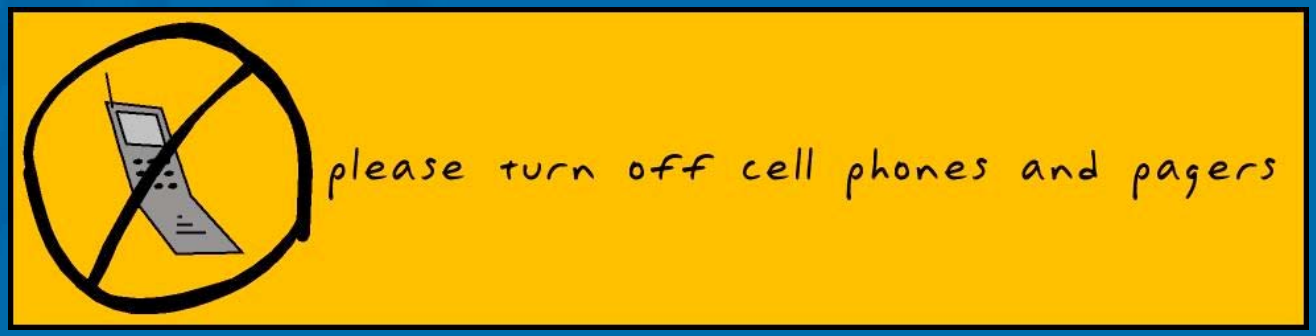
ArcPad Advanced Customization



ArcPad 6.0.1 Extensions

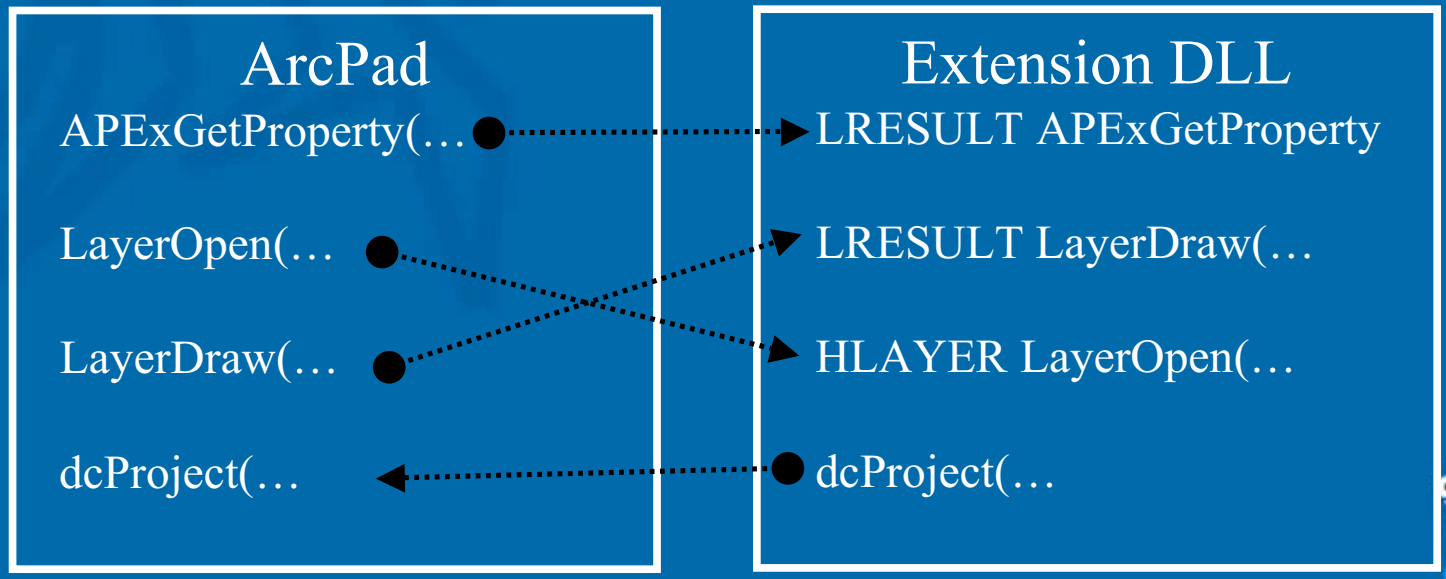
Joe Zastrow

Session Overview

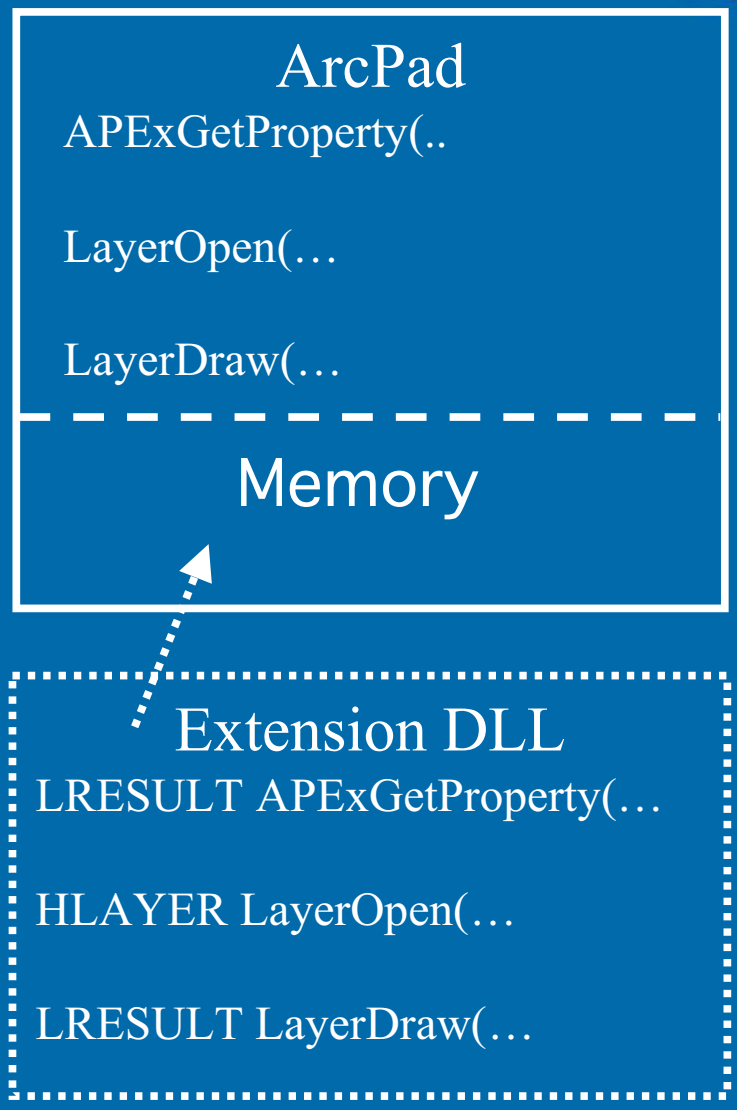
- General Extension Discussion
  - What
  - Purpose
  - Examples
  - Advantages/Disadvantages
  - Requirements
  - Extension Support
- API Overview and Code Samples
  - Function Description
  - Source Code Example

What Is an ArcPad Extension?

- Dynamic Link Library written in C or C++ that adds new functionality to ArcPad.
- DLL provides code for required and optional functions called by ArcPad at certain events or to get information.
- DLL can access some ArcPad functions.



- DLL is stored in ArcPad “extensions” directory.
- DLL auto-loaded into ArcPad at start-up.
- DLL runs as part of ArcPad. No special run-time needed.

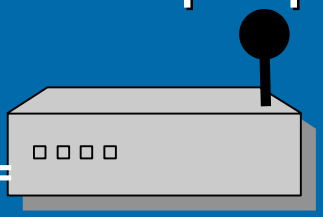


Purpose of an Extension

- Three types of extensions
  - Utility or Tool extension.
  - GPS or device extension.
  - Layer extension.

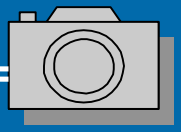
- Add Utility Tools, Methods, and Properties (6.0.1)
  - Utility tools appear on menus.
  - Utility methods called from VB script.
  - Utility properties accessed from VB script.
  - Are not necessarily associated with a layer or device.

- Add support for other devices
  - Support for new devices.
  - Extend or enhance NMEA protocol devices (6.0.1).
  - Add new tools, methods and properties (6.0.1) for a device.



Unsupported tracking and data collection devices

Enhance NMEA devices



Unsupported devices

- Add support for new vector or image data formats.
  - Functions like normal ArcPad data layer.
  - Both read and write access (6.0.1).
  - Can add new tools, methods and properties (6.0.1) for this data.

