. . . please turn off mobile phones and pagers. . . .

Customizing ArcPad

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Presentation Overview

- ArcPad XML
- VBScript
- ArcPad Studio
- ArcPad Object Model
- Using the help system
- Tips and Tricks

ArcPad Customization

- Not ArcObjects for Windows CE
- No embeddable components
- Active Scripting Host
  - VBS runtime provided by system
- File based (ASCII)
  - XML
  - VBScript

Customization Options

- User interface (toolbars, dialogs)
- Additional tools/functionality
- Enforce data integrity
- Create templates for data consistency
- Combine common tasks
- New vector/raster formats and GPS protocols

Extensions Presentations

- ArcPad: Advanced Customization
  - Tuesday 3:30 – 5:00 Room 4 (SDCC)
  - Thursday 10:30 – 12:00 Room 4 (SDCC)

Joe Zastrow

Bill Gates

ArcPad Application Builder

- Developer product for customizing ArcPad 6
- Includes
  - ArcPad 6.0.2
  - ArcPad Studio 6.0.1 (desktop application)
  - Documentation and developer samples
  - First year's Annual Maintenance (Support and upgrades for ArcPad and ArcPad Studio)

Development Model

- Create customization files
  - ArcPad XML
  - VBScript
  - Can be encoded
  - DLL**
- Create data files
  - Shapefiles
  - Rasters (MrSID, PNG, JPG, BMP, CADRG)
- Deploy data and customization files
  - ArcPad looks in certain folders for certain files

XML

- eXtensible Markup Language
- W3C standard
- Interoperable
- Hierarchical tree structure
  - Elements, attributes, values

```
<Person>
  <FirstName>Boy</FirstName>
  <LastName>George</LastName>
  <Occupation>Unemployed</Occupation>
</Person>
```

ArcPad XML

- APX--Affectionately pronounced “apex”
- Language of ArcPad customization
  - Default configuration, Applets, Layer definitions
  - Maps, Preferences, Bookmarks as well
- Similar to AXL where possible

```
<?xml version="1.0" encoding="UTF-8" ?>
<ArcPad>
  <APPLET name="MyApplet">
    <SYSTEMOBJECTS>
      <APPLICATION onstartup="Call Initialize" />
    </SYSTEMOBJECTS>
    <TOOLBARS>
      <TOOLBAR name="MyToolbar" caption="Load Project Data" visible="true">
        <TOOLBUTTON name="tlLoadData" onclick="Call LoadData" image="data.bmp">
          <MENUITEM name="tlSetup" onclick="Call Setup" caption="Setup">
        </TOOLBUTTON>
      </TOOLBAR>
    </TOOLBARS>
  </APPLET>
  <SCRIPT src="MyApplet.vbs" />
</ArcPad>
```

Default Configuration

- Automatically loaded when ArcPad starts
- Stores built-in toolbar visibility
- Stores custom toolbars, system object event handlers, custom forms, scripts
- Saved as ArcPad.apx and located in ArcPad's System folder
  - Default is: \Program Files\ArcPad\System

Applets

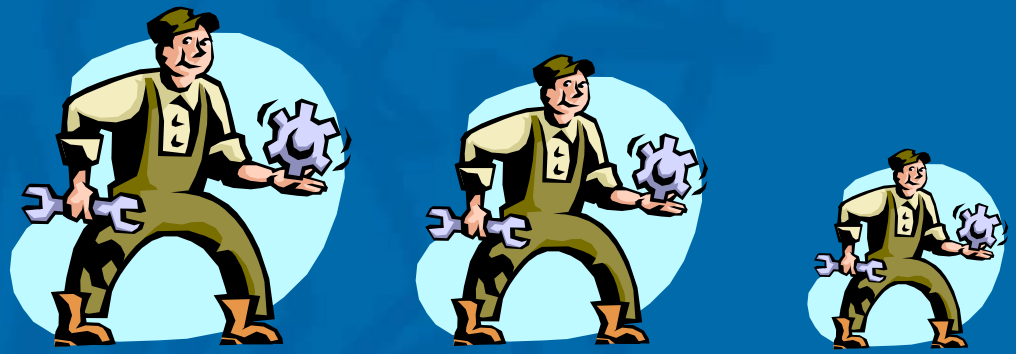
- “Mini-applications” with or without UI
- Automatically loaded when ArcPad starts
- Contain custom toolbars, system object event handlers, custom forms, scripts
- Saved with .APA extension in Applets folder
  - Default is \Program Files\ArcPad\Applets

