

Graphical User Interfaces

CST 205

GUI

- GUI stands for **Graphical User Interface**
- Many powerful applications run from the command line
 - Command line interface (CLI)
 - These applications typically use various arguments to provide control over features

Example command line program

- `youtube-dl`: Original purpose was to watch YouTube videos offline.
- Famous open source project ([GitHub](#))

```
youtube-dl -f bestaudio https://youtu.be/PtJ6yAGjsIs
```

Tkinter

- Python comes bundled with **Tkinter**, which works okay for small applications.

excerpt from the official Python Wiki:

Tkinter is Python's de-facto standard GUI (Graphical User Interface) package. It is a thin object-oriented layer on top of [Tcl/Tk](#).

Tkinter is not the only [GuiProgramming](#) toolkit for Python. It is however the most commonly used one. [CameronLaird](#) calls the yearly decision to keep Tkinter "one of the minor traditions of the Python world."

The Tkinter wiki: <http://tkinter.unpythonic.net/wiki/>



dead link

Qt

- (Apparently) pronounced “cute” 😞
- Qt is a cross-platform application development framework written in C++
- Qt is more than a GUI toolkit -- includes networking, databases, and more.
- Qt is modern, actively developed, very powerful, with good documentation

PyQt

- PyQt is a set of Qt bindings for Python
- Python works well with C++/C frameworks
- The bindings are implemented as a set of Python modules and contain over 1,000 classes.
- PyQt5 is the latest version

Minimal PyQt5 example (uncommented)

```
import sys
from PyQt5.QtWidgets import QApplication, QWidget, QLabel

my_qt_app = QApplication(sys.argv)

my_window = QWidget()

my_window.setGeometry(0,0,400,300)

my_window.setWindowTitle('CST 205!')

my_label = QLabel(my_window)
my_label.setText('Hi!')

my_window.show()
sys.exit(my_qt_app.exec_())
```

(commented version [here](#))

PyQt5 documentation

- Qt 5 (the basis for PyQt5) is absolutely massive.
- The documentation for PyQt5 could be better, but the Qt documentation is excellent.
- Qt documentation has some C++ specific content, but generally can be understood and used without any C++ knowledge.
- I will generally link to the Qt documentation.

QtWidgets module

- The `QtWidgets` module ([docs](#)) provides many classes for creating GUIs.
 - It contains a large set of UI elements.
- Our minimal example imports the following classes from `QtWidgets`: `QApplication`, `QWidget`, `QLabel`

QApplication class

- Every PyQt5 application must create an application object.
- There is precisely **one** `QApplication` object, regardless of the amount of windows created.

```
my_qt_app = QApplication(sys.argv)
```

- The `sys.argv` parameter is a list of command line arguments.

QWidget class

- Base class of all user interface objects in PyQt5.

```
my_window = QWidget()
```

- The default constructor (i.e. arguments) has no parent.
 - A widget with no parent is called a window.
- `QWidget`'s `show()` method displays a widget on the screen.

```
my_window.show()
```

PyQt5 Main Loop

- The main loop of the application is where event handling begins.
- The main loop received events from the window system and dispatches them to the application widgets.
- The main loop ends if we call the `exit()` method or if the main widget is destroyed.
 - `sys.exit()` ensures a clean exit. The The environment will be informed how the application ended.
 - `exec_()` method has an underscore because `exec` is a reserved word in Python.

Minimal PyQt5 example using OOP

```
import sys
from PyQt5.QtWidgets import QApplication, QWidget

class Example(QWidget):
    def __init__(self):
        super().__init__()
        self.setGeometry(0,0,600,600)
        self.setWindowTitle("Testing 123")
        self.show()

app = QApplication(sys.argv)
ex = Example()
sys.exit(app.exec_())
```

Use of `super()`

- `super()` refers to the **parent** class (sometimes called **base** or **super** class)
- `super().__init__()` invokes the `__init__()` method of the parent class.
 - In this case, the parent class is `QWidget`.
- Prior to Python 3 this was written as:
 - `super(Child, self).__init__()`
 - Read more [here](#)