AU LONDON 2019

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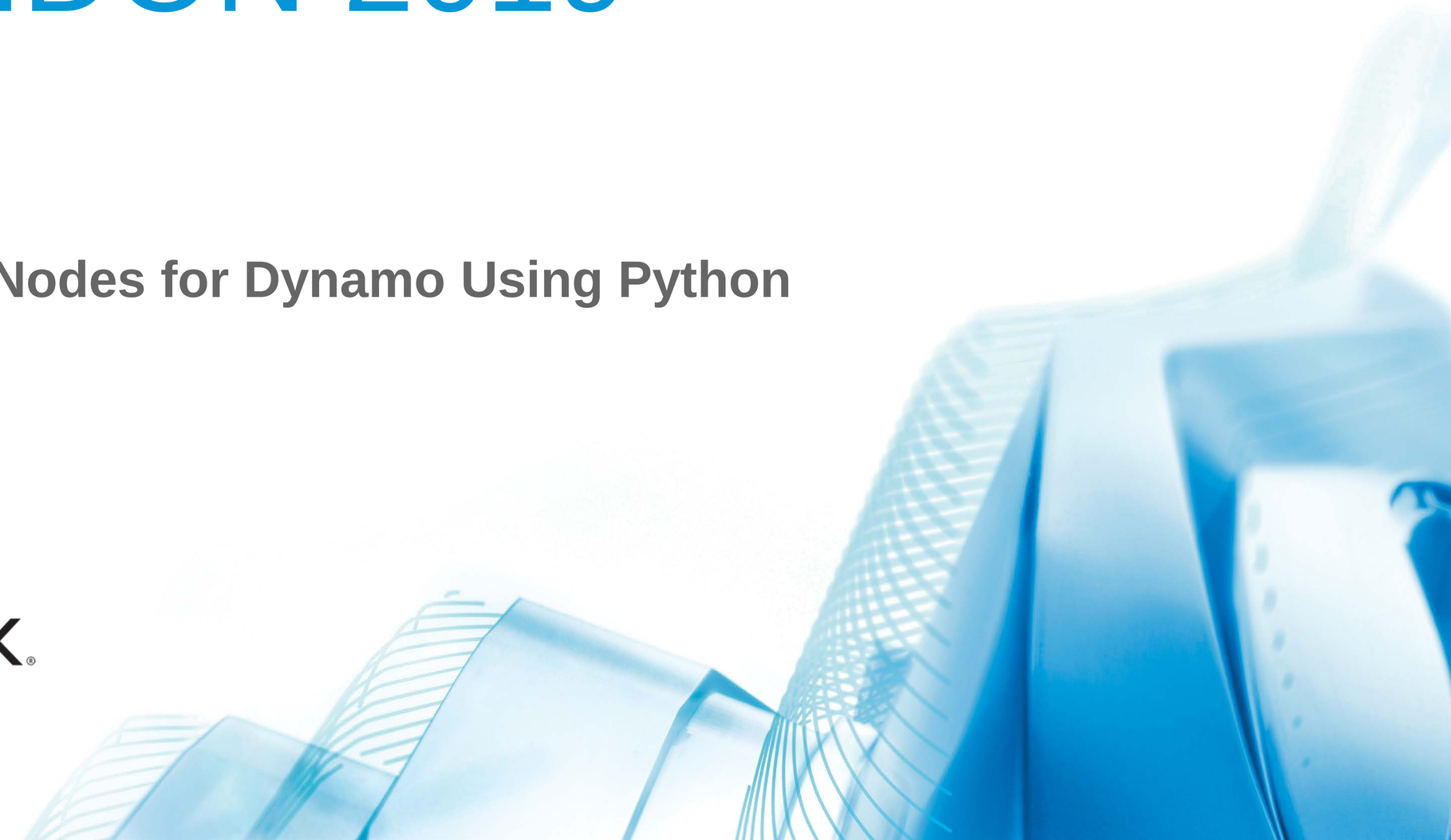
How to Build GUI Nodes for Dynamo Using Python

HANDOUT



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Key Resources

ZETCODE.COM

Step by step instructions on building some WinForms in Iron Python

http://zetcode.com/tutorials/ironpythontutorial/introduction/

VOIDSPACE.ORG

Similar to Zetcode, with a few more methods and controls covered

http://www.voidspace.org.uk/ironpython/winforms/index.shtml

MICROSOFT WINFORMS DOCUMENTATION

The full documentation of WinForms. Examples of all available methods etc. Written in C#

https://docs.microsoft.com/en-us/dotnet/api/system.windows.forms.form?view=netframework-4.8

