Implementing Analysis, Editing and Offline Applications with ArcGIS Runtime SDK for WPF

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Offering ID: 257
Agenda

• Offline applications

• Editing

• Analysis

• Road Ahead
Offline Applications
Offline – Layers

- **Live Data**
  - GraphicsLayer & Graphics

- **Operational Data**
  - LocalDynamicLayers / LocalFeatureLayers

- **Basemap**
  - LocalTiledLayer

- **Map**
Offline – Basemaps

- **ArcGISLocalTiledLayer**

  ```xml
  <esri:ArcGISLocalTiledLayer ID="Topographic USA"
      Path="C:\Program Files (x86)\ArcGIS SDKs\WPF10.2\SDK\Samples\Data\TPKs\Topographic.tpk"/>
  ```

- **Tile Package (.TPK)**
- **Many small pre-rendered images**
- **Created with ArcGIS for Desktop or extracted from cached map service**
- **Same spatial reference considerations as for online tiled layers**
Offline – Operational Layers

- ArcGISLocalDynamicMapServiceLayer

```
<esri:ArcGISLocalDynamicMapServiceLayer ID="USA"
Path="C:\Program Files (x86)\ArcGIS SDKs\WPF10.2\SDK\Samples\Data\MPKs\USCitiesStates.mpk"/>
```

- Map Package (.MPK)
- Map Package created with ArcGIS for Desktop
- Image rendered dynamically from source data
- Uses LocalMapService running in RuntimeLocalServer
Offline – Operational Layers

- ArcGISLocalFeatureLayer

```xml
<esri:ArcGISLocalFeatureLayer ID="States"
Path="C:\Program Files (x86)\ArcGIS SDKs\WPF10.2\SDK\Samples\Data\MPKs\USCitiesStates.mpk"
LayerName="States"/>
```

- References sub-layer within Map Package (.MPK)
- Map Package created with ArcGIS for Desktop
- Uses LocalFeatureService running in RuntimeLocalServer
ArcMap Options

Publishing
Lets you change the location where your map will be staged when publishing to ArcGIS Server. You can override this folder from an ArcGIS Server Connection in Catalog.

Staging Path:
C:\TEMP
Use Default

Show warning when cache exceeds 500.0 MB
Show file location when saving draft service definitions

Packaging
Lets you choose to support the ArcGIS Runtime when packaging.

Enable ArcGIS Runtime Tools

Lets you choose the location to unpack packages for all ArcGIS Desktop applications.

Automatically select location
Use user specified location
Offline Map & Layers
Chris Davies
Offline – RuntimeLocalServer

- Component within ArcGIS Runtime
- Enables API to use
  - Map Packages
  - Geocode Packages
  - Geoprocessing Packages
  - Geometry operations
Offline – LocalServices

- Define LocalServices explicitly
- Set properties on local services to override defaults e.g. MaxRecords, DefaultZValue, StartCompleted
  - Queries:

```xml
<Grid.Resources>
  <esri:LocalMapService x:Key="_localMapService"
    Path="C:\Program Files (x86)\ArcGIS SDKs\WPF10.2\SDK\Samples\Data\MPKs\USCitiesStates.mpk" MaxRecords="1000000"/>
</Grid.Resources>
```

- Editing

```xml
<Grid.Resources>
  <esri:LocalFeatureService x:Key="_localFeatureService"
    Path="C:\Program Files (x86)\ArcGIS SDKs\WPF10.2\SDK\Samples\Data\MPKs\USCitiesStates.mpk" MaxRecords="1000000"/>
</Grid.Resources>
```
Offline – LocalServices

- Bind Service property of local layers to local service resources:

```xml
<esri:ArcGISLocalDynamicMapServiceLayer ID="USA"
  Service="{StaticResource _localMapService}"/>

...

<esri:ArcGISLocalFeatureLayer ID="States"
  Service="{StaticResource _localFeatureService}"
  LayerName="States"/>
```
Offline – LocalServices

- LocalServices may take time to start
  - Longer the first time due to unpack of package
  - Subsequent starts are quicker
- Recommend managing the local service in code
- Create LocalService instances & Start Async

```csharp
LocalMapService localMapService = new LocalMapService(@"..\Maps_and_Data\Map.mpk");
localMapService.StartAsync(localServiceCallback =>
{
    ArcGISDynamicMapServiceLayer localDynamicLayer =
        new ArcGISLocalDynamicMapServiceLayer(localMapService);
    MyMap.Layers.Add(localDynamicLayer);
});
```
Offline – LocalServices

- The Action or StartCompleted always get called regardless of the outcome
  - Check the Error property!

```csharp
LocalMapService localMapService = new LocalMapService
(@"..\Maps_and_Data\Map.mpk");
localMapService.StartAsync(localServiceCallback =>
{
    if (localServiceCallback.ERROR != null)
    {
        // Do something with Error
        return;
    }
    ArcGISDynamicMapServiceLayer localDynamicLayer =
    new ArcGISLocalDynamicMapServiceLayer(localMapService);
    MyMap.Layers.Add(localDynamicLayer);
});
```
Editing
Editing

- **Features edited within FeatureLayers**
  - Source = FeatureServices / LocalFeatureServices
- **FeatureServices published from Map Documents**
  - Symbology
  - Feature templates
  - Field properties (aliases, visibility)
  - Subtypes and attribute domains
  - Attachment support
  - Popups
- **Provides enhanced editing experience**
Editing – Feature Templates
Editing – Feature Templates

