Creating OLE 2.0 Object Containers, Object Servers and Automation Servers with Visual C++ and MFC

by

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Course Outline

- Goals for this class
- A Review of Visual C++ and MFC
- An Overview of OLE
- The MFC OLE Classes
- Building OLE Object Containers
- Building OLE Object Servers
- The Big Payoff: Building OLE Automation Servers
- The Future of OLE: Chicago and Cairo
- General Q&A

Goals for this Class

- Introduce the essential concepts of OLE
- Avoid overdosing your with the esoteric aspects of each
- Expose you to the core technologies provided by VC++ / MFC
- Show you the resources that are available
- Leave you ready to start building OLE applications of your own

Goals for this Class (2)

Have Fun!

Visual C++ and MFC: A Review

- **Programming Paradigm:**
  - Use AppWizard to generate application
  - Use AppStudio to modify/add resources
  - Use ClassWizard to modify application
  - Write a little code
- **Using On-Line Help**
- **Examining the Generated Code**
- **Documents-Views**
- **Etc.**

An Overview of OLE 2.0

Benefits
Terminology
Features
Object Functionality
Compatibility with OLE 1.0
Multiplatform Support
OLE Opportunities

OLE Benefits

- Document-centric approach to computing
- Rich documents which provide more information
- Compound documents for organizing information
- Easier applications integration

OLE Terminology (1)

- Compound Documents (container documents)
  - documents that contain data created by multiple applications
- OLE Objects (OLE items, data items)
  - text, graphics, spreadsheets, sound, etc. that are linked/embedded in a compound document

OLE Terminology (2)

- **Container (container application, client application)**
  - creates/manages a compound document
- **Server (server application)**
  - creates data items linked/embedded in compound document
- **Container-Server**
  - container to some, server to others

OLE Terminology (3)

Full server

- can be run as a standalone application and store its own documents as disk files

Mini-server

- cannot be run standalone
- can only be run via a container
- cannot store its own files
- only useful with embedded items
- Basis for a control

OLE Terminology (4)

Object Linking

- relates data item to compound document via a linkage
- data item is stored by server

Object Embedding

- relates data item to compound document via storage
- data item is stored by container

OLE Terminology (5)

Open editing

- OLE 1.0 method for invoking server to edit OLE object
- uses separate window

In-place Activation

- state of OLE object activated in a container application's compound document

Visual Editing

- OLE 2.0 method for invoking server to edit OLE object
- uses same window
- only available for embedded items

OLE Terminology (6)

OLE automation

- lets one application (server) expose objects to be manipulated
- lets another application (client) manipulate those objects
- exposed objects consist of sets of properties (data members) and methods (member functions)
- basis for custom controls

Automation Server

- application that exposes objects for manipulation

Automation Client

- application that manipulates exposed objects

OLE Features (1)

Visual Editing

directly activate objects in place within documents without switching to a different window

Nested Objects

a contained object can contain other objects

Drag-Drop

drag objects from one application window to another

Cut-Paste

move/copy objects via the clipboard

OLE Features (2)

Component Object Model

- simplifies linking/embedding, better support for container-servers

Version Management

- objects can contain versioning information

Object Conversion

- objects can be converted for use by different applications

Adaptable Links

- maintains links when object is moved/copied

OLE Features (3)

- **Storage-Independent links**
  - embedded objects can update one another's data regardless of file-system
- **Automation**
  - run commands/functions in one application from another

OLE 1.0 - 2.0 Compatibility

- OLE 1.0 and OLE 2.0 applications may coexist on same system
- You may mix-match 1.0/2.0 containers/servers
- OLE 2.0 apps default to OLE 1.0 behavior when dealing with OLE 1.0 app

OLE Multiplatform Support

- Win16
- Win32
  - Windows NT Daytona 2Q-3Q ‘94 (OLE 2.1)
- Apple Macintosh System 7
  - Complete compatibility for compound documents to/from Win16/Win32
  - Uses AppleEvents protocol
- RISC
  - MIPS
  - Alpha

