Why create a mobile app with Python?

by Leonardo Calderon
Senior Developer at Endava

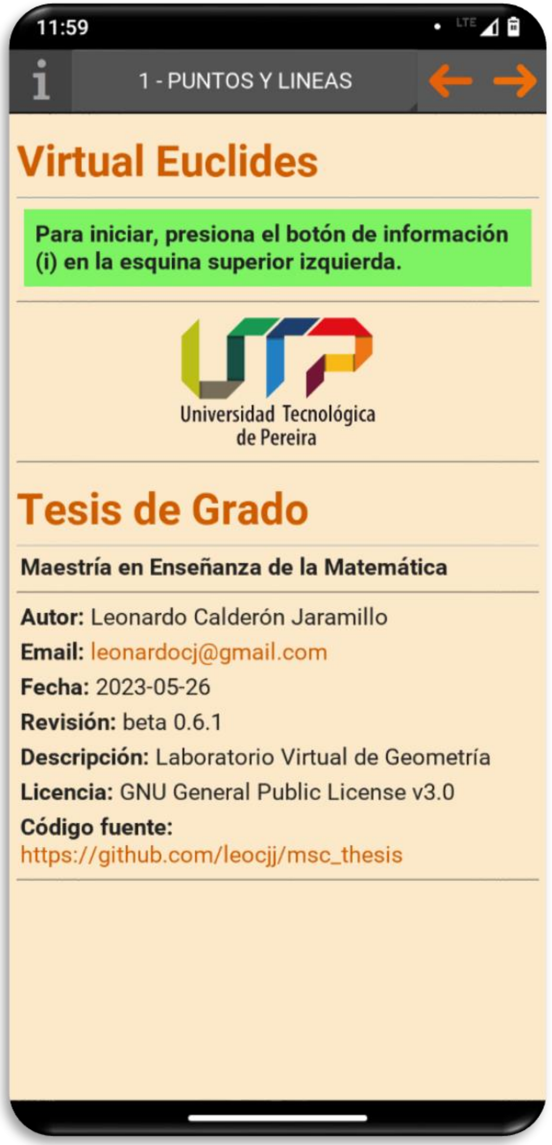
PYCON COLOMBIA 2023

The emotional answer

The rational answer

Because…

- We can!!
- Simple
- Cross-platform
- Native performance - by using OpenGL
- Leverage Python's ecosystem
- All you need is Python
- Easy to share:
  - Go to Google Play Store
  - Look for **Virtual Euclides** (Author LeoCJJ)
  - Install it!!



Virtual Euclides

Para iniciar, presiona el botón de información (i) en la esquina superior izquierda.

Universidad Tecnológica de Pereira

Tesis de Grado

Maestría en Enseñanza de la Matemática

Autor: Leonardo Calderón Jaramillo
Email: leonardocj@gmail.com
Fecha: 2023-05-26
Revisión: beta 0.6.1
Descripción: Laboratorio Virtual de Geometría
Licencia: GNU General Public License v3.0
Código fuente: https://github.com/leocjj/msc_thesis

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About me

I’m a husband, a father,
an engineer,
a software developer…

… I love Math, Physics, and
solving problems,
you could say I love getting
into trouble…

… that’s why I studied a
Master Degree In Math
and this is my thesis story

My initial goal

Universidad Tecnológica de Pereira

A laboratory for teaching Geometry, because I was a STEAM professor

Duru, A. (2010). The experimental teaching in some of topics geometry. *Educational Research and Reviews, 5*(10), 584-592. Retrieved from https://academicjournals.org/journal/ERR/article-abstract/43C57274193

Then...

2020

World lockdown

I lost my job as a Professor

I closed down my consulting entrepreneurship

But also, great things happened

My son was born

And I was hired by Endava

Image created with You.com – YouImagine – AI Image Generator. Model: Stable Diffusion 2.1.

So, I started again...

The **Why** is more powerful than the **How**

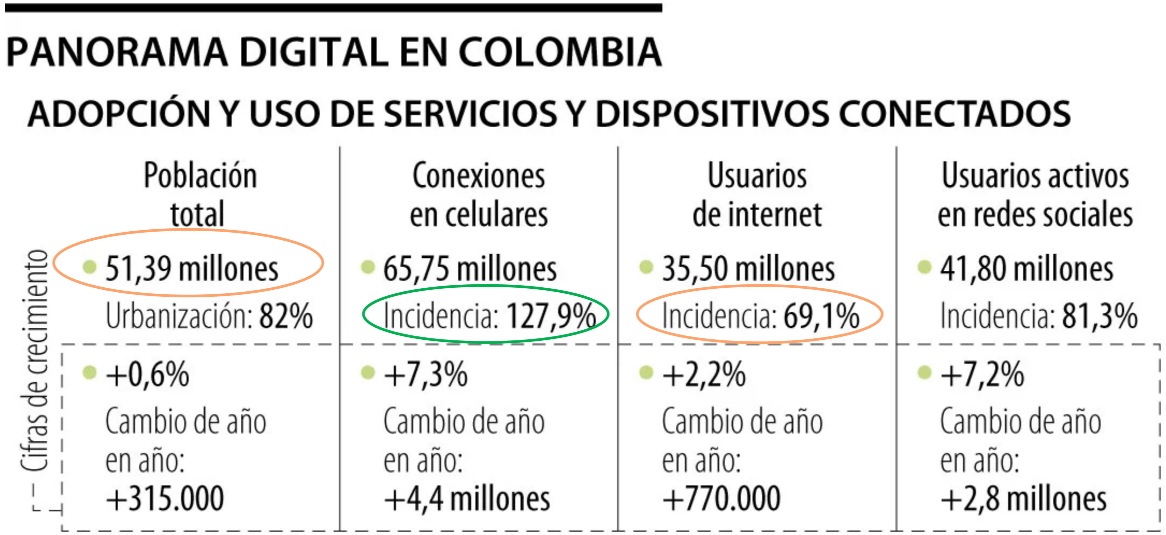
But where should I start

What could I do in the new –remote- world?
→ An app

What kind of app?

Desktop? → **Not everyone has one**
Web? → **Need a device and an ISP**
Mobile? → **Everyone has a cell phone!!**

128% of cell phones
69% of internet access



PANORAMA DIGITAL EN COLOMBIA

ADOPCIÓN Y USO DE SERVICIOS Y DISPOSITIVOS CONECTADOS

	Población total	Conexiones en celulares	Usuarios de internet	Usuarios activos en redes sociales
	51,39 millones	65,75 millones	35,50 millones	41,80 millones
	Urbanización: 82%	Incidencia: 127,9%	Incidencia: 69,1%	Incidencia: 81,3%
Cifras de crecimiento	+0,6% Cambio de año en año: +315.000	+7,3% Cambio de año en año: +4,4 millones	+2,2% Cambio de año en año: +770.000	+7,2% Cambio de año en año: +2,8 millones

