Las Vegas
November 27-30, 2001

Autodesk University

Las Vegas

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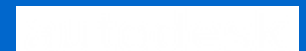# ObjectARX: Tools, Tips and Working Demonstrations

Presented by:

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Developer Consulting Group

Autodesk.

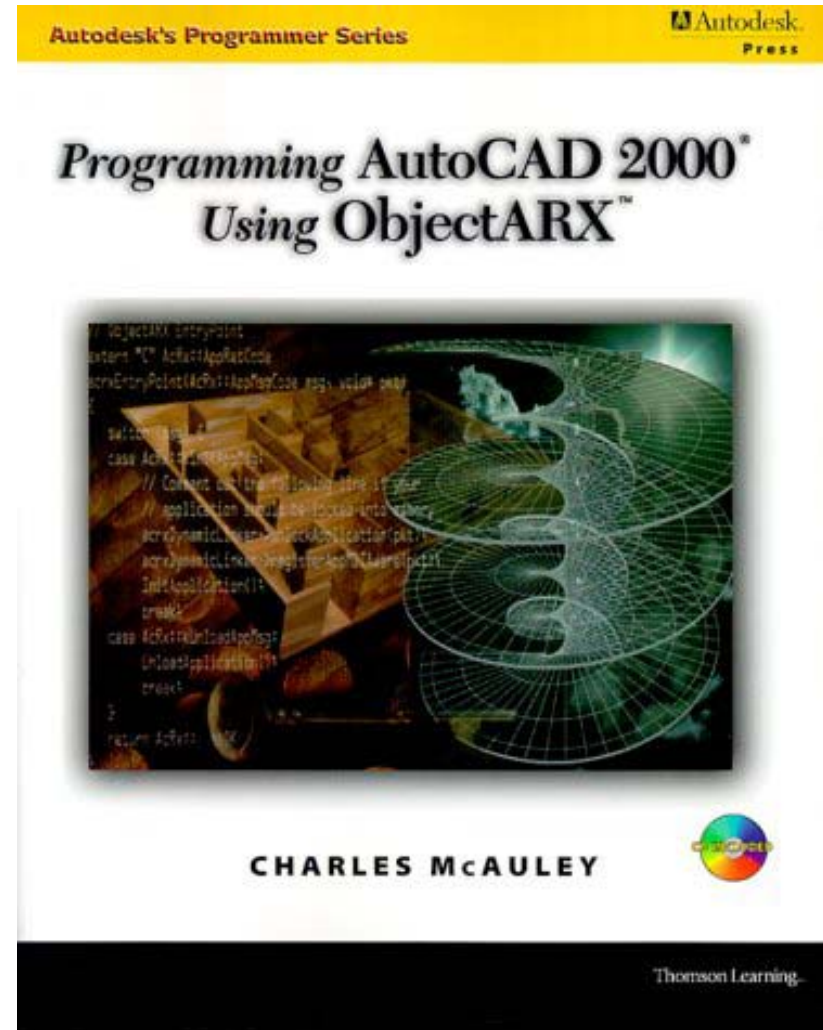Ask all the questions you want – that's why I'm here ☺

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)

```
(command "_LINE" PT1 PT2 "")
```

- C -> ADS -> ADSRX (still not OOP)

```
acedCommand(RTSTR, "_LINE", RTPOINT
   PT1, RTPOINT PT2, RTSTR, "", RTNONE);
```