Layer Definitions

- Deployed with shapefiles (shapefile.APL)
- Contain Edit and Identify forms
  - Rules and validation of attribute data
  - Can also contain general forms
- Layer event handlers, simple metadata, codepage
- Symbology exported from ArcMap/ArcView 3.x

VBScript

- "VB Junior"



VB VBA VBS

- Weakly typed
- Interpreted at run-time
- Supports ActiveX objects

ArcPad Scripts

- VBS code goes inside a script
  - Can be embedded in APX files
- Each is like a program that can run
- Two types
  - Subroutines (AKA subs)
  - Functions (Return a value)

What's in a script?

- Wrapper lines
  - Script name in first line
  - End statement in last line
- Comments, indentation, white space
- VBS code

```
Sub MyScript
    'this is a comment and will be ignored
  MsgBox  "ArcPad is cool!"
End Sub
```

Working with variants

- All variables are variants
  - Behave like appropriate subtype based on context
  - VarType function returns subtype
  - Subtype conversion functions (CLng, CDbl, etc.)
- VarType (45) → vbInteger (2)
- VarType (45.0) → vbDouble (5)
- CDate("Jan 1,2003")

Using Variables

- **Declare** the variable (no type)
  - Dim myVar
- **Set** the variable to store a value or object reference
  - myVar = “I Love ArcPad” → value
  - Set myVar = CreateObject (“Microsoft.XMLDom”) → object ref.
- **Use** the variable to perform operations
  - MsgBox myVar
  - myVar.XXX

Running a script from another script

- Use the Call keyword with () and multiple arguments
- Call is optional with 0 or 1 arguments

- Call aFunction (arg1, arg2, arg3)
- aFunction arg1, arg2, arg3
- Call anotherFunction()
- Call anotherFunction
- anotherFunction
- anotherFunction()

Event Scripting

- Event scripts run when an event is fired
- Objects like Controls, Forms, Map fire events
- Scripts linked to events in APX files

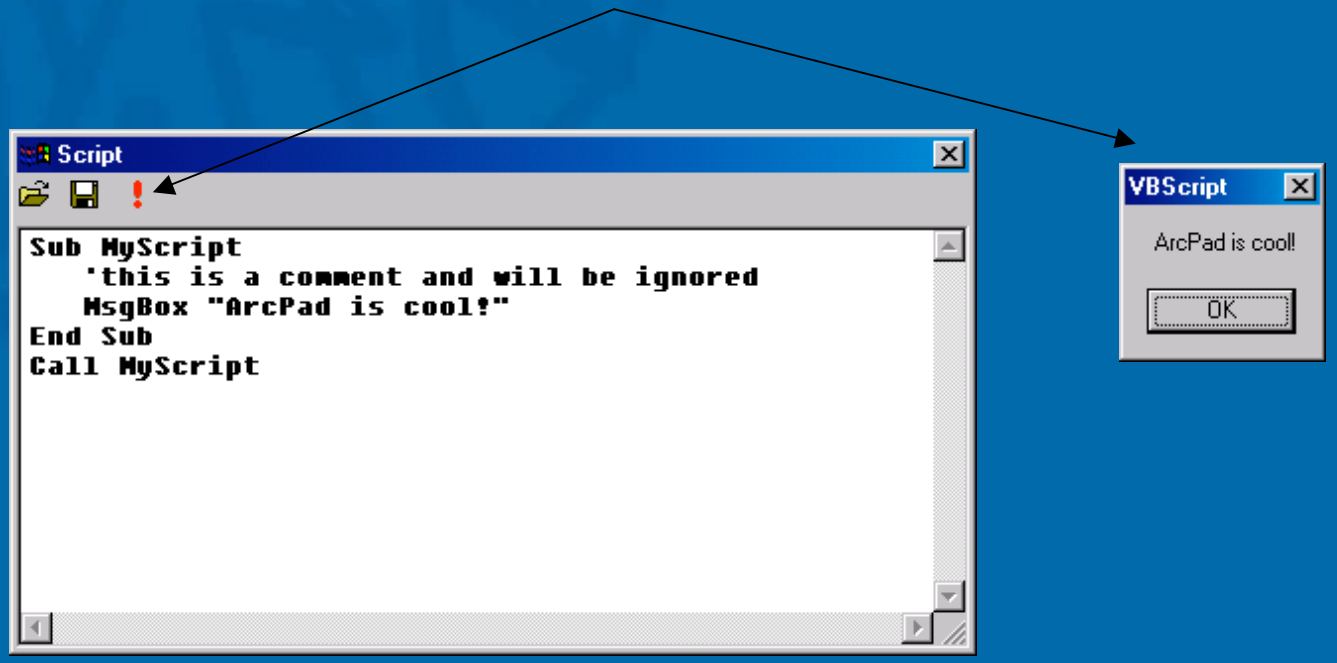
```
<FORM name="frmStatistics" caption="Statistics" width="115"
height="150" font="arial" color="255,0,0," fontsize="9"
fontstyle="bolditalic" onload="call SetInitialLayers">

<TOOLBUTTON name="btnStats" image="sigma.bmp" onclick="call
LoadForm"/>

<GPS onopen="GPS.AutoPanMargin=1"/>
```