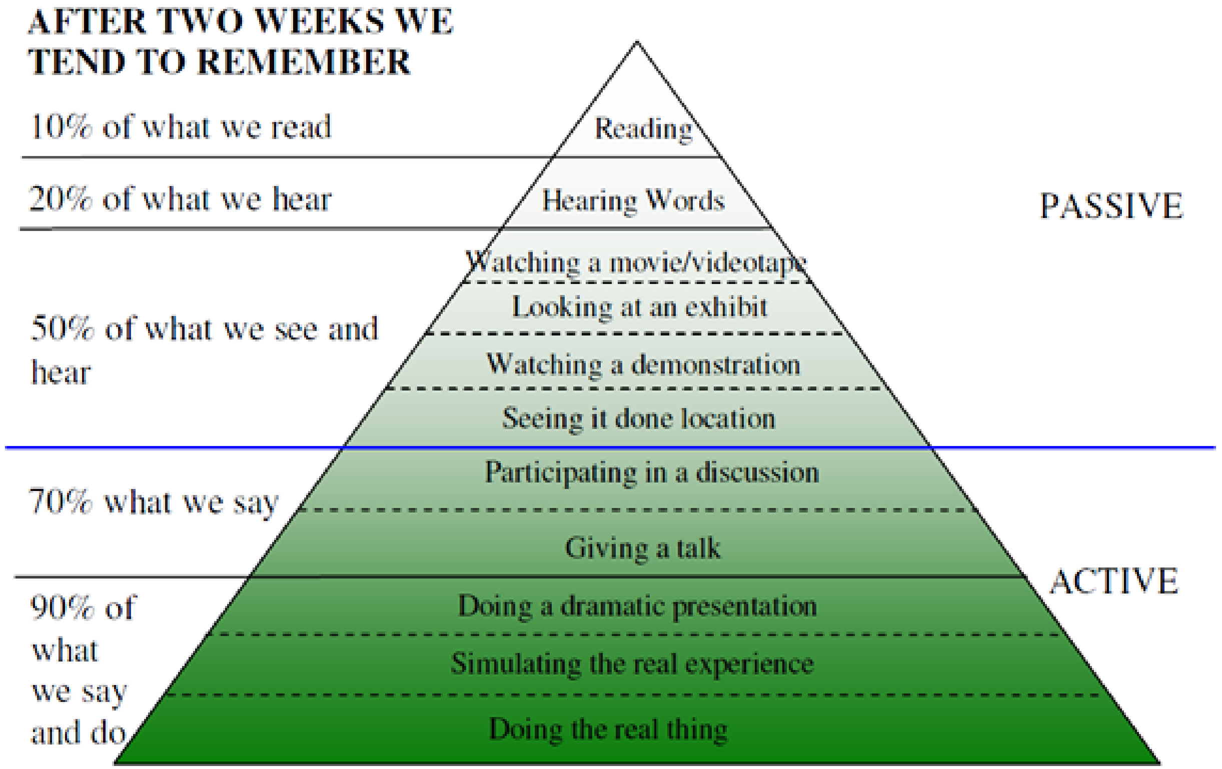
Gaviria, N. (16 de Julio de 2022). Retrieved from Editorial La República:
https://www.larepublica.co/economia/los-celulares-superan-el-total-de-la-poblacion-por-cada-colombiano-hay-1-2-moviles-3403559

From ‘doing’ to ‘simulating’

This gave me x1000 times more access to students

But I’m a Python Developer, not a Mobile Developer

😯



AFTER TWO WEEKS WE TEND TO REMEMBER

10% of what we read — Reading

20% of what we hear — Hearing Words

50% of what we see and hear — Watching a movie/videotape; Looking at an exhibit; Watching a demonstration; Seeing it done location

70% what we say — Participating in a discussion; Giving a talk

90% of what we say and do — Doing a dramatic presentation; Simulating the real experience; Doing the real thing

PASSIVE

ACTIVE

Dale, E. (1969). *Audio-visual methods in teaching* (3 ed.). New York: Holt, Rinehart and Winston.

Exploring an endless list

🥴

Some Technologies / Languages explored

- Java
- Python
- Swift
- Javascript
- Kotlin
- React native

- Ionic
- PhoneGap
- Xamarin
- Sencha
- Flutter

Inmune. (14 de Octubre de 2021). *Lenguajes de programación para móvil*. Retrieved from Immune Technology Institute: https://immune.institute/lenguajes-de-programacion-para-movil/

InnovaAge. (2022). Retrieved from: https://www.innovaportal.com/innovaportal/v/696/1/innova.front/apps-hibridas-vs-nativas-vs-generadas-que-decision-tomar

Sakovich, N. (2022). *Cross-Platform Mobile Development: Five Best Frameworks*. Retrieved from: SaM Solutions: https://www.sam-solutions.com/blog/cross-platform-mobile-development/

Why not Python?

Turtle	docs.python.org/3/library/turtle.html
BeeWare	beeware.org
Kivy	kivy.org
QPython	www.qpython.com
Termux	play.google.com/store/apps
Matplotlib	matplotlib.org
Blender	www.blender.org
Panda3D	www.panda3d.org
Bokeh	bokeh.org
OpenCV	opencv.org
Sandbox	www.sandbox.game

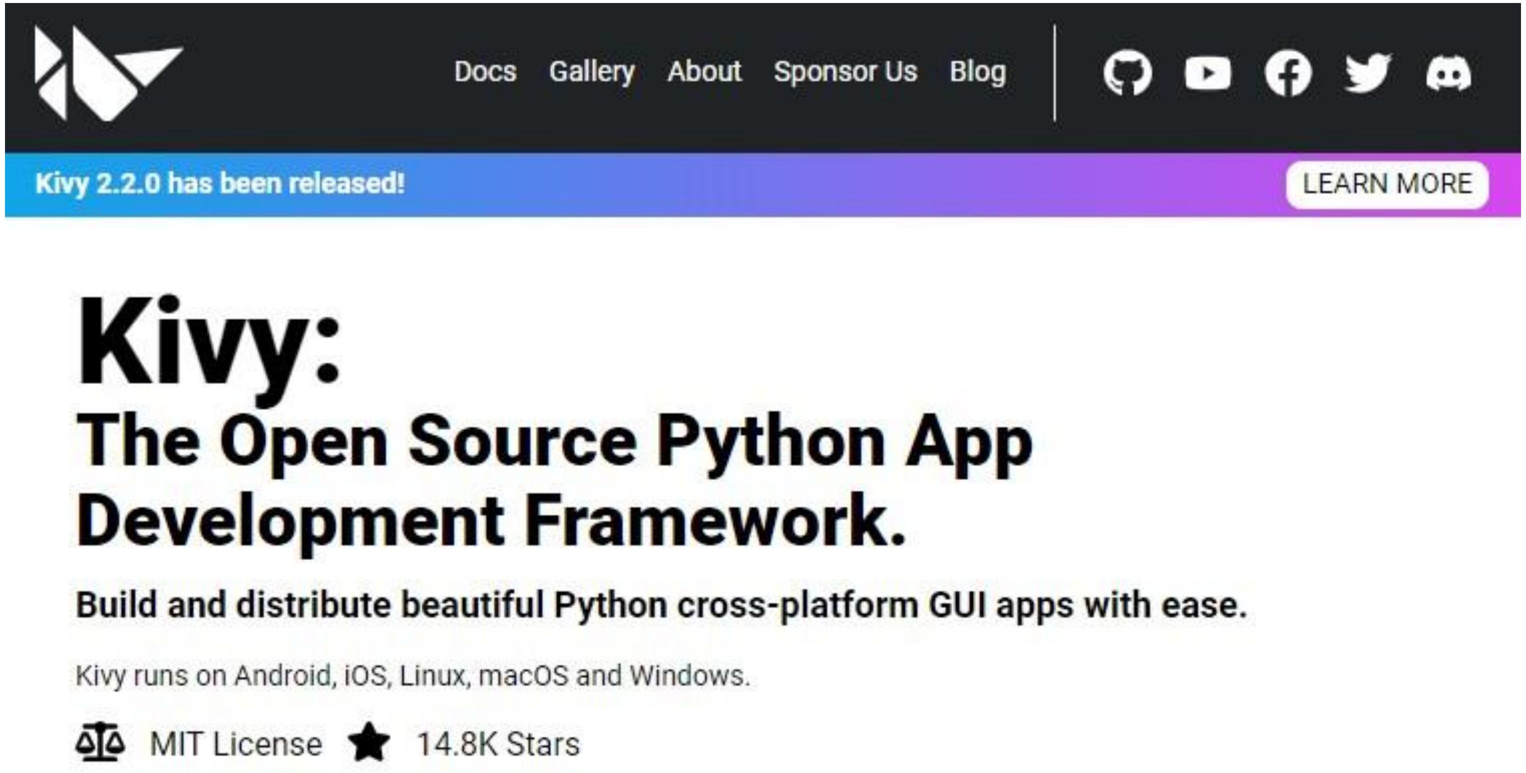
Adabala, P. (26 de Agosto de 2020). *Create and run Python apps on your Android phone*. Retrieved from Opensource: https://opensource.com/article/20/8/python-android-mobile