DYNAMO FORUM

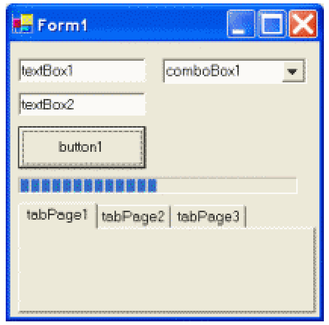
Its not a popular topic, but there are a lot of people on the forum including myself and the Data-Shapes team that can help

https://forum.dynamobim.com/search?q=winform

Key Resources

Dock & Anchor

IronPython & Windows Forms, Part VII



Note

This is part of a series of tutorials on using IronPython with Windows Forms.

```
import clr
clr.AddReference('System.Windows.Forms')

from System.Windows.Forms import Application, Form, Button, DockStyle

class MainForm(Form):
    def __init__(self):
        for i in range(1, 6):
            btn = Button()
            btn.Text = "Button %s" % i
            btn.Dock = DockStyle.Top
            self.Controls.Add(btn)


Application.EnableVisualStyles()
form = MainForm()
Application.Run(form)
```

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Key Terminology

CLASS & OBJECT

A blueprint created by a programmer for an object. This defines a set of attributes that will characterize any object that is instantiated from this class.

```
#In WinForms, any window or a dialog is a Form.
class DropDownForm(Form):

    def __init__(self):     #the __init__ method inside a class is its constructor

        self.Text = "AU London"      #text that appears in the GUI titlebar
        self.Icon = Icon.FromHandle(icon.GetHicon()) #takes a bitmap image and conve
```

An Object is simple an instance of a class

```
ddForm = DropDownForm()
```

```
#combox drop down
cBox = ComboBox()   #dropdown control form
```

Key Terminology

FUNCTION & DEFINITION

A function is a block of organized, reusable code that is used to perform a single, related action. Functions provide better modularity for your application and a high degree of code reusing

A definition Is simple a user defined function

```
def okButtonPressed(self, sender, args):
    self.Close()    #trigger to close the GUI when button is pressed
    self.runNextOutput = True #if the ok button is pressed set runNextOutput as True
```

```
btnOk.Anchor = (AnchorStyles.Bottom | AnchorStyles.Right)
btnOk.Click += self.okButtonPressed  #Register the event on the button bress to trigger the def
```

