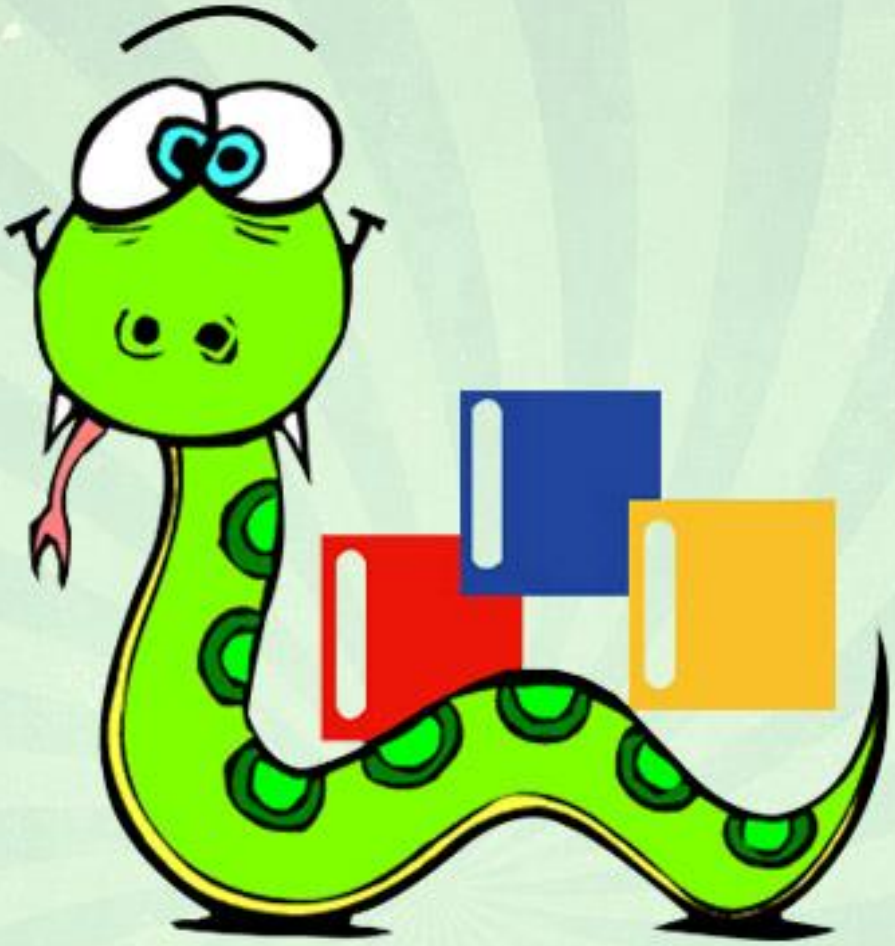

wxPython

GUI Toolkit

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About the Tutorial

wxPython is a blend of wxWidgets and Python programming library. This introductory tutorial provides the basics of GUI programming and helps you create desktop GUI applications.

Audience

This tutorial is designed for software programmers who are keen on learning how to develop GUI applications for the desktop.

Prerequisites

You should have a basic understanding of computer programming terminologies. A basic understanding of Python and any of the programming languages is a plus.

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Table of Contents

1. wxPython – Introduction

wxPython is a Python wrapper for **wxWidgets** (which is written in C++), a popular cross-platform GUI toolkit. Developed by Robin Dunn along with Harri Pasanen, wxPython is implemented as a Python extension module.

Just like wxWidgets, wxPython is also a free software. It can be downloaded from the official website http://wxpython.org. Binaries and source code for many operating system platforms are available for download on this site.

Principal modules in wxPython API include a core module. It consists of **wxObject** class, which is the base for all classes in the API. Control module contains all the widgets used in GUI application development. For example, wx.Button, wx.StaticText (analogous to a label), wx.TextCtrl (editable text control), etc.

wxPython API has GDI (Graphics Device Interface) module. It is a set of classes used for drawing on widgets. Classes like font, color, brush, etc. are a part of it. All the container window classes are defined in Windows module.

Official website of wxPython also hosts Project Phoenix – a new implementation of wxPython for Python 3.*. It focuses on improving speed, maintainability, and extensibility. The project began in 2012 and is still in beta stage.

