Object-oriented & Graphical user interface

面向对象和图形用户界面

Department of Computer Science and Technology

Department of University Basic Computer Teaching

用Python玩转数据

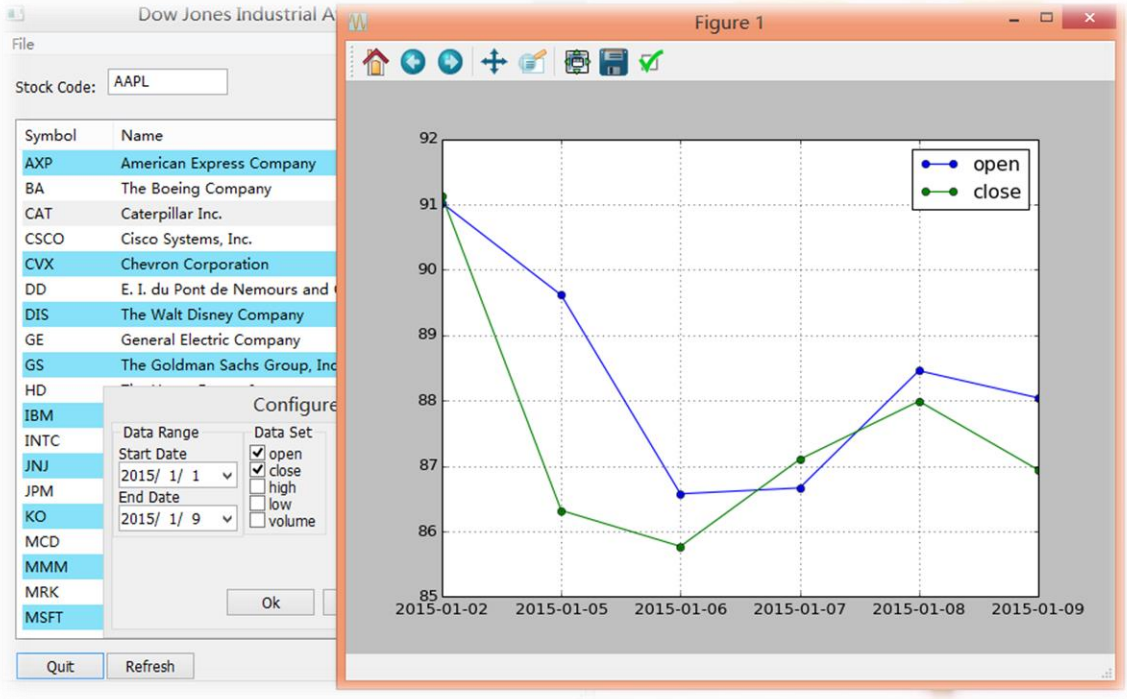
1 GUI与面向对象

字符用户界面


```
6  def func():
7      '''add function'''
8      list1 = []
9      print 'input the numbers:'
10     while 1:
11         a = raw_input()
12         if a == '.':
13             break
14         list1.append(eval(a))
15     sumList = sum(list1)
16     return sumList
```

```
Type "scientific" for more details.
>>> runfile('C:/Python/PPT/week7/iopro.py', wdir=r'
C:/Python/PPT/week7')
>>> func()
input the numbers:
3
5
6
7
.
21
```

图形用户界面


Dow Jones Industrial A
File
Stock Code:
AAPL
Symbol
Name
AXP
American Express Company
BA
The Boeing Company
CAT
Caterpillar Inc.
CSCO
Cisco Systems, Inc.
CVX
Chevron Corporation
DD
E. I. du Pont de Nemours and
DIS
The Walt Disney Company
GE
General Electric Company
GS
The Goldman Sachs Group, Inc
HD
IBM
INTC
JNJ
JPM
KO
MCD
MMM
MRK
MSFT
Configure
Data Range
Start Date
2015/ 1/ 1
End Date
2015/ 1/ 9
Data Set
open
close
high
low
volume
Ok
Quit
Refresh
Figure 1
92
91
90
89
88
87
86
85
2015-01-02
2015-01-05
2015-01-06
2015-01-07
2015-01-08
2015-01-09
open
close

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抽象

面向对象

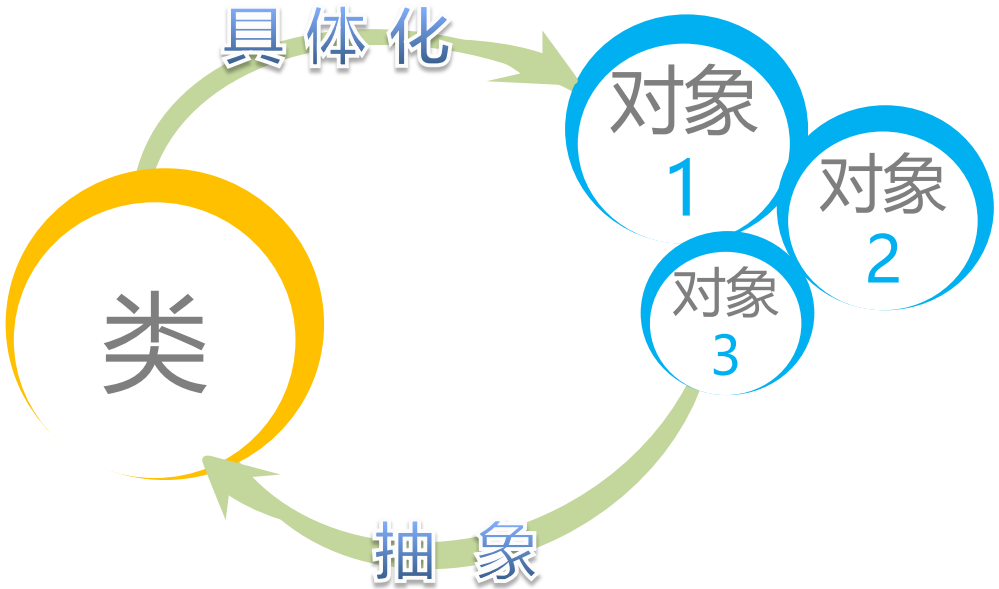
- 对象（实例）
  - 由数据及能对其实施的操作所构成的封装体
- 类
  - 类描述了对象的特征（数据和操作）

- 有名字
- 有矩形框
- 鼠标点击时有效果

- 功能不同：刷新、退出

面向对象 之 抽象

类与对象的关系



类的定义

Source

```
class ClassName(object):
    'define ClassName class'
    class_suite
```

Source

```
class MyDate(object):
    'this is a  very simple
    example class'
    pass
```

万类之源——object

类的方法

- 类的方法定义

Source

```
>>> class Dog(object):
        def greet(self):
            print 'Hi!'
```

实例（Instances）

Source

```
>>> class Dog(object):
        def greet(self):
            print 'Hi!'
```

Source

```
>>> dog = Dog()
>>> dog.greet()
```

- 实例的创建——通过调用类对象
  1. 定义类——Dog
  2. 创建一个实例——dog
  3. 通过实例使用属性或方法——dog.greet

实例属性（Instance Attributes）

File

```
# Filename: doginsta.py
class Dog(object):
    "define Dog class"
    def setName(self, name):
        self.name = name
    def greet(self):
        print "Hi, I am called %s." % self.name
if __name__ == '__main__':
    dog = Dog()
    dog.setName("Paul")
    dog.greet()
```

Output:
Hi, I am called Paul.

