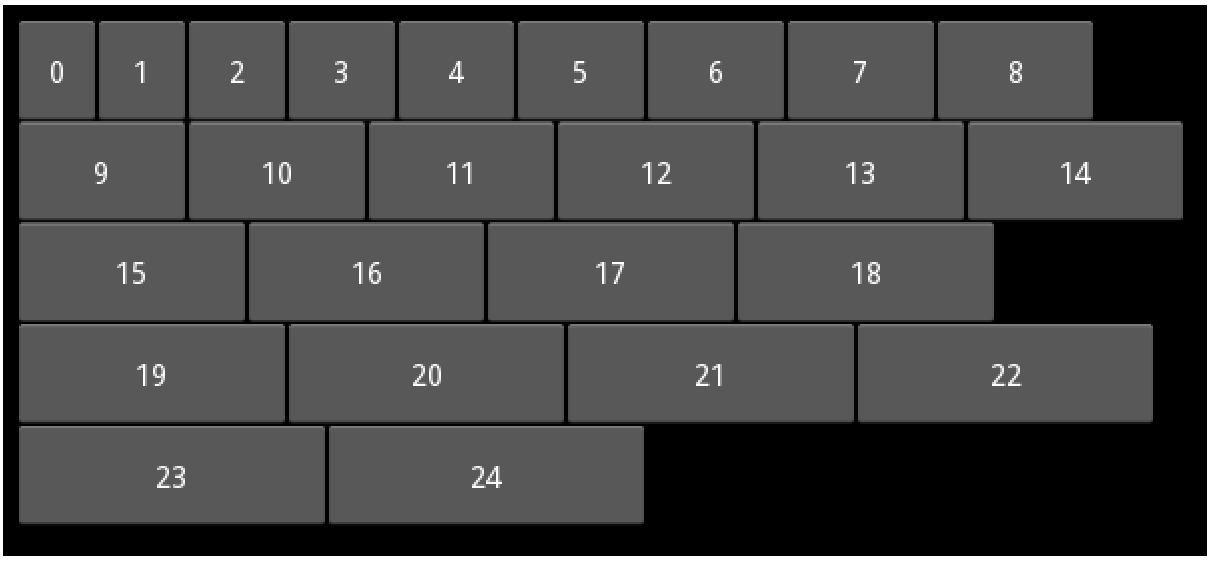


New in version 1.0.5.

The `StackLayout` arranges children vertically or horizontally, as many as the layout can fit. The size of the individual children widgets do not have to be uniform.

For example, to display widgets that get progressively larger in width:

```
root = StackLayout()
for i in range(25):
    btn = Button(text=str(i), width=40 + i * 5, size_hint=(None, 0.15))
    root.add_widget(btn)
```



class `kivy.uix.stacklayout.`**`StackLayout`**(***kwargs*)

Bases: `kivy.uix.layout.Layout`

Stack layout class. See module documentation for more information.

`minimum_height`

Minimum height needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_height` is a `kivy.properties.NumericProperty` and defaults to 0.

`minimum_size`

Minimum size needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_size` is a `ReferenceListProperty` of (`minimum_width`, `minimum_height`) properties.

`minimum_width`

Minimum width needed to contain all children. It is automatically set by the layout.

New in version 1.0.8.

`minimum_width` is a `kivy.properties.NumericProperty` and defaults to 0.

`orientation`

Orientation of the layout.

`orientation` is an `OptionProperty` and defaults to 'lr-tb'.

Valid orientations are 'lr-tb', 'tb-lr', 'rl-tb', 'tb-rl', 'lr-bt', 'bt-lr', 'rl-bt' and 'bt-rl'.

Changed in version 1.5.0: `orientation` now correctly handles all valid combinations of 'lr','rl','tb','bt'. Before this version only 'lr-tb' and 'tb-lr' were supported, and 'tb-lr' was misnamed and placed widgets from bottom to top and from right to left (reversed compared to what was expected).

Note: 'lr' means Left to Right. 'rl' means Right to Left. 'tb' means Top to Bottom. 'bt' means Bottom to Top.

padding

Padding between the layout box and it's children: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a single argument form [padding].

Changed in version 1.7.0: Replaced the NumericProperty with a VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [0, 0, 0, 0].

spacing

Spacing between children: [spacing_horizontal, spacing_vertical].

spacing also accepts a single argument form [spacing].

`spacing` is a `VariableListProperty` and defaults to [0, 0].

CHAPTER

EIGHT

STENCIL VIEW

New in version 1.0.4.

StencilView limits the drawing of child widgets to the StencilView's bounding box. Any drawing outside the bounding box will be clipped (trashed).

The StencilView uses the stencil graphics instructions under the hood. It provides an efficient way to clip the drawing area of children.

Note: As with the stencil graphics instructions, you cannot stack more than 8 stencil-aware widgets.

Note: StencilView is not a layout. Consequently, you have to manage the size and position of its children directly. You can combine (subclass both) a StencilView and a Layout in order to achieve a layout's behavior. For example:

```
class BoxStencil(BoxLayout, StencilView):
    pass
```

class `kivy.uix.stencilview.`**`StencilView`**(***kwargs*)

Bases: `kivy.uix.widget.Widget`

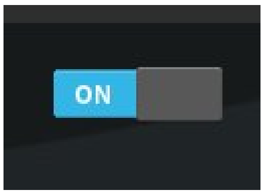
StencilView class. See module documentation for more information.

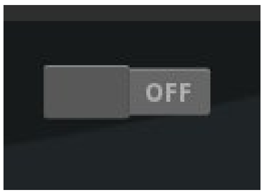
CHAPTER

NINE

SWITCH

New in version 1.0.7.





The Switch widget is active or inactive, like a mechanical light switch. The user can swipe to the left/right to activate/deactivate it:

```
switch = Switch(active=True)
```

To attach a callback that listens to the activation state:

```
def callback(instance, value):
    print('the switch', instance, 'is', value)

switch = Switch()
switch.bind(active=callback)
```

By default, the representation of the widget is static. The minimum size required is 83x32 pixels (defined by the background image). The image is centered within the widget.

The entire widget is active, not just the part with graphics. As long as you swipe over the widget's bounding box, it will work.

Note: If you want to control the state with a single touch instead of a swipe, use the `ToggleButton` instead.

class `kivy.uix.switch.`**`Switch`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

Switch class. See module documentation for more information.

`active`

Indicate whether the switch is active or inactive.

`active` is a `BooleanProperty` and defaults to False.

active_norm_pos

(internal) Contains the normalized position of the movable element inside the switch, in the 0-1 range.

active_norm_pos is a NumericProperty and defaults to 0.

touch_control

(internal) Contains the touch that currently interacts with the switch.

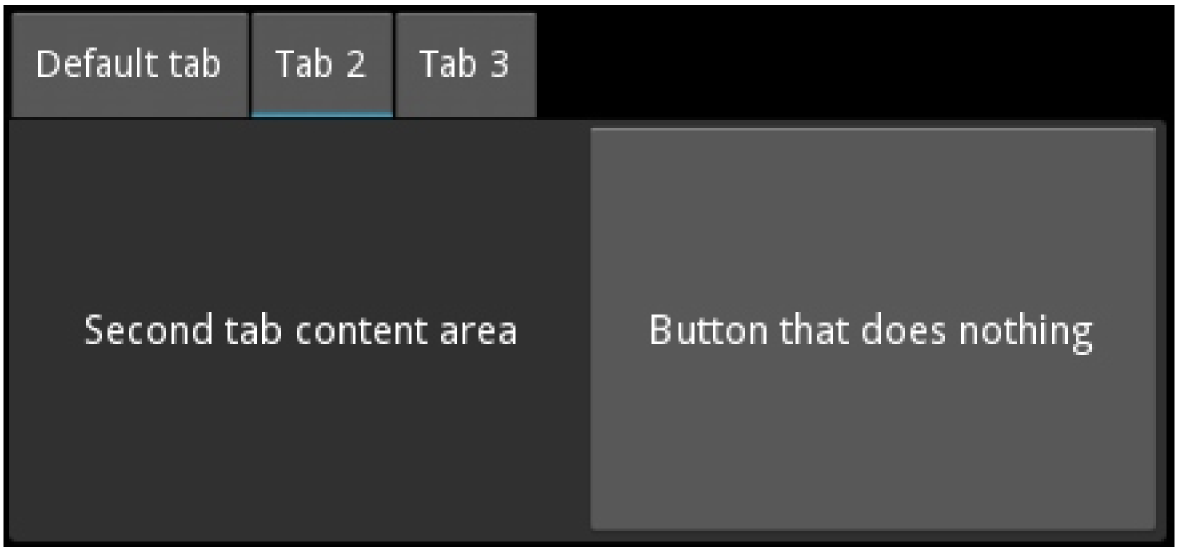
touch_control is an ObjectProperty and defaults to None.

touch_distance

(internal) Contains the distance between the initial position of the touch and the current position to determine if the swipe is from the left or right.

touch_distance is a NumericProperty and defaults to 0.

TABBEDPANEL



New in version 1.3.0.

The *TabbedPanel* widget manages different widgets in tabs, with a header area for the actual tab buttons and a content area for showing the current tab content.

The `TabbedPanel` provides one default tab.

170.1 Simple example

```
'''
TabbedPanel
============

Test of the widget TabbedPanel.
'''

from kivy.app import App
from kivy.uix.tabbedpanel import TabbedPanel
from kivy.uix.floatlayout import FloatLayout
from kivy.lang import Builder

Builder.load_string("""

<Test>:
    size_hint: .5, .5
    pos_hint: {'center_x': .5, 'center_y': .5}
    do_default_tab: False
    TabbedPanelItem:
        text: 'first tab'
        Label:
            text: 'First tab content area'
    TabbedPanelItem:
        text: 'tab2'
        BoxLayout:
            Label:
                text: 'Second tab content area'
            Button:
                text: 'Button that does nothing'
    TabbedPanelItem:
        text: 'tab3'
        RstDocument:
            text: '\\n'.join(("Hello world", "-----------", "You are in the third tab."))

""")

class Test(TabbedPanel):
    pass

class TabbedPanelApp(App):
    def build(self):
        return Test()

if __name__ == '__main__':
    TabbedPanelApp().run()
```

Note: A new class `TabbedPanelItem` has been introduced in 1.5.0 for convenience. So now one can simply add a `TabbedPanelItem` to a `TabbedPanel` and *content* to the `TabbedPanelItem` as in the example provided above.

170.2 Customize the Tabbed Panel

You can choose the position in which the tabs are displayed:

```
tab_pos = 'top_mid'
```

An individual tab is called a TabbedPanelHeader. It is a special button containing a *content* property. You add the TabbedPanelHeader first, and set its *content* property separately:

```
tp = TabbedPanel()
th = TabbedPanelHeader(text='Tab2')
tp.add_widget(th)
```

An individual tab, represented by a TabbedPanelHeader, needs its content set. This content can be any widget. It could be a layout with a deep hierarchy of widgets, or it could be an individual widget, such as a label or a button:

```
th.content = your_content_instance
```

There is one “shared” main content area active at any given time, for all the tabs. Your app is responsible for adding the content of individual tabs and for managing them, but it's not responsible for content switching. The tabbed panel handles switching of the main content object as per user action.

Note: The default_tab functionality is turned off by default since 1.5.0. To turn it back on, set *do_default_tab* = True.

There is a default tab added when the tabbed panel is instantiated. Tabs that you add individually as above, are added in addition to the default tab. Thus, depending on your needs and design, you will want to customize the default tab:

```
tp.default_tab_text = 'Something Specific To Your Use'
```

The default tab machinery requires special consideration and management. Accordingly, an *on_default_tab* event is provided for associating a callback:

```
tp.bind(default_tab = my_default_tab_callback)
```

It's important to note that by default, `default_tab_cls` is of type `TabbedPanelHeader` and thus has the same properties as other tabs.

Since 1.5.0, it is now possible to disable the creation of the `default_tab` by setting `do_default_tab` to False.

