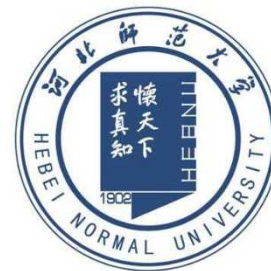


GIS设计与开发

资源与环境科学学院 B521室 刘强

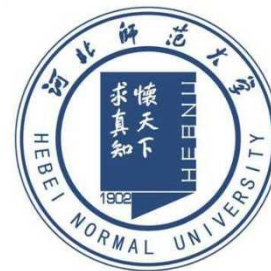
邮箱: liuqiangjp@163.com

手机号: 15733175965

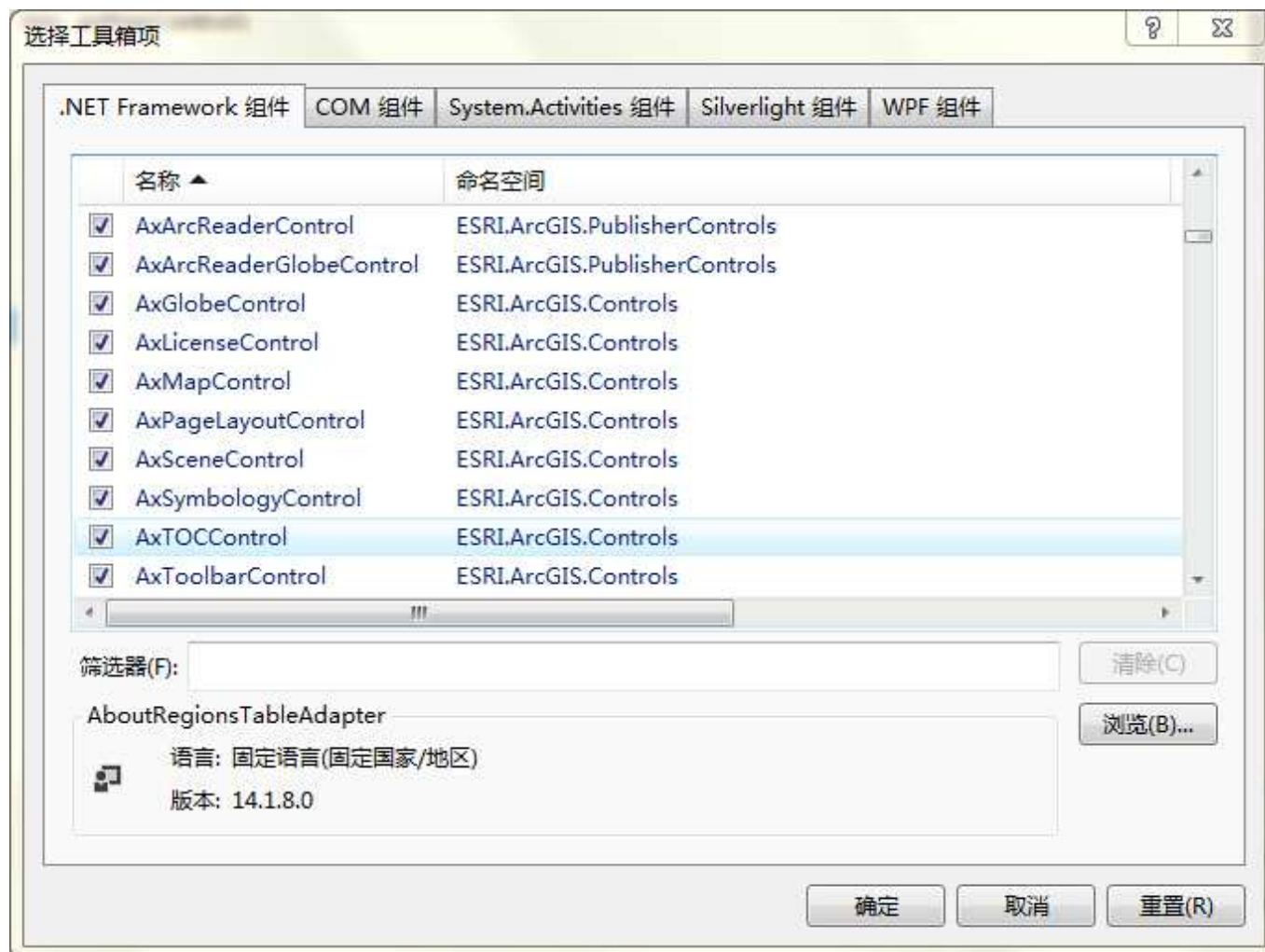


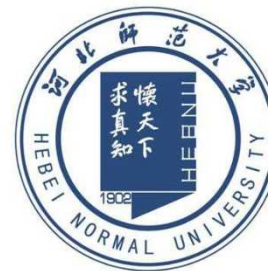
AE控件可视化原理

- 在VS .NET中使用ArcObjects，需要使用ESRI interop程序集，它服务于被放置在.NET窗体上的、位于.NET窗体控件(.NET Windows Controls)中的ArcGIS控件，是托管的.NET代码和非托管的COM代码之间的桥梁。
- 对COM ArcGIS控件(COM ArcGIS Controls)成员的引用都要经过Interop程序集，然后到达实际的COM对象。
- ESRI interop程序集为ArcGIS控件提供了能够位于.NET窗体上的控件，这些控件名前缀为“Ax”，如AxMapControl、AxPageLayoutControl、AxTOCControl和AxToolbarControl.



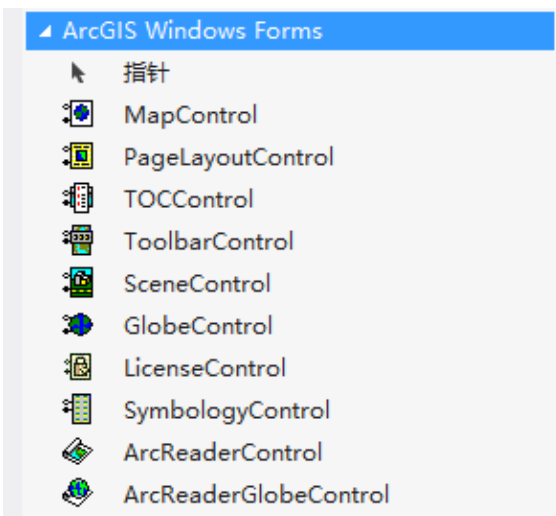
ESRI interop程序集提供的控件



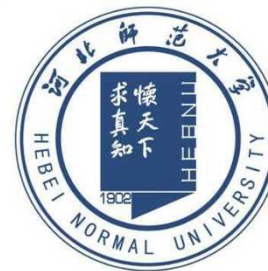


ArcGIS Engine 控件

- 控件在工具箱中的可视化表现，如



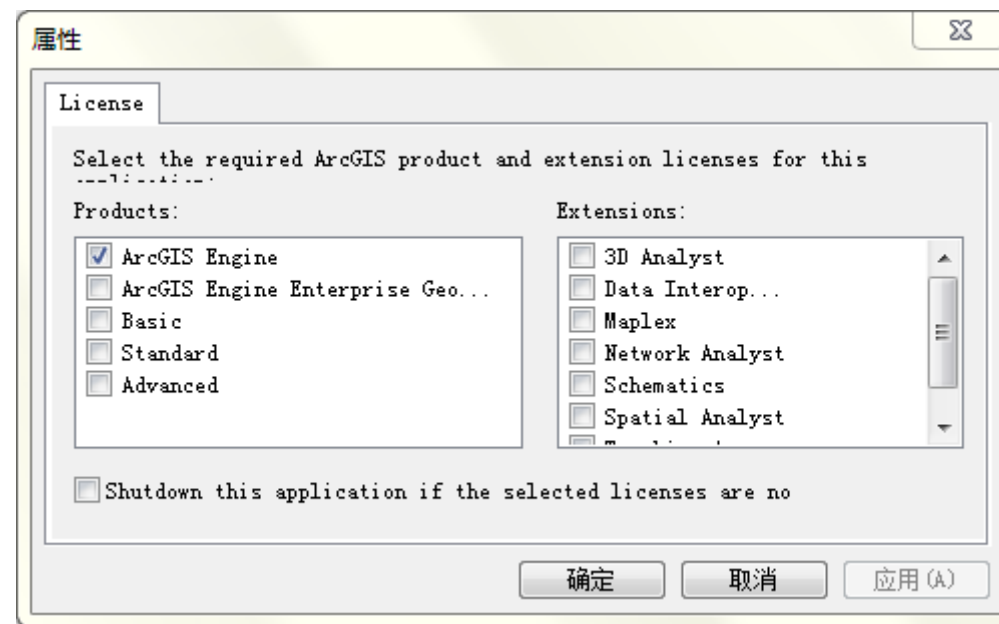
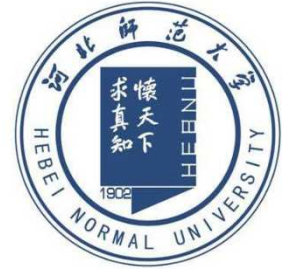
- 每个ArcGIS Engine控件都具有方法、属性与事件，它们能够被控件嵌入的容器(如，.NET窗体)访问。每个控件对象及其功能可以与其他ESRI ArcObjects和自定义控件组合使用，创建用户化的客户应用程序。

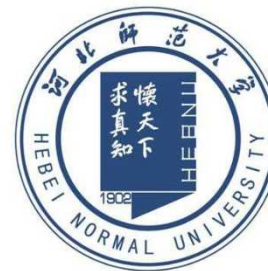


ArcGIS Engine 控件分类

- 权限控件
 - LicenseControl
- 制图控件
 - MapControl
 - PageLayoutControl
 - SceneControl
 - GlobeControl
- 框架控件
 - TocControl
 - ToolbarControl
- 符号控件
 - SymbolologyControl
- 阅读控件
 - ArcReaderControl
 - ArcReaderGlobeControl

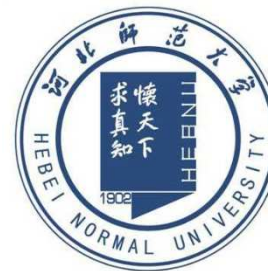
LicenseControl



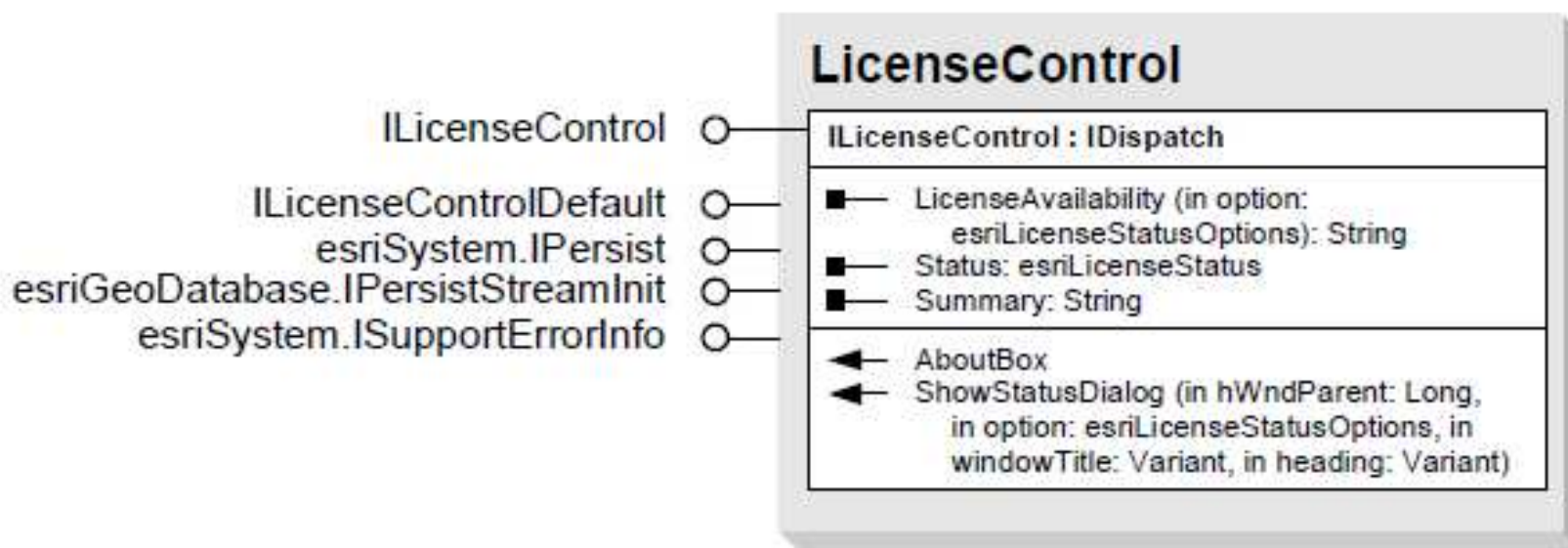


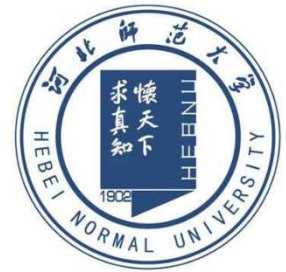
添加许可的几种方法

- 拖动控件 绑定license
- 项目工具 添加license
- 利用项目模板，自动添加license



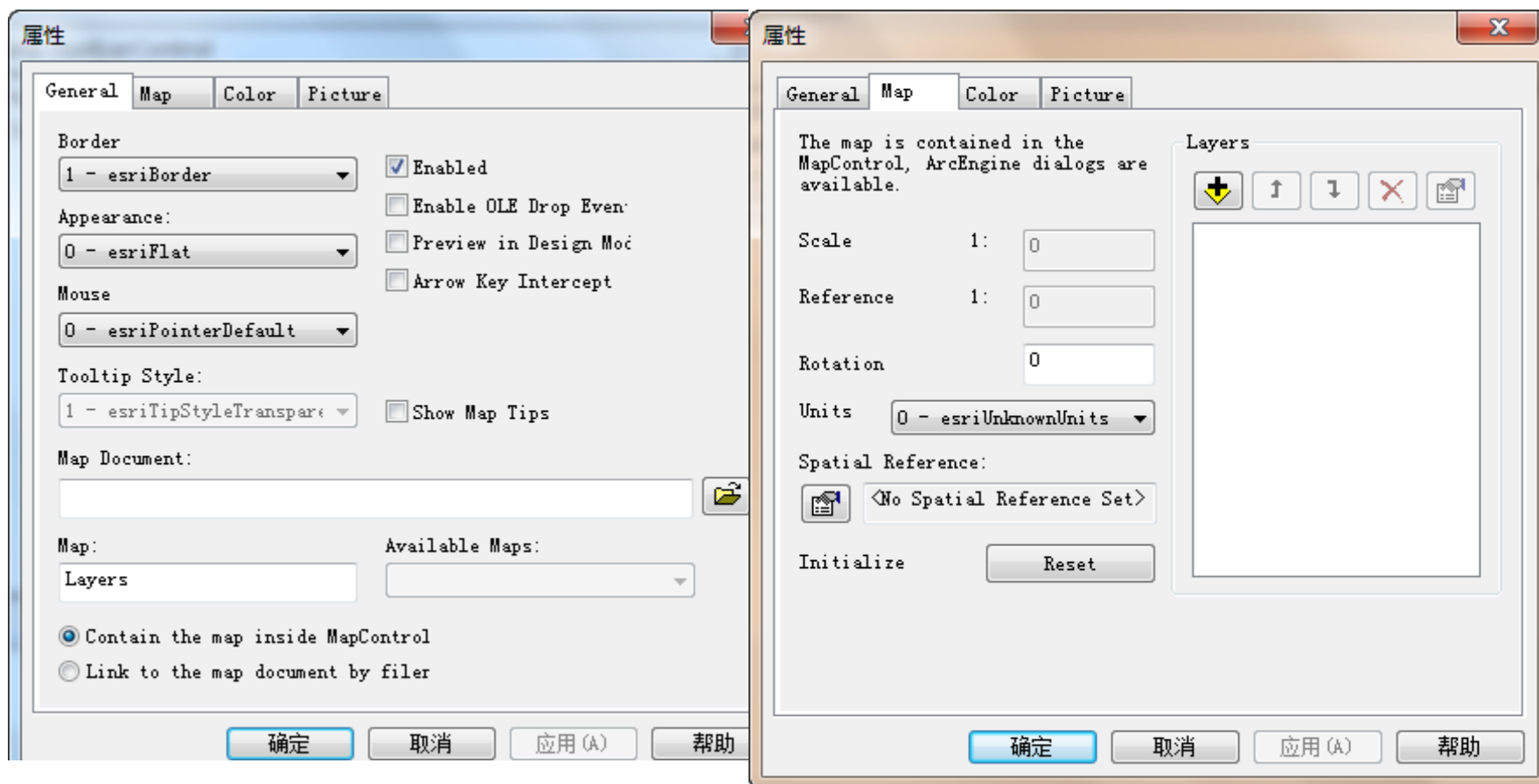
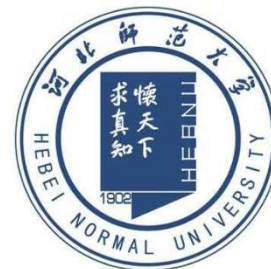
LicenseControl 的 OMD

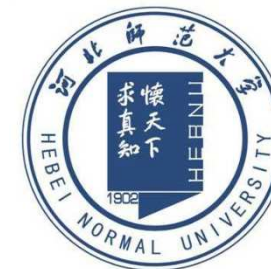




MapControl

- MapControl对应ArcMap中的数据视图，它封装了Map对象，并提供了额外的属性，方法，事件等。
 - 管理控件的外观、显示属性和地图属性；
 - 添加并管理控件中的数据层（data layers）；
 - 装载Map文档（mxd）到控件中；
 - 从其它应用程序拖放数据到控件中；
 - 显示和绘制跟踪图层。
- 在可视化环境中，可以通过控件的“属性”页设置控件的相关属性，也可以通过编程来设置。





Mapcontrol

ArcGIS Developer Help (ESRI.ArcGIS.Controls)

MapControlClass Class

Esri MapControl

Product Availability

Available with ArcGIS Engine.

Description

The MapControl encapsulates the [Map](#) CoClass and provides additional properties, methods and events for: managing the general appearance, display properties and map properties of the control; adding and managing data layers within the control; loading map documents into the control; dropping data onto the control from other applications; and tracking shapes and drawing to the display.

Extended Error Information

Use the [ISupportErrorInfo](#) method [InterfaceSupportsErrorInfo](#) to determine if the object supports extended error information. If the object supports extended error info, VC++ developers should use the OLE/COM [IErrorInfo](#) interface to access the [ErrorInfo](#) object. Visual Basic developers should use the global error object [Err](#) to retrieve this extended error information.

Interfaces

Interfaces	Description
IConnectionPointContainer	Supports connection points for connectable objects.
IMapControl2	Provides access to members that control the MapControl.
IMapControl3	Provides access to members that control the MapControl.
IMapControl4	Provides access to members that control the MapControl.
IMapControlDefault	Provides access to members that control the MapControl.
IMxdContents (esriCarto)	Provides access to members to pass data into and out off a MXD map document file. Codasses that implement this interface can limited the implementation to one property if required.
IPersist	Defines the single method GetClassID , which is designed to supply the CLSID of an object that can be stored persistently in the system. IPersist is the base interface for three other interfaces: IPersistStorage , IPersistStream , and IPersistFile .
IPersistStreamInit	Supports initialized stream-based persistence, regardless of whatever else the object does.
ISupportErrorInfo	Indicates whether a specific interface can return Automation error objects.
ITOCBuddy	Provides access to members that control the TOC buddy.
IToolbarBuddy	Provides access to members that control the ToolbarControl buddy.

Event Interfaces

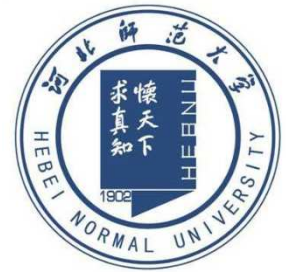
Interfaces	Description
IMapControlEvents2 (default)	Provides access to events that occur with interaction to the MapControl.
ITOCBuddyEvents	Provides access to events that notify the TOC of a change.

Remarks

The MapControl uses a [ScreenDisplay](#) as the display object for drawing and will therefore react to the same keyboard and mouse actions as the [ScreenDisplay](#) object.

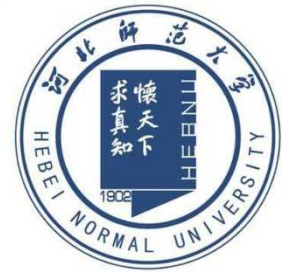
There is no need to declare the MapControl's outbound interface as described below in most development environments, because the interface is automatically implemented.