对象的初始化方法 __init__()

01 当类被调用后，Python将创建实例对象

02 创建完对象以后，Python自动调用的第一个方法为__init__()

03 实例对象作为方法的第一个参数（self）被传递进去，调用类创建实例对象时的参数都传给__init__()

__init__()举例

File

```
# Filename: doginsta.py
class Dog(object):
    "define Dog class"
    def __init__(self, name):
        self.name = name
    def greet(self):
        print "Hi, I am called %s." % self.name
if __name__ == '__main__':
    dog = Dog("Sara")
    dog.greet()
```

Output:
Hi, I am called Sara.

类属性（Class Attributes）

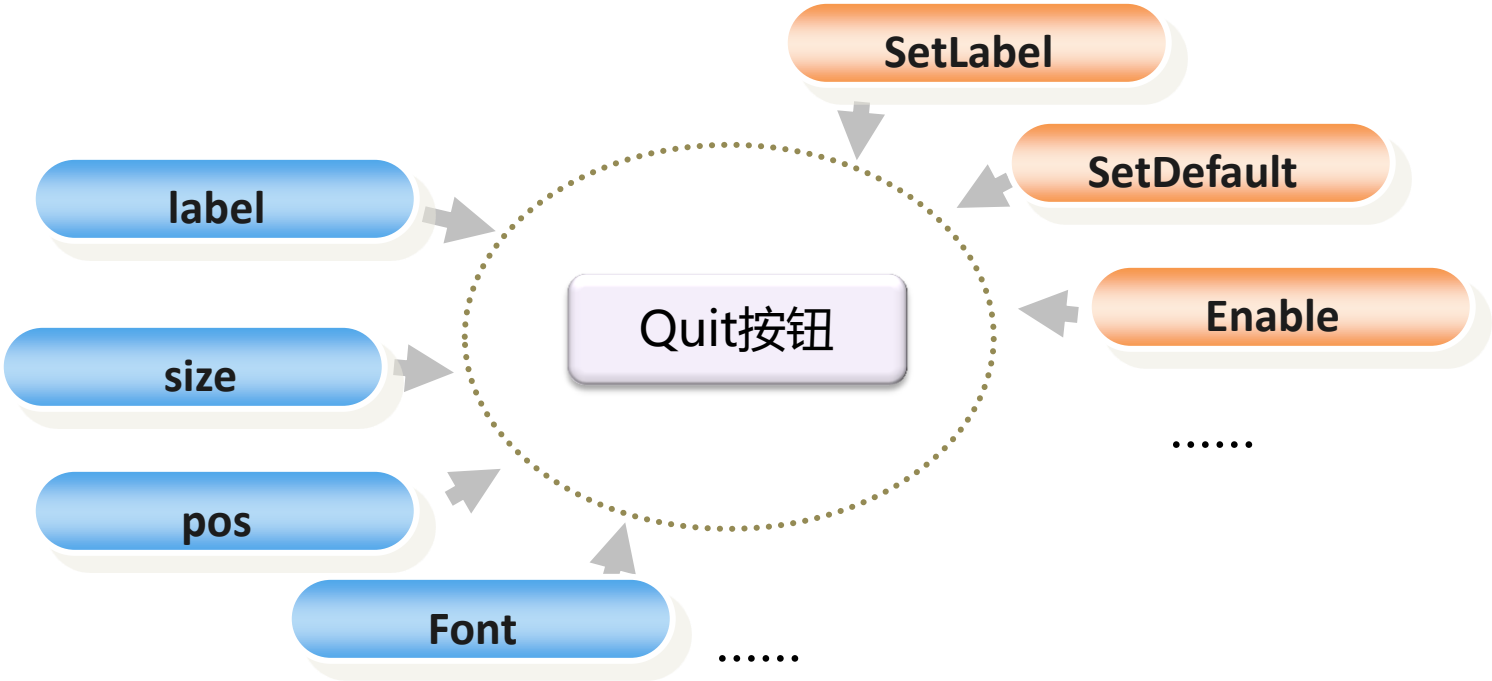
- 类的数据属性（静态成员）

  仅仅是所定义的类的变量
- 在类创建后被使用
- 可以由类中的方法来更新，也可以在主程序中更新
- 类属性和实例无关，修改类属性需要使用类名

File

```
# Filename: doginsta.py
class Dog(object):
   "define Dog class“
   counter = 0
   def __init__(self, name):
      self.name = name
      Dog.counter += 1
   def greet(self):
      print "Hi, I am %s, my number is %d" % (self.name,
Dog.counter)
if __name__ == '__main__':
    dog = Dog("Zara")
    dog.greet()
```

以按钮（Button）为例



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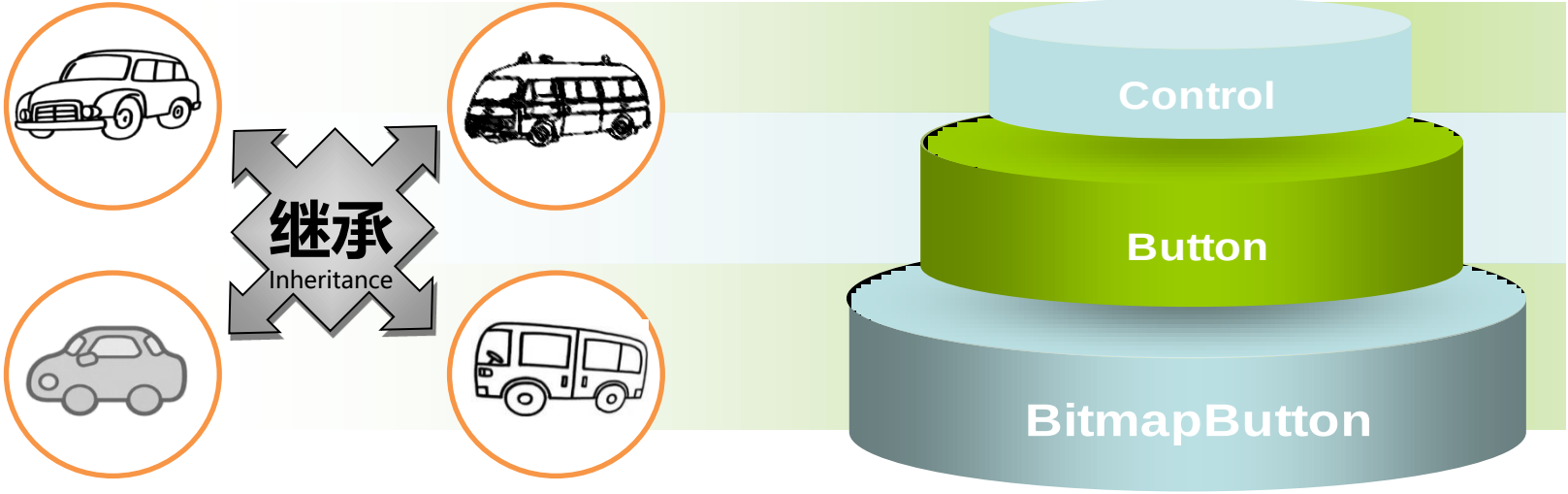
继承