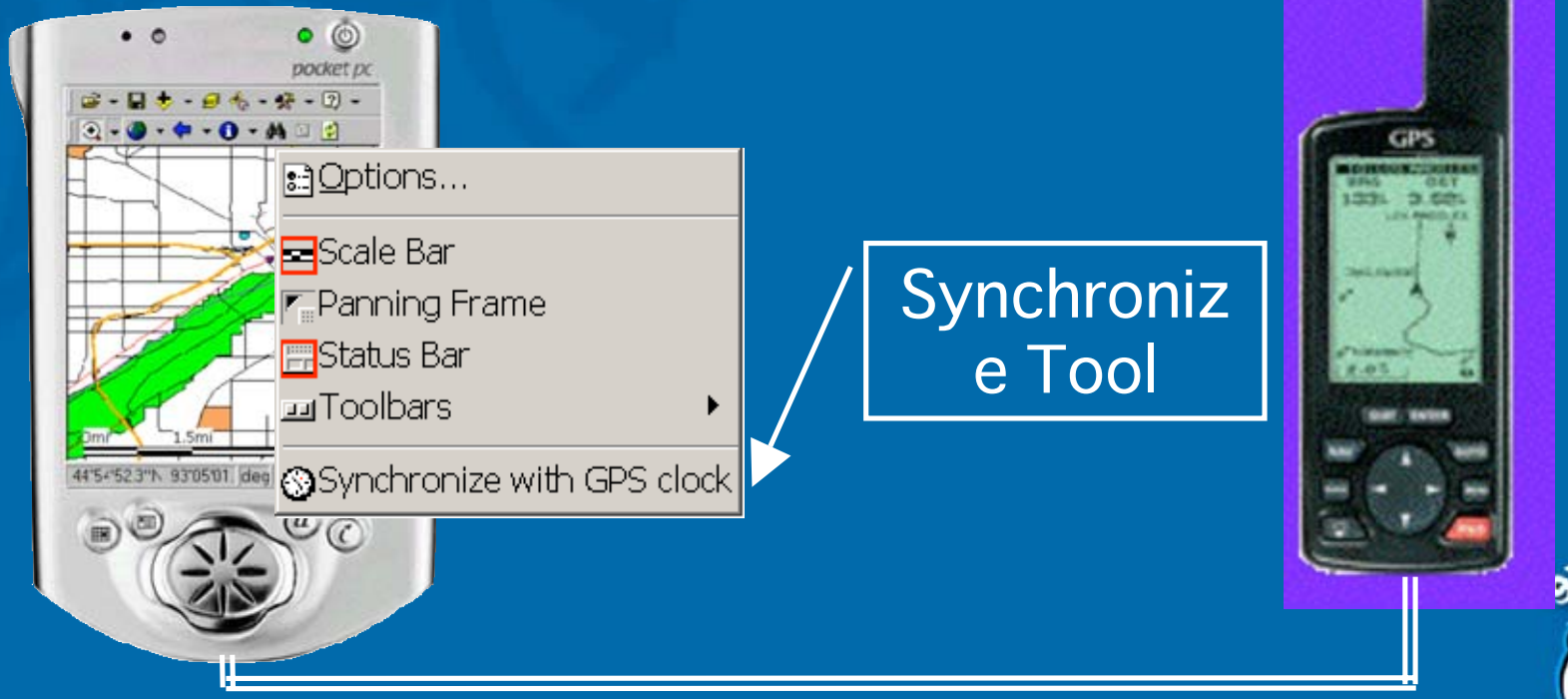
CAD files
Other Vector files

TIFF files
GIF files
Other Image files

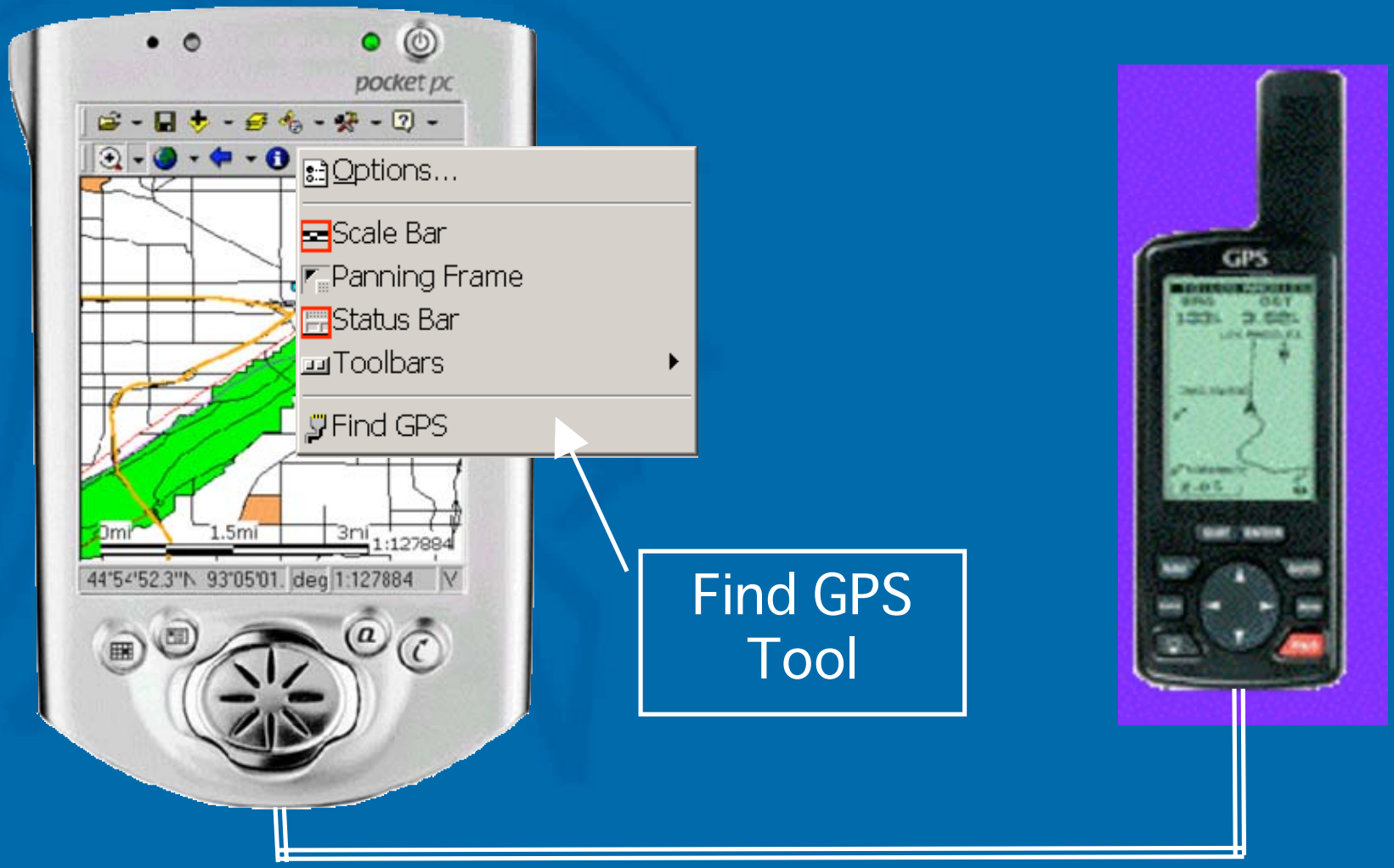
Some Examples of Extensions

- Pocket Camera Extension
  - Enables capture of digital photos within ArcPad or an ArcPad form.
  - Allows seamless linking of photos to geographic features.
  - Supports HP Pocket and PreTec Compact Cameras.
  - Free download from ESRI ArcScripts http://arcscripts.esri.com/

- Synchronize System Clock with GPS Clock
  - Adds menu choice to set the computer system clock to match the GPS clock.
  - Free download from ESRI ArcScripts http://arcscripts.esri.com/

