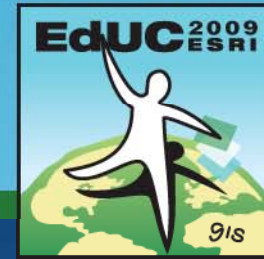


2009 ESRI Education User Conference

July 11–14, 2009

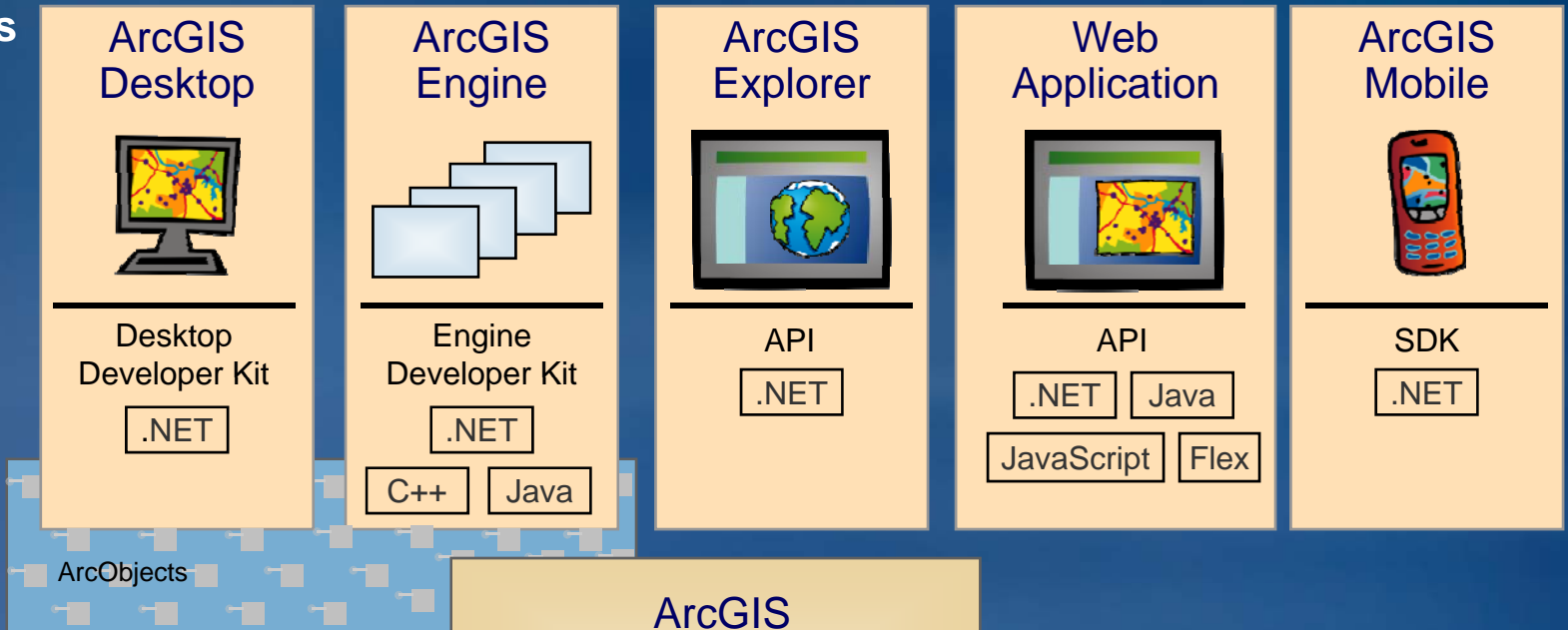


Introduction to Programming ArcObjects Using the MS .NET

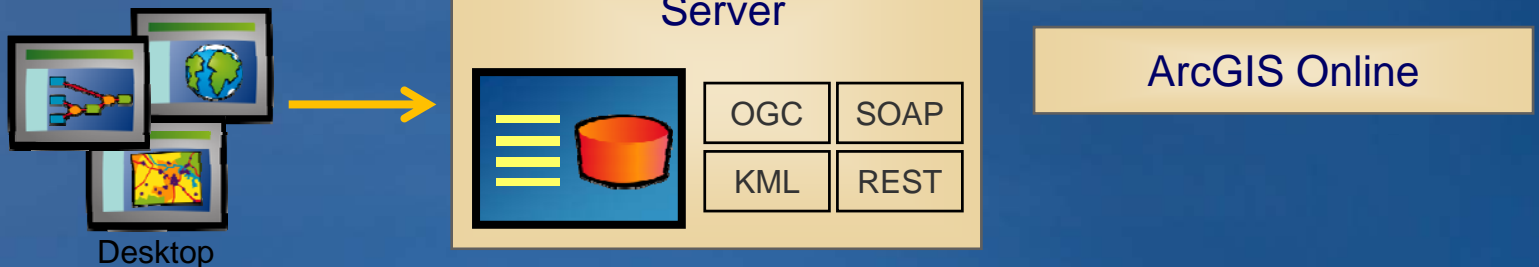
Jorge Ruiz-Valdepeña

What it is

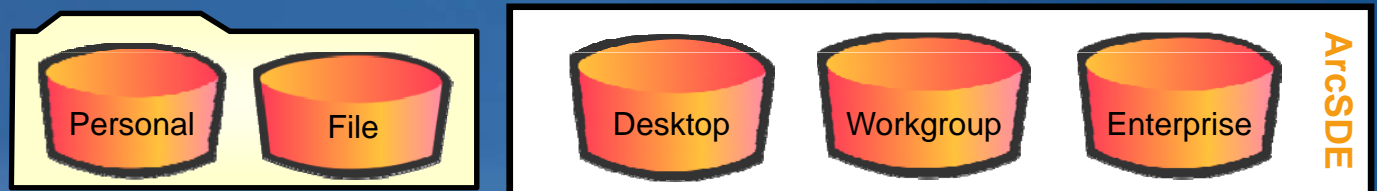
Applications



Services



Data (Geodatabases)



What do I need

- **For developers**
 - Copy protection file (*.ecp) to authorize
 - ArcGIS Desktop license: ArcView or higher
 - OR
 - ArcGIS Engine Developer Kit
- **For end users**
 - ArcGIS Desktop license: ArcView or higher
 - OR
 - ArcGIS Engine Runtime license

What do I need **Software Developer Kit**

- **Developer help**
 - Desktop/Engine Help for .NET (VS2008)
 - Samples
- **DeveloperKit folder**
 - OMDs
 - Samples
 - ESRI Object Browser
 - ESRI Library Locator
- **Code snippets**