父类（基类）子类（派生类）

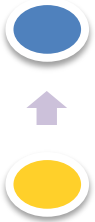


子类的定义

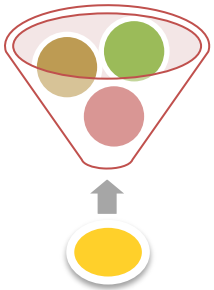
Source

```
class SubClassName (ParentClass1[, ParentClass2, ...]):
    'optional class documentation string'
    class_suite
```

单继承



多继承



子类定义举例和重载

File

```
# Filename: doginsta.py
class Dog(object):
    "define Dog class“
    counter = 0
    def __init__(self, name):
        self.name = name
        Dog.counter += 1
    def greet(self):
        print "Hi, I am %s, my number is %d" %
                (self.name, Dog.counter)
```

File

```
# Filename: overridepro.py
class BarkingDog (Dog):
    "define subclass BarkingDog"
    def greet(self):
        "initial subclass"
         print "Woof! I am %s, my number is
%d" % (self.name, Dog.counter)
if __name__ == '__main__':
    dog = BarkingDog("Zoe")
    dog.greet()
```

私有属性和方法

- 默认情况下，Python 类的成员属性与方法都是“public”
- 提供“访问控制符”来限定成员函数的访问
  - 双下划线(__)

    __var属性会被__classname_var替换，将防止父类与子类中的同名冲突
  - 单下划线(_)

    在属性名前使用一个单下划线字符，防止模块的属性用“from mymodule import *”来加载

用Python玩转数据

GUI的基本框架

创建一个简单的wxPython程序

File

```
# Filename: firstwxPython.py
import wx
app = wx.App()
frame = wx.Frame(None, title = "Hello, World!")
frame.Show(True)
app.MainLoop()
```

上例也可改为：

```
# Filename: mouse.py
import wx

class MyApp(wx.App):
    def OnInit(self):
        frame = wx.Frame(None, title = "Hello, World!")
        frame.Show()
        return True
if __name__ == '__main__':
    app = MyApp()
    app.MainLoop()
```

应用程序对象也可以是wx.App的子类的一个实例

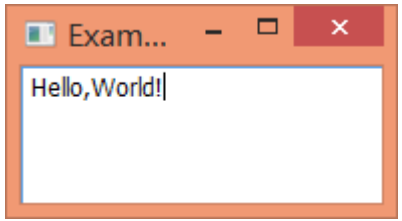
组件

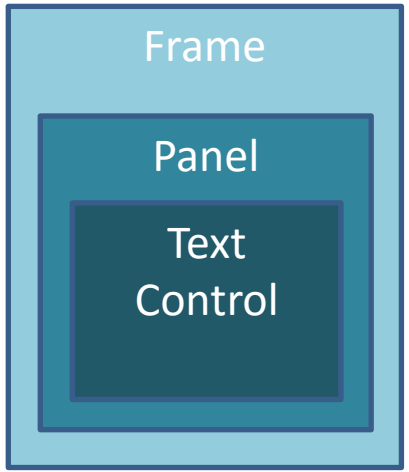
- 组件容器（Containers）——用于容纳其它组件
  - 例：wx.Panel等
- 动态组件（Dynamic Widgets）——可以被用户编辑
  - 例：wx.Button、wx.TextCtrl、wx.ListBox等
- 静态组件（Static Widgets）——显示信息用，不能被用户编辑
  - 例：wx.StaticBitmap、wx.StaticText、wxStaticLine等
- 其它组件
  - 例：wx.ToolBar、wx.MenuBar、wx.StatusBar

又见“Hello，World！”

File

```
# Filename: helloworld.py
import wx
class Frame1(wx.Frame):
    def __init__(self,superior):
        wx.Frame.__init__(self, parent = superior, title = "Example", pos=
(100,200), size= (200,100))
        panel = wx.Panel(self)
        text1= wx.TextCtrl(panel, value = "Hello, World!", size = (200,100))
if __name__ == '__main__':
    app =wx.App()
    frame = Frame1(None)
    frame.Show(True)
    app.MainLoop()
```





事件处理机制(Event Handling)

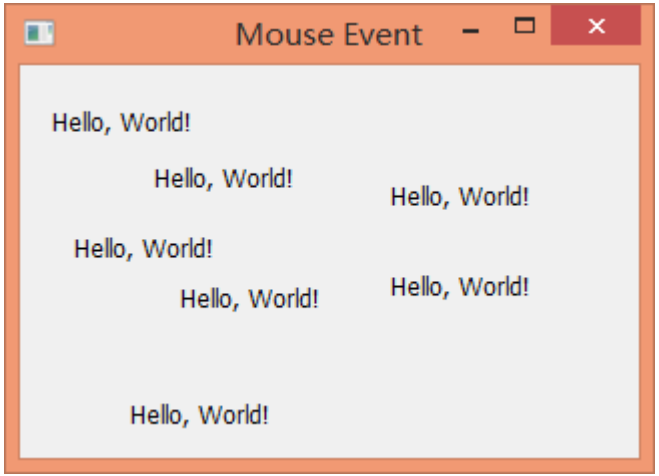
- GUI程序工作的基本机制之一——事件处理
- 事件
  - 移动鼠标，按下鼠标左键、单击按钮等
  - 可以由用户操作触发产生，也可以在程序中创建对象产生
- wxPython程序将特定类型的事件关联到特定的一块代码（方法），当该类型的事件产生时，相关代码将响应事件被自动执行
  - 例：当产生鼠标移动事件时，OnMove()方法将被自动调用

还是Hello, World!