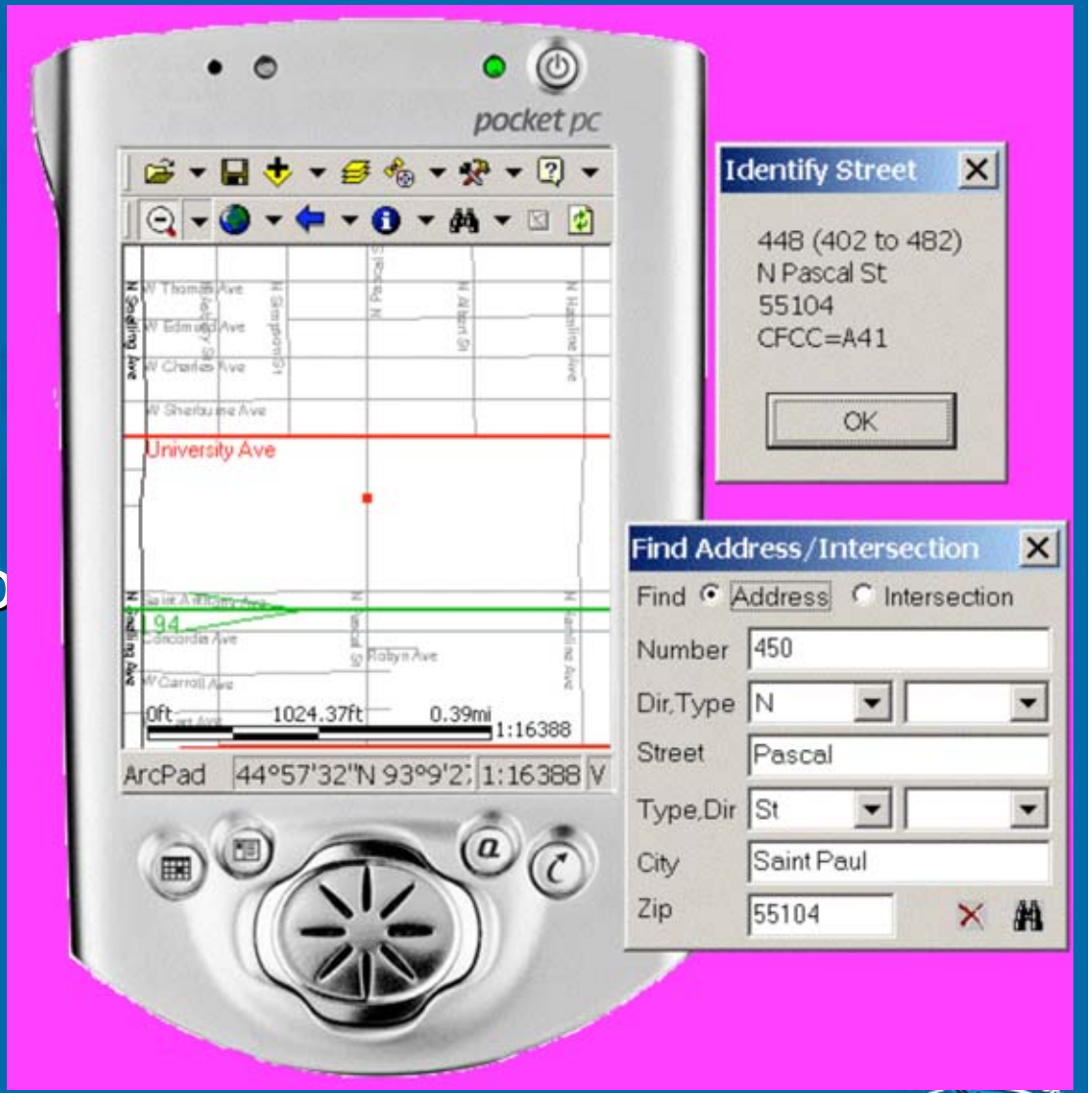


- Find GPS
  - A utility tool that automatically detects an active NMEA or TSIP GPS hooked to your computer or mobile.
  - Appears as menu choice in ArcPad.
  - Free download from ESRI ArcScripts http://arcscripts.esri.com/


pocket pc
Options...
Scale Bar
Panning Frame
Status Bar
Toolbars
Find GPS
0mi
1.5mi
3mi
1:127884
44°54'52.3"N 93°05'01. deg 1:127884
GPS
Find GPS Tool

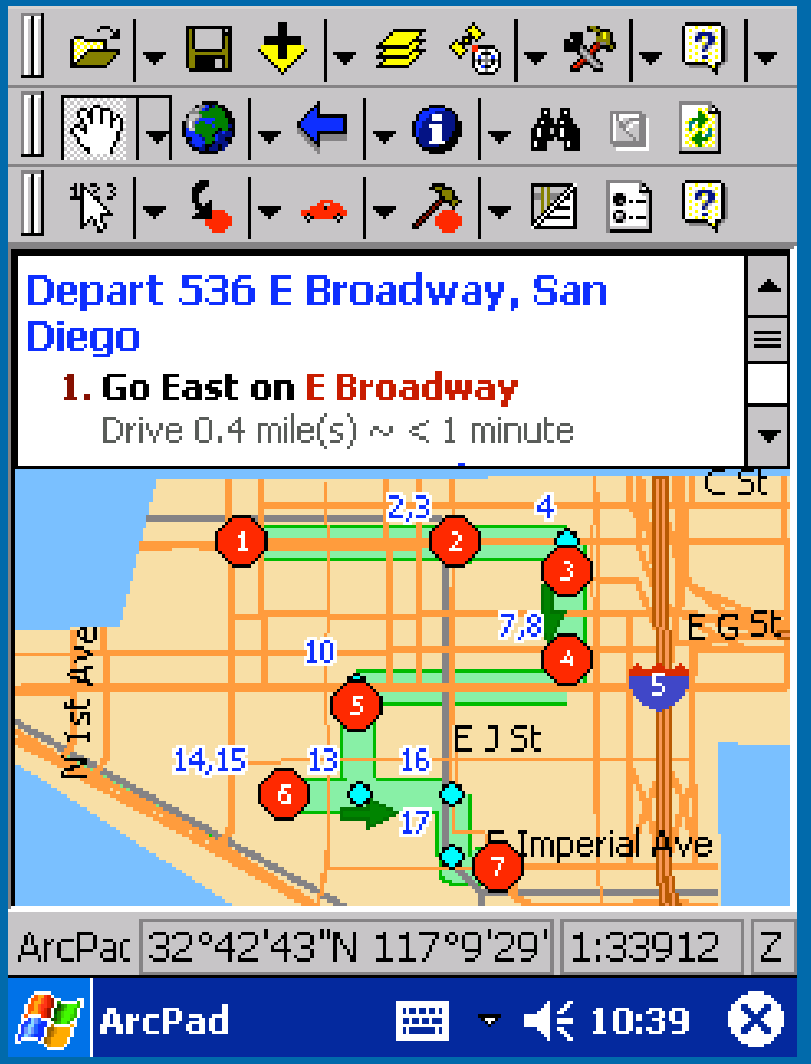
- EDGE Street Map (U.S. Street data by state)
  - Uses EDG street files like normal layers.
  - Draws street symbology and labels based on CFCC (road type) field.
  - Control or modify street symbology and labels based on CFCC field and map scale.
  - Free download from ESRI ArcScripts http://arcscripts.esri.com/

- Reverse geocode and display attributes.
- Geocode a location based on street address or intersection of two streets.
- Specialized data access for fast searches, pan and zoom.



- ArcPad Street Map (U.S. Street data by state)
  - Compressed data format support.
  - Newer data than EDGE. Data sets from:
    - GDT
    - Tele Atlas North America.
  - Data Selection and Extraction.
  - Preset quality map symbology.
  - Evaluation version available at http://www.esri.com/software/arcpad/stmap-downloads.html

- Geocoding.
- Reverse geocoding.
- Point to Point routing.
- Optimized routing.
- Create, delete and modify barriers, stops and pushpins.
- Driving directions.



Extension Advantages

- Flexible. Install only the extensions that you need to use.
- Optional install saves memory and storage. Core ArcPad uses less memory.
- Easier installation than VB script applications because there is usually only one DLL file.
- Faster than ArcPad VB script because it is compiled.

- As functional as ArcPad VB script because it can run ArcPad VB scripts and easily access the ArcPad Object Model (6.0.1).
- “Seamless integration” of new tools, data formats and devices into ArcPad.
- Third party developers can market their own ArcPad extensions.
- Every ArcPad user is potential customer of your extension.

Extension Disadvantages

- Steeper “learning curve” than ArcPad VB script
  - Some knowledge of ArcPad VB Script and ArcPad Object Model may be needed.
  - Microsoft Visual Studio
  - C or C++
  - Windows CE API
  - Windows API
  - ArcPad Extensions API

- May have to develop for multiple CPUs, while ArcPad VB script is device independent.
  - PC Multi-byte (WIN 9x)
  - PC Unicode (NT 4, WIN 2000, WIN XP)
  - Strong Arm and Xscale
  - MIPS
  - SH3
  - SH4
  - X86
- More software and hardware needed than ArcPad VB script development.

