Python for Practice

Kivy

Overview

- https://kivy.org
- Desktop and mobile applications
- Multitouch interface
- Multiplatform
  - Windows, Linux, Android, OS X
- Own markup language for UI design

Hello world

```
from kivy.app import App
from kivy.uix.button import Button

class TestApp(App):
    def build(self):
        return Button(text='Hello World')

TestApp().run()
```

See
e01_hello.py

Application lifecycle

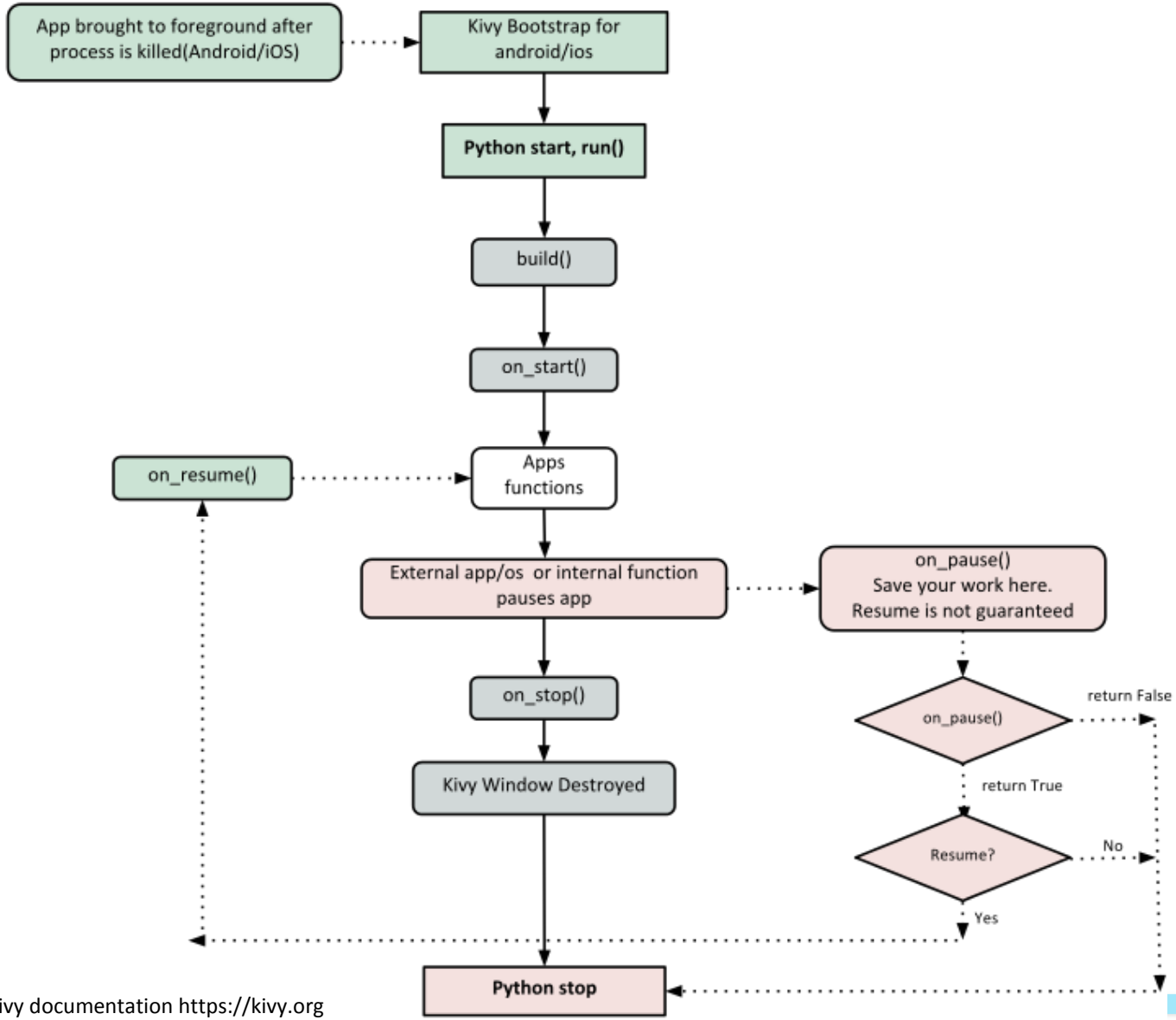


image source: Kivy documentation https://kivy.org

Widgets

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

See e02_widgets.py

KV language

- Separation of presentation and logic
- Loading
  - Implicit
    MyApp -> my.kv
  - Explicit
    Builder.load_file('path/to/file.kv')
- kv file content ~ set of rules
  - (instance) rule
    `Widget:`
  - class rule
    `<Widget>:`

KV language

- kv keywords
  - **app** – instance of application.
  - **root** – base widget/template in the current rule
  - **self** – current widget
- syntax

See e03_kv_language.py

kv

```
#:import name x.y.z
#:import isdir os.path.isdir
#:import np numpy

#:set name value
```

Python equivalent

```
from x.y import z as name
from os.path import isdir
import numpy as np

name = value
```