Key Terminology

METHOD & PROPERTY

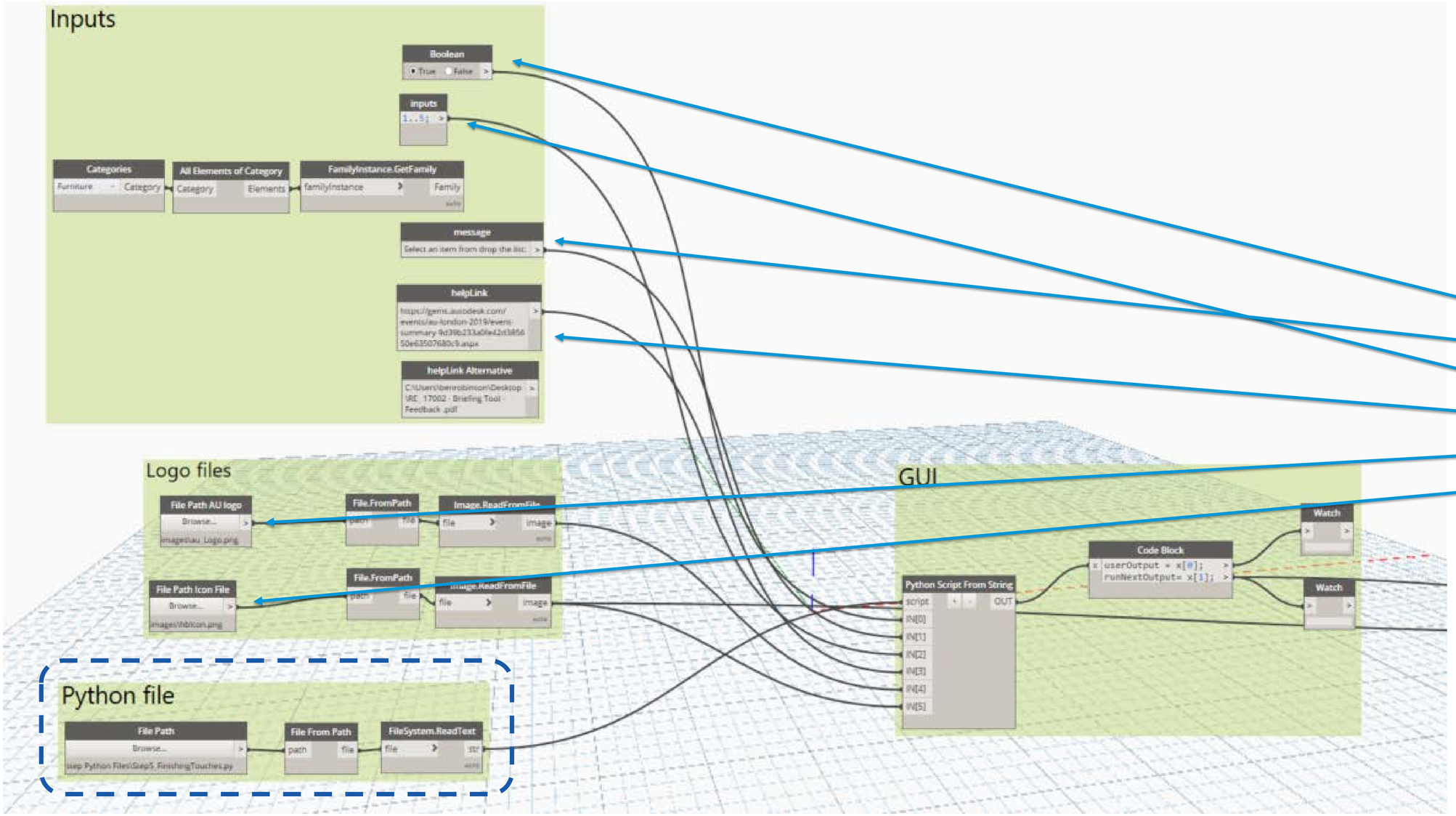
Similar to a function, it called by its name, but it is implicitly associated with an object/class.

https://docs.microsoft.com/en-us/dotnet/api/system.windows.forms.control.controlcollection.addrange?view=netframework-

```
cBox.Width = uiWidth -(spacing*2)
cBox.Items.AddRange(listInput)    # Adds an array of items to the list o
cBox.DropDownStyle = ComboBoxStyle.DropDownList    #setting to dropdown
```

Properties : controllable attributes of an object

Dynamo Setup




```
##############
#INPUTS HERE:

run = IN[0]
message = IN[1]
listInput =tuple(IN[2])
linkaddress = IN[3]
logoFile = IN[4]
icon = IN[5]
```

1: The Boiler Plate & Inputs

A Boiler plate is essentially code that can be reused without context in new applications