ArcGIS Developer Help (ESRI.ArcGIS.Carto)
IMapDocument Interface

.NET Samples

[Implementing a property page for an ArcGIS Engine application](#) (Code Files: [frmMain](#)) | [Load a map document LoadMap](#)) | [Modify map page and printer](#) (Code Files: [ChangeMapPageSize](#)) | [Save a layer file in a MapControl](#)

.NET Related Topics

[How to access maps and layers via the MapDocument](#) | [How to add a layer to a map from a layer file](#) | [How to add display caching](#) | [How to create AOIs and bookmarks](#) | [How to load a password-protected document](#) | [H](#)

The image shows two overlapping windows from the ESRI Developer Kit. The top window is the 'ESRI Object Browser', which displays a search for 'IMapDocument'. The search results table shows 'Interface' for 'IMapDocument' with the description 'Provides access ...'. Below the table, the 'IMapDocument : IUnknown' interface is expanded, showing properties: 'ActiveView: IActiveView', 'DocumentFilename: String', 'DocumentType: esriMapDocumentType', and 'DocumentVersion:'. The bottom window is the 'ESRI Library Locator', which has a search box containing 'IMapDocument'. It shows the result 'IMapDocument is in ESRI.ArcGIS.Carto' and has a checked option for 'Report Search and Copy results for use in .NET'.

What do I need **EDN**

- **ESRI Developer Network**

- Provides tools and resources to build custom GIS solutions

- ◆ Entire ArcGIS system
- ◆ Developer licenses
- ◆ Annual subscription
- ◆ Support discounts
- ◆ Annual Developer Summit
- ◆ Defer production costs

- **ESRI Resource Centers**

- Documentation and downloads
- User communities: Samples, blogs,

<http://edn.esri.com>

ESRI Developer Network (EDN)

Customer Care | EDN.com | Careers

Quick Launch

- Learn more, subscribe
- Access resources and communities
- Find resources for ArcGIS 9.2 and prior
- Manage my EDN subscription
- Get DevSummit information

Get Started with EDN

FOR DEVELOPERS BY DEVELOPERS

Welcome to the new EDN start page!

EDN
ESRI Developer Network

ESRI Developer Network provides a cost-effective way to build custom GIS solutions in applications and services, and every desktop, mobile, and cloud-based system. Developers can access the components and APIs they need to build their own GIS applications.

ArcGIS 9.2
ArcGIS 9.3
ArcGIS 9.3.1
ArcGIS 9.3.1.1

GIS Servers



How do I use it?

- **Blank slate**
 - Different types of projects with code windows
 - No default ArcGIS commands
 - No default mapping environment
- **Programmer adds functionality**
 - .NET controls
 - ArcGIS Engine controls
 - License handling
 - ArcObjects customizations

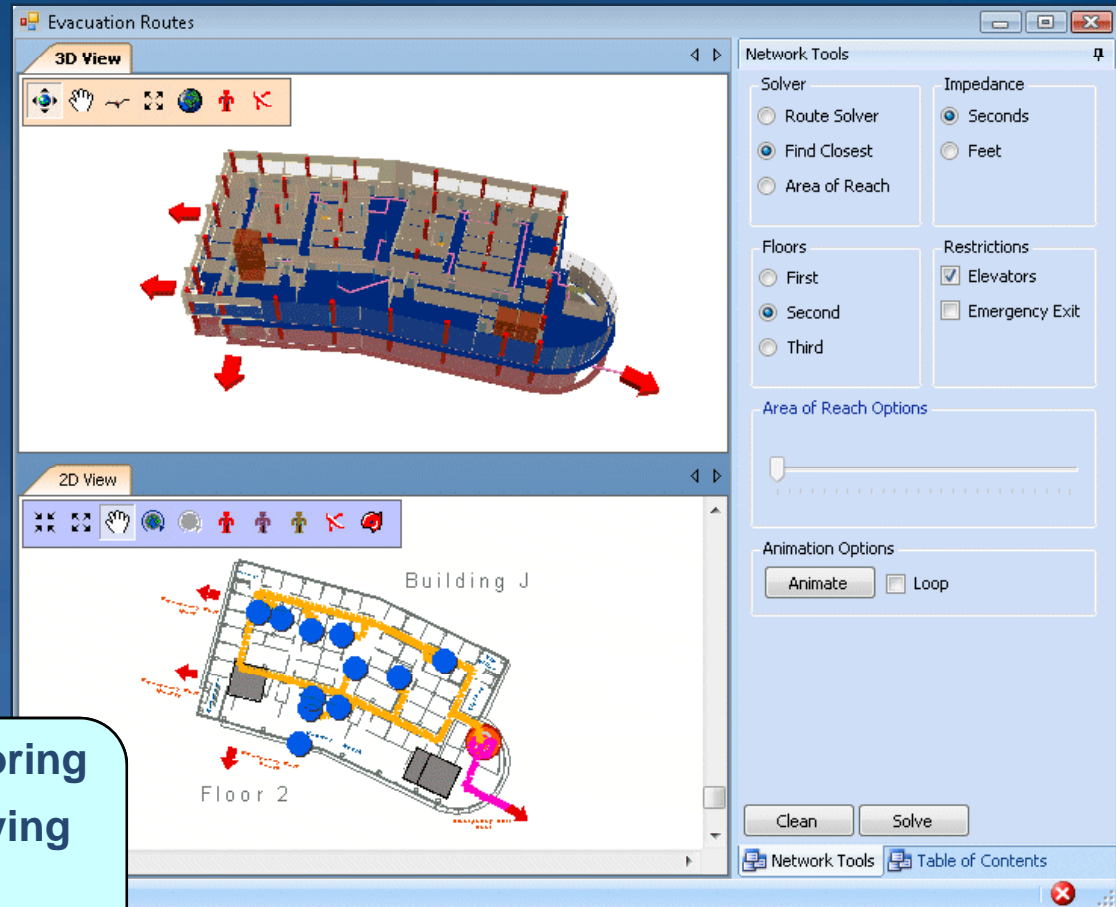
What can I do with it?