Tabs and content can be removed in several ways:

```
tp.remove_widget(widget/tabbed_panel_header)
or
tp.clear_widgets() # to clear all the widgets in the content area
or
tp.clear_tabs() # to remove the TabbedPanelHeaders
```

To access the children of the tabbed panel, use content.children:

```
tp.content.children
```

To access the list of tabs:

```
tp.tab_list
```

To change the appearance of the main tabbed panel content:

```
background_color = (1, 0, 0, .5) #50% translucent red
border = [0, 0, 0, 0]
background_image = 'path/to/background/image'
```

To change the background of a individual tab, use these two properties:

```
tab_header_instance.background_normal = 'path/to/tab_head/img'
tab_header_instance.background_down = 'path/to/tab_head/img_pressed'
```

A TabbedPanelStrip contains the individual tab headers. To change the appearance of this tab strip, override the canvas of TabbedPanelStrip. For example, in the kv language:

```
<TabbedPanelStrip>
    canvas:
        Color:
            rgba: (0, 1, 0, 1) # green
        Rectangle:
            size: self.size
            pos: self.pos
```

By default the tabbed panel strip takes its background image and color from the tabbed panel's background_image and background_color.

class `kivy.uix.tabbedpanel.`**`StripLayout`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.gridlayout.GridLayout`

The main layout that is used to house the entire tabbedpanel strip including the blank areas in case the tabs don't cover the entire width/height.

New in version 1.8.0.

`background_image`
Background image to be used for the Strip layout of the TabbedPanel.
`background_image` is a `StringProperty` anddefaults to a transparent image.

`border`
Border property for the `background_image`.

`border` is a `ListProperty` and defaults to [4, 4, 4, 4]

class `kivy.uix.tabbedpanel.`**`TabbedPanel`**`(`*`**kwargs`*`)`
Bases: `kivy.uix.gridlayout.GridLayout`

The TabbedPanel class. See module documentation for more information.

`background_color`
Background color, in the format (r, g, b, a).

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_disabled_image`
Background image of the main shared content object when disabled.

New in version 1.8.0.

`background_disabled_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/tab'.

`background_image`
Background image of the main shared content object.

`background_image` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/tab'.

`border`
Border used for `BorderImage` graphics instruction, used itself for `background_image`. Can be changed for a custom background.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instructions for more information.

`border` is a `ListProperty` and defaults to (16, 16, 16, 16)

`content`
This is the object holding (current_tab's content is added to this) the content of the current tab. To Listen to the changes in the content of the current tab, you should bind to current_tabs *content* property.

`content` is an `ObjectProperty` and defaults to 'None'.

`current_tab`
Links to the currently selected or active tab.

New in version 1.4.0.

`current_tab` is an `AliasProperty`, read-only.

default_tab

Holds the default tab.

Note: For convenience, the automatically provided default tab is deleted when you change default_tab to something else. As of 1.5.0, this behaviour has been extended to every *default_tab* for consistency and not just the automatically provided one.

`default_tab` is an `AliasProperty`.

default_tab_cls

Specifies the class to use for the styling of the default tab.

New in version 1.4.0.

Warning: *default_tab_cls* should be subclassed from *TabbedPanelHeader*

`default_tab_cls` is an `ObjectProperty` and defaults to *TabbedPanelHeader*. If you set a string, the `Factory` will be used to resolve the class.

Changed in version 1.8.0: The `Factory` will resolve the class if a string is set.

default_tab_content

Holds the default tab content.

`default_tab_content` is an `AliasProperty`.

default_tab_text

Specifies the text displayed on the default tab header.

`default_tab_text` is a `StringProperty` and defaults to 'default tab'.

do_default_tab

Specifies whether a default_tab head is provided.

New in version 1.5.0.

`do_default_tab` is a `BooleanProperty` and defaults to 'True'.

strip_border

Border to be used on `strip_image`.

New in version 1.8.0.

`strip_border` is a `ListProperty` and defaults to [4, 4, 4, 4].

strip_image

Background image of the tabbed strip.

New in version 1.8.0.

`strip_image` is a `StringProperty` and defaults to a empty image.

switch_to(*header*)

Switch to a specific panel header.

tab_height

Specifies the height of the tab header.

`tab_height` is a `NumericProperty` and defaults to 40.

tab_list

List of all the tab headers.

`tab_list` is an `AliasProperty` and is read-only.

tab_pos

Specifies the position of the tabs relative to the content. Can be one of: *left_top*, *left_mid*, *left_bottom*, *top_left*, *top_mid*, *top_right*, *right_top*, *right_mid*, *right_bottom*, *bottom_left*, *bottom_mid*, *bottom_right*.

`tab_pos` is an `OptionProperty` and defaults to 'bottom_mid'.

tab_width

Specifies the width of the tab header.

`tab_width` is a `NumericProperty` and defaults to 100.

class `kivy.uix.tabbedpanel.`**`TabbedPanelContent`**(***kwargs*)

Bases: `kivy.uix.floatlayout.FloatLayout`

The TabbedPanelContent class.

class `kivy.uix.tabbedpanel.`**`TabbedPanelHeader`**(***kwargs*)

Bases: `kivy.uix.togglebutton.ToggleButton`

A Base for implementing a Tabbed Panel Head. A button intended to be used as a Heading/Tab for a TabbedPanel widget.

You can use this TabbedPanelHeader widget to add a new tab to a TabbedPanel.

content

Content to be loaded when this tab header is selected.

`content` is an `ObjectProperty` and defaults to None.

class `kivy.uix.tabbedpanel.`**`TabbedPanelItem`**(***kwargs*)

Bases: `kivy.uix.tabbedpanel.TabbedPanelHeader`

This is a convenience class that provides a header of type TabbedPanelHeader and links it with the content automatically. Thus facilitating you to simply do the following in kv language:

```
<TabbedPanel>:
    ...other settings
    TabbedPanelItem:
        BoxLayout:
            Label:
                text: 'Second tab content area'
            Button:
                text: 'Button that does nothing'
```

New in version 1.5.0.

class `kivy.uix.tabbedpanel.`**`TabbedPanelStrip`**(***kwargs*)

Bases: `kivy.uix.gridlayout.GridLayout`

A strip intended to be used as background for Heading/Tab. This does not cover the blank areas in case the tabs don't cover the entire width/height of the TabbedPanel(use StripLayout for that).

tabbed_panel

Link to the panel that the tab strip is a part of.

`tabbed_panel` is an `ObjectProperty` and defaults to None .

class `kivy.uix.tabbedpanel.`**`TabbedPanelException`**

Bases: `exceptions.Exception`

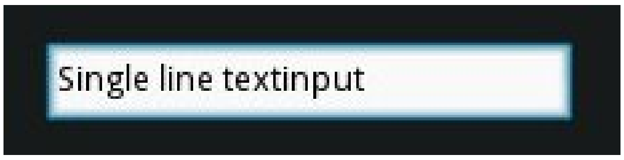
The TabbedPanelException class.

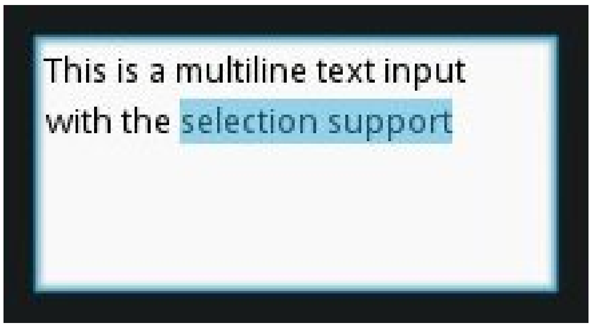
CHAPTER

ONE

TEXT INPUT

New in version 1.0.4.





The `TextInput` widget provides a box of editable plain text.

Unicode, multiline, cursor navigation, selection and clipboard features are supported.

Note: Two different coordinate systems are used with TextInput:

- (x, y) - coordinates in pixels, mostly used for rendering on screen.
- (row, col) - cursor index in characters / lines, used for selection and cursor movement.

171.1 Usage example

To create a multiline textinput ('enter' key adds a new line):

```
from kivy.uix.textinput import TextInput
textinput = TextInput(text='Hello world')
```

To create a singleline textinput, set the multiline property to False ('enter' key will defocus the textinput and emit on_text_validate event):

```
def on_enter(instance, value):
    print('User pressed enter in', instance)

textinput = TextInput(text='Hello world', multiline=False)
textinput.bind(on_text_validate=on_enter)
```

The textinput's text is stored on its TextInput.text property. To run a callback when the text changes:

```
def on_text(instance, value):
    print('The widget', instance, 'have:', value)

textinput = TextInput()
textinput.bind(text=on_text)
```

You can 'focus' a textinput, meaning that the input box will be highlighted and keyboard focus will be requested:

```
textinput = TextInput(focus=True)
```

The textinput is defocused if the 'escape' key is pressed, or if another widget requests the keyboard. You can bind a callback to the focus property to get notified of focus changes:

```
def on_focus(instance, value):
    if value:
        print('User focused', instance)
    else:
        print('User defocused', instance)

textinput = TextInput()
textinput.bind(focus=on_focus)
```

171.2 Selection

The selection is automatically updated when the cursor position changes. You can get the currently selected text from the TextInput.selection_text property.

171.3 Filtering

You can control which text can be added to the TextInput by overwriting TextInput.insert_text().Every string that is typed, pasted or inserted by any other means to the TextInput is passed through this function. By overwriting it you can reject or change unwanted characters.

For example, to write only in capitalized characters:

```
class CapitalInput(TextInput):

    def insert_text(self, substring, from_undo=False):
        s = substring.upper()
        return super(CapitalInput, self).insert_text(s, from_undo=from_undo)
```

Or to only allow floats (0 - 9 and a single period):

```
class FloatInput(TextInput):

    pat = re.compile('[^0-9]')
    def insert_text(self, substring, from_undo=False):
        pat = self.pat
        if '.' in self.text:
            s = re.sub(pat, '', substring)
        else:
            s = '.'.join([re.sub(pat, '', s) for s in substring.split('.', 1)])
        return super(FloatInput, self).insert_text(s, from_undo=from_undo)
```

171.4 Default shortcuts

Shortcuts	Description
Left	Move cursor to left
Right	Move cursor to right
Up	Move cursor to up
Down	Move cursor to down
Home	Move cursor at the beginning of the line
End	Move cursor at the end of the line
PageUp	Move cursor to 3 lines before
PageDown	Move cursor to 3 lines after
Backspace	Delete the selection or character before the cursor
Del	Delete the selection of character after the cursor
Shift + <dir>	Start a text selection. Dir can be Up, Down, Left, Right
Control + c	Copy selection
Control + x	Cut selection
Control + p	Paste selection
Control + a	Select all the content
Control + z	undo
Control + r	redo

class `kivy.uix.textinput.`**`TextInput`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.Widget`

TextInput class. See module documentation for more information.

Events

on_text_validateFired only in multiline=False mode when the user hits 'enter'. This will also unfocus the textinput.

on_double_tapFired when a double tap happens in the text input. The default behavior selects the text around the cursor position. More info at `on_double_tap()`.

on_triple_tapFired when a triple tap happens in the text input. The default behavior selects the line around the cursor position. More info at `on_triple_tap()`.

on_quad_touchFired when four fingers are touching the text input. The default behavior selects the whole text. More info at `on_quad_touch()`.

Warning: When changing a `TextInput` property that requires re-drawing, e.g. modifying the `text`, the updates occur on the next clock cycle and not instantly. This might cause any changes to the `TextInput` that occur between the modification and the next cycle to be ignored, or to use previous values. For example, after a update to the `text`, changing the cursor in the same clock frame will move it using the previous text and will likely end up in an incorrect position. The solution is to schedule any updates to occur on the next clock cycle using `schedule_once()`.

Changed in version 1.7.0: *on_double_tap*, *on_triple_tap* and *on_quad_touch* events added.

`allow_copy`

Decides whether to allow copying the text.

New in version 1.8.0.

`allow_copy` is a `BooleanProperty` and defaults to True.

`auto_indent`

Automatically indent multiline text.

New in version 1.7.0.

`auto_indent` is a `BooleanProperty` and defaults to False.

`background_active`

Background image of the TextInput when it's in focus.

New in version 1.4.1.

`background_active` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/textinput_active'.

`background_color`

Current color of the background, in (r, g, b, a) format.

New in version 1.2.0.

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1] (white).

`background_disabled_active`

Background image of the TextInput when it's in focus and disabled.

New in version 1.8.0.

`background_disabled_active` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/textinput_disabled_active'.

`background_disabled_normal`

Background image of the TextInput when disabled.

New in version 1.8.0.

`background_disabled_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/textinput_disabled'.

`background_normal`

Background image of the TextInput when it's not in focus.

New in version 1.4.1.