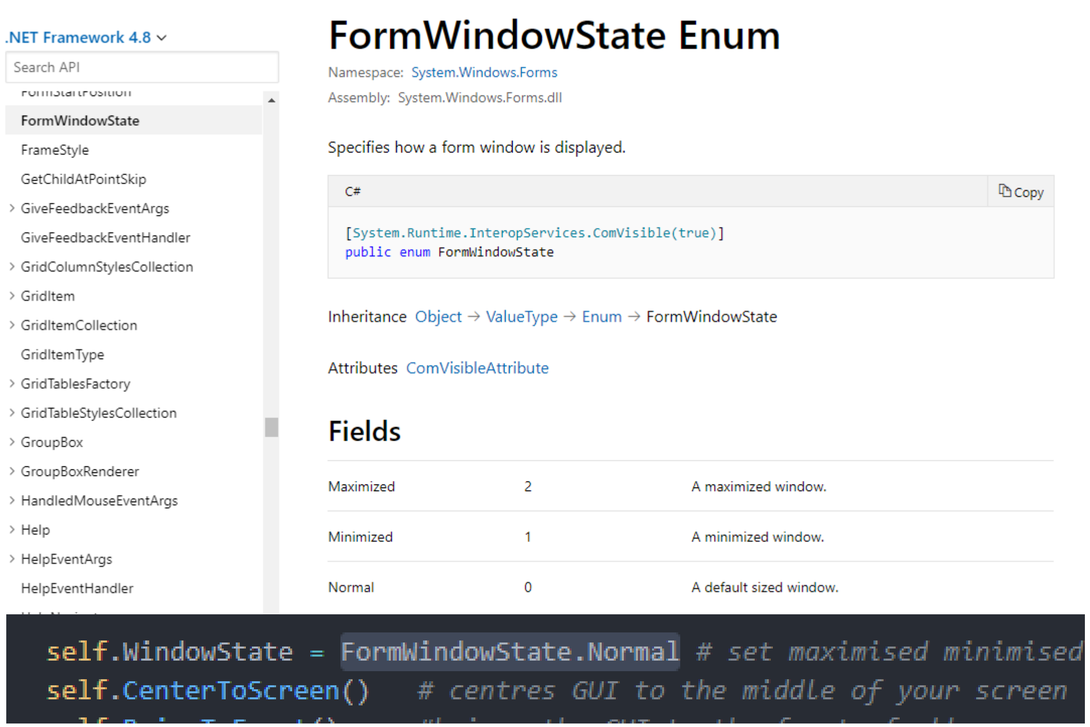
- Not all references are required to build a standalone GUI
  - I keep them incase I will need them further down the line.
  - Then delete unused when imports when it is finished

```
############-------------\-------------############
#My Default Boiler Plate
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *

clr.AddReference('RevitAPIUI')
from  Autodesk.Revit.UI import Selection

clr.AddReference("RevitAPI")
import Autodesk
from Autodesk.Revit.DB import *

clr.AddReference('RevitNodes')
import Revit
clr.ImportExtensions(Revit.Elements)
clr.ImportExtensions(Revit.GeometryConversion)

clr.AddReference('RevitServices')
import RevitServices
from RevitServices.Persistence import DocumentManager
from RevitServices.Transactions import TransactionManager
from System.Collections.Generic import *

import sys
pyt_path = r'C:\Program Files (x86)\IronPython 2.7\Lib'
sys.path.append(pyt_path)

import math
doc = DocumentManager.Instance.CurrentDBDocument
uiapp = DocumentManager.Instance.CurrentUIApplication
app = uiapp.Application

############-------------\-------------############
#INPUTS HERE:


TransactionManager.Instance.EnsureInTransaction(doc)

# "End" the transaction
TransactionManager.Instance.TransactionTaskDone()
```