Farooq, U. (14 de Junio de 2018). *Tools to run Python on Android*. Retrieved from Medium: https://medium.com/@umerfarooq_26378/tools-to-run-python-on-android-9060663972b4

Gui Programming. (5 de Agosto de 2022). *The Python Wiki*. Retrieved from Python Software Foundation: https://wiki.python.org/moin/GuiProgramming

Python on Android. (30 de Agosto de 2022). *The Python Wiki*. Retrieved from Python Software Foundation: https://wiki.python.org/moin/Android

And I chose...



Kivy 2.2.0 has been released!

Kivy:

The Open Source Python App Development Framework.

Build and distribute beautiful Python cross-platform GUI apps with ease.

Kivy runs on Android, iOS, Linux, macOS and Windows.

MIT License ★ 14.8K Stars

Finally

An open-source app

github.com/leocjj/msc_thesis

High availability

play.google.com/store/apps/

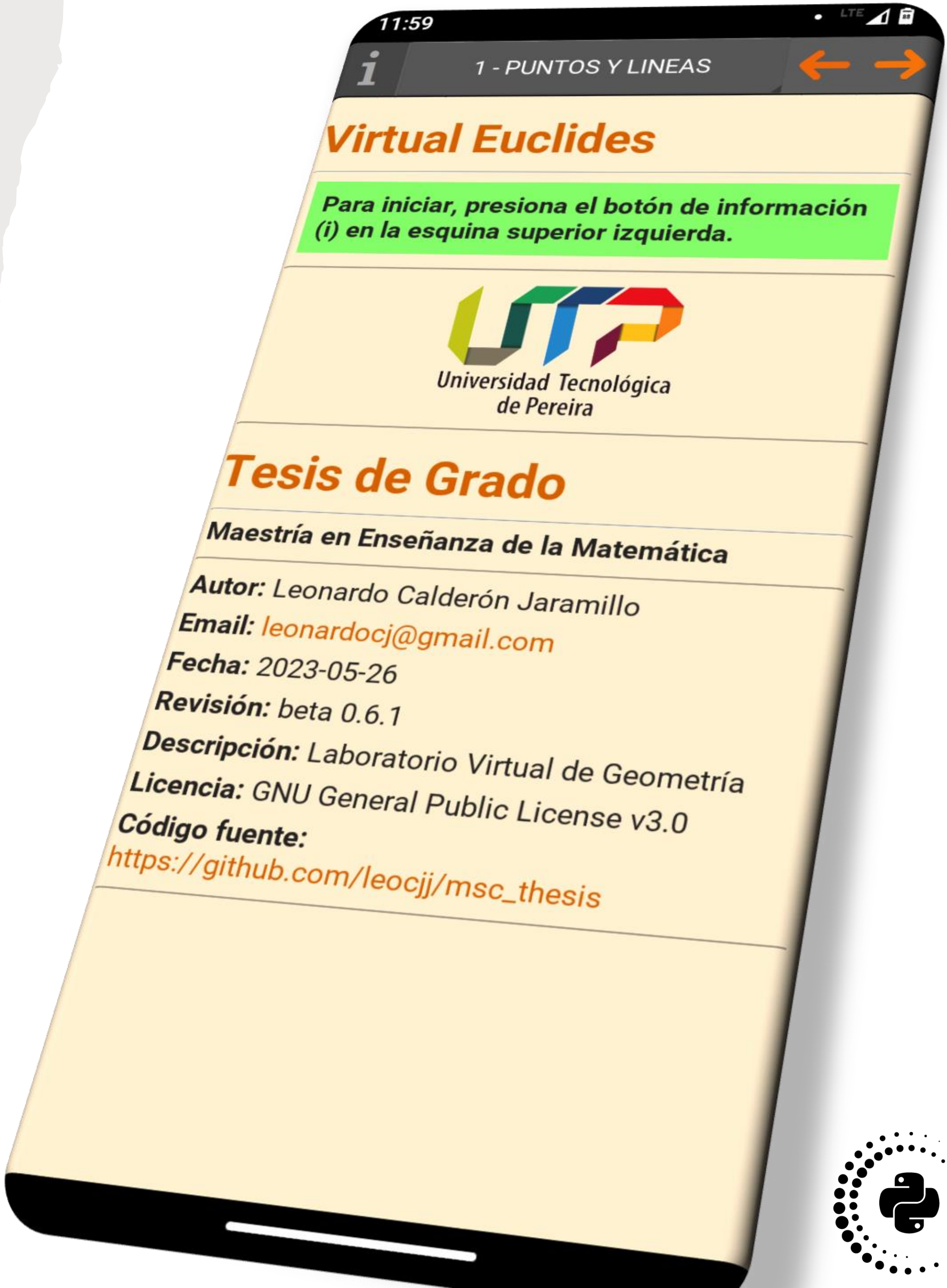
details?id=co.edu.utp.virtualeuclides

Lightweight

less that 20 Mb

Content

2 chapters - 11 sections
40 pages - 29 interactive graphics!!