2. wxPython –Environment

Windows

Prebuilt binaries for Windows OS (both 32 bit and 64 bit) are available on http://www.wxpython.org/download.php page. Latest versions of installers available are:

wxPython3.0-win32-3.0.2.0-py27.exe for 32-bit Python 2.7

wxPython3.0-win64-3.0.2.0-py27.exe for 64-bit Python 2.7

wxPython demo, samples and wxWidgets documentation is also available for download on the same page.

wxPython3.0-win32-docs-demos.exe

Linux

wxPython binaries for many Linux distros can be found in their respective repositories. Corresponding package managers will have to be used to download and install. For instance on Debian Linux, following command should be able to install wxPython.

```
sudo apt-get install python-wxgtk3.0
```

MacOS

Prebuilt binaries for MacOS in the form of disk images are available on the download page of the official website.

3. wxPython – Hello World

A simple GUI application displaying Hello World message is built using the following steps:

- Import wx module.
- Define an object of Application class.
- Create a top level window as object of wx.Frame class. Caption and size parameters are given in constructor.
- Although other controls can be added in Frame object, their layout cannot be managed. Hence, put a Panel object into the Frame.
- Add a StaticText object to display 'Hello World' at a desired position inside the window.
- Activate the frame window by show() method.
- Enter the main event loop of Application object.

```
import wx

app = wx.App()
window = wx.Frame(None,title="wxPython Frame",size=(300,200))
panel=wx.Panel(window)
label=wx.StaticText(panel,label="Hello World",pos=(100,50))
window.Show(True)
app.MainLoop()
```

The above code produces the following output:

wxFrame object is the most commonly employed top level window. It is derived from **wxWindow class**. A frame is a window whose size and position can be changed by the user. It has a title bar and control buttons. If required, other components like menu bar, toolbar and status bar can be enabled. A wxFrame window can contain any frame that is not a dialog or another frame.

4. wxPython – Frame Class

wx.Frame Class has a default constructor with no arguments. It also has an overloaded constructor with the following parameters:

```
Wx.Frame (parent, id, title, pos, size, style, name)
```

Parameter	Description
Parent	Window parent. If 'None' is selected the object is at the top level window. If 'None' is not selected, the frame appears on top of the parent window
id	Window identifier. Usually -1 to let the identifier be generated automatically
Title	Caption to appear in the title bar
Pos	The starting position of the frame. If not given, wxDefaultPosition is as decided by OS
Size	Dimensions of the window. wxDefaultSize is decided by OS
style	Appearance of the window controlled by style constants
name	The internal name of object

Window Style Constants

wx.DEFAULT_FRAME_STYLE
wx.CAPTION
wx.MINIMIZE_BOX
wx.MAXIMIZE_BOX
wx.CLOSE_BOX
wx.SYSTEM_MENU
wx.RESIZE_BORDER

wx.STAY_ON_TOP
wx.FRAME_FLOAT_ON_PARENT

wx.DEFAULT_FRAME_STYLE is defined as:

wx.MINIMIZE_BOX | wx.MAXIMIZE_BOX | wx.RESIZE_BORDER | wx.SYSTEM_MENU | wx.CAPTION | wx.CLOSE_BOX | wx.CLIP_CHILDREN

Example

```
window=wx.Frame(None, -1, “Hello”, pos=(10,10), size=(300,200), style=
wxDEFAULT_FRAME_STYLE, name=”frame”)
```

wx.Frame Class Member Functions

CreateStatusBar()	Creates the status bar at bottom of the window
CreateToolBar()	Creates the toolbar at the top or left of the window
GetMenuBar()	Gets reference to menu bar
GetStatusBar()	Gets reference to statusbar
SetMenuBar()	Displays the menu bar object in the frame
setStatusBar()	Associates the status bar object to the frame
SetToolBar()	Associates a toolbar object to the frame
SetStatusText()	Displays text on the status bar
Create()	Creates a frame with provided parameters
Centre()	Places the frame at the center of display
SetPosition()	Places the frame at given screen coordinates
SetSize()	Resizes the frame to given dimensions
SetTitle()	Inserts the given text in the title bar

wx.Frame event binders

EVT_CLOSE	When the frame is being closed by the user clicking the close button or programmatically
EVT_MENU_OPEN	When a menu is about to be opened
EVT_MENU_CLOSE	When a menu has just been closed
EVT_MENU_HIGHLIGHT	When the menu item with the specified id has been highlighted

5. wxPython – Panel Class

Widgets such as button, text box, etc. are placed on a panel window. **wx.Panel class** is usually put inside a wxFrame object. This class is also inherited from wxWindow class.

Although controls can be manually placed on panel by specifying the position in screen coordinates, it is recommended to use a suitable layout scheme, called **sizer** in wxPython, to have better control over the placement and address the resizing issue.