File

```
# Filename: mouse.py
import wx
class Frame1(wx.Frame):
    def __init__(self,superior):
        … …
        self.panel.Bind(wx.EVT_LEFT_UP, self.OnClick)
    def OnClick(self, event):
        posm = event.GetPosition()
        wx.StaticText(parent = self.panel,label = "Hello, World!",pos = (posm.x, posm.y))

…… #create app and frame, show and execute event loop
```



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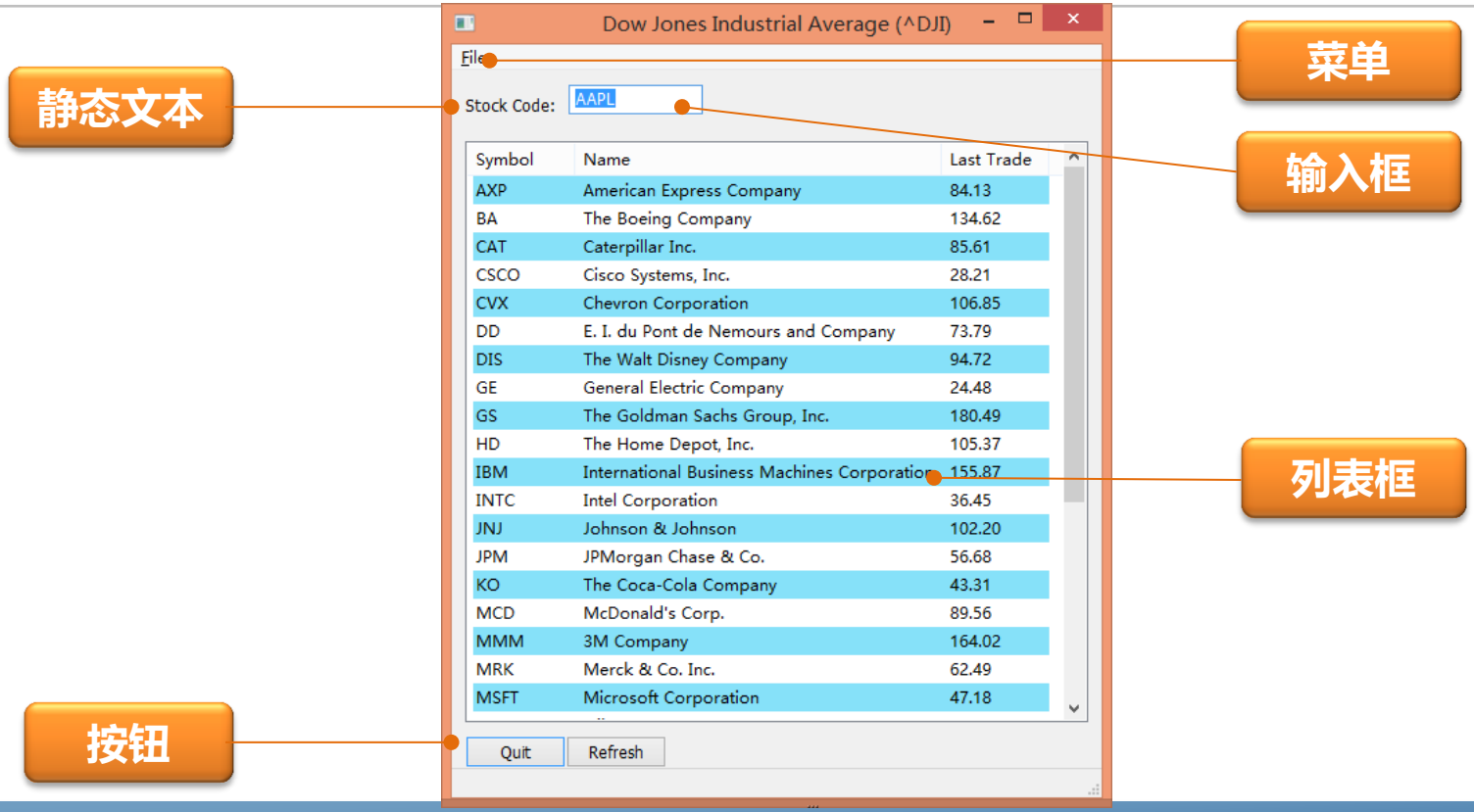
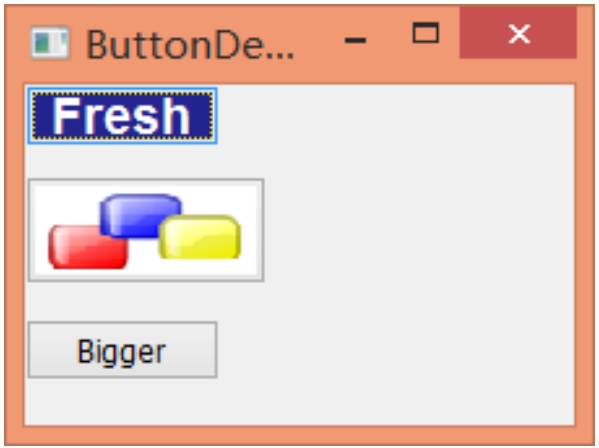
GUI常用组件

应用程序示例


静态文本
菜单
输入框
列表框
按钮
Dow Jones Industrial Average (^DJI)
File
Stock Code:
AAPL
Symbol
Name
Last Trade
AXP American Express Company 84.13
BA The Boeing Company 134.62
CAT Caterpillar Inc. 85.61
CSCO Cisco Systems, Inc. 28.21
CVX Chevron Corporation 106.85
DD E. I. du Pont de Nemours and Company 73.79
DIS The Walt Disney Company 94.72
GE General Electric Company 24.48
GS The Goldman Sachs Group, Inc. 180.49
HD The Home Depot, Inc. 105.37
IBM International Business Machines Corporation 155.87
INTC Intel Corporation 36.45
JNJ Johnson & Johnson 102.20
JPM JPMorgan Chase & Co. 56.68
KO The Coca-Cola Company 43.31
MCD McDonald's Corp. 89.56
MMM 3M Company 164.02
MRK Merck & Co. Inc. 62.49
MSFT Microsoft Corporation 47.18
Quit
Refresh