Virtual Euclides

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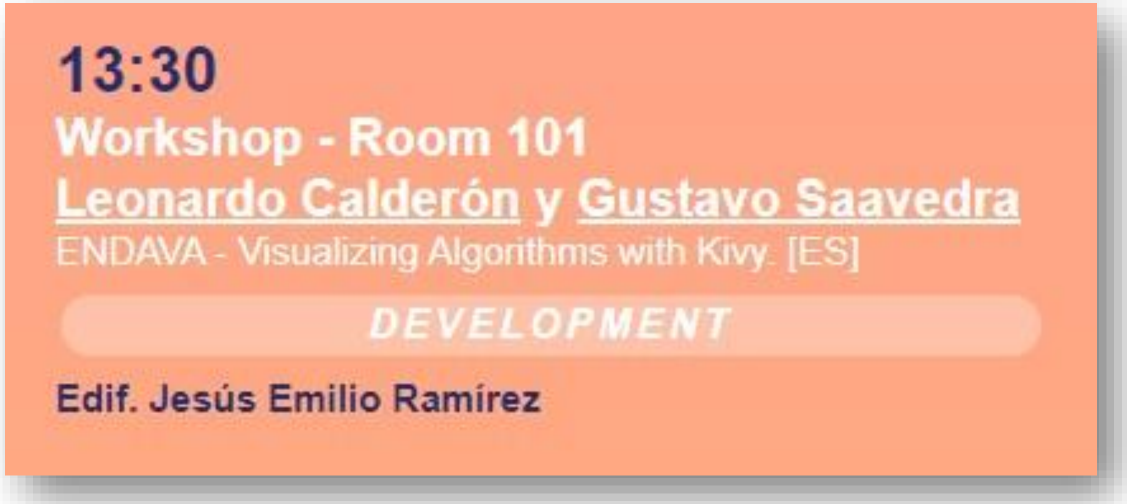
Want to learn more?

An easy environment setup option

```
conda create -n kivy python=3.10
conda activate kivy
conda install kivy -c conda-forge
```



13:30

Workshop - Room 101

Leonardo Calderón y Gustavo Saavedra

ENDAVA - Visualizing Algorithms with Kivy. [ES]

DEVELOPMENT

Edif. Jesús Emilio Ramírez

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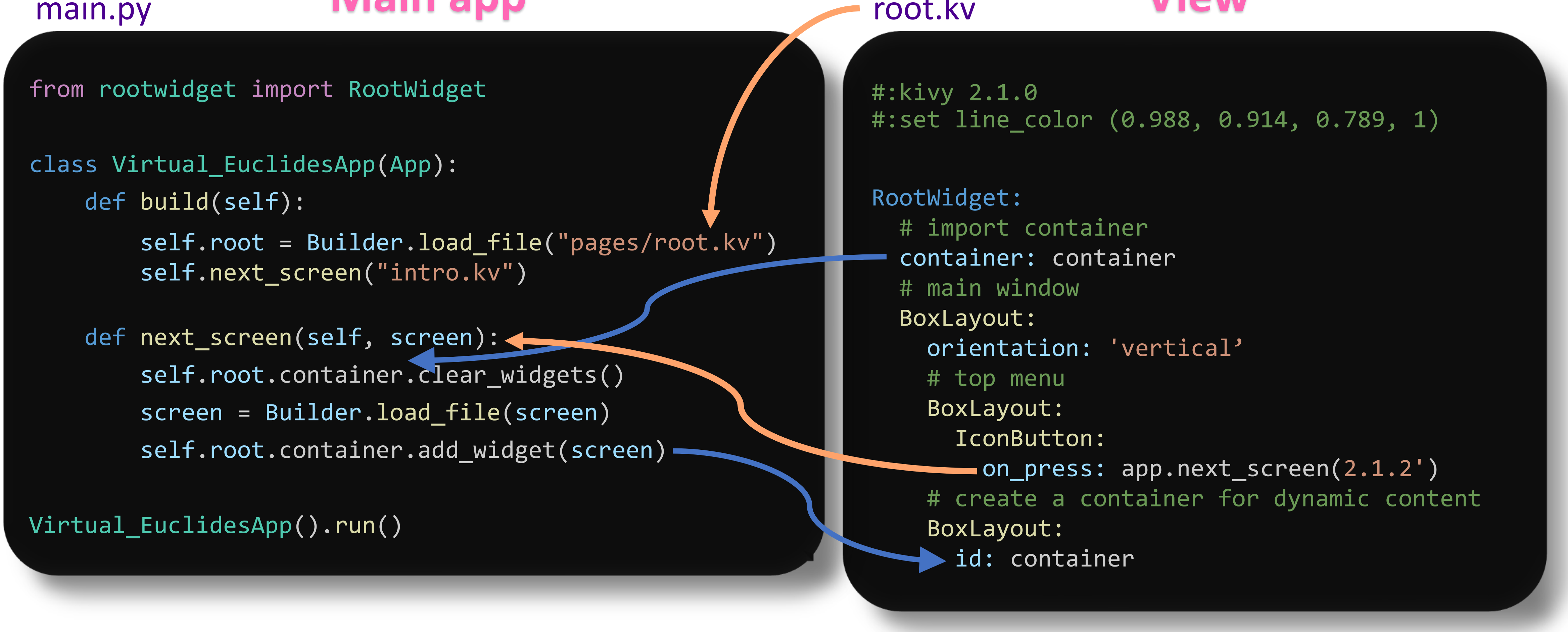
main.py

Main app

root.kv

View



```python
from rootwidget import RootWidget

class Virtual_EuclidesApp(App):
    def build(self):
        self.root = Builder.load_file("pages/root.kv")
        self.next_screen("intro.kv")

    def next_screen(self, screen):
        self.root.container.clear_widgets()
        screen = Builder.load_file(screen)
        self.root.container.add_widget(screen)

Virtual_EuclidesApp().run()
```

```
#:kivy 2.1.0
#:set line_color (0.988, 0.914, 0.789, 1)


RootWidget:
  # import container
  container: container
  # main window
  BoxLayout:
    orientation: 'vertical’
    # top menu
    BoxLayout:
      IconButton:
        on_press: app.next_screen(2.1.2')
    # create a container for dynamic content
    BoxLayout:
      id: container
```

