# C++, GUI Programming, and You.

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## Outline

- GUI Programming in C++
- The Qt Library
- The WxWidgets Library
- Visual C++

## Qt

- Developed by TrollTech
- Comes in Open Source and Commercial Flavours
- Adds nifty features to your C++
  - Garbage Collection!

## Qt Event Handling

- QEventLoop
  - Can be instantiated arbitrarily
- QApplications always have a QEventLoop
  - This is the main event loop
- Filterable
  - User input, Socket Notifiers,Defer, X11Timer Events
- Active Event Loop pulls events off of queue
  - No events? Wait state

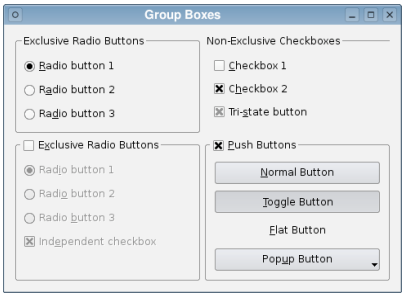
## Events

- QEvent is the parent of all events.
  - Usually sent by Windowing System
    - But can be manually sent
- QEvent uses Types
  - An Int Enumeration
  - Over 100 System defined Types
  - Type IDs 1000-65535 reserved for User Defined Events

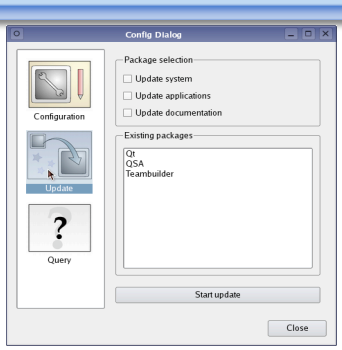
## Qt Example Widgets

- Qt has access to a plethora of Widgets
- Here are some nice pictoral examples.

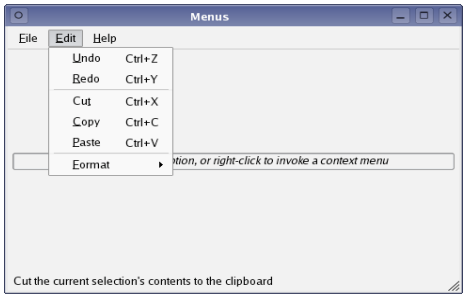
## Group Boxes



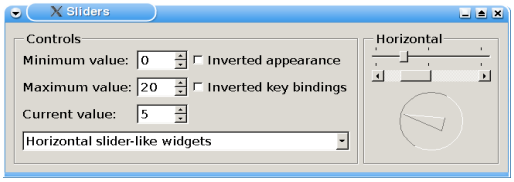

## A Configuration Dialog



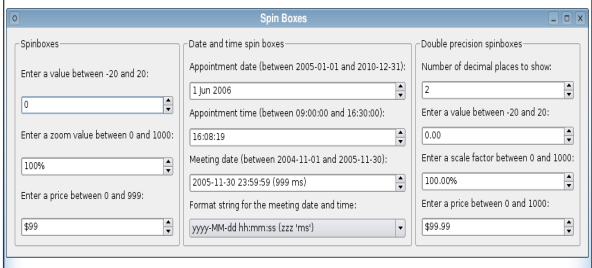
## Menus in a Window




## Slide Bars!



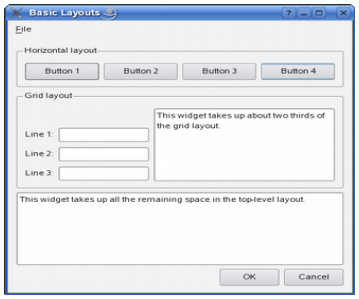

## Spin Boxes




## Qt Layout Management

- Layout Widget
  - A widget that organizes the QObjects added to it.
    - QHBox, QVBox, QGrid
- QLayout
  - Much like Java's layouts
    - QGridLayout == GridBagLayout
  - More Complicated to use, but freer
    - Possibly to extend QLayout for customization

## Layout Widget Example




## Qt Example


## Qt Example Source

```
#include <QApplication>
#include <QPushButton>

int main (int argc, char *argv[])
{
        QApplication app(argc, argv);
        QPushButton hello("Hello world!");
        hello.resize(100, 30);
        hello.show();
        return app.exec();
}
```

