Las Vegas
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ObjectARX: Tools, Tips and Working Demonstrations

Presented by:
Charles McAuley
Developer Consulting Group
Autodesk.

Ask all the questions you want – that’s why I’m here ☺
Shameless Plug for ObjectARX

• What is in here applies to AutoCAD 2000i and AutoCAD 2002 as well.
Developer Consulting Group

• World Wide Workgroup
  – Over 30+ Specialists World Wide

• US Team
  – CA, WA, AZ

• European Team
  – United Kingdom, France

• APAC Team
  – India, China, Japan
ADN Website - Support

http://adn.autodesk.com

Provides access to

• On-line knowledge base
• Call submission
• Newsgroups
• Newsletters
• Answers to frequently asked questions are posted in our on-line knowledge base
• Download the "ObjectARX Wizard"
With a show of hands, how many of you know...

- C++ ?
- Visual LISP/AutoLISP ?
- Visual Basic – VB/VBA ?
- C++ -> MFC (Microsoft Foundation Classes) ?
- COM/ATL ?
- C -> ADS -> ADSRX (Die Hard resbuf defenders!, ads_command gurus!, single linked list warriors!)
What is ObjectARX?

- ObjectARX is an object-oriented C++ API for developers to use, customize, and extend AutoCAD. It provides...
  - Access the AutoCAD database
  - Interact with the AutoCAD editor
  - Create user interfaces using the MFC (AdUi/AcUi).
  - Create custom objects/entities with custom behavior.
  - Notifications and Transactions
  - Lots more...
What is ObjectARX? (2)

• ObjectARX is to AutoCAD as “Eric Clapton” is to one of these...
What are ObjectARX applications?

- ObjectARX applications are Dynamic Link Libraries (DLL), however instead of having a DLL file extension they have an ARX file extension.
  - ARX applications require a host application (AutoCAD) they don’t execute by themselves. This is typical of DLL’s.
How do I create ObjectARX applications?

- Use Visual C++, create a “Win32 Dynamic DLL” and add the required code manually (more work!).
- Use the ObjectARX Wizard (easier, concentrate on getting your job done!).
  - Download it from the ADN web site
    - http://adn.autodesk.com you need to be an ADN member however 😞
  - Download the ObjectARX SDK (contains the ObjectARX Wizard 😊)
    - http://www.autodesk.com/objectarx
Why ObjectARX?

- Power and Speed!
ObjectARX is Object Oriented

• AutoLISP (simple but not OOP)
  \((\text{command} \ "\_\text{LINE}\" \ PT1 \ PT2 \ "")\)

• C -&gt; ADS -&gt; ADSRX (still not OOP)
  \(\text{acedCommand}(\text{RTSTR}, \ "\_\text{LINE}\", \ \text{RTPOINT} \ \text{PT1}, \ \text{RTPOINT} \ \text{PT2}, \ \text{RTSTR}, \ "", \ \text{RTNONE});\)

• ObjectARX (😊 OOP)
  \(\text{pMyLine} = \text{new AcDbLine};\)
  \(\text{pMyLine}-\text{setStartPoint}(\text{pt1});\)
  \(\text{pMyLine}-\text{setEndPoint}(\text{pt2});\)
  \(\text{pMyLine}-\text{setDatabaseDefaults}();\)
What does ObjectARX have?

- **Entities**
  - `AcDbEntity`, `AcDbLine`, `AcDbPolyline`, `AcDbCircle` etc.
What does ObjectARX have? (2)

- Objects
  - `AcDbObject`, `AcDbSymbolTable`, `AcDbLayerTable`, `AcDbLayerTableRecord` etc.
What does ObjectARX have? (3)

- Iterators, lots of Iterators not just Symbol tables!
  - `AcDbSymbolTableIterator`, `AcDbLayerTableIterator` etc.
What does ObjectARX have? (4)

- Transactions, Managers of all kinds!
- Monitors of all types!
What does ObjectARX have? (5)

• Notifications! aka “Reactors” buckets of them!
  - `AcApDocManagerReactor`, `AcDbEntityReactor` etc.
What does ObjectARX have? (6)

- Geometry Classes (AcGe) 2D and 3D let ObjectARX do the math for you!
What does ObjectARX have? (7)

- UI Classes (AdUi/AcUi) lots of them!
  MFC Extension Classes.