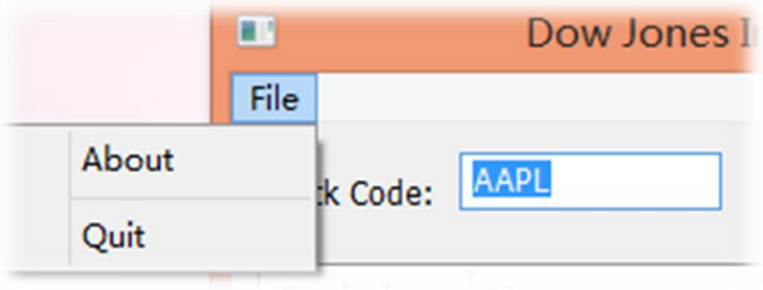
按钮（Button及其家族）

- 功能：接受用户的点击事件，触发相应的操作。
- 常用按钮：
  - wx.Button：文本按钮
  - wx.BitmapButton：位图按钮
  - wx.ToggleButton：开关按钮
- 绑定处理按钮点击的事件



菜单（Menu及其组件）

- 菜单
  - 菜单栏
  - 菜单
  - 菜单项命令
- wxPython用于创建菜单的类：
  - wx.MenuBar
  - wx.Menu
  - wx.MenuItem



菜单常用事件

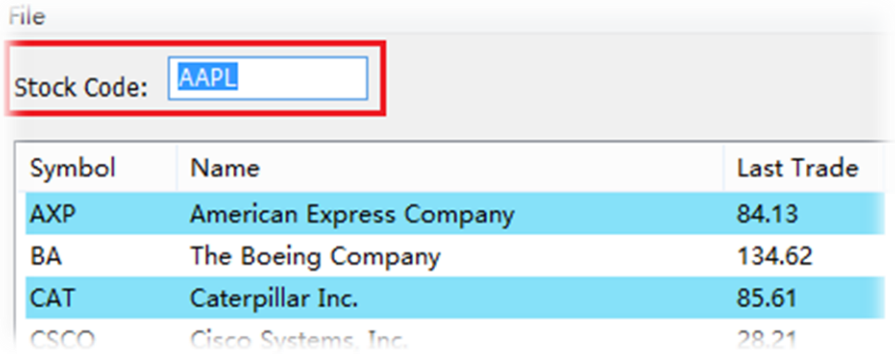
- 菜单事件
  - wx.EVT_MENU

File

```
# Filename: menudemo.py
...

#绑定事件处理器
    self.Bind(wx.EVT_MENU,self.OnClickBigger,biggerItem)
    self.Bind(wx.EVT_MENU,self.OnClickQuit,id=wx.ID_EXIT)
...
#事件处理器
def OnClickBigger(self,e):
    pass
def OnClickQuit(self,e):
    self.Close()
...
```

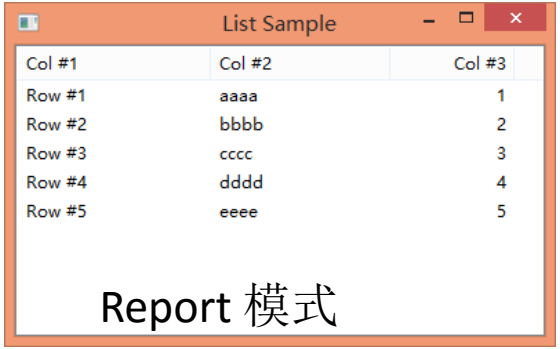
静态文本（StaticText）和文本框（TextCtrl）

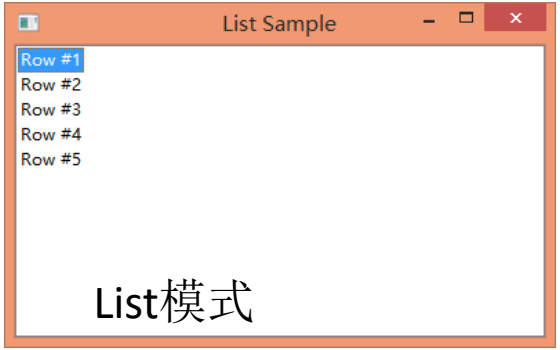
- 文本框用于接收用户在框内输入的信息，或显示由程序提供的信息
- 静态文本框（标签）：
  - 类：wx.StaticText
- 文本框：
  - 类：wx.TextCtrl
  - 常用形式：单行,多行,富文本框



列表（ListCtrl）

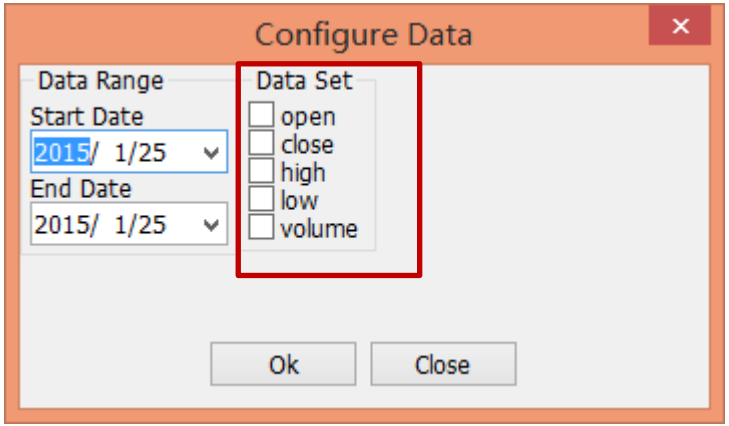
- 列表用于显示多个条目并且可供用户选择
- 列表能够以下面四种不同模式建造：
  - wx.LC_ICON（图标）
  - wx.LC_SMALL_ICON（小图标）
  - wx.LC_LIST（列表）
  - wx.LC_REPORT （报告）





单选（RadioBox）与复选框（CheckBox）

- 复选框用于从一组可选项中，同时选中多个选项
- 对应的，单选框用于从一组互斥的选项中，选取其一



程序示例


```
# Filename: helloworldbtn.py
import wx
class Frame1(wx.Frame):
    def __init__(self,superior):
        wx.Frame.__init__(self, parent = superior, title = "Hello World in wxPython")
        panel = wx.Panel(self)
        sizer = wx.BoxSizer(wx.VERTICAL)
        self.text1= wx.TextCtrl(panel, value = "Hello, World!", size = (200,180), style = wx.TE_MULTILINE)
        sizer.Add(self.text1, 0, wx.ALIGN_TOP | wx.EXPAND)
        button = wx.Button(panel, label = "Click Me")
        sizer.Add(button)
        panel.SetSizerAndFit(sizer)
        panel.Layout()
        self.Bind(wx.EVT_BUTTON,self.OnClick,button)
    def OnClick(self, text):
        self.text1.AppendText("\nHello, World!")
```

