Chapter 3

Architecture

Assignment

- Up to **3/group**
- 3% of assignment mark/about **12% of final**
- Development of a **design/analysis document**, with modelling

Your task...

✔ System with a GUI interface

✔ Help track disease

- ✔ View patient histories
- ✔ Select by region
- ✔ + other functions

✔ Design, not implement.

Submission

✔ Description of **system architecture**

✔ GUI **design/analysis document** concerned with the GUI interface.

Deliverables

- A title page
- Table of contents...
- Introduction - non-technical
- System architecture with justifications
- GUI design/analysis document

Design/analysis document

- Follow suggested structure?
- User requirement, user profile, environment
- **Overview** of the GUI interface
- **Description** of the interface
  - **Prototype** screens
  - **Functional** spec
  - **Behavioural** spec
  - **Justifications** - relating back to user requirement.
  - A **testing** methodology

Design/analysis document

Note that this assignment does not require you to implement the application, just to design one, and to model the design with prototype screens

You could use Java/Visual Basic/ a graphics editor... anything as long as you show screenshots.

Assessment

The assessment will be graded with the following weightings:

Introduction	10%
System architecture	25%
GUI design	50%
Extra	15%

Assessment

- The “Extra” component of the assessment is for submissions which show **clear evidence of extra** thought or care.
- In evaluating the “GUI design” component, I will also be looking for “**justifications** you can make for design decisions”.

Try to achieve **clarity** in your writing and take care in the **structuring** of the document.

Architecture

✔ GUI applications can be BIG

✔ Hence concern with architecture

Architecture

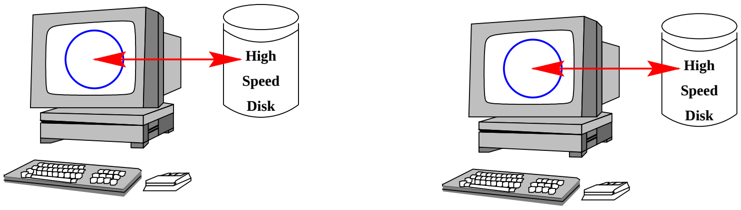
- Standalone
- Shared file
- Shared database
- Web based
  - Simple
  - Scripting
  - Java

Web architecture

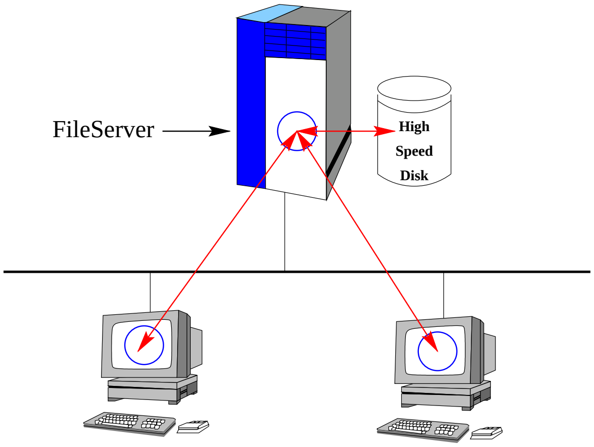
✔ Common to deliver applications via web browsers.

✔ MSIE/Navigator/iCab/Opera.. different in implementation.