- ObjectARX (☺ OOP)

```
pMyLine = new AcDbLine;
pMyLine->setStartPoint(pt1);
pMyLine->setEndPoint(pt2);
pMyLine->setDatabaseDefaults();
```
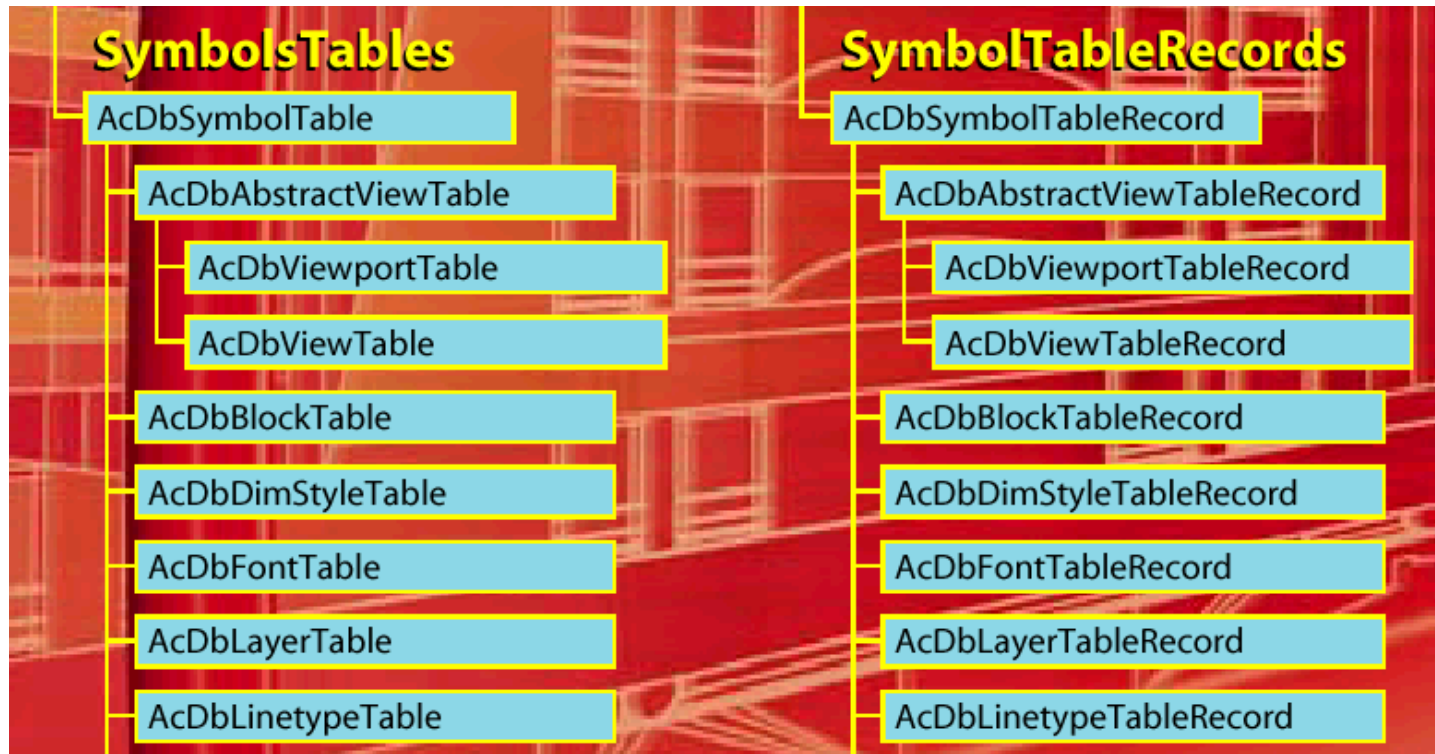
What does ObjectARX have?

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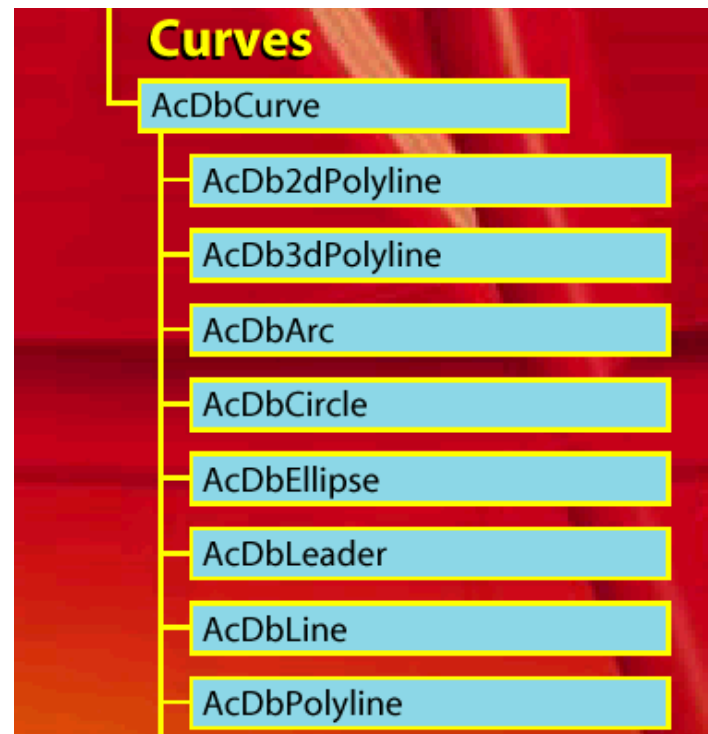
What does ObjectARX have? (2)

- Objects
  - **AcDbObject, AcDbSymbolTable, AcDbLayerTable, AcDbLayerTableRecord etc.**

What does ObjectARX have? (3)

