Cross-Platform Approaches from a Macintosh Perspective

Jonathan Hoyle

AdHoc/MacHack 20

7/29/05

Who am I?

- Jonathan Hoyle
- Just a Mac developer with an opinion
- Made enough bad mistakes in cross-platform projects to learn a little bit
- Currently working for *Eastman Kodak*
- Not representing Kodak, just me
- My vacation time here at MacHack

What this *is* / What this *isn't*

- **Is:**
  - A survey of cross-platform frameworks (zoology not biology)
  - Overview on using REALbasic with C/C++
  - Highly opinionated rantings by the author
- **Isn't:**
  - An in-depth tutorial on every framework
  - An complete introduction on REALbasic

Although not coverage of every approach, after 18 pages it should feel like it is.

Paper Outline

1. Motivation
2. A Word About Java
3. Development Considerations
4. Legacy Cross-Platform Frameworks
5. Modern Cross-Platform Frameworks
6. REALbasic with C/C++
7. 5 Rules for a Cross-Platform Project
8. Summary

1. Motivation

- Mac has a smaller user base
- Difficult to justify separate development efforts for a small market gain
- Many cross-platform approaches
- Not all are Macintosh “friendly”
- Focus on development for:
    - Mac OS X
    - Windows
    - Classic & Linux (if available)

2. A Word About Java

- Great cross-platform environment, but
  - Two Javas: Language front-end/bytecode back-end. Not always the same
  - Performance penalties due to JVM
  - Java's future? (Microsoft vs. Sun)
  - "Lowest common denominator" look & feel
  - Many Java apps are Windows-only
  - Java not exclusive with C++: JNI
    - Recommended compilers:
      - **Free**: *Eclipse*
      - **Paid**: *Idea* from Intellij

3. Development Considerations

a. C/C++ Compilers
b. Mac OS X on Intel
c. Architecting with MVC (Model-View-Controller)

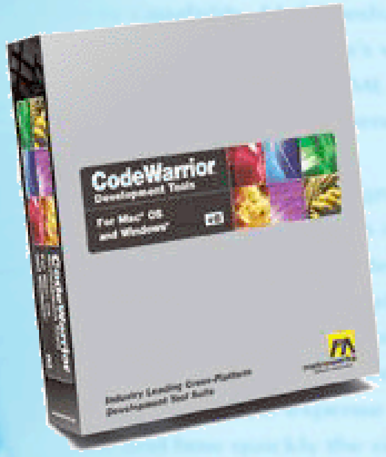
3a. C/C++ Compilers

- Essentially two choices:
  - Metrowerks CodeWarrior
  - Xcode 2.1

vs.

The best compiler for the future?

3a. C++: CodeWarrior



- Dominant for over 10 years
- 90% of shipping Mac apps
- Mac & Win compilers (v9.4)
- Supports Classic & OS X
- Better ANSI compliance (until gcc 4)
- Arguably much better user interface
- Faster compiler, more optimal builds

but… Future very much in doubt

Bash Metrowerks session

Friday 3PM Venice Room

3a. C++: Xcode 2.1

- Ships free with Mac OS X
- gcc-based
- Improving ANSI compliance
- Universal Binaries
- G5 optimizations and 64-bit compilation
- Improved UI with multiple workspaces
- Distributed Builds, Fix & Continue, etc.
- Mac OS X-only
- Apple supported

3a. Best Compiler?

- CodeWarrior’s twin compilers was ideal, **BUT**
- Metrowerks sold off x86 compiler in ‘05
- No Mac commitment since v9.0 in ‘03
- Already written off by most Mac developers
- Xcode has complete support from Apple
- Only Xcode supports Universal Binaries
- Xcode supports G5, 64-bit, forward thinking
- Apple needs to improve Xcode’s GUI more

FINAL ANALYSIS: If CodeWarrior does not support Universal Binaries by 2006, developers will have *no choice* but to choose Xcode.

3b. Mac OS X on Intel

- Xcode's simple checkbox makes it easy
- Be careful about byte-swapping
- Most frameworks will support Intel:
    - CPLAT
    - wxWidgets
    - Qt
- Other IDE's will build Universal Binaries
    - Xcode
    - REALbasic
    - *CodeWarrior?*

3c. Architecting with MVC

- Separate coding of application:
  - *Model*: Core data and business logic
  - *View*: User Interface
  - *Controller*: connects Model & View
- An MVC architected application does not require a x-platform framework
- Model can be written in standard C++
  - View can the be separate, eg:
    - Interface Builder on Mac
    - Visual C# on Windows

4. Legacy X-Platform Frameworks

a. Visual C++ Cross-Compiler

b. Yellow Box for Windows

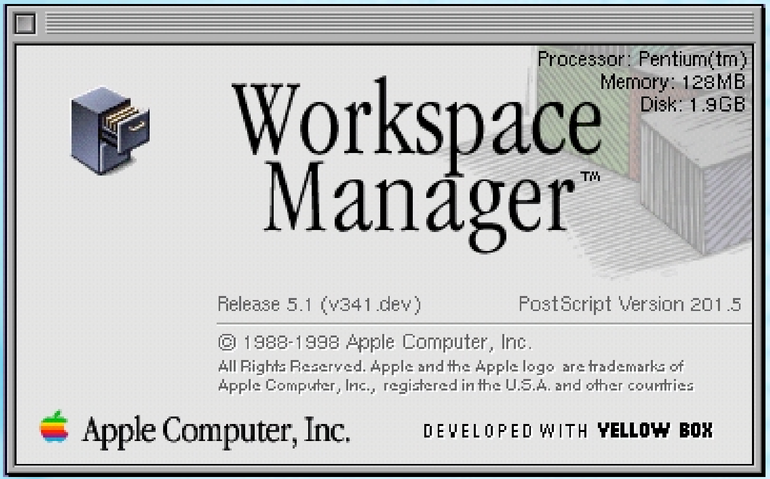
c. Mac2Win

d. PowerPlant for Windows

4a. Visual C++ Cross-Compiler

- Ported MFC apps to Mac
- Windows NT-hosted
- Add-on to VC++ compiler
- 68K first, PowerPC with v4.2
- Obscenely expensive: $1999 (just for the add-on, $495 VC++ not included)
- Built notoriously slow & clunky apps
  - Discontinued in 1996. Remaining inventory slashed to $199.