Testing a script

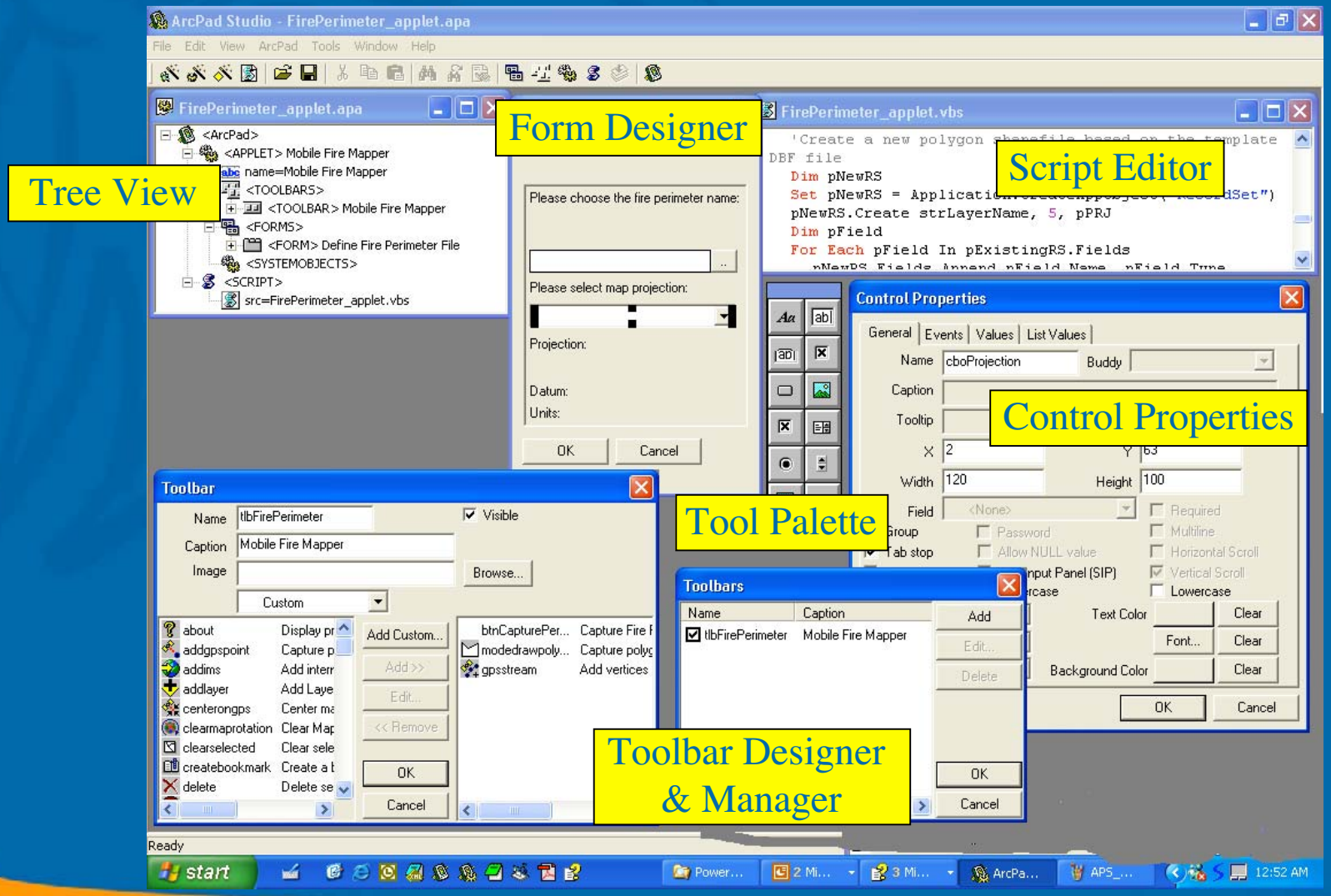
- Ctrl-Enter brings up the Script dialog