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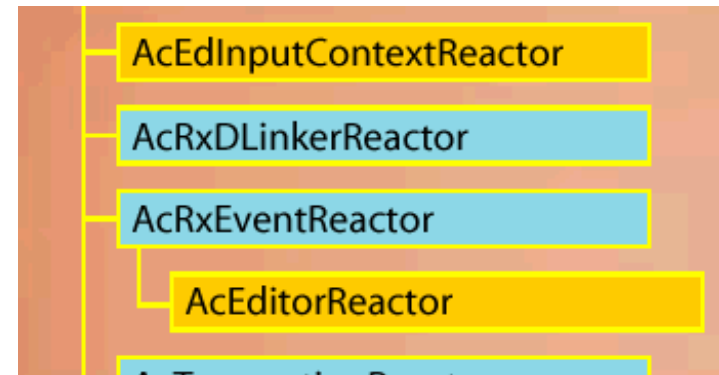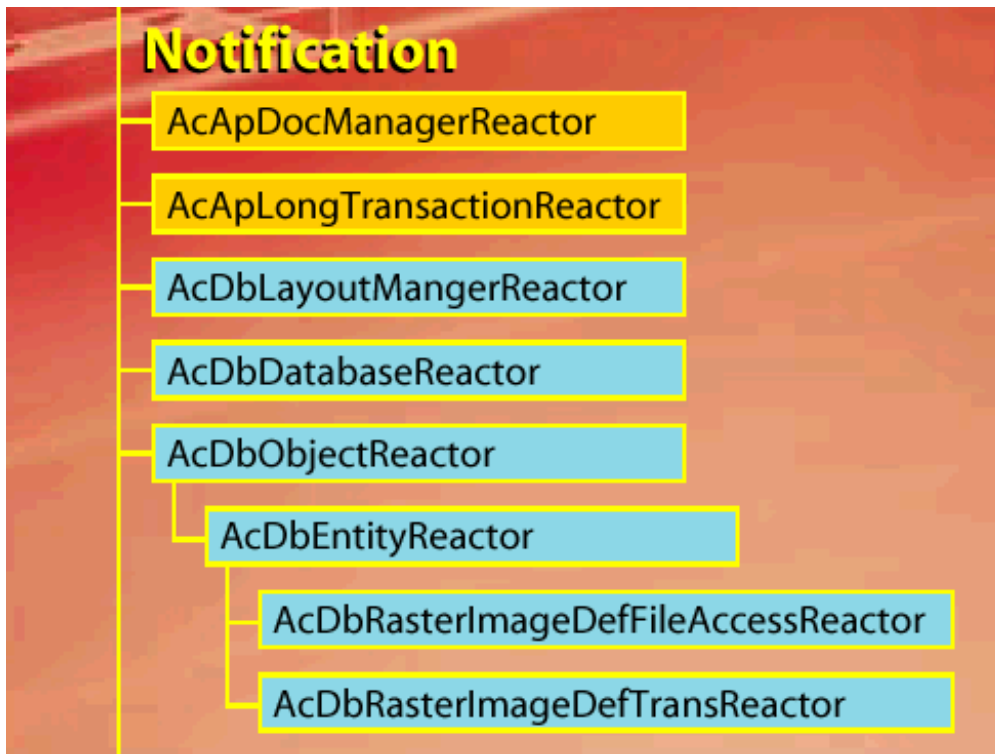 - **AcDbSymbolTableIterator, AcDbLayerTableIterator etc.**
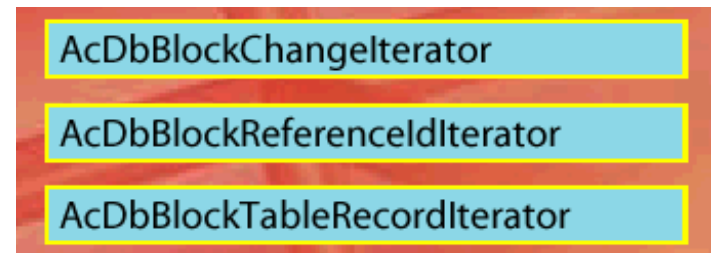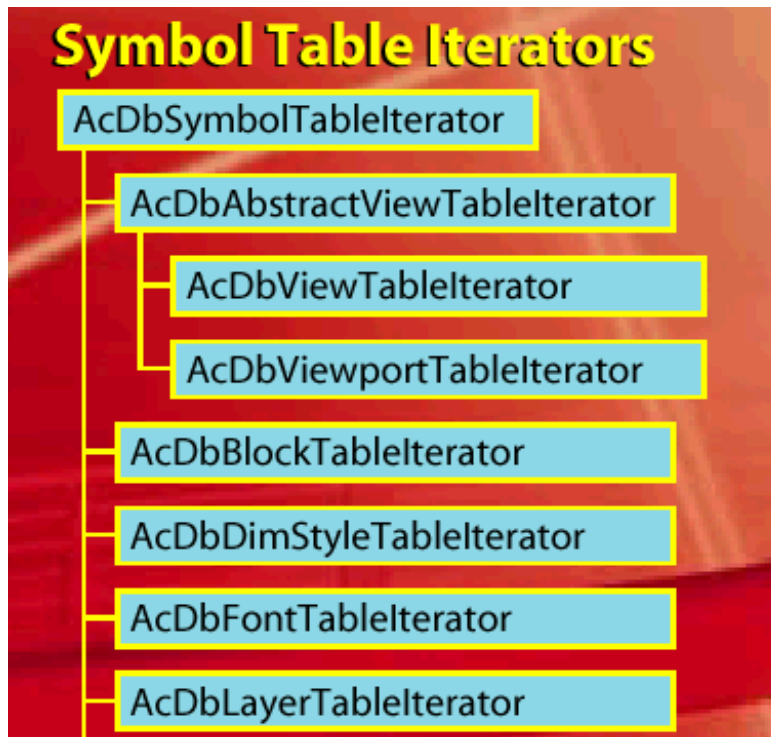
What does ObjectARX have? (4)