4b. Yellow Box for Windows


Processor: Pentium(tm)
Memory: 128MB
Disk: 1.9GB

Workspace Manager™

Release 5.1 (v341.dev)
PostScript Version 201.5

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Apple Computer, Inc.
DEVELOPED WITH YELLOW BOX

- Part of Rhapsody
- NeXTStep API (known today as Cocoa API)
- ProjectBuilder allowed the building of Intel-based applications
- Ran on Rhapsody x86 or Windows
    - Windows runtime: $249 per PC
    - Killed with the advent of Mac OS X

4c. Mac2Win

- Libraries emulating Mac Toolbox
- ~80% Mac API's ported
- Very expensive, royalty-based

- Used to create many Windows ports:
  - *Metrowerks CodeWarrior*
  - *Claris Works*
  - *Macromedia Director*
- Latest versions Carbonized, but barely:
  - No Carbon Events
  - No ultra-modern calls

4d. PowerPlant for Windows

- PowerPlant: the most widely used framework on the Mac
- Using Latitude, created a Windows version in 2001/2002
- Embraced by Adobe
- Outrageously Expensive:
    - $15,000
    - plus 1% royalty on sales > $1.5M
    - capping at $150,000
- Killed in early 2004

5. Modern X-Platform Frameworks

a. CPLAT

b. wxWidgets (formerly wxWindows)