- CBUTTON
  - CAcUiOwnerDrawButton
  - CAcUiOwnerDrawButton
  - CAdUiBitmapButton
  - CAcUiBitmapButton
  - CAcUiPickButton
  - CAcUiSelectButton
  - CAdUiBitmapStatic
  - CAcUiBitmapStatic
ObjectARX Class Hierarchy Chart

• On the ObjectARX SDK download area, there is a PDF file of the ObjectARX Class Hierarchy. (Here is what it looks like!)
  – http://www.autodesk.com/objectarx

• In the ‘classmap’ folder on the SDK there is a dwg file ‘classmap.dwg’, usually I make a dwf out of it and view it in my browser (or Volo View Express).
Extending ObjectARX

- Create our own custom Objects and create your own custom Entities!
- Store your custom Object in the Named Object Dictionary or an entity’s Extension Dictionary.
- Custom Entities have their own behavior – custom grip points, object snaps and behavior.
Extending ObjectARX (2)

- Notice this custom entity has its own grip points and behavior (demo later!).
ObjectARX COM and ATL

- Expose your custom object and entities to any COM compliant language (VB/VBA) using COM wrappers.
- Access to the Object Property’s Manager is via ATL (ObjectARX has a wizard for this).
- Access to the Design Center is via ATL again ObjectARX Wizard to the rescue!
ObjectARX Wizard and VC++ (1)

• Creating an ObjectARX application using the ObjectARX Wizard from Visual C++.
ObjectARX Wizard and VC++ (2)

- The ObjectARX Wizard dialog.
ObjectARX Wizard and VC++ (3)

- The ObjectARX Wizard Toolbar in Visual C++.

- ObjectARX color coded keywords in Visual C++.

```cpp
// ObjectARX 2000 Wizard
extern "C" AcRx::AppRetCode
acrxEntryPoint(AcRx::AppMsgCode msg, void* pkt)
{
    switch (msg) {
    case AcRx::kInitAppMsg:
        // Comment out the following line if your
        // application should be locked into memory
        acrxDynamicLinker->unlockApplication(pkt);
        acrxDynamicLinker->registerAppMDIAware(pkt);
        InitApplication();
        break;
    case AcRx::kUnLoadAppMsg:
        UnloadApplication();
        break;
    }
    return AcRx::kRetOK;
}
ObjectARX Wizard and VC++ (4)

- The ObjectARX Wizard is tightly integrated into Visual C++, notice AutoCAD controls inside VC++ Class Wizard.

- Suffice to say a demo of the ObjectARX Wizard in action is in order!
ObjectARX Wizard Demonstration

• Let us have a quick overview of what the ObjectARX Wizard provides.
  – A word on installing the Wizard (setting up the toolbar)
  – Setting up color coded “user-defined” keywords
  – Setting up ObjectARX ‘inc’ and ‘lib’ paths
  – Header files
  – User defined commands
  – EntryPoint messages
  – Transient Reactors
ObjectARX Wizard Demonstration

- And continuing with our demonstration.
  - ObjectARX Class Wizard - ObjectDBX
  - MFC Support for ObjectARX, ATL support
  - Input Point and ObjectARX application Registration
  - ObjectARX Component Gallery
  - Configuring help and Code Finder
ObjectARX Wizard and VC++ (5)

- So hands up those who do not like the ObjectARX Wizard!

- Now that we are all happy, these are custom AutoCAD entities derived from `AcDbEntity -> AsdkSmiley`

(See the ObjectARX SDK ‘Smiley’ sample.)
ObjectARX Resources

- ObjectARX SDK contains a folder ‘ARXLABS’.
- ObjectARX training supplied by the Developer Consulting Group
  - [http://www.autodesk.com/apitraining](http://www.autodesk.com/apitraining)
  - Class room training
  - Virtual Class room training
- See the “Customization Channel” on the PointA web site.
ObjectARX Resources (2)

• Consider joining the Autodesk Developer Network (ADN).
  – http://adn.autodesk.com

• For more information on ADN go to the “Developer Center” on the Autodesk web site.
  – http://www.autodesk.com
ObjectARX Resources (5)