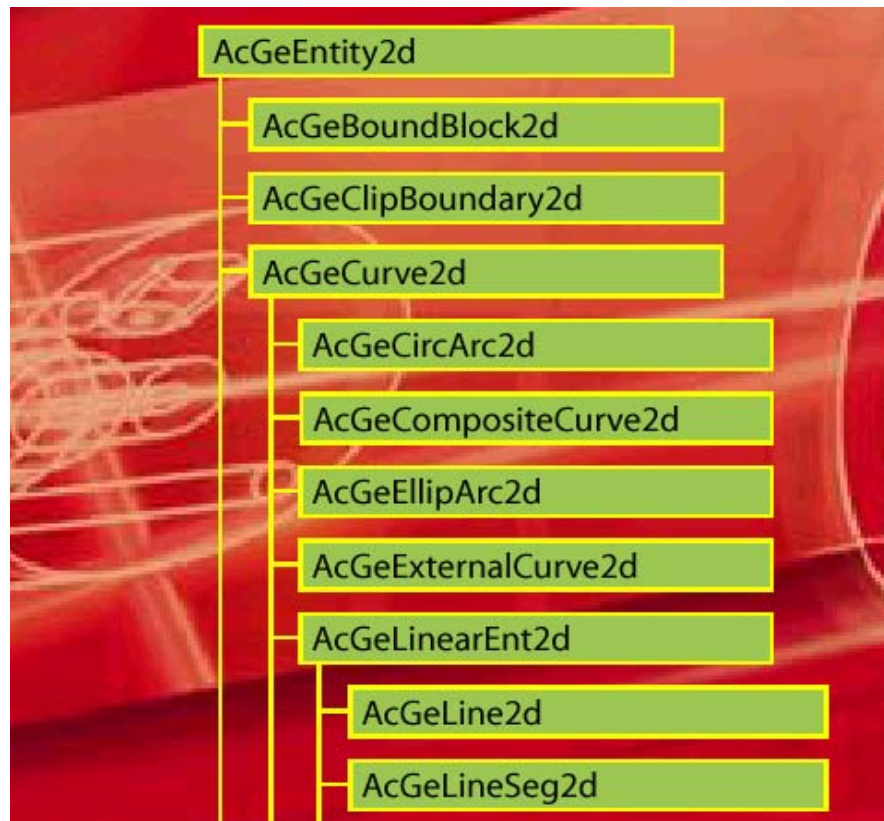- Transactions, Managers of all kinds! Monitors of all types!
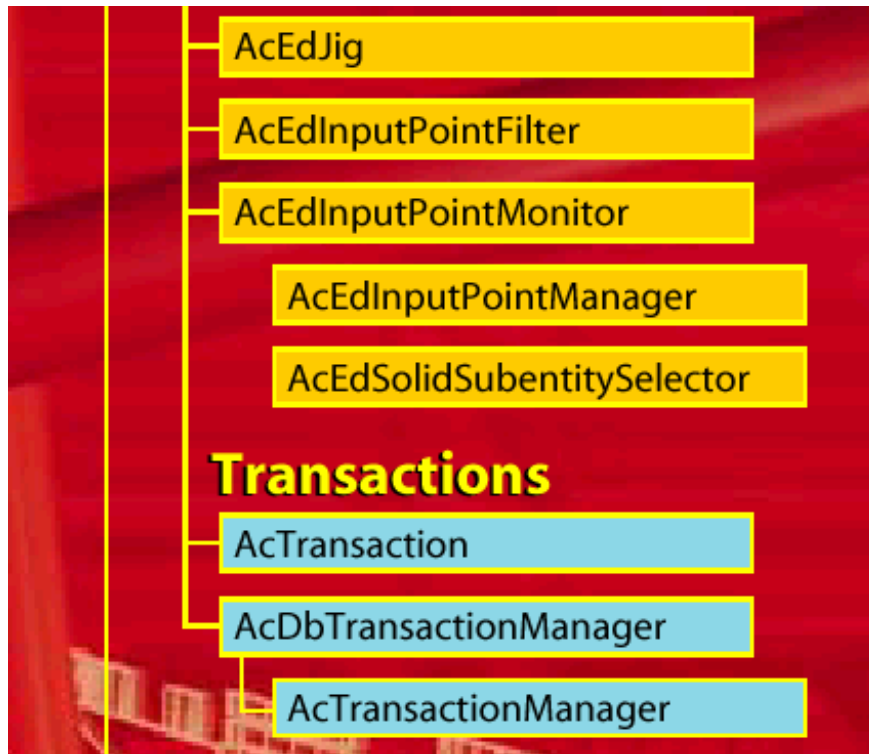
What does ObjectARX have? (5)

