



Programming & Design Patterns for ArcPad

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<http://arcpadteam.blogspot.com/>



Wednesday, March 25th

7:30 AM–6:00 PM

Community Center
Primrose Lobby, PSCC

8:30 AM–10:00 AM

Keynote Session
Oasis 4, PSCC

10:00 AM–4:30 PM

ESRI Showcase
Oasis 1, PSCC

10:30 AM–5:45 PM

Technical Sessions

12 Noon–1:00 PM

Hosted Lunch
Oasis 2 & East Lawn, PSCC

6:00 PM–9:00 PM

DevSummit Party
Oasis 2 & 3, PSCC

Demo Theater Presentations—ESRI Showcase

Oasis 1, PSCC

10:00 AM–11:00 AM

Using Application Configurations to Roll Out a Customized ArcGIS Explorer 900 Experience

11:00 AM–12:00 PM

Extending, Customizing, and Implementing the Situational Awareness Bundle

12:00 PM–1:00 PM

Geometric Networks for Developers

1:00 PM–2:00 PM

Performing Network Analysis with Geoprocessing

2:00 PM–3:00 PM

Developing Applications for ArcGIS for AutoCAD

3:00 PM–4:00 PM

Integrating Microsoft Silverlight with the Web ADF

4:00 PM–5:00 PM

Leverage Dynamic Display in ArcGIS Engine Applications

Meet the Teams—ESRI Showcase

Oasis 1, PSCC

10:30 AM	Geodatabase / Editing
11:00 AM	Network and Logistics
11:30 AM	ArcGIS Engine Controls
12:00 PM	ArcGIS Online
12:30 PM	ArcGIS Mobile
3:00 PM	CAD
4:00 PM	Raster

6 PM–7 PM during the DevSummit Party in Oasis 2 & 3

Java (ArcGIS Server and Engine)

ArcGIS Server JavaScript and Flex

ArcGIS Server .NET ADF and Silverlight

User Presentations—ESRI Showcase

Oasis 1, PSCC

10:00 AM–10:45 AM

**Using OpenLayers with ArcGIS
Server REST API**

11:00 AM–11:45 AM

**Building ArcGIS Mobile Applications with
the WPF Composite Application Library**

12:00 PM–12:45 PM

Harnessing Server Object Extensions

1:00 PM–1:45 PM

**Print & Legend Web Services for
the ArcGIS JS API or WebADF**

2:00 PM–2:45 PM

**Flex, REST, WMS and Distributed
Processing for Economic Development**

3:00 PM–3:45 PM

**Implementing a Custom Image
Server Raster Format**

4:00 PM–4:45 PM

Intro to Agile Software Development

Don't forget to complete your Postsummit Survey.

Completed surveys may be returned to the registration desk, or any evaluation drop box.



Programming & Design Patterns for ArcPad

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Please!
*Turn **OFF** cell phones
and paging devices*



If you're leaving today, please complete your **Postsummit Survey** and return it to the registration desk or any evaluation drop box.

Agenda

- ArcPad 8 Highlights
- Quick introduction into ArcPad customization
- Development Tools
- Forms & Scripting
- ArcPad + ArcGIS Server
- AXF and Geodatabase
- Application Dissections

- What's ahead

<http://arcpadteam.blogspot.com/>

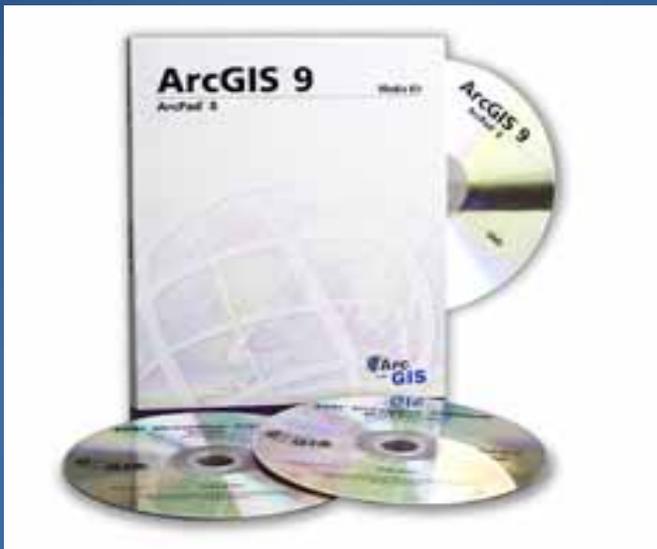
- *Extra slides include in presentation deck*



Feel free to ask questions anytime

ArcPad 8

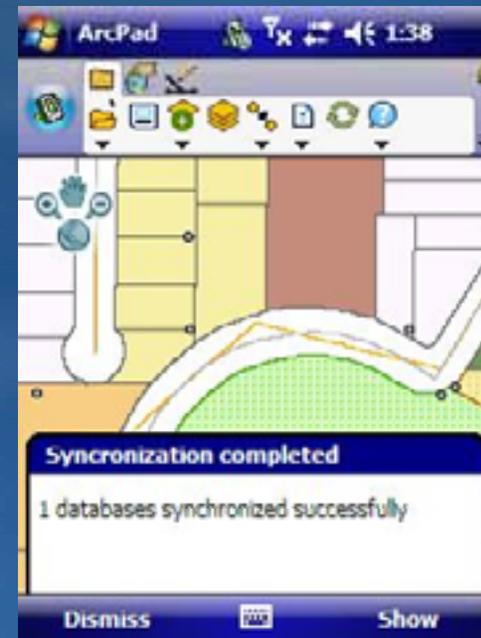
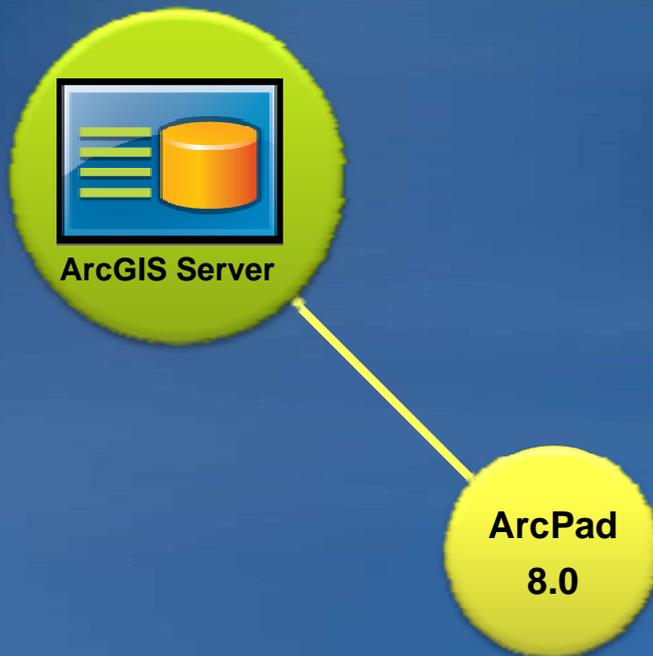
- Released to production
- Shipping on April 7th, 2009