```
#include <dobjdr.h>
#include <dbserv.h>

// minimal error checking for code beauty

void DispDialogExSubstMenu()
{
  // has to do document locking explicitly
  adBDocumentManager->lockDocument(TRUE);
  adBDBObjectTable& dtab = AdBDBObjectTable::Instance()->database();
  adBDBObjectTable& dtab = AdBDBObjectTable::Instance()->database();
  if(dtab.DocumentStatus() == adBDocument::ok)
  { return;
    AdBDBObjectTable& dtab = AdBDBObjectTable::Instance()->database();
  }
}
```
ARXLABS folder on the SDK

- Let us take a look at the ARXLABS folder on the ObjectARX SKD, specifically “ObjectARX 2000 Tutorial.htm”.
SAMPLES folder on the SDK

• The Developer Consulting Group is responsible for the samples that appear in the Samples folder of the ObjectARX SDK.
  – Please note the ADN web site contains more recent versions of the samples in addition to new samples.

• Before you start, take a look at the “SamplesReadMe.htm”, it will help you get started!
DOCSAMPS folder on the SDK

- Not created by DCG. The DOCSAMPS follow the ‘official’ ObjectARX Developers Guide, in that any code in the guide has a corresponding sample in the DOCSAMPS folder. See the “Readme.txt” file.
Time for some real ObjectARX!

Okay time for some real ObjectARX!

Let’s look at as many of the following topics as we can time permitting:

• ObjectARX Entry Point messages
• User defined commands
• AutoCAD database structure (Demo Inspector and ARX Debug app)
• Symbol Tables and Name Object Dictionary (NOD)
• Block Definitions and References
Time for some real ObjectARX! (2)

Continue with, again time permitting:

• Custom Objects/Entities - ObjectDBX
• Transactions
• Transient and Persistent Reactors
• ObjectARX UI (AcUi/AdUi)
• COM Wrappers and ATL
• Other “bits and bobs” as I think of them 😊
EntryPoint Messages and Commands

• Let’s use the ObjectARX Wizard to quickly build and application and create a few commands and discuss.

• Most important messages are
  – AcRx::kInitAppMsg:
  – AcRx::kUnloadAppMsg:

• Adding a command
  – acedRegCmds->addCommand()

• What else is interesting here?
AutoCAD Database and Structure

• Perhaps the easiest way to understand the AutoCAD database structure is to demonstrate this structure using two applications, the first is Inspector and the second is ARXDBG.

• “Inspector” is on the ADN web site and is an example of a dialog bar in ObjectARX.

• “ARXDBG” is on the ‘SAMPLES’ folder on the ObjectARX SDK. (ARXDBG is a great tool!)

• As I demonstrate this please feel free to ask questions!
AutoCAD Database and Structure

• ObjectARX “Golden Rule!” repeat after me 😊...

• “It is very important that any objects open for read or write operations must be closed when you are finished with them. Failure to close open objects will cause AutoCAD to crash - you have been WARNED!”
AutoCAD Database and Structure

• Let’s discuss, in very generic terms the process on opening and closing objects, creating objects and navigating the database structure.

• Understand the process its used repeatedly.
AutoCAD Database and Structure

- Let’s discuss, in very generic terms the process on opening and closing objects, creating objects and navigating the database structure.
- Understand the process its used repeatedly.

- See Step 8 of the ARXLABS – `createLayer()`.
- See Step 8 of the ARXLABS – `asdksetlayer()`. // Iterator
Block Definition and References

• Let’s discuss and demonstrate this using “Inspector”.

• Take a look at the EMPLOYEE block of Step 8 in the ARXLABS.

• See Step 8 of the ARXLABS – askdCreate().
• See Step 8 of the ARXLABS – createBlockRecord().
Custom Object/Entity - ObjectDBX

• What and why – ObjectDBX? What is separation of the UI from the DB? (UI/DB separation). Why is this a good thing?

• Let’s explore with some demo applications that I use.

• Take a look at the ASKDEMPLOYEE custom entity of Step 8 in the ARXLABS.

• Are custom objects/entities worth the cost – you decide!
Transactions

• Have AutoCAD watch what you add to the database in case you change your mind!

• Let’s explore with some demo applications that I use.
  - `startTransaction()`
  - `endTransaction()`
  - `abortTransaction()`
  - `addNewlyCreatedDBObject()`
Notifications/Reactors (Transient and Persistent)

- ObjectARX is very rich when it comes to Notifications/Reactors
- Let’s explore with some of the many Notifications/Reactors with demo applications that I use.
  - AcDbEntityReactor
  - AcApDocManagerReactor
  - AcEditorReactor
  - (please note there are lots more!)
ObjectARX UI

- ObjectARX is very rich when it comes to MFC UI. (AcUi/AdUi)
- Let’s explore with some demo applications that I use.
  - Modal/Modeless Dialogs
  - Toolbars
  - Tab Extension Dialogs
  - Other elements time permitting
COM and ATL

- COM wrappers and ATL
- Let’s explore the AsdkSmiley application, it is in the SAMPLES folder of the ObjectARX SDK.
Thank You!
Developer Consulting Group

Why ObjectARX is just so powerful!