- **Create stand-alone ArcGIS Desktop applications**
- **Create applications that run without user intervention**
- **Automate workflows**
- **Work with ArcGIS Engine**
- **Extend and customize**
 - **ArcGIS Desktop**
 - **ArcGIS Server**

What can I do with it **Stand along Applications**

- **A toolkit for developers**
 - Create easy-to-use desktop applications
 - Single-use license
- **Cross-platform**
- **Development tools**
 - ArcObjects
 - Controls

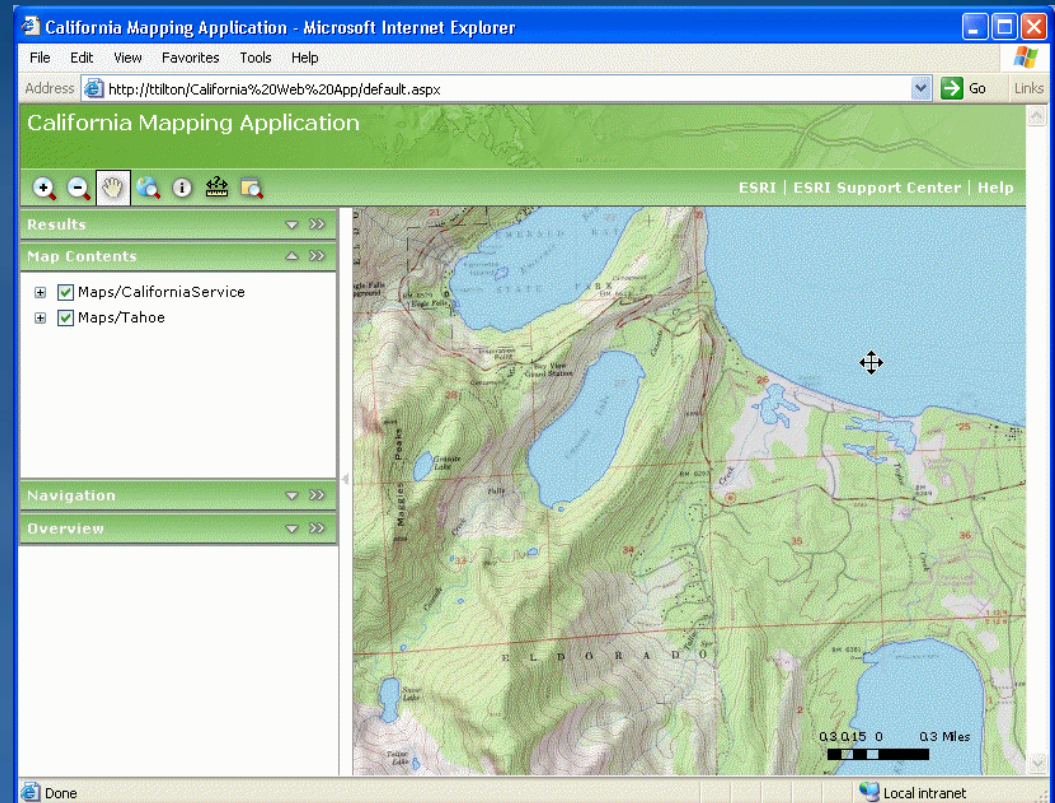
Windows, Solaris, Linux (Intel)



- **Map viewing and authoring**
- **GIS analysis and querying**
- **Editing**
- **Geoprocessing**

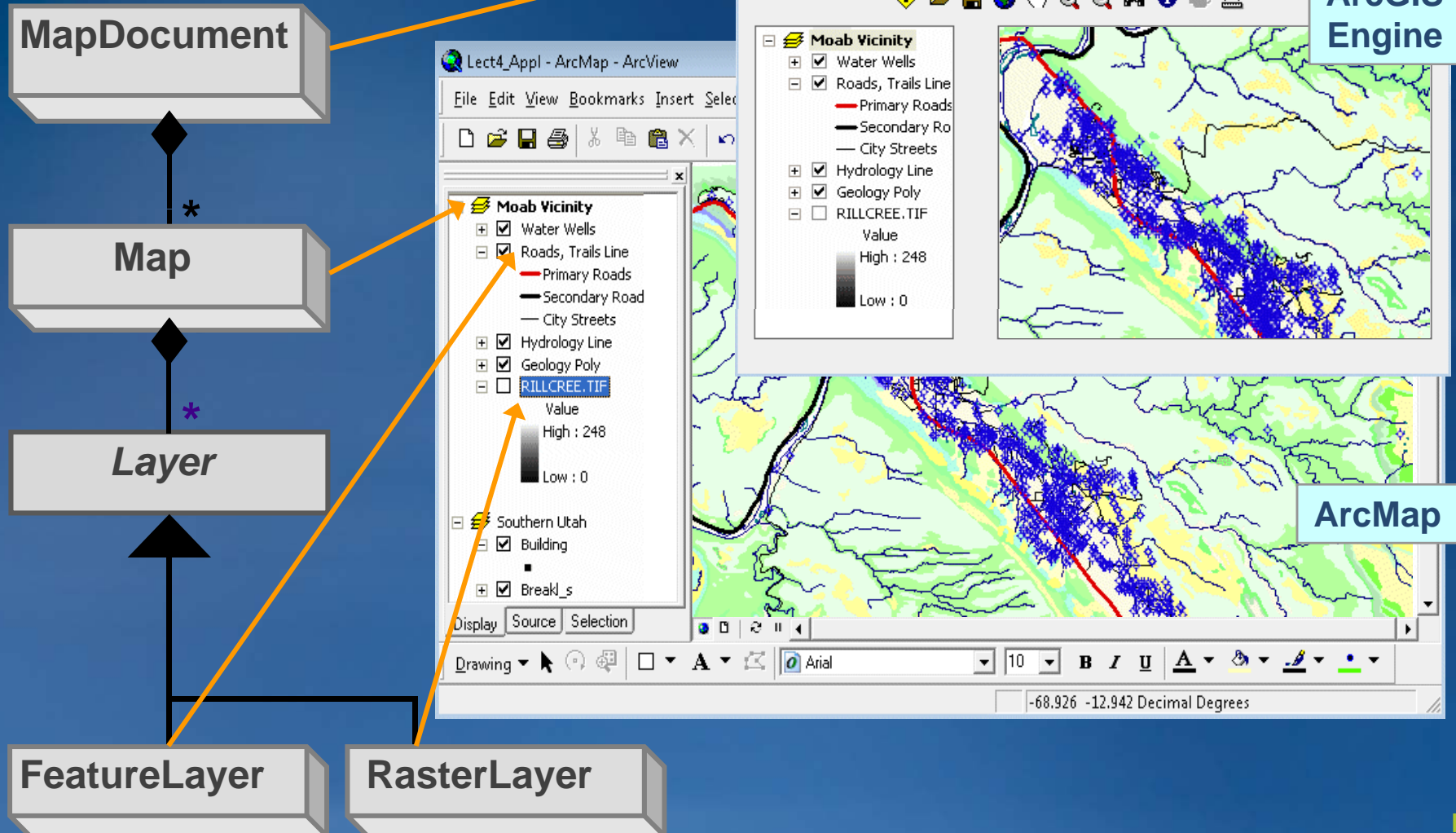
What can I do with it **Integrate with ArcGIS Server**