ArcPad Studio

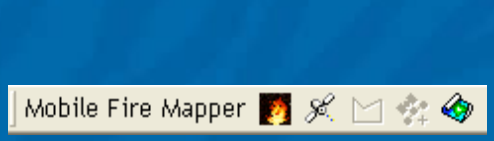
- Create Applets, Default Configurations, Layer Definitions
- Build toolbars and forms
  - Data linked forms
  - Generic dialog forms
- Write scripts

ArcPad Studio



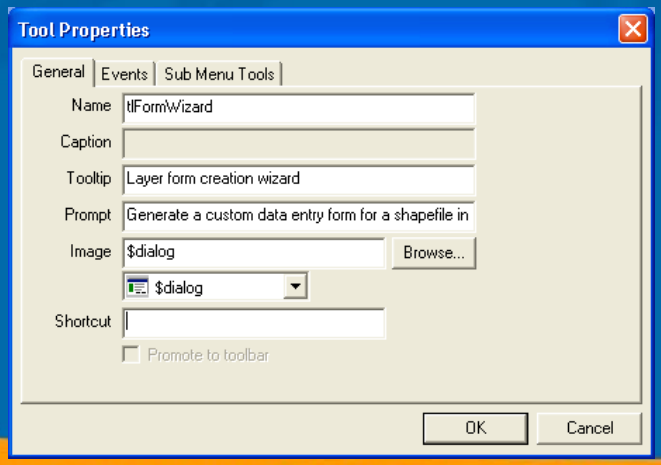
Toolbars

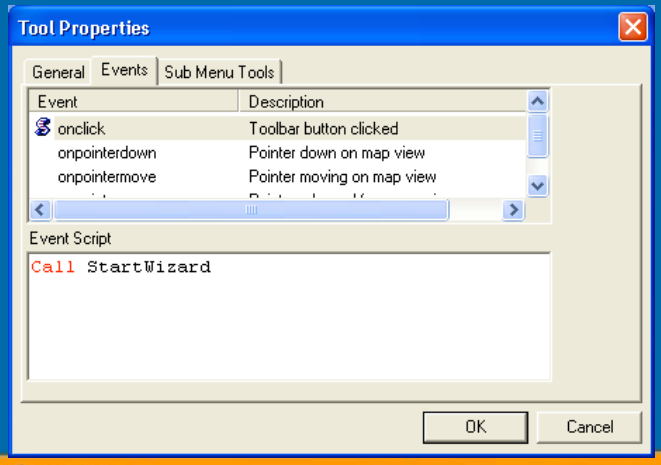
- Tools and sub menus
- All ArcPad commands are available
- Custom tools
- Captions and images



Custom Toolbuttons

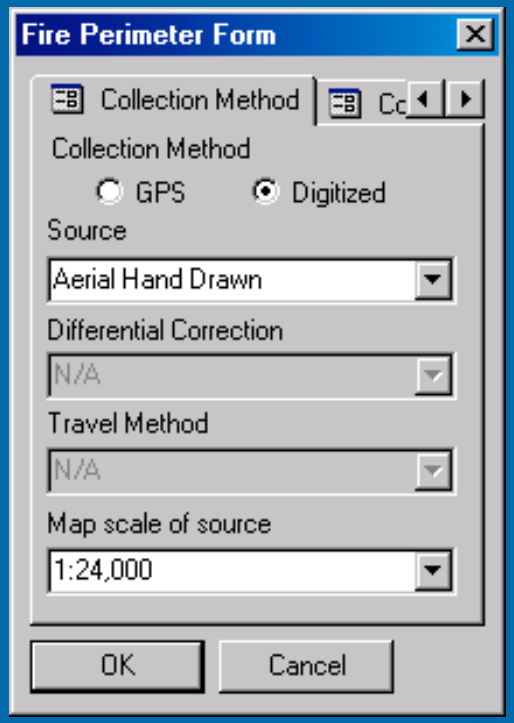
- Write scripts
- Set attributes
- Hook up scripts to events
  - OnClick → Button
  - OnPointer… → Tool