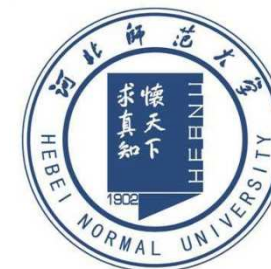
MapControl实现的主要接口

- IMapControlDefault
- IMapControl2
- IMapControl3
- IMapControl4(new in 9.2)
- IMapControlEvents2事件接口
- ITOCBuddy
- IToolbarBuddy

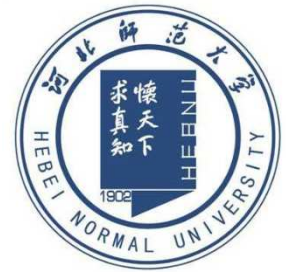


IMapControlDefault

- IMapControlDefault接口
 - IMapControlDefault接口是地图控件缺省接口，多数开发环境自动使用这个接口定义的属性、方法。
 - MapControl被放到一个容器（如窗体）上后，会自动产生一个axMapControl1对象，该对象实现了缺省接口。
 - 该接口代表控件的最新版本接口，MapControl当前最新版本接口为IMapControl4.
 - 当需要使用这个接口的时候，可以使用下面的代码：
 - IMapControlDefault pMapControl =
axMapControl1.Object as IMapControlDefault; (querying
interface)



Properties		Methods	
	ActiveView		LayerCount
	Appearance		Map
	AutoKeyboardScrolling		MapScale
	AutoMouseWheel		MapUnits
	BackColor		MouseIcon
	BorderStyle		MousePointer
	CurrentTool		Object
	CustomProperty		OleDropEnable
	DocumentFilename		ReferenceScale
	DocumentMap		Rotation
	Enabled		ShowMapTips
	Extent		ShowScrollbar
	FullExtent		SpatialReference
	hWnd		TipDelay
	KeyIntercept		TipStyle
			TrackCancel
			VisibleRegion
			AboutBox
			AddLayer
			AddLayerFromFile
			AddShapeFile
			CenterAt
			CheckMxFile
			ClearLayers
			DeleteLayer
			DrawShape
			DrawText
			FlashShape
			FromMapPoint
			LoadMxFile
			MoveLayerTo
			Pan
			ReadMxMaps
			Refresh
			SuppressResizeDrawing
			ToMapPoint
			TrackCircle
			TrackLine
			TrackPolygon
			TrackRectangle

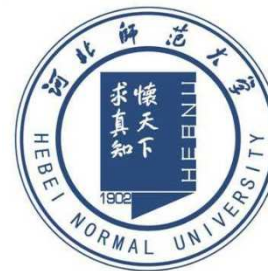


IMapControl2、3、4

- IMapControl2接口是任何一个与MapControl相关的任务的出发点，如设置控件外观，设置Map对象或控件的显示属性，添加或者管理数据图层、地图文档，在控件上绘制图形和返回Geometry等。
- IMapControl3继承IMapControl2，并增加了8个属性和1个方法
 - 如DocumentFilename：返回装入的地图文档的文件名
- IMapControl4，继承IMapControl3，并增加2个属性：
 - public bool AutoKeyboardScrolling {get; set;}: Indicates whether keyboard scrolling is enabled.
 - public bool AutoMouseWheel {get; set;}: Indicates whether the mouse wheel is enabled.

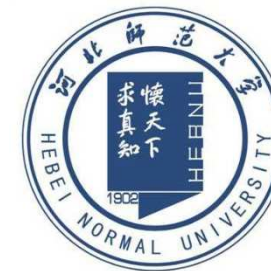


	FlashShape	Flashes a shape on the MapControl, duration is in milliseconds.
	FromMapPoint	Converts a point on the Map (in map units) to device co-ordinates (typically pixels).
	LoadMxFile	Loads the specified Map from the map document into the MapControl. The Map can be an index or a name, if it is not supplied the focus map is used.
	MoveLayerTo	Moves a layer within the Map's collection from its current index position to a new index position.
	Pan	Tracks the mouse while panning the MapControl.
	ReadMxMaps	Opens a map document specified by the supplied filename and reads the maps into an array object.
	Refresh	Redraws the Map, optionally just redraw specified phases or envelope.
	ToMapPoint	Converts a point in device co-ordinates (typically pixels) to a point on the Map (in map units).
	TrackCircle	Rubber-bands a circle on the MapControl.
	TrackLine	Rubber-bands a polyline on the MapControl.
	TrackPolygon	Rubber-bands a polygon on the MapControl.
	TrackRectangle	Rubber-bands a rectangle on the MapControl.



引用控件本身

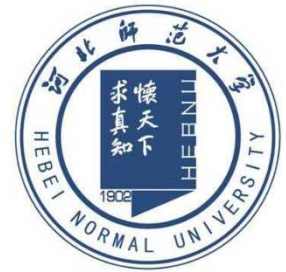
- 当使用IMapControl2接口时：
 - IMapControl2 pMapControl = axMapControl1.Object as IMapControl2;
 - IMapControl2 pMapControl = axMapControl1.GetOcx() as IMapControl2;
- 当使用IMapControl3接口时：
 - IMapControl3 pMapControl = axMapControl1.Object as IMapControl3;
 - IMapControl3 pMapControl = axMapControl1.GetOcx() as IMapControl3;
- 当使用IMapControl4接口时：
 - pMapControl = axMapControl1.Object as IMapControl4;
 - pMapControl = axMapControl1.GetOcx() as IMapControl4;



使用箭头键、鼠标滚轮实现地图导航

- 使用箭头键平移（Panning）地图
 - `axMapControl1.KeyIntercept=(int) esriKeyIntercept.esriKeyInterceptArrowKeys;`
 - `axMapControl1.AutoKeyboardScrolling=true;`
- 使用鼠标滚轮缩放地图
 - `axMapControl1.AutoMouseWheel = true;`

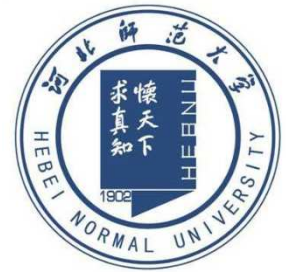
Constant	Value	Description
<code>esriKeyInterceptNone</code>	0	No keys are intercepted.
<code>esriKeyInterceptArrowKeys</code>	1	Intercepts the arrow keys, normally handled by the container to change control focus.
<code>esriKeyInterceptAlt</code>	2	Intercepts the Alt key, normally handled by a container to change focus.
<code>esriKeyInterceptTab</code>	4	Intercepts the Tab key, normally handled by the container to change control focus.
<code>esriKeyInterceptEnter</code>	8	Intercepts the Enter key, normally handled by the container to click the default button.



IMapControlEvents2

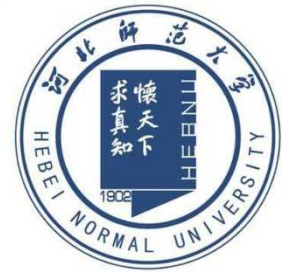
- 定义MapControl能处理的事件
 - OnExtentUpdated是地图的Extent属性发生变化时触发的事件。如，往地图中新增加一个图层，其覆盖范围大于原图的范围。
 - OnAfterscreenDraw是绘屏结束后触发的事件等。
- Generally there is no need to explicitly set event handlers, as most development environments will automatically provide event handlers.

←	OnAfterDraw
←	OnAfterScreenDraw
←	OnBeforeScreenDraw
←	OnDoubleClick
←	OnExtentUpdated
←	OnFullExtentUpdated
←	OnKeyDown
←	OnKeyUp
←	OnMapReplaced
←	OnMouseDown
←	OnMouseMove
←	OnMouseUp
←	OnOleDrop
←	OnSelectionChanged
←	OnViewRefreshed



MapControl控件与MXD文件

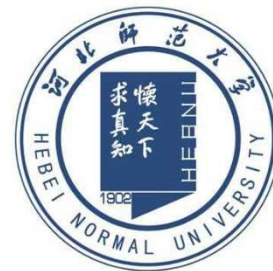
- MapControl控件可以“链接”或“包含”地图文档。
- 对于文档文件，MapControl控件可以直接使用LoadMxFile方法来载入，这是最简单的方法。
- 除此之外，可以使用IMapDocument接口定义的属性和方法来加载一个MXD文件。



载入文档的例子: axMapControl1.LoadMxFile

```
private void LoadMapDocument()
{
    System.Windows.Forms.OpenFileDialog openFileDialog2;
    openFileDialog2 = new OpenFileDialog();
    openFileDialog2.Title = "Open Map Document";
    openFileDialog2.Filter = "Map Documents (*.mxd) | *.mxd";
    openFileDialog2.ShowDialog();
    string sFilePath = openFileDialog2.FileName;
    if (axMapControl1.CheckMxFile(sFilePath))
    {
        axMapControl1.LoadMxFile(sFilePath, 0, Type.Missing);
    }
    else
    {
        MessageBox.Show(sFilePath + " is not a valid ArcMap document");
        return;
    }
}
```

```
public void LoadMxFile (
    string mxPath,
    object mapNameOrIndex,
    object password
);
```



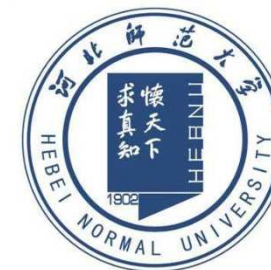
IMapDocument接口

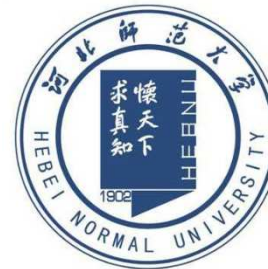
- 在使用控件开发的独立应用程序中，使用的地图文档对象为MapDocument，其主要接口是IMapDocument。
- IMapDocument接口定义了操作和管理文档对象的方法和属性。MapDocument类能够封装地图文档文件，如mxd、mxt和pmf等，它也可以封装一个图层文件 (*.lyr)。使用这个对象可以获取和更新一个文档的内容，设置文档文件的读、写属性，保存一个文档文件 (*.mxd)。

IMapDocument

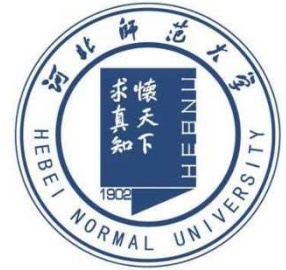
	Methods
←	Close
←	GetVersionInfo
←	New
←	Open
←	ReplaceContents
←	Save
←	SaveAs
←	SetActiveView

■	ActiveView
■	DocumentFilename
■	DocumentType
■	DocumentVersion
■	IsMapDocument
■	IsPasswordProtected
■	IsPresent
■	IsReadOnly
■	IsRestricted
■	Layer
■	Map
■	MapCount
■	PageLayout
■	Printer
■	Thumbnail
■	UsesRelativePaths





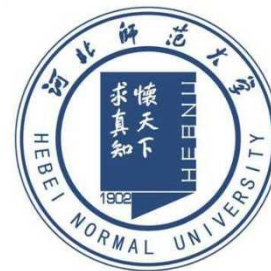
```
IMapDocument m_MapDocument = new MapDocumentClass();
private void LoadMapDoc()
{
    OpenFileDialog openFileDialog2 = new OpenFileDialog();
    openFileDialog2.Title = "Open Map Document";
    openFileDialog2.Filter = "Map Documents (*.mxd) | *.mxd";
    openFileDialog2.ShowDialog();
    string sFilePath = openFileDialog2.FileName;
    If (m_MapDocument.get_IsMapDocument(sFilePath))
    {
        m_MapDocument.Open(sFilePath, "");
        axMapControl1.Map = m_MapDocument.get_Map(0);
        axMapControl1.Refresh();
    }
}
```



```
private void SaveDocument()
```

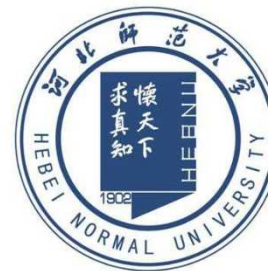
```
{  
    if  
    (m_MapDocument.get_IsReadOnly(m_MapDocument.DocumentFilename) == true)  
    { MessageBox.Show("This map document is read only!");  
      return;    }  
    m_MapDocument.Save(m_MapDocument.UsesRelativePaths,true);  
    MessageBox.Show("Changes saved successfully!");  
}
```

```
[C#]  
public void Save (  
    bool bUseRelativePaths,  
    bool bCreateThumbnail  
);
```



鼠标与控件的交互

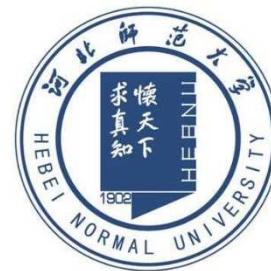
- 用鼠标和地图控件进行交互是最常用的操作，例如改变地图显示范围、移动地图，在控件上绘制几何图形等。



使用鼠标拖曳确定地图显示的范围(拉框放大)

```
private void axMapControl1_OnMouseDown (object sender,  
    ESRI.ArcGIS.MapControl.IMapControlEvents2_OnMouseDownEvent e)  
{  
    //改变地图控件显示范围为当前拖曳的区域  
    axMapControl1.Extent =  
    axMapControl1.TrackRectangle();  
    //刷新地图  
    axMapControl1.Refresh(esriViewDrawPhase.esriViewGeography, null, null);  
}
```

```
public void Refresh  
( esriViewDrawPhase phase, object  
  layerOrElement,   object envelope );
```

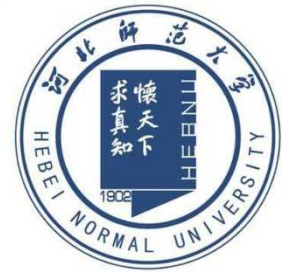


移动、旋转地图

- 在 MapControl中有一种更简单便利的方法 `pan()`来移动其中的地图，还可使用 `Rotation` 属性设置地图的旋转角度。
- 下面方法使用在MapControl控件的 `OnMouseDown`事件中：

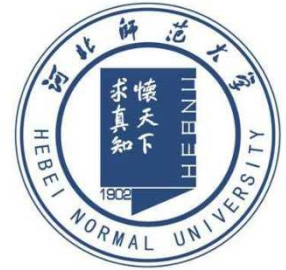
```
axMapControl1.pan();
```

```
axMapControl1.Rotation = 45;
```

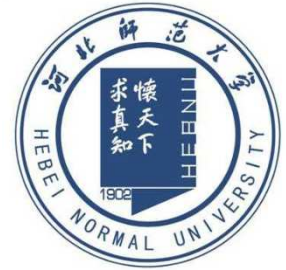


在 MapControl控件中绘制图形

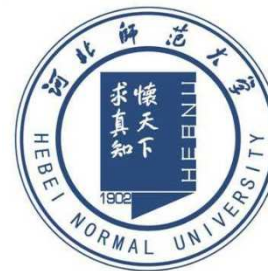
- MapControl控件提供了直接在控件上绘制图形和文字的方法DrawShape与DrawText
- 两种绘制方法绘制的图形都是缓存（cache），而不能真正保存，一旦窗口重绘，这些图形就将消失。



```
private void axMapControl1_OnMouseDown (object sender,  
    ESRI.ArcGIS.MapControl.IMapControlEvents2_OnMouseDownEvent e)  
{  
    //产生拖曳多边形，并绘制  
    IGeometry pGeom = axMapControl1.TrackPolygon();  
    DrawMapShape(pGeom);  
    //刷新地图  
    //axMapControl1.Refresh(esriViewDrawPhase.esriViewGeography, null, null);  
}
```



```
private void DrawMapShape (IGeometry pGeom)
{
    IRgbColor pColor;
    pColor = new RgbColorClass();
    pColor.Red = 220;
    pColor.Green = 112;
    pColor.Blue = 60;
    //新建一个绘制图形的填充符号
    ISimpleFillSymbol pFillsyl;
    pFillsyl = new SimpleFillSymbolClass();
    pFillsyl.Color = pColor;
    object oFillsyl = pFillsyl;
    axMapControl1.DrawShape(pGeom, ref oFillsyl);
}
```

数据选择

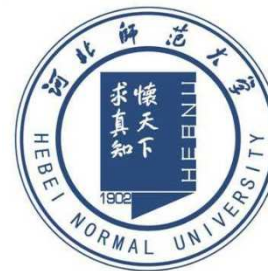
- 在MapControl控件中用户可以很方便地使用SelectByShape方法来构造一个基于Map的选择集。

```
private void axMapControl1_OnMouseDown(object sender,
    IMapControlEvents2_OnMouseDownEvent e)
{
    //产生拖曳多边形
    IGeometry pGeom = axMapControl1.TrackPolygon();
    axMapControl1.Map.SelectByShape(pGeom, null, false);
    axMapControl1.
    Refresh(esriViewDrawPhase.esriViewGeoSelection,null,null);
}
```

- 清除选择集的方法

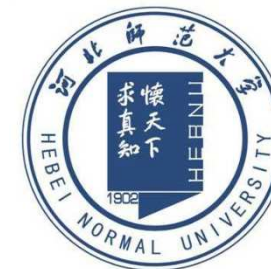
```
axMapControl1.Map.Clearselection();
axMapControl1.ActiveView.Refresh();
```

```
[C#]
public void SelectByShape (
    IGeometry Shape,
    ISelectionEnvironment env,
    bool justOne
);
```

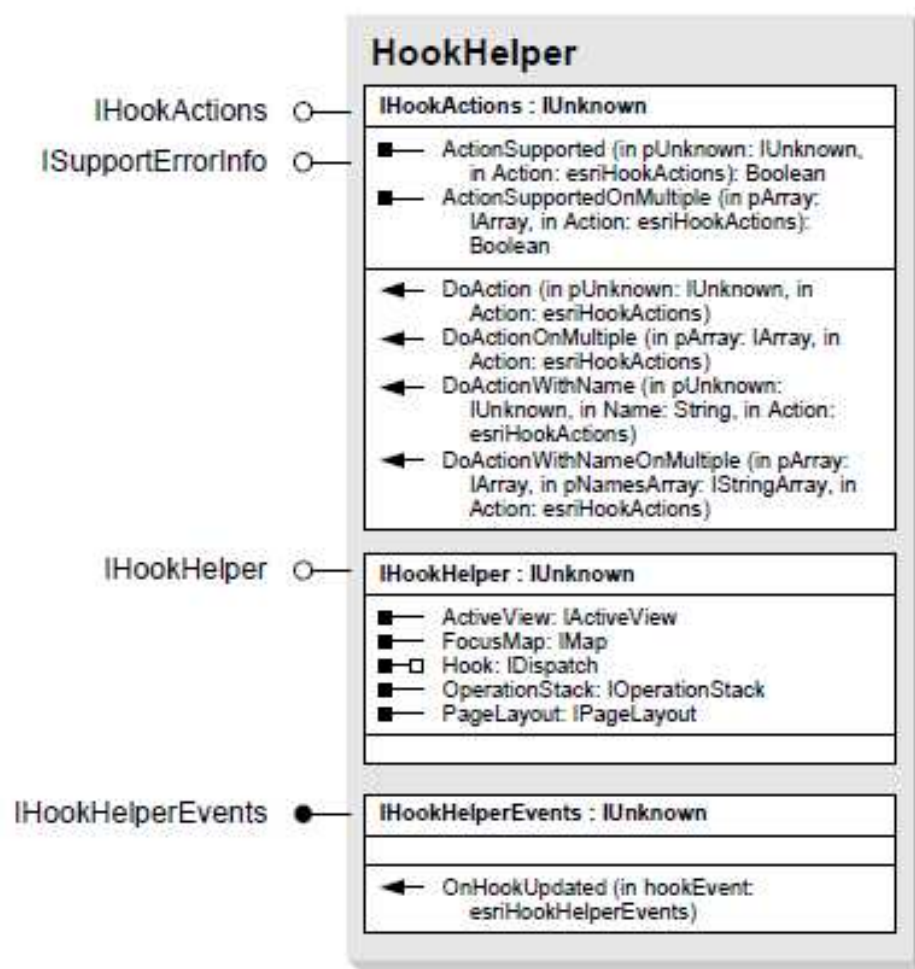


参数传递

- 静态变量
- 委托
- HookHelper

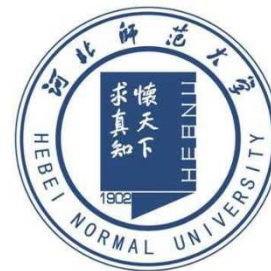


Hookhelper



Map

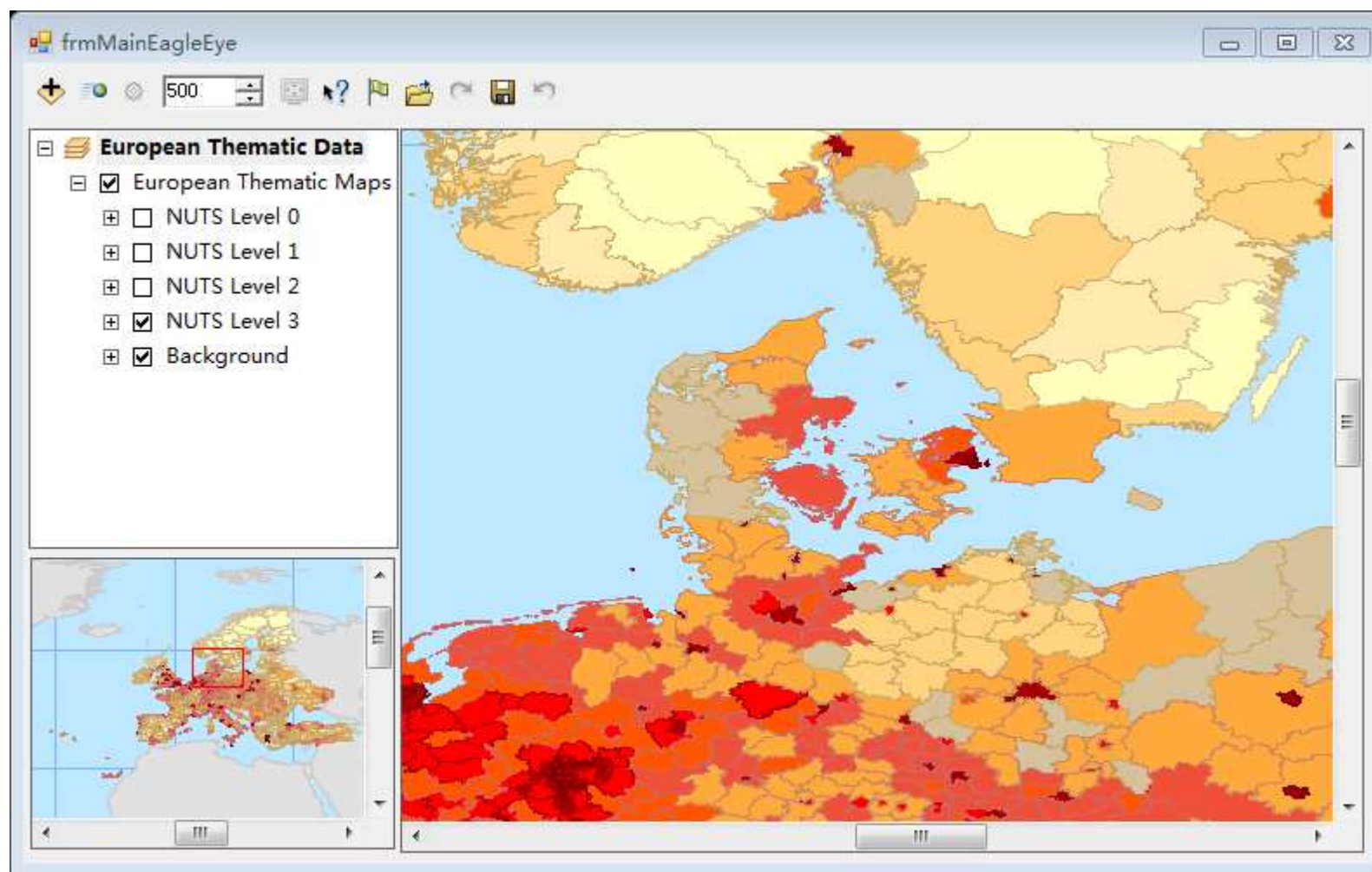
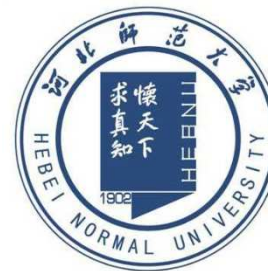
Pagelayout