## Qt Example that Wayne Wrote

```
#include <QT>
#include <QApplication>
#include <QLabel>
#include <QWidget>

int main (int argc, char *argv[])
{
        QApplication app(argc, argv);
        QWidget window;
        window.resize(800,600);
        QLabel first("I'm the first label!", &window);
        QLabel second("I'm the second label!", &window);
        QLabel third("I'm not actually here.", &window);
        first.setGeometry(0,0,800,200);
        second.setGeometry(0,200,800,200);
        third.setGeometry(0,400,800,200);
        window.show();
        return app.exec();
}
```

## WxWidgets

- Yet another C++ GUI Library!
- Released by the Artificial Intelligence Applications Institute at the University of Edinburgh in 1992
  - Originally an in house tool

## WxWidgets Event Handling

- wxEvtHandler
  - Takes events from the event queue
  - Invokes method in the event table on itself
- Why is WxWidgets different?
  - wxWindow is an ancestor of wxEvtHandler
    - Everything that's a window is an event handler
    - In WxWidgets, everything that's visible is a window!

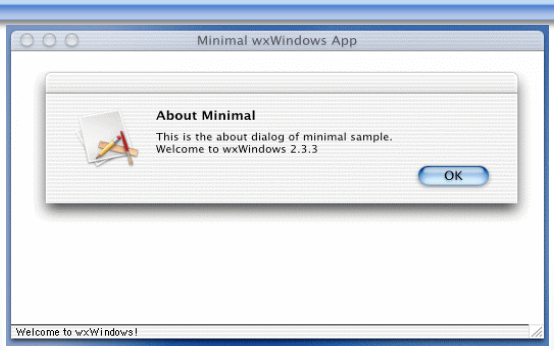
## WxWidgets Main Event Loop

- Every WxWidget application must inherit from the class wxApp
  - wxApp inherits from wxWindow
  - Forces the wxApp ancestor to be the main event loop

## Events in WxWidgets

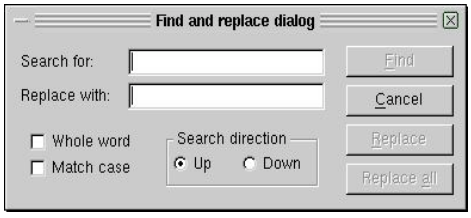
- Descendents of wxEvent class
  - Also uses int Type enumeration
    - Ints are dynamically assigned at run time
- Command Events vs. Non-Command
  - Command events are passed recursively up to a window's parents
  - Non-Command events are not.
- Command events are almost always user generated.

## WxWidgets Example Widgets




## wxGLCanvas


## wxDialog Example




## WxWidgets Layout Management

- wxSizer is the parent Layout class
- Functions by adding wxWindow instances directly to an instance of a wxSizer
- 5 implementing ancestors
  - wxBoxSizer, wxStaticBoxSizer, wxGridSizer, wxFlexGridSizer, CreateButtonSizer

# WxWidgets Example

# WxWidgets Example Source

```
/*
 * hworld.cpp
 * Hello world sample by Robert Roebling
 */

#include "wx/wx.h"

class MyApp: public wxApp
{
    virtual bool OnInit();
};

class MyFrame: public wxFrame
{
public:

    MyFrame(const wxString& title, const wxPoint& pos, const wxSize& size);

    void OnQuit(wxCommandEvent& event);
    void OnAbout(wxCommandEvent& event);

    DECLARE_EVENT_TABLE()
};
```

# It Continues!

```
enum
{
    ID_Quit = 1,
    ID_About,
};

BEGIN_EVENT_TABLE(MyFrame, wxFrame)
    EVT_MENU(ID_Quit, MyFrame::OnQuit)
    EVT_MENU(ID_About, MyFrame::OnAbout)
END_EVENT_TABLE()

IMPLEMENT_APP(MyApp)

bool MyApp::OnInit()
{
    MyFrame *frame = new MyFrame( "Hello World", wxPoint(50,50), wxSize(450,340) );
    frame->Show(TRUE);
    SetTopWindow(frame);
 return TRUE;
}
```