Forms

- Edit, Identify, and General
- Controls can be linked to shapefile attributes
- Always modal
- Lots of events



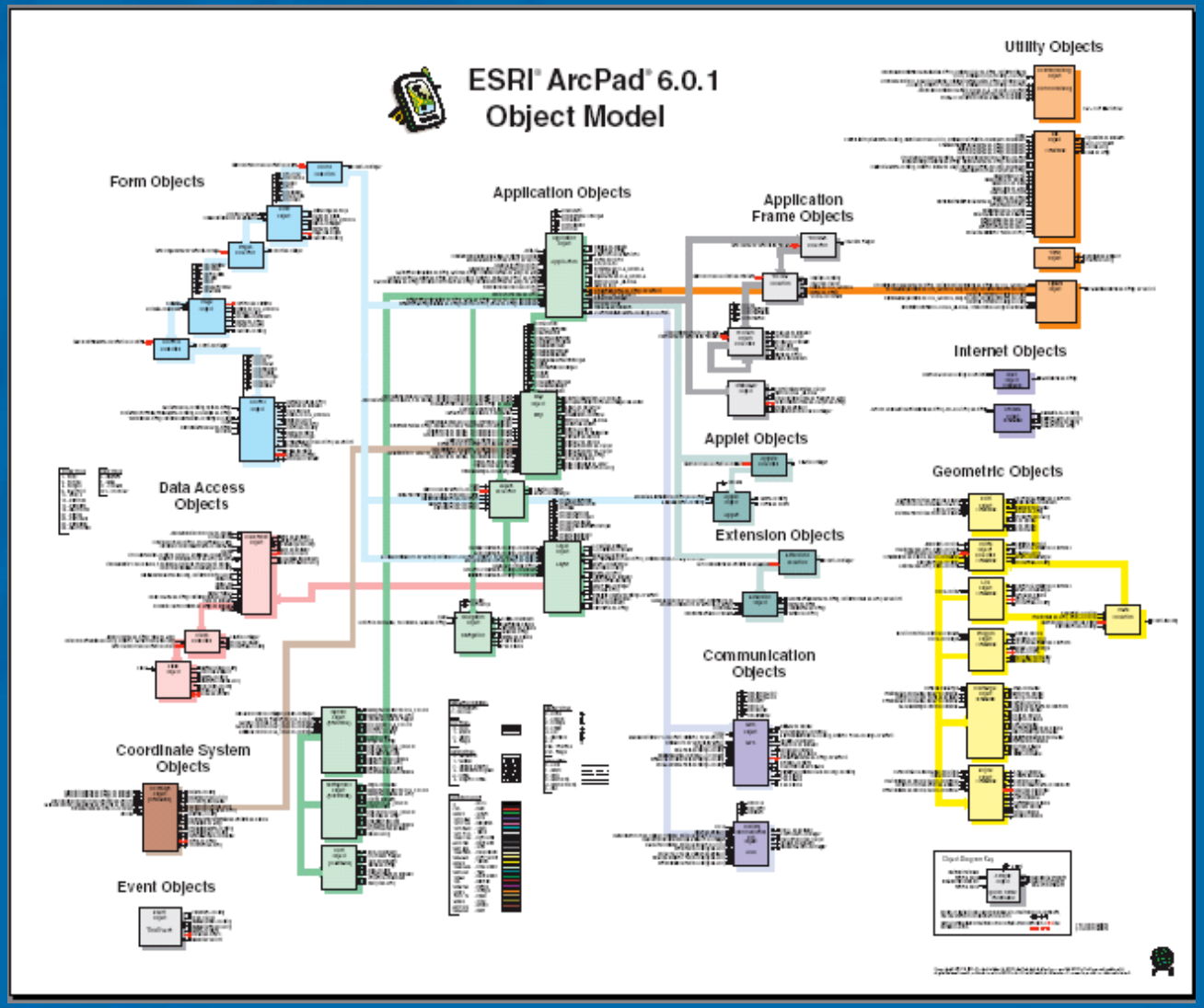
Form Controls

- Label
- Button
- Radio Button
- Combo Box
- Slider
- DateTime
- Text Box
- Check Box
- Image Box
- List Box
- UpDown
- Sub Table