- User does not need ArcGIS Desktop
- Key way to share data across the Internet
 - Geocoding
 - Editing
 - Geoprocessing tools
 - Create custom “tasks”
- Custom Web services
- Mobile applications



Prototype: Access OMDs

- Classes and their objects



Prototype: create pseudocode

Add layers to the MapControl

Access the **ActiveView** from the **MapControl**

Access the **FocusMap** on the **ActiveView**

Make a new **FileGDBWorkspaceFactory** object

Get a **Workspace** from the **FileGDBWorkspaceFactory**

Get the **FeatureClass** from the **Workspace**

Make a new **FeatureLayer** object

Set the **FeatureClass** for the **FeatureLayer**

Assign the **Name** and **ShowTips** properties

Add the **FeatureLayer** to the **FocusMap**

Using Engine controls

Design time

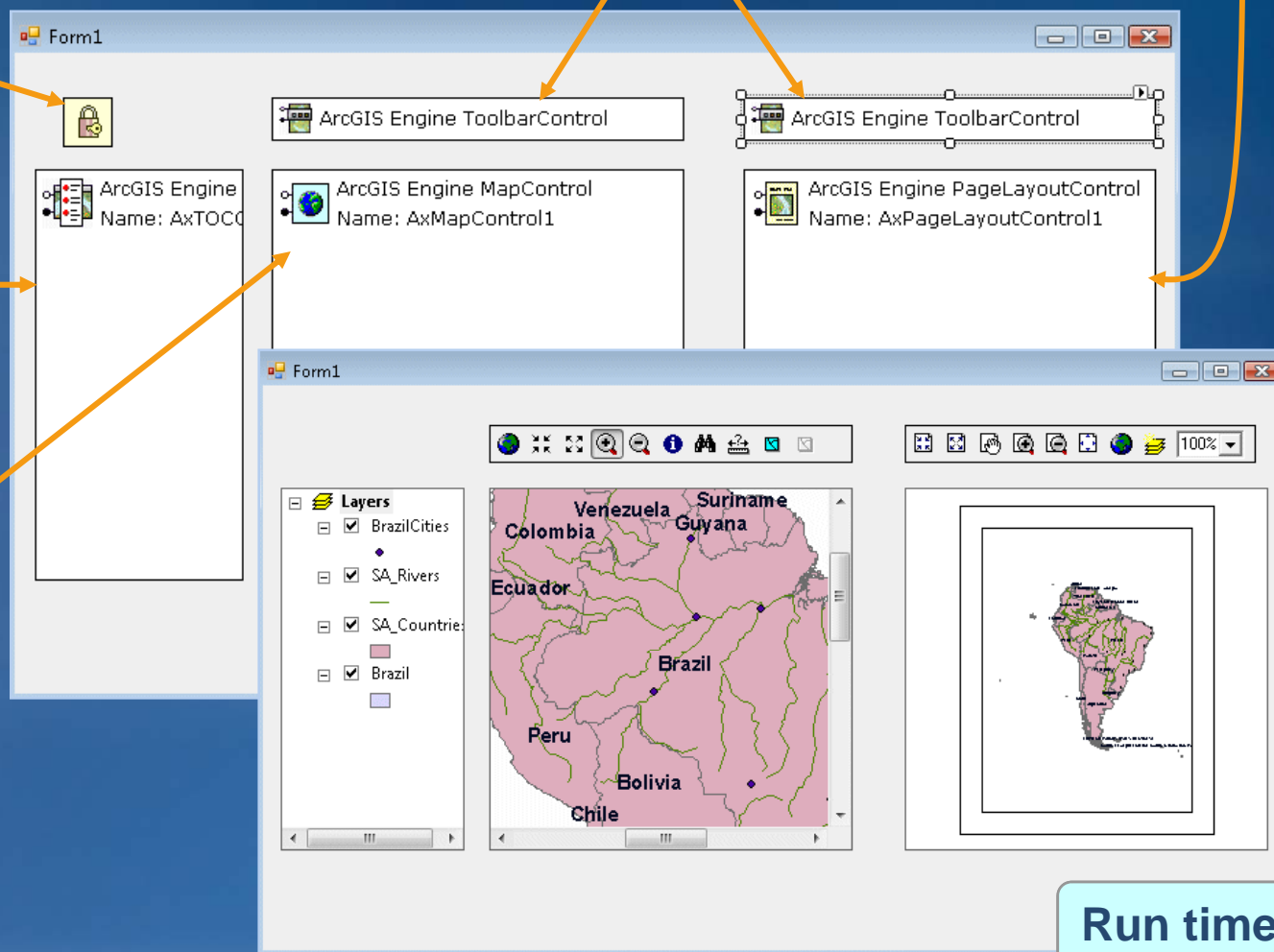
LicenseControl

TOCControl

MapControl

ToolBarControls

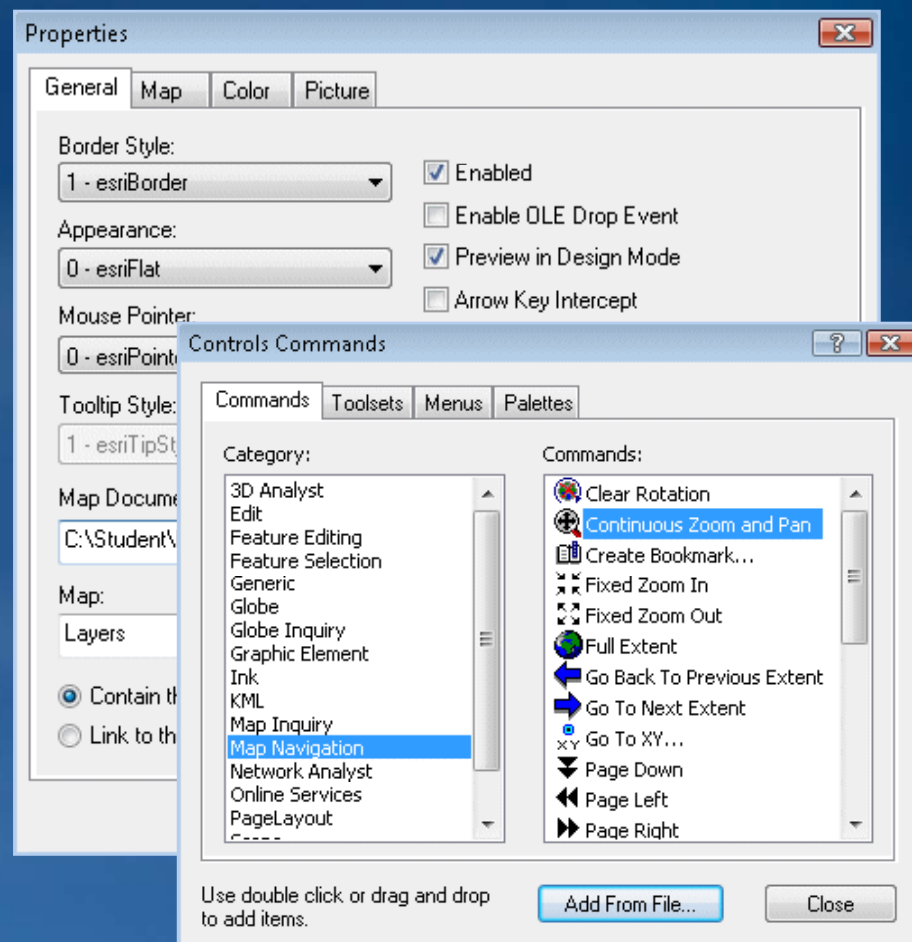
PageLayoutControl



Run time

Getting started with controls

- Framework for developers
- For prototype and testing
- No programming required
- Drag and drop for toolbar
- Interactive property pages
 - Access existing data
 - Load commands and tools
 - Buddy controls



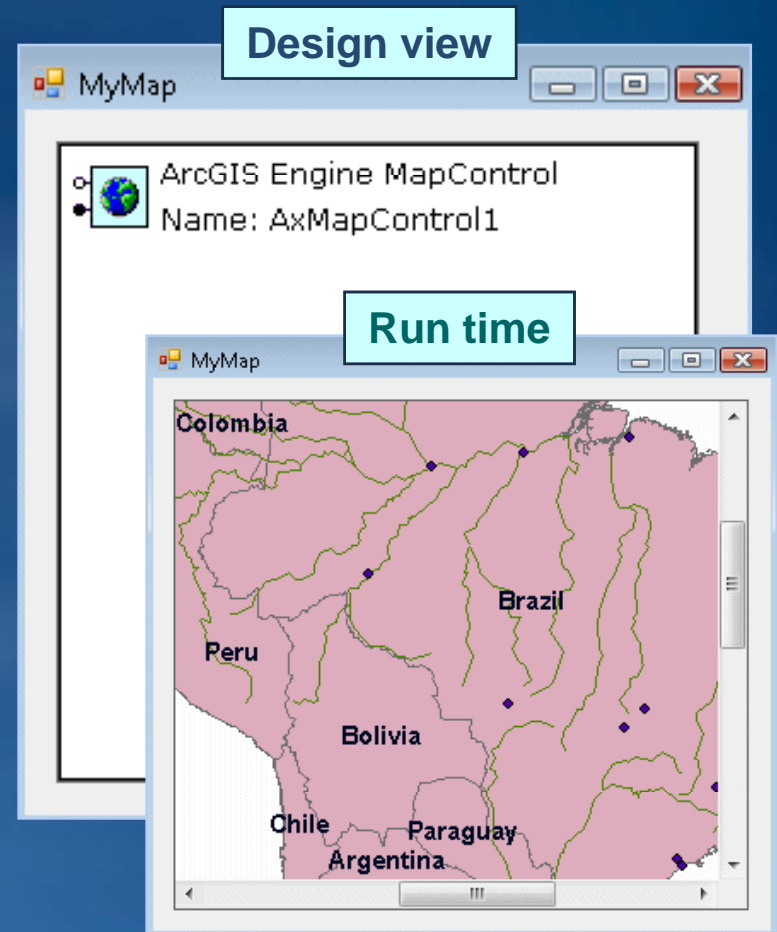
Getting started with controls **Work with Maps**

- **Load data**
 - Map documents
 - Feature classes
 - Layer files
 - Rasters
- **Use for viewing and analysis**
- **Expose mouse and other events**