`background_normal` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/textinput'.

`border`

Border used for `BorderImage` graphics instruction. Used with `background_normal` and `background_active`. Can be used for a custom background.

New in version 1.4.1.

It must be a list of four values: (top, right, bottom, left). Read the BorderImage instruction for more information about how to use it.

`border` is a `ListProperty` and defaults to (4, 4, 4, 4).

`cancel_selection`()

Cancel current selection (if any).

`copy`(*data=''*)

Copy the value provided in argument *data* into current clipboard. If data is not of type string it will be converted to string. If no data is provided then current selection if present is copied.

New in version 1.8.0.

cursor

Tuple of (row, col) values indicating the current cursor position. You can set a new (row, col) if you want to move the cursor. The scrolling area will be automatically updated to ensure that the cursor is visible inside the viewport.

`cursor` is an `AliasProperty`.

cursor_blink

This property is used to blink the cursor graphic. The value of `cursor_blink` is automatically computed. Setting a value on it will have no impact.

`cursor_blink` is a `BooleanProperty` and defaults to False.

cursor_col

Current column of the cursor.

`cursor_col` is an `AliasProperty` to cursor[0], read-only.

cursor_color

Current color of the cursor, in (r, g, b, a) format.

New in version 1.9.0.

`cursor_color` is a `ListProperty` and defaults to [1, 0, 0, 1].

cursor_index(*cursor=None*)

Return the cursor index in the text/value.

cursor_offset()

Get the cursor x offset on the current line.

cursor_pos

Current position of the cursor, in (x, y).

`cursor_pos` is an `AliasProperty`, read-only.

cursor_row

Current row of the cursor.

`cursor_row` is an `AliasProperty` to cursor[1], read-only.

cut()

Copy current selection to clipboard then delete it from TextInput.

New in version 1.8.0.

delete_selection(*from_undo=False*)

Delete the current text selection (if any).

disabled_foreground_color

Current color of the foreground when disabled, in (r, g, b, a) format.

New in version 1.8.0.

`disabled_foreground_color` is a `ListProperty` and defaults to [0, 0, 0, 5] (50% transparent black).

do_backspace(*from_undo=False, mode='bkspc'*)

Do backspace operation from the current cursor position. This action might do several things:

- removing the current selection if available.
- removing the previous char and move the cursor back.
- do nothing, if we are at the start.

do_cursor_movement(*action*)

Move the cursor relative to it's current position. Action can be one of :

- cursor_left: move the cursor to the left
- cursor_right: move the cursor to the right
- cursor_up: move the cursor on the previous line
- cursor_down: move the cursor on the next line
- cursor_home: move the cursor at the start of the current line
- cursor_end: move the cursor at the end of current line
- cursor_pgup: move one "page" before
- cursor_pgdown: move one "page" after

do_redo()

Do redo operation.

New in version 1.3.0.

This action re-does any command that has been un-done by do_undo/ctrl+z. This function is automatically called when *ctrl+r* keys are pressed.

do_undo()

Do undo operation.

New in version 1.3.0.

This action un-does any edits that have been made since the last call to reset_undo(). This function is automatically called when *ctrl+z* keys are pressed.

focus

If focus is True, the keyboard will be requested and you can start entering text into the textinput.

`focus` is a `BooleanProperty` and defaults to False.

Note: Selection is cancelled when TextInput is focused. If you need to show selection when TextInput is focused, you should delay (use Clock.schedule) the call to the functions for selecting text (select_all, select_text).

font_name

Filename of the font to use. The path can be absolute or relative. Relative paths are resolved by the `resource_find()` function.

Warning: Depending on your text provider, the font file may be ignored. However, you can mostly use this without problems.
If the font used lacks the glyphs for the particular language/symbols you are using, you will see '[]' blank box characters instead of the actual glyphs. The solution is to use a font that has the glyphs you need to display. For example, to display क, use a font like freesans.ttf that has the glyph.

`font_name` is a `StringProperty` and defaults to 'DroidSans'.

font_size

Font size of the text in pixels.

`font_size` is a `NumericProperty` and defaults to 10.

foreground_color

Current color of the foreground, in (r, g, b, a) format.

New in version 1.2.0.

`foreground_color` is a `ListProperty` and defaults to [0, 0, 0, 1] (black).

get_cursor_from_index(*index*)
Return the (row, col) of the cursor from text index.

get_cursor_from_xy(*x*, *y*)
Return the (row, col) of the cursor from an (x, y) position.

handle_image_left
Image used to display the Left handle on the TextInput for selection.

New in version 1.8.0.

`handle_image_left` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_left'.

handle_image_middle
Image used to display the middle handle on the TextInput for cursor positioning.

New in version 1.8.0.

`handle_image_middle` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_middle'.

handle_image_right
Image used to display the Right handle on the TextInput for selection.

New in version 1.8.0.

`handle_image_right` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/selector_right'.

hide_keyboard()
Convenience function to hide the keyboard in managed mode

hint_text
Hint text of the widget.

Shown if text is '' and focus is False.

New in version 1.6.0.

`hint_text` a `StringProperty` and defaults to ''.

hint_text_color
Current color of the hint_text text, in (r, g, b, a) format.

New in version 1.6.0.

`hint_text_color` is a `ListProperty` and defaults to [0.5, 0.5, 0.5, 1.0] (grey).

input_filter
Filters the input according to the specified mode, if not None. If None, no filtering is applied.

New in version 1.9.0.

`input_filter` is an `ObjectProperty` and defaults to *None*. Can be one of *None*, *'int'* (string), or *'float'* (string), or a callable. If it is *'int'*, it will only accept numbers. If it is *'float'* it will also accept a single period. Finally, if it is a callable it will be called with two parameter; the string to be added and a bool indicating whether the string is a result of undo (True). The callable should return a new substring that will be used instead.

input_type
The kind of input, keyboard to request

New in version 1.8.0.

`input_type` is an `OptionsProperty` and defaults to 'text'. Can be one of 'text', 'number', 'url', 'mail', 'datetime', 'tel', 'address'.

insert_text(*substring*, *from_undo=False*)

Insert new text at the current cursor position. Override this function in order to pre-process text for input validation.

keyboard_mode

How the keyboard visibility should be managed (auto will have standard behaviour to show/hide on focus, managed requires setting keyboard_visible manually, or calling the helper functions `show_keyboard()` and `hide_keyboard()`.

New in version 1.8.0.

`keyboard_mode` is an `OptionsProperty` and defaults to 'auto'. Can be one of 'auto' or 'managed'.

keyboard_suggestions

If True provides auto suggestions on top of keyboard. This will only work if `input_type` is set to *text*.

New in version 1.8.0.

`keyboard_suggestions` is a `BooleanProperty` defaults to True.

line_height

Height of a line. This property is automatically computed from the `font_name`, `font_size`. Changing the line_height will have no impact.

Note: `line_height` is the height of a single line of text. Use `minimum_height`, which also includes padding, to get the height required to display the text properly.

`line_height` is a `NumericProperty`, read-only.

line_spacing

Space taken up between the lines.

New in version 1.8.0.

`line_spacing` is a `NumericProperty` and defaults to 0.

minimum_height

Minimum height of the content inside the TextInput.

New in version 1.8.0.

`minimum_height` is a readonly `AliasProperty`.

multiline

If True, the widget will be able show multiple lines of text. If False, the "enter" keypress will defocus the textinput instead of adding a new line.

`multiline` is a `BooleanProperty` and defaults to True.

on_double_tap()

This event is dispatched when a double tap happens inside TextInput. The default behavior is to select the word around the current cursor position. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

on_quad_touch()

This event is dispatched when four fingers are touching inside TextInput. The default behavior is to select all text. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

on_triple_tap()

This event is dispatched when a triple tap happens inside TextInput. The default behavior is to select the line around current cursor position. Override this to provide different behavior. Alternatively, you can bind to this event to provide additional functionality.

padding

Padding of the text: [padding_left, padding_top, padding_right, padding_bottom].

padding also accepts a two argument form [padding_horizontal, padding_vertical] and a one argument form [padding].

Changed in version 1.7.0: Replaced AliasProperty with VariableListProperty.

`padding` is a `VariableListProperty` and defaults to [6, 6, 6, 6].

padding_x

Horizontal padding of the text: [padding_left, padding_right].

padding_x also accepts a one argument form [padding_horizontal].

`padding_x` is a `VariableListProperty` and defaults to [0, 0]. This might be changed by the current theme.

Deprecated since version 1.7.0: Use `padding` instead.

padding_y

Vertical padding of the text: [padding_top, padding_bottom].

padding_y also accepts a one argument form [padding_vertical].

`padding_y` is a `VariableListProperty` and defaults to [0, 0]. This might be changed by the current theme.

Deprecated since version 1.7.0: Use `padding` instead.

password

If True, the widget will display its characters as the character '*'.

New in version 1.2.0.

`password` is a `BooleanProperty` and defaults to False.

paste()

Insert text from system `Clipboard` into the `TextInput` at current cursor position.

New in version 1.8.0.

readonly

If True, the user will not be able to change the content of a textinput.

New in version 1.3.0.

`readonly` is a `BooleanProperty` and defaults to False.

reset_undo()

Reset undo and redo lists from memory.

New in version 1.3.0.

scroll_x

X scrolling value of the viewport. The scrolling is automatically updated when the cursor is moved or text changed. If there is no user input, the scroll_x and scroll_y properties may be changed.

`scroll_x` is a `NumericProperty` and defaults to 0.

scroll_y

Y scrolling value of the viewport. See `scroll_x` for more information.

`scroll_y` is a `NumericProperty` and defaults to 0.

select_all()

Select all of the text displayed in this TextInput.

New in version 1.4.0.

select_text(*start*, *end*)

Select a portion of text displayed in this TextInput.

New in version 1.4.0.

Parameters

startIndex of textinput.text from where to start selection

endIndex of textinput.text till which the selection should be displayed

selection_color

Current color of the selection, in (r, g, b, a) format.

Warning: The color should always have an "alpha" component less than 1 since the selection is drawn after the text.

selection_color is a ListProperty and defaults to [0.1843, 0.6549, 0.8313, .5].

selection_from

If a selection is in progress or complete, this property will represent the cursor index where the selection started.

Changed in version 1.4.0: selection_from is an AliasProperty and defaults to None, readonly.

selection_text

Current content selection.

selection_text is a StringProperty and defaults to '', readonly.

selection_to

If a selection is in progress or complete, this property will represent the cursor index where the selection started.

Changed in version 1.4.0: selection_to is an AliasProperty and defaults to None, readonly.

show_keyboard()

Convenience function to show the keyboard in managed mode

tab_width

By default, each tab will be replaced by four spaces on the text input widget. You can set a lower or higher value.

tab_width is a NumericProperty and defaults to 4.

text

Text of the widget.

Creation of a simple hello world:

```
widget = TextInput(text='Hello world')
```

If you want to create the widget with an unicode string, use:

```
widget = TextInput(text=u'My unicode string')
```

text a StringProperty.

use_bubble

Indicates whether the cut/copy/paste bubble is used.

New in version 1.7.0.

`use_bubble` is a `BooleanProperty` and defaults to True on mobile OS's, False on desktop OS's.

`use_handles`

Indicates whether the selection handles are displayed.

New in version 1.8.0.

`use_handles` is a `BooleanProperty` and defaults to True on mobile OS's, False on desktop OS's.

CHAPTER

TWO

TOGGLE BUTTON

The `ToggleButton` widget acts like a checkbox. When you touch/click it, the state toggles between 'normal' and 'down' (as opposed to a `Button` that is only 'down' as long as it is pressed).

Toggle buttons can also be grouped to make radio buttons - only one button in a group can be in a 'down' state. The group name can be a string or any other hashable Python object:

```
btn1 = ToggleButton(text='Male', group='sex',)
btn2 = ToggleButton(text='Female', group='sex', state='down')
btn3 = ToggleButton(text='Mixed', group='sex')
```

Only one of the buttons can be 'down'/checked at the same time.

To configure the ToggleButton, you can use the same properties that you can use for a `Button` class.

class `kivy.uix.togglebutton.`**`ToggleButton`**`(`***kwargs*`)`

Bases: `kivy.uix.behaviors.ToggleButtonBehavior`, `kivy.uix.button.Button`

Toggle button class, see module documentation for more information.

CHAPTER

THREE

TREE VIEW

New in version 1.0.4.