DEMO

Create a toolbar and form in ArcPad Studio

ArcPad Object Model



ArcPad Object Model

- Most of ArcPad's guts exposed to scripts
- 38 objects, 100s of properties, methods, events
  - 4 new objects, 125 new members added at 6.0.1

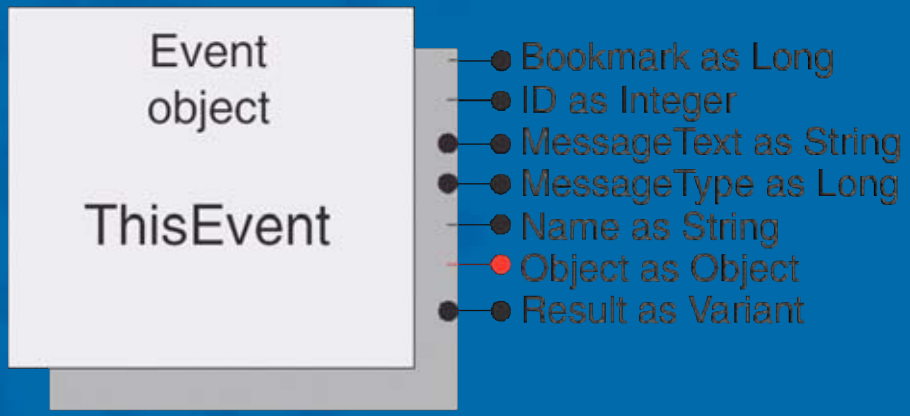
Properties and Methods

- Get a property
  - MsgBox “The map name is “ & Map.Name
- Set a property
  - Map.Name = “Soil map”
- Call a method
  - Map.AddLayerFromFile “D:\Data\Soils.shp”
  - Map.IdentifyXY IngX, IngY
  - Map.Refresh

Events

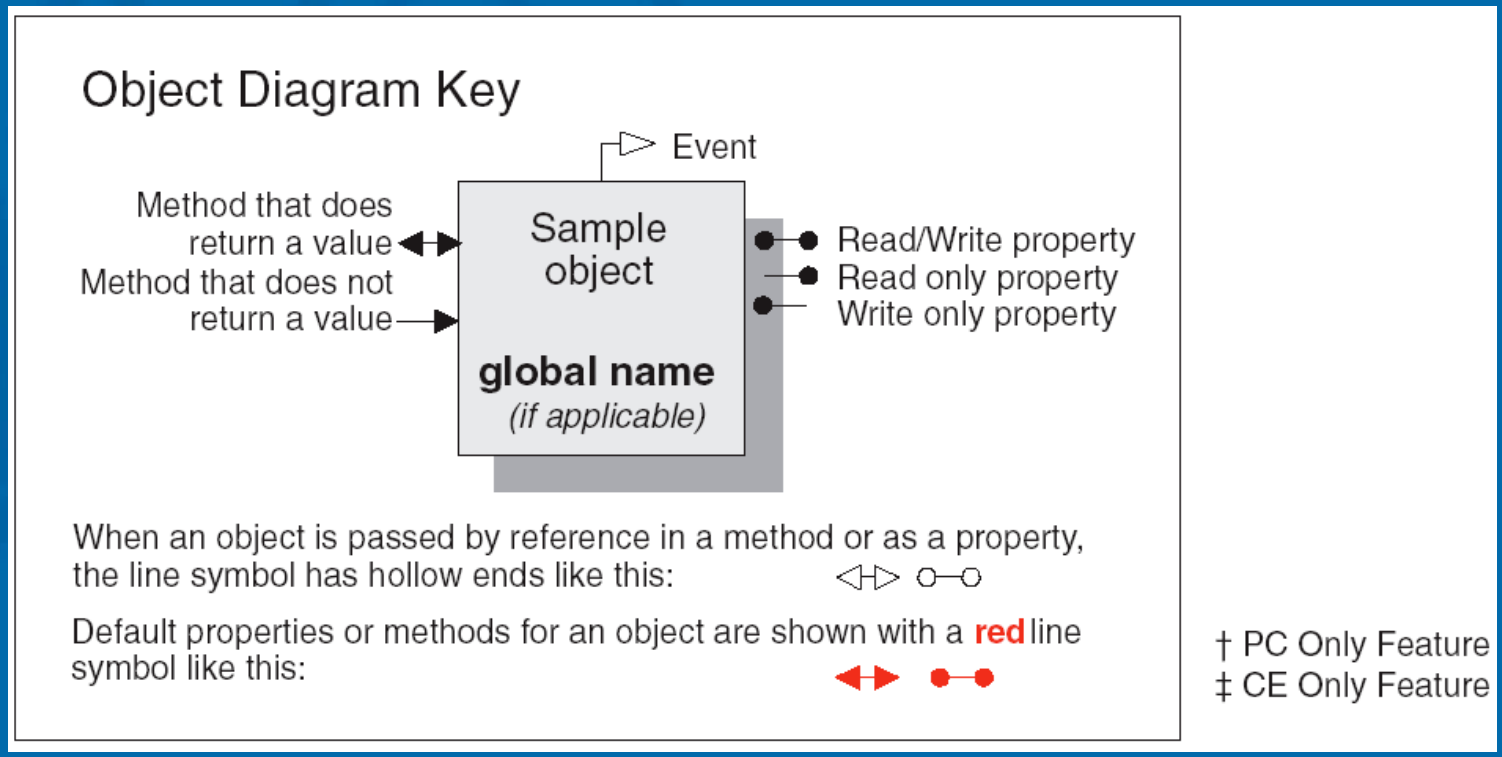
- Many objects fire events you can respond to
  - Map is opened → OnOpen
  - GPS position is received → OnPosition
  - Button is clicked → OnClick
  - Form is closed → OnOK/OnCancel
- Events are synchronous
- Event handler object