*.mxd

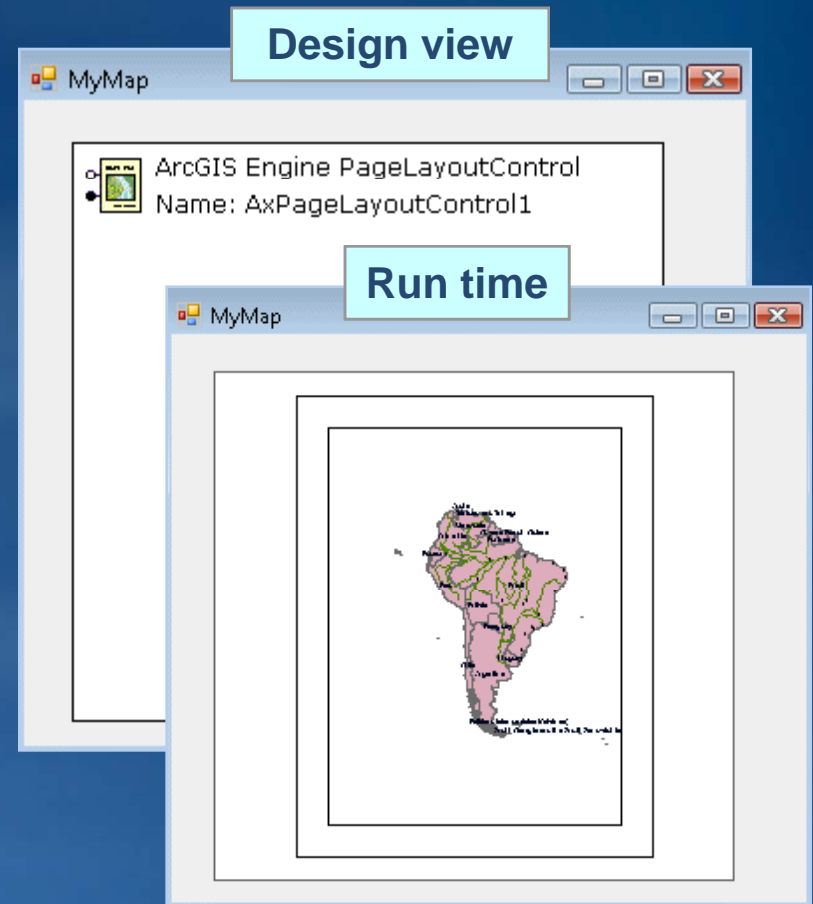
*.mxt

*.pmf



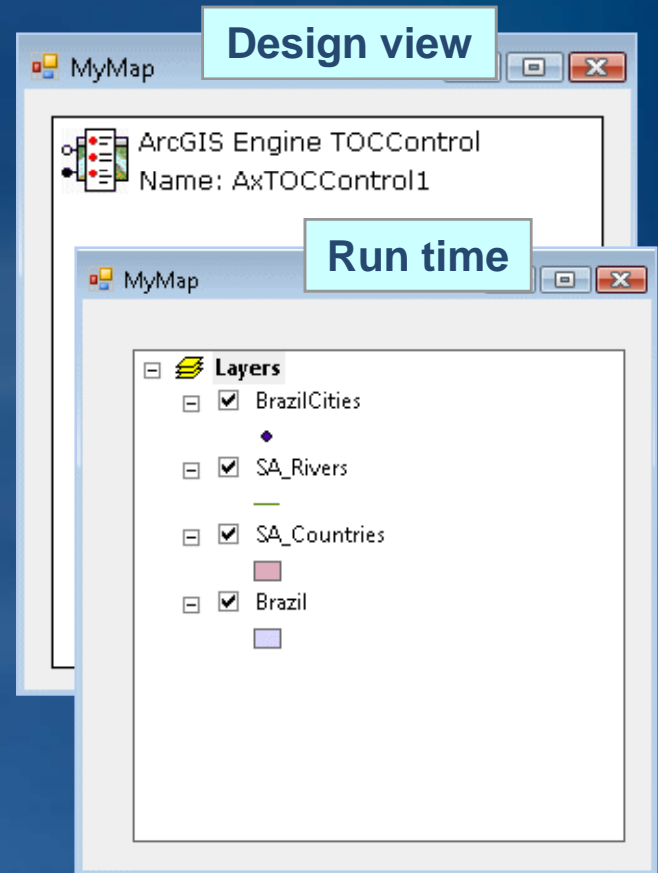
Getting started with controls **Work with Layouts**

- **Load data**
 - Map documents
 - Feature classes
 - Layer files
 - Rasters
- **Display data frames**
- **Draw all elements in one view**
- **Create layouts**
 - North arrows, scale bars, legend
- **Print**



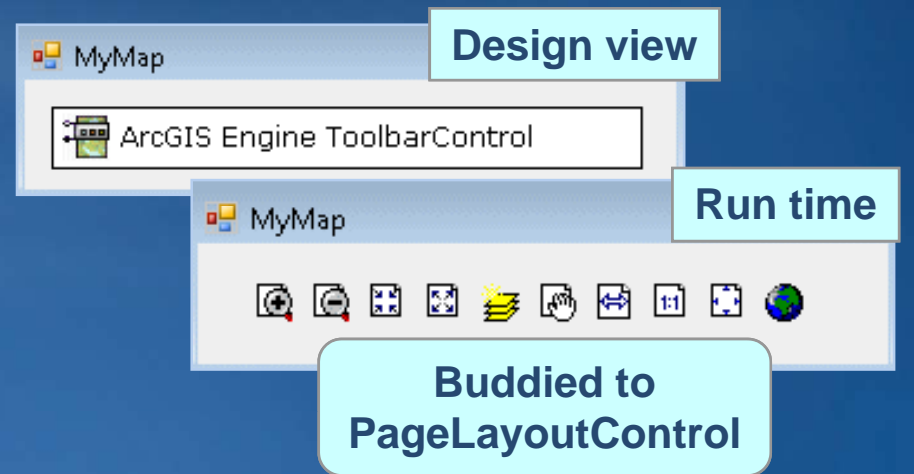
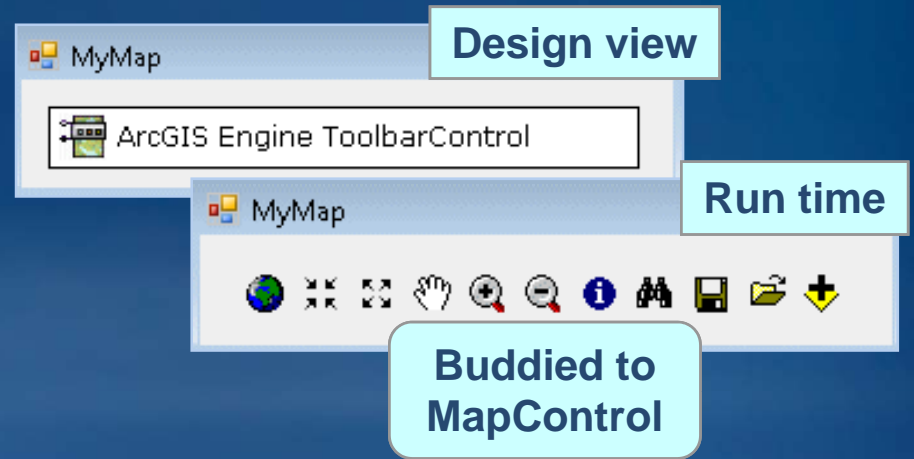
What is next

- **Set a buddy control**
- **Display layers and symbols**
 - For the buddied control
- **Control layer visibility**
- **Limitations**
 - Does not replicate ArcMap table of contents
 - Cannot reorder layers (default behavior)
 - No default context menus



What is next **Work with ToolBars and Tools**

- **Container for commands**
 - Buttons
 - Tools
- **Set a buddy control**
- **Commands interact with control**
 - MapControl
 - PageLayoutControl



Using Code (COM/NET)

```
Dim activeView As IActiveView
activeView = axMapControl1.ActiveView

Dim focusMap As IMap
focusMap = ?

Dim fileGDBWSF As IWorkspaceFactory = New FileGDBWorkspaceFactory

Dim workspace As IWorkspace
workspace = fileGDBWSF.? ("C:\Database\World.gdb" ,0)

Dim fws As IFeatureWorkspace
fws = CType(? , IFeatureWorkspace) 'Explicit casting

Dim featClass As IFeatureClass
featClass = fws.OpenFeatureClass( "Countries" )

Dim featLayer As IFeatureLayer = New FeatureLayer
featLayer.FeatureClass = ?
featLayer.Name = "Countries"
featLayer.ShowTips = True

focusMap.AddLayer(featLayer)
```

What do I need

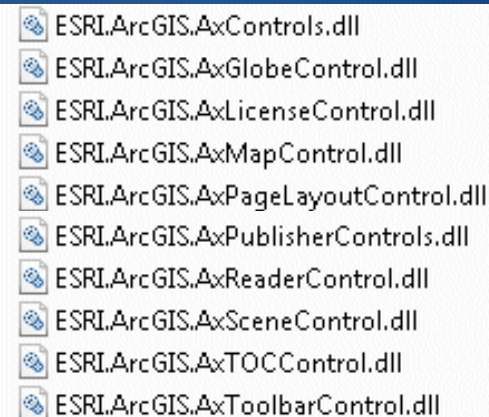
- .NET projects must reference the ESRI assemblies
- Import namespace to access ArcObjects .NET types
 - Use as coding shortcuts

```
'Without importing the namespace  
Dim activeView As ESRI.ArcGIS.Carto.IActiveView
```

```
'Visual Basic .NET keyword > Imports  
Imports ESRI.ArcGIS.Carto  
Dim activeView As IActiveView
```

```
'Visual C# .NET keyword > using  
using ESRI.ArcGIS.Carto;
```