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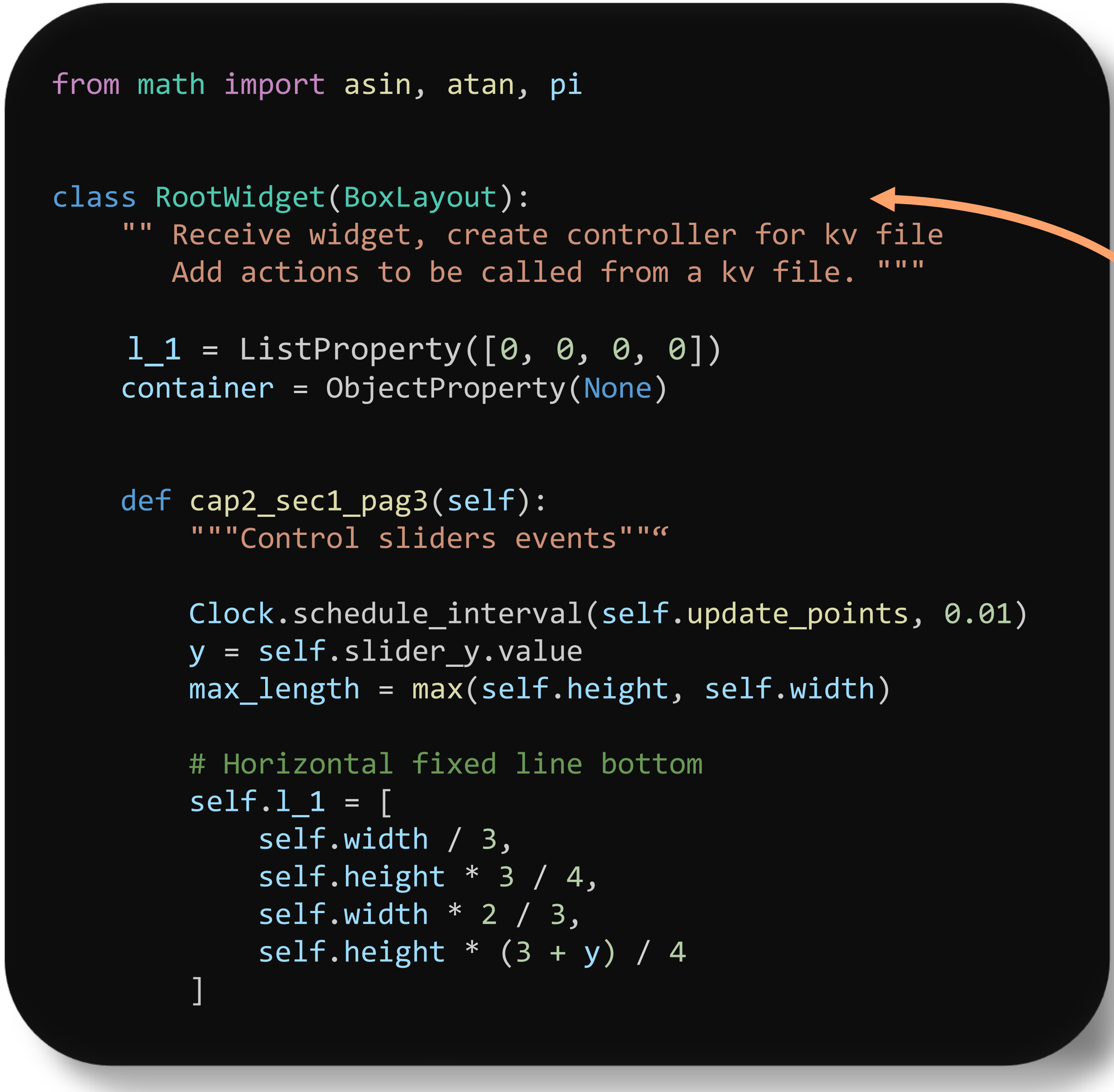
rootwidget.py