- Notifications! aka "Reactors" buckets of them!
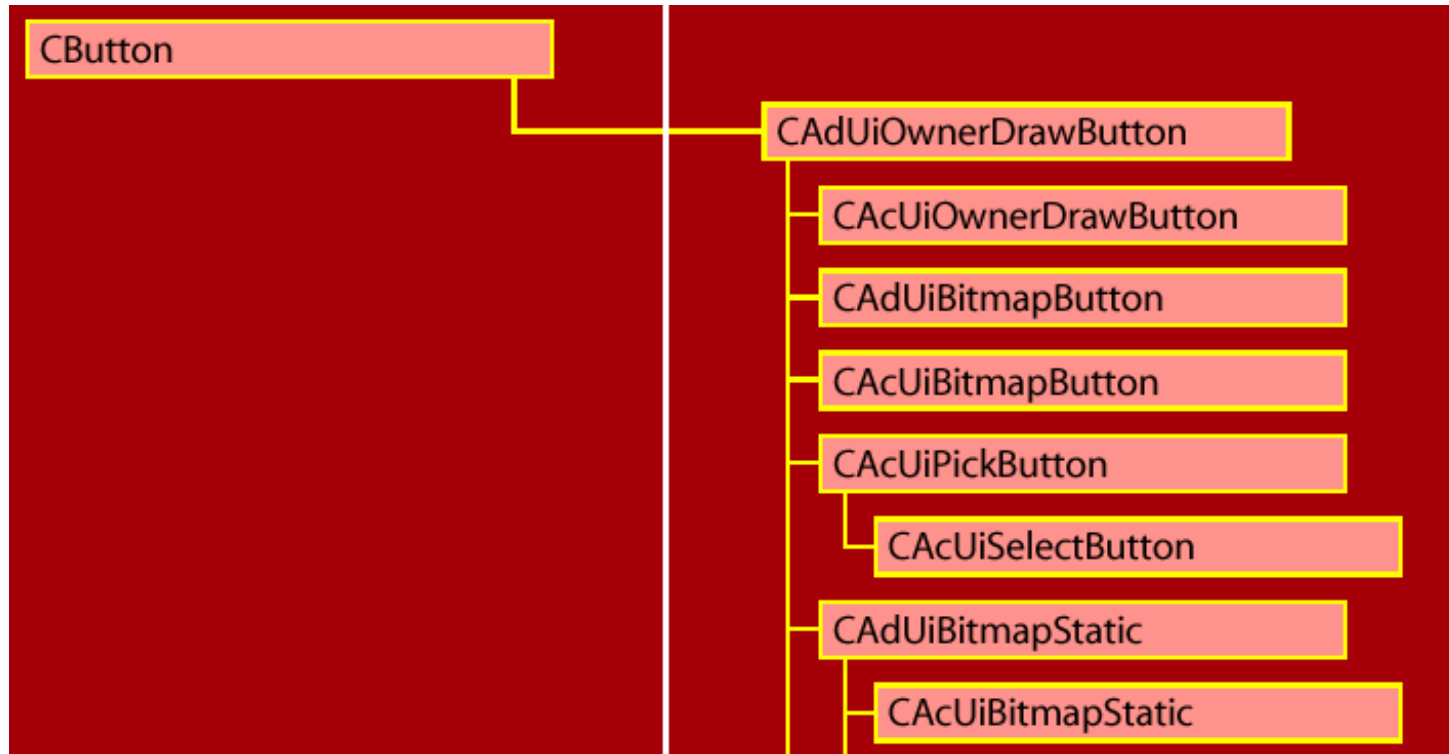 - **AcApDocManagerReactor, AcDbEntityReactor etc.**

- 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.

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 you 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!).