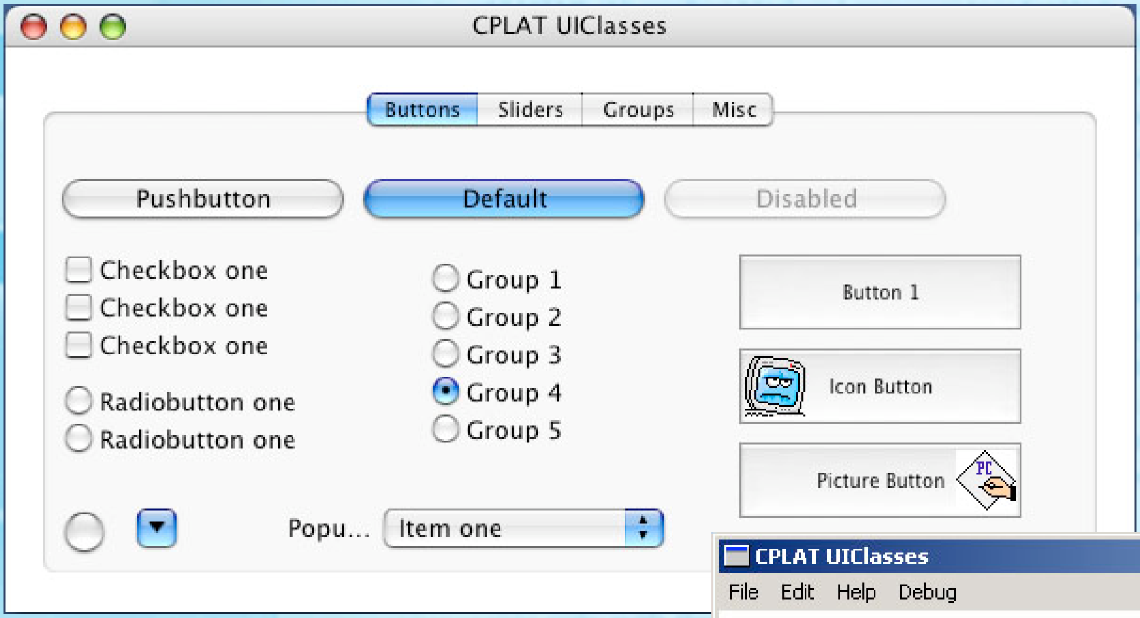
c. Qt

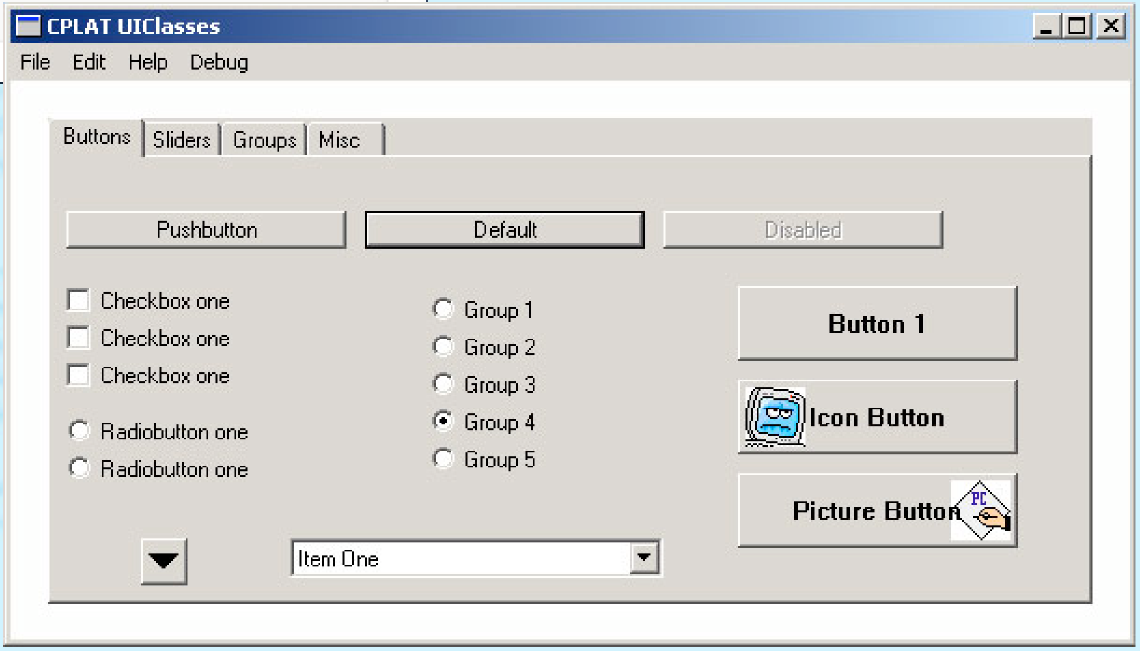
d. Other Cross-Platform Frameworks

5a. CPLAT by kSoft

- Price: $50 per developer (no royalties)
- Mac OS X, Classic, Windows (Linux soon)
- CodeWarrior (Mac & Win), Xcode, Visual C++
- Mac target is a first class citizen
- Amazing work by one Ken Stahlman
- Reminiscent of PowerPlant
- Can convert .nib files into XML for GUI
    - Very comfortable, most Mac-like feel of the frameworks

5a. CPLAT screenshots

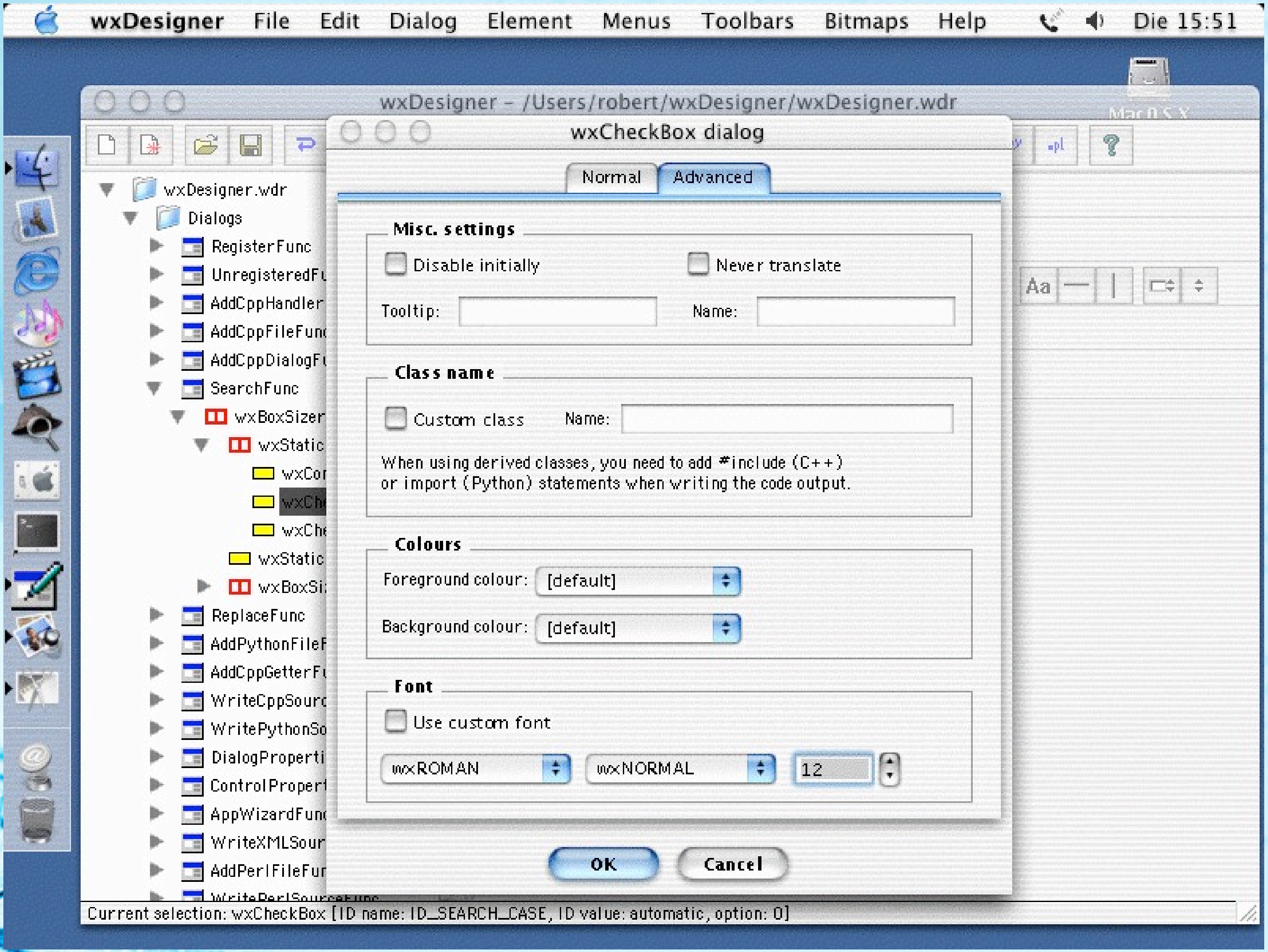




5b. wxWidgets (formerly wxWindows)

