Building Powerful, Integrated Mobile Applications with ArcGIS Mobile

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Agenda

- Introduction
- Basic Workflow
- Developer perspective
- Examples
- ArcGIS Mobile at 9.3...
- Questions
ArcGIS Server 9.2

- Complete & Integrated server-based GIS
- Out-of-the-box applications and services
- Rich developer opportunities

Java .NET

ArcGIS Server

Spatial Data Management

Visualization (Mapping)

Spatial Analysis

ArcGIS Desktop
ArcGIS Explorer
WebMap Applications
ArcGIS Mobile
What is Mobile GIS?

- Extension of GIS beyond the office and into the mobile environment
- Solutions centered on Geographic information forming a geocentric system
- Solutions integrating Geographic information into existing deployments, forming a geospatially-enabled system
Mobile platforms

- Smart Phones
- Pocket PC phones
- Tablet PC/Laptops
ArcGIS Server Architecture
Basic SOA Components

![Diagram of Basic Logical SOA Components]

- Consumers
- SOA Infrastructure
- Producers
ArcGIS Mobile SDK

ArcGIS Server technology for developing mobile solutions
ArcGIS Mobile SDK

- An ArcGIS Server developer solution for mobile applications
- An SDK that ships with ArcGIS Server for building Mobile applications.
- A Suite of .NET Components for developing custom server-centric lightweight mobile applications
ArcGIS Mobile SDK

- Supports field workflows
  - Data viewing
  - Feature inspection
  - Basic data collection

- Direct synchronization with ArcGIS Server

- Connected and disconnected environments

- Windows Mobile and Desktop platforms
ArcGIS Mobile Workflow

Build, Author, Design, Integrate, Secure, Serve, Deploy, and Sync mobile GIS applications and services
ArcGIS Mobile workflow

1. Build your Mobile Geodatabase
2. Author your Mobile Map
3. Design your Mobile Application
4. Integrate with existing solutions
5. Secure server and client data
6. Serve your Mobile Map Service
7. Deploy your Mobile Solution
8. Synchronize your Mobile GIS solution
ArcGIS Mobile SDK: Overview

Microsoft Visual Studio
ArcGIS Mobile SDK
Data Extractor

Get Schema
Extract Base Data

URL
Web Services

Device Application (EXE)

Device DB

Deploy

Get Schema
Extract Base Data

Device Application (EXE)

Device DB

Deploy

Day to day
Data Synchronization

Mobile
ArcGIS Server Setup

- **Build Mobile Geodatabase**
  - Information Model
  - Transaction Model
- **Author your Mobile Map**
- **Set up the server**
- **Publish the map as a map service with Mobile Data Access Capabilities**
Geodatabase Considerations

- Simplify background data
- Use Integer fields where you can
  - Text and Float(double) can impact Mobile Platforms performance
  - Use Coded Value Domains
- Use minimum number of fields
  - Hiding fields in ArcMap also removes them from the mobile client
- Use a Version in SDE for your mobile crews
  - This can help with the flow of field edits
  - You can build the cache using default and in code have ArcGIS Mobile post to a mobile version
- Blob fields are supported
  - They could impact performance on syncing
Use ArcMap to design your mobile map

Caution - Maps created for desktop monitors are not suitable for field use!

Considerations:
- Form factor of device (impacts scale dependency and symbol width)
- Amount and complexity of data
- Design for the environment
  - Contrast
  - Symbology
    - Limit Polygon fill
  - Determine Background data vs. operational data

For more information see the Developer Help topic "Preparing Data and Maps" in the section "Developing Mobile Applications using the Mobile ADF".
Symbology

- **Marker symbols**
  - Rasterizes the symbol
  - Choose based on scale it needs to be displayed

- **Use simple line symbols**
  - Supports simple line symbols, character line symbols, and hash line symbols, but it does not support marker line symbols and line decorations

- **Polygons**
  - Supports layered polygon symbols where the outline line symbol chosen may be a character or hash line symbol. The framework does not support other fill symbols types (picture fill symbols, marker fill symbols, line fill symbols).