In **wxPanel constructor**, the parent parameter is the wx.Frame object in which the panel is to be placed. Default value of id parameter is wx.ID_ANY, whereas the default style parameter is wxTAB_TRAVERSAL.

wxPython API has the following sizers, using which controls are added into a panel object:

wx.BoxSizer	Widgets are arranged in a vertical or horizontal box
wx.StaticBoxSizer	Adds a staticbox around the sizer
wx.GridSizer	One control each added in equal sized cells of a grid
wx.FlexGridSizer	Control added in cell grid can occupy more than one cell
wx.GridBagSizer	Controls explicitly positioned in a grid and spanning over more than one row and/or column

Sizer object is applied as the layout manager of the panel using SetSizer() method of wxPanel class.

```
wx.Panel.SetSizer(wx.???Sizer())
```

Panel object in turn is added to the top level frame.

6. wxPython – GUI Builder Tools

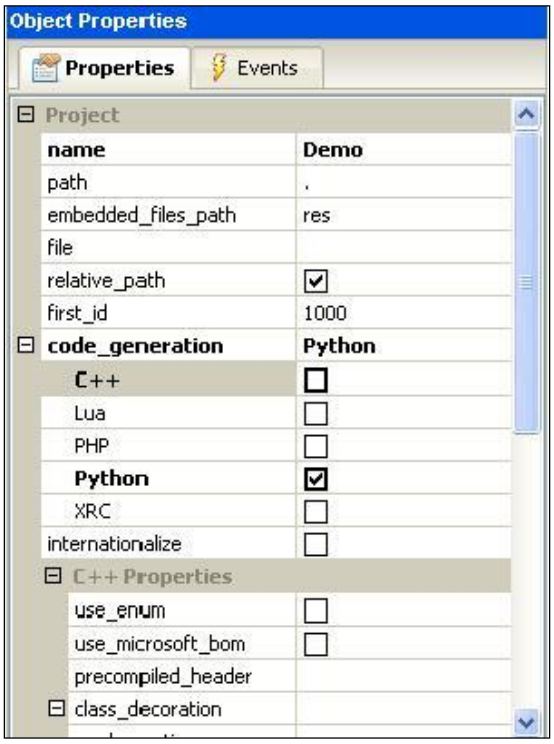
Creating a good looking GUI by manual coding can be tedious. A visual GUI designer tool is always handy. Many GUI development IDEs targeted at wxPython are available. Following are some of them:

- wxFormBuilder
- wxDesigner
- wxGlade
- BoaConstructor
- gui2py

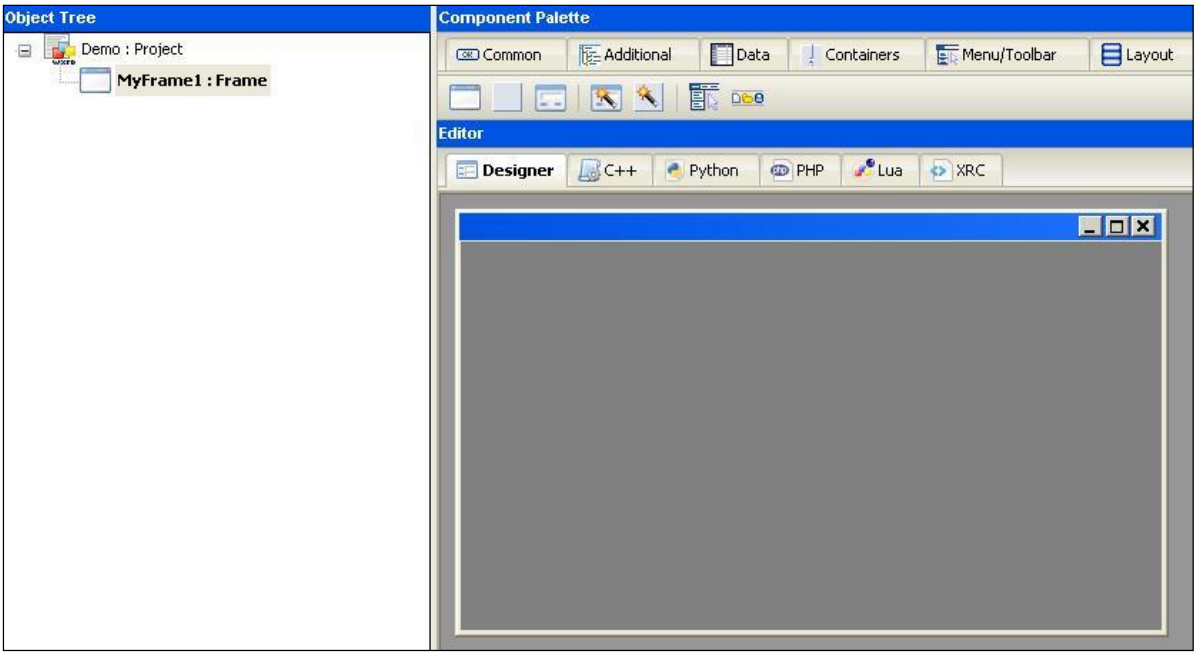
wxFormBuilder is an open source, cross-platform WYSIWYG GUI builder that can translate the wxWidget GUI design into C++, Python, PHP or XML format. A brief introduction to usage of wxFormBuilder is given here.