Hardware and Software Development Requirements

- A Windows PC
  - WIN 9X, XP, 2000, or NT 4.0
  - You can't do debug emulation on WIN 9x.
- One or more mobile devices
  - Strong Arm, Xscale, MIPS, SH3, SH4, X86
  - WIN CE 2.11, 2.12, or 3.0
- PC <-> Mobile Device connection
  - Serial, USB, Network
- Microsoft ActiveSync 3.1 or higher (free)

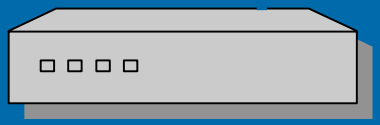
Direct
Connection

(Serial, USB)

Network

Connection

(Wire or Wireless)



- ArcPad Application Builder 6.0.1
- Microsoft Visual C++ 6.0
- Microsoft Embedded Visual Toolkit 3.0 (free)
- Windows CE H/PC Pro 2.11 Toolkit (free)
- ALLEGROFPC X86 2.11 Toolkit (free)

Extension Support

- Help File Documentation
- One year of support
- “Include” files to build extension
- User to User Forum

- Sample extensions
  - Utility sample
    - Pack DBF file (6.0.1)
  - Layer samples
    - Generate files (read only)
    - BNA files (read/write) (6.0.1)
  - GPS samples
    - SONY IPS1000 and IPS3000
    - NEMA0182
    - STF
  - Commented source code
  - Ready to build
    - Visual C++ 6.0 project files (PC platform)
    - Embedded Toolkit 3.0 project (all mobile device platforms)

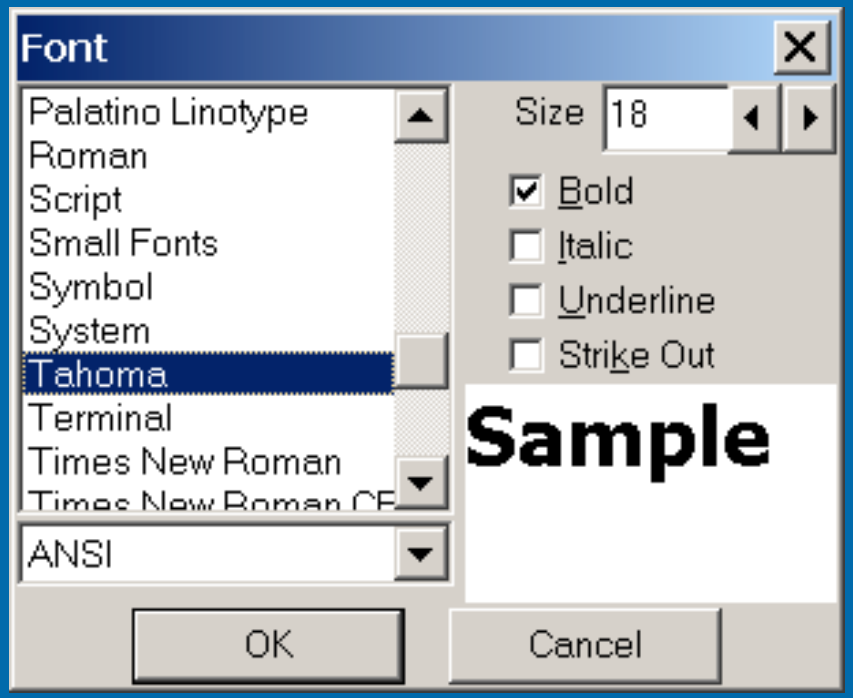
API Overview

- About forty API functions and about sixty helper functions
  - Many options and properties.
  - Some are required, but many optional.
  - You decide how much functionality your extension will have by which functions and properties you support and use.
  - Designed to be upward and downward compatible.

- Helper functions
  - Functions and macros provided by “ArcPad” to assist the extension developer.
  - Access to ArcPad’s object model (6.0.1)
  - Execute ArcPad scripts
  - Debugging functions
  - Text I/O functions
  - Point in polygon
  - Line in or passes through box
  - Box overlap
  - “On-the-fly” project and “unproject” coordinates
  - Map to screen coordinate transformation
  - Color picker
  - Font picker

Color Picker

Font Picker

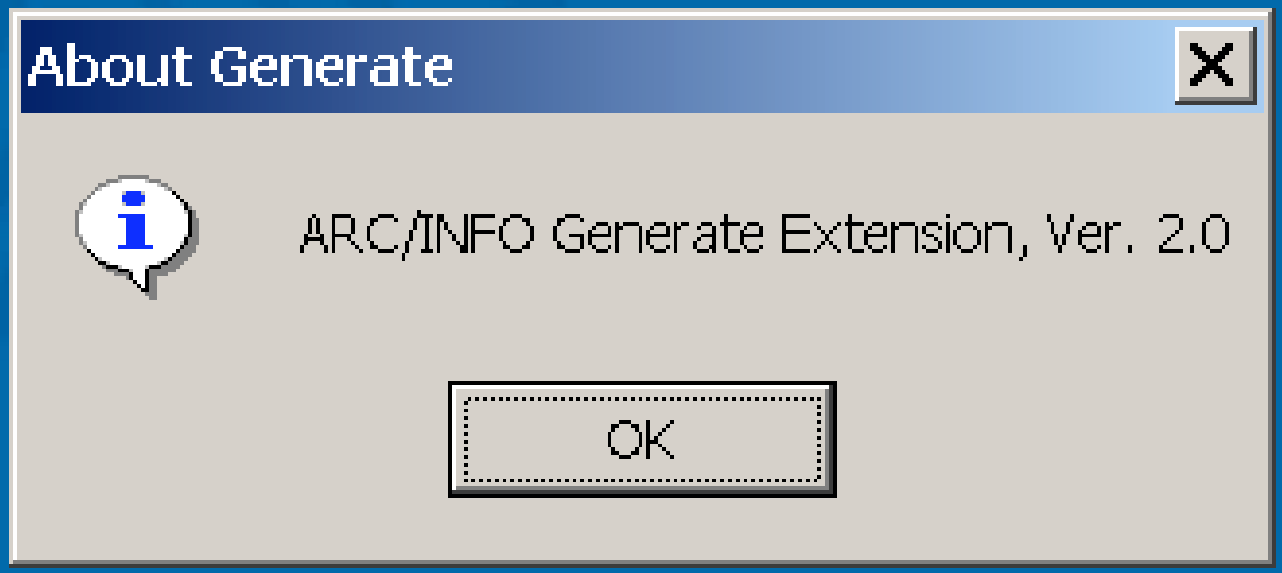


Common Functions

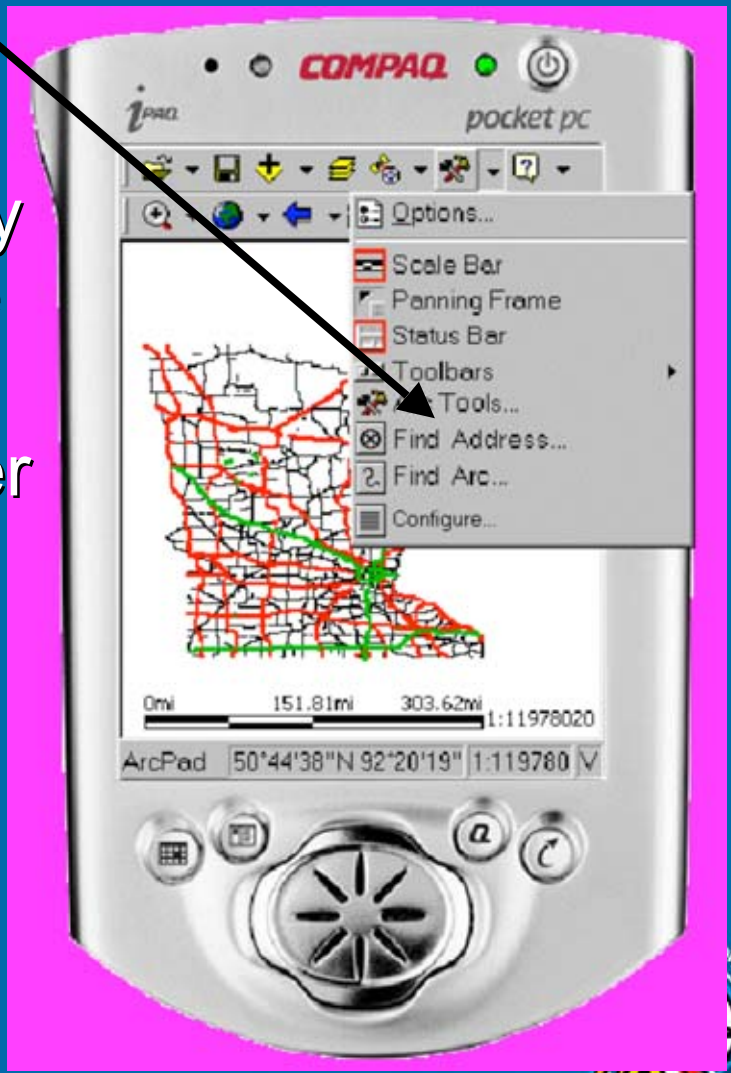
- APExInitialize
  - Invoked when ArcPad starts.
  - Do any internal initializations or resource allocation.
  - Specifies what type of extension.
    - Vector data
    - Raster data
    - GPS
    - Utility tool (6.0.1)
- APExTerminate
  - Invoked when ArcPad terminates.
  - Do any internal cleanup or resource de-allocation.

- APExGetProperty
  - Invoked by ArcPad to get properties (information) from the extension.
    - Extension name
    - Extension description
    - “Tool” information
  - Most properties are optional.
- APExSetProperty (6.0.1)
  - Invoked by ArcPad to set properties or inform the extension of an event.
    - GPS type and last position at GPS activation.
    - Current language locale.