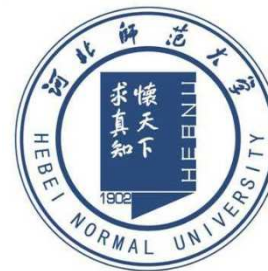


练习题

- AE中控件共有几个，分为哪几类？
- License控件程序中必须有吗？
- 请写出Mapcontrol带入地图文档的核心代码。
- 在AE中两个不同的类传递地图对象时一般采用哪种参数传递方式？请写出核心代码。

鹰眼图

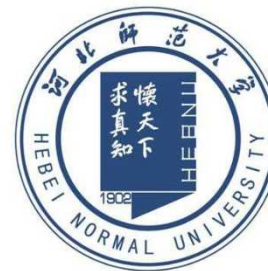




设计思路

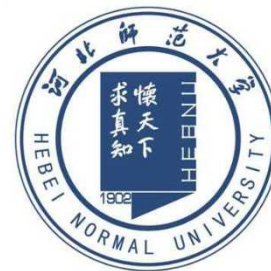
- 这个例子中有两个AxMapControl控件：
 - 主控件axMapControl1和鹰眼控件axMapControl2.
 - 要实现鹰眼功能，关键有两点
 - 一是如何让两个控件显示的数据保持一致
 - 另一点是如何绘制鹰眼控件中的显示方框。

控件名称	控件类型	备注
axMapControl1		主图
axMapControl2		鸟瞰图
axToolbarControl1		
axTOCControl1		



两个控件的数据共享

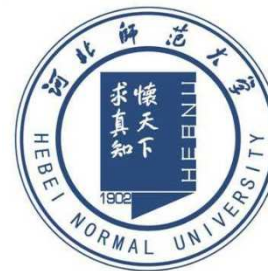
```
private void axMapControl1_OnMapReplaced (object sender,  
    IMapControlEvents2_OnMapReplacedEvent e)  
{  
    IMap pMap;  
    pMap = axMapControl1.Map;  
    int i ;  
    for( i = 0; i<= pMap.LayerCount - 1;i++)  
    {  
  
        axMapControl2.Map.AddLayer(pMap.get_Layer(i));  
    }  
}
```



绘制鹰眼控件中的显示方框

- 红色边框其实是一个面，只是填充的颜色是透明的而已;
- 窗体视图的范围发生变化后，会触发控件的 **OnExtentUpdated** 事件，绘制方框的方法就在这个事件中进行:

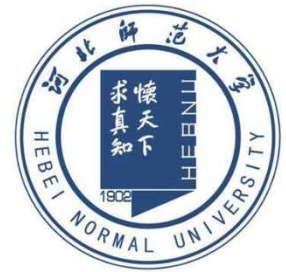
```
– private void axMapControl1_OnExtentUpdated(object  
  sender, IMapControlEvents2_OnExtentUpdatedEvent e)  
  {  
      .....  
  }
```

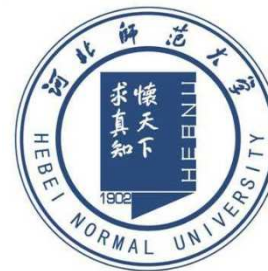



i++ VS i--

-
- 两个TOC

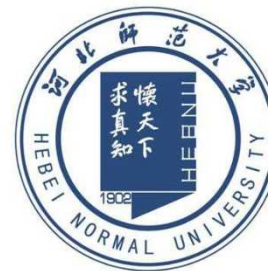
直接在mapcontrol上的鹰眼





新窗体中的鹰眼

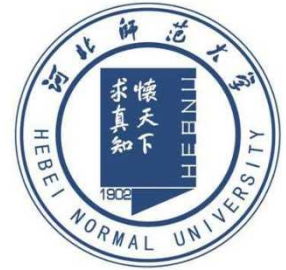
- 参数传递

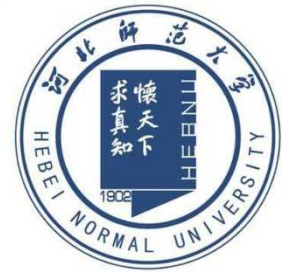


MapControlApplication

- 从EngineApplication到MapControlApplication
- License的添加方法

实现Engine控件随窗体变化。





控件的Anchor属性与Dock属性

1)Anchor属性：锁定控件某边与窗体某边之间的距离

设置方法：

属性窗口：图示法设置

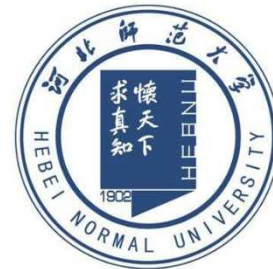
代码设置：控件名.Anchor = AnchorStyles.方向；

2)Dock属性：控件附着在窗体的某个边界上并贯穿整个窗体

设置方法：

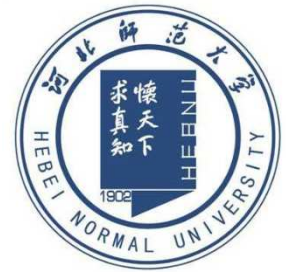
属性窗口：图示法设置

代码设置：控件名.Dock = DockStyles.方向；



控件常用属性

- 控件的共性与个性
 - 控件的常用属性
 - 1)Text: 设置或获取控件上显示的文本内容，大部分控件具有。
 - 2)名称: 控件对象的唯一标识，默认名称，约定名称。所有控件都有。事件过程框架认识。
 - 3)Enabled: 决定了控件在运行时是否允许用户进行操作，逻辑值: true OR false
 - 4)Visible: 决定了控件在运行时是否可见,逻辑值
 - 5)Font:控件字体的对象，字体名、字号、字形等。
 - 设置方法:
 - 属性窗口
 - 代码:
 - 控件名.Font= New System.Drawing.Font(字体属性值);



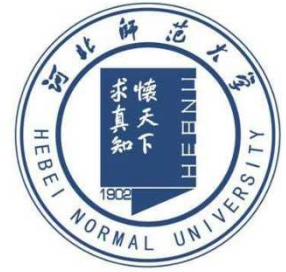
6) Location与Size：决定控件位置与大小

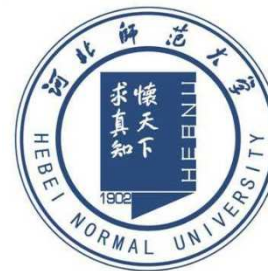
- Location:X(水平值)、Y(垂直值)
- Size:Height(高度)、Width(宽度)
- 设置方法
 - 可视化调整
- 属性窗口
 - 代码设置：
 - `TextBox1.Size = New System.Drawing.Size(100, 200)`
 - `TextBox1.Location = New System.Drawing.Point(100, 100)`

7)ForeColor与BackColor:控件的前景色与背景色

- 设置方法:
- 属性窗口
- 代码设置: `Color`结构

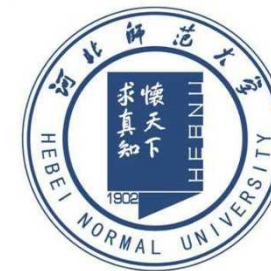
对照OMD、帮助、属性和方法，
剖析许可控件、地图控件；

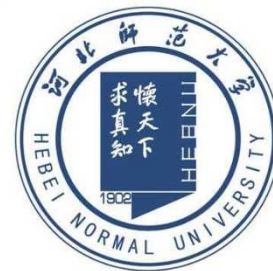




编写鼠标拉框放大功能：

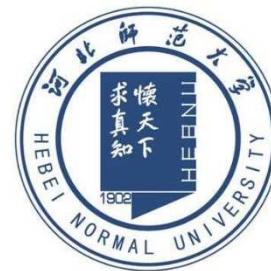
通过各种方式测试 IMapControlDefault接口功能;





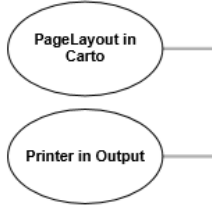
PageLayoutControl概述

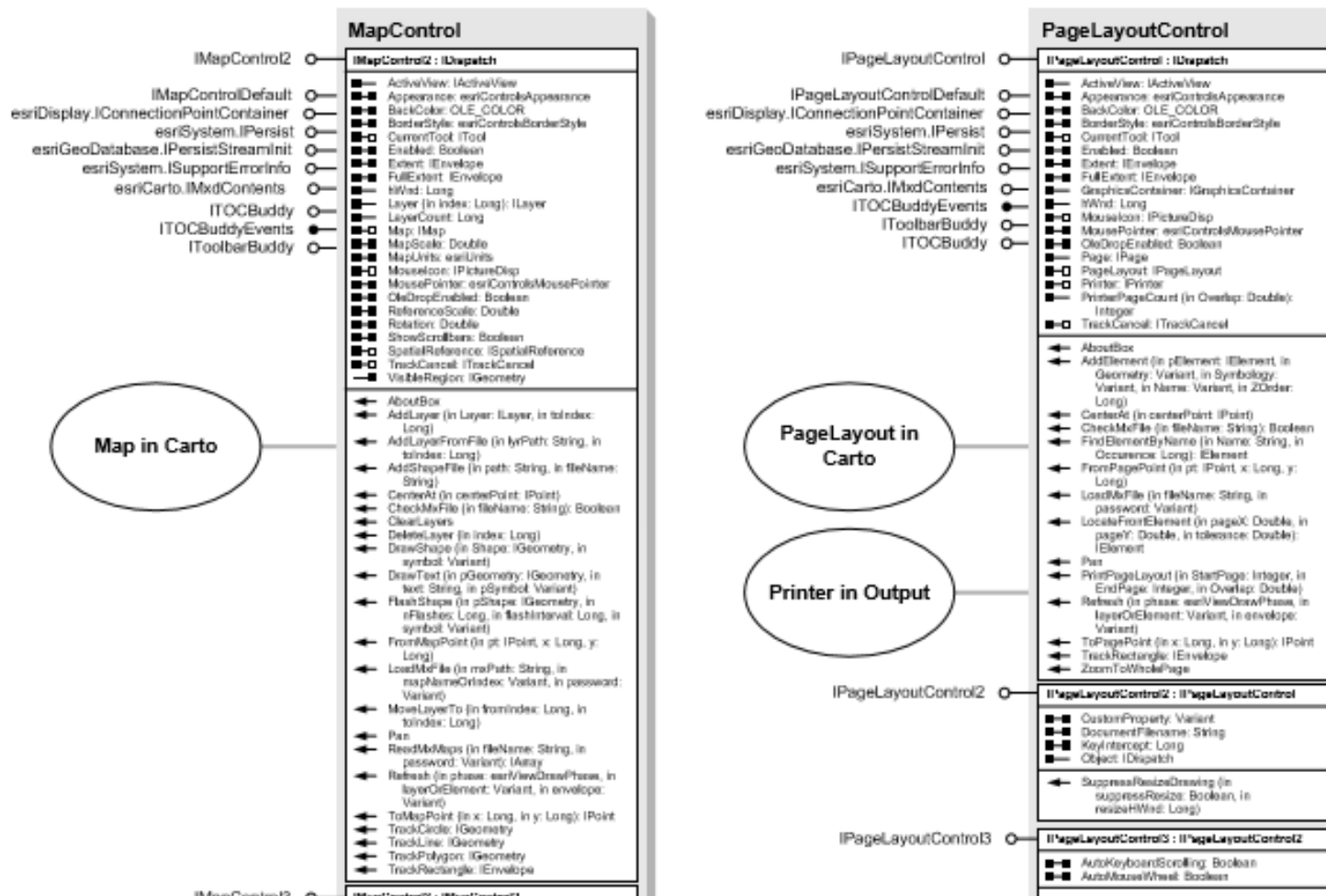
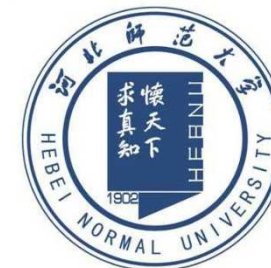
- PageLayoutControl对应于ArcMap中的布局视图(Layout View)，它封装了PageLayout对象，提供了布局视图中控制地图元素的属性和方法。
- 与MapControl控件相似，PageLayoutControl控件并不仅仅只是包含了一个PageLayout对象，它也拥有许多附加的事件、属性和方法。
- 页面布局（通常简称为布局）是在页面上编排和组织地图元素的集合，旨在用于地图打印。
 - 布局中排布的常见地图元素包括一个或多个数据框（每个数据框都含有一组有序的地图图层）、比例尺、指北针、地图标题、描述性文本和符号图例。
 - 打印机、页面布局、大小、单位

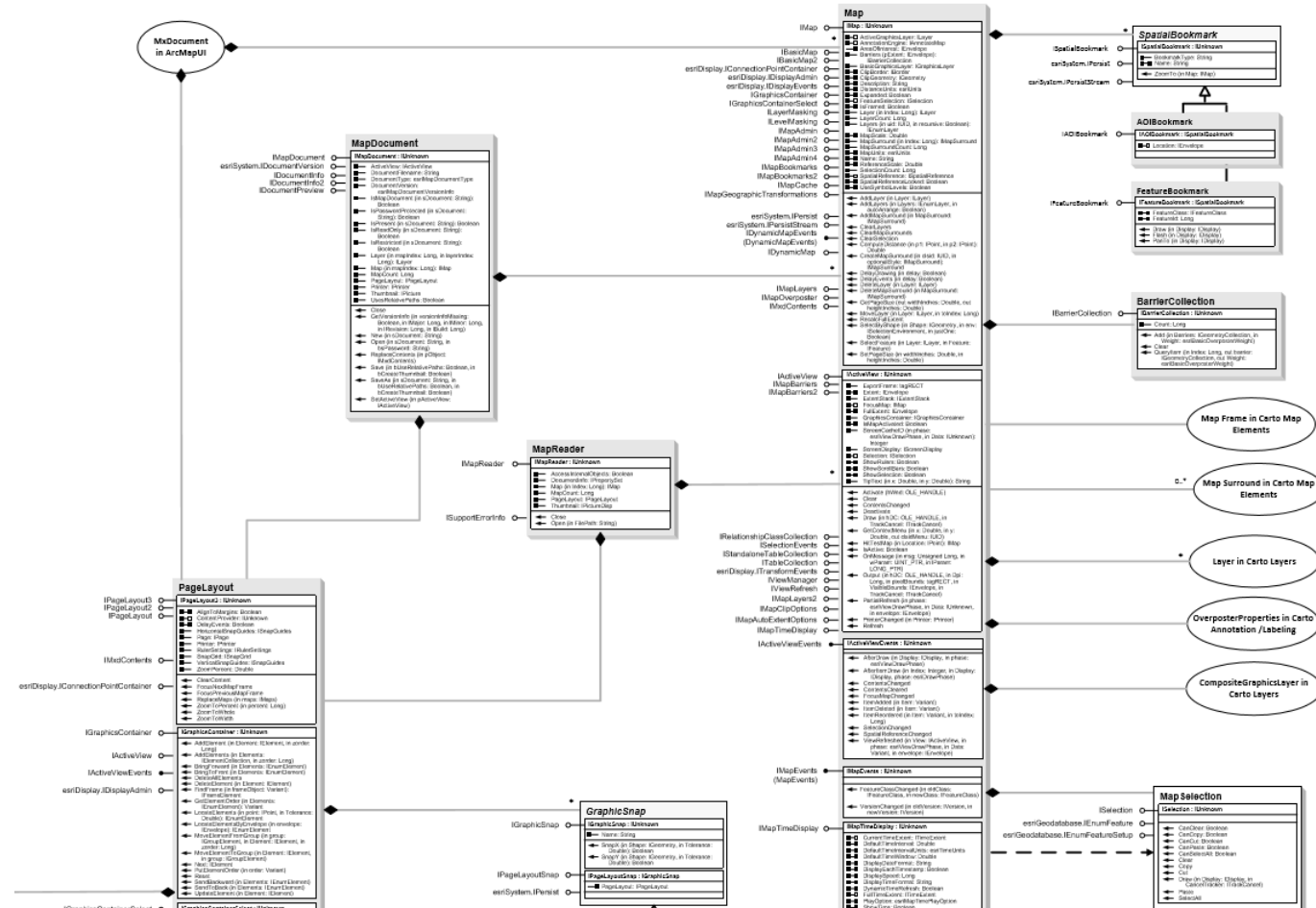
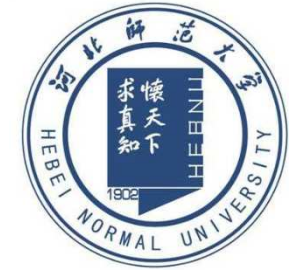


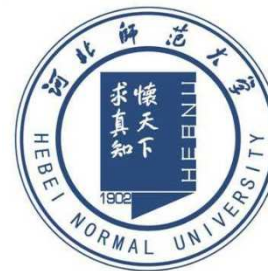
PageLayoutControl实现的接口

- PageLayoutControl控件同样实现了多个接口
 - IPageLayoutControlDefault
 - IPageLayoutControl
 - IPageLayoutControl2
 - IPageLayoutControl3 (New after 9.2)
 - IPageLayoutControlEvents





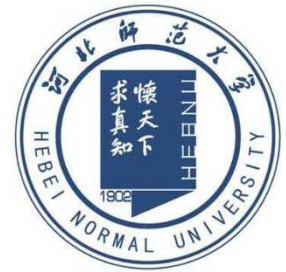




PageLayoutControl应用：操作MXD文件

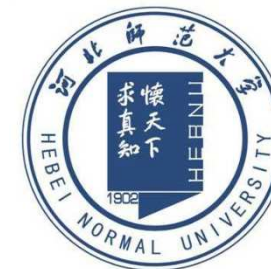
- 在AxPageLayoutControl控件对MXD文件的操作，与MapControl类似。
- PageLayout控件中打开MXD文件的方法：
 - 控件的LoadMxFile方法;
 - IMapDocument接口的Open方法

```
private void OpenMapDocument()
{
    IMapDocument m_MapDocument = new MapDocumentClass();
    OpenFileDialog openFileDialog1 = new OpenFileDialog();
    openFileDialog1.Title = "Open Map Document";
    openFileDialog1.Filter = "Map Documents (*.mxd)|*.mxd";
    openFileDialog1.ShowDialog();
    string sFilePath = openFileDialog1.FileName;
    m_MapDocument.Open(sFilePath, "");
    axPageLayoutControl1.PageLayout = m_MapDocument.PageLayout;
    axPageLayoutControl1.Refresh();
}
```



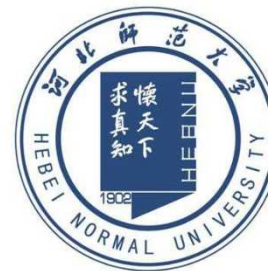
PageLayoutControl应用：保存地图文档

```
private void SaveDocument()
{
    //Check that the document is not read only.
    //m_MapDocument必须实例化，并打开了地图文档
    if
(m_MapDocument.get_IsReadOnly(m_MapDocument.DocumentFil
ename) == true)
    {   MessageBox.Show("This map document is read only!");
        return;
    }
    //Save with the current relative path setting.
    m_MapDocument.Save(m_MapDocument.UsesRelativePaths,
true);
    MessageBox.Show("Changes saved successfully!");
}
```

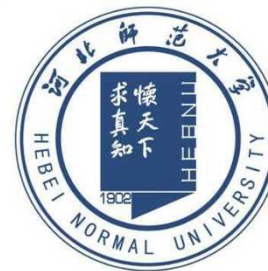


PageLayoutControl应用：另存地图文档

```
private void SaveAsDocMenuItem_Click (object sender, EventArgs e)
{ //Open a file dialog for saving map documents.
    saveFileDialog1.Title = "Save Map Document As";
    saveFileDialog1.Filter = "Map Documents (*.mxd)|*.mxd";
    saveFileDialog1.ShowDialog();
    string sFilePath = saveFileDialog1.FileName;
    if (sFilePath == "") return;
    if (sFilePath == m_MapDocument.DocumentFilename)
    { //Save changes to the current document.
        SaveDocument(); //调用前一页的过程定义
    }
    else
    { //SaveAs a new document with relative paths.
        m_MapDocument.SaveAs(sFilePath, true, true);
        //Open the document.
        m_MapDocument.Open(sFilePath, "");
        MessageBox.Show("Document saved successfully!");
    }
}
```