Assemblies

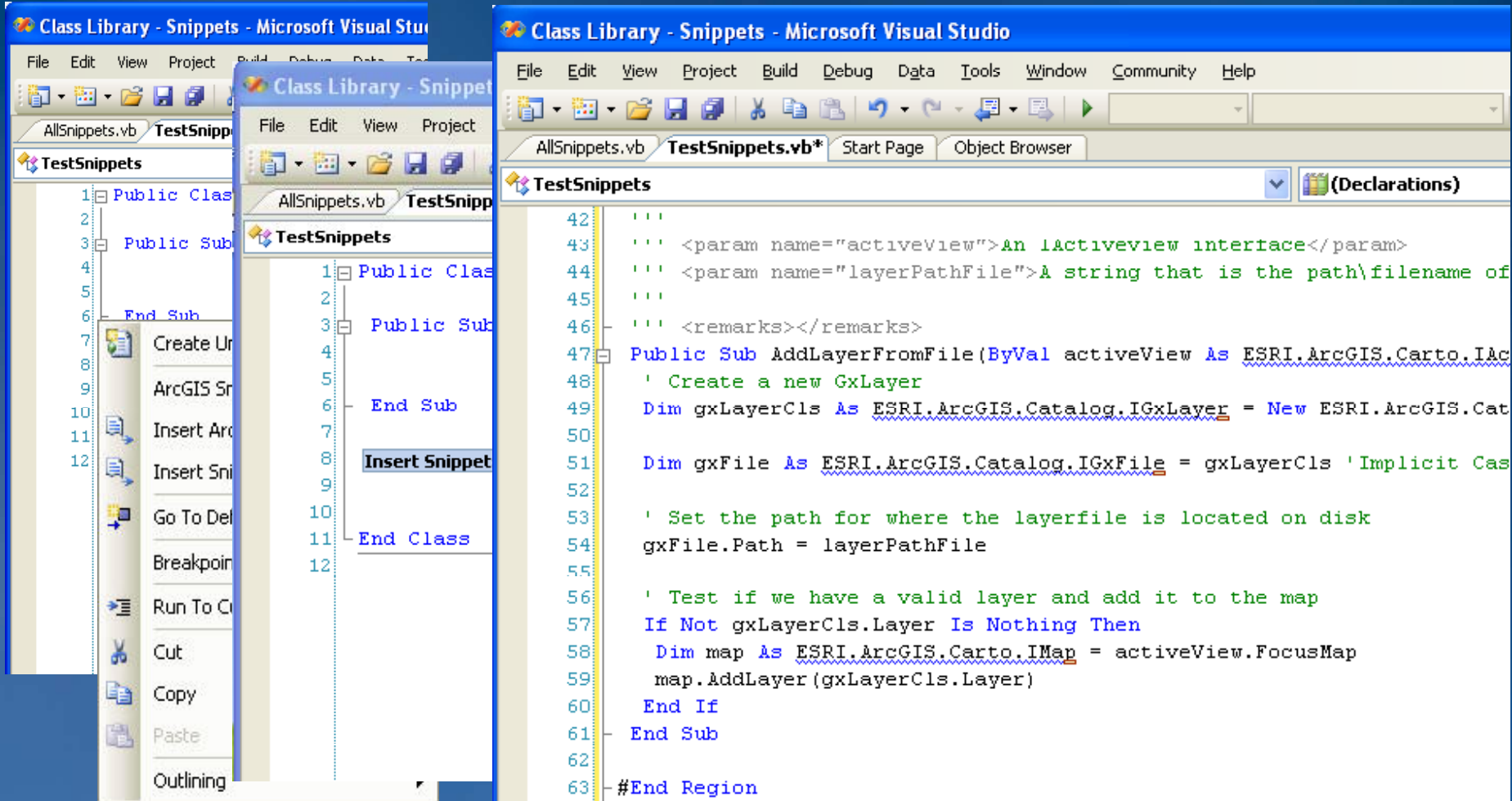


- ESRI.ArcGIS.AxControls.dll
- ESRI.ArcGIS.AxGlobeControl.dll
- ESRI.ArcGIS.AxLicenseControl.dll
- ESRI.ArcGIS.AxMapControl.dll
- ESRI.ArcGIS.AxPageLayoutControl.dll
- ESRI.ArcGIS.AxPublisherControls.dll
- ESRI.ArcGIS.AxReaderControl.dll
- ESRI.ArcGIS.AxSceneControl.dll
- ESRI.ArcGIS.AxTOCControl.dll
- ESRI.ArcGIS.AxToolbarControl.dll

...\Program Files\ArcGIS\DotNet

What do I need .Net code snippets

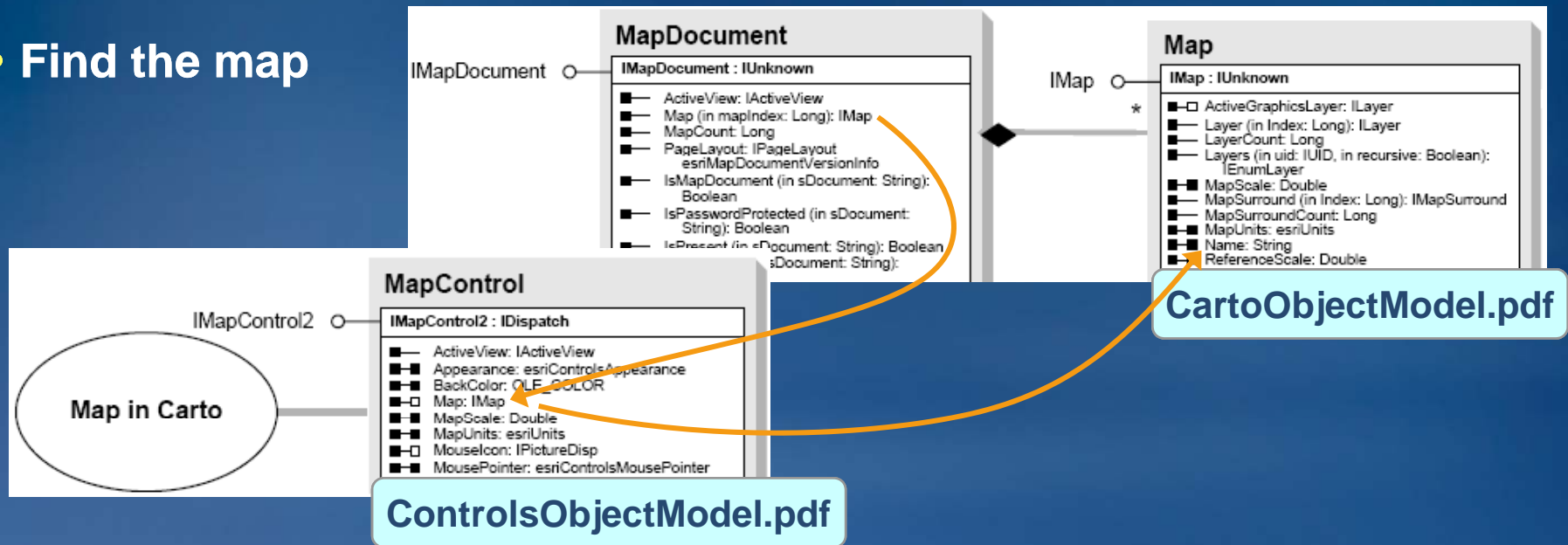
- Insert Snippet – Reusable ArcObjects code