ArcPad 8 Highlights

ArcGIS Server ArcPad Extension

- Synchronize ArcPad field edits directly with ArcGIS Server



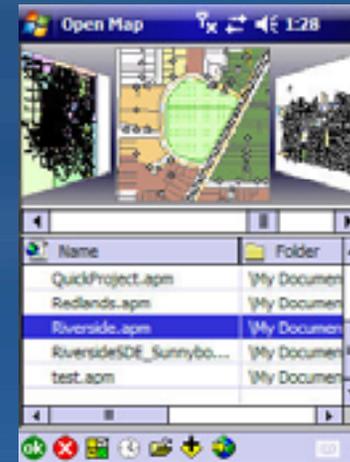
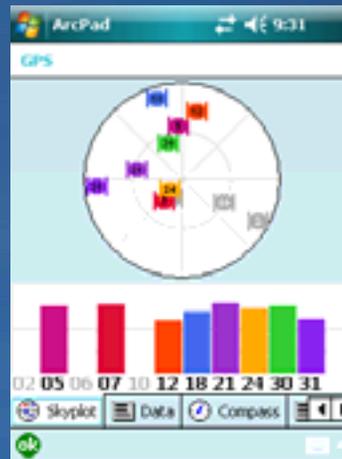
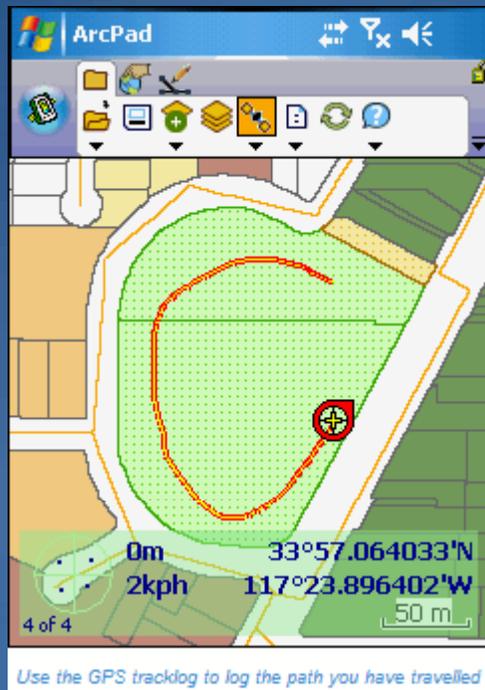
Connecting the field to the enterprise...

...Delivering accuracy, currency, and productivity to the Enterprise

ArcPad 8 Highlights

A new modern user interface

- New Dynamic Toolbars
- Improved GPS User Interface

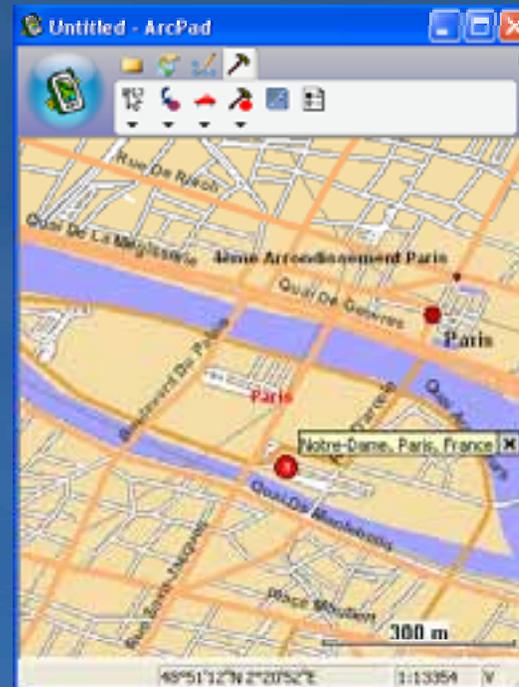


Makes it easier to use and access critical information...

ArcPad 8 Highlights

Improved Streetmap extension

- Provides an easier method to find addresses and locations
- Ships with Streetmap Premium dataset for North America and Europe



makes it easier to enter and find location information ...

ArcPad 8 Highlights

Includes ArcPad Studio and becomes maintenance based

- **ArcPad and ArcPad Application Builder are combined into one single product**
 - Every license of ArcPad will now include a copy of ArcPad Studio
- **ArcPad 8 is a maintenance based product**
 - Comes with one year maintenance that includes software updates, technical support, and other benefits



Maintenance

Makes ArcPad more consistent with other ESRI products

ARCPAD PLATFORM CHOICE

What Platform Should I Develop For – Does it Matter?

Windows



Windows Mobile



DEVELOPMENT IN ARCPAD

What can I customize?

- **User interface (toolbars, dialogs)**
- **Create additional tools/functionality**
- **Enforce data integrity**
- **Create templates for data consistency**
- **Combine common tasks**
- **New data formats, protocols, projections, datum transformations, and devices**
- **Automate workflow with Geoprocessing**
- **Enhance desktop tools and workflows with ArcObjects**

Main Customisation Areas

- **Default ArcPad Environment**
 - My ArcPad/ArcPad.apx
- **Applets**
 - Adds functionality to ArcPad environments
 - Usually consists of at least a custom toolbar + scripts
- **Data Specific Customisation**
 - Symbology, Forms, Scripts
 - Deployed with Data
 - Imbedded in data files if using AXF
 - Associated with data files if using Shapefiles

Development Tools and Environments

- **ArcPad Data Manager (ArcMap)**
 - Data preparation and packaging for deployment
- **Toolbar Manager**
 - Simple toolbar re-configuration
- **ArcPad Studio**
 - Main development environment
 - Creating applets and forms
 - Editing scripts
 - Work with AXF data
 - View schema and table contents
 - Run SQL commands
- **ArcGIS Toolbox**
 - Developing automated workflows
- **Visual Studio**
 - Extension development in C++
 - External forms development with .NET
 - ArcObjects – Customised workflows and tools