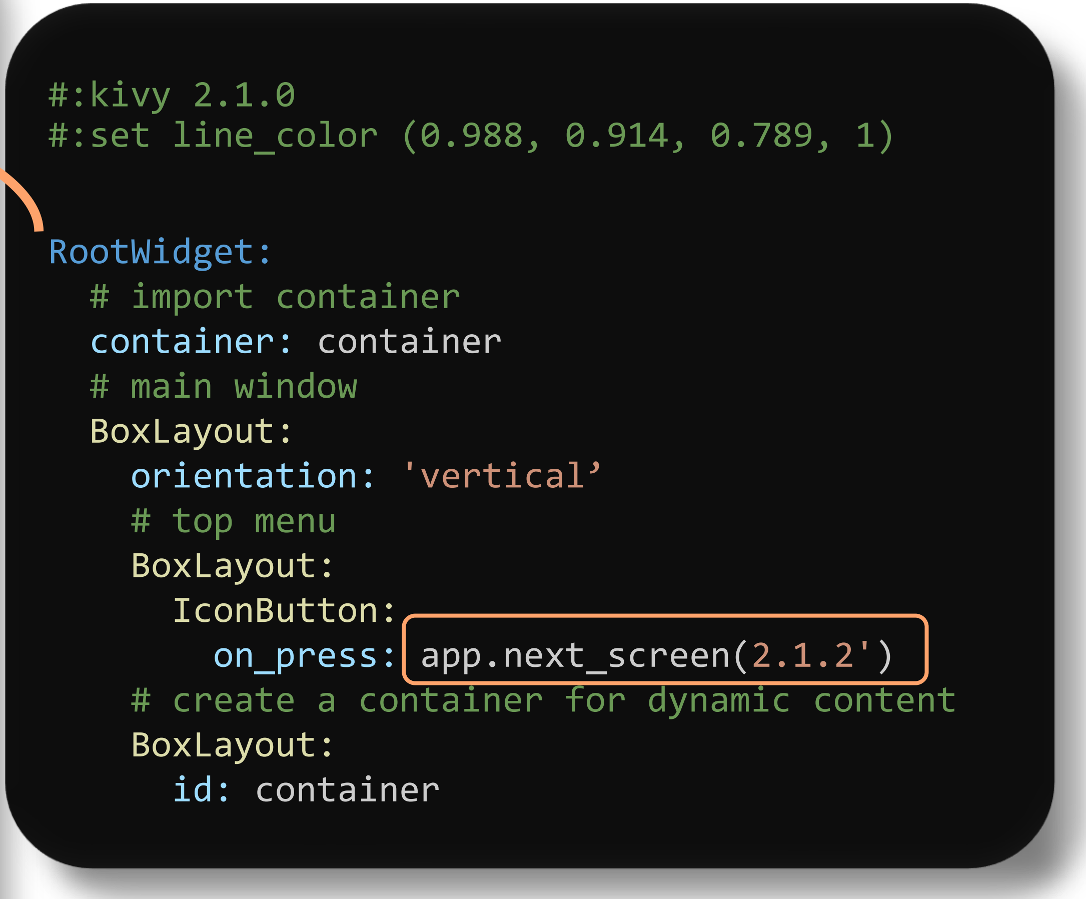
Controller



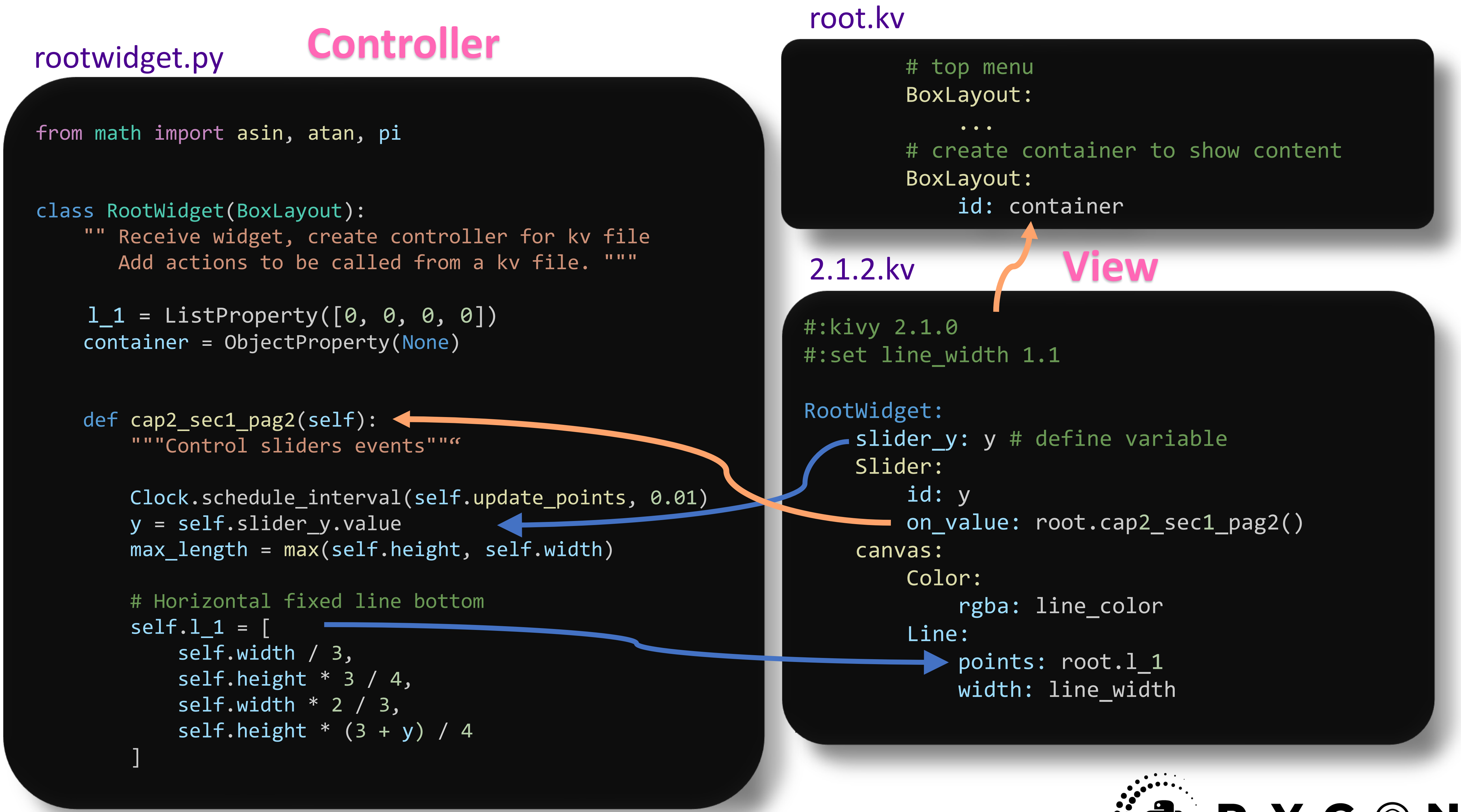
```python
from math import asin, atan, pi


class RootWidget(BoxLayout):
    "" Receive widget, create controller for kv file
       Add actions to be called from a kv file. """

    l_1 = ListProperty([0, 0, 0, 0])
    container = ObjectProperty(None)


    def cap2_sec1_pag3(self):
        """Control sliders events""“

        Clock.schedule_interval(self.update_points, 0.01)
        y = self.slider_y.value
        max_length = max(self.height, self.width)

        # Horizontal fixed line bottom
        self.l_1 = [
            self.width / 3,
            self.height * 3 / 4,
            self.width * 2 / 3,
            self.height * (3 + y) / 4
        ]
```

root.kv

View



```
#:kivy 2.1.0
#:set line_color (0.988, 0.914, 0.789, 1)

RootWidget:
  # import container
  container: container
  # main window
  BoxLayout:
    orientation: 'vertical’
    # top menu
    BoxLayout:
      IconButton:
        on_press: app.next_screen(2.1.2')
    # create a container for dynamic content
    BoxLayout:
      id: container
```



rootwidget.py

Controller

```python
from math import asin, atan, pi


class RootWidget(BoxLayout):
    "" Receive widget, create controller for kv file
       Add actions to be called from a kv file. """

    l_1 = ListProperty([0, 0, 0, 0])
    container = ObjectProperty(None)


    def cap2_sec1_pag2(self):
        """Control sliders events""“

        Clock.schedule_interval(self.update_points, 0.01)
        y = self.slider_y.value
        max_length = max(self.height, self.width)

        # Horizontal fixed line bottom
        self.l_1 = [
            self.width / 3,
            self.height * 3 / 4,
            self.width * 2 / 3,
            self.height * (3 + y) / 4
        ]
```

root.kv

```
        # top menu
        BoxLayout:
            ...
        # create container to show content
        BoxLayout:
            id: container
```

2.1.2.kv

View

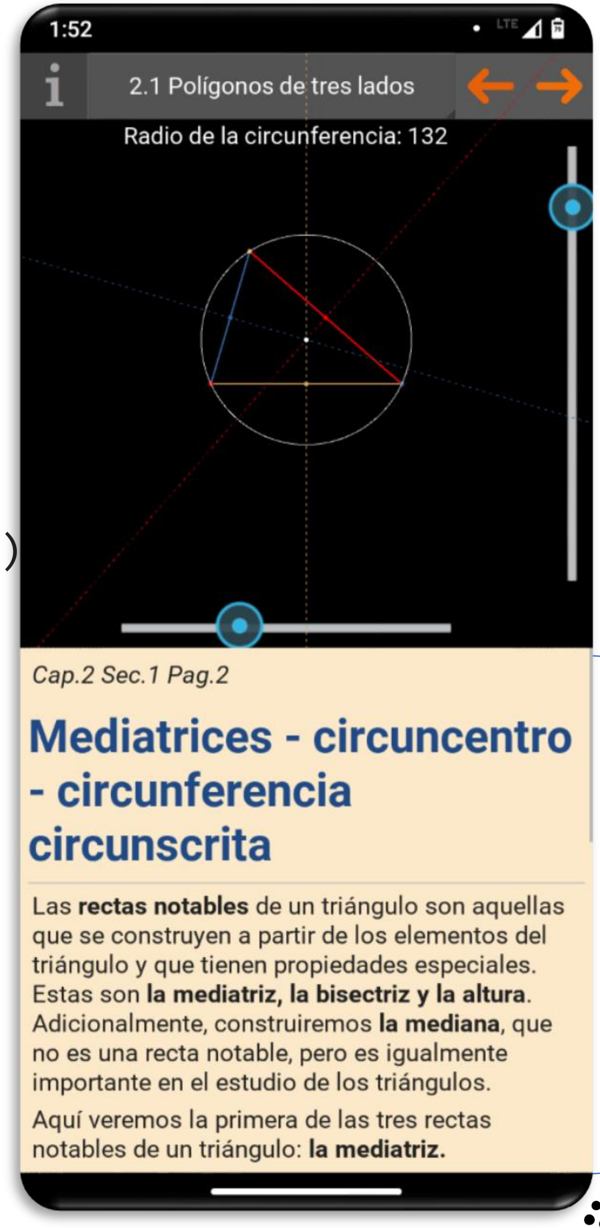
```
#:kivy 2.1.0
#:set line_width 1.1

RootWidget:
    slider_y: y # define variable
    Slider:
        id: y
        on_value: root.cap2_sec1_pag2()
    canvas:
        Color:
            rgba: line_color
        Line:
            points: root.l_1
            width: line_width
```

root.kv

```
# top menu
BoxLayout:



# for content
BoxLayout:
    id: container
```