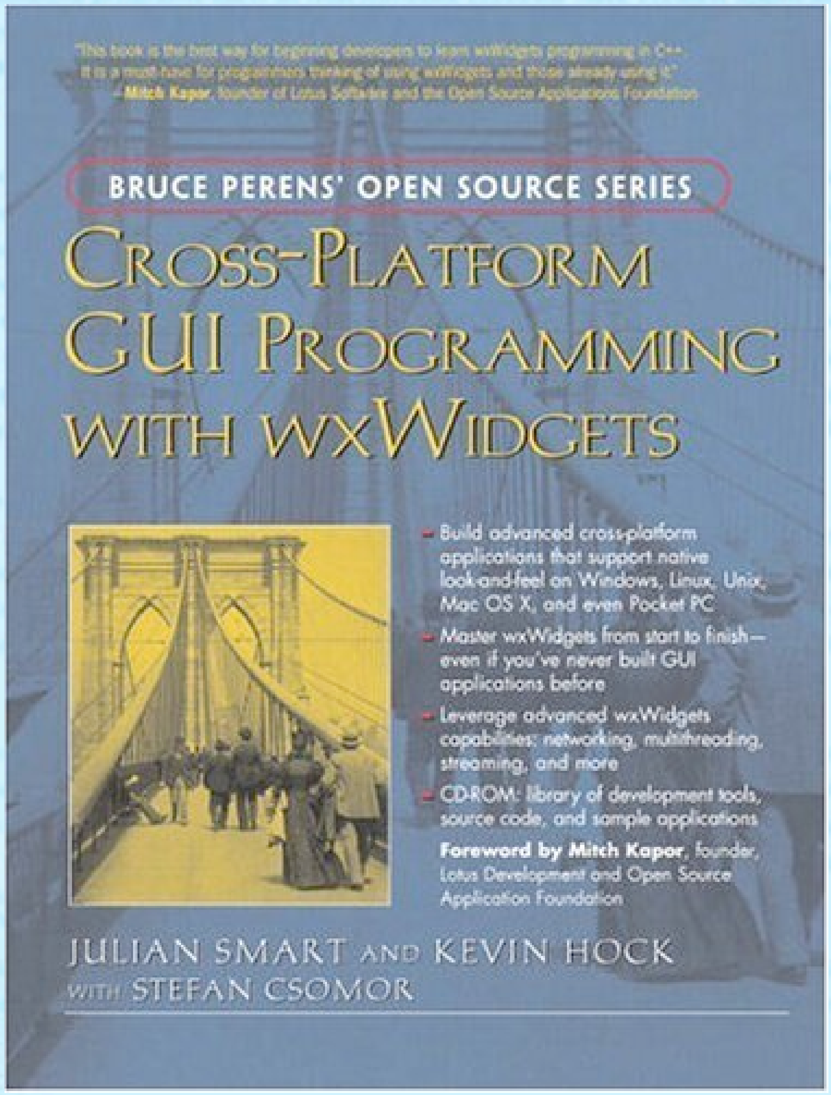
- Open Source, free no royalties, no restrictions
- Mac OS X, Classic, Windows, Linux, others
- CodeWarrior (Mac only), Xcode, VC++, others
- Reminiscent of MFC (awkward Mac feel)
- Improving with Open Source community
- Many apps, including *AOL Communicator*
- GUI design tools: *wxDesigner* & *DialogBlocks*
- Does not integrate with InterfaceBuilder
    - Bounties for bugs needing fixing
    - Best free framework for general dev

5b. wxDesigner



Current selection: wxCheckBox [ID name: ID_SEARCH_CASE, ID value: automatic, option: 0]

5b. wxWidgets Further Reading



"This book is the best way for beginning developers to learn wxWidgets programming in C++. It is a must-have for programmers thinking of using wxWidgets and those already using it."
—**Mitch Kapor**, founder of Lotus Software and the Open Source Applications Foundation

BRUCE PERENS' OPEN SOURCE SERIES

CROSS-PLATFORM GUI PROGRAMMING WITH WXWIDGETS

- Build advanced cross-platform applications that support native look-and-feel on Windows, Linux, Unix, Mac OS X, and even Pocket PC
- Master wxWidgets from start to finish—even if you've never built GUI applications before
- Leverage advanced wxWidgets capabilities: networking, multithreading, streaming, and more
- CD-ROM: library of development tools, source code, and sample applications

Foreword by Mitch Kapor, founder, Lotus Development and Open Source Application Foundation