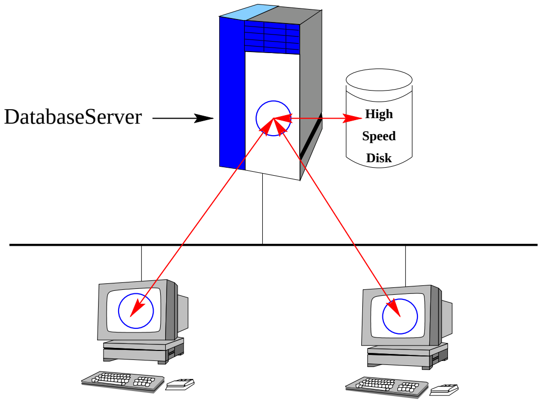
Standalone



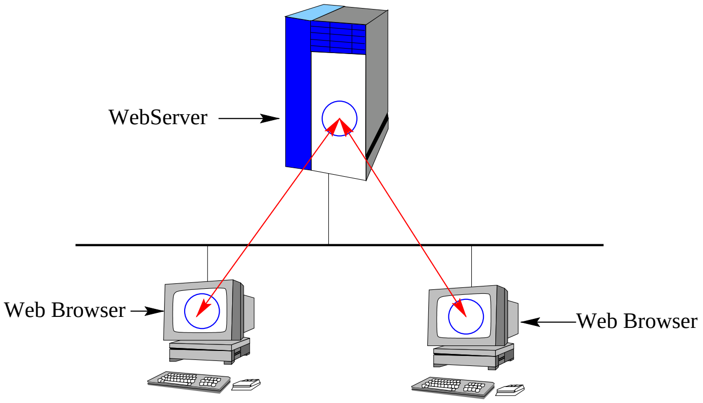
Shared file



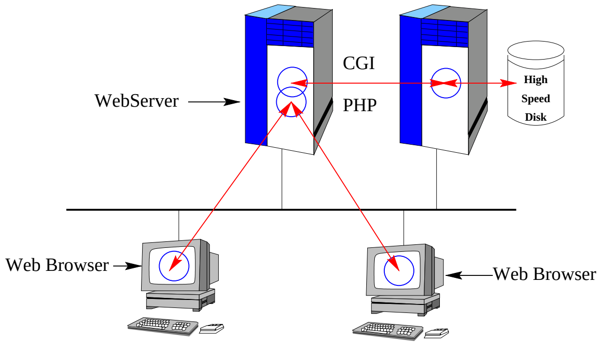
Shared database



Web server



Active scripting



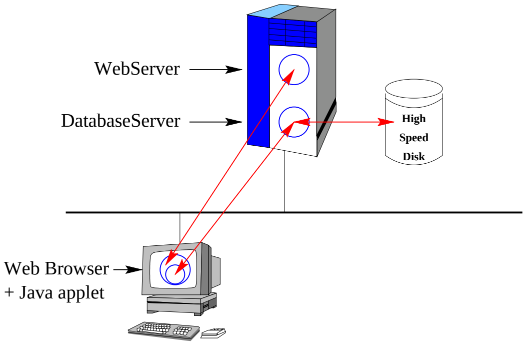
Java applet

An even more complex GUI application might be constructed using a series of interlinked web pages containing Java applets. The advantage of this, is two fold.

1. The processing **load on** the web **server** may be **reduced**.
2. The Java applet can directly[3] communicate with a database server.

[3] Note that there are some security concerns here.

Java applet



Chapter 4

First steps

GUI programming

In elementary programming styles, there is a single thread-of-control

- ✔ GUI programs respond to **events**
- ✔ Restructuring programs as a group of ***callbacks***.

GUI mainline

CODE LISTING **GUICode.c**

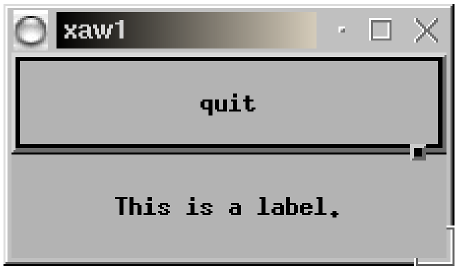
```
#include <any GUI header files needed>

int
main ()
{
    RegisterAllCallbacks ();
    LoopForever ();
}
```

How not to ...

Don’t do it the hard way!

X API



X source

CODE LISTING **xaw1.c**

```
#include   <stdio.h>
#include   <X11/Intrinsic.h>
#include   <X11/StringDefs.h>
#include   <X11/Xaw/Command.h>
#include   <X11/Xaw/Paned.h>
#include   <X11/Xaw/Label.h>

void
quit_callback (widget, client_data, call_data)
     Widget widget;
     caddr_t client_data;
     caddr_t call_data;
{
    exit (0);
}

main (argc, argv)
     int argc;
     char *argv[];
{                               /* main */
    Widget parent;
    Arg args[20];
    int n;
    Widget pane_widget, quit_widget;
    Widget label_widget;

    /* Set up top-level shell widget */
    parent = XtInitialize (argv[0], "Xaw1", NULL, 0, &argc, argv);
    /* Set up pane to control whole application */
    n = 0;
    pane_widget = XtCreateManagedWidget ("pane",
                                         panedWidgetClass, parent, args, n);
    /* Set up command widget to act as a push button */
    n = 0;
    quit_widget = XtCreateManagedWidget ("quit",
                                         commandWidgetClass,
                                         pane_widget, args, n);
    /* Set up a callback function */
    XtAddCallback (quit_widget, XtNcallback, quit_callback, (caddr_t) NULL);
    /* Set up label widget */
    n = 0;
    XtSetArg (args[n], XtNlabel, "This is a label.");
    n++;
    label_widget = XtCreateManagedWidget ("label",
                                          labelWidgetClass,
                                          pane_widget, args, n);
    /* Map widgets and handle events */
    XtRealizeWidget (parent);
    XtMainLoop ();
}
```