- APExDialogAbout
  - Allows you to create your About dialog box for your extension.

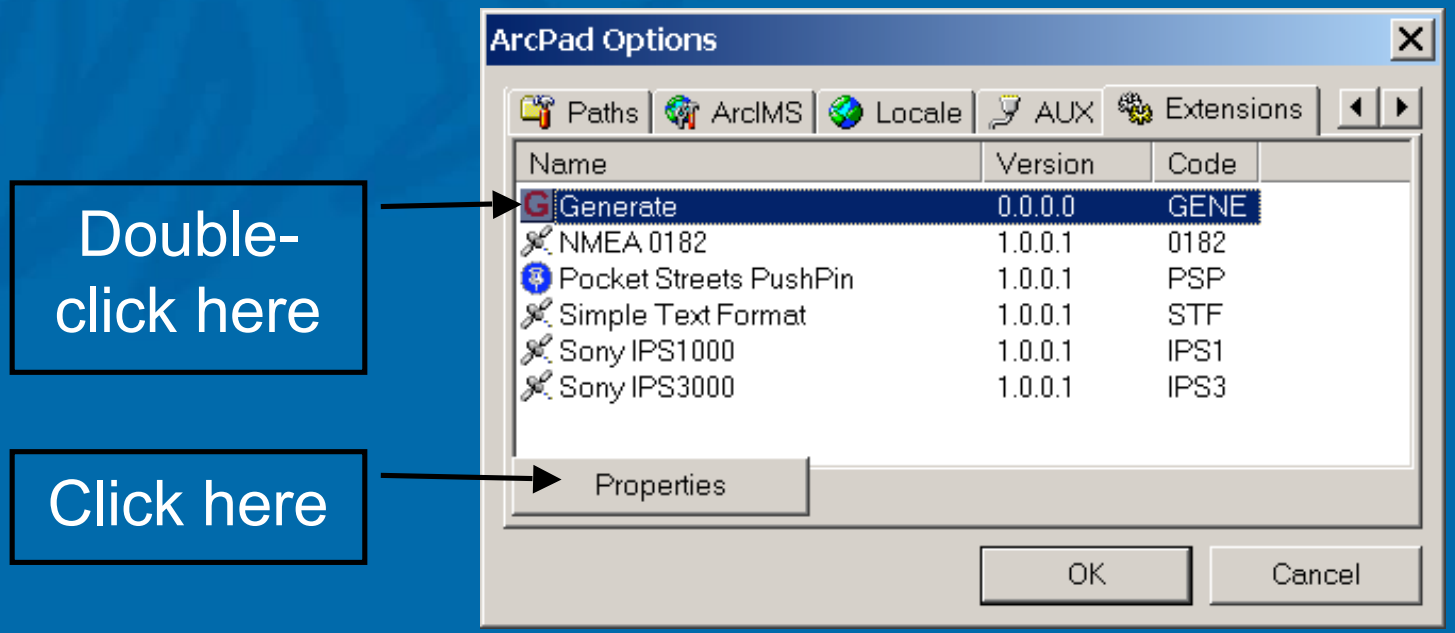


- APExTools
  - Add one or more choices to the ArcPad menus.
  - Add new functionality to ArcPad within the extension.
  - Can have utility, layer or GPS tools.
  - Invoked after user picks menu choice and optional layer.



- SendMessage
  - Send Windows messages to other programs.
  - Send Windows messages to ArcPad from extension or other programs.
  - Send ArcPad VB scripts to ArcPad using WM_COPYDATA message.
    - Access scripting object model.
    - Execute VB script commands.
  - Send strings to GPS device or AUX port.
    - Send initialization strings to GPS or AUX port.
    - Send special commands to GPS or AUX port.

- APExDialogProperties
  - Allows you to create your own dialog box to edit additional information about the extension (i.e., extension configuration data)
  - Invoked from Options dialog box clicking the Properties button.



- APExGetObjectProperty (6.0.1)
- APExSetObjectProperty (6.0.1)
  - Create your own extension properties.
  - Accessible by ArcPad VB script applets to get or set the properties of the extension.
  - Accessed by the ExProperties property of the Extension object.
  - Can be used to pass information back and forth between applet and extension.
  - The extension developer decides the name of properties, the value of the properties and what they do.

- APExEscape
  - Create your own extension methods.
  - Called by ArcPad VB script applets to execute functions in the extension.
  - Executed by the Escape method of the Extension object.
  - Can pass parameters and return a value.
  - Can be used to do functions that can't be done in VB Script or the applet.
  - Can be used to do resource intensive operations in the extension for the applet.
  - The extension developer decides what this function will do.

GPS and AUX Functions

- The GPS and AUX routines provide access to GPS or other AUX devices so you can add support for these devices in ArcPad.
- Three different mutually ways to access GPS device.

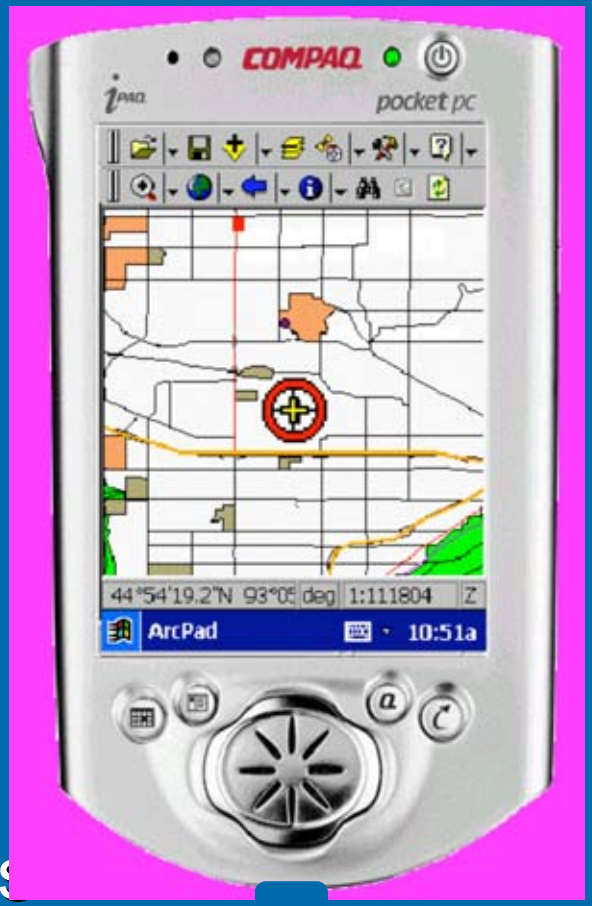
- APExPreTranslateNMEA
  - Invoked when NMEA message received from serial port.
  - Filter and extract information NMEA messages for enhanced device support.
- GPSOpen
  - Invoked when GPS port is opened.
  - ArcPad controls port I/O and calls your extension functions when data available.
- GPSOpenEx
  - Invoked when GPS port needs to be opened.
  - Your extension controls threaded port I/O. You tell ArcPad when data is available (WM_ARCPAD_GPSRXREADY).

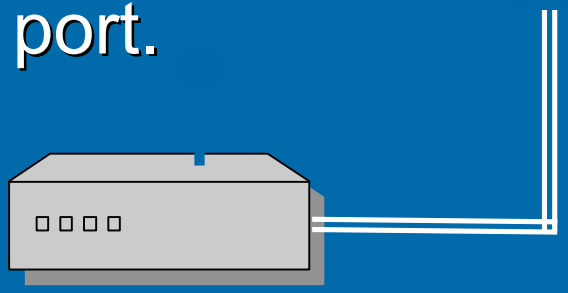
- GPSClose
  - Invoked when device is closed (GPSOpen).
  - Invoked when device needs to be closed (GPSOpenEX).
- GPSWrite (6.0.1)
  - Invoked when ArcPad needs to write data to GPS port (GPSOpenEx).

- GPSParse
  - Invoked by ArcPad when “raw device” message (data) is ready and needs to be parsed.
  - Assumes message ends with LF.
  - Parsed data passed back to ArcPad via “Instrument” structure.
    - *x,y,z* coordinates
    - Status
    - PDOP
    - SOG
    - COG
    - Other device data

- GPSRxHandler
  - An optional prefilter for GPSParse (GPSOpen).
  - Useful for handling non-LF device data.
  - Examines and modifies data from device before GPSParse.
  - Receives data from device as it is received. Message may be incomplete.
  - Indicates when data is ready for GPSParse to receive.
- GPSPoll
  - An optional function called at “timed” intervals to request data from device (GPSOpen).