- **Assess text symbols**
  - Tahoma 8pt font is a good font and size for labeling features on a Pocket PC or smart phone device. However, if the text is rotated, you should consider a larger font size. Justification of text is not supported
Publish Mobile Web Service

- Publish using ArcGIS Server Manager or ArcCatalog
- Publish Map Service with Mobile data access capabilities enabled
  - Creates a WSDL for Mobile
- Reliance on ArcGIS server quality of service
- Test the service by Adding the ?wsdl to the end of the url
Design Mobile Application

- Mobile SDK installed as part of ArcGIS Server
- Use Visual Studio 2005:
  - Windows Mobile 5.0 for Pocket PC
  - Pocket PC 2003
  - Windows Mobile 5.0 for Smartphone
  - Tablets and Notebooks (Windows XP)
- IDE Integration
- Build Simple and focused user interfaces
- Develop for function and form factor

ArcGIS Mobile Components
Deploy Mobile Solution

- Design your Mobile Application
- Integrate with existing solutions
- Generate initial client data
- Secure server and client data
- Deploy to devices
Deploy Mobile Package

- Developer shares the responsibility to deploy application and the data to the user
- Cab deployment
- Click once deployment
- Push
  - System Management Server
  - SOTI MobiControl
  - iAnywhere Afaria
  - ...

Deployment

PUSH to Device

Copied to Device

PULLED by Device

Over-the-air Provisioning

SD/MMC AutoRun

ActiveSync

E-mail
Hyperlink a file

SMS
Hyperlink to a file

Other...
Map Cache Extractor Sample

- Sample comes with ArcGIS Server
- Allows you to create a map cache before deploying
- Minimizes data synchronization and bandwidth requirements
- Don’t create a large cache
Synchronize Mobile GIS Solution

Application:

- Takes responsibility for managing the sync process
- Pushes and pulls new and updated features
- Leverages spatial and attribute queries to optimize feature pull from the Server
Synchronize Mobile GIS Solution

- **Wireless access**
  - Wi-Fi
  - Cellular Networks (EDGE, EVDO, HSDPA, …)
  - Other networks with internet access

- **Docked access**
  - LAN
  - Cradle (Active Sync)
ArcGIS Mobile SDK

Prerequisites, SDK Features – Map, GPS, ADO.Net, Visual Studio Components and Integration, and Application Deployment
ArcGIS Mobile SDK: Prerequisites

- Visual Studio 2005
- Familiarity with
  - .Net Framework 2.0
  - .Net Compact Framework 2.0
  - C# or VB.NET
- SDK for Windows Mobile 5.0 for Pocket PC 5.0 development
- SDK for Windows Mobile 5.0 for Smartphone 5.0 development
- Active Sync 4.1 or higher installed
- Thorough understanding of ADO.Net concepts
- Access to mobile devices to test deployment
- Access to GPS devices
- Devices Security
- Familiarity with field work flows
- Familiarity with ArcGIS Server
.NET Compact Framework considerations

- It’s a subset of .Net Framework
- Optimized for Smart Devices
- Not everything works the same
- Read the documentation

- You should use Visual Studio Emulators to develop, actual devices to test and deploy
ArcGIS Server Mobile Components

ArcGIS Mobile Components
- GPRS
- EDGE
- HSDPA
- 802.11
- Cradle

ArcGIS Server
- Web Services
- Web Services & Data
- Server Manager

Enterprise Systems
- Replication
- SDE

User Experience
Business Logic
Data & Web Svc
ArcGIS Mobile SDK: Features

Overview

- Suite of .Net Mobile GIS components
- Designed for Client-Server applications
- Support multiple connectivity scenarios
- Long and Short Transactions
- Versioned editing
- Provide disconnected editing capabilities
- Leverage Visual Studio 2005 WinForms
- Small footprint and high performance
- Comprehensive developer help
  - Visual Studio integration
  - Walkthrough, Samples
  - Online documentation
ArcGIS Mobile SDK: Target Platforms

- Microsoft .NET/.NET Compact Framework 2.0
- Windows Mobile 5.0
  - PocketPC
  - Smartphone
- Windows Mobile for Pocket PC 2003, 2003 SE
- Windows CE 5.0
- Windows XP
ArcGIS Mobile SDK: Seamless MS Visual Studio Integration

Win Forms

Data Sync Components

UI Controls

Data Components

GPS Components


Network Resources

Device Data Store

Microsoft Visual Studio 2005
ArcGIS Mobile SDK: Core components

ArcGIS Server

Map

MapCache

Server Connection

URL

MapAction

Feature Layer

Annotation Layer

Raster Layer
Server Synchronization Considerations

- Applications:
  - Take responsibility for managing the sync process
  - Push and Pull new and updated features
  - Leverage spatial and attribute queries to optimize feature pull from the Server
ArcGIS Mobile SDK: Map and Map Cache Components