Endpoint: 0.7373 < 90°
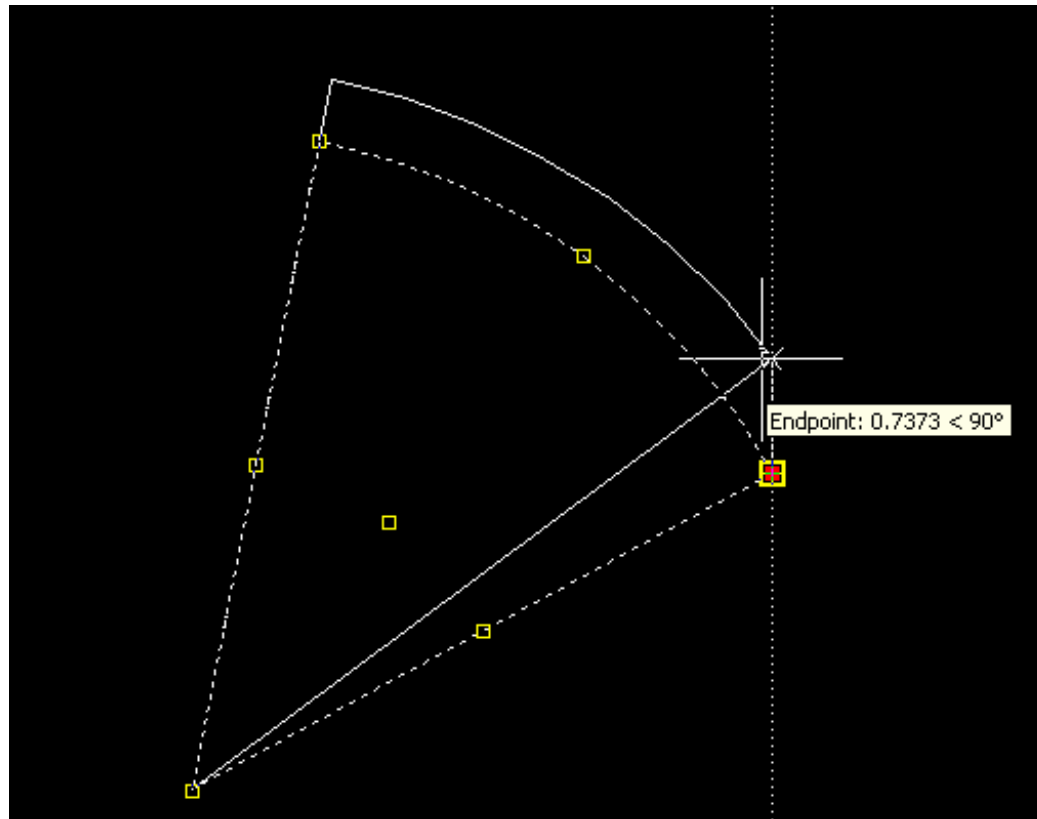
ObjectARX COM and ATL

- 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).