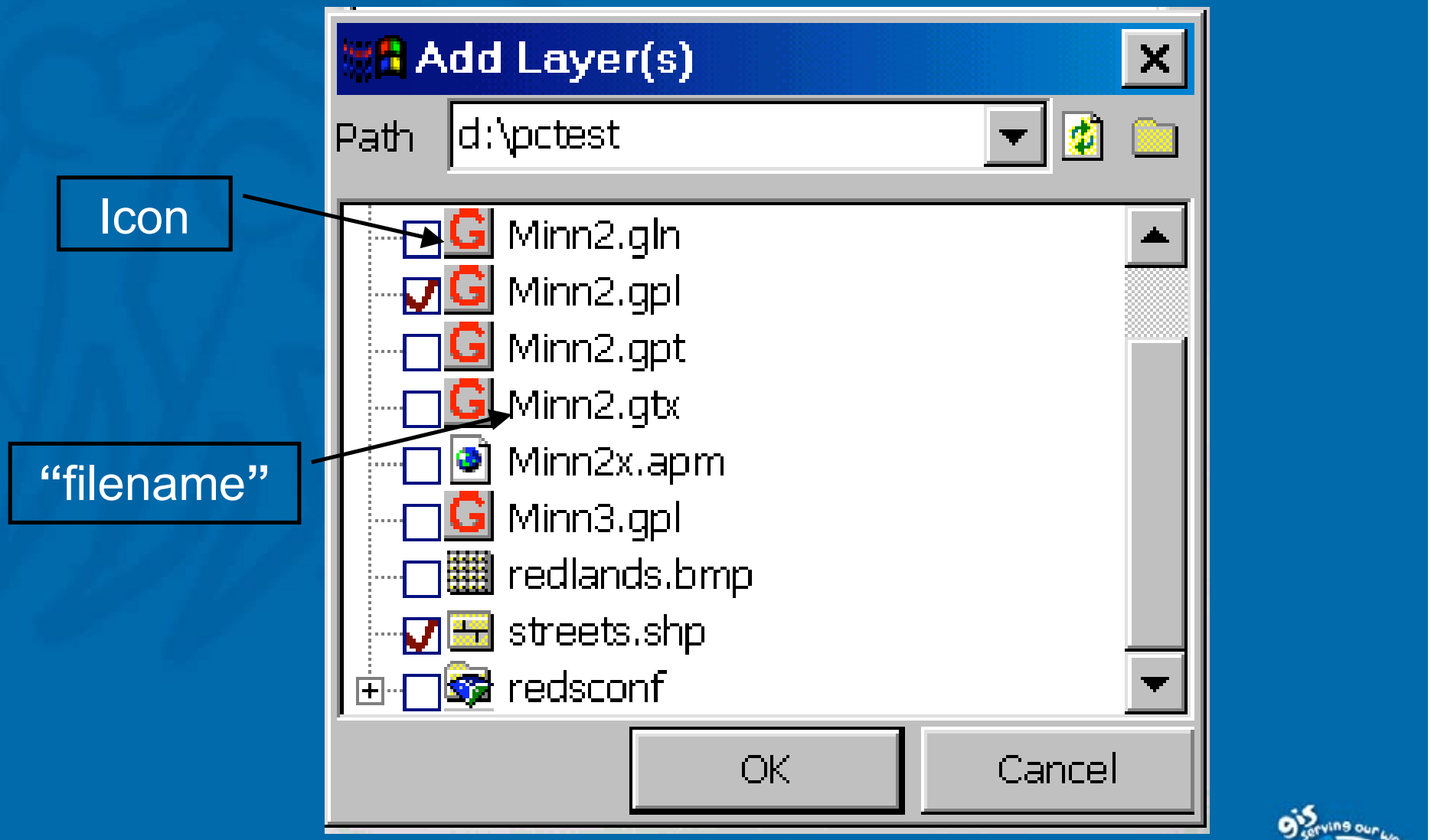
- AUXOpen
- AUXCLose
- AUXParse
- AUXRxHandler
  - Invoked when AUX port is opened or closed or data is available for processing.
  - Allows real-time tracking of data read from devices attached to AUX port.





Layer Functions

- LayerIsValidPath (filename)
  - Invoked during “Add Layer” for project.
  - Return TRUE if “filename” is a layer “supported” by this extension.
  - “Supported” layers automatically added to the “Add Layer” list box for user selection.
  - You can also supply an icon.

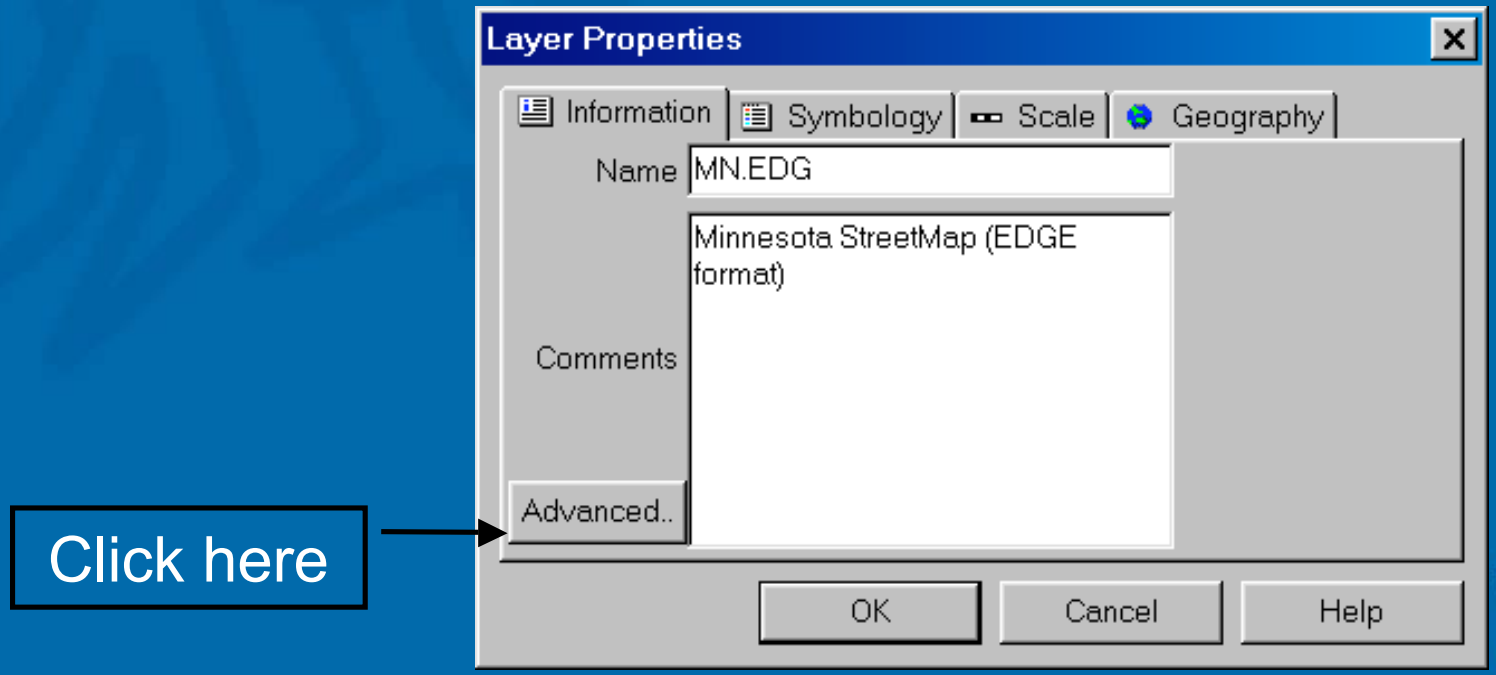

Add Layer(s)
Path
d:\pctest
Minn2.gln
Minn2.gpl
Minn2.gpt
Minn2.gtx
Minn2x.apm
Minn3.gpl
redlands.bmp
streets.shp
redsconf
OK
Cancel
Icon
"filename"

- LayerOpen
  - Invoked when a layer file is to be opened for use.
  - Prepares layer file for reading.
  - Calculates extent of layer.
  - Allocates any resources needed by layer.
- LayerClose
  - Invoked to close an open layer.
  - De-allocates any resources allocated during LayerOpen.

- LayerGetProperty
  - Invoked by ArcPad to get different properties about a layer or a layer feature.
    - Layer Types
      - Normal, Reprojectable, AUX, dynamic and editable (6.0.1).
    - Layer Description
    - Layer and feature extents
    - Layer field information
    - Symbology information
    - Projection information
    - Layer Editing information (6.0.1)
    - Geometry for feature editing (6.0.1)
  - Most properties are optional.