DESKTOP TOOLS

ArcPad Data Manager

- **Prepare Data Content**
- **Combine Updated Data with Customisation**
 - Use previously customised project as template
- **Configure for deployment environment**
 - Desktop orientated
 - Geoprocessing
 - ArcGIS Server publication
- **Package Data for Deployment**
 - Ready to deploy .CAB & .ZIP files



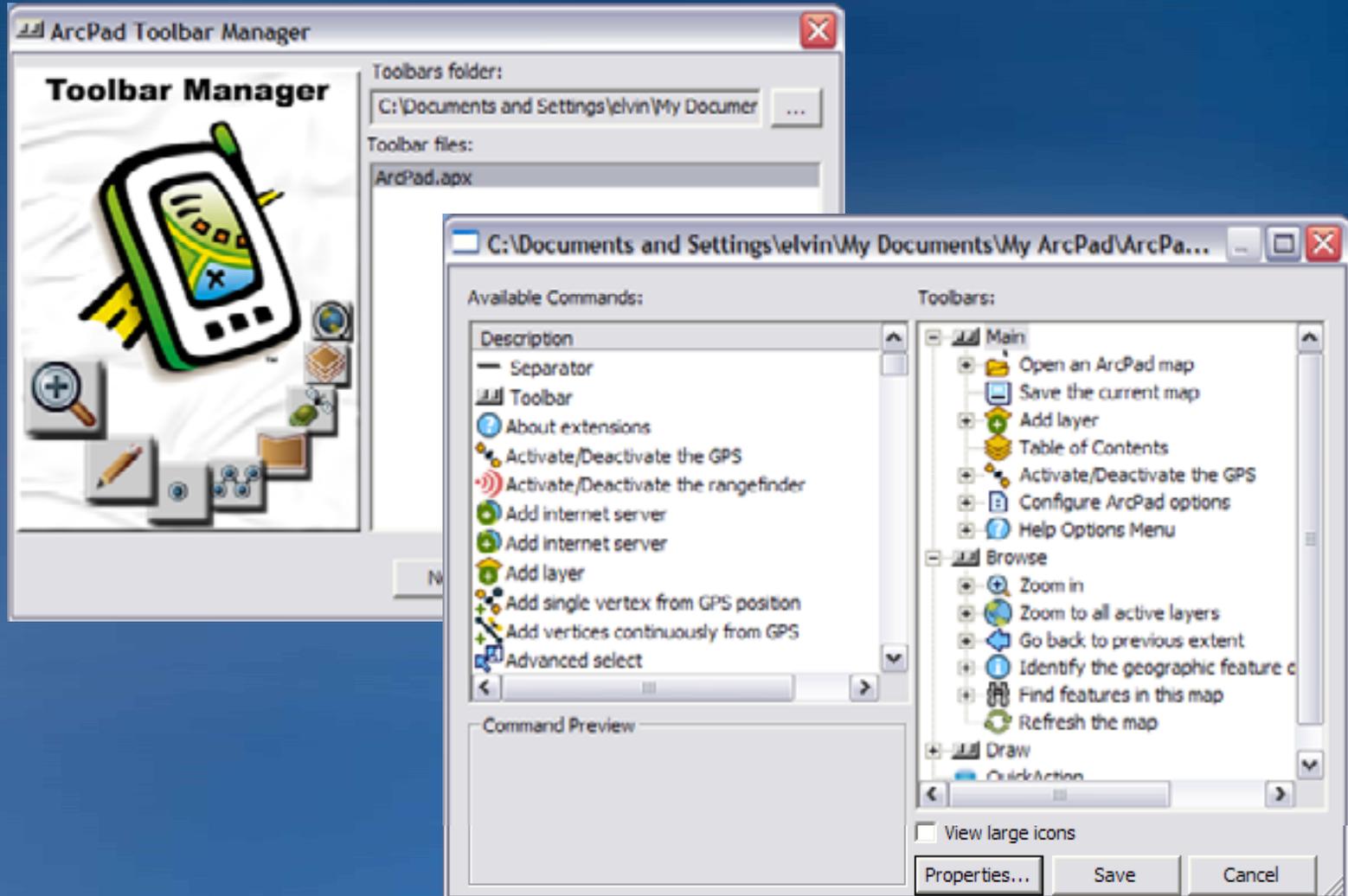
THE NEW TOOLBARS

Toolbar customisation

- Built in toolbars replaced with default toolbars
 - Default toolbars configuration in My ArcPad\ArcPad.apx
- Keyboard operable
- Higher resolution .ICO format icons
 - 16x16 and 32x32 pixels
 - More colors, including alpha blending
 - Standard icons can be replaced
 - Pre ArcPad 8 icons in 'Icons' folder
- **Tip: Delete ArcPad.apx to restore default toolbar configuration**



Toolbar Manager



FORMS DEVELOPMENT

Creating Forms

- ArcPad Data Manager automatically creates a “QuickForm” style form when preparing data

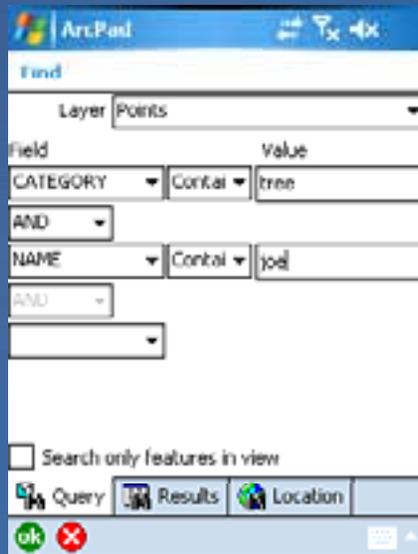


- Customise default data forms in ArcPad Studio
 - Change layout
 - Add/remove fields
 - Add scripts for specialized behaviour and validation
- Add additional forms
 - Login user
 - Query forms for workorders/taskings