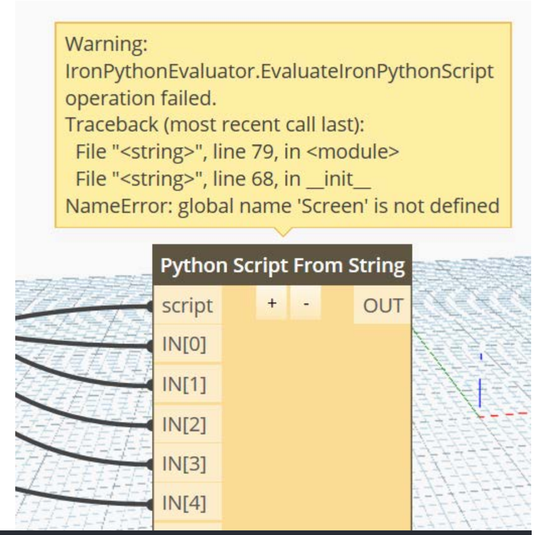
2: Hello World GUI

- 1: Add the WinForms and drawing assemblies
- 2: import the individual references we need now
- 3: For the main form create a class called “DropDownForm” this will use the Form class to create our GUI
- 4: __init__“ is a constructor in Python classes. Its called to create the GUI object and initiate the forms attributes
- 5: self represents the instance of the class. By using the "*self*" keyword we can access the *attributes* and *methods* of the class such as .Text which sets the title of the GUI
- 6: Create an instance of our DropDownForm() class
- 7: Run the application

```
import sys
pyt_path = r'C:\Program Files (x86)\IronPython 2.7\Lib'
sys.path.append(pyt_path)

import math
doc = DocumentManager.Instance.CurrentDBDocument
uiapp = DocumentManager.Instance.CurrentUIApplication
app = uiapp.Application

##########-----------\-----------##########
#UI additional references
clr.AddReference("System.Windows.Forms")  1
clr.AddReference("System.Drawing")

from System.Windows.Forms import Application, Form  2

##########-----------\-----------##########
#INPUTS HERE:

run = IN[0]
message = IN[1]
listInput =tuple(IN[2])     #Combo box requires tuple not list input
url = IN[3]
logoFile = IN[4]
icon = IN[5]


# create a instance of the form class called DropDownform.
#In Winforms, any window or a dialog is a Form.
class DropDownForm(Form):  3
    def __init__(self):  4 #the __init__ method inside a class is its constructor
        self.Text = "AU London"  5 #text that appears in the GUI titlebar


ddForm = DropDownForm()  6

if run:     #if input is true run the application.
    Application.Run(ddForm)  7
```




```
self.WindowState = FormWindowState.Normal # set maximised minimised
self.CenterToScreen()    # centres GUI to the middle of your screen
```




```
clr.AddReference("System.Drawing")

from System.Windows.Forms import Application, Form, FormWindowState#, Screen
from System.Drawing import Icon, Color
```

Tip 1

To find a list of all properties and methods of the Form Class check the below documentation

https://docs.microsoft.com/en-us/dotnet/api/system.windows.forms.form?view=netframework-4.8

Tip 2

If you use a control and get the above error it will be because you have not imported the control from Windows.Forms

3: Basic Form Controls

- 1: GUI require widgets/controls: ways of receiving inputs (buttons etc.) When we use any control it must be imported.
- 2: Get a bitmap image from at the input path and use it as the GUI icon
- 3: These methods ensure the GUI comes to the front your screen and is scaled normally
- 4: Get the size of the user's screen and make the GUI ¼ dimension of the screen.
- 5: *FormBorderStyle = FormBorderStyle.FixedDialog stops the form from being scaled in size by a user. Disable this for testing incase controls disappear*
- *6: Create 2 output values to store the values of the item selected and run control*

```python
from System.Windows.Forms import Application, Form, FormWindowState, Screen
from System.Drawing import Icon, Color

############-------------\-------------############
#INPUTS HERE:

run = IN[0]
message = IN[1]
listInput =tuple(IN[2])     #Combo box requires tuple not list input
url = IN[3]
logoFile = IN[4]
icon = IN[5]

userOutputDefaultStr = "No selection made, Re-run, and select an item from the dropdown menu" #set

# create a instance of the form class called DropDownform.
#In Winforms, any window or a dialog is a Form.
class DropDownForm(Form):

    def __init__(self):     #the __init__ method inside a class is its constructor

        self.Text = "AU London"      #text that appears in the GUI titlebar
        self.Icon = Icon.FromHandle(icon.GetHicon()) #takes a bitmap image and converts to a file t
        self.BackColor = Color.FromArgb(255, 255, 255)

        self.WindowState = FormWindowState.Normal # set maximised minimised or normal size GUI
        self.CenterToScreen()   # centres GUI to the middle of your screen
        self.BringToFront()     #brings the GUI to the front of all opens windows.
        self.Topmost = True    # true to display the GUI infront of any other active forms

        screenSize = Screen.GetWorkingArea(self)  #get the size of the computers main screen, as th
        self.Width = screenSize.Width / 4  #set the size of the form based on the size of the users
        self.Height = screenSize.Height / 4
        uiWidth = self.DisplayRectangle.Width    #get the size of the form to use to scale form ele
        uiHeight = self.DisplayRectangle.Height

        #self.FormBorderStyle = FormBorderStyle.FixedDialog      # fixed dialog stops the user from

        self.userOutput = userOutputDefaultStr  #create a container to store the output from the fo
        self.runNextOutput =  False  #set these default values

############-------------\-------------############




ddForm = DropDownForm()

if run:     #if input is true run the application.
    Application.Run(ddForm)
```

