Image Processing & GUI Programming with Qt

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Why learn Qt?

- Object-Oriented C++ GUI library (and more)
- Cross-platform (Windows-Mac-Linux)
- Open Source & Commercial licenses
- Resources: Documentation, Mailing Lists, Forums, etc
- Used in industry:
  - Adobe, Google, KDE, Skype, …
  - http://trolltech.com/products/qt/qtinuse/qtcustomers

Qt Demo's

- Mainwindow
- Affine Transformations
- Text Editor
- OpenGL

Event-Driven Programming

Imperative

```
main() {
  step1();
  step2();

  …

  return 0;
}
```

Event-Driven

```
while(true) {

  process-event(Queue);

  setState(…);

}
```

Event-Driven Programming

- In imperative programming, the *programmer* has control of the order of execution of functions. With event-driven programming the *user interaction* determines the order of execution.
- Event-Driven programs consist of an *event-loop* and an *event-queue*.
  - **Event-Loop**: an infinite loop that either waits for events or processes events in the event-queue.
  - **Event-Queue**: a queue which receives its input from user interaction, sensors, or other events.
- GUI's are implemented using event-driven programming paradigm

Installing Qt

- Download Qt for your platform
  - Note: The Windows open-source version only works with Mingw compiler, included in the installer.
- On Windows run installer
  - May need to add Qt libs to your environment variables if installer does not do so.
- On Mac and Linux follow instructions to build

Programming with Qt

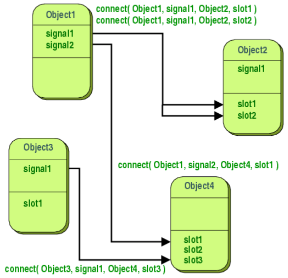
CODE

Compiling

- Save all your source files to a folder.
- Open your command-line:
  ```
  % cd /path/sourcecode/
  % qmake -project
  % qmake
  % make
  ```
- Run the executable, or fix any errors

Programming with Qt

- Signals and Slots
  - Classes must use the Q_OBJECT macro when using signals-slots


Object1
signal1
signal2
connect(Object1, signal1, Object2, slot1)
connect(Object1, signal1, Object2, slot2)
Object2
signal1
slot1
slot2
Object3
signal1
slot1
connect(Object1, signal2, Object4, slot1)
Object4
slot1
slot2
slot3
connect(Object3, signal1, Object4, slot3)

Programming with Qt

- Qt provides some garbage collection. This only works if you pass a *parent* to the class constructors.
- QImage data allocated with **new** must be released manually with **delete**.

QImage

- Open an image: `Qimage img(“C:\path\pic.jpg”);`
- Save an image: `img.save(“C:\path\pic2.jpg”);`
- Read a pixel: `QRgb colors = img.pixel(i,j);`
  - Reading colors:
    - `int red = qRed(colors);`
    - `int green = qGreen(colors);`
    - `int blue = qBlue(colors);`
- Writing a pixel:
  - `img.setPixel(i,j,colors);`
  - `Img.setPixel(i,j,qRgb(red, green, blue));`

Resources

- Vendor: http://www.trolltech.com
- Documentation / API Reference / Tutorials: http://doc.trolltech.com/4.2/index.html
- Download: http://www.trolltech.com/developer/downloads/qt/index
- Forums: http://www.qtforum.org
- The Independent Qt Tutorial: http://www.digitalfanatics.org/projects/qt_tutorial/