TreeView is a widget used to represent a tree structure. It is currently very basic, supporting a minimal feature set.

173.1 Introduction

A TreeView is populated with TreeViewNode instances, but you cannot use a TreeViewNode directly. You must combine it with another widget, such as Label, Button or even your own widget. The TreeView always creates a default root node, based on TreeViewLabel.

TreeViewNode is a class object containing needed properties for serving as a tree node. Extend TreeViewNode to create custom node types for use with a TreeView.

For constructing your own subclass, follow the pattern of TreeViewLabel which combines a Label and a TreeViewNode, producing a TreeViewLabel for direct use in a TreeView instance.

To use the TreeViewLabel class, you could create two nodes directly attached to root:

```
tv = TreeView()
tv.add_node(TreeViewLabel(text='My first item'))
tv.add_node(TreeViewLabel(text='My second item'))
```

Or, create two nodes attached to a first:

```
tv = TreeView()
n1 = tv.add_node(TreeViewLabel(text='Item 1'))
tv.add_node(TreeViewLabel(text='SubItem 1'), n1)
tv.add_node(TreeViewLabel(text='SubItem 2'), n1)
```

If you have a large tree structure, perhaps you would need a utility function to populate the tree view:

```
def populate_tree_view(tree_view, parent, node):
    if parent is None:
        tree_node = tree_view.add_node(TreeViewLabel(text=node['node_id'],
                                                     is_open=True))
    else:
        tree_node = tree_view.add_node(TreeViewLabel(text=node['node_id'],
                                                     is_open=True), parent)

    for child_node in node['children']:
        populate_tree_view(tree_view, tree_node, child_node)
```

```
tree = {'node_id': '1',
        'children': [{'node_id': '1.1',
                      'children': [{'node_id': '1.1.1',
                                    'children': [{'node_id': '1.1.1.1',
                                                  'children': []}]},
                                   {'node_id': '1.1.2',
                                    'children': []},
                                   {'node_id': '1.1.3',
                                    'children': []}]},
                     {'node_id': '1.2',
                      'children': []}]}


class TreeWidget(FloatLayout):
    def __init__(self, **kwargs):
        super(TreeWidget, self).__init__(**kwargs)

        tv = TreeView(root_options=dict(text='Tree One'),
                      hide_root=False,
                      indent_level=4)

        populate_tree_view(tv, None, tree)

        self.add_widget(tv)
```

The root widget in the tree view is opened by default and has text set as 'Root'. If you want to change that, you can use the `TreeView.root_options` property. This will pass options to the root widget:

```
tv = TreeView(root_options=dict(text='My root label'))
```

173.2 Creating Your Own Node Widget

For a button node type, combine a `Button` and a `TreeViewNode` as follows:

```
class TreeViewButton(Button, TreeViewNode):
    pass
```

You must know that, for a given node, only the `size_hint_x` will be honored. The allocated width for the node will depend of the current width of the TreeView and the level of the node. For example, if a node is at level 4, the width allocated will be:

treeview.width - treeview.indent_start - treeview.indent_level * node.level

You might have some trouble with that. It is the developer's responsibility to correctly handle adapting the graphical representation nodes, if needed.

class `kivy.uix.treeview.`**`TreeView`**(***kwargs*)
Bases: `kivy.uix.widget.Widget`

TreeView class. See module documentation for more information.

Events

on_node_expand: **(node,)**Fired when a node is being expanded

on_node_collapse: **(node,)**Fired when a node is being collapsed

`add_node`(*node, parent=None*)
Add a new node to the tree.

Parameters

node: **instance of a `TreeViewNode`**Node to add into the tree *parent*: **instance of a TreeViewNode, defaults to None**Parent node to attach the new node. If *None*, it is added to the root node.

Returnsthe node *node*.

get_node_at_pos(*pos*)
Get the node at the position (x, y).

hide_root
Use this property to show/hide the initial root node. If True, the root node will be appear as a closed node.

hide_root is a BooleanProperty and defaults to False.

indent_level
Width used for the indentation of each level except the first level.

Computation of indent for each level of the tree is:

```
indent = indent_start + level * indent_level
```

indent_level is a NumericProperty and defaults to 16.

indent_start
Indentation width of the level 0 / root node. This is mostly the initial size to accommodate a tree icon (collapsed / expanded). See indent_level for more information about the computation of level indentation.

indent_start is a NumericProperty and defaults to 24.

iterate_all_nodes(*node=None*)
Generator to iterate over all nodes from *node* and down whether expanded or not. If *node* is *None*, the generator start with root.

iterate_open_nodes(*node=None*)
Generator to iterate over all the expended nodes starting from *node* and down. If *node* is *None*, the generator start with root.

To get all the open nodes:

```
treeview = TreeView()
# ... add nodes ...
for node in treeview.iterate_open_nodes():
    print(node)
```

load_func
Callback to use for asynchronous loading. If set, asynchronous loading will be automatically done. The callback must act as a Python generator function, using yield to send data back to the treeview.

The callback should be in the format:

```
def callback(treeview, node):
    for name in ('Item 1', 'Item 2'):
        yield TreeViewLabel(text=name)
```

load_func is a ObjectProperty and defaults to None.

minimum_height
Minimum height needed to contain all children.

New in version 1.0.9.

minimum_height is a kivy.properties.NumericProperty and defaults to 0.

minimum_size

Minimum size needed to contain all children.

New in version 1.0.9.

minimum_size is a ReferenceListProperty of (minimum_width, minimum_height) properties.

minimum_width

Minimum width needed to contain all children.

New in version 1.0.9.

minimum_width is a kivy.properties.NumericProperty and defaults to 0.

remove_node(*node*)

Removes a node from the tree.

New in version 1.0.7.

Parameters

node: **instance of a TreeViewNode**Node to remove from the tree. If *node* is root, it is not removed.

root

Root node.

By default, the root node widget is a TreeViewLabel with text 'Root'. If you want to change the default options passed to the widget creation, use the root_options property:

```
treeview = TreeView(root_options={
    'text': 'Root directory',
    'font_size': 15})
```

root_options will change the properties of the TreeViewLabel instance. However, you cannot change the class used for root node yet.

root is an AliasProperty and defaults to None. It is read-only. However, the content of the widget can be changed.

root_options

Default root options to pass for root widget. See root property for more information about the usage of root_options.

root_options is an ObjectProperty and defaults to {}.

select_node(*node*)

Select a node in the tree.

selected_node

Node selected by TreeView.select_node() or by touch.

selected_node is a AliasProperty and defaults to None. It is read-only.

toggle_node(*node*)

Toggle the state of the node (open/collapsed).

class kivy.uix.treeview.**TreeViewException**

Bases: exceptions.Exception

Exception for errors in the TreeView.

class kivy.uix.treeview.**TreeViewLabel**(***kwargs*)

Bases: kivy.uix.label.Label, kivy.uix.treeview.TreeViewNode

Combines a Label and a TreeViewNode to create a TreeViewLabel that can be used as a text node in the tree.

See module documentation for more information.

class `kivy.uix.treeview.`**`TreeViewNode`**`(`***kwargs*`)`
Bases: `object`

TreeViewNode class, used to build a node class for a TreeView object.

`color_selected`
Background color of the node when the node is selected.

`color_selected` is a `ListProperty` and defaults to [.1, .1, .1, 1].

`even_color`
Background color of even nodes when the node is not selected.

`bg_color` is a `ListProperty` ans defaults to [.5, .5, .5, .1].

`is_leaf`
Boolean to indicate whether this node is a leaf or not. Used to adjust the graphical representation.

`is_leaf` is a `BooleanProperty` and defaults to True. It is automatically set to False when child is added.

`is_loaded`
Boolean to indicate whether this node is already loaded or not. This property is used only if the `TreeView` uses asynchronous loading.

`is_loaded` is a `BooleanProperty` and defaults to False.

`is_open`
Boolean to indicate whether this node is opened or not, in case there are child nodes. This is used to adjust the graphical representation.

Warning: This property is automatically set by the `TreeView`. You can read but not write it.

`is_open` is a `BooleanProperty` and defaults to False.

`is_selected`
Boolean to indicate whether this node is selected or not. This is used adjust the graphical representation.

Warning: This property is automatically set by the `TreeView`. You can read but not write it.

`is_selected` is a `BooleanProperty` and defaults to False.

`level`
Level of the node.

`level` is a `NumericProperty` and defaults to -1.

`no_selection`
Boolean used to indicate whether selection of the node is allowed ornot.
`no_selection` is a `BooleanProperty` and defaults to False.

`nodes`
List of nodes. The nodes list is different than the children list. A node in the nodes list represents a node on the tree. An item in the children list represents the widget associated with the node.

Warning: This property is automatically set by the `TreeView`. You can read but not write it.

`nodes` is a `ListProperty` and defaults to [].

`odd`

This property is set by the TreeView widget automatically and is read-only.

`odd` is a `BooleanProperty` and defaults to False.

`odd_color`

Background color of odd nodes when the node is not selected.

`odd_color` is a `ListProperty` and defaults to [1., 1., 1., 0.].

`parent_node`

Parent node. This attribute is needed because the `parent` can be None when the node is not displayed.

New in version 1.0.7.

`parent_node` is an `ObjectProperty` and defaults to None.

CHAPTER

FOUR

VIDEO

The `Video` widget is used to display video files and streams. Depending on your Video core provider, platform, and plugins, you will be able to play different formats. For example, the pygame video provider only supports MPEG1 on Linux and OSX. GStreamer is more versatile, and can read many video containers and codecs such as MKV, OGV, AVI, MOV, FLV (if the correct gstreamer plugins are installed). Our `VideoBase` implementation is used under the hood.

Video loading is asynchronous - many properties are not available until the video is loaded (when the texture is created):

```
def on_position_change(instance, value):
    print('The position in the video is', value)
def on_duration_change(instance, value):
    print('The duration of the video is', video)
video = Video(source='PandaSneezes.avi')
video.bind(position=on_position_change,
           duration=on_duration_change)
```

class `kivy.uix.video.`**`Video`**(***kwargs*)

Bases: `kivy.uix.image.Image`

Video class. See module documentation for more information.

`duration`

Duration of the video. The duration defaults to -1, and is set to a real duration when the video is loaded.

`duration` is a `NumericProperty` and defaults to -1.

`eos`

Boolean, indicates whether the video has finished playing or not (reached the end of the stream).

`eos` is a `BooleanProperty` and defaults to False.

`loaded`

Boolean, indicates whether the video is loaded and ready for playback or not.

New in version 1.6.0.

`loaded` is a `BooleanProperty` and defaults to False.

`options`

Options to pass at Video core object creation.

New in version 1.0.4.

`options` is an `kivy.properties.ObjectProperty` and defaults to {}.

play

Deprecated since version 1.4.0: Use `state` instead.

Boolean, indicates whether the video is playing or not. You can start/stop the video by setting this property:

```
# start playing the video at creation
video = Video(source='movie.mkv', play=True)

# create the video, and start later
video = Video(source='movie.mkv')
# and later
video.play = True
```

`play` is a `BooleanProperty` and defaults to False.

Deprecated since version 1.4.0: Use `state` instead.

position

Position of the video between 0 and `duration`. The position defaults to -1 and is set to a real position when the video is loaded.

`position` is a `NumericProperty` and defaults to -1.

seek(*percent*)

Change the position to a percentage of duration. Percentage must be a value between 0-1.

Warning: Calling seek() before the video is loaded has no impact.

New in version 1.2.0.

state

String, indicates whether to play, pause, or stop the video:

```
# start playing the video at creation
video = Video(source='movie.mkv', state='play')

# create the video, and start later
video = Video(source='movie.mkv')
# and later
video.state = 'play'
```

`state` is an `OptionProperty` and defaults to 'stop'.

unload()

Unload the video. The playback will be stopped.

New in version 1.8.0.

volume

Volume of the video, in the range 0-1. 1 means full volume, 0 means mute.

`volume` is a `NumericProperty` and defaults to 1.