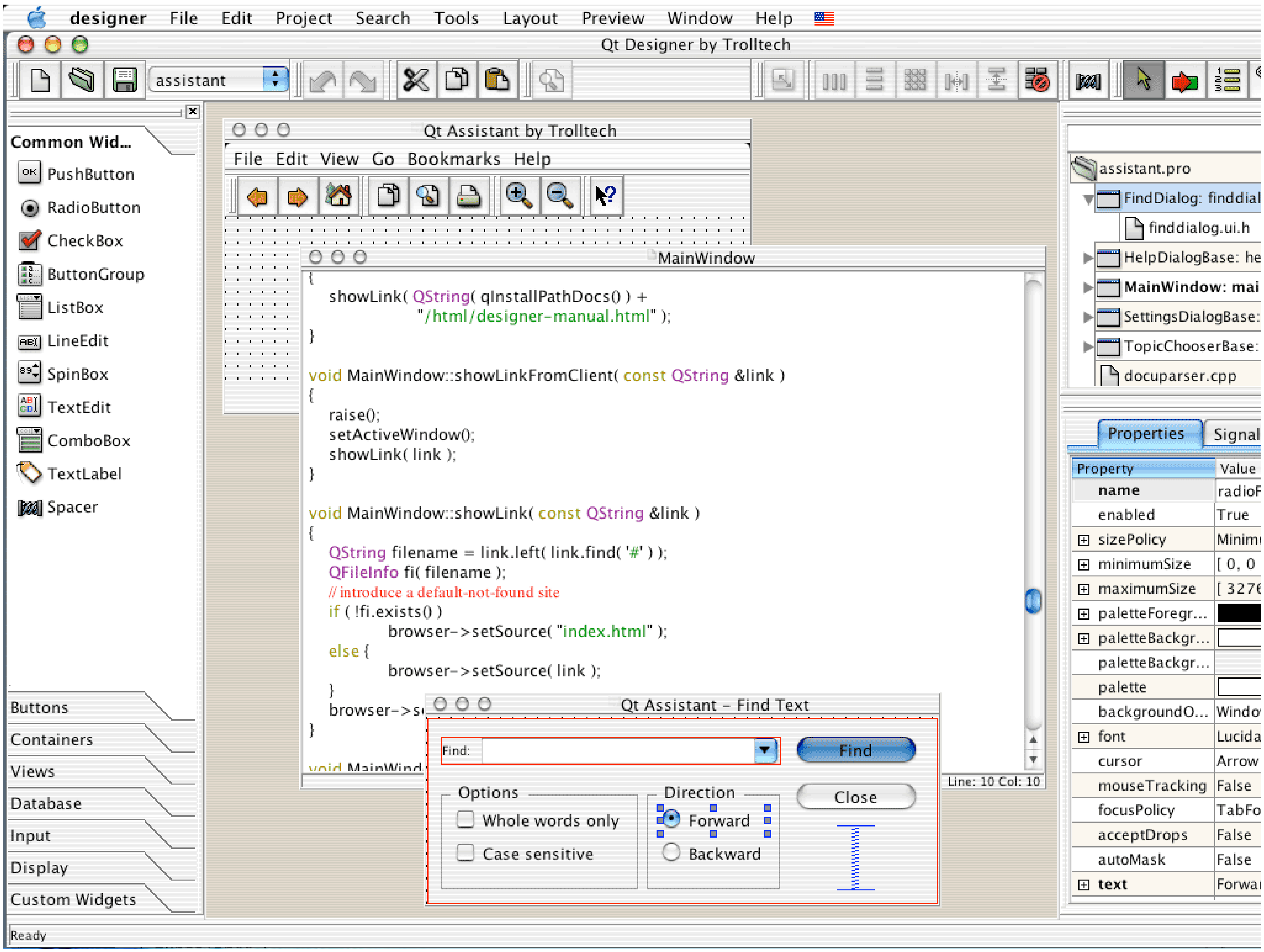
JULIAN SMART AND KEVIN HOCK
WITH STEFAN CSOMOR

5c. Qt by Trolltech

- Tiered pricing: $1790 Pro license, $2880 Enterprise, free for Open Source
- Mac OS X, Windows, Linux
- Xcode, Visual C++, gcc
- Very sophisticated, 400 C++ classes
- Many Mac apps: *KOffice* & *PostgreSQL*
- RAD tools: *QtDesigner* and others

Cross-Platform Development with Qt

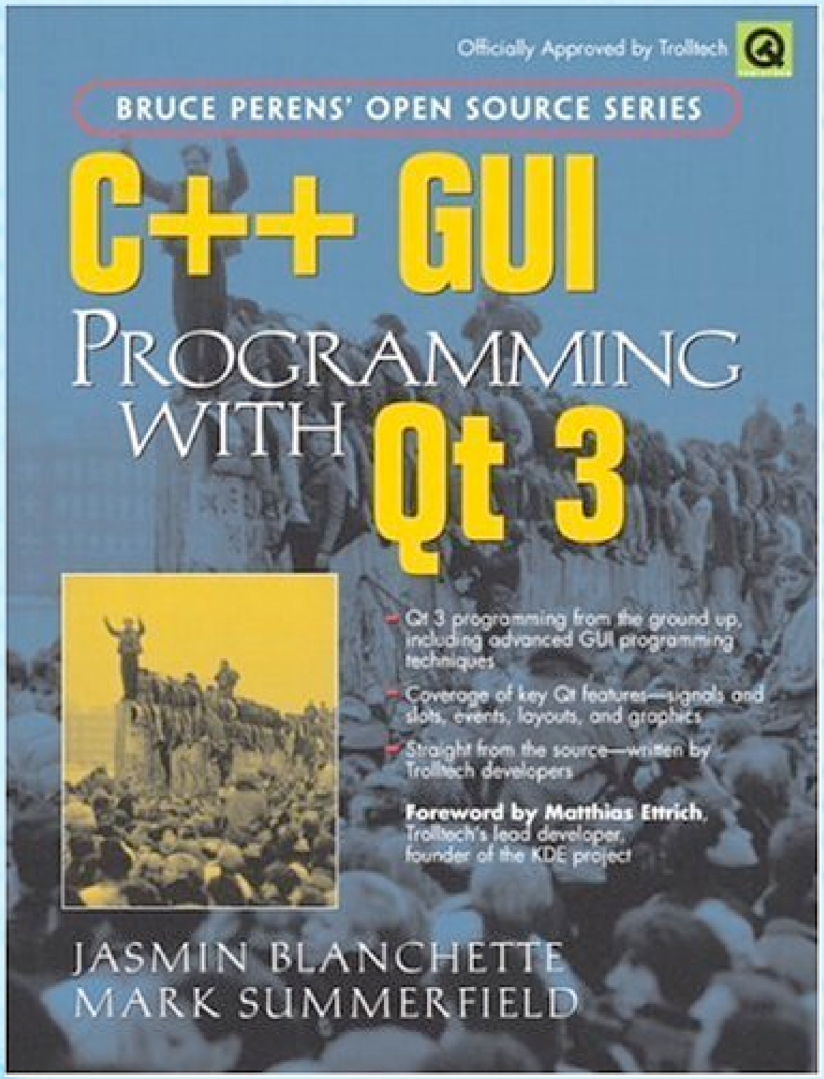
Scott Collins, Friday 2PM Venice



```
{
    showLink( QString( qInstallPathDocs() ) +
              "/html/designer-manual.html" );
}

void MainWindow::showLinkFromClient( const QString &link )
{
    raise();
    setActiveWindow();
    showLink( link );
}

void MainWindow::showLink( const QString &link )
{
    QString filename = link.left( link.find( '#' ) );
    QFileInfo fi( filename );
    // introduce a default-not-found site
    if ( !fi.exists() )
        browser->setSource( "index.html" );
    else {
        browser->setSource( link );
    }
    browser->s
}

void MainWind
```