X compilation

```
gcc -o xaw1 xaw1.c -lXt -lXaw
```

Win32 API

CODE LISTING **SimpleWin32.c**

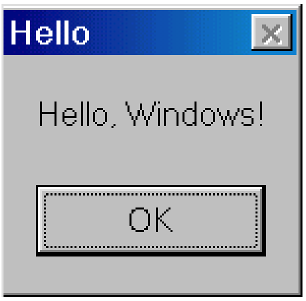
```
#include <windows.h>

int STDCALL
WinMain (HINSTANCE hInst, HINSTANCE hPrev, LPSTR lpCmd, int nShow)
{
    MessageBox (NULL, "Hello, Windows!", "Hello", MB_OK);
    return 0;
}
```

Win32 compilation

```
gcc -oSimpleWin32 SimpleWin32.c -mwindows
```

Win32 application


Hello

Hello, Windows!

Win32 application

CODE LISTING **BiggerWin.c**

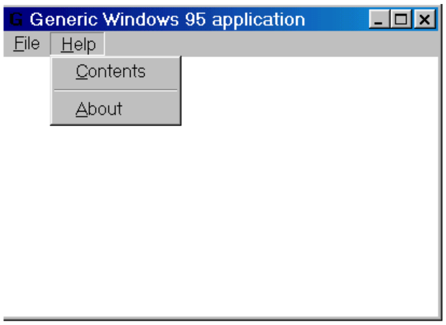
```
#include <windows.h>
#include <string.h>

int STDCALL
WinMain (HINSTANCE hInst, HINSTANCE hPrev, LPSTR lpCmd, int nShow)
{
    HWND hwndMain;              /* Handle for the main window. */
    MSG msg;                    /* A Win32 message structure. */
    WNDCLASSEX wndclass;        /* A window class structure. */
    char *szMainWndClass = "WinTestWin";
    memset (&wndclass, 0, sizeof (WNDCLASSEX));
    wndclass.lpszClassName = szMainWndClass;
    wndclass.cbSize = sizeof (WNDCLASSEX);
    wndclass.style = CS_HREDRAW | CS_VREDRAW;
    wndclass.lpfnWndProc = MainWndProc;
    wndclass.hInstance = hInst;
    wndclass.hIcon = LoadIcon (NULL, IDI_APPLICATION);
    wndclass.hIconSm = LoadIcon (NULL, IDI_APPLICATION);
    wndclass.hCursor = LoadCursor (NULL, IDC_ARROW);
    wndclass.hbrBackground = (HBRUSH) GetStockObject (WHITE_BRUSH);
    RegisterClassEx (&wndclass);
    hwndMain = CreateWindow (szMainWndClass, "Hello", WS_OVERLAPPEDWINDOW,
                             CW_USEDEFAULT, CW_USEDEFAULT, CW_USEDEFAULT,
                             CW_USEDEFAULT, NULL, NULL, hInst, NULL);
    ShowWindow (hwndMain, nShow);
    UpdateWindow (hwndMain);
    while (GetMessage (&msg, NULL, 0, 0)) {
        TranslateMessage (&msg);
        DispatchMessage (&msg);
    }
    return msg.wParam;
}
```

Win32 application

The full source code and a makefile is available at http://www.comp.nus.edu.sg/˜cs3283/ftp/generic.tgz.

Win32 application



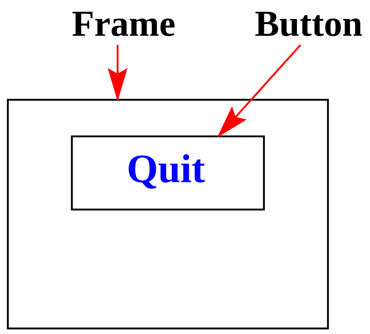
Win32 programming

Interesting tutorial at http://www.winprog.org/tutorial.

OO GUI toolkits

No one object-oriented standard for GUI applications

Event handling



Frame

Button

Quit

GTK+

✔ GTK+ is a multi-platform toolkit

✔ By using CygWin GTK+ works on Win32.

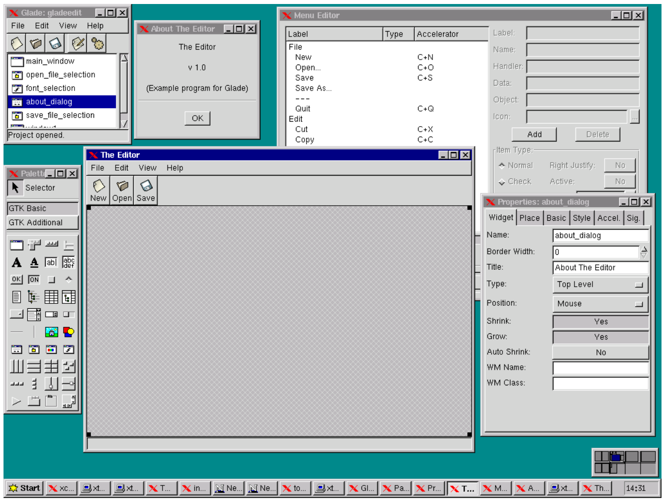
✔ GTK+ is free software and part of the GNU Project.