用Python玩转数据

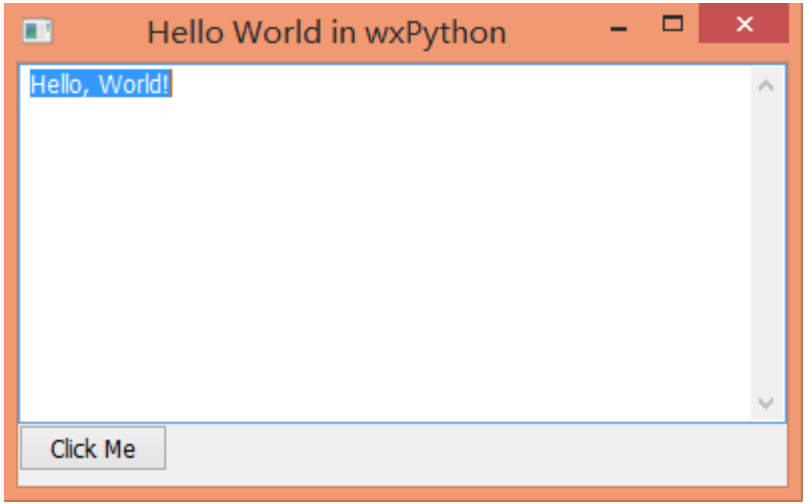
布局管理

布局管理

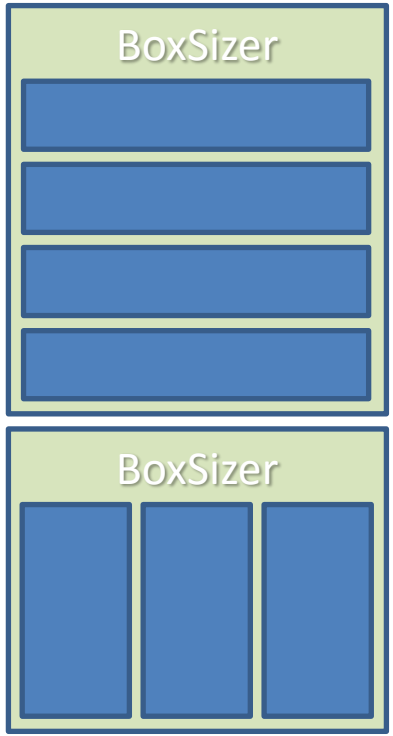
- 绝对定位 - 每个窗口组件被创建时可以显式地指定它的位置和大小
  - 缺点：定位不灵活
  - 调整大小困难
  - 受设备、操作系统甚至字体影响
- 灵活布局的解决方案 - sizer
  - 每个sizer有自己的定位策略
  - 开发者只需要选择合适策略的sizer将窗口组件放入，并且指定好需求即可

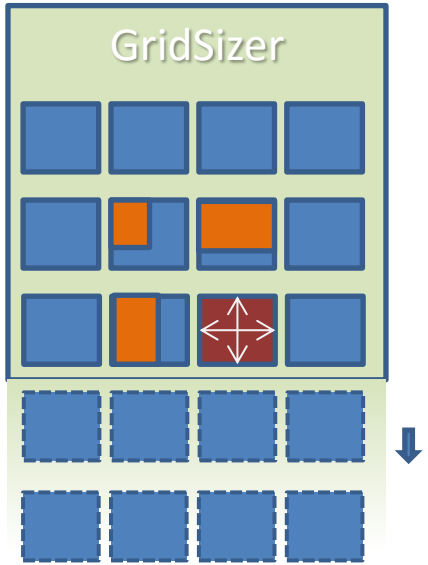
sizer

- sizer本身不是一个容器或一个窗口组件。它只是一个屏幕布局的算法
- sizer允许嵌套
- wxPython常用的sizer
  - wx.BoxSizer
  - wx.FlexGridSizer
  - wx.GridSizer
  - wx.GridBagSizer
  - wx.StaticBoxSizer