Property	Value
name	radioF
enabled	True
⊞ sizePolicy	Minim
⊞ minimumSize	[0, 0
⊞ maximumSize	[3276
⊞ paletteForegr...	■
⊞ paletteBackgr...	□
paletteBackgr...	
palette	□
backgroundO...	Windo
⊞ font	Lucida
cursor	Arrow
mouseTracking	False
focusPolicy	TabFo
acceptDrops	False
autoMask	False
⊞ text	Forwa

5c. Qt Further Reading


Officially Approved by Trolltech
BRUCE PERENS' OPEN SOURCE SERIES
C++ GUI
PROGRAMMING WITH Qt 3
Qt 3 programming from the ground up, including advanced GUI programming techniques
Coverage of key Qt features—signals and slots, events, layouts, and graphics
Straight from the source—written by Trolltech developers
Foreword by Matthias Ettrich, Trolltech's lead developer, founder of the KDE project
JASMIN BLANCHETTE
MARK SUMMERFIELD

5d. Other X-Platform Frameworks

- CroPL II *(Cross-Platform Library)*
- YAAF *(Yet Another Application Framework)*
- FLTK *(Fast Light Toolkit)*
- Whisper
- ZooLib

6. REALbasic with C/C++

- A cross-platform “Interface Builder”
- Similar to Visual Basic
- Integrates with C++ code
- Using MVC architecture, RB can generate the GUI and C++ the core:

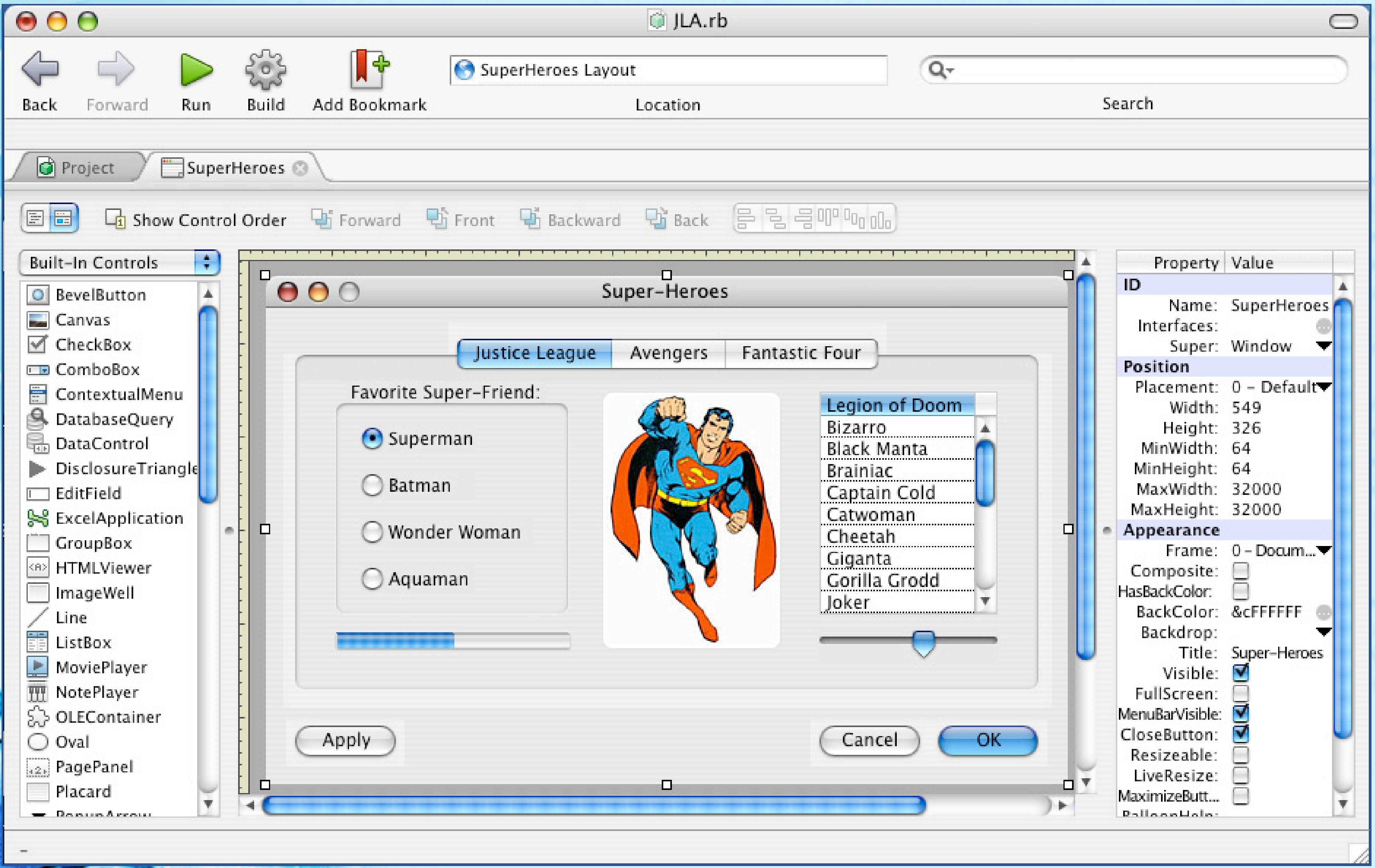
    a. Creating the REALbasic GUI

    b. Creating the C++ Library

    c. Example: C++ Code

    d. Example: REALbasic Code

6a. Creating REALbasic GUI



Property	Value
ID	
Name:	SuperHeroes
Interfaces:	
Super:	Window
Position	
Placement:	0 - Default
Width:	549
Height:	326
MinWidth:	64
MinHeight:	64
MaxWidth:	32000
MaxHeight:	32000
Appearance	
Frame:	0 - Docum...
Composite:	☐
HasBackColor:	☐
BackColor:	&cFFFFFF
Backdrop:	
Title:	Super-Heroes
Visible:	✓
FullScreen:	☐
MenuBarVisible:	✓
CloseButton:	✓
Resizeable:	☐
LiveResize:	☐
MaximizeButt...	☐