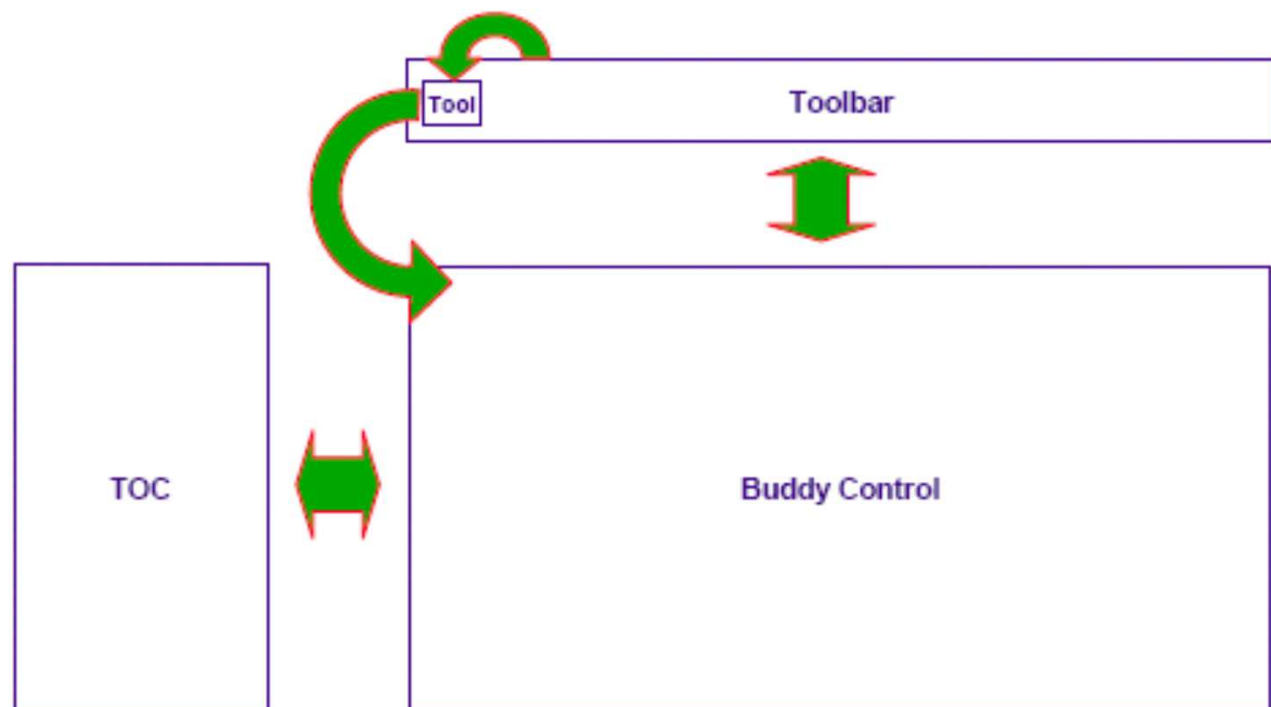


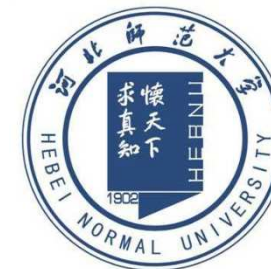
-
- 框架控件
 - TOCControl
 - ToolbarControl



框架控件

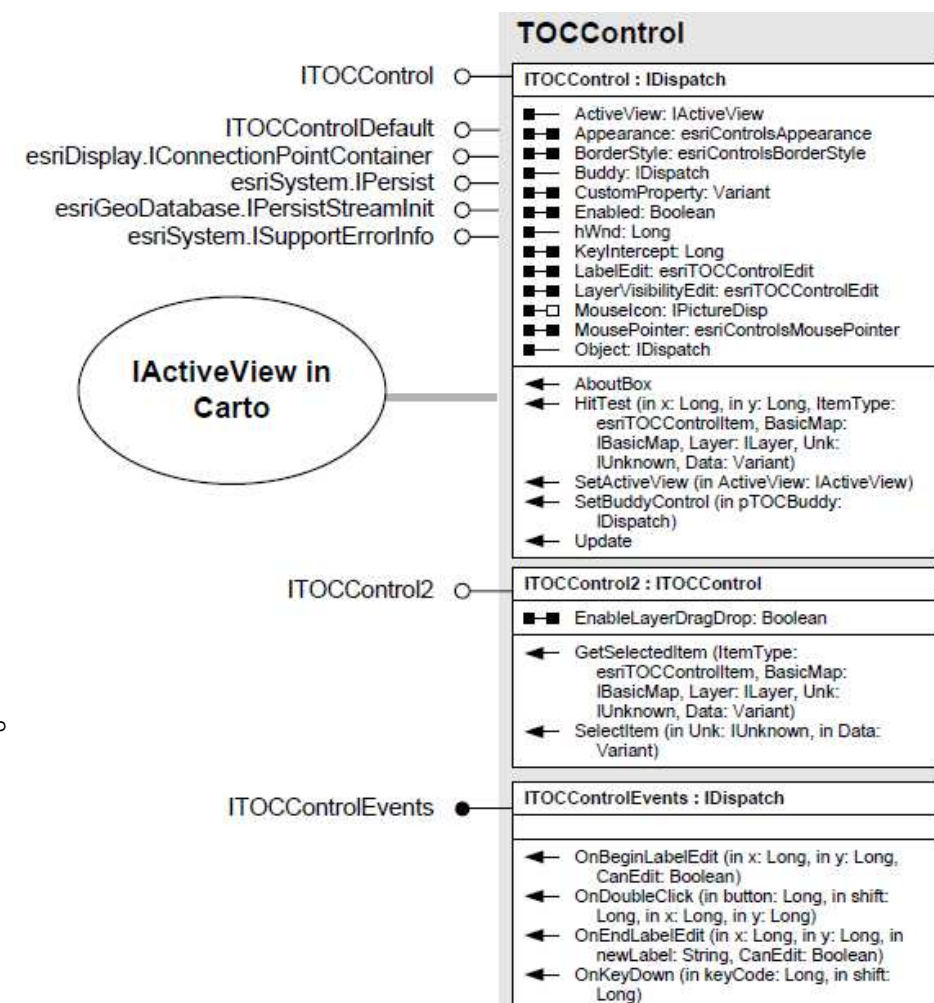
- ToolbarControl 和TOCControl 被设计成和其它控件协同工作。
- 通过一个**buddy**控件自动捆绑在一起。
- 根据彼此的状态 通信和同步
 - 例子: active tool, layer visibility

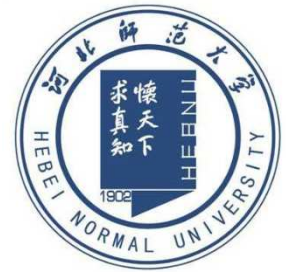




TOCControl

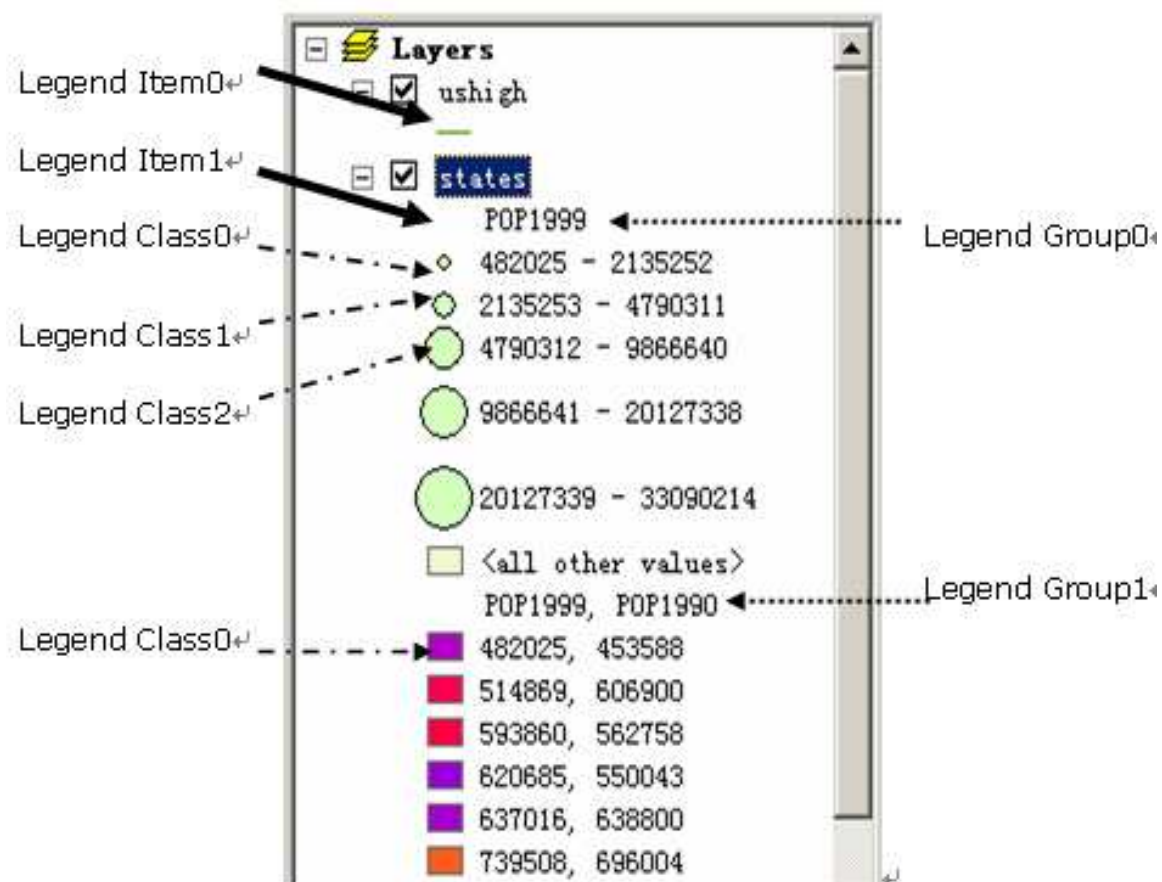
- 显示所有的图层和符号
 - Simple symbols, renderers
 - Group layers
- TOCControl必须要与一个“伙伴控件”协同工作。
 - “伙伴控件”可以是MapControl、PageLayoutControl、SceneControl或GlobeControl
 - “伙伴控件”可以在设计时通过TOCControl属性页设置或用SetBuddyControl方法通过编程设置。
- TOCControl的主要接口
- ITOCControl、ITOCControl2、ITOCControlEvents

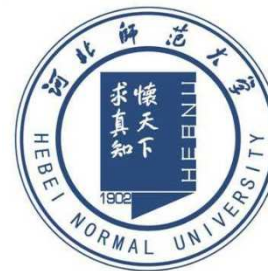




ITOCControl.HitTest方法

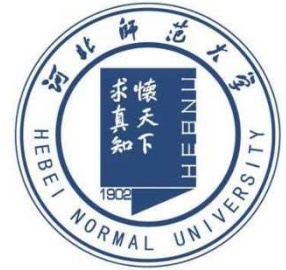
- public void **HitTest** (int X, int Y, ref esriTOCControlItem ItemType, ref IBasicMap BasicMap, ref ILayer Layer, ref object Unk, ref object Data);用于获取用户在TOCControl中点击的相关信息。
 - **ItemType**: TOCControl中项的类型, 如none、map、layer、heading或legend class.
 - **BasicMap**: 指定地图 对象。
 - **Layer**: ILayer 对象。
 - **Unk** : ILegendGroup(图例组, 一个图层可以有多种符号化方案)对象。
 - **Data**: 用户点击的图例组中某个图例的索引号(长整型); 联合使用图例组Unk和这个索引号, 可以获得用户点击的图例(legend class); 如果这个索引号为-1, 表明用户点击的是图例中的标题头。





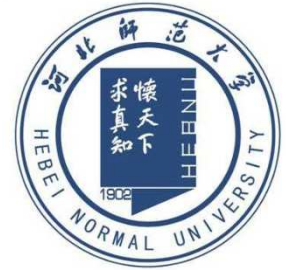
ITOCControl.HitTest方法应用

```
IBasicMap map = new MapClass();
ILayer layer = new FeatureLayerClass();
object other = new object();
object index = new object();
esriTOCControlItem item = new esriTOCControlItem();
//Determine what kind of item has been clicked on
axTOCControl1.HitTest(e.x, e.y, ref item, ref map, ref layer, ref
other, ref index);
if (e.button == 1) //判断用户是否按了鼠标左键
{   if (layer == null) return;
    IFeatureLayer featureLayer = layer as IFeatureLayer;
    if (featureLayer == null) return;
    IGeoFeatureLayer geoFeatureLayer = (IGeoFeatureLayer)
featureLayer;
```

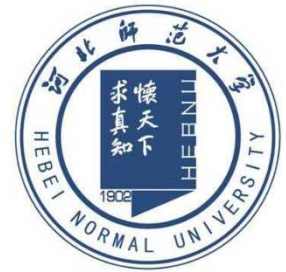


ITOCControl.HitTest方法应用

```
ILegendClass pLegendClass = new LegendClassClass();
ISymbol symbol = null;
if (other is ILegendGroup && (int)index != -1)
{
    pLegendClass = ((ILegendGroup)other).get_Class((int)index);
    symbol = pLegendClass.Symbol;
}
if (symbol == null) return;
symbol = GetSymbolBySymbolSelector(symbol); /弹出符号选择对话框让用户选择新的符号
if (symbol == null) return;
pLegendClass.Symbol = symbol;
this.Activate();
axMapControl1.ActiveView.ContentChanged();
axMapControl1.Refresh(esriViewDrawPhase.esriViewGeography,
null, null);
axTOCControl1.Update();
}
```



- private **ISymbol** GetSymbolByControl(**ISymbol** symbolType)
 { **ISymbol** symbol = null;
 IStyleGalleryItem styleGalleryItem = null;
 esriSymbologyStyleClass styleClass =
 esriSymbologyStyleClass.esriStyleClassMarkerSymbols;
 if (symbolType is **IMarkerSymbol**)
 { styleClass = esriSymbologyStyleClass.esriStyleClassMarkerSymbols; }
 if (symbolType is **ILineSymbol**)
 { styleClass = esriSymbologyStyleClass.esriStyleClassLineSymbols; }
 if (symbolType is **IFillSymbol**)
 { styleClass = esriSymbologyStyleClass.esriStyleClassFillSymbols; }
 GetSymbolByControlForm symbolForm = new
 GetSymbolByControlForm(styleClass);
 symbolForm.ShowDialog();
 styleGalleryItem = symbolForm.m_styleGalleryItem;
 if (styleGalleryItem == null) return null;
 symbol = styleGalleryItem.Item as **ISymbol**;
 symbolForm.Dispose(); this.Activate(); return symbol; }



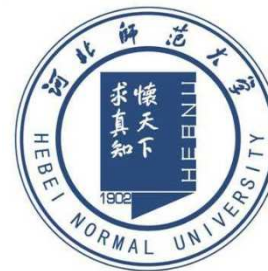
ITOCControl2 (New in 9.2)

- 与ITOCControl相比，ITOCControl2多了以下1个属性和2个方法：
 - public bool **EnableLayerDragDrop** {get; set;} : 指示图层是否可以拖放，以改变图层的顺序。
 - public void **GetSelectedItem** (ref **esriTOCControlItem** ItemType, ref **IBasicMap** BasicMap, ref **ILayer** Layer, ref **object** Unk, ref **object** Data) : 返回TOCControl中被选择项。
 - public void **SelectItem** (object Unk, object Data) : 用于设置TOCControl中的选择项，如：



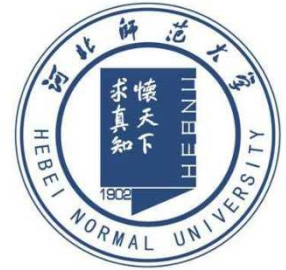
SelectItem

```
//Selecting the focus map
axTOCControl1.SelectItem( axTOCControl1.ActiveView.FocusM
ap);
//Selecting a layer in the focus map
axTOCControl1.SelectItem
(axTOCControl1.ActiveView.FocusMap.get_Layer(0));
//To select an item within a LegendGroup
ILayer layer =
axTOCControl1.ActiveView.FocusMap.get_Layer(0);
ILegendInfo legendInfo = (ILegendInfo) layer;
ILegendGroup legendGroup = legendInfo.get_LegendGroup(0)
//Select a heading
axTOCControl1.SelectItem (legendGroup);
//Select a legend class
axTOCControl1.SelectItem (legendGroup, 2);
```

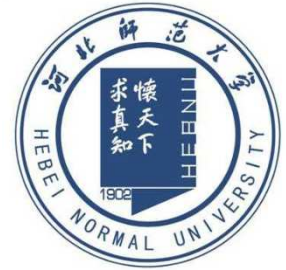


ITOCControlEvents接口

- ITOCControlEvents是一个事件接口，它定义了TOCControl能够处理的全部事件
 - OnMouseDown
 - OnMouseMove
 - OnMouseUp
 - OnDoubleClick
 - OnBeginLabelEdit
 - OnEndLabelEdit
 - OnKeyDown
 - OnKeyUp



- private void axTOCControl1_OnBeginLabelEdit
(object sender,
ITOCControlEvents_OnBeginLabelEditEvent e)
{
.....
m_TOCControl.HitTest(e.x, e.y, ref item, ref map, ref layer, ref
other, ref index); //已在其它地方（如窗体的Load事件中）
声明为ITOCControl类型的变量，并已实例化
if (item != esriTOCControlItem.esriTOCControlItemLayer)
{ e.canEdit = false; }
}

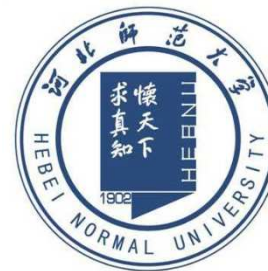


- ```
private void axTOCControl1_OnEndLabelEdit(object
sender,ITOCControlEvents_OnEndLabelEditEvent e)
{
 //Prevent empty labels
 if (e.newLabel.Trim() == "")
 {
 e.canEdit = false;
 }
}
```



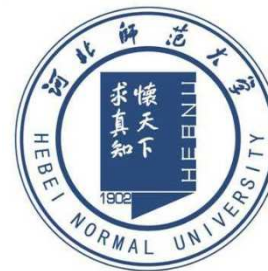
# 从EngineAPP到MapAPP

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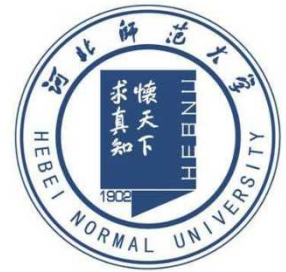
# 参数传递

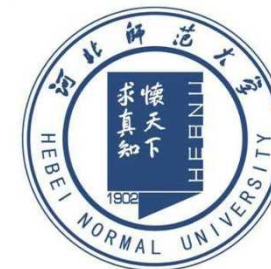
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# MapControl与PageLayoutControl联动

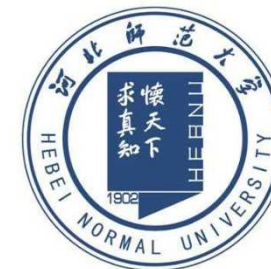
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# SystemUI Namespace