2.1.2.kv

```
RootWidget:

  slider_y: y

  Slider:
    id: y
    on_value:
      root.cap2_sec1_pag2()

  canvas:
    Color:
      rgba: line_color
    Line:
      points: root.l_1

  RstDocument:
    source: “2.1.2.rst"
```



1:52

2.1 Polígonos de tres lados

Radio de la circunferencia: 132

Cap.2 Sec.1 Pag.2

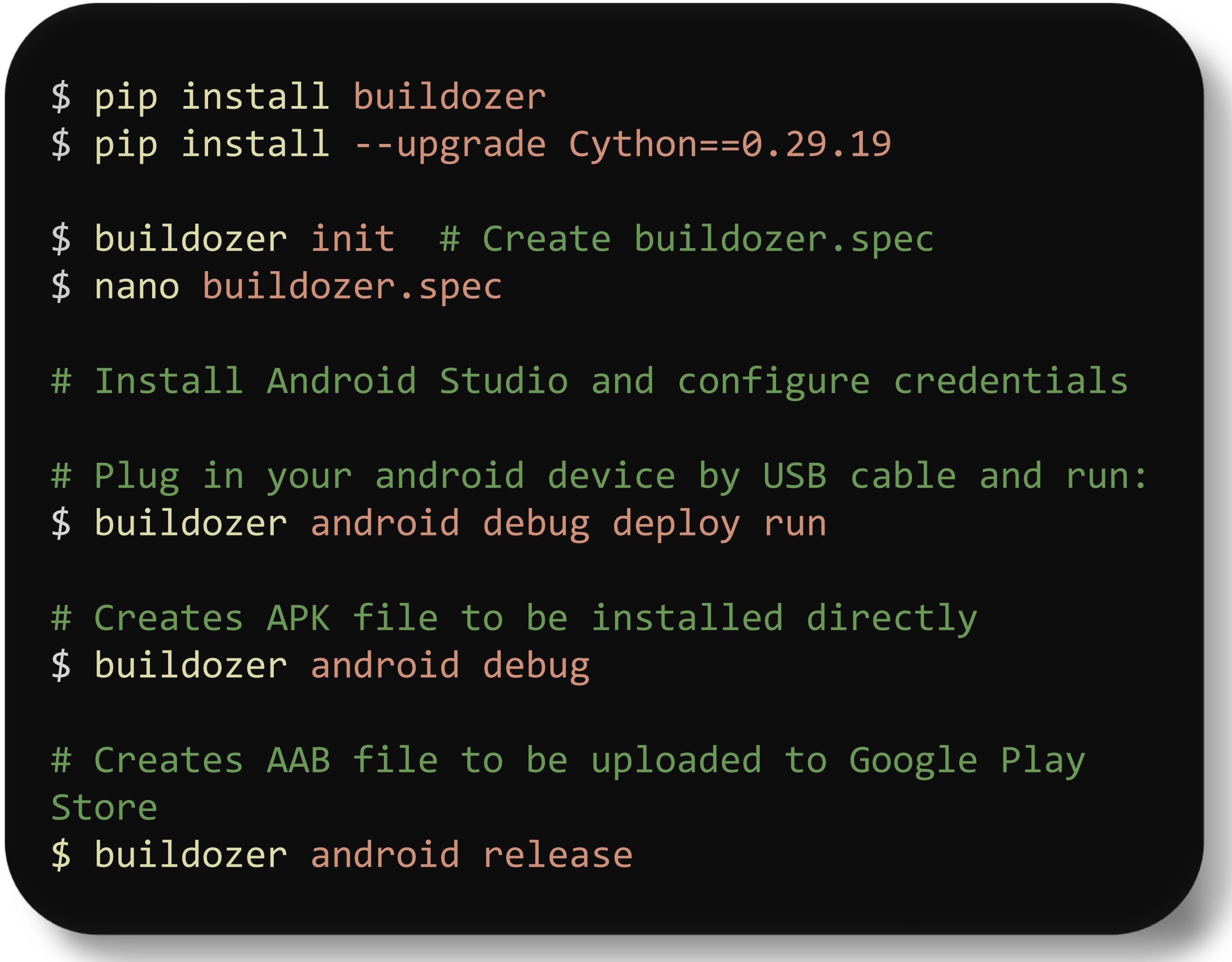
Mediatrices - circuncentro - circunferencia circunscrita

Las **rectas notables** de un triángulo son aquellas que se construyen a partir de los elementos del triángulo y que tienen propiedades especiales. Estas son **la mediatriz, la bisectriz y la altura**. Adicionalmente, construiremos **la mediana**, que no es una recta notable, pero es igualmente importante en el estudio de los triángulos.

Aquí veremos la primera de las tres rectas notables de un triángulo: **la mediatriz.**