6a. REALbasic GUI (continued)

For more information, download the demo available at: http://www.realbasic.com

Also see:

Write a Cross-Platform Game in Two Hours

by Jonathan Johnson

Saturday 2-4PM

Pompeii 2

6b. Creating the C++ Library

- Dynamic Library types:
  - Mac OS 9/X CFM: *Carbon Shared Library*
  - Mac OS X Mach-O: *dylib*
  - Windows: *DLL*
- Use C wrappers for flexibility:
  - **`extern "C"`** around functions
  - Standardize, eg: **`ClassName_MethodName`**
    - CFM & Windows DLL functions need to be `__declspec(dllexport)`

6c. Example: C++ code (1)

```
// Model C++ class
class MyModel
{
  public:
    MyModel();
    virtual ~MyModel();
    void foo(int parm1, double parm2);
    int bar(const char *parm);
  protected:
    :
};
```

6c. Example: C++ code (2)

```
// Exported C Wrapper declarations
extern "C"
{
  export int MyModel_Create();
  export void MyModel_Destroy(int modelHdl);
  export void MyModel_Foo(int modelHdl, int parm1,
                                            double parm2);
  export int MyModel_Bar(int modelHdl,
                                        const char *parm);
}
          // Export macro
          #ifdef __MACH__
            #define export
          #else
            #define export __declspec(dllexport)
          #endif
```

6c. Example: C++ code (3)

```
// Wrapper function implementations
int MyModel_Create()
{ return (int) new MyModel; }

void MyModel_Destroy(int modelHdl)
{ delete ((MyModel *) modelHdl); }

void MyModel_Foo(int modelHdl, int parm1,
                                  double parm2)
{ ((MyModel *) modelHdl)->foo(parm1, parm2); }

int MyModel_Bar(int modelHdl, const char *parm)
{ return ((MyModel *) modelHdl)->bar(parm); }
```

6d. Example: REALbasic (1)

```
// Define the model library name
#if TargetCarbon
  const ModelLib = "MyModel Library"
#endif

#if TargetMachO
  const ModelLib =
     "@executable_path/../../../libMyModel.dylib"
#endif

#if TargetWin32
  const ModelLib = "MyModel.dll"
#endif
           #if TargetLinux
             const ModelLib = "libMyModel.so"
           #endif
```

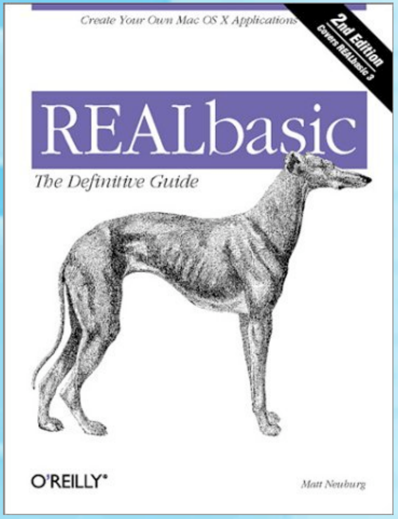
6d. Example: REALbasic (2)

```
// Define the model library name
Declare Function MyModel_Create lib ModelLib
                                       () as integer

Declare Sub MyModel_Destroy lib ModelLib
                                (modelHdl as integer)

Declare Sub MyModel_Foo lib ModelLib(modelHdl
   as integer, parm1 as integer, parm2 as double)

Declare Function MyModel_Bar lib ModelLib
(modelHdl as integer, parm as Cstring) as integer
```

6d. Example: REALbasic (3)

```
// Call the library code
Dim modelHandle as integer
Dim barValue as integer

modelHandle = MyModel_Create()
MyModel_Foo(modelHandle, 12, 3.0)
barValue = MyModel_Bar(modelHandle, ”MacHack!")
MyModel_Destroy(modelHandle)

return barValue
```