OLE Opportunities with VC++ (1)

- Turn your application into OLE container
  - Lets users link/embed server objects in your app's documents
  - Lets users use visual editing to access embedded server objects
  - Open editing still available for OLE 1.0 or linked objects

OLE Opportunities with VC++ (2)

- Turn your application into an OLE server
  - Lets users store your application's data in container documents
  - Lets app integrators combine your app with others

OLE Opportunities with VC++ (3)

- Turn your application into a container-server
  - Get the benefits of both

OLE Opportunities with VC++ (4)

- Turn your VC++ application into an Automation Server
  - Automation clients can drive your application for services
  - VB is a built-in Automation Client

MFC's OLE Support

- Containers
- Servers
  - Full Servers
  - Mini-Servers
- Automation Servers
- Based on Document-View architecture
  - COleDocument
  - CDocItem
    - COleClientItem
    - COleServerItem
  - View class will have CDocItem-derived class pointer

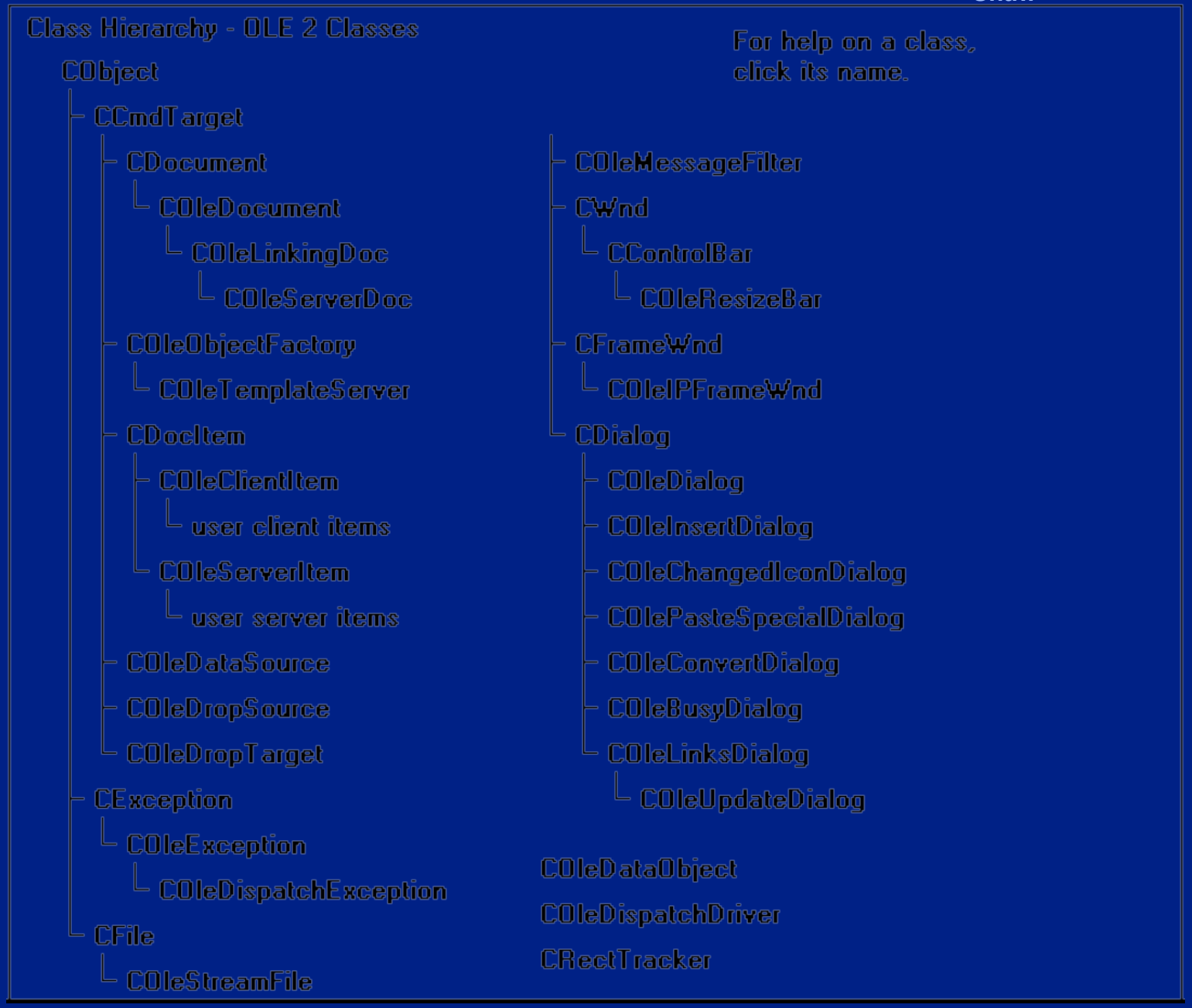
MFC's OLE 2.0 Support: The Good News

- Container and visual editing support
- Server and visual editing support
- OLE Automation support
- Drag-drop, Cut-Paste

MFC's OLE 2.0 Support: The Bad News

- No support for Imoniker
- IUnknown interface implemented but not exposed
- IMarshall not implemented, but used internally
- Partial Compound file support

The MFC OLE Classes



Building OLE Applications

Building OLE Containers
Building OLE Servers
Building OLE Automation Servers

Building OLE Containers

- The Contain application
- Invoke AppWizard
  - Use OLE Options dialog to select “Container” option
  - Use Classes dialog to override generated class names, set document type and extension
  - Generate the application
- Try out the container

Ideas for extending the Container application

Additional Visual Editing support
Drag-drop support
Embedded links

Building OLE Servers

- The OText application
- Invoking AppWizard
  - Using the OLE dialog to select Server
  - Using Classes dialog to derive view from CEditView
  - Generate the application
- Add code to serialize the contents of the view
- Add code to turn on word-wrap
- Build OText

Building OLE Automation Servers

- What is Automation?
- Benefits of Automation
- History of Automation
- Automation is like making an API Call