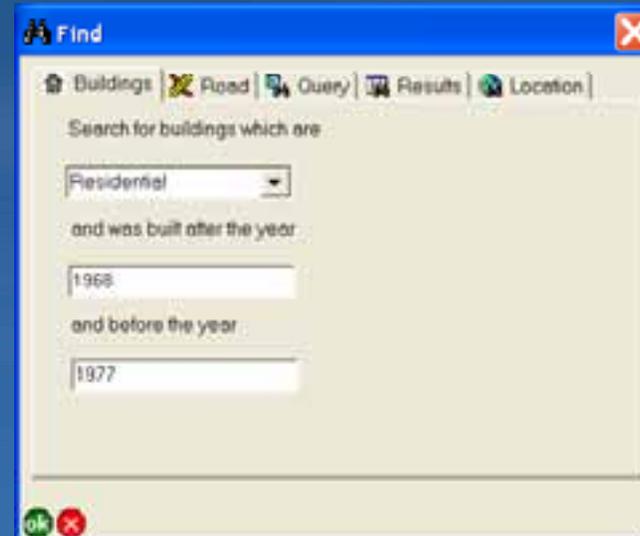
QueryForms

- Query values and operators template
- Automatically loaded into Find dialog when layer is loaded
- Become especially useful in ArcGIS environments
 - Create live workorders/taskings searches

Query Builder



Find dialog with query forms

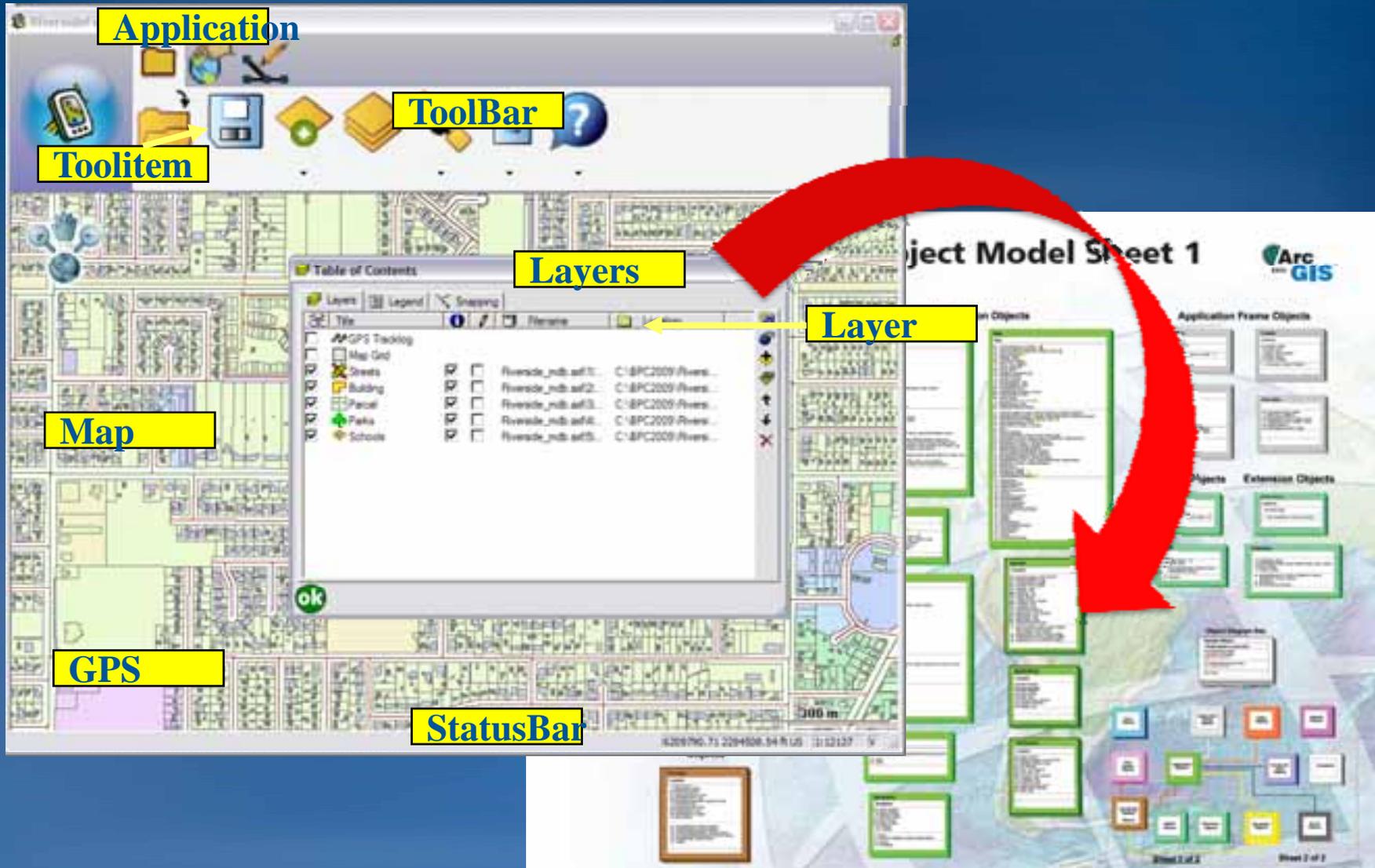


SCRIPTING

Scripting

- **Event Driven Environment**
 - **User Interface Events**
 - Toolbars
 - Map Actions
 - Forms
 - **System Events**
 - GPS
 - Timers
 - State Changes
- **Language Choices**
 - VBScript
 - Jscript
 - Others possible but not commonly used

Common ArcPad Objects in the UI

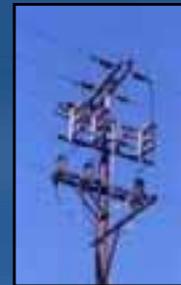
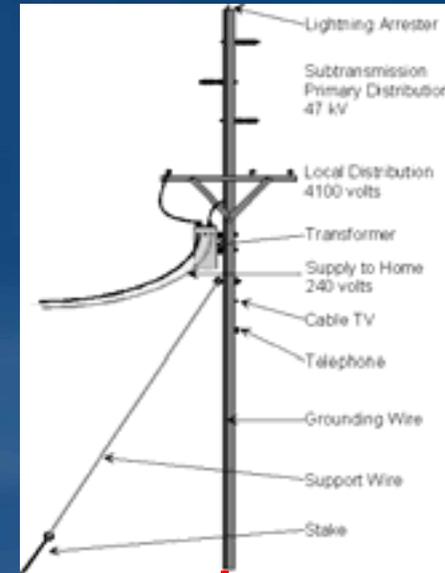


AXF

A “*LIGHTWEIGHT GEODATABASE*”

Geodatabase requirements for the field (*You keep asking us for this!*)

- 1 to many relationships
 - Each feature can support multiple sets of attributes in separate tables
- Geodatabase attribute rules supported in data rather than forms
 - Easier to create forms
 - Don't need to use scripts to manage relationships
- Geodatabase subtypes



PoleID	Type	Built
123	Wood	8-Oct-99
124	Steel	5-Jul-87
125	Wood	7-Jun-99

PoleID	Insulator #	Type
123	1	200kv
123	2	400kv
123	3	200kv



PoleID	Insulator#	Inspector	Date
123	1	Jian	1-Jan-00
123	1	Elvin	5-Feb-04
123	1	Craig	10-Jun-06

AXF – What is it?

