


## CS481 - Object-Oriented Programming

### *C++ & MS Windows*

- ❖ C++ commonly used
  - To build Microsoft Windows applications
- ❖ MS-Win == OOP ??
  - Windows has some OO characteristics
- ❖ Class libraries (MFC, OWL, ...)



1

### *MFC*

- ❖ Microsoft Foundation Classes
  - Ships with MS Visual C++
  - Supplied (licensed?) by other vendors
- ❖ Thin C++ wrapper
  - Windows API clearly visible
  - Maps messages to member functions

2

### *OWL*

- ❖ Object Windows Library
  - Borland - ships with BC++
  - Similar to MFC (?)
- ❖ Version 1.0 versus 2.5
  - 1.0: non-standard virtual syntax
  - 2.5: standard C++

3

### *Other Frameworks*

- ❖ Third party class libraries
  - Platform-independent?
  - High-level user interface functions?
- ❖ Vendor dependence
  - Less tied to one OS/environment?
  - More tied to framework vendor?

4

### *MFC Initialization*

```

BOOL CbfswApp::InitInstance()
{
    SetDialogBkColor();
    LoadStdProfileSettings();

    AddDocTemplate(
        new CMultiDocTemplate(
            IDR_BFSWTYPE,
            RUNTIME_CLASS(CbfswDoc),
            RUNTIME_CLASS(CMDIChildWnd),
            RUNTIME_CLASS(CbfswView)));
}
    
```

5

### *MFC Initialization*

```

// create main MDI Frame window
CMainFrame* pMainFrame =
    new CMainFrame;
if (!pMainFrame->
    LoadFrame(IDR_MAINFRAME))
    return FALSE;
pMainFrame->ShowWindow(m_nCmdShow);
pMainFrame->UpdateWindow();
m_pMainWnd = pMainFrame;
...
    
```

6

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**MS-Win Classes**

- ❖ Windows, dialogs, documents
  - Derived classes in application
- ❖ Controls
  - Button, edit, list box, etc.
- ❖ GDI interface objects
  - Pen, brush, font, device contexts, etc.

**MFC Drawing**

```
void CbfswView::OnDraw(CDC* pDC)
{
    CbfswDoc* pDoc = GetDocument();
    pDoc->Draw (pDC);
}
```

8

**MFC Drawing**

```
void CStripChart::OnPaint ()
{
    CPaintDC dc(this);
    CRect rect1;

    rect1 = GetWinRect();
    rect1.right += 1;
    rect1.bottom += 1;
    dc.Rectangle(&rect1);
}
```

9

**MFC Drawing**

```
void CStripTrace::Draw
    (CDC* pDC, int xPos)
{
    int yMin, yMax, yText;
    CPen* pOldPen; ...
    pOldPen = pDC->SelectObject
        (&m_pen);
    pDC->MoveTo(xPos, yMin);
    pDC->LineTo(xPos, yMax - 1);
    pDC->SelectObject(pOldPen);
    ...
}
```

10

**MFC Drawing**

```
oldTextColor =
    pDC->SetTextColor(m_color);
oldTextAlign =
    pDC->SetTextAlign
        (TA_RIGHT | TA_BASELINE);
yText = ...;
pDC->TextOut
    (xPos, yText, m_textVal);
m_textVal.Empty();
pDC->SetTextColor(oldTextColor);
pDC->SetTextAlign(oldTextAlign);
```

**Message Mapping**

- ❖ Windows messages
  - Notify application of events, etc.
  - Passed to window procedure
- ❖ Mapped to member functions
  - Translation table for each class/object
  - Event looked up, function called

12

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### MFC Message Map

```

BEGIN_MESSAGE_MAP(CBfswApp, CWinApp)
//{{AFX_MSG_MAP(CBfswApp)
ON_COMMAND(ID_APP_ABOUT,
           OnAppAbout)
//}}AFX_MSG_MAP
ON_COMMAND(ID_FILE_NEW,
           CWinApp::OnFileNew)
ON_COMMAND(ID_FILE_OPEN,
           CWinApp::OnFileOpen)
...
END_MESSAGE_MAP()
    
```

13

### Persistent Objects

- ❖ Application “document”
  - Consists of objects? (graphics, text)
- ❖ How to save/load?
  - Save - overload << for data object
  - Load - overload >>
    - ◆ Must also construct object (version?)

14

### Resource Tools

- ❖ Windows resources
  - Menus, dialogs, bitmaps, strings, ...
- ❖ Data stored as part of .exe
- ❖ Resource editor/compiler
- ❖ Framework classes associated

15

### Code Generation

- ❖ Class tools
  - E.g., MS ClassWizard
- ❖ Generates source code
  - Derived class declarations
  - Member function implementations
  - Forward/reverse engineering (??)

16

### Dialog Data

- ❖ Dialog boxes
  - Created in resource editor?
  - Data entered/displayed in controls
- ❖ Map C++ object data in/out
  - Connects data members to controls
  - Add routines for user-defined types

17

### MFC Dialog Data

```

void CDaqDlg::DoDataExchange
(CDataExchange* pDX)
{
...
//{{AFX_DATA_MAP(CDqDlg)
DDX_Text(pDX, IDC_DAQ_SPGR,
         m_daqSpGr);
DDV_MinMaxDouble(pDX, m_daqSpGr,
                 0.5, 2.);
//}}AFX_DATA_MAP
DDX_Control(pDX, IDC_DAQ_PUMP,
            m_daqPump);
    
```

18

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