- Automation is *not* like making an API Call
- How Automation works under-the-hood
- OLE's IDispatch Interface
- OLE Automation the Easy Way
- Building an Automation Server with VC++: 4 Easy Steps
- Building an Automation Client with VB: 3 Easy Steps

What is Automation?

- Solution to cross-application language support for systems and application programming
- Lets applications expose functions that can be called by other applications
  - Exposed functions are 'wrappers' for variables and functions in your application
  - Exposed application variables are called properties
  - Exposed application functions are called methods
  - Application exposing automation functions is an automation server (VC++, Excel, etc.)
  - Application accessing exposed automation functions is an automation client (VB, Excel, etc.)
- Automation clients extend their own functionality by automating the functionality of the server

Benefits of Automation

- End-users can use a single macro language (VBA)
- End-users can use the same interface in disparate applications
- Developers can use their own tools
  (provided the language/tool supports Automation)
- One application can drive another
- You can automate tasks that use multiple applications
- Anyone can write a new macro language and, as long as it supports automation, use the new language to drive automation servers
- Object-oriented: reusable code, easy integration, encapsulation

The History of Automation

- Users want a common macro language
- Microsoft originally planned to define a language and a programming environment
  - BAD IDEA!
  - You'd be restricted to one choice of language
  - You'd be restricted to one choice of tool
- Automation lets you define the commands
  - GOOD IDEA!
  - Each server exposes its functionality
  - Any client can invoke exposed functions
  - End users get their choice of tool/language (VBA, others)

Automation Is Like Making An API Call:

- Client just makes a function call
- Similar to calling an exported function
- Don't statically link to automation methods, but dynamically link to them at runtime

Automation Is *Not* Like Making An API Call:

- DLLs / APIs don't provide direct access to owner's properties or variables
- Application calling DLL must know names of DLL functions in advance
- Automation client can dynamically query server to discover methods / properties, data types and parameters