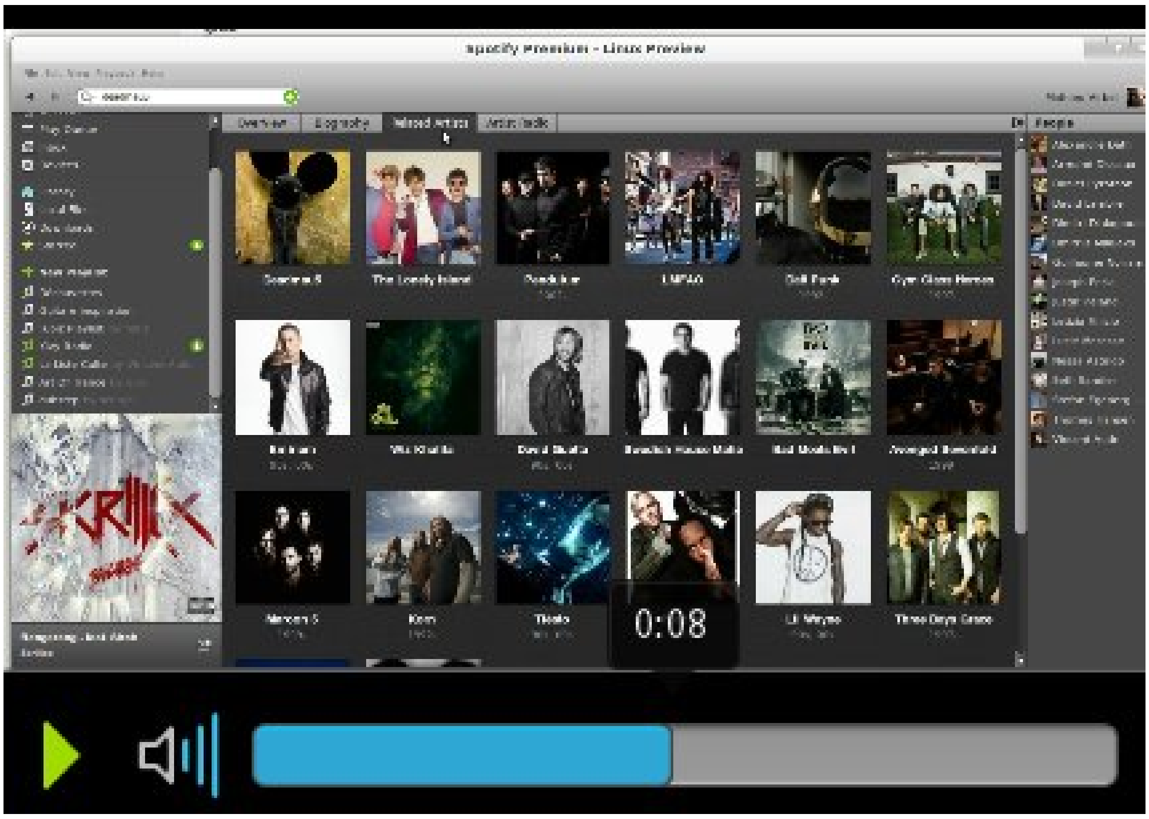
CHAPTER

FIVE

VIDEO PLAYER

New in version 1.2.0.

The video player widget can be used to play video and let the user control the play/pausing, volume and position. The widget cannot be customized much because of the complex assembly of numerous base widgets.



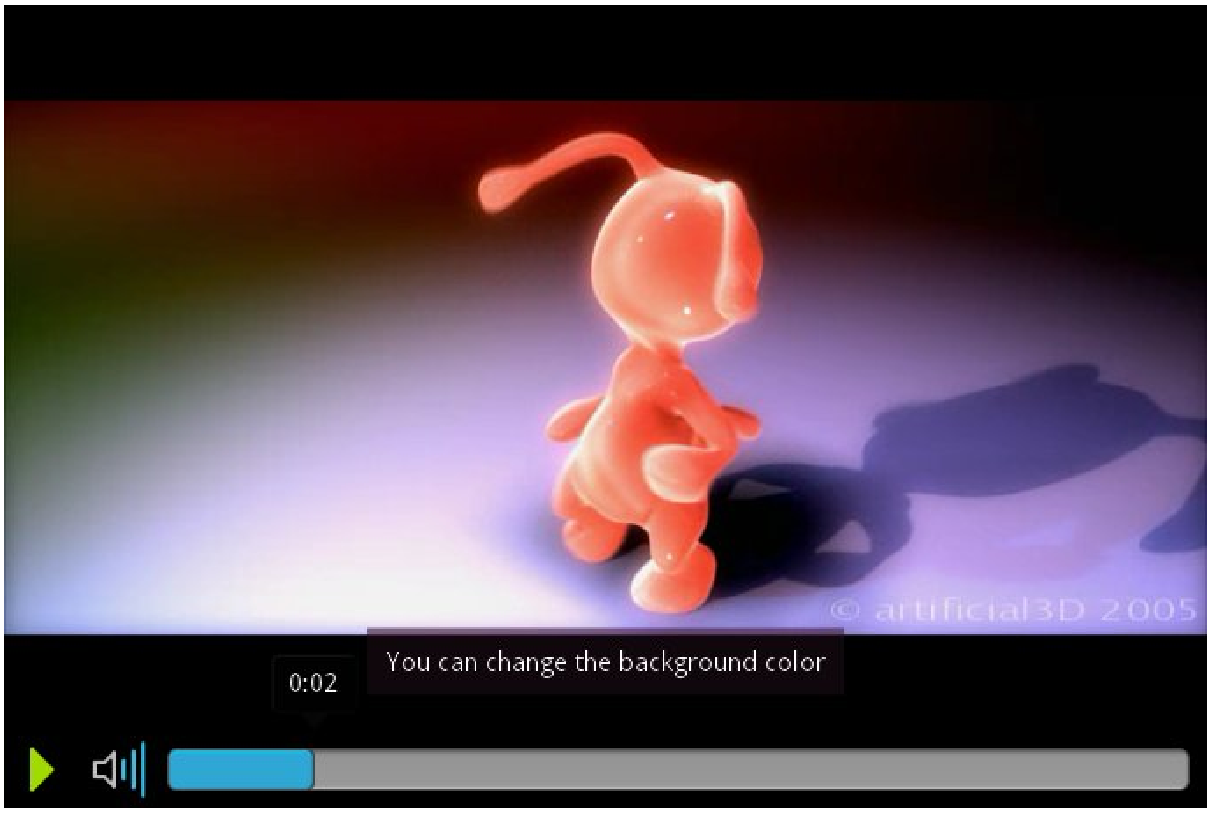
175.1 Annotations

If you want to display text at a specific time and for a certain duration, consider annotations. An annotation file has a ".jsa" extension. The player will automatically load the associated annotation file if it exists.

An annotation file is JSON-based, providing a list of label dictionary items. The key and value must match one of the `VideoPlayerAnnotation` items. For example, here is a short version of a jsa file that you can find in *examples/widgets/softboy.jsa*:

```
[
    {"start": 0, "duration": 2,
    "text": "This is an example of annotation"},
    {"start": 2, "duration": 2,
    "bgcolor": [0.5, 0.2, 0.4, 0.5],
    "text": "You can change the background color"}
]
```

For our softboy.avi example, the result will be:



If you want to experiment with annotation files, test with:

```
python -m kivy.uix.videoplayer examples/widgets/softboy.avi
```

175.2 Fullscreen

The video player can play the video in fullscreen, if `VideoPlayer.allow_fullscreen` is activated by a double-tap on the video. By default, if the video is smaller than the Window, it will be not stretched.

You can allow stretching by passing custom options to a `VideoPlayer` instance:

```
player = VideoPlayer(source='myvideo.avi', state='play',
    options={'allow_stretch': True})
```

175.3 End-of-stream behavior

You can specify what happens when the video has finished playing by passing an *eos* (end of stream) directive to the underlying `VideoBase` class. *eos* can be one of 'stop', 'pause' or 'loop' and defaults to 'stop'. For example, in order to loop the video:

```
player = VideoPlayer(source='myvideo.avi', state='play',
    options={'eos': 'loop'})
```

Note: The *eos* property of the VideoBase class is a string specifying the end-of-stream behavior. This property differs from the *eos* properties of the VideoPlayer and Video classes, whose *eos* property is simply a boolean indicating that the end of the file has been reached.

class `kivy.uix.videoplayer.`**`VideoPlayer`**`(`***kwargs*`)`
Bases: `kivy.uix.gridlayout.GridLayout`

VideoPlayer class. See module documentation for more information.

`allow_fullscreen`
By default, you can double-tap on the video to make it fullscreen. Set this property to False to prevent this behavior.

`allow_fullscreen` is a `BooleanProperty` defaults to True.

`annotations`
If set, it will be used for reading annotations box.

`annotations` is a `StringProperty` and defaults to ''.

`duration`
Duration of the video. The duration defaults to -1 and is set to the real duration when the video is loaded.

`duration` is a `NumericProperty` and defaults to -1.

`fullscreen`
Switch to fullscreen view. This should be used with care. When activated, the widget will remove itself from its parent, remove all children from the window and will add itself to it. When fullscreen is unset, all the previous children are restored and the widget is restored to its previous parent.

Warning: The re-add operation doesn't care about the index position of it's children within the parent.

`fullscreen` is a `BooleanProperty` and defaults to False.

`image_loading`
Image filename used when the video is loading.

`image_loading` is a `StringProperty` and defaults to 'data/images/image-loading.gif'.

`image_overlay_play`
Image filename used to show a "play" overlay when the video has not yet started.

`image_overlay_play` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/player-play-overlay'.

`image_pause`
Image filename used for the "Pause" button.

`image_pause` is a `StringProperty` and defaults to 'atlas://data/images/defaulttheme/media-playback-pause'.

`image_play`
Image filename used for the "Play" button.

image_play is a StringProperty and defaults to 'atlas://data/images/defaulttheme/media-playback-start'.

image_stop

Image filename used for the "Stop" button.

image_stop is a StringProperty and defaults to 'atlas://data/images/defaulttheme/media-playback-stop'.

image_volumehigh

Image filename used for the volume icon when the volume is high.

image_volumehigh is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-high'.

image_volumelow

Image filename used for the volume icon when the volume is low.

image_volumelow is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-low'.

image_volumemedium

Image filename used for the volume icon when the volume is medium.

image_volumemedium is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-medium'.

image_volumemuted

Image filename used for the volume icon when the volume is muted.

image_volumemuted is a StringProperty and defaults to 'atlas://data/images/defaulttheme/audio-volume-muted'.

options

Optional parameters can be passed to a Video instance with this property.

options a DictProperty and defaults to {}.

play

Deprecated since version 1.4.0: Use state instead.

Boolean, indicates whether the video is playing or not. You can start/stop the video by setting this property:

```
# start playing the video at creation
video = VideoPlayer(source='movie.mkv', play=True)

# create the video, and start later
video = VideoPlayer(source='movie.mkv')
# and later
video.play = True
```

play is a BooleanProperty and defaults to False.

position

Position of the video between 0 and duration. The position defaults to -1 and is set to the real position when the video is loaded.

position is a NumericProperty and defaults to -1.

seek(*percent*)

Change the position to a percentage of the duration. Percentage must be a value between 0-1.

Warning: Calling seek() before video is loaded has no effect.

source

Source of the video to read.

source is a StringProperty and defaults to ''.

Changed in version 1.4.0.

state

String, indicates whether to play, pause, or stop the video:

```
# start playing the video at creation
video = VideoPlayer(source='movie.mkv', state='play')

# create the video, and start later
video = VideoPlayer(source='movie.mkv')
# and later
video.state = 'play'
```

state is an OptionProperty and defaults to 'play'.

thumbnail

Thumbnail of the video to show. If None, VideoPlayer will try to find the thumbnail from the source + '.png'.

thumbnail a StringProperty and defaults to ''.

Changed in version 1.4.0.

volume

Volume of the video in the range 0-1. 1 means full volume and 0 means mute.

volume is a NumericProperty and defaults to 1.

class kivy.uix.videoplayer.**VideoPlayerAnnotation**(***kwargs*)

Bases: kivy.uix.label.Label

Annotation class used for creating annotation labels.