6. REALbasic Further Reading


Create Your Own Mac OS X Applications

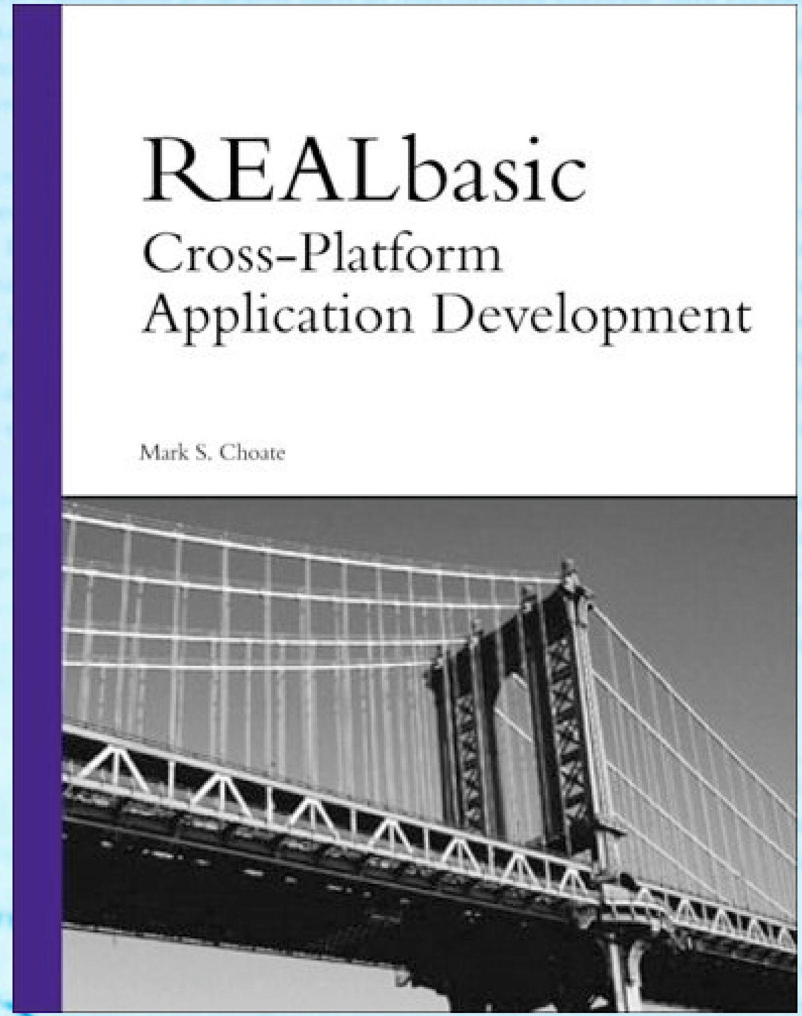
2nd Edition Covers REALbasic 3

REALbasic

The Definitive Guide

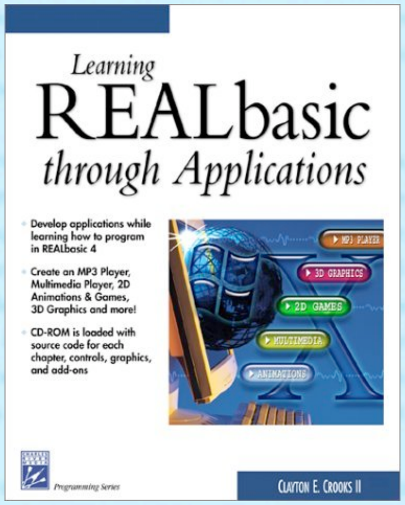
O'REILLY®

Matt Neuburg


REALbasic

Cross-Platform Application Development

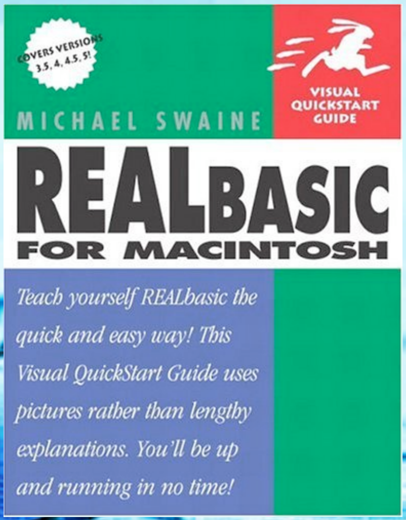
Mark S. Choate


Learning REALbasic through Applications

- Develop applications while learning how to program in REALbasic 4
- Create an MP3 Player, Multimedia Player, 2D Animations & Games, 3D Graphics and more!
- CD-ROM is loaded with source code for each chapter, controls, graphics, and add-ons

Programming Series

Clayton E. Crooks II

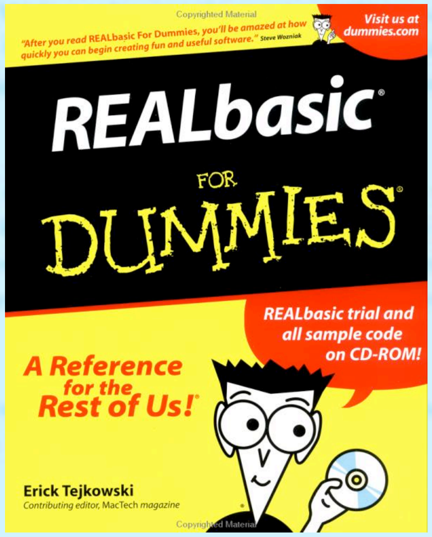

COVERS VERSIONS 3.5, 4, 4.5, 5!

MICHAEL SWAINE

VISUAL QUICKSTART GUIDE

REALBASIC FOR MACINTOSH

Teach yourself REALbasic the quick and easy way! This Visual QuickStart Guide uses pictures rather than lengthy explanations. You'll be up and running in no time!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"After you read REALbasic For Dummies, you'll be amazed at how quickly you can begin creating fun and useful software." Steve Wozniak

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REALbasic trial and all sample code on CD-ROM!

A Reference for the Rest of Us!®

Erick Tejkowski

Contributing editor, MacTech magazine

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7. 5 Rules for a X-Platform Project

1. Design using MVC architecture
2. Have Mac & Windows developers working together from the start
3. Single shared code branch, using **`#ifdef`**’s if necessary
4. Be ANSI compliant. Use standardized tools and code, such as STL.
5. Place both a Mac & PC on each developer’s desk

8. Summary

- C++ cross-platform frameworks:
  - CPLAT: Mac-friendly, great value for $50
  - wxWidgets: clumsy, MFC-like, but best for a free, non-restriction development
  - Qt: most powerful, also most expensive, but free for Open Source development
- C++ with REALbasic
  - Architect using MVC
  - Place model code into a C++ DLL
  - View app written in REALbasic

For more information…

Copies of the paper, slides & sample code:

http://www.jonhoyle.com/MacHack