- Map component draws data from the map cache (threaded drawing)
- Map Cache stores map data on device.
- Map Cache component synchronizes updates with Server.
- Map supports markup/graphics on Display
- Map supports drawing of custom layers
- Map rotation supported
ArcGIS Mobile SDK: Map Actions

- Components used for Mouse and Keyboard interaction
- Enhanced designer experience
- Reduces the amount of code you need to write
ArcGIS Mobile SDK: GPS Components

- NMEA GPS implementation
- Smart GPS Map display
- Interface with Serial and File GPS
- Fires events with GPS positions for use in your custom tools
ArcGIS Mobile SDK: Scale Bar

- Displays current map scale
- Supports different unit types
- Animated when synchronizing with Server
ArcGIS Mobile SDK: ADO.Net interface

- Spatial and attribute queries on map cache feature layers
- Queries are executed against local data
- Data loaded to
  - FeatureLayerDataTable (ADO DataTable) *Forward and Backward
  - FeatureDataReader (ADO IDataReader) *Forward only, faster
- Updates supported
ArcGIS Mobile SDK: Editing Features

- Edits can be performed in a disconnected mode
- Geometry editing via Sketch Map Action and Components
- Create and update points, lines and polygon geometry
- Supports snapping to all Feature Layers
- Attributes editing via ADO.Net components
ArcGIS Mobile SDK: Editing

- Edits can be performed in a disconnected mode
- Only SDE layers are editable
- Connection required to synchronize updates with the server
- Editing is supported for non-versioned and versioned transaction models.
- Coarse grained Sketching components for geometry construction
- Attribute editing via ADO.Net components
ArcGIS Mobile: Application and Data Deployment

Data Extraction → Visual Studio → Application Development → ArcGIS Server

ArcGIS Server → Web Service

Posts Edits → Refresh Data

Connection → Day to Day synchronization from the Field

Mobile Applications → Viewing Application

Editing Application → Deployment

MapCache Extractor
ArcGIS Mobile SDK : Features Overview

- Suite of .NET Mobile GIS components
- Support multiple connectivity scenarios
- Full Support of Geodatabase Transaction Model
- Leverage Visual Studio 2005 WinForms
- Small footprint and high performance
- Comprehensive developer help
  - Visual Studio integration
  - Walkthrough, Samples
  - Online documentation
ArcGIS Mobile SDK: Target Platforms

- Microsoft .NET/.NET Compact Framework 2.0
- Windows Mobile 5.0
  - PocketPC
  - Smartphone
- Windows Mobile for Pocket PC 2003, 2003 SE
- Windows CE 5.0
- Windows XP/2000
ArcGIS Mobile SDK: Editing

- Edits can be performed in a disconnected mode
- Only ArcSDE layers are editable
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ArcGIS Mobile

- **Developer Kit**
  - Part of the Server ADF
  - C:\Program Files\ArcGIS\DeveloperKit\SamplesNET\Server\Mobile_Applications

- **Types of Samples**
  - PPC03 = Pocket PC 2003
  - PPC05 = Windows Mobile 5
  - WinCSharp = Windows 32(xp or 2000)
    - Only in C#

- **Walkthroughs**
  - PPC03, PPC05, WinCSharp and WinVBNet
ArcGIS Mobile

- Developer Kit Online - EDN

Smart Device applications
- Mobile walkthrough: PocketPC Application
- Mobile walkthrough: Smartphone Application
- PocketPC: Basic GPS
- PocketPC: Custom Layer
- PocketPC: Editor
- PocketPC: ESRI Construction
- PocketPC: GeoData Relation
- PocketPC: GeoRSS Read
- PocketPC: Live Traffic
- PocketPC: MapTips
- PocketPC: MapViewer
- PocketPC: Rubberband Selection

Windows applications
- Mobile walkthrough: Windows Application
- Basic GPS
- Business Template - County Code Enforcement
- Business Template - Fire Risk Assessment
- Business Template - Playground Equipment Inventory
- Business Template - Road Accident Data Collection
- Business Template - Stormwater Inlet Inventory
- Custom Layer
- Data Binding
- Editor
- Extractor
- Geometry Relationship
- GeoRSS Sample
- MapTips
- MapViewer
- Measure Map Action
- Password Protection
- Rubberband Selection
- Secure Connection
ArcGIS Mobile SDK: Prerequisites