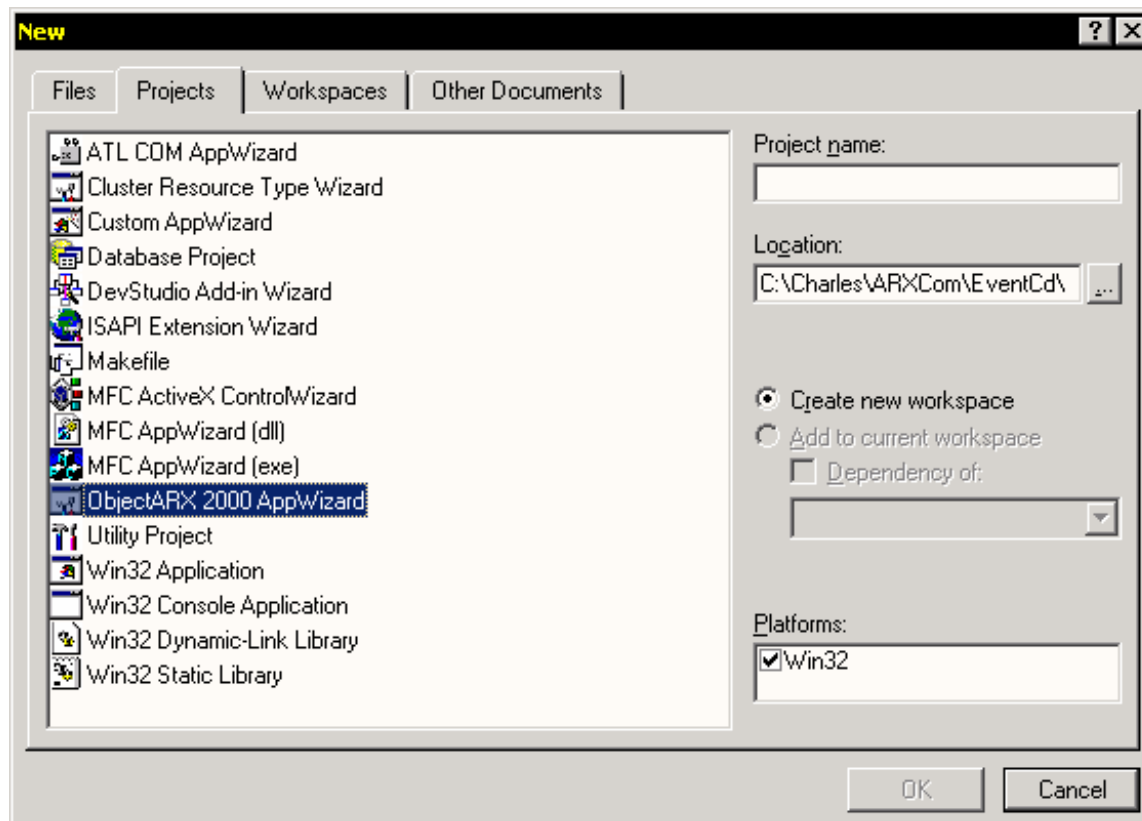- Access to the Design Center is via ATL again ObjectARX Wizard to the rescue!
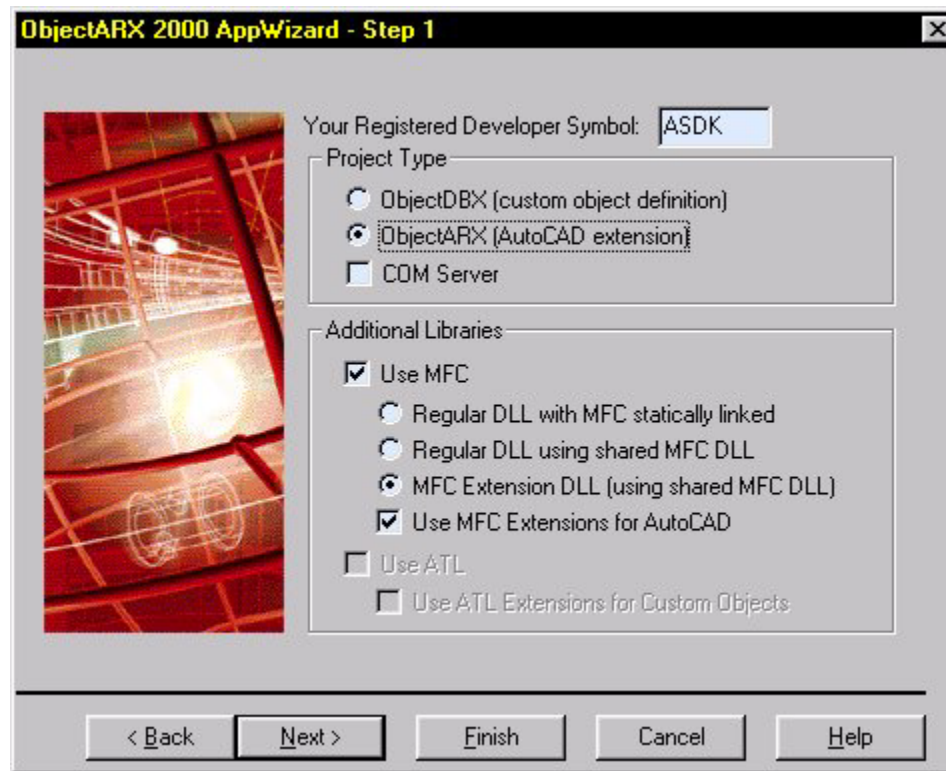
ObjectARX COM and ATL (2)
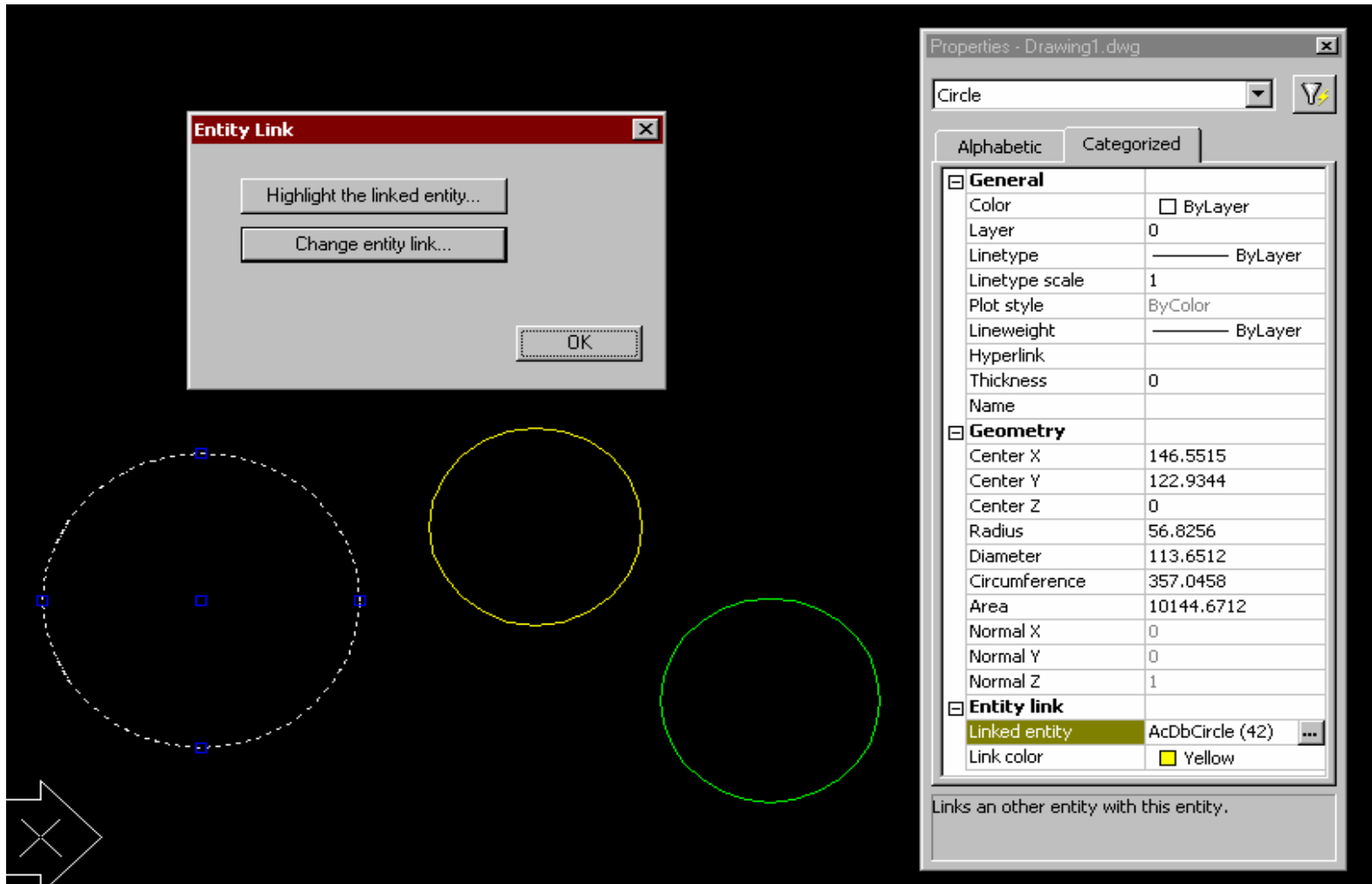
ObjectARX Wizard and VC++ (1)