# Will it end?

```
MyFrame::MyFrame(const wxString& title, const wxPoint& pos, const wxSize& size)
: wxFrame((wxFrame *)NULL, -1, title, pos, size)
{
    wxMenu *menuFile = new wxMenu;

    menuFile->Append( ID_About, "&About..." );
    menuFile->AppendSeparator();
    menuFile->Append( ID_Quit, "E&xit" );

    wxMenuBar *menuBar = new wxMenuBar;
    menuBar->Append( menuFile, "&File" );

    SetMenuBar( menuBar );

    CreateStatusBar();
    SetStatusText( "Welcome to wxWindows!" );
}
```

## Yeah. Finally.

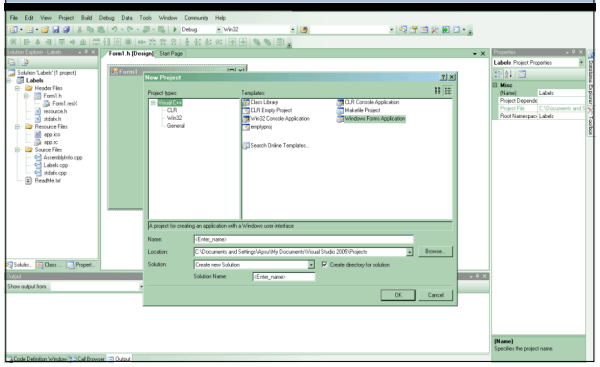
```
void MyFrame::OnQuit(wxCommandEvent& WXUNUSED(event))
{
    Close(TRUE);
}

void MyFrame::OnAbout(wxCommandEvent& WXUNUSED(event))
{
    wxMessageBox("This is a wxWindows Hello world sample",
        "About Hello World", wxOK | wxICON_INFORMATION, this);
}
```

## Visual C++

- Microsoft's Implementation of C++
- With a shiny front end of Visual Studio

## Visual C++ UIDE



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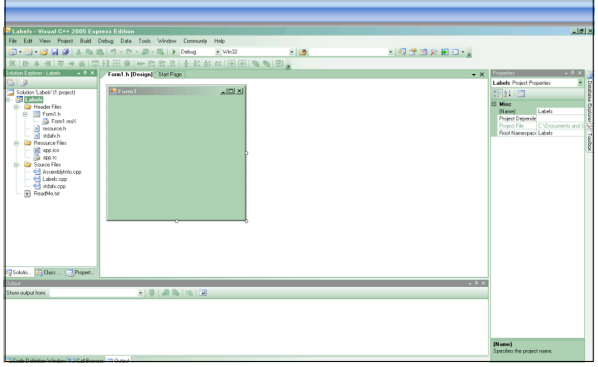
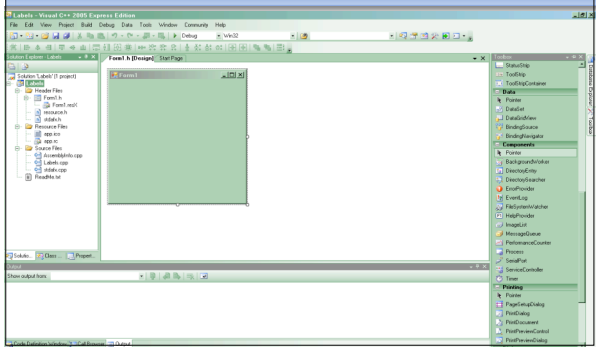
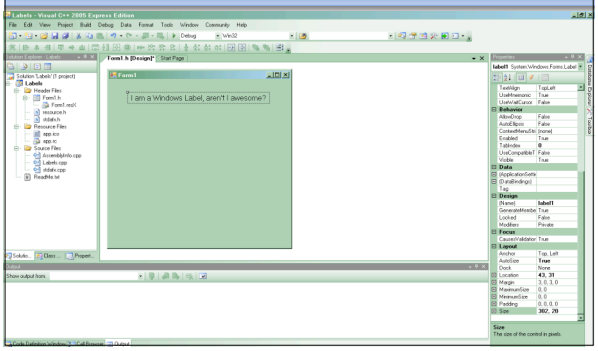