First of all the latest version of wxFormBuilder needs to be downloaded and installed from http://sourceforge.net/projects/wxformbuilder/. On opening the application, a new project with blank grey area at the center appears.

Give a suitable name to the project and choose Python as code generation language. This is done in the Object properties window as shown in the following image:

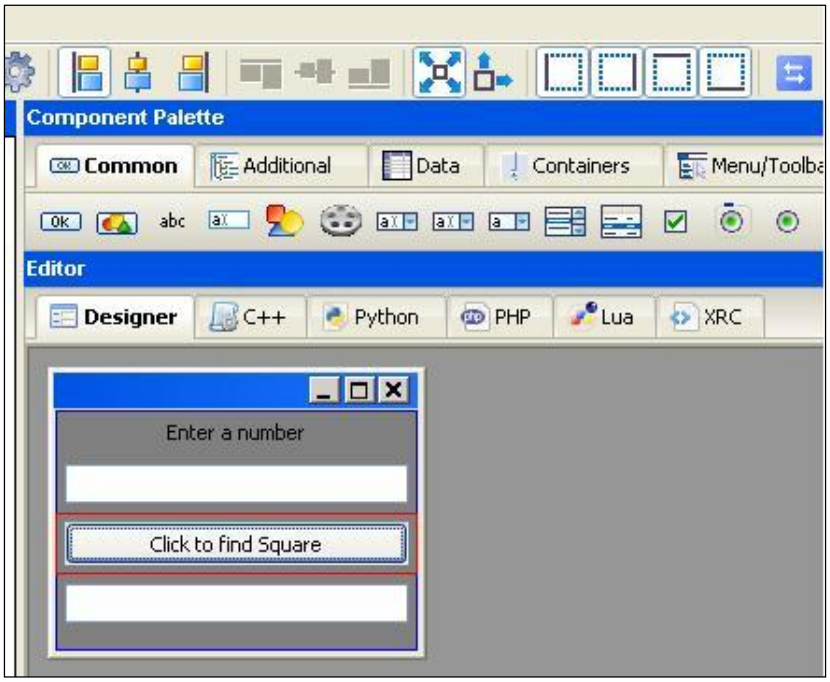


Then from 'Forms' tab of components palette, choose Frame.

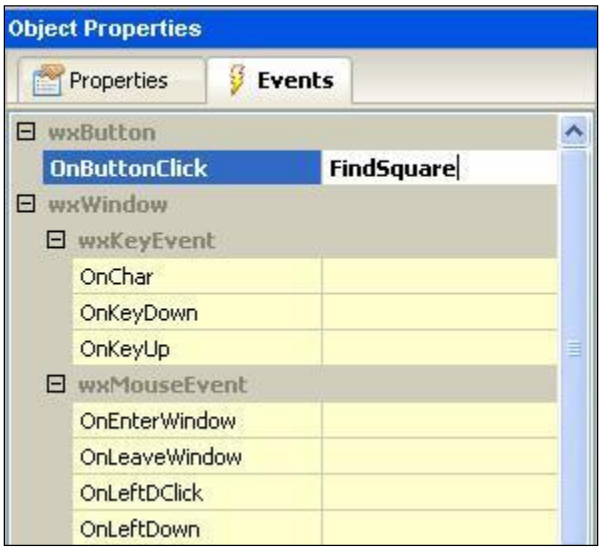


Add a vertical wxBoxSizer from 'Layouts' tab.

Add necessary controls in the Box with suitable captions. Here, a StaticText (label), two TextCtrl objects (text boxes) and a wxButton object are added. The frame looks like the following image:



Enable Expand and Stretch on these three controls. In the object properties for wxButton object, assign a function findsquare() to OnButtonClick event.