Additional keys are available:

- bgcolor: [r, g, b, a] - background color of the text box
- bgsource: 'filename' - background image used for the background text box
- border: (n, e, s, w) - border used for the background image

duration

Duration of the annotation.

duration is a NumericProperty and defaults to 1.

start

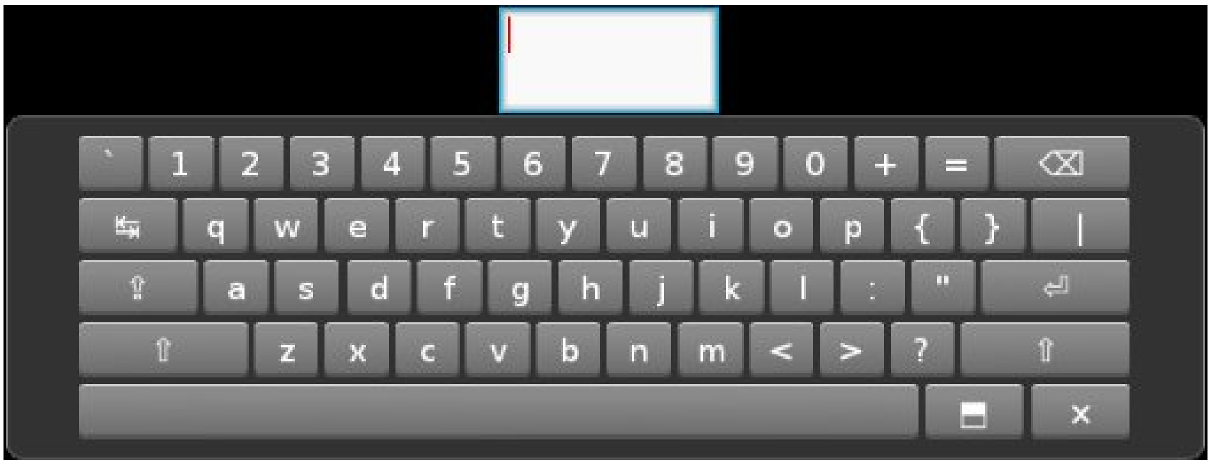
Start time of the annotation.

start is a NumericProperty and defaults to 0.

CHAPTER

SIX

VKEYBOARD



New in version 1.0.8.

VKeyboard is an onscreen keyboard for Kivy. Its operation is intended to be transparent to the user. Using the widget directly is NOT recommended. Read the section Request keyboard first.

176.1 Modes

This virtual keyboard has a docked and free mode:

- docked mode (`VKeyboard.docked` = True) Generally used when only one person is using the computer, like a tablet or personal computer etc.
- free mode: (`VKeyboard.docked` = False) Mostly for multitouch surfaces. This mode allows multiple virtual keyboards to be used on the screen.

If the docked mode changes, you need to manually call `VKeyboard.setup_mode()` otherwise the change will have no impact. During that call, the VKeyboard, implemented on top of a `Scatter`, will change the behavior of the scatter and position the keyboard near the target (if target and docked mode is set).

176.2 Layouts

The virtual keyboard is able to load a custom layout. If you create a new layout and put the JSON in `<kivy_data_dir>/keyboards/<layoutid>.json`, you can load it by setting `VKeyboard.layout` to your layoutid.

The JSON must be structured like this:

```
{
    "title": "Title of your layout",
    "description": "Description of your layout",
    "cols": 15,
    "rows": 5,

    ...
}
```

Then, you need to describe the keys in each row, for either a "normal", "shift" or a "special" (added in version 1.9.0) mode. Keys for this row data must be named *normal_<row>*, *shift_<row>* and *special_<row>*. Replace *row* with the row number. Inside each row, you will describe the key. A key is a 4 element list in the format:

```
[ <text displayed on the keyboard>, <text to put when the key is pressed>,
  <text that represents the keycode>, <size of cols> ]
```

Here are example keys:

```
# f key
["f", "f", "f", 1]
# capslock
["\u21B9", "         ", "tab", 1.5]
```

Finally, complete the JSON:

```
{
    ...
    "normal_1": [
        ["‘", "‘", "‘", 1],    ["1", "1", "1", 1],    ["2", "2", "2", 1],
        ["3", "3", "3", 1],    ["4", "4", "4", 1],    ["5", "5", "5", 1],
        ["6", "6", "6", 1],    ["7", "7", "7", 1],    ["8", "8", "8", 1],
        ["9", "9", "9", 1],    ["0", "0", "0", 1],    ["+", "+", "+", 1],
        ["=", "=", "=", 1],    ["\u232b", null, "backspace", 2]
    ],

    "shift_1": [ ... ],
    "normal_2": [ ... ],
    "special_2": [ ... ],
    ...
}
```

176.3 Request Keyboard

The instantiation of the virtual keyboard is controlled by the configuration. Check *keyboard_mode* and *keyboard_layout* in the *Configuration object*.

If you intend to create a widget that requires a keyboard, do not use the virtual keyboard directly, but prefer to use the best method available on the platform. Check the `request_keyboard()` method in the *Window*.

If you want a specific layout when you request the keyboard, you should write something like this (from 1.8.0, numeric.json can be in the same directory as your main.py):

```
keyboard = Window.request_keyboard(
    self._keyboard_close, self)
if keyboard.widget:
    vkeyboard = self._keyboard.widget
    vkeyboard.layout = 'numeric.json'
```

class `kivy.uix.vkeyboard.`**`VKeyboard`**(***kwargs*)
Bases: `kivy.uix.scatter.Scatter`

VKeyboard is an onscreen keyboard with multitouch support. Its layout is entirely customizable and you can switch between available layouts using a button in the bottom right of the widget.

Events

on_key_down: **keycode, internal, modifiers**Fired when the keyboard received a key down event (key press).

on_key_up: **keycode, internal, modifiers**Fired when the keyboard received a key up event (key release).

`available_layouts`

Dictionary of all available layouts. Keys are the layout ID, and the value is the JSON (translated into a Python object).

`available_layouts` is a `DictProperty` and defaults to {}.

`background`

Filename of the background image.

`background` a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard`

`background_border`

Background image border. Used for controlling the `border` property of the background.

`background_border` is a `ListProperty` and defaults to [16, 16, 16, 16]

`background_color`

Background color, in the format (r, g, b, a). If a background is set, the color will be combined with the background texture.

`background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

`background_disabled`

Filename of the background image when vkeyboard is disabled.

New in version 1.8.0.

`background_disabled` is a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard__disabled_background`.

`callback`

Callback can be set to a function that will be called if the VKeyboard is closed by the user.

`target` is an `ObjectProperty` instance and defaults to None.

`collide_margin`(*x*, *y*)

Do a collision test, and return True if the (x, y) is inside the vkeyboard margin.

`docked`

Indicate whether the VKeyboard is docked on the screen or not. If you change it, you must manually call `setup_mode()` otherwise it will have no impact. If the VKeyboard is created by the Window, the docked mode will be automatically set by the configuration, using the *keyboard_mode* token in *[kivy]* section.

`docked` is a `BooleanProperty` and defaults to False.

key_background_color

Key background color, in the format (r, g, b, a). If a key background is set, the color will be combined with the key background texture.

`key_background_color` is a `ListProperty` and defaults to [1, 1, 1, 1].

key_background_down

Filename of the key background image for use when a touch is active on the widget.

`key_background_down` a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard_key_down`.

key_background_normal

Filename of the key background image for use when no touches are active on the widget.

`key_background_normal` a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard_key_normal`.

key_border

Key image border. Used for controlling the `border` property of the key.

`key_border` is a `ListProperty` and defaults to [16, 16, 16, 16]

key_disabled_background_normal

Filename of the key background image for use when no touches are active on the widget and vkeyboard is disabled.

..versionadded:: 1.8.0

`key_disabled_background_normal` a `StringProperty` and defaults to `atlas://data/images/defaulttheme/vkeyboard_disabled_key_normal`.

key_margin

Key margin, used to create space between keys. The margin is composed of four values, in pixels:

```
key_margin = [top, right, bottom, left]
```

`key_margin` is a `ListProperty` and defaults to [2, 2, 2, 2]

layout

Layout to use for the VKeyboard. By default, it will be the layout set in the configuration, according to the *keyboard_layout* in *[kivy]* section.

Changed in version 1.8.0: If layout is a .json filename, it will loaded and added to the available_layouts.

`layout` is a `StringProperty` and defaults to None.

layout_path

Path from which layouts are read.

`layout` is a `StringProperty` and defaults to `<kivy_data_dir>/keyboards/`

margin_hint

Margin hint, used as spacing between keyboard background and keys content. The margin is composed of four values, between 0 and 1:

```
margin_hint = [top, right, bottom, left]
```

The margin hints will be multiplied by width and height, according to their position.

`margin_hint` is a `ListProperty` and defaults to [.05, .06, .05, .06]

refresh(*force=False*)
(internal) Recreate the entire widget and graphics according to the selected layout.

setup_mode(**largs*)
Call this method when you want to readjust the keyboard according to options: `docked` or not, with attached `target` or not:

- If `docked` is True, it will call `setup_mode_dock()`
- If `docked` is False, it will call `setup_mode_free()`

Feel free to overload these methods to create new positioning behavior.

setup_mode_dock(**largs*)
Setup the keyboard in docked mode.

Dock mode will reset the rotation, disable translation, rotation and scale. Scale and position will be automatically adjusted to attach the keyboard to the bottom of the screen.

Note: Don't call this method directly, use `setup_mode()` instead.

setup_mode_free()
Setup the keyboard in free mode.

Free mode is designed to let the user control the position and orientation of the keyboard. The only real usage is for a multiuser environment, but you might found other ways to use it. If a `target` is set, it will place the vkeyboard under the target.

Note: Don't call this method directly, use `setup_mode()` instead.

target
Target widget associated with the VKeyboard. If set, it will be used to send keyboard events. If the VKeyboard mode is "free", it will also be used to set the initial position.

`target` is an `ObjectProperty` instance and defaults to None.

CHAPTER

SEVEN

WIDGET CLASS

The Widget class is the base class required to create a Widget. This widget class is designed with a couple of principles in mind:

Event Driven Widget interaction is built on top of events that occur. If a property changes, the widget can respond to the change in the 'on_<propname>' callback. If nothing changes, nothing will be done. That's the main goal of the Property class.

Separate the widget and its graphical representation Widgets don't have a *draw()* method. This is done on purpose: The idea is to allow you to create your own graphical representation outside the widget class. Obviously you can still use all the available properties to do that, so that your representation properly reflects the widget's current state. Every widget has its own Canvas that you can use to draw. This separation allows Kivy to run your application in a very efficient manner.

Bounding Box / Collision Often you want to know if a certain point is within the bounds of your widget. An example would be a button widget where you want to only trigger an action when the button itself is actually touched. For this, you can use the Widget.collide_point() method, which will return True if the point you pass to it is inside the axis-aligned bounding box defined by the widget's position and size. If a simple AABB is not sufficient, you can override the method to perform the collision checks with more complex shapes, e.g. a polygon. You can also check if a widget collides with another widget with Widget.collide_widget().

We also have some default values and behaviors that you should be aware of:

- A Widget is not a Layout: it will not change the position or the size of its children. If you want control over positioning or sizing, use a Layout.
- The default size of a widget is (100, 100). This is only changed if the parent is a Layout. For example, if you add a Label inside a Button, the label will not inherit the button's size or position because the button is not a *Layout*: it's just another *Widget*.
- The default size_hint is (1, 1). If the parent is a Layout, then the widget size will be the parent layout's size.
- Widget.on_touch_down(), Widget.on_touch_move(), Widget.on_touch_up() don't do any sort of collisions. If you want to know if the touch is inside your widget, use Widget.collide_point().

177.1 Using Properties

When you read the documentation, all properties are described in the format:

```
<name> is a <property class> and defaults to <default value>.
```

e.g.

text is a StringProperty and defaults to ''.

If you want to be notified when the pos attribute changes, i.e. when the widget moves, you can bind your own callback function like this:

```
def callback_pos(instance, value):
    print('The widget', instance, 'moved to', value)

wid = Widget()
wid.bind(pos=callback_pos)
```

Read more about *Properties*.

177.2 Basic drawing

Widgets support a range of drawing instructions that you can use to customize the look of your widgets and layouts. For example, to draw a background image for your widget, you can do the following:

```
def redraw(self, args):
    self.bg_rect.size = self.size
    self.bg_rect.pos = self.pos

widget = Widget()
with widget.canvas:
    widget.bg_rect = Rectangle(source="cover.jpg", pos=self.pos, size=self.size)
widget.bind(pos=redraw, size=redraw)
```

To draw a background in kv:

```
Widget:
    canvas:
        Rectangle:
            source: "cover.jpg"
            size: self.size
            pos: self.pos
```

These examples only scratch the surface. Please see the kivy.graphics documentation for more information.