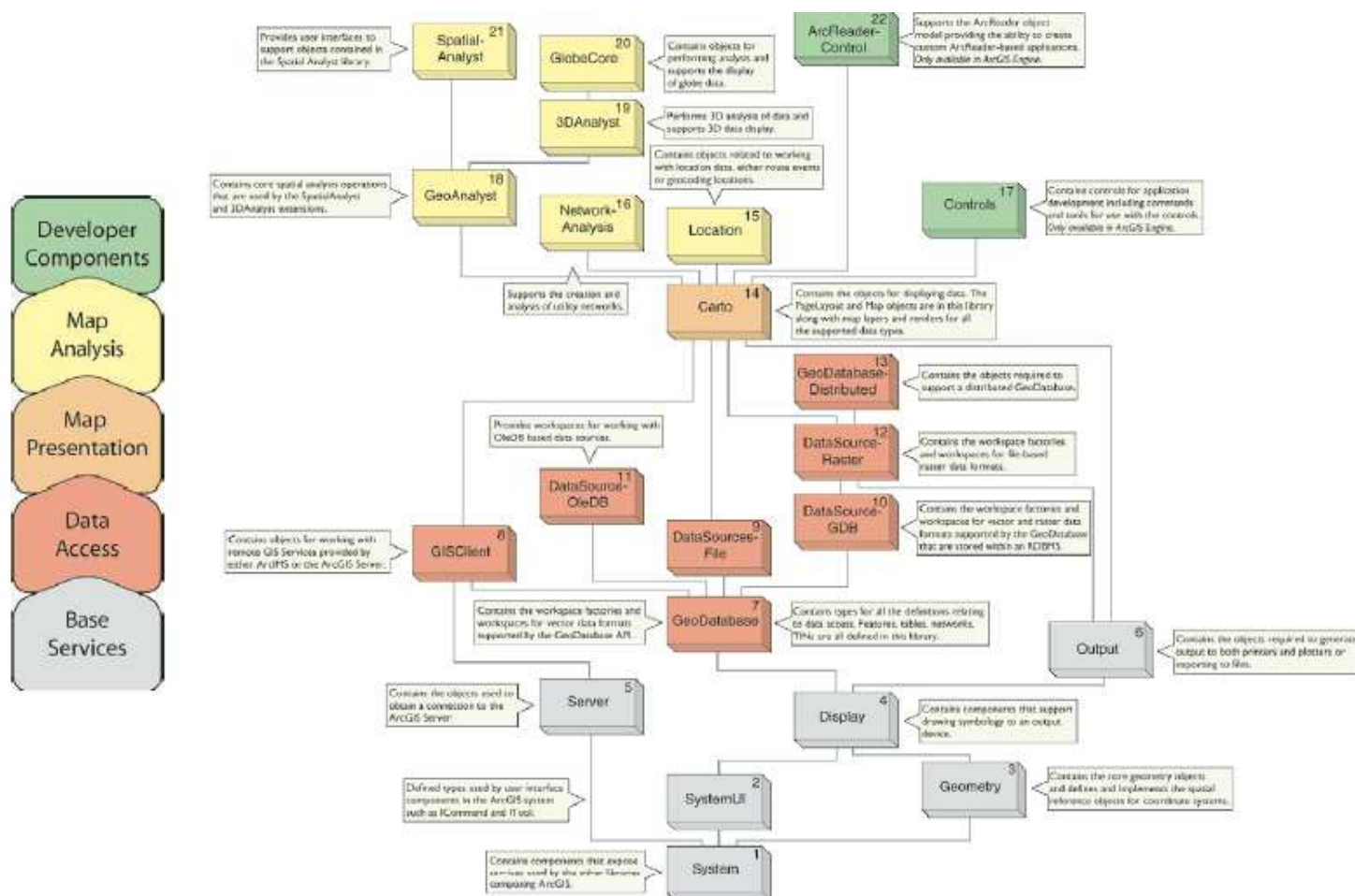
| System Namespace Cont...                                                                                                                                                                                                                                             | ITool Interface                                                                                                      | ICommand Interface | SystemUI Namespace Co... X | TOCControl Class | Using the control comma... | 管理内容(M) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------|------------------|----------------------------|---------|
| ArcGIS Developer Help (ESRI.ArcGIS.SystemUI)                                                                                                                                                                                                                         |                                                                                                                      |                    |                            |                  |                            |         |
| <b>SystemUI Namespace Contents</b>                                                                                                                                                                                                                                   |                                                                                                                      |                    |                            |                  |                            |         |
| <p>The SystemUI library mainly defined types used by user interface components in the ArcGIS system. Interfaces such as ICommand and ITool are defined in this library. Implementation of these types done in one or more libraries, higher in the Architecture.</p> |                                                                                                                      |                    |                            |                  |                            |         |
| <b>Interfaces</b>                                                                                                                                                                                                                                                    |                                                                                                                      |                    |                            |                  |                            |         |
| Interface                                                                                                                                                                                                                                                            | Description                                                                                                          |                    |                            |                  |                            |         |
| <a href="#">IArcGISPortal</a>                                                                                                                                                                                                                                        | Provides access to the IArcGISPortal Interface.                                                                      |                    |                            |                  |                            |         |
| <a href="#">IArcGISSingleSignon</a>                                                                                                                                                                                                                                  | Provides access to the IArcGISSingleSignon Interface.                                                                |                    |                            |                  |                            |         |
| <a href="#">IArcGISSingleSignon2</a>                                                                                                                                                                                                                                 | Provides access to the IArcGISSingleSignon2 Interface.                                                               |                    |                            |                  |                            |         |
| <a href="#">IComboBox</a>                                                                                                                                                                                                                                            | Provides access to members that define a COM combo box.                                                              |                    |                            |                  |                            |         |
| <a href="#">IComboBoxHook</a>                                                                                                                                                                                                                                        | Provides methods to program system provided combo boxes.                                                             |                    |                            |                  |                            |         |
| <a href="#">ICommand</a>                                                                                                                                                                                                                                             | Provides access to members that define a COM command.                                                                |                    |                            |                  |                            |         |
| <a href="#">ICommandHost</a>                                                                                                                                                                                                                                         | Provides access to the ICommandHost Interface.                                                                       |                    |                            |                  |                            |         |
| <a href="#">ICommandSubType</a>                                                                                                                                                                                                                                      | Provides access to members that define a subtyped command.                                                           |                    |                            |                  |                            |         |
| <a href="#">ICompletionNotify</a>                                                                                                                                                                                                                                    | Provides access to a method that advises the framework that the control user has indicated completion.               |                    |                            |                  |                            |         |
| <a href="#">IComponentTip</a>                                                                                                                                                                                                                                        | Provides a tip for a component that is displayed by the What's This Help tool.                                       |                    |                            |                  |                            |         |
| <a href="#">IComPropertySheetEvents</a>                                                                                                                                                                                                                              | Provides access to events that occur on a COM property sheet.                                                        |                    |                            |                  |                            |         |
| <a href="#">IDataObjectHelper</a>                                                                                                                                                                                                                                    | Provides access to members for OLE drag and drop.                                                                    |                    |                            |                  |                            |         |
| <a href="#">IItemDef</a>                                                                                                                                                                                                                                             | Provides access to members that define an item on a commandbar.                                                      |                    |                            |                  |                            |         |
| <a href="#">IMenuDef</a>                                                                                                                                                                                                                                             | Provides access to members that define a menu.                                                                       |                    |                            |                  |                            |         |
| <a href="#">IMultiItem</a>                                                                                                                                                                                                                                           | Provides access to members that define a multiItem.                                                                  |                    |                            |                  |                            |         |
| <a href="#">IMultiItemEx</a>                                                                                                                                                                                                                                         | Provides access to members that define a multiItem with extended features.                                           |                    |                            |                  |                            |         |
| <a href="#">IMultiItemSeparator</a>                                                                                                                                                                                                                                  | Extends multiItem capabilities to support separators.                                                                |                    |                            |                  |                            |         |
| <a href="#">IOperation</a>                                                                                                                                                                                                                                           | Provides access to members that control Operations.                                                                  |                    |                            |                  |                            |         |
| <a href="#">IOperationStack</a>                                                                                                                                                                                                                                      | Provides access to members that control the Operation Stack.                                                         |                    |                            |                  |                            |         |
| <a href="#">IPaletteDef</a>                                                                                                                                                                                                                                          | Provides access to members that define a ToolbarPalette.                                                             |                    |                            |                  |                            |         |
| <a href="#">IProgressDialog</a>                                                                                                                                                                                                                                      | Provides access to members that work with a progress dialog.                                                         |                    |                            |                  |                            |         |
| <a href="#">ISystemMouseCursor</a>                                                                                                                                                                                                                                   | Provides access to members that load and get mouse cursor.                                                           |                    |                            |                  |                            |         |
| <a href="#">ITool</a>                                                                                                                                                                                                                                                | Provides access to members that define a tool.                                                                       |                    |                            |                  |                            |         |
| <a href="#">IToolBarDef</a>                                                                                                                                                                                                                                          | Provides access to members that define a toolbar.                                                                    |                    |                            |                  |                            |         |
| <a href="#">IToolControl</a>                                                                                                                                                                                                                                         | Provides access to members that define a toolcontrol.                                                                |                    |                            |                  |                            |         |
| <a href="#">IToolKeys</a>                                                                                                                                                                                                                                            | Allows a tool to override system shortcut keys.                                                                      |                    |                            |                  |                            |         |
| <a href="#">IToolPalette</a>                                                                                                                                                                                                                                         | Tool palette.                                                                                                        |                    |                            |                  |                            |         |
| <a href="#">IToolSelectedLayer</a>                                                                                                                                                                                                                                   | Provides access to members that set and get the current selected layer, which selection commands and tools works on. |                    |                            |                  |                            |         |

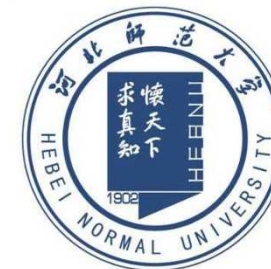


# System Namespace

| System Namespace Cont...                                                                                                                                                      | ITool Interface                                                                                                               | ICommand Interface | SystemUI Namespace Co... | TOCControl Class | Using the control comma... | 管理内容(M) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------|------------------|----------------------------|---------|
| ArcGIS Developer Help (ESRI.ArcGIS.esriSystem)                                                                                                                                |                                                                                                                               |                    |                          |                  |                            |         |
| <b>System Namespace Contents</b>                                                                                                                                              |                                                                                                                               |                    |                          |                  |                            |         |
| The System library is the lowest level library in the ArcGIS architecture. The library contains components that expose services used by the other libraries composing ArcGIS. |                                                                                                                               |                    |                          |                  |                            |         |
| <b>Interfaces</b>                                                                                                                                                             |                                                                                                                               |                    |                          |                  |                            |         |
| Interface                                                                                                                                                                     | Description                                                                                                                   |                    |                          |                  |                            |         |
| <a href="#">IAMFSerializer</a>                                                                                                                                                | Provides access to high-level AMF serialization methods.                                                                      |                    |                          |                  |                            |         |
| <a href="#">IAMFWriter</a>                                                                                                                                                    | Provides access to members that control the sequential writing of AMF.                                                        |                    |                          |                  |                            |         |
| <a href="#">IAngleFormat</a>                                                                                                                                                  | Provides access to members that format angles.                                                                                |                    |                          |                  |                            |         |
| <a href="#">IAngularConverter</a>                                                                                                                                             | Provides access to methods that allow an angle to be converted from one direction unit to another.                            |                    |                          |                  |                            |         |
| <a href="#">IAngularConverter2</a>                                                                                                                                            | Provides access to methods that allow an angle to be converted from one direction unit to another.                            |                    |                          |                  |                            |         |
| <a href="#">IAnimationProgressor</a>                                                                                                                                          | Provides access to members that report progress using an animation.                                                           |                    |                          |                  |                            |         |
| <a href="#">IAoInitialize</a>                                                                                                                                                 | Provides access to members that initialize licensing for ArcGIS Desktop, Engine, and Server.                                  |                    |                          |                  |                            |         |
| <a href="#">IArcGISLocale</a>                                                                                                                                                 | Provides access to members for the ArcGIS locale.                                                                             |                    |                          |                  |                            |         |
| <a href="#">IArray</a>                                                                                                                                                        | Provides access to members that control a simple array of objects.                                                            |                    |                          |                  |                            |         |
| <a href="#">IArray2</a>                                                                                                                                                       | Provides access to replace an object in the array.                                                                            |                    |                          |                  |                            |         |
| <a href="#">IAuthorizeLicense</a>                                                                                                                                             | Provides access to members that authorize Esri licenses.                                                                      |                    |                          |                  |                            |         |
| <a href="#">IAutoExtension</a>                                                                                                                                                | Indicator interface that identifies an extension that automatically enables and disables as needed.                           |                    |                          |                  |                            |         |
| <a href="#">IBlobStream</a>                                                                                                                                                   | Provides access to members that control a Blob Stream.                                                                        |                    |                          |                  |                            |         |
| <a href="#">IByteSwapStreamIO</a>                                                                                                                                             | Provides access to members that support the Byte Swap Helper object.                                                          |                    |                          |                  |                            |         |
| <a href="#">ICategoryFactory</a>                                                                                                                                              | Provides access to members that work with the category factory.                                                               |                    |                          |                  |                            |         |
| <a href="#">ICheckProgressor</a>                                                                                                                                              | Provides access to members that report progress in stepped increments with checkmarks.                                        |                    |                          |                  |                            |         |
| <a href="#">IChildExtension</a>                                                                                                                                               | Provides access to the parent extension of this extension. Indicates that this extension has a parent extension.              |                    |                          |                  |                            |         |
| <a href="#">IClassID</a>                                                                                                                                                      | Provides access to methods identifying class ID.                                                                              |                    |                          |                  |                            |         |
| <a href="#">IClassify</a>                                                                                                                                                     | Provides access to members that control the classification methods.                                                           |                    |                          |                  |                            |         |
| <a href="#">IClassifyGEN</a>                                                                                                                                                  | Provides access to members that control classification.                                                                       |                    |                          |                  |                            |         |
| <a href="#">IClassifyMinMax</a>                                                                                                                                               | Provides access to members that control the classification methods that require only a minimum and maximum value to classify. |                    |                          |                  |                            |         |
| <a href="#">IClassifyMinMax2</a>                                                                                                                                              | Provides access to members that control the classification methods that require a data range only.                            |                    |                          |                  |                            |         |
| <a href="#">IClone</a>                                                                                                                                                        | Provides access to members that control cloning of objects.                                                                   |                    |                          |                  |                            |         |
| <a href="#">IComponentCategoryInfo</a>                                                                                                                                        | Provides access to members that work with the component category manager.                                                     |                    |                          |                  |                            |         |
| <a href="#">IComponentCategoryManager</a>                                                                                                                                     | Provides access to members that work with the component category manager.                                                     |                    |                          |                  |                            |         |
| <a href="#">ICustomNumberFormat</a>                                                                                                                                           | Provides access to members that format numbers in a customizable way.                                                         |                    |                          |                  |                            |         |
| <a href="#">IDeviationInterval</a>                                                                                                                                            | Provides access to members that control the classification methods that require a standard deviation based range.             |                    |                          |                  |                            |         |
| <a href="#">IDirectionFormat</a>                                                                                                                                              | Provides access to members that format directions.                                                                            |                    |                          |                  |                            |         |

# ArcGIS Engine的主要共享程序集





# ICommand

System Namespace Cont...ITool InterfaceICommand Interface XSystemUI Namespace Co...TOCControl ClassUsing the control comma...管理内容(M)

ArcGIS Developer Help (ESRI.ArcGIS.SystemUI)

ICommand Interface

Provides access to members that define a COM command.

**Product Availability**  
Available with ArcGIS Engine, ArcGIS Desktop, and ArcGIS Server.

**Description**  
ICommand is the primary interface implemented by most customizations (commands) that appear on toolbars and menus in all the ArcGIS for Desktop applications. There are several types of co

- Buttons and menu items are the simplest types of commands. Buttons generally appear as icons on toolbars and menu items appear in menus. A simple action is performed when the button c clicked.
- Tools are similar to buttons but they also require interaction with the application's display. The Zoom In command is a good example of a tool--you click or drag a rectangle over a map before redrawn to show the map contents in more detail. Tools must additionally implement **ITool**.
- Tool controls are commands that act like comboboxes or editboxes. Comboboxes let you choose an option from a drop-down list. For example, in ArcMap, you can choose which layer(s) you features from when working with a map. Editboxes are editable textboxes where you can type in text. Tool controls must additionally implement **IToolControl**.

**When To Use**  
Use the ICommand interface to query the properties of a COM command or to create your own COM command.  
When you are creating a new COM command, you must implement the ICommand interface in your class code. This interface determines the behavior and properties of simple commands such a menu items. For example, the ICommand interface sets command properties such as caption, name, category, bitmap, statusbar message, tooltip, help context id and help file, enabled state, and It also defines what action happens when the command is clicked.

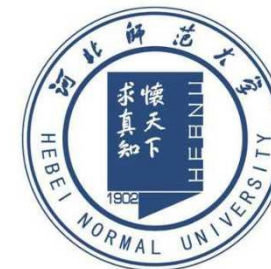
**Members**

All v

|                                 | Description                                                     |
|---------------------------------|-----------------------------------------------------------------|
| ■ <a href="#">Bitmap</a>        | The bitmap that is used as the icon on this command.            |
| ■ <a href="#">Caption</a>       | The caption of this command.                                    |
| ■ <a href="#">Category</a>      | The name of the category with which this command is associated. |
| ■ <a href="#">Checked</a>       | Indicates if this command is checked.                           |
| ■ <a href="#">Enabled</a>       | Indicates if this command is enabled.                           |
| ■ <a href="#">HelpContextID</a> | The help context ID associated with this command.               |
| ■ <a href="#">HelpFile</a>      | The name of the help file associated with this command.         |
| ■ <a href="#">Message</a>       | The statusbar message for this command.                         |
| ■ <a href="#">Name</a>          | The name of this command.                                       |
| ← <a href="#">OnClick</a>       | Occurs when this command is clicked.                            |
| ← <a href="#">OnCreate</a>      | Occurs when this command is created.                            |
| ■ <a href="#">Tooltip</a>       | The tooltip for this command.                                   |

**Classes that implement ICommand**

| Classes | Description |
|---------|-------------|
|---------|-------------|



# Icommand Class

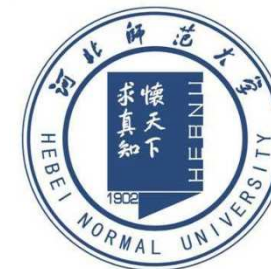
System Namespace Cont... ITool Interface **ICommand Interface** X SystemUI Namespace Co... TOCControl Class Using the control comma... 管理内容(M)

## Classes that implement ICommand

| Classes                                                               | Description                                                                                      |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <a href="#">AddUserMenuItem (esriCatalogUI)</a>                       | Context menu command to create database users.                                                   |
| <a href="#">AnimationCreateTimeTrackCommand (esriAnimationUI)</a>     | Command to create a new time layer track.                                                        |
| <a href="#">AutoCompletePolygonFeatureTool (esriEditor)</a>           | Tool that uses the AutoCompletePolygon Task to create a new Polygon from a Line sketch geometry. |
| <a href="#">Button (esriFramework)</a>                                | Button CoType.                                                                                   |
| <a href="#">ColorCorrectionWindowCommand (esriArcMapUI)</a>           | Opens Color Correction Window                                                                    |
| <a href="#">CommandHost</a>                                           | Use this class to host C++ command implementations in a Toolbar.                                 |
| <a href="#">ConstructPointsCommand (esriEditor)</a>                   |                                                                                                  |
| <a href="#">ContinueFeatureTool (esriEditor)</a>                      |                                                                                                  |
| <a href="#">Controls3DAnalystContourTool (esriControls)</a>           | Generates the contour that passes through a query point.                                         |
| <a href="#">Controls3DAnalystSteepestPathTool (esriControls)</a>      | Generates the steepest path down from a point.                                                   |
| <a href="#">ControlsAddDataCommand (esriControls)</a>                 | Browses data sets and adds data.                                                                 |
| <a href="#">ControlsAGOLSignonCommand (esriControls)</a>              | ArcGIS Online Signin Command.                                                                    |
| <a href="#">ControlsAlignBottomCommand (esriControls)</a>             | Aligns selected elements to the bottom.                                                          |
| <a href="#">ControlsAlignCenterCommand (esriControls)</a>             | Aligns selected elements to the horizontal center.                                               |
| <a href="#">ControlsAlignLeftCommand (esriControls)</a>               | Aligns selected elements to the left.                                                            |
| <a href="#">ControlsAlignMiddleCommand (esriControls)</a>             | Aligns selected elements to the vertical center.                                                 |
| <a href="#">ControlsAlignRightCommand (esriControls)</a>              | Aligns selected elements to the right.                                                           |
| <a href="#">ControlsAlignToMarginsCommand (esriControls)</a>          | Toggles whether alignment is to page margins or elements in the selection.                       |
| <a href="#">ControlsAlignTopCommand (esriControls)</a>                | Aligns selected elements to the top.                                                             |
| <a href="#">ControlsBringForwardCommand (esriControls)</a>            | Brings the selected element(s) forward.                                                          |
| <a href="#">ControlsBringToFrontCommand (esriControls)</a>            | Brings the selected element(s) to the front.                                                     |
| <a href="#">ControlsClearSelectionCommand (esriControls)</a>          | Unselects the currently selected features in all layers.                                         |
| <a href="#">ControlsContextHelpCommand (esriControls)</a>             | Provides context sensitive help for toolbar items.                                               |
| <a href="#">ControlsDistributeHorizontallyCommand (esriControls)</a>  | Distributes selected elements evenly in the vertical direction.                                  |
| <a href="#">ControlsDistributeVerticallyCommand (esriControls)</a>    | Distributes selected elements evenly in the horizontal direction.                                |
| <a href="#">ControlsDynamicDisplayNavigatorCommand (esriControls)</a> | Toggles the Dynamic Display in view navigator on or off.                                         |
| <a href="#">ControlsEditingAttributeCommand (esriControls)</a>        | Shows the feature property editor.                                                               |
| <a href="#">ControlsEditingClearCommand (esriControls)</a>            | Delete the selected element(s).                                                                  |
| <a href="#">ControlsEditingCopyCommand (esriControls)</a>             | Copy the selected element(s).                                                                    |
| <a href="#">ControlsEditingCutCommand (esriControls)</a>              | Cut the selected element(s).                                                                     |
| <a href="#">ControlsEditingEditTool (esriControls)</a>                | Edits features and their geometries.                                                             |
| <a href="#">ControlsEditingPasteCommand (esriControls)</a>            | Paste the clipboard contents into your map.                                                      |