Setting out the GUI Controls

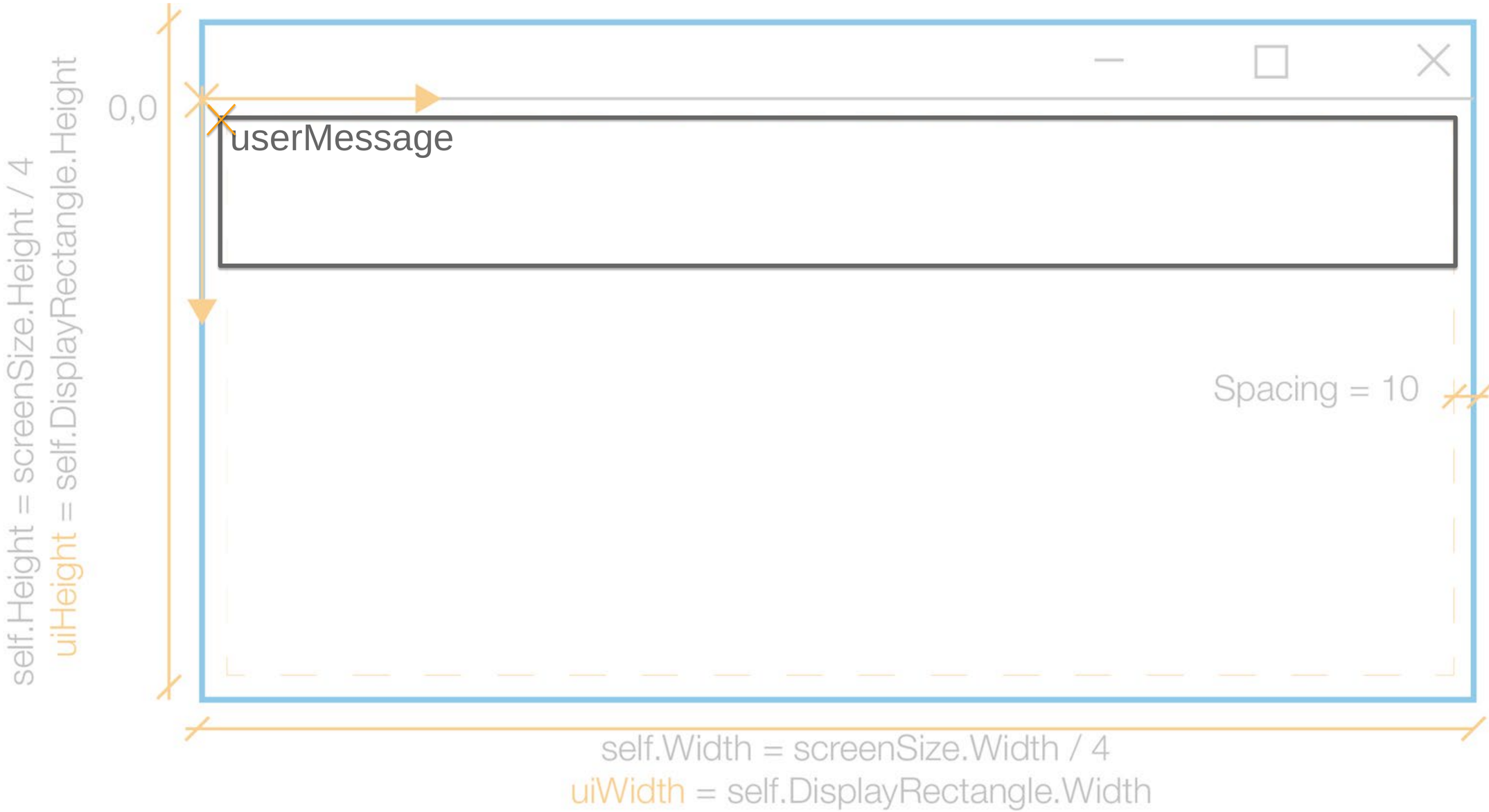
4: Adding Simple Controls

- 1: The label control allows text to be added to the GUI .
- 2: Point object is required in order to location a control (X,Y)
- 3: Size the label using uiWidth + uiHeight. This ensures is scales will the GUI for different type screens.
- 4: self.Controls.Add() Adds the control to the GUI
- 5: Get the ratio of logo height to width. Value must be a float as an int will round to the nearest 1.
- 6: SizeMode scale the image to fit the input size.
- 7: AnchorStyles lock the control to a given corner(s) this is needed if the user can change the size of the GUI

```
from System.Windows.Forms import Application, Form, FormWindowState, Screen, Label, PictureBox,
from System.Drawing import Icon, Color, Font, Point, Size
```

```
44
45  ##############------------\------------##############
46          spacing = 10    #spacing size for GUI elements to form a consistent
47
48          # creates the text box for a info message
49      1   userMessage = Label()   #label displays texts
50          font = Font("Helvetica ", 10)
51          userMessage.Text = message
52          userMessage.Font = font
53      2   userMessage.Location = Point(spacing, spacing)
54      3   userMessage.Size = Size(uiWidth-(spacing*2),(uiHeight/4))
55          self.Controls.Add(userMessage)
56      4
57
58  #////////////////////////////////////////////////////////////////////////////////
59          #logo file
60          logo =PictureBox()
61          logo.Image = logoFile
62      5   ratio =  float(logo.Height)/ float(logo.Width)  #needs to be a floa
63          logo.Size = Size(uiWidth/4, (uiHeight/4)*ratio) #scale the image by
64          logo.Location = Point(spacing, (uiHeight- logo.Height)-spacing)
65      6   logo.SizeMode = PictureBoxSizeMode.Zoom     # zooms the image to f
66      7   logo.Anchor = (AnchorStyles.Bottom | AnchorStyles.Left)      #ancho
67          self.Controls.Add(logo)
68          #logo.BorderStyle = BorderStyle.Fixed3D    #gives a border to the p
69
70
71
72
73  ddForm = DropDownForm()
74
75  if run:     #if input is true run the application.
76      Application.Run(ddForm)
77
78
```

Setting out the GUI Controls