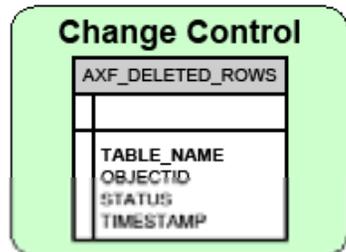
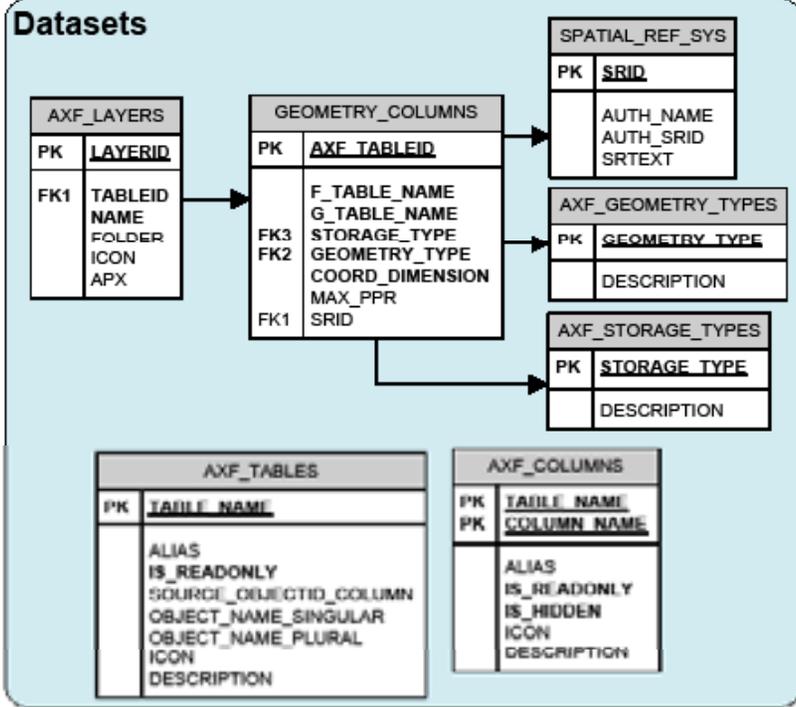
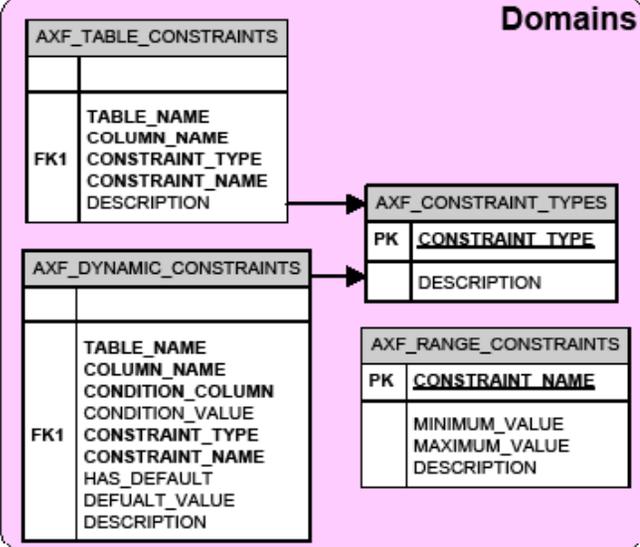
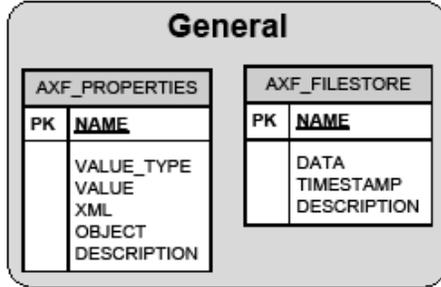
- A “Lightweight Geodatabase”
- Built on top of Microsoft SQL Server Compact Edition
 - A fully fledged mobile SQL database supported on both Windows and Windows Mobile platforms (same file format)
 - .AXF files are SQL Server Compact databases
- Simplistic analogy is ‘shapefiles’ in a database
- Created using :
 - ArcPad Data Manager (ArcMap)
 - ArcPad Geoprocessing Tools (ArcToolbox)

AXF and Geodatabase

Geodatabase		AXF
Feature Classes	POLES	Table
Feature Geometry	[Geometry]	GEOMETRY_COLUMNS entry 'BLOB' type column in feature table
Coded Value Domains	MATERIAL: Wood, Concrete, Steel	A table linked to with a foreign key relationship
Range Domains	DIAMETER: 6 to 12	A check constraint ArcPad determines check constraints by reading the AXF Information Schema
Sub types	PURPOSE: Telephone, Power, Multipurpose	Additional table linked to with multi key foreign key relationship
Relationship	POLES have INSULATORS	Additional table for each relationship linked to parent via foreign key
Spatial Reference	WGS 1984	Entry in SPATIAL_REF_SYS table with foreign key relationship to feature table

AXF Schema

AXF ArcPad 7.1 System Tables



SAMPLE APPLICATION “PROPERTY CENSUS”

Enhancing Forms using Scripts+AXF+SQL

- **Our example : Editing related tables**
- **Project :**
 - **Property Census**
 - **Edit existing property feature attribute (not creating features)**
 - **Add/edit related data to a property**
 - **Multi dwelling information**
 - **Use a simple 2 page for data input**
 - **Page 1: Property details**
 - **Page 2: Related dwelling information (1-Many)**