- Visual Studio 2005
  - C# or VB.NET
- Windows Mobile SDKs (Pocket PC/Smartphone)
- Active Sync 4.1 or higher installed
- Access to mobile devices to test deployment
- Access to GPS devices
- Familiarity with
  - .NET Framework 2.0/.NET Compact Framework 2.0
- Thorough understanding of ADO.Net concepts
- Device Security
- Familiarity with ArcGIS Server
General Coding Guidelines

- **Multiple threaded environment**
  - Use BeginInvoke to push arguments to the UI

- **Dispose of objects that implement IDisposable**
  - Wrap inside using block

- **Menu vs. Tool considerations**
Examples
My Border Security Scenario
Scenario

My Border Security Agency

Headquarters

Field Office Charmel

Patrol Officer in the Field Chris

Local Law Enforcement Agency

Police Officer in the Field Gary
Dover, DE NASCAR Events
Texas Hurricane Exercise
Using the Mobile ADF to Track Cell Phone Locations
ArcGIS Mobile

9.3
9.3 Requirements

- **What to Build:**
  - Windows Mobile application

- **Target Customers:**
  - Enterprise Field Workers

- **Core functionality:**
  - Field Mapping
  - Asset Inventory and Maintenance
  - Incident Reporting

*Synchronize in the Field*
What is ArcGIS Mobile?

- ArcGIS Mobile compliments ArcGIS Server and allows an organization to deploy maps and GIS tasks to their mobile workers.

- ArcGIS Mobile includes:
  - Application
  - Runtime
  - SDK
ArcGIS Mobile Application

- **GIS tasks:**
  - View and navigate maps
  - Collect new GIS features
  - Update existing GIS features
  - Synchronize with GIS Server
  - Use Global Positioning System
  - Search for GIS features
  - Manage a work list
  - Check Device Status

- **Supports Windows Mobile 5 & 6 devices**
ArcGIS Server Manager

- **Use ArcGIS Server Manager To:**
  - Serve Mobile Maps
  - Create Mobile Projects

- **Server Manager is a host for:**
  - Deploying mobile projects
  - Deploying mobile applications
  - Serving mobile maps
ArcGIS Mobile SDK and Runtime

- Build mobile GIS application for ArcGIS Server
- SDK part of ArcGIS Server and EDN
- Runtime for Windows Mobile 5 or 6 and Windows XP or Vista
ArcGIS Mobile Application
ArcGIS Mobile Application

- Task-driven user experience
- Configurable using Server Manager

**Targets:**
- Simple GIS Feature Editing
- Map Viewing

**Target Platforms:**
- Windows Mobile 5 Pocket PC
- Windows Mobile 6 Professional
ArcGIS Mobile Tasks

- Core Tasks for 9.3
  - View Map
  - Collect Features
  - Search Features
  - View Work List
  - Synchronize
  - View Status
View Map Task

- Navigate the Map
  - Using GPS Receiver
  - Using Rocker/Stylus

- Browse Features
  - Pan to features
  - View feature attributes
Collect Features Task

- Guided workflow for capturing new GIS features in the field
  - Choose feature type
  - Set shape of feature
    - Using stylus/rocker
    - Using GPS
    - Entering XY location
  - Set attributes for feature
Search Features Task

- Search for GIS features stored locally on the device
  - Choose feature type or layer
  - Define search criteria
    - Fields/values to search against
    - Search area
  - Find features
  - Act on results
    - Browse on Map
    - View Attributes
    - Edit Attributes
    - Add to Work List task
View Work List Task

- Manages a list of features that you can edit or browse to on map
  - View the state of features
  - Sorts features by distance from you
  - View/edit feature attributes
  - Delete features

Add features to the work list from your Search results.
Synchronize Task

- Receive status on synchronization
  - Last date/time you posted/received updates
  - Number of updates on the device
- Send updates to the server
  - Posts all updates to the device
- Get Data from the server
  - Define layers and extent
Status Task

- Set and manage the connection to a GPS receiver

- Use the Status task to monitor the health of the device
  - Network
  - Battery
Creating Mobile Applications using ArcGIS Server Manager
ArcGIS Server Manager

- 9.2 Create and manage mobile web services
- Create and manage mobile projects
- Deploy mobile projects and applications to devices
Create and Manage Mobile Applications