- 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)
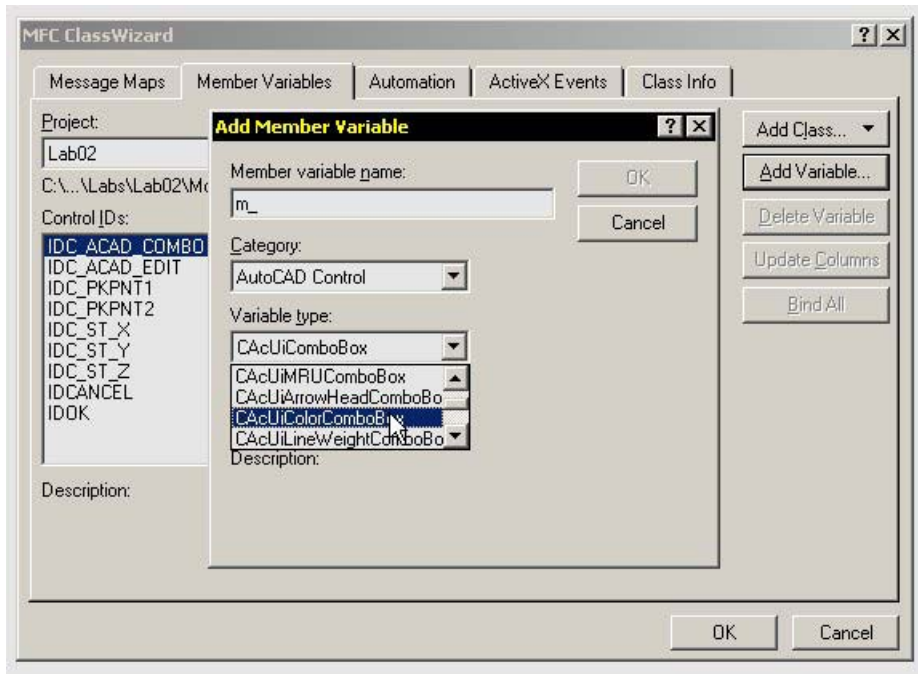
- The ObjectARX Wizard Toolbar in Visual C++.

- ObjectARX color coded keywords in Visual C++.

```
/////////////////////////////////////////////////
// ObjectARX EntryPoint
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 entitles 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
  - Class room training
  - Virtual Class room training
- See the "Customization Channel" on the PointA web site.
  - http://www.autodesk.com/pointa "Productivity Center"

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 (3)

ObjectARX Resources (4)

Autodesk University

ObjectARX Resources (5)

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" in 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.
  - **strartTransation()**
  - **endTransaction()**
  - **abortTransaction()**
  - **addNewlyCreatedDBRObject()**

Notifications/Reactors (Transient and Persistent)

- ObjectARX is very rich when it comes to Notifications/Reactors

- Let's explore with some 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 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