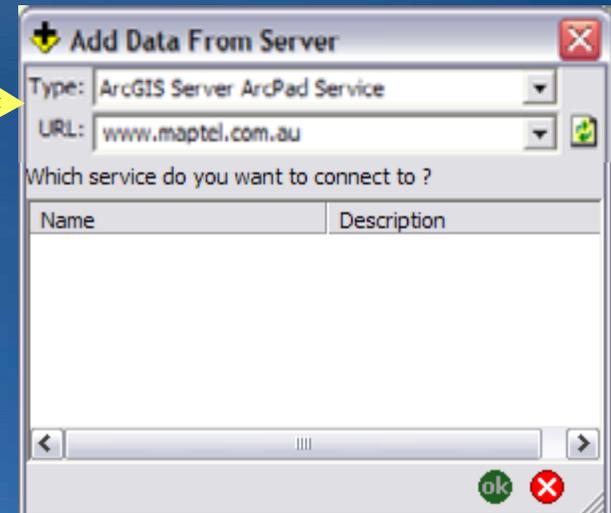
ARCPAD + ARCGIS SERVER

Enabling your application for ArcGIS Server

- Easy 😊
- Use ArcPad Data Manager to “Author Project for ArcGIS Server”
- “Subscribe” to a ArcGIS Service from within ArcPad



- Use ArcPad
- Synchronize



**REAL WORLD APPLICATION
“VICTORIAN BUSHFIRE
DISASTER REPOSE”**

The Disaster



Victorian Bushfires Disaster Response

- Search all properties with bushfire disaster
- Seek out all locations where shelter from fire may have been sought
- Document property damage and collect exhibits locations with forms and photographs
- Real time progress and information feedback
- 5781 Properties Searched using paper and electronic methods
- 1539 properties searched electronically with wireless connectivity direct to central server
- 9600 Georeferenced photographs