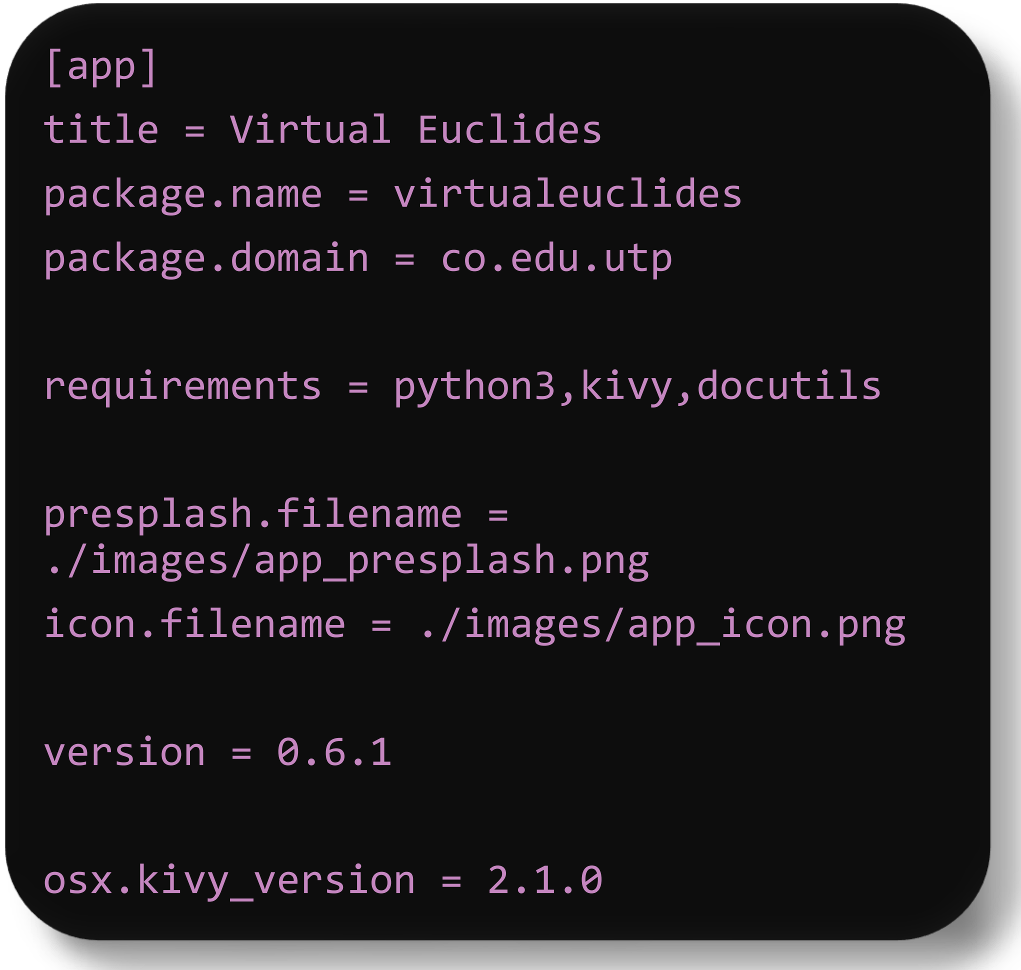
2.1.2.rst
ReStructuredText

Deployment



```
$ pip install buildozer
$ pip install --upgrade Cython==0.29.19

$ buildozer init  # Create buildozer.spec
$ nano buildozer.spec

# Install Android Studio and configure credentials

# Plug in your android device by USB cable and run:
$ buildozer android debug deploy run

# Creates APK file to be installed directly
$ buildozer android debug

# Creates AAB file to be uploaded to Google Play
Store
$ buildozer android release
```

buildozer.spec

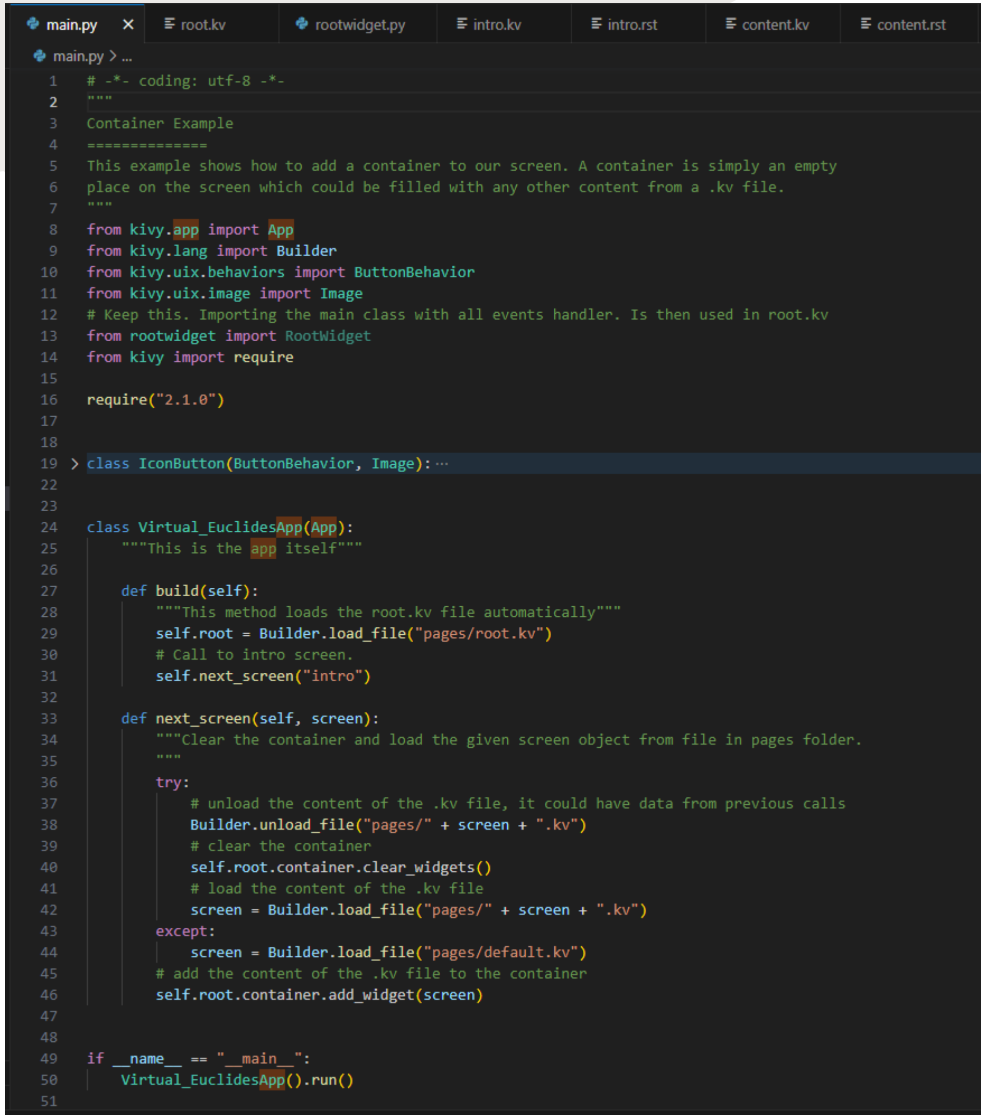


```
[app]
title = Virtual Euclides
package.name = virtualeuclides
package.domain = co.edu.utp

requirements = python3,kivy,docutils

presplash.filename =
./images/app_presplash.png
icon.filename = ./images/app_icon.png

version = 0.6.1

osx.kivy_version = 2.1.0
```

Demo time

VS Code

kv_101



```python
# -*- coding: utf-8 -*-
"""
Container Example
==============
This example shows how to add a container to our screen. A container is simply an empty
place on the screen which could be filled with any other content from a .kv file.
"""
from kivy.app import App
from kivy.lang import Builder
from kivy.uix.behaviors import ButtonBehavior
from kivy.uix.image import Image
# Keep this. Importing the main class with all events handler. Is then used in root.kv
from rootwidget import RootWidget
from kivy import require

require("2.1.0")


class IconButton(ButtonBehavior, Image):...


class Virtual_EuclidesApp(App):
    """This is the app itself"""

    def build(self):
        """This method loads the root.kv file automatically"""
        self.root = Builder.load_file("pages/root.kv")
        # Call to intro screen.
        self.next_screen("intro")

    def next_screen(self, screen):
        """Clear the container and load the given screen object from file in pages folder.
        """
        try:
            # unload the content of the .kv file, it could have data from previous calls
            Builder.unload_file("pages/" + screen + ".kv")
            # clear the container
            self.root.container.clear_widgets()
            # load the content of the .kv file
            screen = Builder.load_file("pages/" + screen + ".kv")
        except:
            screen = Builder.load_file("pages/default.kv")
        # add the content of the .kv file to the container
        self.root.container.add_widget(screen)


if __name__ == "__main__":
    Virtual_EuclidesApp().run()

```

Demo using scrcpy

Connect USB

cmd

> scrcpy

github.com/Genymobile/scrcpy

Thank you!!

Leonardo Calderon
Senior Developer at Endava

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leonardocj@gmail.com
linkedin.com/in/leonardocj/