- **Mobile Applications Catalog**
  - Create new mobile application projects
  - Manage a catalog of mobile projects on web server
Create and Manage Mobile Projects

- Specify an application project name and brief description.
Create Mobile Projects

- Set Operational map resource (mobile service)
  - Define map layer properties
    - Editable layers
    - Viewable/Searchable layers
    - Editable/Viewable fields
    - GPS collection properties
Create Mobile Projects

- Configure application tasks
  - Change name/description of task
  - Remove unwanted tasks
Mobile Application Deployment

- Pull model
  - Pull mobile application from server to device
    - Using Web Browser on device
  - Pull mobile projects from server to device
    - Using ArcGIS Mobile application
    - Using Web Browser on device
Mobile Application Deployment

- **Push model**
  - Provision device with application
    - Use ActiveSync, Windows Mobile Device Center
    - Use 3rd Party system (SMS, SOTI MobiControl, others)
  - Send project file to device
    - Email project file and open on device
    - Use ActiveSync, Windows Mobile Device Center
    - Use 3rd Party deployment system
Using ArcGIS Desktop to Author, Build and Publish Mobile Content
Steps To Designing Mobile Projects

1. Understand Field Workflows
2. Design and Build Mobile Geodatabase
3. Author and Publish Mobile Maps
4. Build Data Deployment Packages
5. Define QA procedures and practices
1. Understanding Field Workflows

- What tasks need to be accomplished in the field?
- What layers of information are required?
  - Operational
  - Base Map
- What type of device is being used? What are its capabilities, battery life, GPS, etc?
- Is in-the-field synchronization possible?
2. Designing Mobile Geodatabases

- Choose the right Information Model

- Choose the right Transactional Model
3. Authoring Mobile Maps

- **Mobile Map Design Considerations:**
  - Design for purpose
    - Remove unnecessary layers of information
    - Set scale dependency based on scales of work (walk, drive, etc)
    - Render editable layers to define feature types
  - Design for the environment
    - Establish contrast, choose meaningful symbology
  - Design for device form factor
    - Set scale dependency based on device resolution
    - Set symbol width based upon device resolution

- **Determine Base Map Data vs. Operational Data**
  - Compress Base Map Data using Create Mobile Base Map GP Tool
  - Build Operational Mobile Cache using Generate Mobile Service Cache
4. Build Data Deployment Packages

- **New Mobile Toolset inside of Server Toolbox**
  - Create Mobile Base Map Tool
    - Support large base map datasets
  - Generate Mobile Service Cache Tool
    - Create mobile caches for deployment

- **Use Standard Deployment Technology**
  - ActiveSync, Windows Mobile Device Center
  - Microsoft SMS
  - SOTI MobiControl
Mobile GP Tools

- Create Mobile Base Map Tool
  - Creates an Base Map Data Set to be provisioned on mobile devices as base map layers
Mobile GP Tools

- **Generate Mobile Service Cache**
  - Creates a mobile service cache for all operational layers.
  - Uses published mobile web service as input and extracts layers.
5. Define QA procedures

- Geodatabase Replication
- Version Management
- ETL Geoprocessing Tools
- Leverage PLTS, JTX and other QA tools
ArcGIS Mobile SDK
ArcGIS Mobile 9.3 SDK

- Key 9.3 Improvements:
  - Ease of Deployment
  - Performance improvements
  - Improved Editing tools/sketching API
  - Better Support for Projections
  - Simplified coordinate management
Deployment Improvements

- At 9.2 SDK runtime deployed with each application (to application folder).
- At 9.3 SDK runtime is deployed once.
- SDK runtime is provided as a signed .CAB file.
Performance Improvements

- Support for static, local base map data
- Improved handling of server requests when retrieving data
- Improved handling of GPS display
Editing tools

- Improved, simplified API for sketching.
- New sketch tools for updating existing geometries.
- Sketch display handled through new SketchGraphicsLayer
- Ability to create your own sketch tools
Projections

- Improved support of ArcGIS map projections.
- Now Mobile client supports all but GRID/HARN based map projections.
Coordinate Management

- At 9.2 developers had to handle the conversion between integer and map coordinates.
- At 9.3 developers no longer need to translate between map coordinates and server coordinates.
Finding Information
ArcGIS Mobile Resource Center

- Quickly locate:
  - Application help topics
  - Server help topics
  - Desktop help topics
  - Developer help
  - Knowledge base, forums, blogs
Questions?