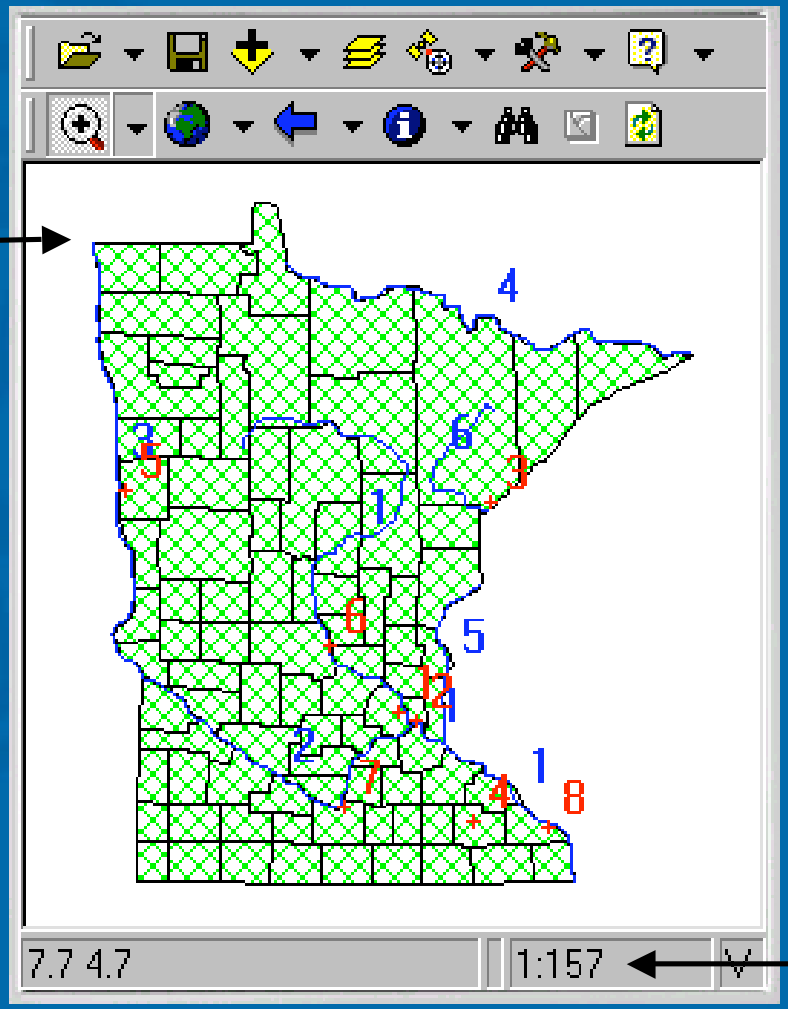
- LayerSetProperty
  - Invoked by ArcPad to set different properties about a layer or layer feature.
    - Symbology information
    - Feature geometry after editing (6.0.1)
    - Editing status (6.0.1)

- LayerDialogProperties
  - Invoked when user pushes “Advanced” button on Layer Information Dialog.
  - Allows you to create your own dialog box to edit additional information about the layer (i.e., layer configuration data).



- LayerDraw
  - Invoked to draw the layer on the ArcPad screen.
  - Passes the following information
    - Window handle (HWND)
    - Window device contexts (HDC)
    - Map scale
    - Map extent of area to draw
    - Extent (size) of window (device units)

HWND, HDC

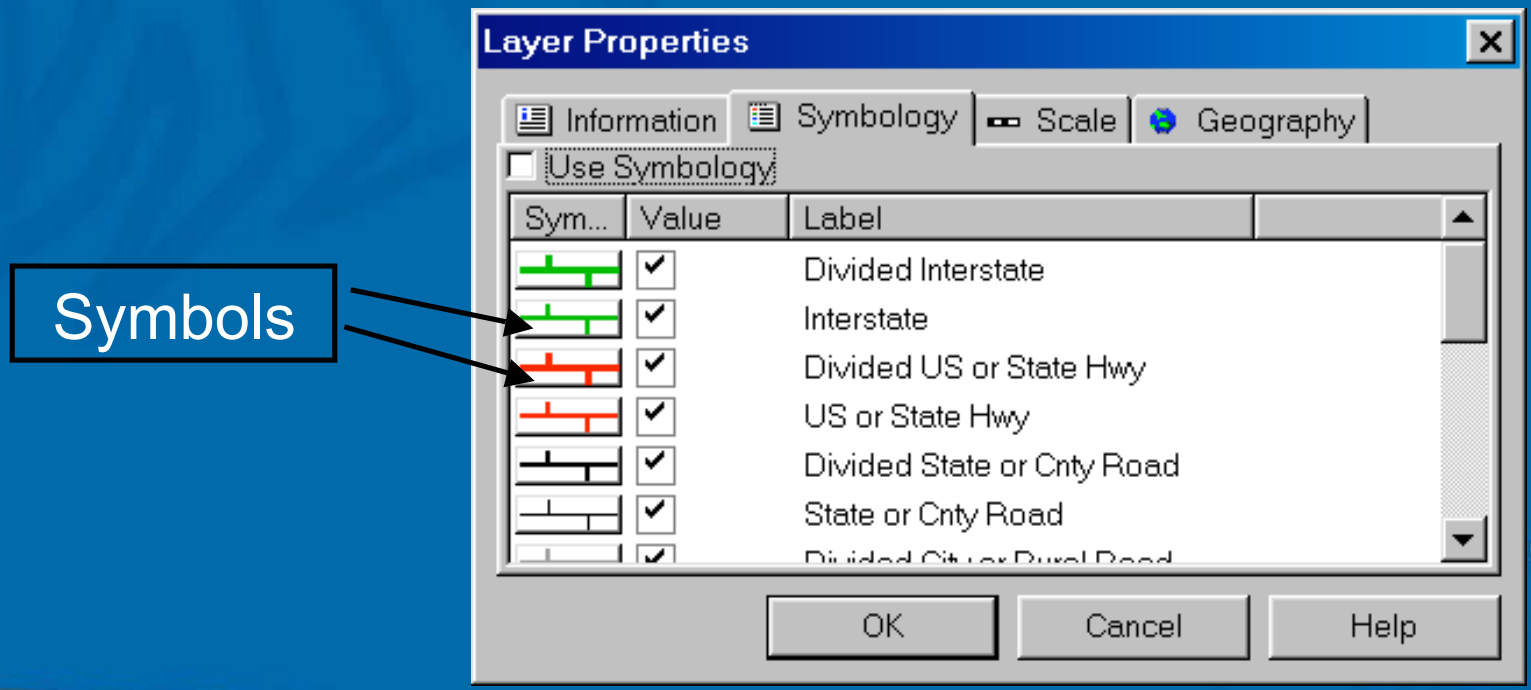


Y Extent and Size

Map Scale

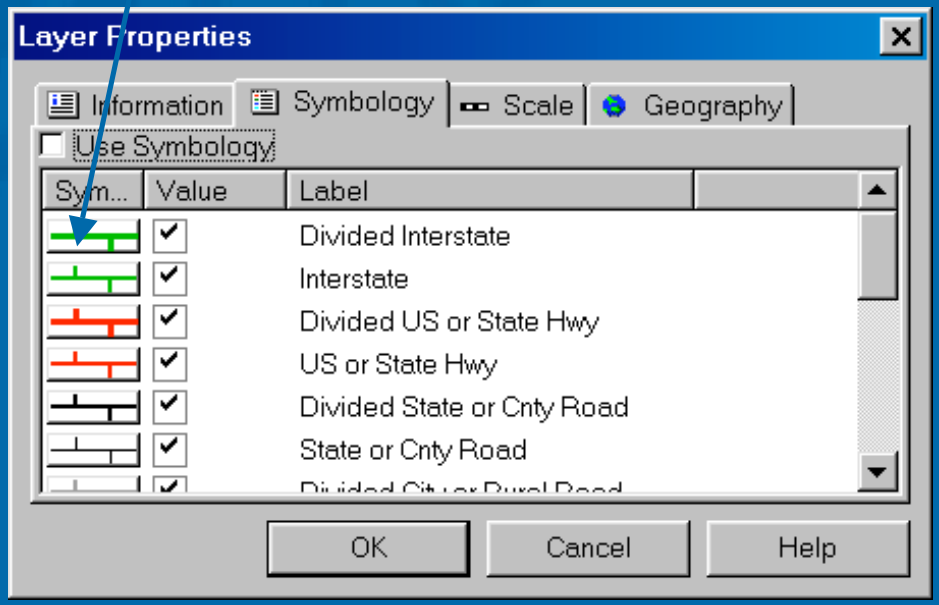
X Extent and Size

- LayerDrawSymbol
  - Invoked to draw a “sample” symbol on the symbology dialog box.
  - Allows turning on/off of certain types of symbols and text of the layer.
  - Used with LayerDraw to draw symbology.