177.3 Widget touch event bubbling

When you catch touch events between multiple widgets, you often need to be aware of the order in which these events are propogated. In Kivy, events bubble up from the most recently added widget and then backwards through its children (from the most recently added back to the first child). This order is the same for the *on_touch_move* and *on_touch_up* events.

If you want to reverse this order, you can raise events in the children before the parent by using the *super* command. For example:

```
class MyWidget(Widget):
    def on_touch_down(self, touch):
        super(MyWidget, self).on_touch_down(touch)
        # Do stuff here
```

In general, this would seldom be the best approach as every event bubbles all the way through event time and there is no way of determining if it has been handled. In order to stop this event bubbling, one of these methods must return *True*. At this point, Kivy assumes the event has been handled and the propogation stops.

This means that the recommended approach is to let the event bubble naturally but swallow the event if it has been handled. For example:

```
class MyWidget(Widget):
    def on_touch_down(self, touch):
        If <some_condition>:
            # Do stuff here and kill the event
            return True
        else:
            # Continue normal event bubbling
            return super(MyWidget, self).on_touch_down(touch)
```

This approach gives you good control over exactly how events are dispatched and managed. Sometimes, however, you may wish to let the event be completely propogated before taking action. You can use the `Clock` to help you here:

```
class MyLabel(Label):
    def on_touch_down(self, touch, after=False):
        if after:
            print "Fired after the event has been dispatched!"
        else:
            Clock.schedule_once(lambda dt: self.on_touch_down(touch, True))
            return super(MyLabel, self).on_touch_down(touch)
```

class `kivy.uix.widget.`**`Widget`**`(`***kwargs*`)`

Bases: `kivy.uix.widget.WidgetBase`

Widget class. See module documentation for more information.

Events

on_touch_down:Fired when a new touch event occurs

on_touch_move:Fired when an existing touch moves

on_touch_up:Fired when an existing touch disappears

Warning: Adding a *__del__* method to a class derived from Widget with Python prior to 3.4 will disable automatic garbage collection for instances of that class. This is because the Widget class creates reference cycles, thereby preventing garbage collection.

Changed in version 1.0.9: Everything related to event properties has been moved to the `EventDispatcher`. Event properties can now be used when contructing a simple class without subclassing `Widget`.

Changed in version 1.5.0: The constructor now accepts on_* arguments to automatically bind callbacks to properties or events, as in the Kv language.

`add_widget``(`*widget, index=0, canvas=None*`)`

Add a new widget as a child of this widget.

Parameters

widget: **`Widget`**Widget to add to our list of children.

index: **int, defaults to 0**Index to insert the widget in the list.

New in version 1.0.5.

canvas: **str, defaults to None**Canvas to add widget's canvas to. Can be 'before', 'after' or None for the default canvas.

New in version 1.9.0.

```
>>> from kivy.uix.button import Button
>>> from kivy.uix.slider import Slider
>>> root = Widget()
>>> root.add_widget(Button())
>>> slider = Slider()
>>> root.add_widget(slider)
```

`canvas` = None
Canvas of the widget.

The canvas is a graphics object that contains all the drawing instructions for the graphical representation of the widget.

There are no general properties for the Widget class, such as background color, to keep the design simple and lean. Some derived classes, such as Button, do add such convenience properties but generally the developer is responsible for implementing the graphics representation for a custom widget from the ground up. See the derived widget classes for patterns to follow and extend.

See `Canvas` for more information about the usage.

`center`
Center position of the widget.

`center` is a `ReferenceListProperty` of (`center_x`, `center_y`) properties.

`center_x`
X center position of the widget.

`center_x` is an `AliasProperty` of (`x` + `width` / 2.).

`center_y`
Y center position of the widget.

`center_y` is an `AliasProperty` of (`y` + `height` / 2.).

`children`
List of children of this widget.

`children` is a `ListProperty` and defaults to an empty list.

Use `add_widget()` and `remove_widget()` for manipulating the children list. Don't manipulate the children list directly unless you know what you are doing.

`clear_widgets`(*children=None*)
Remove all widgets added to this widget.

Changed in version 1.8.0: *children* argument can be used to select the children we want to remove. It should be a list of children (or filtered list) of the current widget.

`cls`
Class of the widget, used for styling.

`collide_point`(*x, y*)
Check if a point (x, y) is inside the widget's axis aligned boundingbox.
Parameters
x: **numeric**X position of the point (in window coordinates)
y: **numeric**Y position of the point (in window coordinates)
Returnsbool, True if the point is inside the bounding box.

```
>>> Widget(pos=(10, 10), size=(50, 50)).collide_point(40, 40)
True
```

`collide_widget`(*wid*)

Check if the other widget collides with this widget. Performs an axis-aligned bounding box intersection test by default.

Parameters

wid: `Widget` **class**Widget to collide with.

Returnsbool, True if the other widget collides with this widget.

```
>>> wid = Widget(size=(50, 50))
>>> wid2 = Widget(size=(50, 50), pos=(25, 25))
>>> wid.collide_widget(wid2)
True
>>> wid2.pos = (55, 55)
>>> wid.collide_widget(wid2)
False
```

`disabled`

Indicates whether this widget can interact with input or not.

Note:

1.Child Widgets, when added to a disabled widget, will be disabled automatically.

2.Disabling/enabling a parent disables/enables all of its children.

New in version 1.8.0.

`disabled` is a `BooleanProperty` and defaults to False.

`export_to_png`(*filename*, **args*)

Saves an image of the widget and its children in png format at the specified filename. Works by removing the widget canvas from its parent, rendering to an `Fbo`, and calling `save()`.

Note: The image includes only this widget and its children. If you want to include widgets elsewhere in the tree, you must call `export_to_png()` from their common parent, or use `screenshot()` to capture the whole window.

Note: The image will be saved in png format, you should include the extension in your filename.

New in version 1.9.0.

`get_parent_window`()

Return the parent window.

Returns Instance of the parent window. Can be a `WindowBase` or `Widget`.

`get_root_window`()

Return the root window.

Returns Instance of the root window. Can be a `WindowBase` or `Widget`.

`height`

Height of the widget.

`height` is a `NumericProperty` and defaults to 100.

Warning: Keep in mind that the *height* property is subject to layout logic and that this has not yet happened at the time of the widget's *__init__* method.

`id`

Unique identifier of the widget in the tree.

`id` is a `StringProperty` and defaults to None.

Warning: If the id is already used in the tree, an exception will be raised.

ids

This is a dictionary of ids defined in your kv language. This will only be populated if you use ids in your kv language code.

New in version 1.7.0.

ids is a DictProperty and defaults to an empty dict {}.

The ids are populated for each root level widget definition. For example:

```
# in kv
<MyWidget@Widget>:
    id: my_widget
    Label:
        id: label_widget
        Widget:
            id: inner_widget
            Label:
                id: inner_label
    TextInput:
        id: text_input
    OtherWidget:
        id: other_widget


<OtherWidget@Widget>
    id: other_widget
    Label:
        id: other_label
        TextInput:
            id: other_textinput
```

Then, in python:

```
>>> widget = MyWidget()
>>> print(widget.ids)
{'other_widget': <weakproxy at 041CFED0 to OtherWidget at 041BEC38>,
'inner_widget': <weakproxy at 04137EA0 to Widget at 04138228>,
'inner_label': <weakproxy at 04143540 to Label at 04138260>,
'label_widget': <weakproxy at 04137B70 to Label at 040F97A0>,
'text_input': <weakproxy at 041BB5D0 to TextInput at 041BEC00>}
>>> print(widget.ids['other_widget'].ids)
{'other_textinput': <weakproxy at 041DBB40 to TextInput at 041BEF48>,
'other_label': <weakproxy at 041DB570 to Label at 041BEEA0>}
>>> print(widget.ids['label_widget'].ids)
{}
```

on_touch_down(*touch*)

Receive a touch down event.

Parameters

touch: MotionEvent **class**Touch received. The touch is in parent coordinates. See relativelayout for a discussion on coordinate systems.

Returns bool. If True, the dispatching of the touch event will stop.

on_touch_move(*touch*)

Receive a touch move event. The touch is in parent coordinates.

See on_touch_down() for more information.

on_touch_up(*touch*)

Receive a touch up event. The touch is in parent coordinates.

See on_touch_down() for more information.

opacity

Opacity of the widget and all its children.

New in version 1.4.1.

The opacity attribute controls the opacity of the widget and its children. Be careful, it's a cumulative attribute: the value is multiplied by the current global opacity and the result is applied to the current context color.

For example, if the parent has an opacity of 0.5 and a child has an opacity of 0.2, the real opacity of the child will be 0.5 * 0.2 = 0.1.

Then, the opacity is applied by the shader as:

```
frag_color = color * vec4(1.0, 1.0, 1.0, opacity);
```

opacity is a NumericProperty and defaults to 1.0.

parent

Parent of this widget.

parent is an ObjectProperty and defaults to None.

The parent of a widget is set when the widget is added to another widget and unset when the widget is removed from its parent.

pos

Position of the widget.

pos is a ReferenceListProperty of (x, y) properties.

pos_hint

Position hint. This property allows you to set the position of the widget inside its parent layout, in percent (similar to size_hint).

For example, if you want to set the top of the widget to be at 90% height of its parent layout, you can write:

```
widget = Widget(pos_hint={'top': 0.9})
```

The keys 'x', 'right' and 'center_x' will use the parent width. The keys 'y', 'top' and 'center_y' will use the parent height.

See *Float Layout* for further reference.

Note: pos_hint is not used by all layouts. Check the documentation of the layout in question to see if it supports pos_hint.

---

pos_hint is an ObjectProperty containing a dict.

proxy_ref

Return a proxy reference to the widget, i.e. without creating a reference to the widget. See weakref.proxy for more information.

New in version 1.7.2.

remove_widget(*widget*)

Remove a widget from the children of this widget.

Parameters

widget: `Widget`Widget to remove from our children list.

```
>>> from kivy.uix.button import Button
>>> root = Widget()
>>> button = Button()
>>> root.add_widget(button)
>>> root.remove_widget(button)
```

`right`

Right position of the widget.

`right` is an `AliasProperty` of (`x` + `width`).

`size`

Size of the widget.

`size` is a `ReferenceListProperty` of (`width`, `height`) properties.

`size_hint`

Size hint.

`size_hint` is a `ReferenceListProperty` of (`size_hint_x`, `size_hint_y`) properties.

See `size_hint_x` for more information.

`size_hint_x`

X size hint. Represents how much space the widget should use in the direction of the X axis relative to its parent's width. Only the `Layout` and `Window` classes make use of the hint.

The value is in percent as a float from 0. to 1., where 1. means the full size of his parent. 0.5 represents 50%.

`size_hint_x` is a `NumericProperty` and defaults to 1.

`size_hint_y`

Y size hint.

`size_hint_y` is a `NumericProperty` and defaults to 1.

See `size_hint_x` for more information.

`to_local`(*x*, *y*, *relative=False*)

Transform parent coordinates to local coordinates. See `relativelayout` for details on the coordinate systems.

Parameters

relative: **bool, defaults to False**Change to True if you want to translate coordinates to relative widget coordinates.

`to_parent`(*x*, *y*, *relative=False*)

Transform local coordinates to parent coordinates. See `relativelayout` for details on the coordinate systems.

Parameters

relative: **bool, defaults to False**Change to True if you want to translate relative positions from a widget to its parent coordinates.

`to_widget`(*x*, *y*, *relative=False*)

Convert the given coordinate from window to local widget coordinates. See `relativelayout` for details on the coordinate systems.

`to_window`(*x*, *y*, *initial=True*, *relative=False*)

Transform local coordinates to window coordinates. See `relativelayout` for details on the coordinate systems.

top

Top position of the widget.

`top` is an `AliasProperty` of (`y` + `height`).

walk(*restrict=False*, *loopback=False*)

Iterator that walks the widget tree starting with this widget and goes forward returning widgets in the order in which layouts display them.

Parameters

***restrict*: bool, defaults to False**If True, it will only iterate through the widget and its children (or children of its children etc.). Defaults to False.

***loopback*: bool, defaults to False**If True, when the last widget in the tree is reached, it'll loop back to the uppermost root and start walking until we hit this widget again. Naturally, it can only loop back when *restrict* is False. Defaults to False.

ReturnsA generator that walks the tree, returning widgets in the forward layout order.