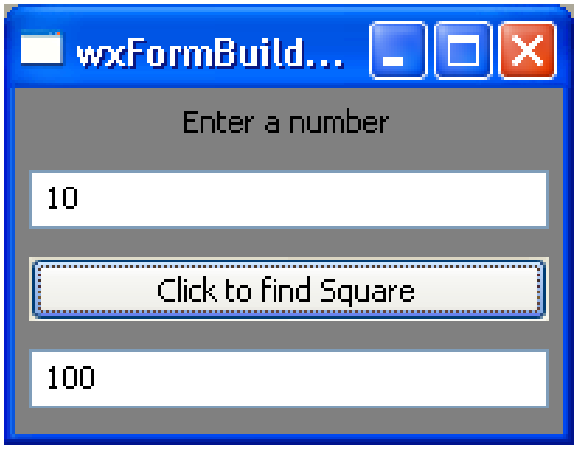
Save the project and press F8 to generate Python code for developed GUI. Let the generated file be named as Demo.py

In the executable Python script, import demo.py and define FindSquare() function. Declare Application object and start a main event loop. Following is the executable code:

```
import wx

#import the newly created GUI file
import demo

class CalcFrame(demo.MyFrame1):
    def __init__(self,parent):
        demo.MyFrame1.__init__(self,parent)

    def FindSquare(self,event):
        num = int(self.m_textCtrl1.GetValue())
        self.m_textCtrl2.SetValue (str(num*num))



app = wx.App(False)
frame = CalcFrame(None)
frame.Show(True)
```

```
#start the applications
app.MainLoop()
```

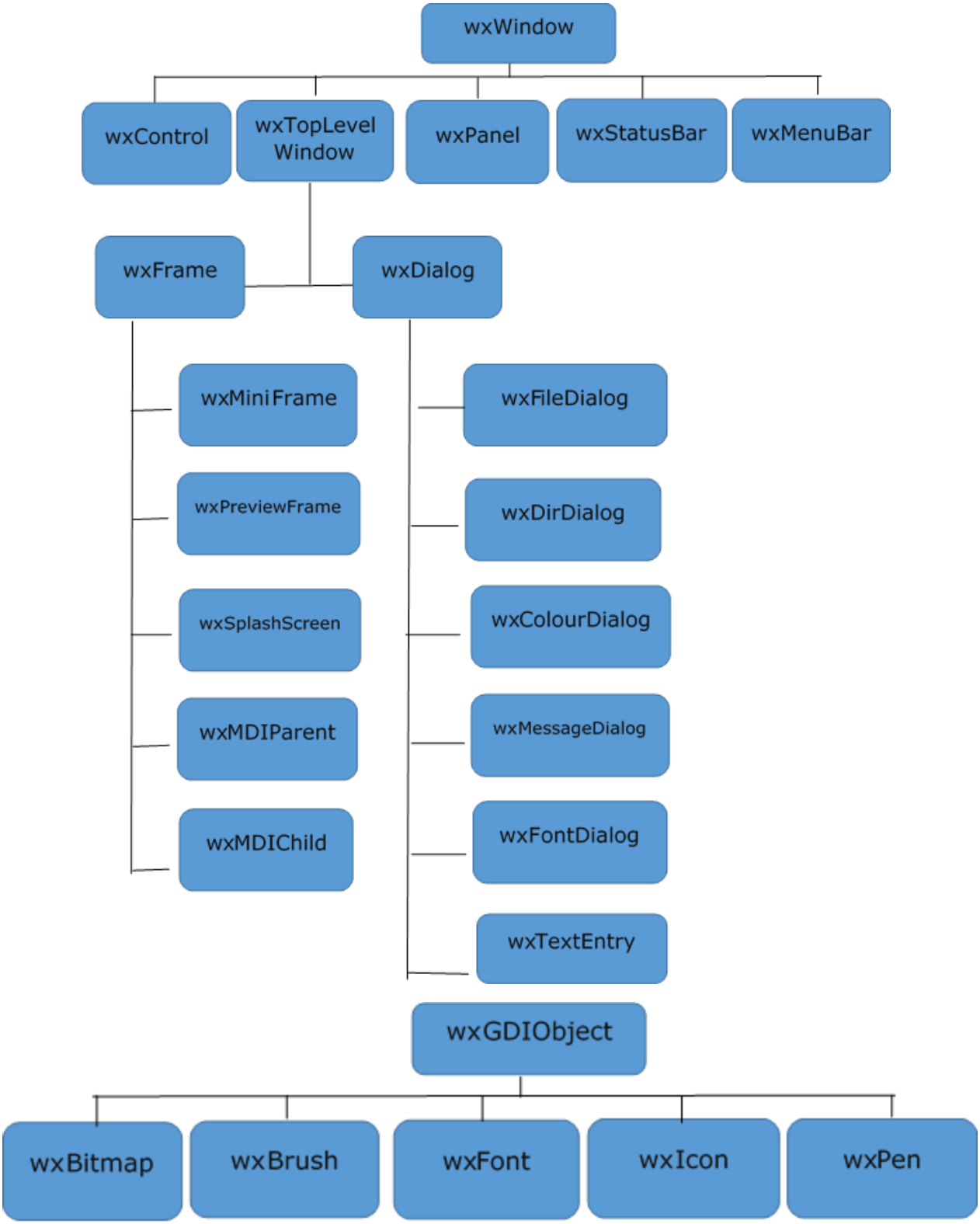
The above code produces the following output:

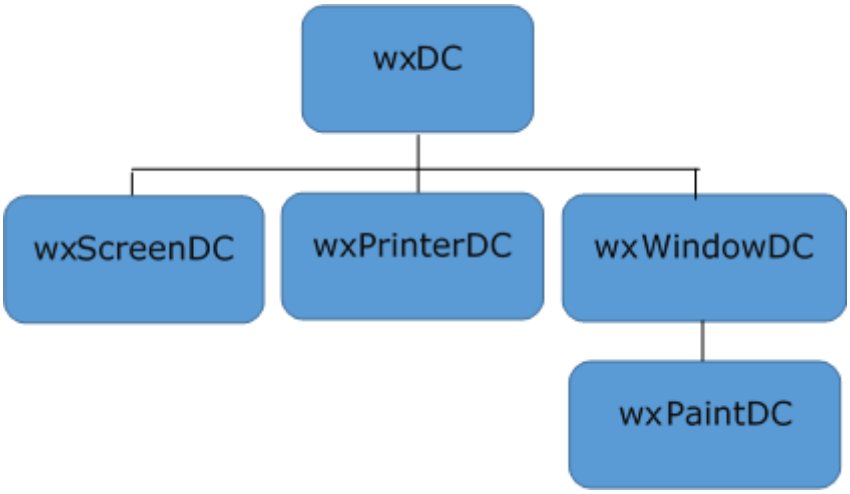


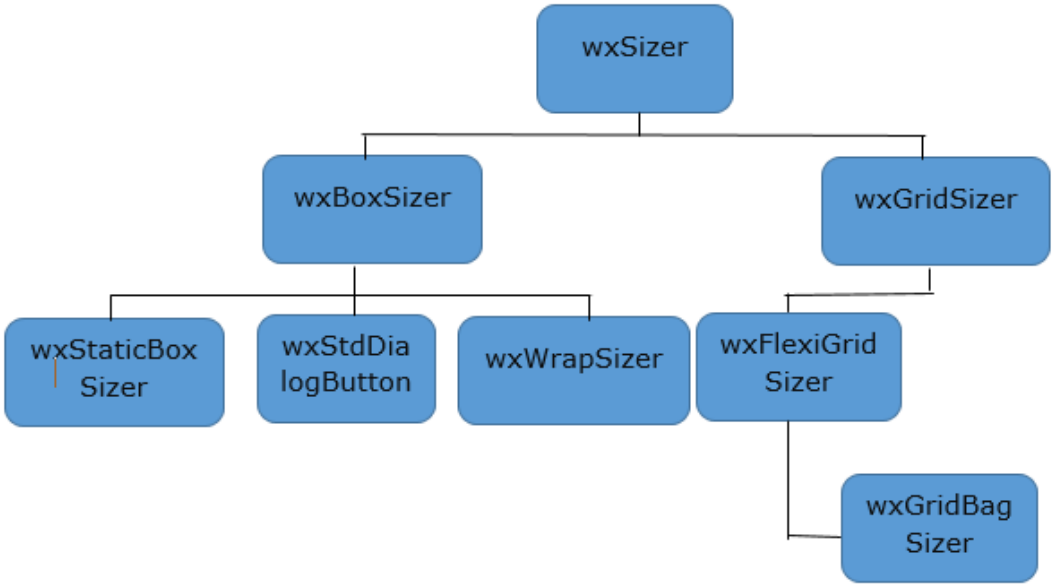
7. wxPython – Major Classes

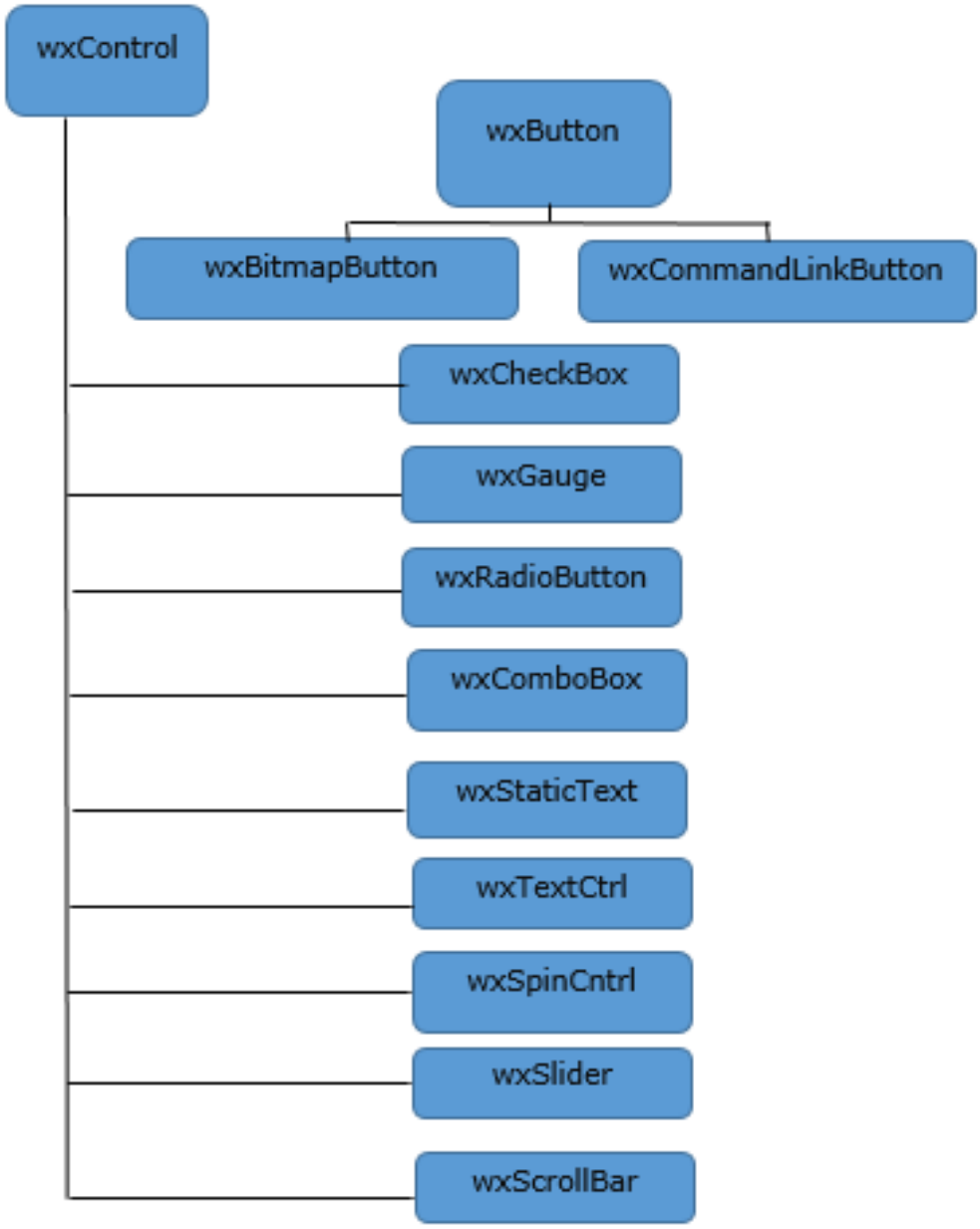
Original wxWidgets (written in C++) is a huge class library. GUI classes from this library are ported to Python with wxPython module, which tries to mirror the original wxWidgets library as close as possible. So, wx.Frame class in wxPython acts much in the same way as wxFrame class in its C++ version.

wxObject is the base for most of the classes. An object of wxApp (wx.App in wxPython) represents the application itself. After generating the GUI, application enters in an event loop by MainLoop() method. Following diagrams depict the class hierarchy of most commonly used GUI classes included in wxPython.