Events

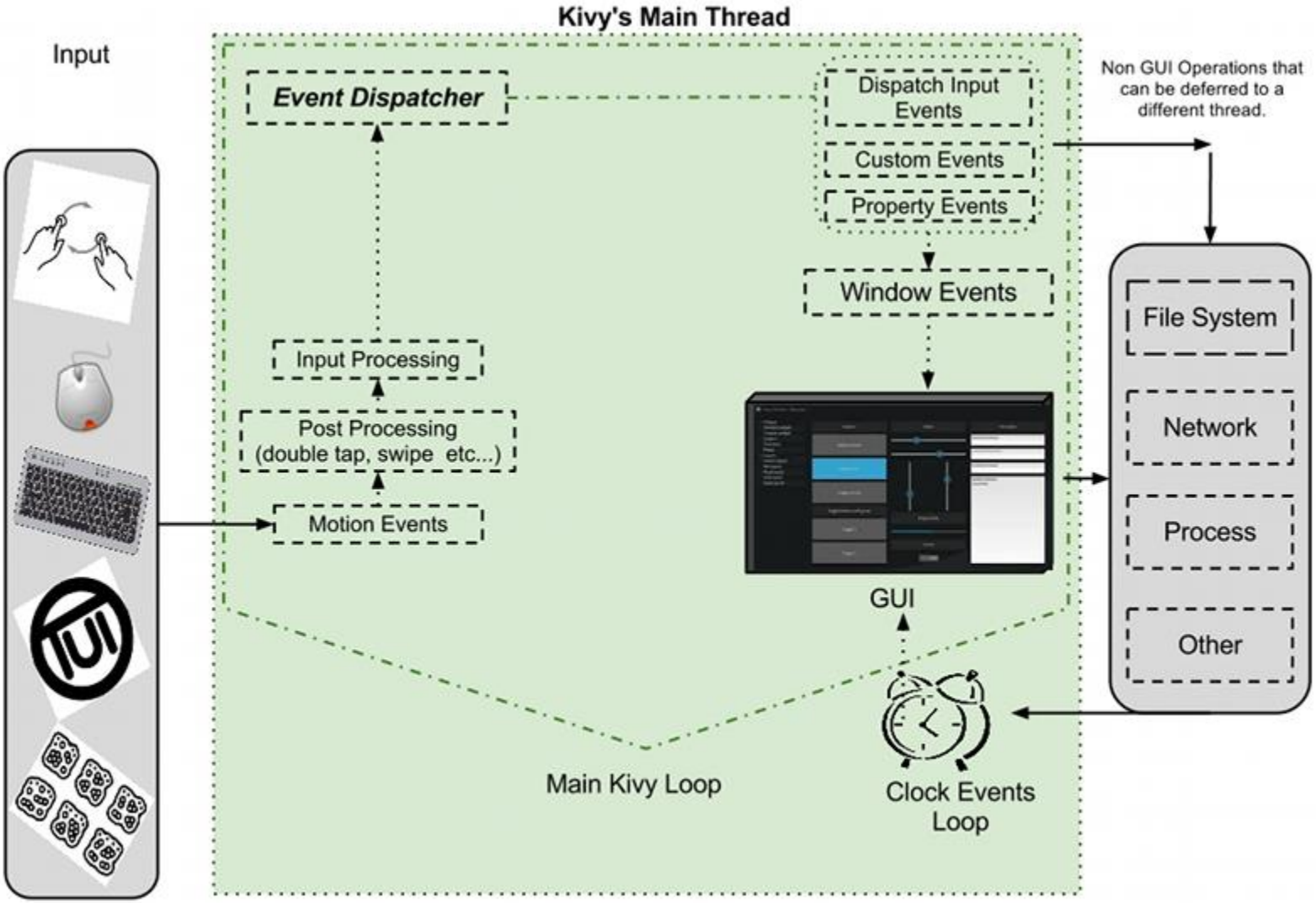


image source: Kivy documentation https://kivy.org

Events

- Single thread UI
  - do not block the UI thread
- Repetitive events

```
count = 0

def my_callback(dt):
    global count
    count += 1
    if count == 10:
        print('Last call')
        return False
    print('My callback is called')

Clock.schedule_interval(my_callback, 1 / 30.)
```

Stop repeating

Use
schedule_once(callback, delay)
for non-repetitive events

Events

- Widget events
  - property events – widget changes its position or size,…
  - widget-defined event – e.g., button pressed or released

Own events

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

    def do_something(self, value):
        self.dispatch('on_test', value)

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

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


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

Has to be implemented by all objects that produce events

Properties

- produce events such that when an attribute of an object changes, all properties that reference that attribute are automatically updated

- **`StringProperty`**
- **`NumericProperty`**
- **`BoundedNumericProperty`**
- **`ObjectProperty`**
- **`DictProperty`**
- **`ListProperty`**
- **`OptionProperty`**
- **`AliasProperty`**
- **`BooleanProperty`**
- **`ReferenceListProperty`**

Property and events

```
class CustomBtn(Widget):

    pressed = ListProperty([0, 0])

    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)

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

Handling touch/click on the widget

properties, by default, provide an on_<property_name> event

Property and events

- Binding to properties
  - to monitor changes

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

See e04_properties.py

Input

- Support for multiple different inputs
  - mouse, touchscreen, accelerometer, gyroscope,…
- MotionEvent
  - Touch events – contain at least position (x,y)
  - No touch events – all other events
- Methods
  - on_motion()
  - on_touch_down()
  - on_touch_move()
  - on_touch_up()

Motion event profiles

- Depends on HW
- Which info is available

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

See e05_event_profiles.py

Motion event profiles

- Profiles
  - angle — 2D angle. Accessed via the a property
  - button — Mouse button (‘left’, ‘right’, ‘middle’, ‘scrollup’ or ‘scrolldown’). Accessed via the button property
  - markerid — Marker or Fiducial ID. Accessed via the fid property
  - pos — 2D position. Accessed via the x, y or pos properties
  - pos3d — 3D position. Accessed via the x, y or z properties
  - pressure — Pressure of the contact. Accessed via the pressure property
  - shape — Contact shape. Accessed via the shape property

Touch event

- Special type of motion event
  - has is_touch property True
- Dispatched to **ALL** currently displayed widgets

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

See e06_touch_event.py

Taps

- Double & triple taps