ThisEvent Object



- Contains information about the current event
  - Bookmark of selected feature
  - Object that fired the event
  - Page/Control validation status
  - ID of external event

OMD Legend


Object Diagram Key
Event
Method that does return a value
Method that does not return a value
Sample object
global name
(if applicable)
Read/Write property
Read only property
Write only property
When an object is passed by reference in a method or as a property, the line symbol has hollow ends like this:
Default properties or methods for an object are shown with a red line symbol like this:
† PC Only Feature
‡ CE Only Feature

ArcPad Objects

- 12 functional groups

- Application
- Form
- Extension
- Coordinate System
- Geometric
- Internet
- Application Frame
- Applet
- Data Access
- Communication
- Event
- Utility

Project Coordinates Example

```
Sub ProjectLLToMap (dblLat, dblLon)
        'Create a point object
        Dim pPt
        Set pPt = Application.CreateAppObject ("Point")

        'Create a WGS 1984 Lat/Lon CoordSys object
        'Assumes the file WGS 1984.prj exists in the My Documents folder
        Dim pLatLonCS
        Set pLatLonCS = Application.CreateAppObject ("CoordSys")
        pLatLonCS.Import Application.System.Properties("PersonalFolder") & "\WGS 1984.prj"

        'Set the point object's coordsys to Lat/Lon WGS 1984
        Set pPt.CoordinateSystem = pLatLonCS

        'Assign the lat/lon values to the point object
        pPt.X = dblLon
        pPt.Y = dblLat

        'Project the point to the map's coordinate system
        Dim pProj
        Set pProj = Map.CoordinateSystem.Project(pPt)

        'Display the projected coordinates
        MsgBox "X: " & pProj.X & vbCr & "Y: " & pProj.y, vbInformation, "Projected coordinates"

        'Clean up
        Set pPt = Nothing
        Set pLatLonCS = Nothing
        Set pProj = Nothing
End Sub
```

Editing Example

```
Sub MakeEditable
  'Check if the layer can be made editable
  If Not Map.Layers("MyLayer").CanEdit Then
    MsgBox "MyLayer cannot be edited.",vbExclamation,"Error"
    Exit Sub
  End If

  'Make it editable
   Map.Layers("MyLayer").Editable = True
End Sub
```

Scripting Spaces

- Several instances of scripting engines created
  - Application→ArcPad.apx
  - Applets→Each loaded applet (.APA file)
  - Layers→Each loaded layer with an .APL file
- Application.UserProperties can store variables that can be accessed from any scripting space
- The .Execute method can execute scripts that reside in a different scripting space

```
Application.Applets("MyCoolApp").Execute("ProcessData")
```

Feature Attributes

- Feature level access to shapefiles and DBF tables
- Shapefiles/DBF tables in the current map or stored on disk
- Attribute queries
- Create new shapefiles & DBF tables
- Use ADO/ADOCE to communicate with Access, SQL, Oracle, and other databases.