For example, given a tree with the following structure:

```
GridLayout:
    Button
    BoxLayout:
        id: box
        Widget
        Button
    Widget
```

walking this tree:

```
>>> # Call walk on box with loopback True, and restrict False
>>> [type(widget) for widget in box.walk(loopback=True)]
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>,
    <class 'Widget'>, <class 'GridLayout'>, <class 'Button'>]
>>> # Now with loopback False, and restrict False
>>> [type(widget) for widget in box.walk()]
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>,
    <class 'Widget'>]
>>> # Now with restrict True
>>> [type(widget) for widget in box.walk(restrict=True)]
[<class 'BoxLayout'>, <class 'Widget'>, <class 'Button'>]
```

New in version 1.9.0.

walk_reverse(*loopback=False*)

Iterator that walks the widget tree backwards starting with the widget before this, and going backwards returning widgets in the reverse order in which layouts display them.

This walks in the opposite direction of `walk()`, so a list of the tree generated with `walk()` will be in reverse order compared to the list generated with this, provided *loopback* is True.

Parameters

***loopback*: bool, defaults to False**If True, when the uppermost root in the tree is reached, it'll loop back to the last widget and start walking back until after we hit widget again. Defaults to False.

ReturnsA generator that walks the tree, returning widgets in the reverse layout order.

For example, given a tree with the following structure:

```
GridLayout:
    Button
```

```
        BoxLayout:
            id: box
            Widget
            Button
        Widget
```

walking this tree:

```
>>> # Call walk on box with loopback True
>>> [type(widget) for widget in box.walk_reverse(loopback=True)]
[<class 'Button'>, <class 'GridLayout'>, <class 'Widget'>,
    <class 'Button'>, <class 'Widget'>, <class 'BoxLayout'>]
>>> # Now with loopback False
>>> [type(widget) for widget in box.walk_reverse()]
[<class 'Button'>, <class 'GridLayout'>]
>>> forward = [w for w in box.walk(loopback=True)]
>>> backward = [w for w in box.walk_reverse(loopback=True)]
>>> forward == backward[::-1]
True
```

New in version 1.9.0.

`width`

Width of the widget.

`width` is a `NumericProperty` and defaults to 100.

Warning: Keep in mind that the *width* property is subject to layout logic and that this has not yet happened at the time of the widget's *__init__* method.

`x`

X position of the widget.

`x` is a `NumericProperty` and defaults to 0.

`y`

Y position of the widget.

`y` is a `NumericProperty` and defaults to 0.

class `kivy.uix.widget.`**`WidgetException`**

Bases: `exceptions.Exception`

Fired when the widget gets an exception.

CHAPTER

EIGHT

UTILS

Changed in version 1.6.0: The OrderedDict class has been removed. Use the collections.OrderedDict.

`kivy.utils.`**`intersection`**`(`*set1, set2*`)`
Return the intersection of 2 lists.

`kivy.utils.`**`difference`**`(`*set1, set2*`)`
Return the difference between 2 lists.

`kivy.utils.`**`strtotuple`**`(`*s*`)`
Convert a tuple string into a tuple with some security checks. Designed to be used with the eval() function:

```
a = (12, 54, 68)
b = str(a)         # return '(12, 54, 68)'
c = strtotuple(b)  # return (12, 54, 68)
```

`kivy.utils.`**`get_color_from_hex`**`(`*s*`)`
Transform a hex string color to a kivy `Color`.

`kivy.utils.`**`get_hex_from_color`**`(`*color*`)`
Transform a kivy `Color` to a hex value:

```
>>> get_hex_from_color((0, 1, 0))
'#00ff00'
>>> get_hex_from_color((.25, .77, .90, .5))
'#3fc4e57f'
```

New in version 1.5.0.

`kivy.utils.`**`get_random_color`**`(`*alpha=1.0*`)`
Returns a random color (4 tuple).

Parameters
alpha[float, defaults to 1.0] If alpha == 'random', a random alpha value is generated.

`kivy.utils.`**`is_color_transparent`**`(`*c*`)`
Return True if the alpha channel is 0.

`kivy.utils.`**`boundary`**`(`*value, minvalue, maxvalue*`)`
Limit a value between a minvalue and maxvalue.

`kivy.utils.`**`deprecated`**`(`*func*`)`
This is a decorator which can be used to mark functions as deprecated. It will result in a warning being emitted the first time the function is used.

class `kivy.utils.`**`SafeList`**
Bases: `list`

List with a clear() method.

Warning: Usage of the iterate() function will decrease your performance.

`kivy.utils.`**`interpolate`**`(`*value_from, value_to, step=10*`)`

Interpolate between two values. This can be useful for smoothing some transitions. For example:

```
# instead of setting directly
self.pos = pos

# use interpolate, and you'll have a nicer transition
self.pos = interpolate(self.pos, new_pos)
```

Warning: These interpolations work only on lists/tuples/doubles with the same dimensions. No test is done to check the dimensions are the same.

class `kivy.utils.`**`QueryDict`**

Bases: `dict`

QueryDict is a dict() that can be queried with dot.

New in version 1.0.4.

```
d = QueryDict()
# create a key named toto, with the value 1
d.toto = 1
# it's the same as
d['toto'] = 1
```

`kivy.utils.`**`platform`** **= platform name: 'linux' from: <kivy.utils.Platform object at 0x8f178cc>**

New in version 1.3.0.

Deprecated since 1.8.0: Use platform as variable instaed of a function.

Calling platform() will return one of: *win*, *linux*, *android*, *macosx*, *ios* or *unknown*.

Changed in version 1.8.0.

platform also behaves like a regular variable in comparisons like so:

```
from kivy import platform
if platform == 'linux':
    do_linux_things()
if platform() == 'linux': # triggers deprecation warning
    do_more_linux_things()
foo = {'linux' : do_linux_things}
foo[platform]() # calls do_linux_things
p = platform # assigns to a module object
if p == 'android':
    do_android_things()
p += 'some string' # error!
```

`kivy.utils.`**`escape_markup`**`(`*text*`)`

Escape markup characters found in the text. Intended to be used when markup text is activated on the Label:

```
untrusted_text = escape_markup('Look at the example [1]')
text = '[color=ff0000]' + untrusted_text + '[/color]'
w = Label(text=text, markup=True)
```

New in version 1.3.0.

class `kivy.utils.`**`reify`**(*func*)

Bases: `object`

Put the result of a method which uses this (non-data) descriptor decorator in the instance dict after the first call, effectively replacing the decorator with an instance variable.

It acts like @property, except that the function is only ever called once; after that, the value is cached as a regular attribute. This gives you lazy attribute creation on objects that are meant to be immutable.

Taken from the Pyramid project.

CHAPTER

NINE

VECTOR

The `Vector` represents a 2D vector (x, y). Our implementation is made on top of a Python list.

Example for constructing a Vector:

```
>>> # Construct a point at 82,34
>>> v = Vector(82, 34)
>>> v[0]
82
>>> v.x
82
>>> v[1]
34
>>> v.y
34

>>> # Construct by giving a list of 2 values
>>> pos = (93, 45)
>>> v = Vector(pos)
>>> v[0]
93
>>> v.x
93
>>> v[1]
45
>>> v.y
45
```

179.1 Optimized usage

Most of the time, you can use a list for arguments instead of using a Vector. For example, if you want to calculate the distance between 2 points:

```
a = (10, 10)
b = (87, 34)

# optimized method
print('distance between a and b:', Vector(a).distance(b))

# non-optimized method
va = Vector(a)
vb = Vector(b)
print('distance between a and b:', va.distance(vb))
```

179.2 Vector operators

The `Vector` supports some numeric operators like +, -, /:

```
>>> Vector(1, 1) + Vector(9, 5)
[10, 6]

>>> Vector(9, 5) - Vector(5, 5)
[4, 0]

>>> Vector(10, 10) / Vector(2., 4.)
[5.0, 2.5]

>>> Vector(10, 10) / 5.
[2.0, 2.0]
```

You can also do in-place operations:

```
>>> v = Vector(1, 1)
>>> v += 2
>>> v
[3, 3]
>>> v *= 5
[15, 15]
>>> v /= 2.
[7.5, 7.5]
```

class `kivy.vector.`**`Vector`**`(`**largs*`)`

Bases: `list`

Vector class. See module documentation for more information.

`angle``(`*a*`)`

Computes the angle between a and b, and returns the angle in degrees.

```
>>> Vector(100, 0).angle((0, 100))
-90.0
>>> Vector(87, 23).angle((-77, 10))
-157.7920283010705
```

`distance``(`*to*`)`

Returns the distance between two points.

```
>>> Vector(10, 10).distance((5, 10))
5.
>>> a = (90, 33)
>>> b = (76, 34)
>>> Vector(a).distance(b)
14.035668847618199
```

`distance2``(`*to*`)`

Returns the distance between two points squared.

```
>>> Vector(10, 10).distance2((5, 10))
25
```

`dot``(`*a*`)`

Computes the dot product of a and b.

```
>>> Vector(2, 4).dot((2, 2))
12
```

static **in_bbox**(*point, a, b*)
Return True if *point* is in the bounding box defined by *a* and *b*.

```
>>> bmin = (0, 0)
>>> bmax = (100, 100)
>>> Vector.in_bbox((50, 50), bmin, bmax)
True
>>> Vector.in_bbox((647, -10), bmin, bmax)
False
```

length()
Returns the length of a vector.

```
>>> Vector(10, 10).length()
14.142135623730951
>>> pos = (10, 10)
>>> Vector(pos).length()
14.142135623730951
```

length2()
Returns the length of a vector squared.

```
>>> Vector(10, 10).length2()
200
>>> pos = (10, 10)
>>> Vector(pos).length2()
200
```

static **line_intersection**(*v1, v2, v3, v4*)
Finds the intersection point between the lines (1)v1->v2 and (2)v3->v4 and returns it as a vector object.

```
>>> a = (98, 28)
>>> b = (72, 33)
>>> c = (10, -5)
>>> d = (20, 88)
>>> Vector.line_intersection(a, b, c, d)
[15.25931928687196, 43.911669367909241]
```

Warning: This is a line intersection method, not a segment intersection.

For math see: http://en.wikipedia.org/wiki/Line-line_intersection

normalize()
Returns a new vector that has the same direction as vec, but has a length of one.

```
>>> v = Vector(88, 33).normalize()
>>> v
[0.93632917756904444, 0.3511234415883917]
>>> v.length()
1.0
```

rotate(*angle*)
Rotate the vector with an angle in degrees.

```
>>> v = Vector(100, 0)
>>> v.rotate(45)
>>> v
[70.710678118654755, 70.710678118654741]
```

static **segment_intersection**(*v1, v2, v3, v4*)
Finds the intersection point between segments (1)v1->v2 and (2)v3->v4 and returns it as a vector object.

```
>>> a = (98, 28)
>>> b = (72, 33)
>>> c = (10, -5)
>>> d = (20, 88)
>>> Vector.segment_intersection(a, b, c, d)
None
```

```
>>> a = (0, 0)
>>> b = (10, 10)
>>> c = (0, 10)
>>> d = (10, 0)
>>> Vector.segment_intersection(a, b, c, d)
[5, 5]
```

x

x represents the first element in the list.

```
>>> v = Vector(12, 23)
>>> v[0]
12
>>> v.x
12
```

y

y represents the second element in the list.

```
>>> v = Vector(12, 23)
>>> v[1]
23
>>> v.y
23
```

CHAPTER

WEAK METHOD

The `WeakMethod` is used in the Clock class to allow a reference to a bound method that permits the associated object to be garbage collected. Check examples/core/clock_method.py for more information.

This WeakMethod class is taken from the recipe http://code.activestate.com/recipes/81253/, based on the nicodemus version. (thanks to him !)

class `kivy.weakmethod.`**`WeakMethod`**`(`*method*`)`
Bases: `object`

Implementation of a weakref for functions and bound methods.

`is_dead``()`
Returns True if the referenced callable was a bound method and the instance no longer exists. Otherwise, return False.

Part V
APPENDIX

The appendix contains licensing information and an enumeration of all the different modules, classes, functions and variables available in Kivy.

CHAPTER

ONE

LICENSE

Kivy 1.7.2 and 1.8 are now under MIT License. Previous version are still under LGPL 3 license.

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https://github.com/kivy/kivy/blob/master/LICENSE

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PYTHON MODULE INDEX

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