```
def on_touch_down(self, touch):
    if touch.is_double_tap:
        ...
```

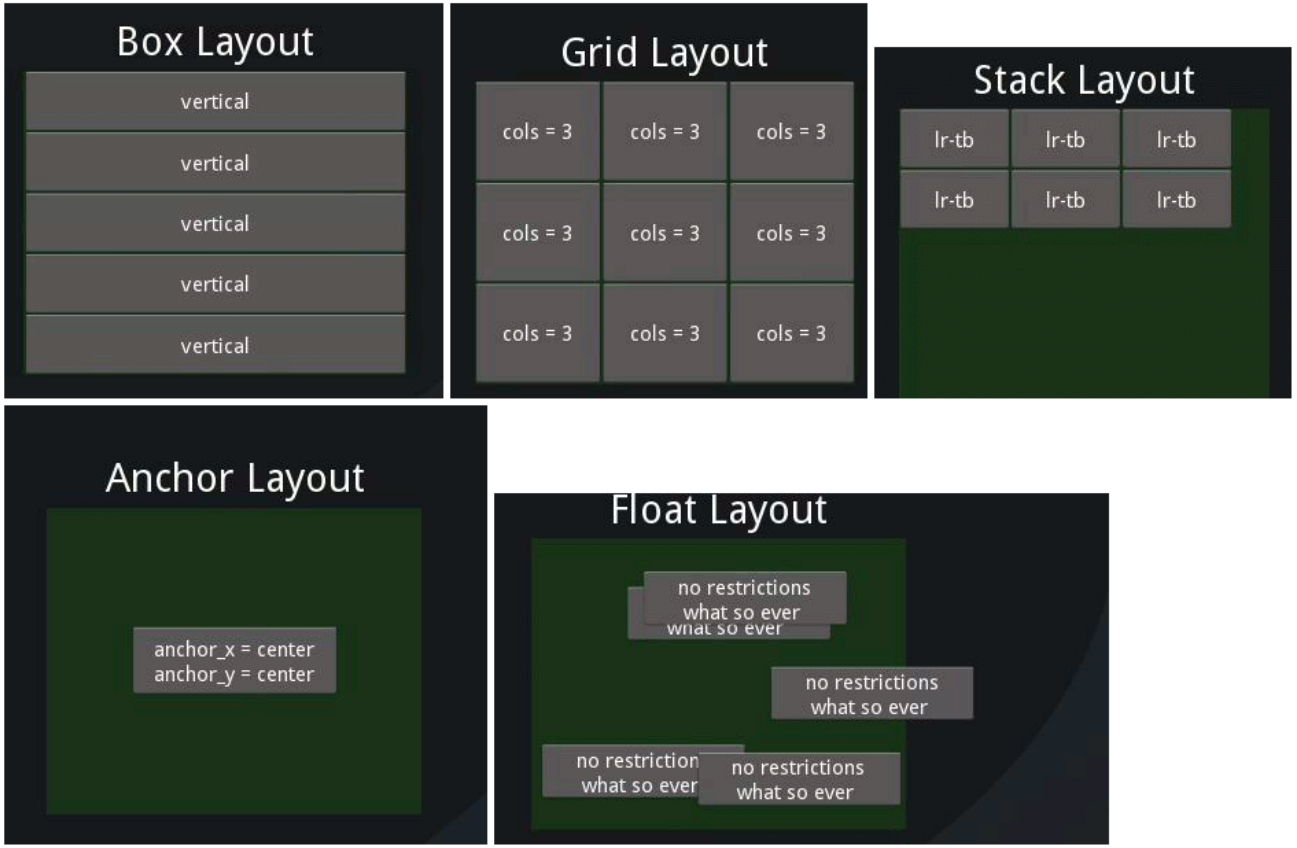
```
def on_touch_down(self, touch):
    if touch.is_triple_tap:
        ...
```

See e07_double_triple_tap.py

Widgets

- Organized in the widget tree
  - all children in the children attribute
- Methods to manipulate widgets
  - add_widget()
  - remove_widget()
  - clear_widgets()
- Z index
  - lower indexed widgets will be drawn above those with a higher index
    - root.add_widget(widget, index)
    - default is 0 – widgets added later are drawn on top of the others

Layouts



- plus Relative layout
  - like Float, but children positions are relative to layout position, not the screen

Layouts

- size_hint
  - values from 0 to 1 or None
  - defaults (1, 1)
    - 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)
- pos_hint
  - a dict
  - defaults to empty
  - attributes – x, y, right, top, center_x, center_y
    - relative to its parent
- layouts honor both differently
  - see documentation

Canvas

- Each widget has a canvas
  - graphical representation of the widget
- Canvas – drawing board with drawing instructions
  - context instructions
  - vertex instructions
- “three” canvases
  - canvas – “main” canvas
  - canvas.before – drawn before the main