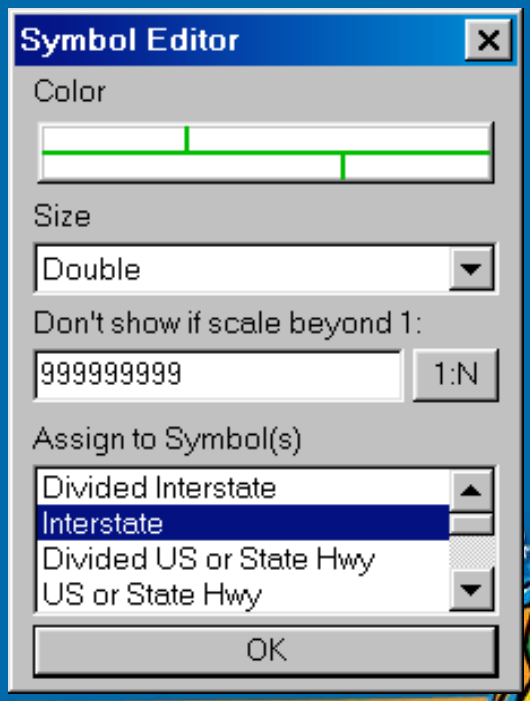


- LayerDialogSymbol
  - Allows you to provide your own dialog box to edit symbology.
  - Invoked when user clicks on symbol.
  - Used with LayerDraw to draw symbology.

Click here



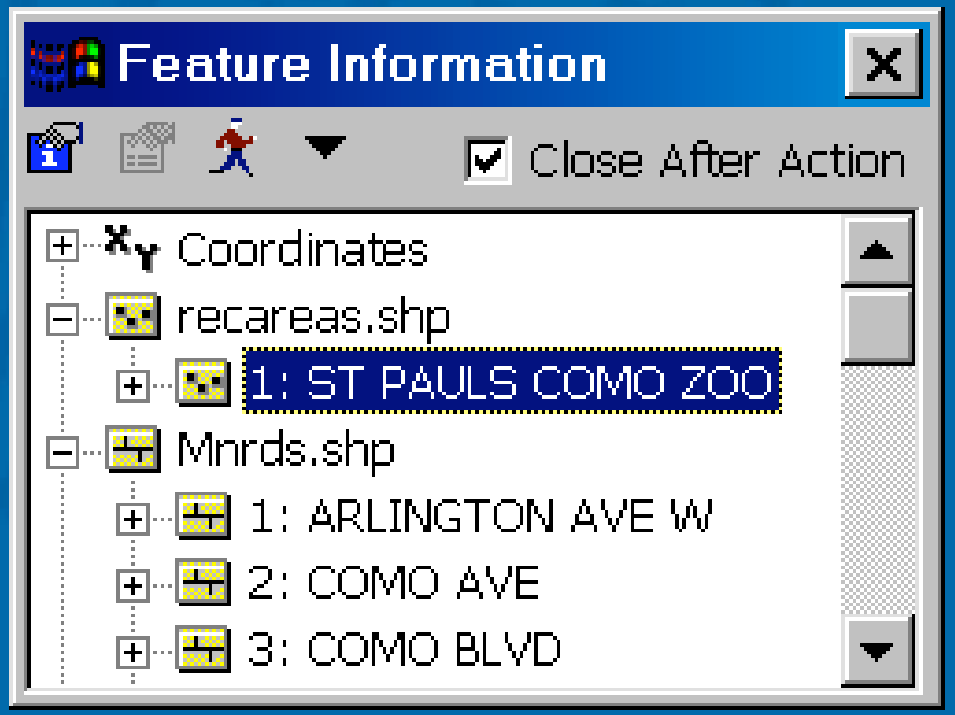
Symbol dialog box

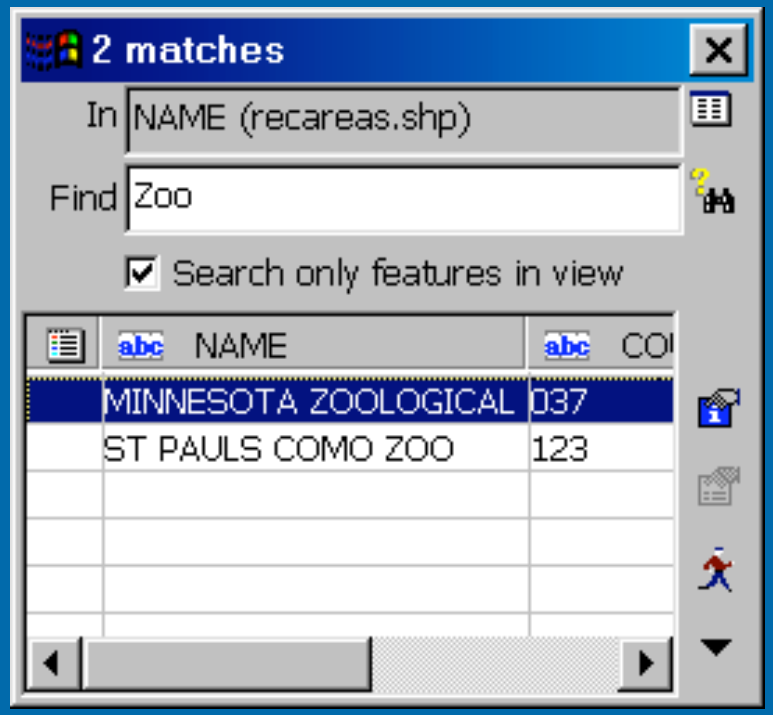


- LayerQuery
  - Provides “query” (search) functionality via ArcPad interface and dialog boxes.
    - Advanced Select
    - Find
    - Hyperlink
    - Identify
  - Invoked once for each feature in layer.
  - Indicate if next feature is inside a specified area (box).

Advanced Select

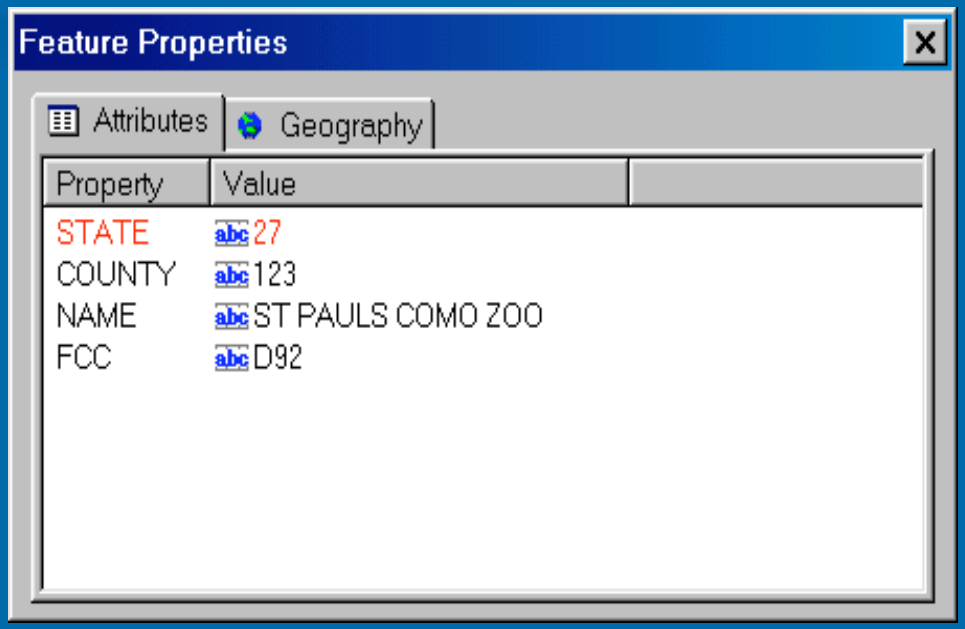
Find





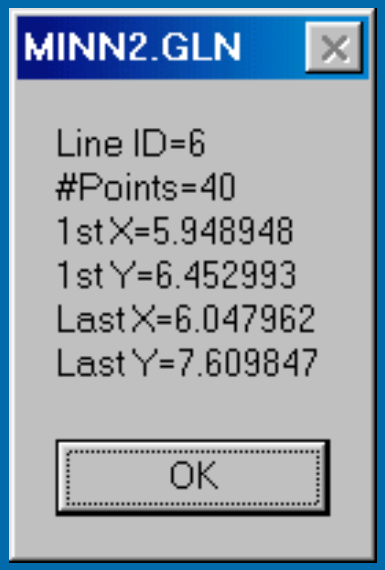
Hyperlink

Identify



- LayerDialogIdentify
- LayerDialogHyperlink
  - Invoked when Identify or Hyperlink buttons pushed.
  - Allows you to provide your own dialog box and functionality for these buttons.
  - Overrides LayerQuery, if present.

User defined Identify



- LayerSaveProperty
  - Invoked just before layer is closed
  - Used to pass optional strings of data (“name=value”) back to ArcPad that will be permanently saved with the project
  - Invoked until you indicate there are no more strings to save
- LayerLoadProperty
  - Invoked just after layer is opened
  - Invoked for each string of data that was saved by LayerSaveProperty

- Editing Functions (6.0.1)
  - LayerCreate
    - Invoked to create a new layer.
  - LayerDialogFeature
    - Invoked just when attribute data needs to be displayed (identify), created or edited.
  - LayerDeleteFeature
    - Invoked to delete a particular feature.
  - LayerCreateFeature
    - Invoked to create a new feature.

Extension Questions