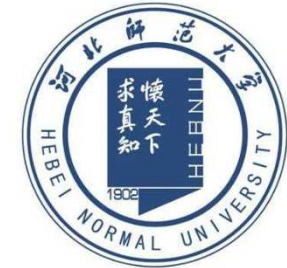


# OpenDoc



| System Namespace Cont... | ITool Interface | Command Interface X                                                               | SystemUI Namespace Co... | TOCControl Class | Using the control comma...                                                                 | 管理内容(M) |
|--------------------------|-----------------|-----------------------------------------------------------------------------------|--------------------------|------------------|--------------------------------------------------------------------------------------------|---------|
|                          |                 | <a href="#">ControlsNetworkAnalystVehicleRoutingProblemCommand (esriControls)</a> |                          |                  | Optimizes the route assignment and sequence for a set of orders using a fleet of vehicles. |         |
|                          |                 | <a href="#">ControlsNetworkAnalystWindowCommand (esriControls)</a>                |                          |                  | Show/Hide the Network Analyst Window.                                                      |         |
|                          |                 | <a href="#">ControlsNewCircleTool (esriControls)</a>                              |                          |                  | Draws a circle.                                                                            |         |
|                          |                 | <a href="#">ControlsNewCurveTool (esriControls)</a>                               |                          |                  | Draws a cubic Bezier curve.                                                                |         |
|                          |                 | <a href="#">ControlsNewEllipseTool (esriControls)</a>                             |                          |                  | Draws an ellipse.                                                                          |         |
|                          |                 | <a href="#">ControlsNewFrameTool (esriControls)</a>                               |                          |                  | Creates a new frame element.                                                               |         |
|                          |                 | <a href="#">ControlsNewFreeHandTool (esriControls)</a>                            |                          |                  | Draws a freehand line.                                                                     |         |
|                          |                 | <a href="#">ControlsNewLineTool (esriControls)</a>                                |                          |                  | Draws a straight line.                                                                     |         |
|                          |                 | <a href="#">ControlsNewMarkerTool (esriControls)</a>                              |                          |                  | Create a new marker graphic element.                                                       |         |
|                          |                 | <a href="#">ControlsNewPolygonTool (esriControls)</a>                             |                          |                  | Draws a polygon.                                                                           |         |
|                          |                 | <a href="#">ControlsNewRectangleTool (esriControls)</a>                           |                          |                  | Draws a rectangle.                                                                         |         |
|                          |                 | <a href="#">ControlsNudgeDownCommand (esriControls)</a>                           |                          |                  | Moves the selected element(s) down.                                                        |         |
|                          |                 | <a href="#">ControlsNudgeLeftCommand (esriControls)</a>                           |                          |                  | Moves the selected element(s) left.                                                        |         |
|                          |                 | <a href="#">ControlsNudgeRightCommand (esriControls)</a>                          |                          |                  | Moves the selected element(s) right.                                                       |         |
|                          |                 | <a href="#">ControlsNudgeUpCommand (esriControls)</a>                             |                          |                  | Moves the selected element(s) up.                                                          |         |
|                          |                 | <a href="#">ControlsOpenDocCommand (esriControls)</a>                             |                          |                  | Opens an existing map.                                                                     |         |
|                          |                 | <a href="#">ControlsPageFocusNextMapCommand (esriControls)</a>                    |                          |                  | Moves the focus to the next data frame.                                                    |         |
|                          |                 | <a href="#">ControlsPageFocusPreviousMapCommand (esriControls)</a>                |                          |                  | Moves the focus to the previous data frame.                                                |         |
|                          |                 | <a href="#">ControlsPageNewMapCommand (esriControls)</a>                          |                          |                  | Creates a new data frame.                                                                  |         |
|                          |                 | <a href="#">ControlsPagePanTool (esriControls)</a>                                |                          |                  | Pans the map layout by dragging it.                                                        |         |
|                          |                 | <a href="#">ControlsPageZoom100PercentCommand (esriControls)</a>                  |                          |                  | Zooms the map layout to 100% (1:1).                                                        |         |
|                          |                 | <a href="#">ControlsPageZoomInFixedCommand (esriControls)</a>                     |                          |                  | Zooms in on the center of the map layout.                                                  |         |
|                          |                 | <a href="#">ControlsPageZoomInTool (esriControls)</a>                             |                          |                  | Zooms in on the map layout by clicking a point or dragging a box.                          |         |
|                          |                 | <a href="#">ControlsPageZoomOutFixedCommand (esriControls)</a>                    |                          |                  | Zooms out on the center of the map layout.                                                 |         |
|                          |                 | <a href="#">ControlsPageZoomOutTool (esriControls)</a>                            |                          |                  | Zooms out on the map layout by clicking a point or dragging a box.                         |         |
|                          |                 | <a href="#">ControlsPageZoomPageToLastExtentBackCommand (esriControls)</a>        |                          |                  | Goes back to previous extent of the map layout.                                            |         |
|                          |                 | <a href="#">ControlsPageZoomPageToLastExtentForwardCommand (esriControls)</a>     |                          |                  | Goes forward to the next extent of the map layout.                                         |         |
|                          |                 | <a href="#">ControlsPageZoomPageWidthCommand (esriControls)</a>                   |                          |                  | Zooms to the width of the page.                                                            |         |
|                          |                 | <a href="#">ControlsPageZoomToolControl (esriControls)</a>                        |                          |                  | Zooms the map layout by a particular percentage.                                           |         |
|                          |                 | <a href="#">ControlsPageZoomWholePageCommand (esriControls)</a>                   |                          |                  | Zooms to the whole map layout.                                                             |         |
|                          |                 | <a href="#">ControlsRedoCommand (esriControls)</a>                                |                          |                  | Redoes the last operation.                                                                 |         |
|                          |                 | <a href="#">ControlsRotateElementTool (esriControls)</a>                          |                          |                  | Rotates the selected text or graphic(s).                                                   |         |
|                          |                 | <a href="#">ControlsRotateLeftCommand (esriControls)</a>                          |                          |                  | Rotates the selected text or graphic(s) 90 degrees counterclockwise.                       |         |
|                          |                 | <a href="#">ControlsRotateRightCommand (esriControls)</a>                         |                          |                  | Rotates the selected text or graphic(s) 90 degrees clockwise.                              |         |
|                          |                 | <a href="#">ControlsSaveAsDocCommand (esriControls)</a>                           |                          |                  | Saves current map document to a new file.                                                  |         |
|                          |                 | <a href="#">ControlsSceneExpandFOVCommand (esriControls)</a>                      |                          |                  | Expands the field of view.                                                                 |         |

# ITool



System Namespace Cont...
ITool Interface
ICommand Interface
SystemUI Namespace Co...
TOCCControl Class
Using the control comma...
管理内容(M)

ArcGIS Developer Help (ESRI.ArcGIS.SystemUI)
ITool Interface

Provides access to members that define a tool.

**Product Availability**  
Available with ArcGIS Engine, ArcGIS Desktop, and ArcGIS Server.

**Description**  
Tools are similar to buttons but they also require interaction with the application's display. The Zoom In command is a good example of a tool--you click or drag a rectangle over a map before the display is redrawn to show the map contents in more detail.

**When To Use**  
Use the ITool interface to query the properties of a built-in tool or to create your own COM tool.

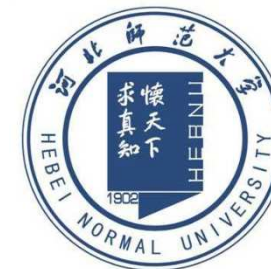
When you are creating a new COM tool, you need to implement both the **ICommand** interface and the **ITool** interface in your class code. With the ITool interface you can define what occurs on events such as mouse move, mouse button press/release, keyboard key press/release, double-click, and right click.

**Members**

|   | All                           | Description                                                             |
|---|-------------------------------|-------------------------------------------------------------------------|
| ← | <a href="#">Cursor</a>        | The mouse pointer for this tool.                                        |
| ← | <a href="#">Deactivate</a>    | Causes the tool to no longer be the active tool.                        |
| ← | <a href="#">OnContextMenu</a> | Context menu event occurred at the given xy location.                   |
| ← | <a href="#">OnDbClick</a>     | Occurs when a mouse button is double clicked when this tool is active.  |
| ← | <a href="#">OnKeyDown</a>     | Occurs when a key on the keyboard is pressed when this tool is active.  |
| ← | <a href="#">OnKeyUp</a>       | Occurs when a key on the keyboard is released when this tool is active. |
| ← | <a href="#">OnMouseDown</a>   | Occurs when a mouse button is pressed when this tool is active.         |
| ← | <a href="#">OnMouseMove</a>   | Occurs when the mouse is moved when this tool is active.                |
| ← | <a href="#">OnMouseUp</a>     | Occurs when a mouse button is released when this tool is active.        |
| ← | <a href="#">Refresh</a>       | Occurs when a screen display in the application is refreshed.           |

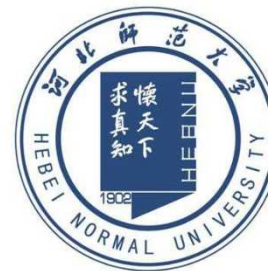
**Classes that implement ITool**

| Classes                                                          | Description                                                                                       |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <a href="#">AutoCompletePolygonFeatureTool (esriEditor)</a>      | Tool that uses the AutoCompletePolygon Task to create a new Polygon from a Line sketch geometry.  |
| <a href="#">ContinueFeatureTool (esriEditor)</a>                 |                                                                                                   |
| <a href="#">Controls3DAnalystContourTool (esriControls)</a>      | Generates the contour that passes through a query point.                                          |
| <a href="#">Controls3DAnalystSteepestPathTool (esriControls)</a> | Generates the steepest path down from a point.                                                    |
| <a href="#">ControlsEditingEditTool (esriControls)</a>           | Edits features and their geometries.                                                              |
| <a href="#">ControlsEditingSketchTool (esriControls)</a>         | Adds points to the edit sketch.                                                                   |
| <a href="#">ControlsGenericGetPositionTool (esriControls)</a>    | Tools that can be used to retrieve the cursor coordinates as the user clicks on the map or globe. |



# ITool Class

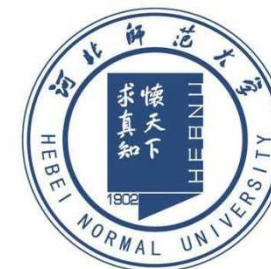
| System Namespace Cont...                                         | <b>ITool Interface</b> X                                                                                                                                    | ICommand Interface | SystemUI Namespace Co... | TOCControl Class | Using the control comma... | 管理内容(M) |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------|------------------|----------------------------|---------|
| <b>Classes that implement ITool</b>                              |                                                                                                                                                             |                    |                          |                  |                            |         |
| Classes                                                          | Description                                                                                                                                                 |                    |                          |                  |                            |         |
| <a href="#">AutoCompletePolygonFeatureTool (esriEditor)</a>      | Tool that uses the AutoCompletePolygon Task to create a new Polygon from a Line sketch geometry.                                                            |                    |                          |                  |                            |         |
| <a href="#">ContinueFeatureTool (esriEditor)</a>                 |                                                                                                                                                             |                    |                          |                  |                            |         |
| <a href="#">Controls3DAnalystContourTool (esriControls)</a>      | Generates the contour that passes through a query point.                                                                                                    |                    |                          |                  |                            |         |
| <a href="#">Controls3DAnalystSteepestPathTool (esriControls)</a> | Generates the steepest path down from a point.                                                                                                              |                    |                          |                  |                            |         |
| <a href="#">ControlsEditingEditTool (esriControls)</a>           | Edits features and their geometries.                                                                                                                        |                    |                          |                  |                            |         |
| <a href="#">ControlsEditingSketchTool (esriControls)</a>         | Adds points to the edit sketch.                                                                                                                             |                    |                          |                  |                            |         |
| <a href="#">ControlsGenericGetPositionTool (esriControls)</a>    | Tools that can be used to retrieve the cursor coordinates as the user clicks on the map or globe.                                                           |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeFixedLineOfSightTool (esriControls)</a> | Rotates the observer around the target.                                                                                                                     |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeFlyTool (esriControls)</a>              | Flies over the globe.                                                                                                                                       |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeHyperlinkTool (esriControls)</a>        | Hyperlinks to features on a globe, if more than one hyperlink is under the cursor a dialog is shown allowing the user to select which hyperlink to jump to. |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeIdentifyTool (esriControls)</a>         | Finds features on a globe, launches a modeless dialog to search fields in globe layers.                                                                     |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeLookAroundTool (esriControls)</a>       | Rotates the observer to look around.                                                                                                                        |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeMeasureTool (esriControls)</a>          | Measures features on a globe, a floating tooltip is used to show the result. The message property returns a string for the status bar                       |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeNavigateTool (esriControls)</a>         | Navigates the globe.                                                                                                                                        |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeOrbitalFlyTool (esriControls)</a>       | Flies in orbital trajectories over the globe.                                                                                                               |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobePanDragTool (esriControls)</a>          | Trackball style pan tool.                                                                                                                                   |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobePanTool (esriControls)</a>              | Pans the globe.                                                                                                                                             |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeSelectFeaturesTool (esriControls)</a>   | Selects features by clicking.                                                                                                                               |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeSwipeTool (esriControls)</a>            | Interactively reveals layers on a globe.                                                                                                                    |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeTargetCenterTool (esriControls)</a>     | Centers view at selected target.                                                                                                                            |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeTargetPanTool (esriControls)</a>        | Pans to selected target.                                                                                                                                    |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeTargetZoomTool (esriControls)</a>       | Zooms to selected target.                                                                                                                                   |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeWalkTool (esriControls)</a>             | Walks on the globe surface.                                                                                                                                 |                    |                          |                  |                            |         |
| <a href="#">ControlsGlobeZoomInOutTool (esriControls)</a>        | Dynamically zooms in or out the globe.                                                                                                                      |                    |                          |                  |                            |         |
| <a href="#">ControlsInkEraserTool (esriControls)</a>             | Erases ink from a map or layout.                                                                                                                            |                    |                          |                  |                            |         |
| <a href="#">ControlsInkGenericDrawTool (esriControls)</a>        | A generic ink drawing tool.                                                                                                                                 |                    |                          |                  |                            |         |
| <a href="#">ControlsInkHighlightTool (esriControls)</a>          | Draws semi-transparent ink on a map or layout.                                                                                                              |                    |                          |                  |                            |         |
| <a href="#">ControlsInkPenTool (esriControls)</a>                | Draws colored ink on a map or layout.                                                                                                                       |                    |                          |                  |                            |         |
| <a href="#">ControlsMapHyperlinkTool (esriControls)</a>          | Hyperlinks to features on a map, if more than one hyperlink is under the cursor a dialog is shown allowing the user to select which hyperlink to jump to.   |                    |                          |                  |                            |         |
| <a href="#">ControlsMapIdentifyTool (esriControls)</a>           | Identifies features on a map, launches a modeless identify dialog containing the results.                                                                   |                    |                          |                  |                            |         |
| <a href="#">ControlsMapMeasureTool (esriControls)</a>            | Measures features on a map, a floating tooltip is used to show the result. The message property returns a string for the status bar.                        |                    |                          |                  |                            |         |
| <a href="#">ControlsMapPanTool (esriControls)</a>                | Pans the map.                                                                                                                                               |                    |                          |                  |                            |         |



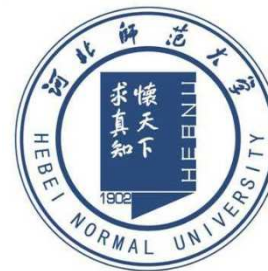
# ICommand

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- 在ArcGIS Engine中，一些工具对象是从ICommand继承来的，Esri已经封装好供直接调用，如ControlsMapZoomOutTool、ControlsMapZoomPanTool等，

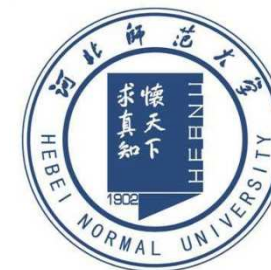


| 接口名                                       | 作用        |
|-------------------------------------------|-----------|
| ControlsFullScreenCommandClass            | 全屏显示      |
| ControlsMapZoomInFixedCommand             | 固定比例放大    |
| ControlsMapZoomOutFixedCommand            | 固定比例缩小    |
| ControlsMapZoomToLastExtentBackCommand    | 前一视图      |
| ControlsMapZoomToLastExtentForwardCommand | 后一视图      |
| ControlsNudgeDownCommand                  | 向下移动选定的元素 |
| ControlsNudgeLeftCommand                  | 向左移动选定的元素 |
| ControlsNudgeRightCommand                 | 向右移动选定的元素 |
| ControlsNudgeUpCommand                    | 向上移动选定的元素 |
| ControlsOpenDocCommand                    | 打开地图      |



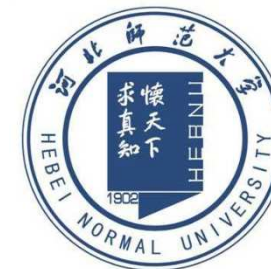
# ITool

- 同ICommand接口类似，ArcGIS Engine也有很多对象继承了ITool接口，如ControlsMapPanTool、ControlsNewCircleTool等，



| 接口名                     | 作用                          |
|-------------------------|-----------------------------|
| ControlsMapPanTool      | 拖动地图                        |
| ControlsMapRotateTool   | 旋转数据框                       |
| ControlsMapZoomInTool   | 通过点击一个点或拖动框放大               |
| ControlsMapZoomOutTool  | 通过点击一个点或拖动框缩小               |
| ControlsMapZoomPanTool  | 向上/向下拖动鼠标左键放大/缩小，或拖动鼠标右键平移。 |
| ControlsNewCircleTool   | 绘制圆                         |
| ControlsNewCurveTool    | 绘制贝塞尔曲线                     |
| ControlsNewEllipseTool  | 绘制椭圆                        |
| ControlsNewFreeHandTool | 绘制徒手线                       |
| ControlsNewLineTool     | 绘制线                         |
| ControlsNewPolygonTool  | 绘制多边形                       |
| ControlsNewRectangle    | 绘制矩形                        |

# OMD

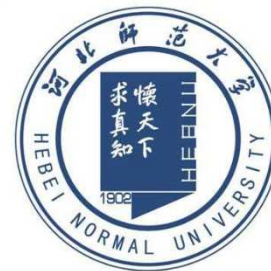


## Interfaces

| ICommand : IUnknown |                               |
|---------------------|-------------------------------|
| ■                   | Bitmap: OLE_HANDLE            |
| ■                   | Caption: String               |
| ■                   | Category: String              |
| ■                   | Checked: Boolean              |
| ■                   | Enabled: Boolean              |
| ■                   | HelpContextID: Long           |
| ■                   | HelpFile: String              |
| ■                   | Message: String               |
| ■                   | Name: String                  |
| ■                   | Tooltip: String               |
| ←                   | OnClick                       |
| ←                   | OnCreate (in hook: IDispatch) |

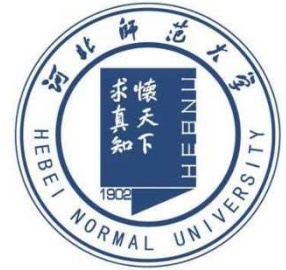
| ITool : IUnknown |                                                                       |
|------------------|-----------------------------------------------------------------------|
| ■                | Cursor: OLE_HANDLE                                                    |
| ←                | Deactivate: Boolean                                                   |
| ←                | OnContextMenu (in x: Long, in y: Long): Boolean                       |
| ←                | OnDblClick                                                            |
| ←                | OnKeyDown (in keyCode: Long, in shift: Long)                          |
| ←                | OnKeyUp (in keyCode: Long, in shift: Long)                            |
| ←                | OnMouseDown (in button: Long, in shift: Long, in x: Long, in y: Long) |
| ←                | OnMouseMove (in button: Long, in shift: Long, in x: Long, in y: Long) |
| ←                | OnMouseUp (in button: Long, in shift: Long, in x: Long, in y: Long)   |
| ←                | Refresh (in hdc: OLE_HANDLE)                                          |





# 使用方法:

- 通过编程创建命令的一个新例程，并将单个ArcGIS控件传递给OnCreate方法。
- 如果命令只实现了ICommand接口，开发人员可以在适当的时候调用OnClick方法以执行特定行动。
- 如果命令为实现了ICommand接口和ITool接口的工具，开发人员必须将该工具设置为ArcGIS控件中的CurrentTool。ArcGIS控件会将任何键盘和鼠标事件传送给该工具。



- 例如:

```
ICommand cmd = new Symbology.UniqueValueRenderer();
```

```
cmd.OnCreate(axMapControl1. Object);
```

```
if (cmd.Enabled) cmd.OnClick();
```

```
ICommand pCommand = new ControlsSelectFeaturesToolClass();
```

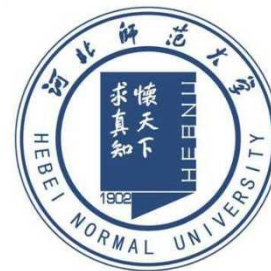
```
pCommand.OnCreate(axMapControl1.Object);
```

```
axMapControl1.CurrentTool = pCommand as ITool;
```

```
BaseTool tool = new SelectAdjacentFeatures();
```

```
tool.OnCreate(axMapControl1. Object);
```

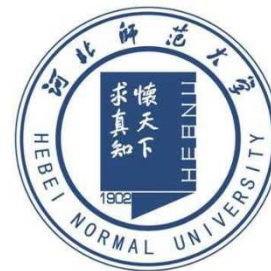
```
axMapControl1.CurrentTool = tool;
```



# TOC鼠标键的响应分析

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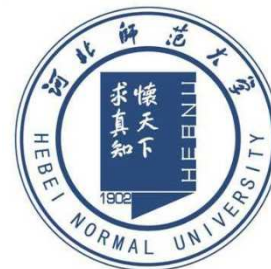
- 左键VS右键
- 点击框架（地图），右键
- 点击图层，右键
- 点击图例，左键



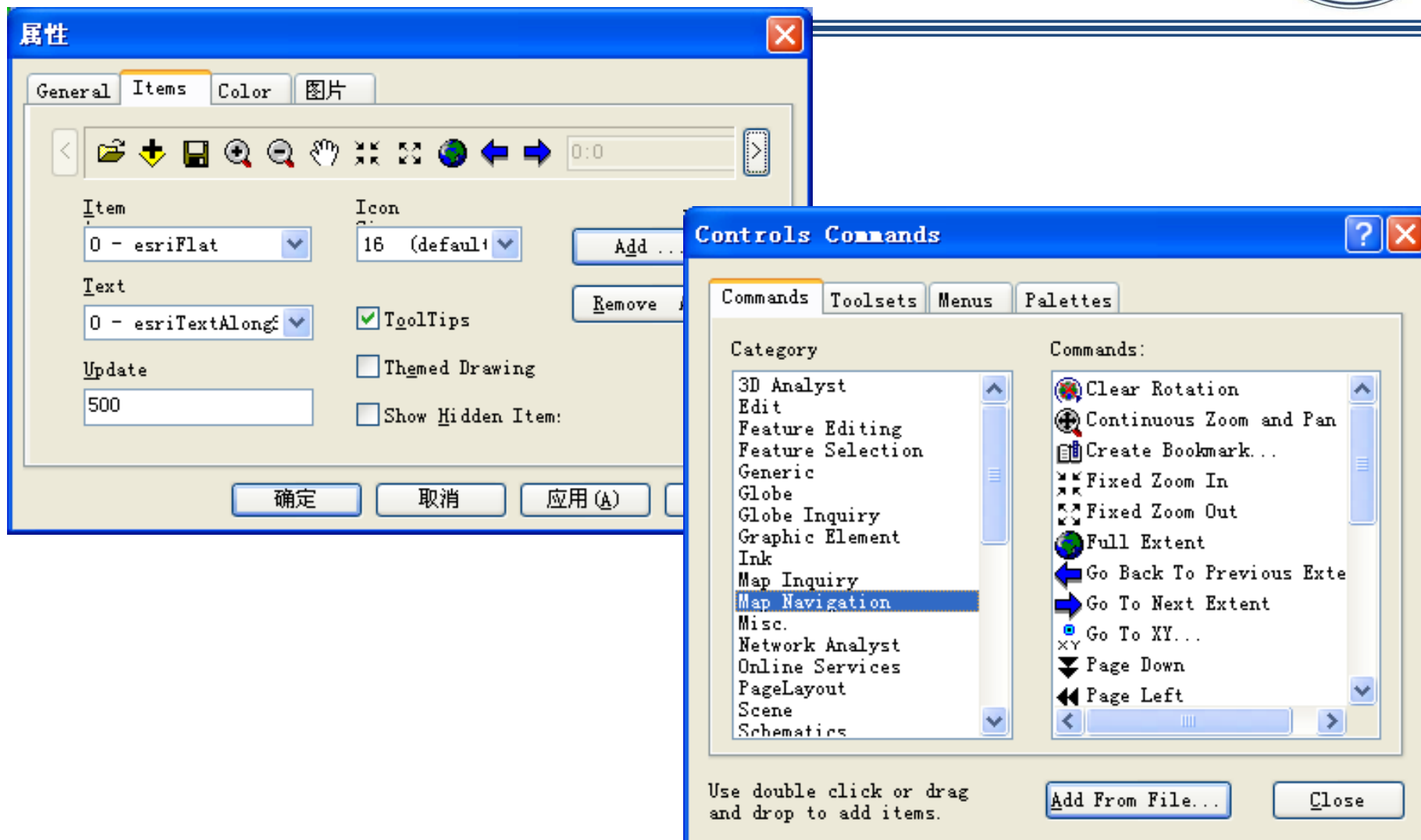
# 练习题

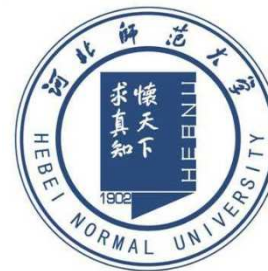
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- 命令封装有几种类型？
- ICommand与ITool在事件响应中的区别有哪些？