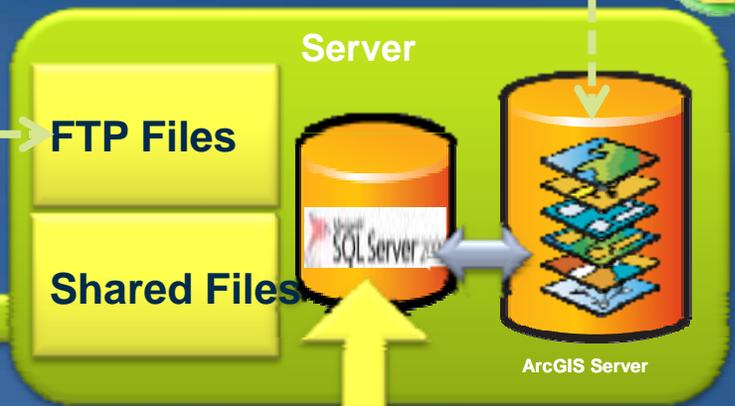


VicFires 2009 Disaster Response Data Processing System

ArcPad Field
Devices
Synchronizing
Directly
With Server

Command Post
Workstations

GPS Cameras



Server
Console

GIS
Workstation
s
Using
ArcGIS
Desktop

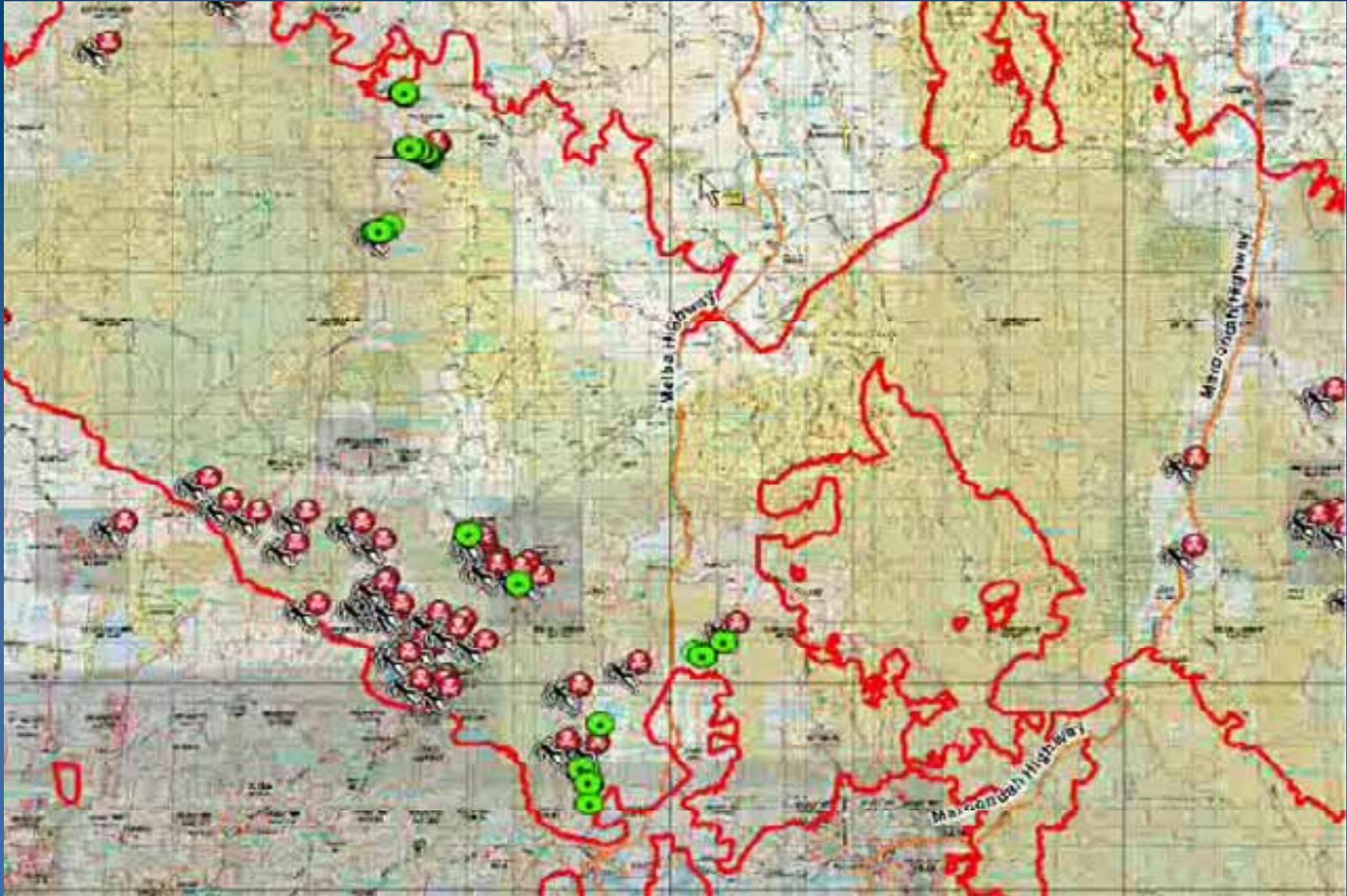
Paper Forms

Data Entry Workstations Using
MS Access Forms for Input to SQL Server

Published Interactive Map Views
That can be Viewed Externally
Via Web Browsers



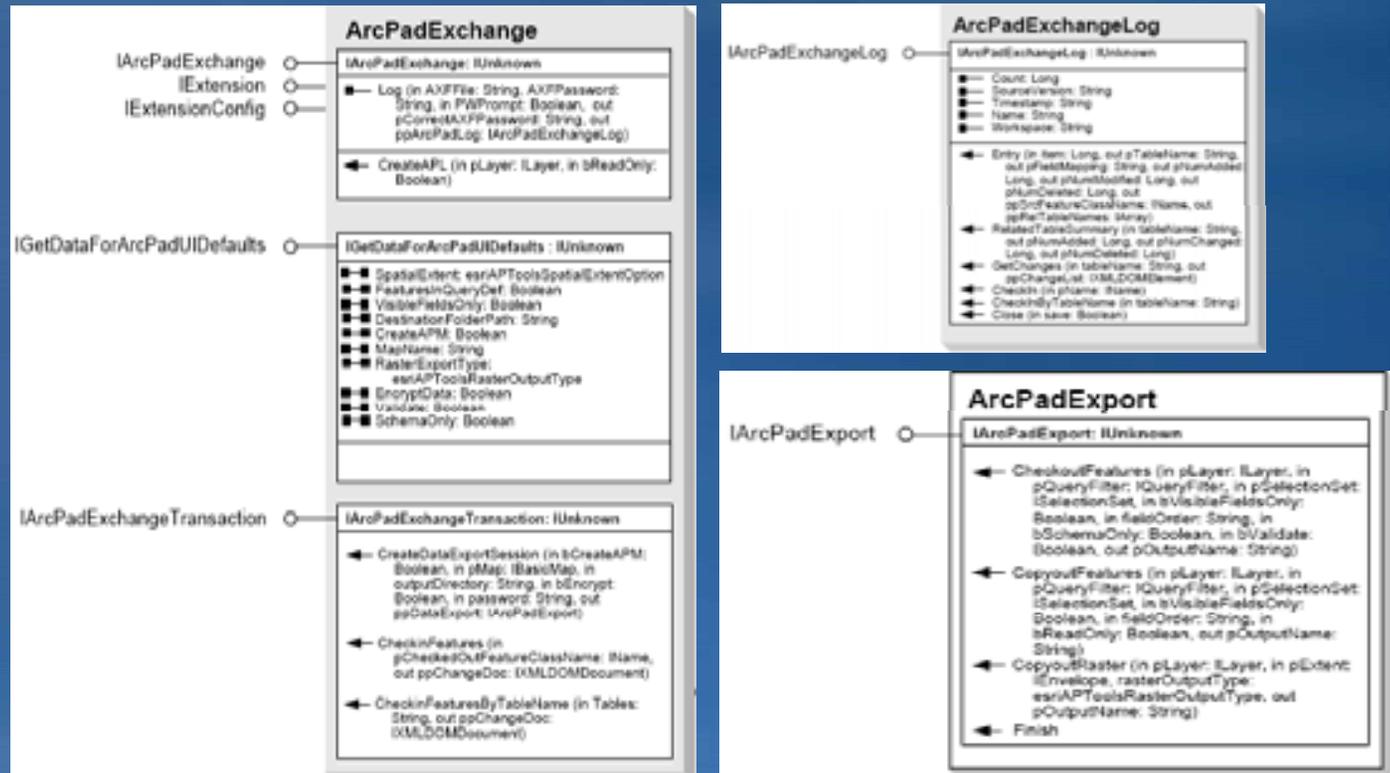
In Operation



DEVELOPING AUTOMATED WORKFLOWS

ArcPad API's available in ArcObjects

- ArcPad Data Manager APIs (ArcObjects)
- Custom check-out
- Custom check-in



GOING FURTHER

Going Further...

- **.NET and .NET Compact Framework**
 - Interface with AXF data via ADO.NET
 - Strong SQL Server Compact support in .NET environment
 - Create advanced external forms in .NET Framework
 - Invoke from ArcPad with a script
 - Pass feature's unique AXF_OBJECTID as parameter
- **Extensions**

AHEAD...

ArcPad, the road the ahead...

- **Modernize ArcPad Studio**
- **Improve the developer experience**
- **Support Microsoft Virtual Earth tiles**
- **Improve the existing camera support.**
- **Continue to improve the quality of the product**



Developers, Developers, Developers, Developers

For more information

- ArcPad web page (esri.com/arcpad)
 - Evaluation software
 - ArcPad Templates
 - Third Party extensions (Related Products)
- ArcPad online support (support.esri.com)
- ArcPad Discussion Forum
(Accessed via ArcPad online support)
- ArcPad Knowledge Base (<http://support.esri.com>)
- ArcScripts (arcscripts.esri.com)
- “Working with ArcPad” and “Customizing ArcPad” on ESRI Virtual Campus

- ArcPad Team Blog (<http://arcpadteam.blogspot.com/>)

EXTRAS...

Integrating external sensors

- **ArcPad supports external sensors for data capture**
 - GPS, Rangefinder, and Camera are exposed in the object model
- **Developers can add support for additional serial devices**
 - Bluetooth devices supported via Serial Port Protocol (SPP)
 - AUX object provides two way communication with sensors
 - Water quality, soil pH, temperature, ...