5: ComboBox Control

- 1: ComboBox is a drop down and text input control
- 2: Add a list of items for the drop down using .AddRange()
- 3: ComboBoxStyle.DropDownList remove the ability for a user to input a text value into the control
- 4: SelectedIndexChanged+= registers the event handler of the user selecting an item from the control to then run the def dropDownOutput
- 5: self = instance of the form class (dropDownOutput)
  sender = the control object sending that raised the event
  Args = the argument/event from the sender
  assign the select item to userOutput variable
- 6: assign the output of ddForm.userOutput to results and output it

```
98          logo.Image = logoFile
99          ratio =  float(logo.Height)/ float(logo.Width)  #needs to be a floa
100         logo.Size = Size(uiWidth/4, (uiHeight/4)*ratio) #scale the image by
101         logo.Location = Point(spacing, (uiHeight- logo.Height)-spacing)
102         logo.SizeMode = PictureBoxSizeMode.Zoom     # zooms the image to fi
103         logo.Anchor = (AnchorStyles.Bottom | AnchorStyles.Left)      #ancho
104         self.Controls.Add(logo)
105         #logo.BorderStyle = BorderStyle.Fixed3D    #gives a border to the p
106
107 #############------------\------------#############
108
109         #combox drop down
110 (1)     cBox = ComboBox()   #dropdown control form
111         cBox.Location = Point(spacing,uiHeight/2)
112         cBox.Width = uiWidth -(spacing*4)
113 (2)     cBox.Items.AddRange(listInput)    # Adds an array of items to the l
114 (3)     cBox.DropDownStyle = ComboBoxStyle.DropDownList     #setting to dro
115 (4)     cBox.SelectedIndexChanged += self.dropDownOutput  #.Click+= registe
116         self.Controls.Add(cBox)
117
118
119 #############------------\-----------------------------------------------
120         #when a user selects a item in the drop down the dropDownOutput met
121 (5)     def dropDownOutput(self, sender, args):     #self is the instance of th
122             self.userOutput = sender.SelectedItem   #output the selected item.
123
124
125 ddForm = DropDownForm()
126
127 if run:     #if input is true run the application.
128     Application.Run(ddForm)
129
130 (6) results = ddForm.userOutput
131
132     OUT = results
```