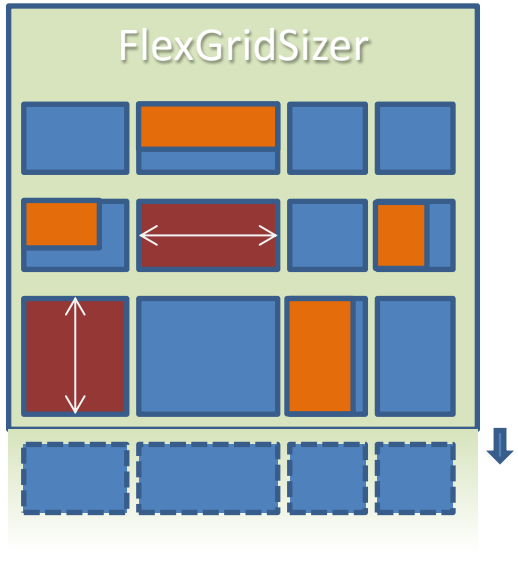


各种sizer示意



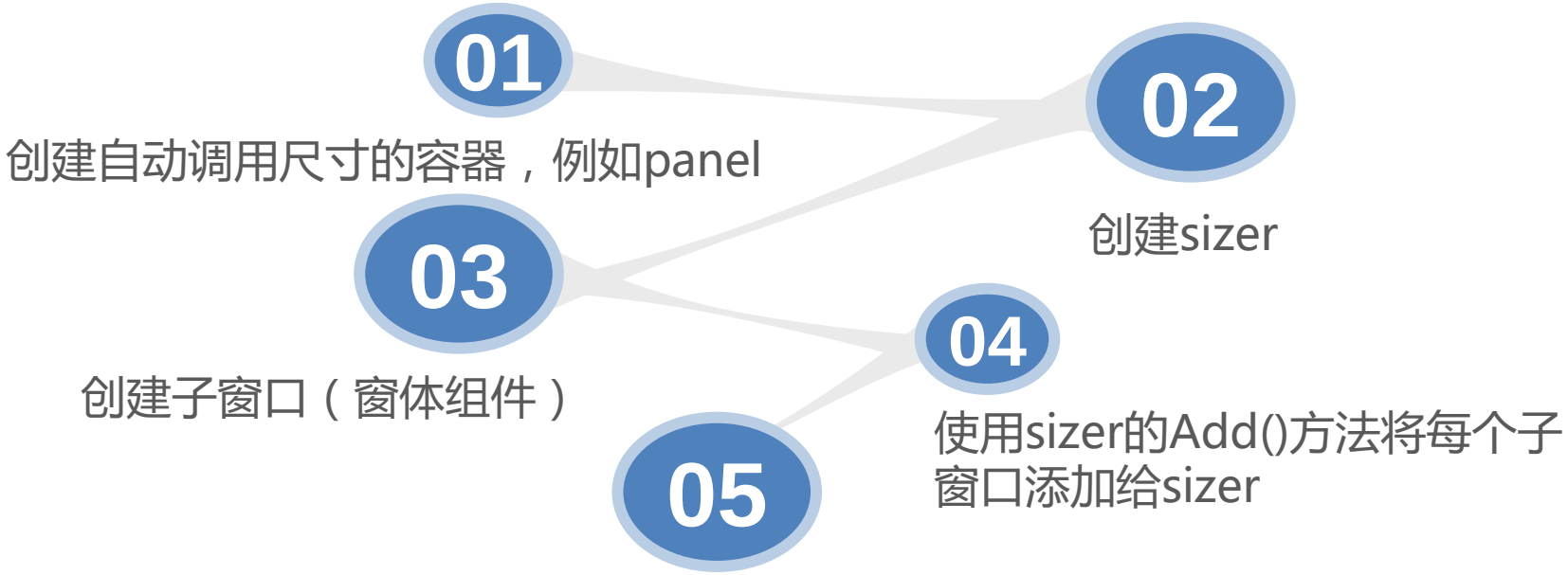


所有组件大小一致，固定一个方向，在另外一个方向生长



行高和列宽由最大的组件决定

使用sizer的步骤


01
创建自动调用尺寸的容器，例如panel
02
创建sizer
03
创建子窗口（窗体组件）
04
使用sizer的Add()方法将每个子窗口添加给sizer
05
调用容器的SetSizer(sizer)方法

示例程序

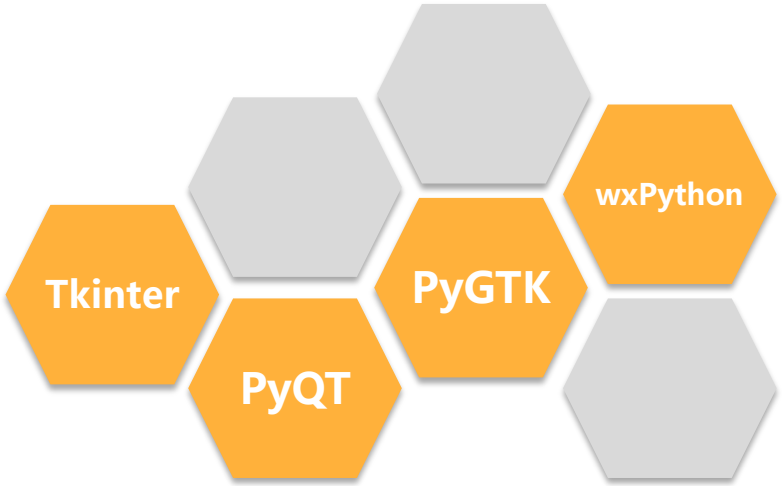

```
# Filename: helloworldbtn.py
import wx
class Frame1(wx.Frame):
    def __init__(self,superior):
        wx.Frame.__init__(self, parent = superior, title = "Hello World in wxPython")
        panel = wx.Panel(self)
        sizer = wx.BoxSizer(wx.VERTICAL)
        self.text1= wx.TextCtrl(panel, value = "Hello, World!", size = (200,180), style = wx.TE_MULTILINE)
        sizer.Add(self.text1, 0, wx.ALIGN_TOP | wx.EXPAND)
        button = wx.Button(panel, label = "Click Me")
        sizer.Add(button)
        panel.SetSizerAndFit(sizer)
        panel.Layout()
        self.Bind(wx.EVT_BUTTON,self.OnClick,button)
    def OnClick(self, text):
        self.text1.AppendText("\nHello, World!")
```

7

用Python玩转数据

其他GUI库

Python的GUI实现



wxPython

开源软件，具有优秀的跨平台能力。官网：

http://wxpython.org

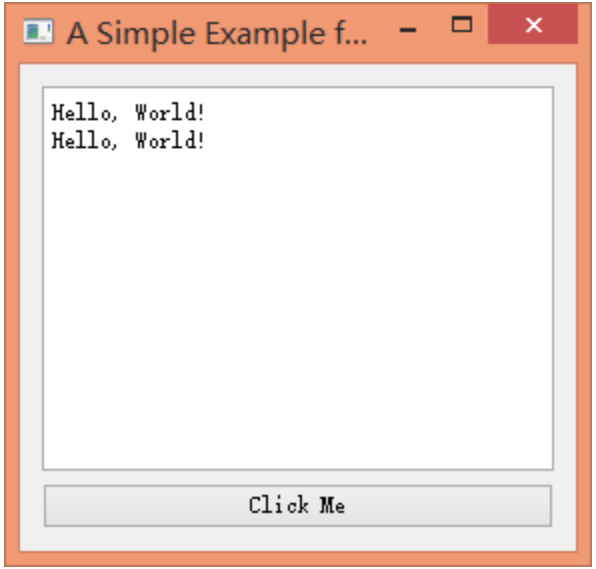
PyQt

- 是Python语言的GUI编程解决方案之一
- 提供了GPL与商业协议两种授权方式，可以免费地用于自由软件的开发
- 跨平台：可以运行于Microsoft Windows、Mac OS X、Linux以及其它类Unix平台上

PyQt简单示例

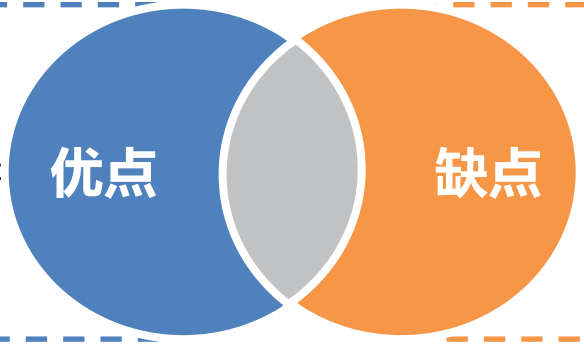
File

```
# Filename: PyQTexample.py
import sys
from PyQt4.QtGui import *

class TestWidget(QWidget):
    def __init__(self):
        QWidget.__init__(self, windowTitle=u"A Simple Example for PyQt.")
        self.outputArea=QTextBrowser(self)
        self.helloButton=QPushButton(self.trUtf8("Click Me"), self)
        self.setLayout(QVBoxLayout())
        self.layout().addWidget(self.outputArea)
        self.layout().addWidget(self.helloButton)
        self.helloButton.clicked.connect(self.sayHello)

    def sayHello(self):
        self.outputArea.append(self.trUtf8("Hello, World!"))

app=QApplication(sys.argv)
testWidget=TestWidget()
testWidget.show()
sys.exit(app.exec_())
```



PyQT的优缺点

- 文档比其他GUI库丰富
- 与Qt、C++开发经验互通
- 可使用大多数为Qt开发的组件
- 有方便的周边工具支持PyQt，如QtDesigner，Eric4