Automation Under-the-Hood

- Automation Server exposes end-user level functions through OLE interface known as IDispatch
  - IDispatch can be implemented on any OLE object
  - IDispatch is, for the most part, independent of the rest of OLE
- Automation Client uses IDispatch to:
  - Learn names of functions
  - Retrieve and check function parameters
  - Invoke functions
- IDispatch assumes each function has a unique ID

OLE's IDispatch Interface

GetTypeInfoCount

Retrieves number of functions and parameters

GetTypeInfo

Retrieves function and parameter names

GetIDsOfNames

Maps function names to function IDs

Invoke

Invokes function with a given ID

OLE Automation the Easy Way

- Create Automation Servers with Visual C++
  - Why VC++?
    - VC++ is a built-in OLE automation server
    - VC++ can expose the variables/functions of any CCmdTarget-derived class
- Create Automation Clients with Visual Basic (or VBA-based application)
  - Why VB?
    - VB is a built-in OLE automation client
    - VB requires only 3 lines of code to initialize, create and invoke an object

Building an Automation Server with VC++: 4 Easy Steps

- Select "Automation Support" in AppWizard when you create your application
  - Adds OLE automation derivation and dispatch table to document class
- Build your application
- Use ClassWizard to expose any variables (properties) and functions (methods)
- Run the application once
  - Registers the exposed object(s) with Windows

Building an Automation Client with VB: 3 Easy Steps

- Add an object variable to your application
- Initialize the object via a call to CreateObject
  - Pass CreateObject the object name
- Call functions exposed by the object (go wild!)

Building an OLE Automation Server

- The AutoServ Application
- Generate the initial application
  - Invoke AppWizard
  - Use OLE Options dialog to check “Automation support”
  - Use Classes dialog to override class names and set file extension
  - Generate the application

Building an OLE Automation Server (2)

- Add a dialog to prompt for an initial string, position
  - Use AppStudio to create the new dialog
  - Use ClassWizard to add a new dialog class
  - Add code to create the new dialog when the document class is initialized
  - Use ClassWizard to add a WM_INITDIALOG handler and set the focus to a control
- Add a new dialog for editing the string
  - Use AppStudio to create new dialog
  - Use ClassWizard to add a new dialog class

Building OLE an Automation Server (3)

- Add a menu item to invoke the editing dialog
  - Use AppStudio to add the menu item
  - Use ClassWizard to tie menu item to a message handler and invoke the new dialog
- Add data members for the string and position to the document class
  - Modify the Serialize function in the document class to serialize the data
  - Modify the view class' OnDraw function to display the string

Building an OLE Automation Server (4)

- Trap left mouse button messages
  - Use ClassWizard to trap the WM_LBUTTONDOWN message for the view
- Add a Refresh function to the document class
- Run AutoServ

Building an OLE Automation Server (5)

- Expose the position variables as properties
- Expose the string variable as a property
- Expose the Refresh function as a method
- Create/Expose a ShowWindow function, if needed by the client

Build the OLE Automation Client in VB

Add the object variable
Initialize the object variable
Call the exposed functions
Run the VB Automation Client

The Future of Windows: Chicago and Cairo

- No Program Manager or File Manager: Explorer
- Document-centric, query-based approach
- No program groups, files or directories
- Instead: program icons, documents, folders

The Future of OLE: Cairo

- OLE-aware from the ground-up
- Every folder, document, pane, control is an OLE object
- Globally available, built-in OLE objects
- Every OLE object has exposed properties / methods
- Heavy use of OLE and OLE Automation
- OLE forms instead of dialogs
- OLE distributed object support via DCE RPC

Pointers to Sources: OLE

- Visual Basic Programmer's Journal, March-April Issue
- OLE 2.0 SDK - Microsoft
- MS VC++ 1.5 "Books On-Line"
- OLE JumpStart CD - Microsoft
- "Inside OLE 2.0" by Kraig Brockschmidt - MS Press
- Win32 Professional Developer's Conference

General Q&A

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