  - canvas.after – drawn after the main
- (0,0) is BOTTOM, left
- Instructions are “permanent”
  - can be updated

See
e08_canvas.py
e09_canvas.py

Popups

- Dialog windows

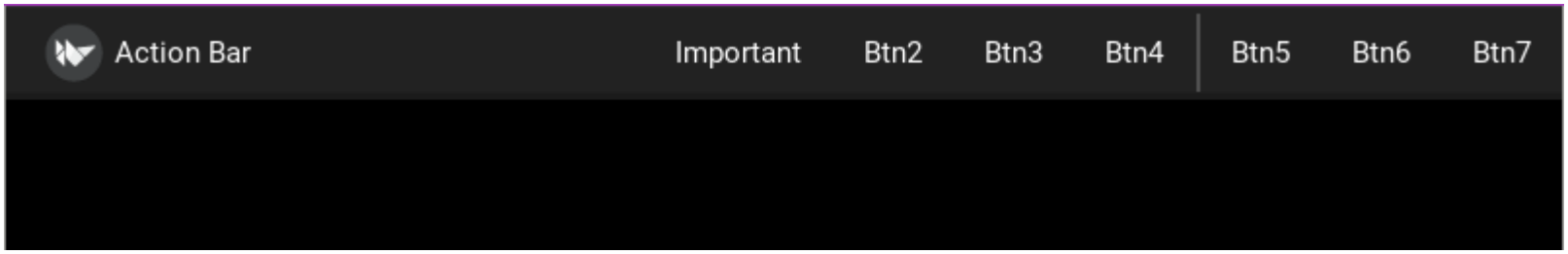
```
popup = Popup(title='Test popup',
    content=Label(text='Hello world'),
    size_hint=(None, None), size=(400, 400))
popup.open()
```

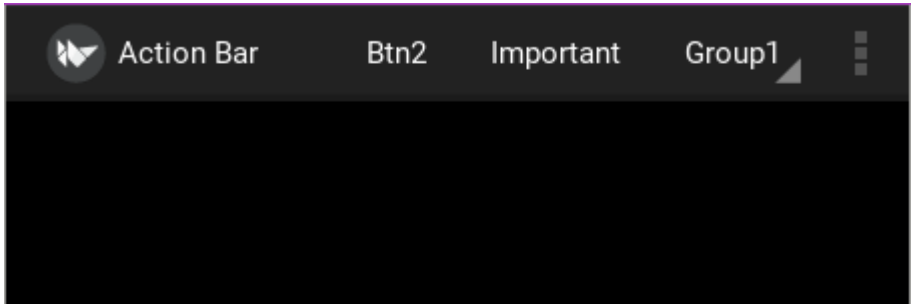
  - by default auto-dismissible
    - tap outside the popup
    - auto_dismiss=False
  - close from code
    - popup.close()
      - bindable

See e10_popup.py

ActionBar

- “menu”
  - ActionView
    - ActionButton
    - ActionGroup
    - ActionOverflow





See e11_bar.py

Widgets IDs

- Referencing to kv file

```
<MyWidget>:
  Label:
    id: my_label
```

```
class MyWidget(Widget):
    def on_button_press(self):
        self.ids.my_label.text = 'pressed'
```

- or

```
<MyWidget>:
  my_label: my_label
  Label:
    id: my_label
```

```
class MyWidget(Widget):
    my_label = ObjectProperty(None)
```

See e12_ids.py

Kivy on Android

- Deployment
  - Buildozer
  - python-for-android
  - Kivy Launcher
- Plyer
  - pythonic, platform-independent API to use features commonly found on mobile platforms
- Pyjnius
  - access Java classes directly from Python

See kivy_launcher_apps

See e13_plyer.py

Task

- Create a calculator