- 要注意避免内存泄露
- 运行时庞大
- 需要学习一些C++知识

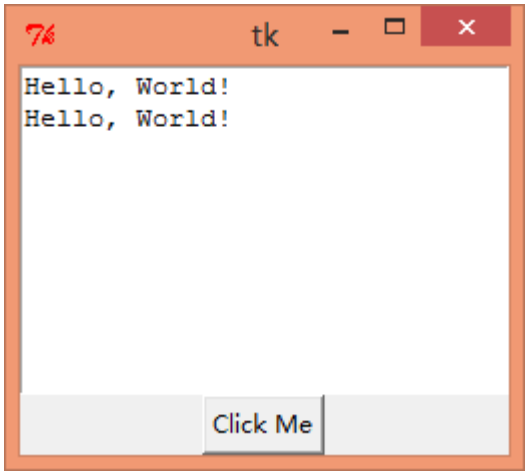
Tkinter

- Tkinter绑定了 Python 的 Tk GUI 工具集 ，通过内嵌在 Python 解释器内部的 Tcl 解释器实现
- Tkinter 的调用转换成 Tcl 命令，然后交给 Tcl 解释器进行解释，实现 Python 的 GUI 界面

Tkinter简单示例

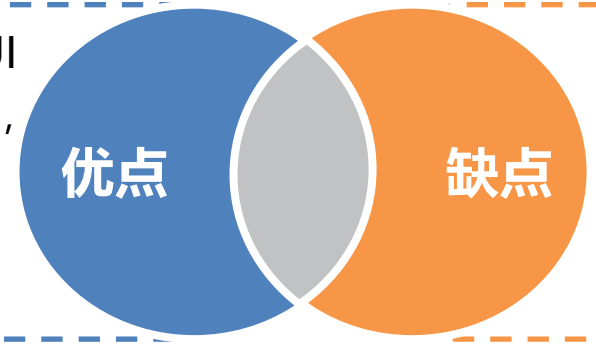
File

```
# Filename: Tkinterdemo.py
import Tkinter
class Tkdemo(object):
    def __init__(self):
        self.root=Tkinter.Tk()
        self.txt=Tkinter.Text(self.root,width=30,height=10)
        self.txt.pack()
        self.button=Tkinter.Button(self.root,text='Hello',
                command=self.sayhello)
        self.button.pack()
    def sayhello(self):
        self.txt.insert(Tkinter.INSERT,"Hello, World!\n")
d=Tkdemo()
d.root.mainloop()
```



Tkinter的优缺点

- 历史最悠久， 是Python 事实上的标准 GUI
  - Python 中使用 Tk GUI 工具集的标准接口，已包括在标准的Python Windows 安装中
  - 著名的 IDLE 用 Tkinter 实现 GUI
- 创建的 GUI 简单，学起来和用起来也简单



- 性能不太好，执行速度慢

PyGTK

- PyGTK是一套 GTK+ GUI 库的Python封装
- pyGTK为创建桌面程序提供了一套综合的图形元素和其它使用的编程工具
- PyGTK是基于LGPL协议的免费软件
- 许多 Gnome 下的著名应用程序的 GUI 都是使用 PyGTK 实现的，比如 BitTorrent ， GIMP 和 Gedit 都有可选的实现

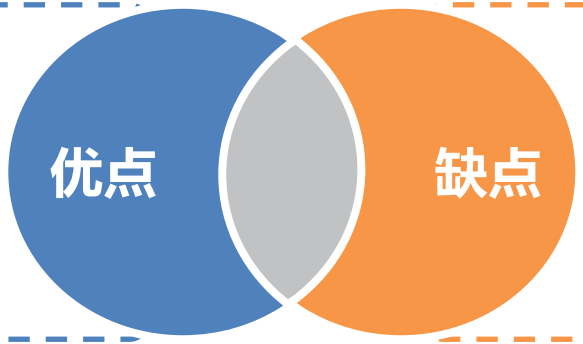
PyGTK的简单示例

File

```
#hello-gtk.py
import pygtk
pygtk.require('2.0')
import gtk

class HelloWorld:

    def hello(self, widget, data=None):
        textbuffer = self.textview.get_buffer()
        startiter, enditer = textbuffer.get_bounds()
        content_text = textbuffer.get_text(startiter, enditer)
        content_text += "Hello, World!\n"
        textbuffer.set_text(content_text)

    def __init__(self):
        self.window = gtk.Window(gtk.WINDOW_TOPLEVEL)
        self.window.set_title("A Simple Example of PyGtk")
        self.window.connect("delete_event", self.delete_event)
        self.window.connect("destroy", self.destroy)
        self.window.set_border_width(10)
        box1 = gtk.VBox(False, 0)
        self.window.add(box1)
        box1.show()
        sw = gtk.ScrolledWindow()
        sw.set_policy(gtk.POLICY_AUTOMATIC,
gtk.POLICY_AUTOMATIC)
        self.textview = gtk.TextView()
        textbuffer = self.textview.get_buffer()
        sw.add(self.textview)
        sw.show()
        self.textview.show()
        box1.pack_start(sw)

        self.button = gtk.Button("Click Me")
        self.button.connect("clicked", self.hello, None)
        self.button.show()
        box1.pack_start(self.button, expand=False, fill=False)
        self.window.show()

    def main(self):
        gtk.main()

if __name__ == "__main__":
    hello = HelloWorld()
    hello.main()
```

PyGTK的优缺点

- 底层的GTK+提供了各式的可视元素和功能
- 能开发在GNOME桌面系统运行的功能完整的软件



- 在Windows平台表现不太好

用Python玩转数据

综合应用

图形用户界面


Dow Jones Industrial Average (^DJI)
File
Stock Code:
AAPL
Symbol
Name
Last Trade
AXP
American Express Company
84.13
BA
The Boeing Company
134.62
CAT
Caterpillar Inc.
85.61
CSCO
Cisco Systems, Inc.
28.21
CVX
Chevron Corporation
106.85
DD
E. I. du Pont de Nemours and Company
73.79
DIS
The Walt Disney Company
94.72
GE
General Electric Company
24.48
GS
The Goldman Sachs Group, Inc.
180.49
HD
The Home Depot, Inc.
105.37
IBM
International Business Machines Corporation
155.87
INTC
Intel Corporation
36.45
JNJ
Johnson & Johnson
102.20
JPM
JPMorgan Chase & Co.
56.68
KO
The Coca-Cola Company
43.31
MCD
McDonald's Corp.
89.56
MMM
3M Company
164.02
MRK
Merck & Co. Inc.
62.49
MSFT
Microsoft Corporation
47.18
Quit
Refresh