A

Working with code

- Access maps from MapDocument
- Find the map



```
Imports ESRI.ArcGIS.Carto
Dim mapDoc As IMapDocument = New MapDocument
mapDoc.Open( "C:\Data\MapsAndLayers.mxd" )
AxMapControl1.Map = mapDoc.Map(0) ' Indexed
MessageBox.Show("Map name: " & AxMapControl1.Map.Name)
```

Working with code **Accessing the Workspace**

- Create new type of WorkspaceFactory

```
Dim wFactory As IWorkspaceFactory  
wFactory = New FileGDBWorkspaceFactory
```

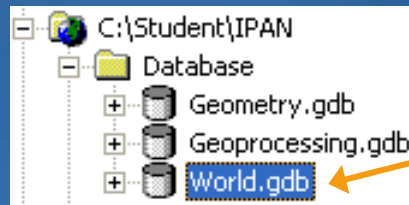
- Open and OpenFromFile return Iworkspace

```
Dim workspace As IWorkspace
```

← Open (in ConnectionProperties: IPropertySet,
in hWnd: OLE_HANDLE): IWorkspace
← OpenFromFile (in fileName: String, in hWnd:
OLE_HANDLE): IWorkspace

- Set the workspace

```
workspace = wFactory.OpenFromFile _  
("C:\Student\IPAN\Database\World.gdb" , 0)
```



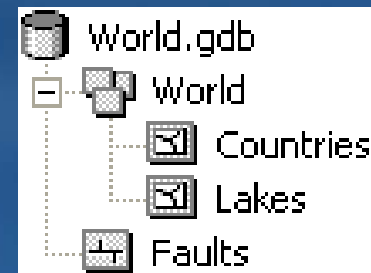
Working with code Access the Feature Class

- Feature classes
 - Geodatabase feature class, shapefile, CAD feature class, etc.
- IFeatureWorkspace :: OpenFeatureClass
 - Returns object reference to IFeatureClass

```
← OpenFeatureClass (in Name: String):  
IFeatureClass
```

- QI to IFeatureWorkspace

```
Dim featWS As IFeatureWorkspace  
featWS = workspace ' QI
```



- Open feature class

```
Dim featClass As IFeatureClass  
featClass = featWS.OpenFeatureClass("Lakes")
```

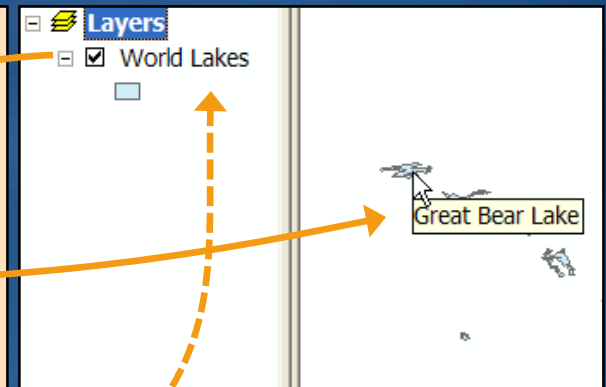

Working with code Set Layer Properties

- Must create layer and set properties
 - featClass from previous slide references Lakes layer
- Use general or specific interfaces
 - Depending on properties you want to set

```
Dim fLyr As IFeatureLayer = New FeatureLayer
fLyr.FeatureClass = featClass

'Set Layer properties
fLyr.Name = "World Lakes"
fLyr.ShowTips = True

'Add the layer to map control
axMapControl1.ActiveView.FocusMap.AddLayer(fLyr)
```



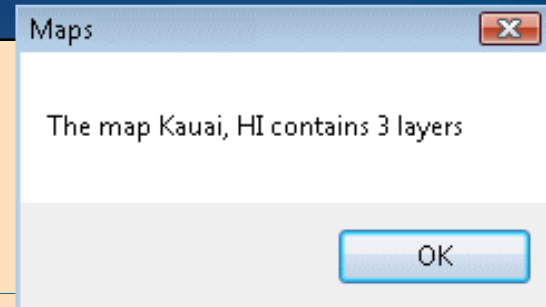
What is next

- MapControl corresponds to data view in ArcMap

```
Dim actView As IActiveView  
actView = axMapControl1.ActiveView
```

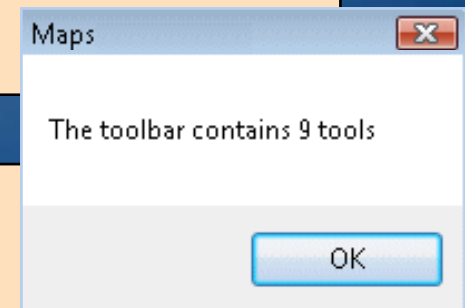
```
Dim countyMap As IMap  
countyMap = actView.FocusMap
```

```
MessageBox.Show("The map " & countyMap.Name & _  
    " contains " & _  
    countyMap.LayerCount & " layers")
```



```
MessageBox.Show("The map " & _  
    axMapControl1.ActiveView.FocusMap.Name & _  
    " contains " & _  
    axMapControl1.ActiveView.FocusMap.LayerCount & _  
    " layers")
```

```
MessageBox.Show("The toolbar contains " & _  
    axToolbarControl1.Count & "tools")
```



Where do you go from here?

- **Other ESRI instructor-led courses**
 - **Developing Applications with ArcGIS Engine Using the Microsoft .NET Framework**
 - **Developing Applications with ArcGIS Server Using the Microsoft .NET Framework**
 - **Extending ArcGIS Desktop Applications**

Let's build an application

- **Exercise A**
 - **Out of the box**