# ToolbarControlClass

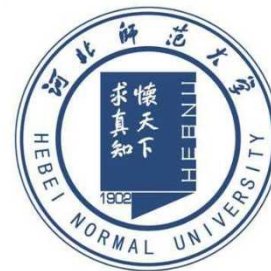




# ToolBarControl及相关对象

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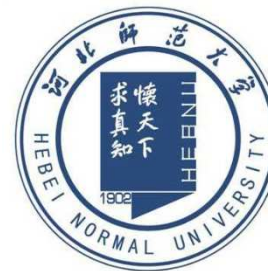
1. ToolBarControl控件
2. ToolBarControl上的命令
3. ToolBarItem
4. 更新命令
5. ToolBarMenu 组件类
6. ToolBarPalette （工具条面板）
7. CommandPool
8. 操作栈(OperationStack)
9. 定制



# ToolBarControl及相关对象

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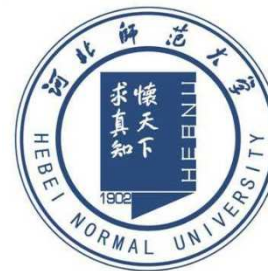
1. ToolBarControl控件
2. ToolBarControl上的命令
3. ToolBarItem
4. 更新命令
5. ToolBarMenu 组件类
6. ToolBarPalette
7. CommandPool
8. 操作栈(OperationStack)
9. 定制



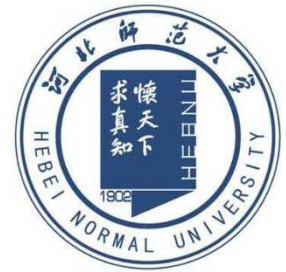
# 01 ToolbarControl控件

- ToolbarControl使用钩子（hook）来联系命令对象与MapControl 或 PageLayoutControl 等控件，并提供属性、方法、事件用于：
  1. 管理控件的外观；
  2. 设置伙伴控件；
  3. 添加、删除命令项；
  4. 设置当前工具；
  5. 定制工具。
- ToolbarControl要与一个“伙伴控件”协同工作。“伙伴控件”可以是MapControl、PageLayoutControl、SceneControl或GlobeControl。
- “伙伴控件”可以在设计时通过ToolbarControl属性页设置或用SetBuddyControl方法通过编程设置。





- ToolbarControl主要接口有：
  - IToolbarControl
  - IToolbarControl2
  - IToolbarControlDefault
  - IToolbarControlEvents (default)



# IToolbarControl与IToolbarControl2

- IToolbarControl2接口是任何与ToolbarControl有关的任务的出发点，如设置控件的外观，设置伙伴控件，添加或删除命令、工具、菜单，定制ToolbarControl的内容。
- IToolbarControl接口提供的主要属性
  - Buddy、CommandPool、CurrentTool、Customize、CustomProperty、Enabled、Object、OperationStack、ToolTips、TextAlignment、UpdateInterval等。
- IToolbarControl接口提供的主要方法
  - AddItem、AddMenuItem、AddToolbarDef、Find、GetItem、GetItemRect、HitTest、MoveItem、Remove、RemoveAll、SetBuddyControl、Update等。

# IToolbarControl2 (New in 9.2)

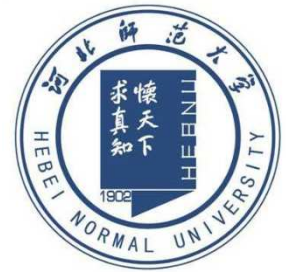


- 与IToolbarControl相比， IToolbarControl2增加了以下：
  1. public bool AlignLeft {get; set;}
  2. public uint BackColor {get; set;}
  3. public uint FadeColor {get; set;}
  4. public esriToolbarFillDirection FillDirection {get; set;}
  5. public int IconSize {get; set;}
  6. public void LoadItems ( IStream pStream );
  7. public esriToolbarOrientation Orientation {get; set;}
  8. public void SaveItems ( IStream pStream );
  9. public bool ShowHiddenItems {get; set;}
  10. public bool ThemedDrawing {get; set;}: 是否有后面的圆角矩形。
  11. public bool Transparent {get; set;}

ThemedDrawing为true

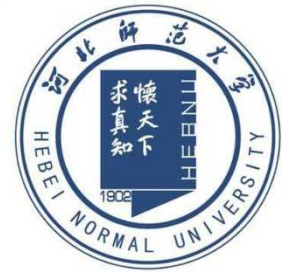


ThemedDrawing为false



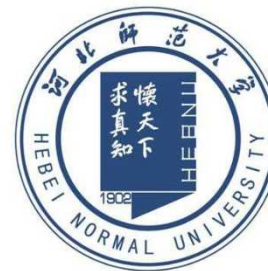
# IToolbarControlDefault

- 在绝大多数开发环境中，在容器（窗体）中放置 ToolbarControl 控件，将产生一个名叫 axToolbarControl1 的对象，这个对象上直接可用的属性和方法对应于 IToolbarControlDefault 接口上的属性和方法，加上容器特有的属性和方法。
- IToolbarControlDefault 接口的属性和方法，与 ToolbarControl 的最高编号主接口的属性、方法相同。例如，目前版本中，IToolbarControlDefault 等同于 IToolbarControl2，但在未来的版本中，将变为 IToolbarControl3。在软件开发中，使用 IToolbarControlDefault 接口，能够保证总是访问最新版本的 ToolbarControl。



# IToolbarControlEvents

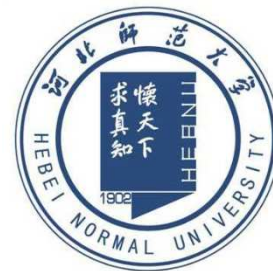
- **IToolbarControlEvents**是一个事件接口，它定义了 ToolbarControl能够处理的全部事件，如**OnBuddyChanged**、**OnDoubleClick**、**OnItemClick**、**OnKeyDown**、**OnKeyUp**、**OnMouseDown**、**OnMouseMove**、**OnMouseUp**。



# ToolBarControl及相关对象

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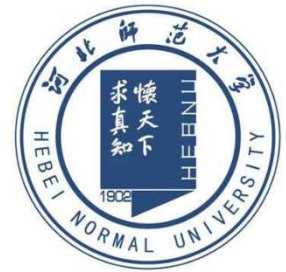
1. ToolBarControl控件
2. ToolBarControl上的命令
3. ToolBarItem
4. 更新命令
5. ToolBarMenu 组件类
6. ToolBarPalette
7. CommandPool
8. 操作栈(OperationStack)
9. 定制



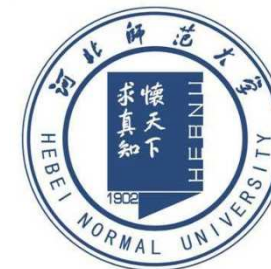
## 02 ToolbarControl上的命令

- 当一个命令对象驻留在ToolbarControl后，将调用 ICommand.OnCreate()，该方法传递一个hook参数给应用程序(hook为ToolbarControl的伙伴控件)。
- 命令的实现测试是否支持hook对象，如果不支持该hook对象，那么该命令无效；如果支持该hook对象，命令将存储该hook对象，以便以后使用。
  - 例如，打开地图文档命令设计用于MapControl的，该MapControl作为hook参数被传递给OnCreate()，该命令保存该hook参数以便后面使用。如果ToolbarControl作为hook参数被传递给OnCreate事件，该命令将检测该ToolbarControl的伙伴控件的类型，如果该伙伴控件为一GlobeControl，而该命令是为MapControl设计的，那么这时该命令无效。



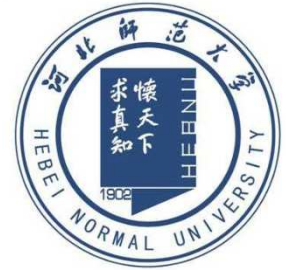


- 驻留在ToolBarControl 上的命令项，当用户点击时，将调用该命令的  **ICommand.OnClick()** 方法。依据命令项的类型，命令将使用 **hook** 参数访问来自于伙伴控件的对象，执行相应的功能。有以下3种类型的命令项：
  1. **简单命令(Command)**: 当用户点击时，将调用该命令的  **ICommand.OnClick()** 方法，执行相应的功能。
  2. **工具(Tool)**: 需要用户与伙伴控件交互，才能完成需要的功能。当用户点击ToolBarControl 上的某一工具时，该工具就成为该ToolBarControl的**CurrentTool**，ToolBarControl 并将其设置为伙伴控件**CurrentTool**，并将接收来自于伙伴控件的鼠标、键盘事件。
  3. **工具控件(ToolControl)**: 类似于下拉列表框，驻留在ToolBarControl上的一个小窗口，由  **IToolControl.hWnd** 提供窗口句柄。只能向ToolBarControl添加特定工具控件的一个实例。



- 设计时，可以通过ToolbarControl 的属性对话框将命令项添加到ToolbarControl 上。
- 也可以通过编程将命令项添加到ToolbarControl上，使用IToolbarControl.AddItem方法有三种方式将命令项添加到ToolbarControl上：
  - 使用UID对象(使用GUID)
  - 使用progID

| Constant                    | Value | Description               |
|-----------------------------|-------|---------------------------|
| esriCommandStyleTextOnly    | 0     | Display text only.        |
| esriCommandStyleIconOnly    | 1     | Display icon only.        |
| esriCommandStyleIconAndText | 2     | Display icon and text.    |
| esriCommandStyleMenuBar     | 4     | Display bar as main menu. |



---

---

//Adding a command by UID

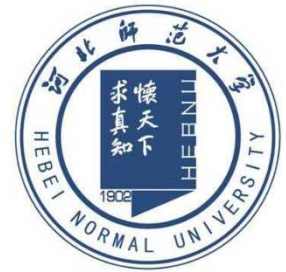
```
UID uID = new UIDClass();
uID.Value = "esriControls.ControlsMapFullExtentCommand";
axToolbarControl1.AddItem(uID,-1,-1,false,0,
 esriCommandStyles.esriCommandStyleIconOnly);
```

//Adding a command by ProgID

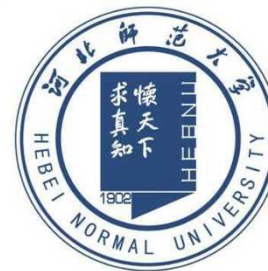
```
string progID = "esriControls.ControlsMapFullExtentCommand";
axToolbarControl1.AddItem(progID,-1,-1, false, 0,
 esriCommandStyles.esriCommandStyleIconOnly);
```

//Adding a command by ICommand

```
ICommand command = new
 ControlsMapFullExtentCommandClass();
axToolbarControl1.AddItem(command,-1,-1,false,0,
 esriCommandStyles.esriCommandStyleIconOnly);
```



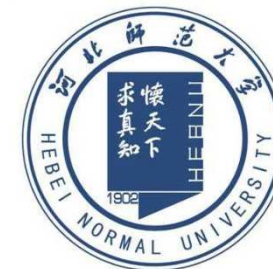
- ArcObjects中命令、工具等的CLSID、ProgID
  - Developing with ArcGIS>>>Learning ArcObjects>>>General ArcObjects references>>>Names and IDs
  - 自定义命令、工具等的CLSID、ProgID，命令类、工具类中可以找到。



# ToolBarControl及相关对象

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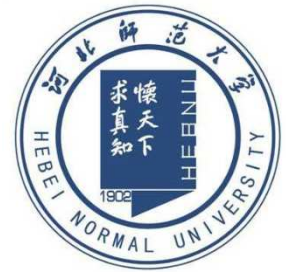
1. ToolBarControl控件
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## 03 ToolStripItem

- ToolStripItem就是驻留在ToolStripControl或菜单上的单个Command, Tool, ToolControl, ToolStripMenu, ToolStripPalette or ToolStripItem对象。
- ToolStripItem的主要接口有：IToolStripItem。


|     |                                |
|-----|--------------------------------|
|     | All                            |
| ■   | <a href="#">Command</a>        |
| ■ ■ | <a href="#">CustomProperty</a> |
| ■ ■ | <a href="#">Group</a>          |
| ■ ■ | <a href="#">GroupSpacing</a>   |
| ■   | <a href="#">Menu</a>           |
| ■ ■ | <a href="#">Style</a>          |
| ■   | <a href="#">UID</a>            |














- **IToolbarItem**接口的属性决定工具条命令项的外观。例如，工具条命令项是否在其左侧有一条垂直线表示是否开始一个命令组(**Group**)，及命令项的样式(**Style**)是否有一个位图、标题或两者都有。**Command**和**Menu**属性返回工具条命令项代表的实际命令或菜单。
- **ToolBarItem**是一个不可创建的对象。引用不可创建的对象必须通过其它对象获得，可以使用**IToolbarControl.GetItem**方法获得**ToolBarItem**。

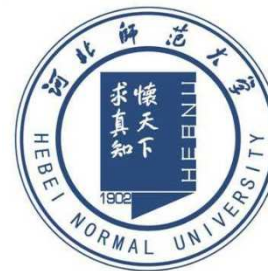
- Note: the **IToolbarItem** interface has been superseded by **IToolbarItem2**.
- Type属性: esriToolbarItemType

|                                   |
|-----------------------------------|
| <b>esriToolbarItemUnknown</b>     |
| <b>esriToolbarItemCommand</b>     |
| <b>esriToolbarItemTool</b>        |
| <b>esriToolbarItemToolControl</b> |
| <b>esriToolbarItemMenu</b>        |
| <b>esriToolbarItemPalette</b>     |
| <b>esriToolbarItemMultiItem</b>   |



|                                                                                       |                   |
|---------------------------------------------------------------------------------------|-------------------|
|                                                                                       | All               |
|    | Command           |
|    | CustomProperty    |
|    | Group             |
|    | GroupSpacing      |
|    | <u>ItemObject</u> |
|    | Menu              |
|    | <u>MultiItem</u>  |
|  | <u>Palette</u>    |
|  | Style             |
|  | <u>Type</u>       |
|  | UID               |

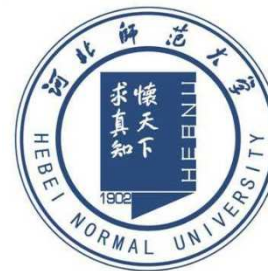




# ToolBarControl及相关对象

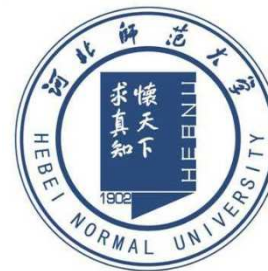
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1. ToolBarControl控件
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## 04 更新命令

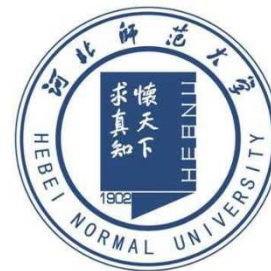
- 默认情况下，ToolBarControl每半秒钟自动更新其自身一次，以确保驻留在ToolBarControl上的每个工具条命令项的外观与其底层命令的Enabled、Bitmap和Caption等属性同步。
- 改变UpdateInterval属性可以更改更新的频率。UpdateInterval为0会停止任何自动发生的更新，开发人员必须编程调用Update方法以刷新每个工具条命令项的状态。
- 在应用程序中首次调用Update方法时，ToolBarControl会检测每个工具条命令项的ICommand.OnCreate方法是否已经被调用过。如果还没有调用过该方法，则该ToolBarControl作为“钩子(hook)”被自动传递给ICommand.OnCreate方法。



# ToolBarControl及相关对象

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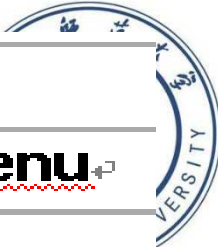
1. ToolBarControl控件
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3. ToolBarItem
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## 05 ToolbarMenu 组件类

- 工具条菜单(ToolbarMenu)提供了菜单项的实现，其上可以驻留命令(Command)、工具(Tool)、工具控件(ToolControl)、动态菜单(Multitem)和工具条面板(ToolbarPalette)。ArcGIS 10版本之前，ToolbarMenu上只能驻留单击命令，不能驻留其他对象。
- 工具条菜单(ToolbarMenu)可以
  - 驻留在ToolbarControl上
  - 或作为“子菜单”驻留在另一个工具条菜单上
  - 或作为右键菜单出现。

- ToolbarMenu的主要接口有： IToolbarMenu、 IToolbarMenu2 。










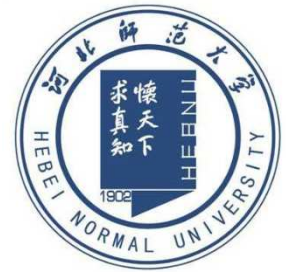
|   |                    |
|---|--------------------|
| ← | <u>AddItem</u>     |
| ← | <u>AddSubMenu</u>  |
| ■ | Bitmap             |
| ■ | Caption            |
| ■ | <u>CommandPool</u> |
| ■ | Count              |
| ← | Find               |
| ← | <u>GetItem</u>     |
| ← | <u>GetMenuDef</u>  |
| ■ | Hook               |
| ← | <u>MoveItem</u>    |
| ← | <u>PopupMenu</u>   |
| ← | Remove             |
| ← | <u>RemoveAll</u>   |
| ← | <u>SetHook</u>     |



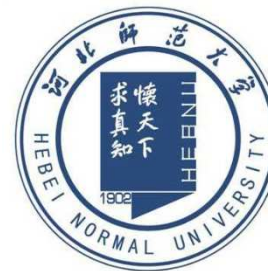
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- IToolbarMenu2

|                                                                                       | Non-inherited ▼ |
|---------------------------------------------------------------------------------------|-----------------|
|    | AddMultiItem    |
|    | AlignLeft       |
|    | Customize       |
|    | IconSize        |
|  | MouseIcon       |
|  | MousePointer    |
|  | ThemedDrawing   |



- ToolbarMenu的构建有两种方式：
  1. 先实现IMenuDef，创建菜单对象，假设为MenuDefA；再实例化一个ToolbarMenu对象，假设为ToolbarMenuA；然后使用IToolbarMenu2.AddItem方法，将MenuDefA对象添加到ToolbarMenuA对象；最后，使用IToolbarControl.AddItem 或 IToolbarControl.AddMenuItem方法将ToolbarMenuA添加到工具条控件上。
  2. 使用IToolbarMenu2接口中的属性、方法将已有的命令添加到ToolbarMenu对象上来构建菜单；ToolbarMenu上的子菜单又可以使另一个ToolbarMenu的实例。

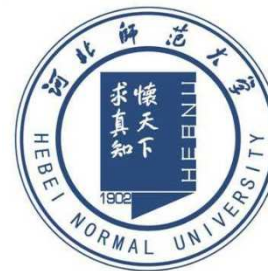


# ToolBarControl及相关对象

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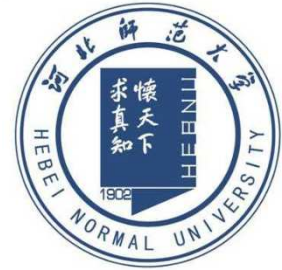


## 06 ToolbarPalette

- ToolbarPalette(工具条面板) 提供了面板项的实现，其上可以驻留命令和工具，但不能驻留ToolControl、ToolbarMenu 以及Multitem对象。ToolbarPalette可以驻留在ToolbarControl上或作为弹出面板出现。
- IToolbarPalette是ToolbarPalette的主要接口。该接口定义的属性有：ActiveItem、AlignLeft、Caption、CommandPool、Count、Customize、Hook、IconSize、MouseIcon、MousePointer、ThemedDrawing、ToolTips；定义的方法有：AddItem、Find、GetItem、MoveItem、PopupPalette、Remove、RemoveAll、SetHook。

|   |             |
|---|-------------|
|   | All ▾       |
| ■ | Caption     |
| ← | GetItemInfo |
| ■ | ItemCount   |
| ■ | Name        |

- ToolbarPalette的构建有两种方式：
  1. 先实现IPaletteDef，创建面板对象，假设为PaletteDefA；再实例化一个ToolbarPalette对象，假设为ToolbarPaletteA；然后使用IToolbarPalette.AddItem方法，将PaletteDefA对象添加到ToolbarPaletteA对象；最后，使用IToolbarControl.AddItem方法将ToolbarPaletteA添加到工具条控件上。
  2. 使用IToolbarPalette接口中的属性、方法将已有的命令、工具添加到ToolbarPalette对象上来构建面板。