6: Button Controls

- 1: Create a button control called btnOk
- 2: when the button is clicked register the event to run the def okButtonPressed
- 3: when the button is pressed close the form and set the runNextOutput variable btnOk = True, btnCancel = False
- 4: default values created act as output control. So if a user selects an item from the dropdown but does not press the next button the runNextOutput variable will return False.
- 5: User must select an item and click the btnOk to output the select item and True.

```
78
79      self.userOutput = userOutputDefaultStr #create a container to store the output from the
80      self.runNextOutput =  False  #set these default values
81
82
```

```
120     #Create ok button
121     btnOk = Button()    #create a button control
122     btnOk.Text = "Next"
123     btnOk.Location = Point(uiWidth - ((btnOk.Width * 2) + spacing ), uiHeight - (btnOk.Height
124     btnOk.Anchor = (AnchorStyles.Bottom | AnchorStyles.Right)
125     btnOk.Click += self.okButtonPressed    #Register the event on the button bress to trigger
126     self.Controls.Add(btnOk)
127
128     #Create Cancel Button
129     btnCancel = Button()
130     #btnCancel.Parent = self
131     btnCancel.Text = "Cancel"
132     btnCancel.Location = Point(uiWidth - (btnOk.Width + spacing), uiHeight - (btnOk.Height +
133     btnCancel.Anchor = (AnchorStyles.Bottom | AnchorStyles.Right)
134     btnCancel.Click += self.CnlButtonPressed
135     self.Controls.Add(btnCancel)
136
137
138 #############------------\-------------------------------------------------------------------
139     #when a user selects a item in the drop down the dropDownOutput method is called.
140 def dropDownOutput(self, sender, args):     #self is the instance of the GUI form. Sender is
141     self.userOutput = sender.SelectedItem   #output the selected item.
142
143 def okButtonPressed(self, sender, args):
144     self.Close()    #trigger to close the GUI when button is pressed
145     self.runNextOutput = True #if the ok button is pressed set runNextOutput as True
146
147 def CnlButtonPressed(self, sender, args):
148     self.Close()
149     self.runNextOutput = False #if the ok button is pressed set runNextOutput as False
150
151
152 ddForm = DropDownForm()
153
154 if run:     #if input is true run the application.
155     Application.Run(ddForm)
156
157     if ddForm.userOutput == userOutputDefaultStr:       #if the user does not select a item So th
158         results = ddForm.userOutput, ddForm.runNextOutput       #output the default string and ru
159     else:
160         results = ddForm.userOutput, ddForm.runNextOutput       #else if someone has selected a i
161
162     OUT = results
```

6: Finishing Touches

- 1: Create a linkLabel control: A button which activates a link
- 2: link is assigned to helpLink.Tag
- 3: when the link is pressed the event is logged to run the def openLink
- 4: Create a Panel. It's meant for grouping but can be used for colour
- 5: Sets its colour using the FromArgb method and set the border style to fixed 3D
- 6: If the link is a weblink you need webbrowser.Open()

  if it's a pdf etc you need System.Diagnostics.Process……

  Don't forget the additional import references!

```
import webbrowser   #needed to open a url
import System.IO    #needed to be able to open a pdf

#from System.Windows.Forms import *
from System.Windows.Forms import Application, Form, FormWindowState, Screen, Label, PictureBox, PictureBoxSizeM
from System.Windows.Forms import Button, LinkLabel, Panel
from System.Drawing import Icon, Color, Font, Point, Size
```

```
        #Create a weblink
1       helplink = LinkLabel()
        helplink.Text = "User Guide"
2       helplink.Tag = linkaddress      #tag is the web address
3       helplink.Click += self.openLink  #register click event with event handler
        helplink.Location = Point(uiWidth - ((btnOk.Width *3)+ spacing), uiHeight - (btnOk.Heigh
        self.Controls.Add(helplink)
        helplink.Anchor = (AnchorStyles.Bottom | AnchorStyles.Left)


4       colourPanel = Panel()
        colourPanel.Height = cBox.Height + spacing #Locate the panel behind the combo box.
        colourPanel.Width = uiWidth
        colourPanel.Location = Point(0,(uiHeight/3)-5)
5       colourPanel.BorderStyle = BorderStyle.Fixed3D # graphical style to pronounce the edge of
        colourPanel.BackColor = Color.FromArgb(1, 125, 199)  #set background colour by RGB value
        self.Controls.Add(colourPanel)


##############------------\-------------------------------------------------------------------
        #when a user selects a item in the drop down the dropDownOutput method is called.
    def dropDownOutput(self, sender, args):     #self is the instance of the GUI form. Sender is
        self.userOutput = sender.SelectedItem   #output the selected item.

    def okButtonPressed(self, sender, args):
        self.Close()    #trigger to close the GUI when button is pressed
        self.runNextOutput = True #if the ok button is pressed set runNextOutput as True

    def CnlButtonPressed(self, sender, args):
        self.Close()
        self.runNextOutput = False #if the ok button is pressed set runNextOutput as False

    def openLink(self, sender, event):
        webbrowser.open(sender.Tag)     #open a weblink
6       #System.Diagnostics.Process.Start(sender.Tag);  #to open a PDF
        self.Close()
        self.runNextOutput = False
```