8. wxPython – Event Handling

Unlike a console mode application, which is executed in a sequential manner, a GUI based application is event driven. Functions or methods are executed in response to user's actions like clicking a button, selecting an item from collection or mouse click, etc., called events.

Data pertaining to an event which takes place during the application's runtime is stored as object of a subclass derived from **wx.Event**. A display control (such as Button) is the source of event of a particular type and produces an object of Event class associated to it. For instance, click of a button emits a wx.CommandEvent. This event data is dispatched to event handler method in the program. wxPython has many predefined event binders. An **Event binder** encapsulates relationship between a specific widget (control), its associated event type and the event handler method.

For example, to call **OnClick() method** of the program on a button's click event, the following statement is required:

```
self.b1.Bind(EVT_BUTTON, OnClick)
```

Bind() method is inherited by all display objects from wx.EvtHandler class. EVT_.BUTTON here is the binder, which associates button click event to OnClick() method.

Example

In the following example, the MoveEvent, caused by dragging the top level window – a wx.Frame object in this case – is connected to **OnMove() method** using wx.EVT_MOVE binder. The code displays a window. If it is moved using mouse, its instantaneous coordinates are displayed on the console.

```
import wx

class Example(wx.Frame):

    def __init__(self, *args, **kw):
        super(Example, self).__init__(*args, **kw)
        self.InitUI()

    def InitUI(self):
        self.Bind(wx.EVT_MOVE, self.OnMove)
        self.SetSize((250, 180))
```

```
        self.SetTitle('Move event')
        self.Centre()
        self.Show(True)

    def OnMove(self, e):
        x, y = e.GetPosition()
        print "current window position x=",x," y=",y

ex = wx.App()
Example(None)
ex.MainLoop()
```

The above code produces the following output:

current window position x= 562 y= 309

current window position x= 562 y= 309

current window position x= 326 y= 304

current window position x= 384 y= 240

current window position x= 173 y= 408

current window position x= 226 y= 30

current window position x= 481 y= 80

Some of the subclasses inherited from wx.Event are listed in the following table:

wxKeyEvent	Occurs when a key is presses or released
wxPaintEvent	Is generated whenever contents of the window needs to be redrawn
wxMouseEvent	Contains data about any event due to mouse activity like mouse button pressed or dragged
wxScrollEvent	Associated with scrollable controls like wxScrollbar and wxSlider
wxCommandEvent	Contains event data originating from many widgets such as button, dialogs, clipboard, etc.
wxMenuEvent	Different menu-related events excluding menu command button click
wxColourPickerEvent	wxColourPickerCtrl generated events
wxDirFileickerEvent	Events generated by FileDialog and DirDialog

Events in wxPython are of two types. Basic events and Command events. A basic event stays local to the window in which it originates. Most of the wxWidgets generate command events. A **command event** can be propagated to window or windows, which are above the source window in class hierarchy.

Example

Following is a simple example of event propagation. The complete code is:

```
import wx

class MyPanel(wx.Panel):

    def __init__(self, parent):
        super(MyPanel, self).__init__(parent)

        b=wx.Button(self, label='Btn', pos=(100,100))
        b.Bind(wx.EVT_BUTTON, self.btnclk)
        self.Bind(wx.EVT_BUTTON, self.OnButtonClicked)
```

```
    def OnButtonClicked(self, e):

        print 'Panel received click event. propagated to Frame class'
        e.Skip()

    def btnclk(self,e):
        print "Button received click event. propagated to Panel class"
        e.Skip()


class Example(wx.Frame):

    def __init__(self,parent):
        super(Example, self).__init__(parent)

        self.InitUI()


    def InitUI(self):

        mpnl = MyPanel(self)
        self.Bind(wx.EVT_BUTTON, self.OnButtonClicked)

        self.SetTitle('Event propagation demo')
        self.Centre()
        self.Show(True)

    def OnButtonClicked(self, e):

        print 'click event received by frame class'
        e.Skip()

ex = wx.App()
```

```
Example(None)
ex.MainLoop()
```

In the above code, there are two classes. **MyPanel**, a wx.Panel subclass and Example, a wx.Frame subclass which is the top level window for the program. A button is placed in the panel.

This Button object is bound to an event handler btnclk() which propagates it to parent class (MyPanel in this case). Button click generates a **CommandEvent** which can be propagated to its parent by Skip() method.

MyPanel class object also binds the received event to another handler OnButtonClicked(). This function in turn transmits to its parent, the Example class. The above code produces the following output:

Button received click event. Propagated to Panel class.

Panel received click event. Propagated to Frame class.

Click event received by frame class.