---

- //Create a ToolbarPalette

```
m_ToolbarPalette = new ToolbarPaletteClass();
```

- //Add new items to the ToolbarPalette

```
m_ToolbarPalette.AddItem("esriControls.ControlsSelectTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewCircleTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewCurveTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewEllipseTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewLineTool",0,-1);
```

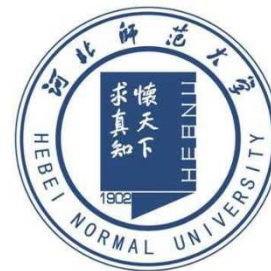
```
m_ToolbarPalette.AddItem("esriControls.ControlsNewPolygonTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewRectangleTool",0,-1);
```

```
m_ToolbarPalette.AddItem("esriControls.ControlsNewFreeHandTool",0,-1);
```

- //Add the ToolbarPalette to the ToolbarControl

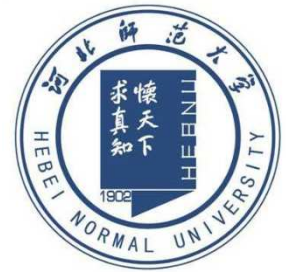
```
axToolbarControl1.AddItem(m_ToolbarPalette, 0, -1, true, 0,
 esriCommandStyles.esriCommandStyleIconAndText);
```



# ToolBarControl及相关对象

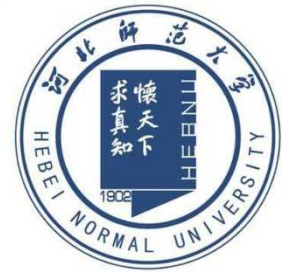
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1. ToolBarControl控件
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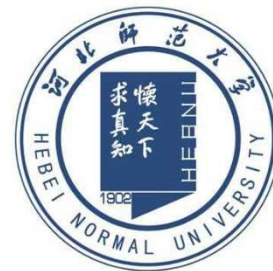


# 07 CommandPool

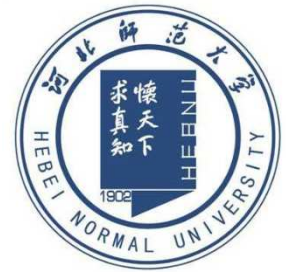
- 每个ToolBarControl、ToolBarMenu 和 ToolbarPalette都有一个命令池(CommandPool)，用于管理其使用的命令对象的集合。一般来说，开发人员不会与命令池进行交互。当通过ToolBarControl属性页或编程将命令添加到ToolBarControl中时，该命令自动添加到命令池中。命令对象要么作为唯一识别该命令的一个UID对象(使用GUID)、要么作为命令对象的一个现有实例被添加到命令池中。



- 如果命令对象的一个现有实例被添加，并且该命令没有一个UID，则命令池中可以有同一命令的多个实例存在。如果提供了一个UID对象，命令池可以确定该命令是否已经存在于命令池中，而且如果存在的话就可以重用该命令之前的实例。命令池通过追踪是否已经调用过命令的OnCreate方法来完成这个工作。如果已经调用过OnCreate方法，则将重用该命令并增加其使用次数(UsageCount)。



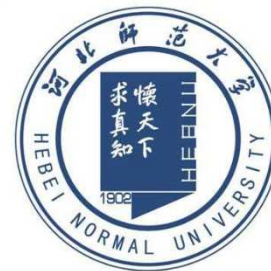
- 例如，如果向某个ToolBarControl中添加两次“ZoomIn”工具并提供UID，则当ToolBarControl上的一个“ZoomIn”工具被选择并显示“按下(pressed)”时，另一个“ZoomIn”工具也会显示“按下(pressed)”状态，因为它们使用同一个命令对象。当应用程序包含多个ToolBarControl或工具条菜单时，开发人员应确保每个ToolBarControl和工具条菜单使用相同的命令池，以保证在应用程序中只创建了命令的一个实例。



---

```
 ICommandPool m_CommandPool = new
CommandPoolClass();
axToolBarControl1.CommandPool =
m_CommandPool;
axToolBarControl2.CommandPool =
m_CommandPool;
```

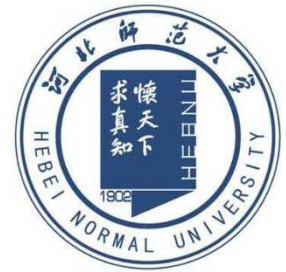




# ToolBarControl及相关对象

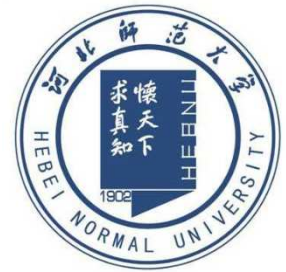
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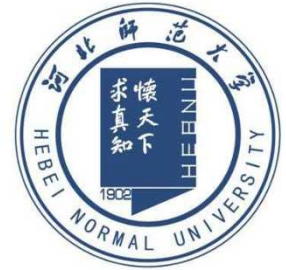


## 08 操作栈(OperationStack)

- ToolbarControl有一个操作栈(OperationStack), 用于管理“撤销(undo)”和“重做(redo)”功能。由每个工具条命令项的底层命令将操作添加到操作栈中, 以便可以根据需要将操作前滚或后滚。例如, 由于误操作, 删除了某个地理要素, 可以点击ToolbarControl上的“undo”命令, 撤消该操作。

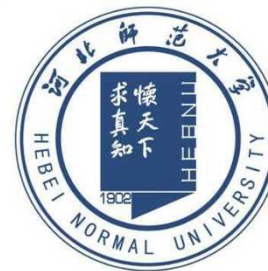


- 命令是否可以利用操作栈取决于该命令的实现。  
典型情况下，开发人员为应用程序创建一个单个的控件操作栈(**ControlsOperationStack**), 并将其设置给每个ToolBarControl。撤消和重做命令可以添加到**使用了操作栈**的ToolBarControl上。
- 说明：活动视图(**ActiveView**)中的范围变化(**Extent changes**)是保存在**IActiveView.ExtentStack**中，而不是在**OperationStack**中。



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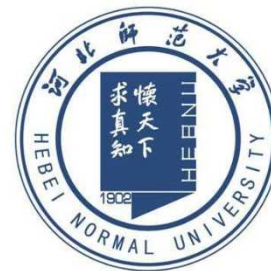
```
IOperationStack operationStack = new
ControlsOperationStackClass();
axToolbarControl1. OperationStack =
operationStack ;
axToolbarControl2. OperationStack =
operationStack ;
```



# ToolBarControl及相关对象

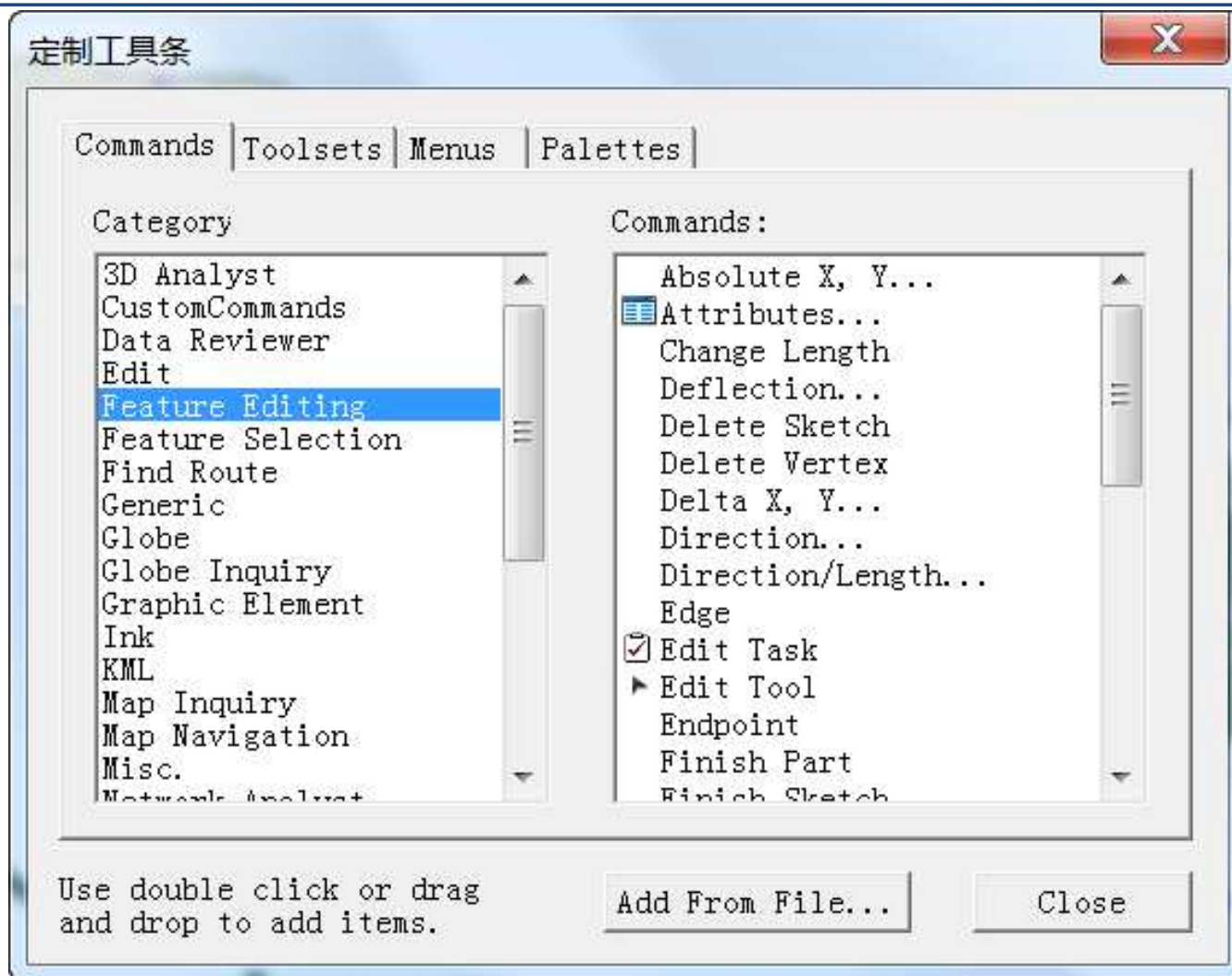
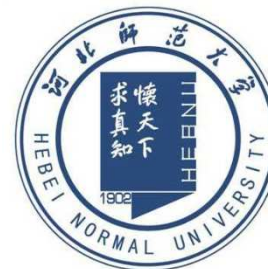
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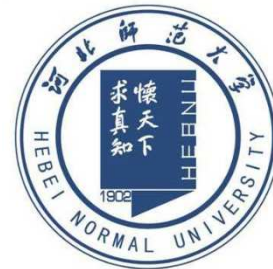
1. ToolBarControl控件
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7. CommandPool
8. 操作栈(OperationStack)
9. 定制



## 09 定制

- ToolbarControl有一个Customize属性(true/false), 可以设置该属性以使ToolbarControl处于定制模式。允许终端用户重新安排、删除和添加命令项以及改变这些命令项的外观。
- 当ToolbarControl处于定制模式时, 开发人员可以编程启动非模态定制对话框(CustomizeDialog)。定制对话框列出了所有的控件命令以及任何自定义命令、工具集和菜单。

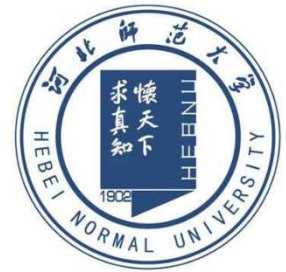




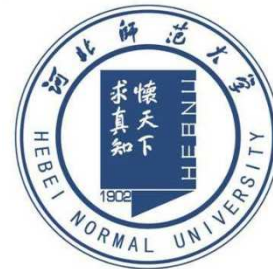
# CustomizeDialog

- **CustomizeDialog**包含一个无模态对话框，允许程序运行时将 **commands, toolbar definitions (toolsets)** 和 **menu definitions** 等添加到 **ToolbarControl** 上，当 **IToolbarControl.Customize** 设置为**true**时。





- CustomizeDialog的主要接口为：ICustomizeDialog和事件接口ICustomizeDialogEvents。
- ICustomizeDialog接口的属性
  - DialogTitle、IsDialogActive、DoubleClickDestination、CommandsCategory、MenusCategory、ToolbarsCategory、ShowAddFromFile。
- ICustomizeDialog接口的方法
  - StartDialog、CloseDialog、SetDoubleClickDestination。
- ICustomizeDialogEvents 接口成员：OnStartDialog、OnCloseDialog。



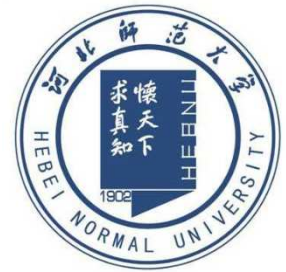
# 定制开发实例

- 首先声明一个 **ICustomizeDialog** 类型的全局变量 **m\_CustomizeDialog**，并实例化，代码如下：

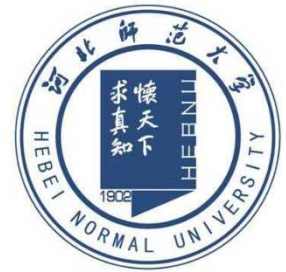
```
private ICustomizeDialog m_CustomizeDialog = new
 CustomizeDialogClass();
```

- 接着，声明如下两个事件变量：

```
private ICustomizeDialogEvents_OnStartDialogEventHandler
 startDialogE;
private ICustomizeDialogEvents_OnCloseDialogEventHandler
 closeDialogE;
```

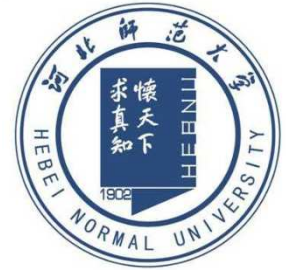


- 为每个事件产生一个代理（ delegate ）
  - 命名： 事件接口+\_+事件名+ EventHandler
  - 例如：  
IActiveViewEvents\_SelectionChangedEventHandler
- 创建一个.NET事件接口
  - 命名： 事件接口+\_+ Event
  - 例如： IActiveViewEvents\_Event

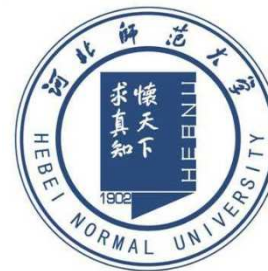


- 创建一个名为CreateCustomizeDialog的方法，在该方法中添加代码，对两个事件变量和定制对话框进行有关设置：

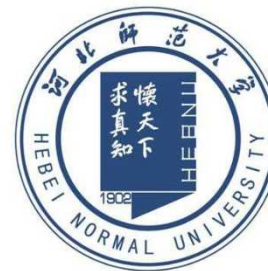
```
private void CreateCustomizeDialog()
{
 ICustomizeDialogEvents_Event pCustomizeDialogEvent =
 m_CustomizeDialog as ICustomizeDialogEvents_Event;
 startDialogE = new
 ICustomizeDialogEvents_OnStartDialogEventHandler(OnStartDialogHandler);
 pCustomizeDialogEvent.OnStartDialog += startDialogE;
 closeDialogE = new
 ICustomizeDialogEvents_OnCloseDialogEventHandler(OnCloseDialogHandler);
 pCustomizeDialogEvent.OnCloseDialog += closeDialogE;
 m_CustomizeDialog.DialogTitle = "Customize ToolbarControl Items";
 m_CustomizeDialog.SetDoubleClickDestination(axToolbarControl1);
}
```



- 在窗体Form1的Load调用CreateCustomizeDialog方法：
- private void Form1\_Load(object sender, System.EventArgs e)  
{  
    //.....  
    CreateCustomizeDialog();  
    //.....  
}



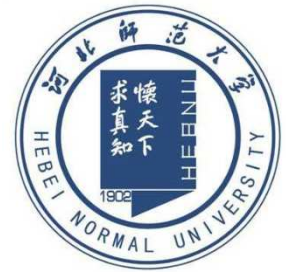
- 向窗体Form1中添加一个复选框并将其命名为chkCustomize，标题为“Customize”。
- 在复选框chkCustomize的CheckedChanged事件处理方法中添加如下代码：
- ```
private void chkCustomize_CheckedChanged(object sender, EventArgs e)
{
    // Show or hide the Customize dialog box.
    if (chkCustomize.Checked == false)
        m_CustomizeDialog.CloseDialog();
    else
        m_CustomizeDialog.ShowDialog(axToolbarControl1.hWnd);
}
```



- 添加下面的OnStartDialog和OnCloseDialog事件处理器，在打开或关闭定制对话框时会触发这两个方法。
- private void **OnStartDialogHandler** ()
 { axToolBarControl1.Customize = true;

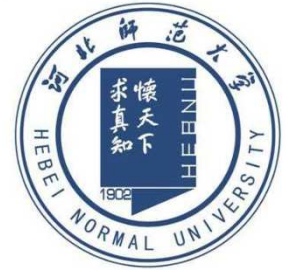
 }
- private void **OnCloseDialogHandler** ()
 {
 axToolBarControl1.Customize = false;

 chkCustomize.Checked = false;
 }
 — 按以上步骤就能实现ToolBarControl的定制。

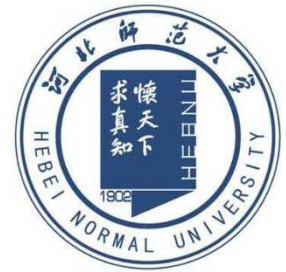


内置的命令

- **ArcObjects**开发包提供了大量内置的命令、工具条及工具、工具控件和菜单等，开发人员在自己的GIS应用开发中可以直接使用这些对象。
- 这些内置的命令、工具等的名称、GUID (CLSID/ProgID)、子命令/子工具序号等信息可以查阅开发文档。
 - **Developing with ArcGIS>>>Learning ArcObjects>>>General ArcObjects references>>>Names and IDs**

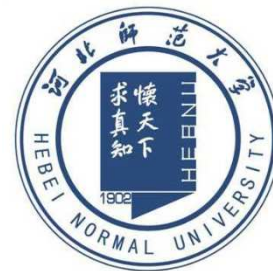


- Names and IDs
 - ArcCatalog commands
 - ArcGlobe commands
 - ArcMap commands
 - ArcScene commands
 - ArcGIS Engine commands
 - Extensions



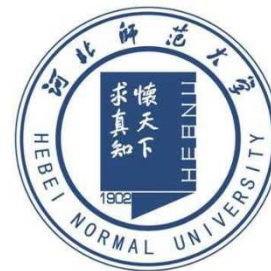
ArcGIS Engine commands概述

- ESRI.ArcGIS.Controls类库中提供了大量的命令、工具条及工具、工具控件和菜单等，开发人员在自己的GIS应用开发中可以直接使用这些对象。使用这些对象有两种方式：
 - 一是通过ToolbarControl控件使用
 - 二是不通过ToolbarControl控件使用
- 开发人员也可以通过创建自己的自定义命令、工具和菜单来扩展ArcGIS提供的命令集。HookHelper、GlobeHookHelper和SceneHookHelper对象可用于简化这种开发。



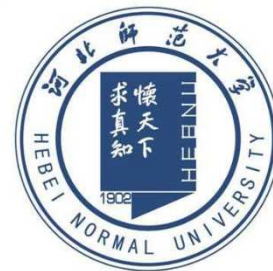
与 ToolbarControl一起使用

- 通过ToolbarControl控件使用Control Commands有三条途径：
 - 在程序设计阶段，通过ToolbarControl控件的**属性页**添加
 - 在程序代码中，使用**AddItem, AddMenuItem**或**AddToolBarDef**方法将要用到的Control Commands的实例对象添加到ToolbarControl控件中，使用**AddItem** 或 **AddSubMenu**方法添加到 **ToolBarMenu**上；
 - 最终用户可以通过**Customize**对话框进行设置(当ToolbarControl控件的Customize设置为true时有效)。



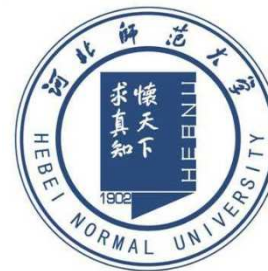
独立使用（without the ToolbarControl）

- 有的时候应用程序可能并不需要ToolbarControl:
 - ① ToolbarControl的可视化外观可能不符合应用程序的需要。
 - ② 为ToolbarControl 创建命令的开销并不需要。
 - ③ 应用程序中已经有一个现有的应用程序框架。
 - ④ ToolbarControl及其驻留的命令不易于跨多个“伙伴控件”使用。
- 在这些情况下，开发人员必须直接操作MapControl、PageLayoutControl等控件。应用程序需要其他用户界面组件，如命令按钮、菜单和列表框等，可能要由开发环境提供。



使用方法:

- 通过编程创建命令的一个新例程，并将单个ArcGIS控件传递给OnCreate方法。
- 如果命令只实现了ICommand接口，开发人员可以在适当的时候调用OnClick方法以执行特定行动。
- 如果命令为实现了ICommand接口和ITool接口的工具，开发人员必须将该工具设置为ArcGIS控件中的CurrentTool。ArcGIS控件会将任何键盘和鼠标事件传送给该工具。



- 例如:

```
ICommand cmd = new Symbology.UniqueValueRenderer();
```

```
cmd.OnCreate(axMapControl1. Object);
```

```
if (cmd.Enabled) cmd.OnClick();
```

```
ICommand pCommand = new ControlsSelectFeaturesToolClass();
```

```
pCommand.OnCreate(axMapControl1.Object);
```

```
axMapControl1.CurrentTool = pCommand as ITool;
```

```
BaseTool tool = new SelectAdjacentFeatures();
```

```
tool.OnCreate(axMapControl1. Object);
```

```
axMapControl1.CurrentTool = tool;
```