Read and parse AUX port example (JScript)

```
function ReadAUXForTemp()  
{  
  // called in OnComm event to read data from AUX port  
  
  // read from the AUX port  
  var strRawData = AUX.ReadLine();  
  
  // parse the comma-delimited data  
  var arrParsedData = strRawData.split(",");  
  
  // if data is valid, return the temperature  
  if (arrParsedData[0] == "$PTEMP")  
    return (parseFloat(arrParsedData[1]));  
  else  
    return (NaN);  
}
```

Using .NET With ArcPad and AXF

- AXF files can be updated by multiple tasks simultaneously
- Visual Studio has native support for working with SQL Server Compact Edition database via ADO.NET
- Can use .NET grid control to display and modify SQL data
- Create .NET forms that perform sophisticated data manipulation

- The general approach is to pass **AXF_OBJECTID** between ArcPad and .NET application
- .NET application sends event message back to ArcPad to trigger a script or the refresh map

Working with AXF in scripts

- **DataSource** object's **Execute** method allows any SQL statement to be run against the AXF file
 - Bulk Updates
 - Bulk Deletes
 - Statistical queries (Aggregate functions)
 - Sort records
 - Copy data between tables
- Much faster than iterating with **RecordSet** object

Deep Dive into AXF

- **Use Studio to Examine an AXF structure**
- **What is in a AXF?**
 - **Schema tables (AXF_*, SPATIAL_REF_SYS, GEOMETRY_COLUMNS)**
 - **Define rules not handled by database engine**
 - **Feature tables**
 - **Each feature is a row**
 - **Point geometry stored in X, Y, Z, M column; poly geometry in BLOBs**
 - **Related tables (FORIEGN KEY to parent feature table)**
 - **Coded value domain and subtype tables (FORIGEN KEY from feature and related tables)**
 - **Layer definitions (AXF_LAYERS)**
 - **ArcPad XML format as per .APL**
 - **Multiple layer definitions per feature table possible**
 - **Script and other application 'files' (AXF_FILESTORE)**

Working with AXF in Visual Studio

- Visual Studio recognizes .SDF files, so use this handy Windows XP command line tip:

```
fsutil hardlink create <filename>.sdf <filename>.axf
```

- Use Visual Studio's 'Server Explorer' to examine .AXF database contents
- Create .AXF access buy using **DataGrid** and/or **BindingSource** controls
- After debugging your application change code to use .AXF file instead of .SDF
- Install ArcPad on Windows Mobile emulator

AXF Tips

- Generally not a good idea to tinker with tables prefix with 'AXF_'
- In feature tables columns named with 'AXF_' prefix are ArcPad managed
 - AXF_OBJECTID is the feature's unique identifier – automatically assigned
- Must update AXF_STATUS features modified or deleted using direct SQL
 - Update AXF_STATUS, AXF_TIMESTAMP for new or modified features
 - Add entry to AXF_DELETED_ROWS for deleted features
 - When developing code, check status in Studio
- Use SQL transactions on bulk operations to maintain integrity in case of failure

Row#	AXF_OBJECTID	OBJECTID	FieldID	Purpose	Material	InstallationDate	Comments	SHAPE_X	SHAPE_Y	AXF_TIMESTAMP	AXF_STATUS
1	1	1	125	1	0	2007-10-30 22:53:18	NOLE	57.566530518913	22.376188862789	2007-10-30 12:53:20	16777216-03
2	2	2	124	0	0	2007-10-30 22:53:24	NOLE	55.782094840773	18.5880238412047	2007-10-30 12:53:20	16777216-03
3	3	3	126	0	0	2007-10-30 23:54:04		55.820504248807	23.9110881296137	2007-10-30 12:54:11	16777216-03

AXF_STATUS – 'Bit mapped' value

- C = Created (1)
- M = Modified (2)
- D = Deleted (128)
- G = Geometry Modified (256)
- R = Related Modified (65536)
- P = Processed / checked-in (16777216)
- E = Error (2147483648)

Green = Processed

Red = Error

Orange = Unprocessed / modified / created

ArcPad Workflow Automation using Scripting

- Use Python scripts to generate check out data and check back in
- Use command line tools to copy to/from device

```
# Create the Geoprocessor object
GP = win32com.client.Dispatch("esriGeoprocessing.GpDispatch.1")

# Load required toolboxes
GP.AddToolbox("C:/Program Files/ArcGIS/ArcToolbox/Toolboxes/ArcPad Tools.tbx")

# set the directory of the GP object
GP.workspace = geoDB

# Find the name of the geodatabase and the working directory
# Create a ; delimited string to store all feature classes
# Create a list of search directories
# - including root geodatabase dir, and all datasets
# - add root directory
# Find all feature datasets in the geodatabase
...
...
...
# Finally, perform the checkout
try:
    print "\nPerforming check out for ArcPad"
    GP.ArcPadCheckout_ArcPad(featureClasses, "", "", "", axfFile)
    print "\nGenerated " + axfFile
except:
    print "\nError creating AXF file. Check that the output file doesn't already exist."
```

<http://srego.com/sregocetp.htm>

<http://www.codeproject.com/ce/rcmd.asp>

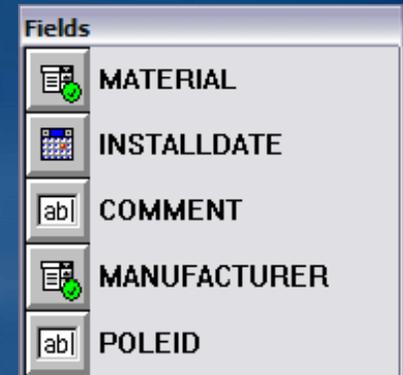
Going further with Extensions

- Extensions are written in native C/C++ code
- Delivered as DLLs
- Are platform specific

- **Layer**
 - New file formats
- **Camera**
 - Custom hardware
- **GPS**
 - Specialized GPS equipment
- **Rangefinder**
 - New rangefinder equipment
- **Projection**
 - Custom projection types and algorithms
- **Datum**
 - Custom datum transformation algorithms

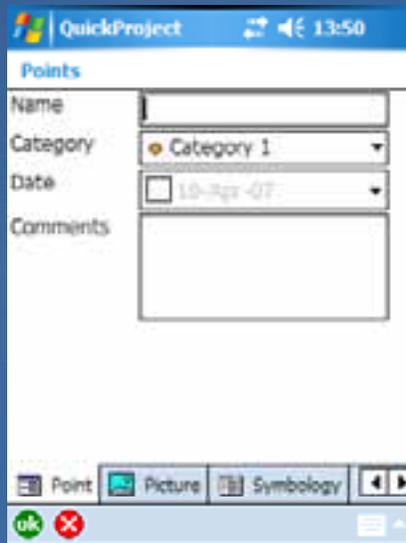
New Form Controls

- Attribute via symbology picker control
- “Smart” fields
- New ‘Fields’ palette in studio
 - Drag fields to form
 - Studio chooses most appropriate control for field type



SYMBOLOLOGYFIELD control

- Simplest example example is to create a QuickProject
- You can use this control on your own forms
- Symbol and text are taken from symbology as defined in ArcMap for the layer
- You can add values on the fly



“Smart” fields - DOMAINCOMBO

- Special type of combo box control
- Automatically validates according to domain rules
- Drop down list is automatically filled with domain values
- Drop down list changes according to subtype
- No scripting required!