GTK+

GTK+ has an object-oriented architecture with component libraries:

- GDK - A wrapper for low-level windowing functions.
- GTK - An advanced widget set.

Glade



Glade: gladeedit

main_window
open_file_selection
font_selection
about_dialog
save_file_selection

Project opened.

About The Editor

The Editor

v 1.0

(Example program for Glade)

Menu Editor

Label	Type	Accelerator
File		
New		C+N
Open...		C+O
Save		C+S
Save As...		

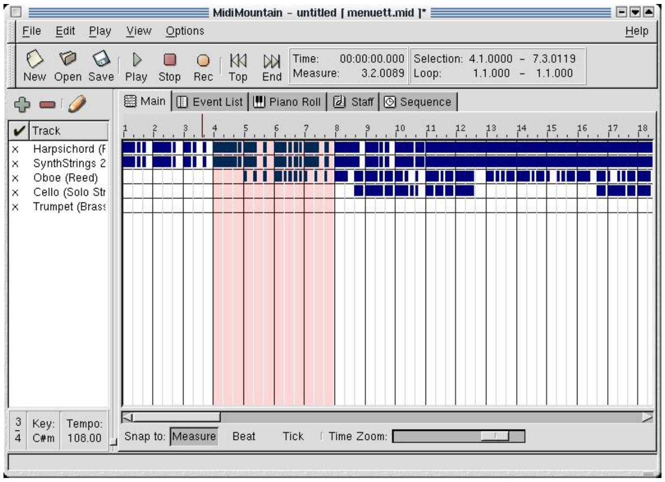
Quit		C+Q
Edit		
Cut		C+X
Copy		C+C

Item Type: ○ Normal ○ Check; Right Justify: No; Active: No

Properties: about_dialog

Name: about_dialog
Border Width: 0
Title: About The Editor
Type: Top Level
Position: Mouse
Shrink: Yes
Grow: Yes
Auto Shrink: No
WM Name:
WM Class:

Glade application



Time: 00:00:00.000
Measure: 3.2.0089
Selection: 4.1.0000 – 7.3.0119
Loop: 1.1.000 – 1.1.000
3/4
Key: C#m
Tempo: 108.00
Snap to: Measure

MFC

- ✔ OO toolkit to access Win32
- ✔ DLL contains code for MFC
- ✔ Linked at runtime.
- ✔ Base class CObject

Notation

One characteristic of MFC programs is the use of Hungarian (prefix) notation for variable names. It is common to see MFC program variables prefixed with type identifiers. For example:

- **dLocalMax** is a double variable
- **iLocalMin** is an integer variable.

Java/Swing

✔ Originally the graphical toolkit for Java was AWT, the Abstract Windowing Toolkit.

✔ It is fairly primitive, and the new Swing toolkit provides much more functionality.

✔ AWT is native code, with a Java API, but Swing is implemented on-top-of AWT.

Swing

✔ Swing components inherit from **java.awt.component**, and the Swing classes that are similar to AWT classes are prefixed with the letter "**J**".

✔ For example, the AWT **Button** class is renamed **JButton**.

✔ You can mix-and-match AWT and Swing components.

Swing

Java/Swing may be used in two distinct ways:

1. Producing a standalone application.
2. Producing an applet to run within a web browser.

One of the features of Swing is that it implements a pluggable look-and-feel.

The look-and-feel can even be changed dynamically.

Web interfaces

Categories:

- **Server-side dynamic pages**
- **Server-side scripting**
- **Client-side scripting**
- **Client-side applets**

We will look at some of these methods later in the course.

Scripting languages

✔ Scripting languages which can produce GUI interfaces are relatively easy to use.

✔ An effective strategy for building GUI applications is to write the GUI part in a scripting language, and to write the core ’difficult’ part in C.

Summary of topics

In this module, we introduced the following topics:

- Programming styles to avoid
- Event driven architectures
- OO toolkits
- Web-based systems
- Scripting languages

Further study

- **http://www.public.asu.edu/~tobiazz/papers/thesis/local/gui_toolkit_list.html**