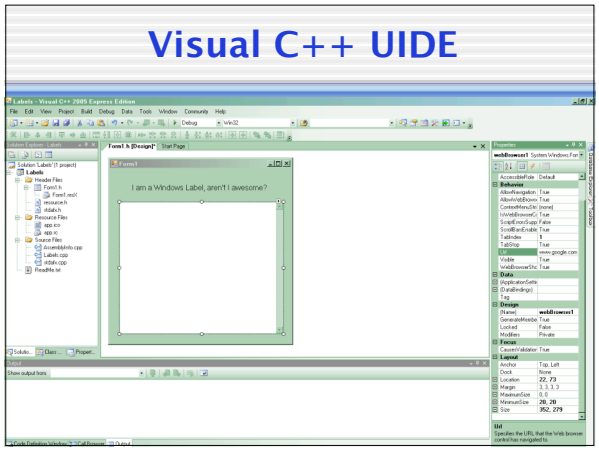
# Visual C++ UIDE



# Visual C++ UIDE




# Visual C++ UIDE




# Visual C++ Sample Code

```
#pragma once

namespace Labels {

	using namespace System;
	using namespace System::ComponentModel;
	using namespace System::Collections;
	using namespace System::Windows::Forms;
	using namespace System::Data;
	using namespace System::Drawing;


	public ref class Form1 : public System::Windows::Forms::Form
	{
	public:
		Form1(void)
		{
			InitializeComponent();
	}
```

## Form 1 Continues

```
protected:
        ~Form1()
        {
                if (components)
                {
                        delete components;
                }
        }
private: System::Windows::Forms::Label^  label1;
protected:
private: System::Windows::Forms::WebBrowser^  webBrowser1;

private:
        System::ComponentModel::Container ^components;
```

## More Form 1

```
#pragma region Windows Form Designer generated code
                void InitializeComponent(void)
                {
                        this->label1 = (gcnew System::Windows::Forms::Label());
                        this->webBrowser1 = (gcnew System::Windows::Forms::WebBrowser());
                        this->SuspendLayout();
                        this->label1->AutoSize = true;
                        this->label1->Font = (gcnew System::Drawing::Font(L"Microsoft Sans Serif", 12,
    System::Drawing::FontStyle::Regular,
  System::Drawing::GraphicsUnit::Point,
                                static_cast<System::Byte>(0)));
                        this->label1->Location = System::Drawing::Point(43, 31);
                        this->label1->Name = L"label1";
                        this->label1->Size = System::Drawing::Size(302, 20);
                        this->label1->TabIndex = 0;
                        this->label1->Text = L"I am a Windows Label, aren\'t I awesome\?";
                        this->webBrowser1->Location = System::Drawing::Point(22, 73);
                        this->webBrowser1->MinimumSize = System::Drawing::Size(20, 20);
                        this->webBrowser1->Name = L"webBrowser1";
```

## Last of Form 1

```
                        this->webBrowser1->Size = System::Drawing::Size(352, 279);
                        this->webBrowser1->TabIndex = 1;
                        this->webBrowser1->Url = (gcnew
    System::Uri(L"http://www.google.com",
 System::UriKind::Absolute));
                        this->AutoScaleDimensions = System::Drawing::SizeF(6, 13);
                        this->AutoScaleMode =
    System::Windows::Forms::AutoScaleMode::Font;
                        this->ClientSize = System::Drawing::Size(392, 373);
                        this->Controls->Add(this->webBrowser1);
                        this->Controls->Add(this->label1);
                        this->Name = L"Form1";
                        this->Text = L"Form1";
                        this->ResumeLayout(false);
                        this->PerformLayout();
        }
#pragma endregion
    };
}
```

## Labels.cpp

```
// Labels.cpp : main project file.

#include "stdafx.h"
#include "Form1.h"

using namespace Labels;

[STAThreadAttribute]
int main(array<System::String ^> ^args)
{
    // Enabling Windows XP visual effects before any controls are created
    Application::EnableVisualStyles();
    Application::SetCompatibleTextRenderingDefault(false);

    // Create the main window and run it
    Application::Run(gcnew Form1());
    return 0;
}
```

## Hey, where's GTK+?

- /GTK+/.configure
- Mac: You need Cairo
- /Cairo/.configure
- Mac: You need libpng
- /libpng/.configure;make;make install
  - Success!
- /Cairo/.configure
- Mac: You need libpng

## You Are Now Entering:


## this.destroy();

- Questions?