Feature Geometry

- Support Z and measure fields
- MGRS coordinate of any point/vertex
- Distance and bearing between points
- Point in poly for polygon and rectangles
- Length and area
- Shape extents
- Creatable & editable

External Device Communication

- Read/Write access to GPS receiver
  - Direct access to GPS measurements
  - Validity of current GPS fix
  - Access to NMEA sentences as they arrive
- Read/write access to any attached serial device
  - Read/write text or binary data
  - Uses include control or monitoring of other instruments or devices

Inter-Application Communication

- Several ways to communicate between ArcPad and another application (eVB, eVC++, …)
  - Windows APIs (FindWindow, ShowWindow, SendMessage, PostMessage) exposed to VBScript via the System object
  - ArcPad can receive a script via a WM_COPYDATA message and an event via a custom (WM_ARCPAD_EXEVENT) message
  - Exchange data by reading/writing to a text/binary file
  - Make your app scriptable and expose it to ArcPad

Internet Communication

- Move some application logic to the server side
  - If ArcPad can't do it…do it elsewhere!
  - However, you must be connected to the internet (wired or wireless)
- INET object provides connectivity with generic web servers (ASP, etc.)
- ArcIMS object provides connectivity with ArcIMS

➔ However, you are responsible for constructing requests and parsing responses

DEMO

Mobile Fire Mapper

Using the Help System

- All documentation is digital
- OMD
- Customizing ArcPad Help
  - Object reference
  - APX reference
  - ArcPad Studio help
  - Extension reference
  - How To
  - Developer Samples

Reusing Code

- Use relative references wherever possible
  - OnLoad event of a form
    Set pForm = ThisEvent.Object
    Set pForm = Applet.Forms("frmStats")
  - OnClick event of a checkbox
    Set pControls = ThisEvent.Object.Parent.Controls
    Set pControls = Applet.Forms.Pages("Page2").Controls
  - OnOpen event of a layer
    Set pRS = Layer.Records
    Set pRS = Map.Layers("Soils.shp").Records

Reusing Code

- Works:

  <LAYER
  onload="Map.Layers("soils.shp").Editable = True">

- Better:

  <LAYER onload="Layer.Editable = True">

- Best:

  <LAYER onload="Call InitLayer">

Debugging Scripts

- Runtime errors reported by VBScript are often not packed with information
  - But at least you do get a line number
- Line 1, Column 1 errors usually mean the subroutine called in an event handler is not recognized
  - Associated .VBS file is not present
  - Sub name doesn't match between APX and VBS files
- Always use Option Explicit to help catch typos
- Always click the Compile button in Studio's script editor

Dealing with Directory Paths

- Directory structures are very different between Windows CE and desktop Windows
  - Avoid hard-coding paths wherever possible!
- Layer.FilePath returns the path of a layer
- Application.Properties returns
  - Default maps & data path (Application.Properties("DataPath"))
  - System files path (Application.Properties("SystemPath"))
  - Applets files path (Application.Properties("AppletsPath"))
- Application.System.Properties returns
  - My Documents path (Application.System.Properties("PersonalFolder"))
  - Windows temp folder path (Application.System.Properties("TempFolder"))

Want More?? – Room 4

- Introduction to ArcPad 6
  - Tuesday 8:30 – 10:00
  - Wednesday 1:30 – 3:00
- Customizing ArcPad with App Builder
  - Tuesday 1:30 – 3:00
  - Thursday 8:30 – 10:00
- Advanced Customization
  - Tuesday 3:30 – 5:00
  - Thursday 10:30 – 12:00
- ArcGIS Editing: Mobile Data Capture Techniques
  - Wednesday 8:30 – 10:00
  - Thursday 1:30 – 3:00

Resources

- http://msdn.microsoft.com/scripting/
- http://www.pocketpc.com/
- http://www.devbuzz.com/
- news://microsoft.public.scripting.vbscript
- news://microsoft.public.pocketpc.developer
- http://support.esri.com
- http://arcscripts.esri.com

Open to Questions