<table>
<thead>
<tr>
<th>Facility Identifier</th>
<th>Material</th>
<th>Diameter</th>
<th>Install Date</th>
<th>Year Lined</th>
<th>Liner Type</th>
<th>From Manhole</th>
<th>To Manhole</th>
<th>Water Type</th>
<th>Enabled</th>
<th>Active Flag</th>
<th>Owned By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ductile Iron</td>
<td>12&quot;</td>
<td>&lt;Null&gt;</td>
<td>&lt;Null&gt;</td>
<td>&lt;Null&gt;</td>
<td>&lt;Null&gt;</td>
<td>&lt;Null&gt;</td>
<td>Sewage</td>
<td>True</td>
<td>True</td>
<td>Our Agency</td>
</tr>
</tbody>
</table>

**Template Properties**

- **Name:** 12" Ductile Iron Sewer
- **Description:** A 12" PVC Ductile Iron Gravity Main.
- **Tags:** Line
- **Default Tool:** Line
- **Target Layer:** Sewer Gravity Mains

**View**

- **Facility Identifier:** <Null>
- **Material:** Ductile Iron
- **Diameter:** 12"
- **Install Date:** <Null>
- **Year Lined:** <Null>
- **Liner Type:** <Null>
- **From Manhole:** <Null>
- **To Manhole:** <Null>
- **Water Type:** Sewage
- **Enabled:** True
- **Active Flag:** True
- **Owned By:** Our Agency
Editing – API

- UI controls for editing
  - Automatically use feature templates
- Finer grained control over editing
  - Add / Edit / Delete features directly on FeatureLayer
  - Access FeatureTemplates via LayerInfo property
    - Prototype geometry + attributes
- Editor tracking
  - Track individual edits to users
- Ownership based Editing
  - Control edits on a per user basis
Editing – UI Components

• Toolkit assembly contains UI controls:
  - Editor widget toolbar
  - Template picker
  - Feature Data Form
  - Feature Data Grid
  - Attachment editor

• Customize controls or create custom workflows with API
Editing

Chris Davies
Editing – Workflows

- Online

- Offline – check-out / check-in
Editing – New Offline Workflows for 10.2

- Offline from ArcGIS Online & Portal
  - Deploy
  - Synchronize

- Offline from Desktop
  - Package and Deploy
  - Checkin
Analysis
Analysis

- Identify Task
- Hit Testing
- Query Task
- Geometry Task
- Geoprocessing

Graphics
Analysis – Hit Testing

- Feature intersection in screen coordinates
- **GraphicsLayer** and **FeatureLayer**
  - Objects that exist in memory on the client
- **FindGraphicsInHostCoordinates()** method
  - Input Point or Rectangle in screen coordinates
  - Maximum hits overload
- Default is topmost feature only for performance
- Hit Testing is enabled and happening all the time
  - To support UI interaction e.g. MapTips
- Disable if not required on specific layers
  - ...Layer.IsHitTestVisible = False
Analysis – Identify Task

- Return features intersected by input geometry
  - Envelope, Point, Multipoint, Polyline, or Polygon
- Operates on all layers in a dynamic map service
- Follows Task pattern
- Identify Parameters
  - All layers, specific layers by ID, topmost layer, visible layers, Tolerance in pixels
- IdentifyTask.ExecuteAsync
- IdentifyResult
  - Includes Feature as Graphic object, Layer ID and Layer name
Analysis – Query Task

- Return features matching SQL query and/or geometry spatial relationship
- Operates on specific layer within dynamic map service
- Follows Task pattern
- Query
  - Any valid where clause e.g. “POP >= 1000000”
  - Query Geometry
  - Time extent
- QueryTask.ExecuteAsync
- FeatureSet result contains Graphic features
Analysis – Geometry Task

- Geometric calculations including:
  - Buffer
  - Determine spatial relationships
  - Determine distances between geometries
  - Compute Union, Intersection and Difference

- Operate on arrays of individual geometries

- Follows Task pattern

- Need to get features as graphic objects
  - Use Hit Test, IdentifyTask, QueryTask

- Online:
  - http://www.arcgis.com/home/item.html?id=2e18b487043641538f02028cc2495c0e

- Local: LocalGeometryService
Analysis – Geoprocessor Task

- Provides access to ArcGIS functionality not available in the API
- Exposed as server-side Geoprocessing services
- Based on ArcGIS Tools, Scripts, Models
- Accessed via the Geoprocessor Task
- Follows Task pattern
- Input / output data types are determined by the Geoprocessing Service
Analysis – Geoprocessor Task

• **ExecuteAsync**
  - Synchronous on the server
  - No feedback until Job completes or Fails

• **SubmitJobAsync**
  - Asynchronous on the server
  - Can poll for job status

• **Can request GP Service draws feature / raster outputs in a Map Service**
Offline – Tasks

- **Identify / Query: Map Package (.MPK)**
  - Executes in the RuntimeLocalServer

- **Geocode: Locator Package (.GCPK)**
  - Use .LOC file or GDB for large locators

- **Routing & Analysis: Geoprocessing Package (.GPK)**
  - Executes in the RuntimeLocalServer
  - Same optimization considerations as when publishing for ArcGIS for Server
Offline Analysis

Mike Branscomb
Road Ahead
Roadmap – 10.2

• Simplified asynchronous code
  - Support for Async and Await (VS2012 & .NET 4.5)
  - IdentifyTask, QueryTask, Locator task, etc
  - LocalServer / LocalServices

```csharp
LocalMapService localMapService = new LocalMapService(@"..\data\mpks\USCitiesStates.mpk");

localMapService = await localMapService.StartAsync() as LocalMapService;

QueryTask queryTask = new QueryTask(localMapService.UrlMapService + "/2");

Query query = new Query()
{ Where = "1=1", ReturnGeometry = true, OutSpatialReference = MyMap.SpatialReference };

QueryResult queryResult = await queryTask.ExecuteTaskAsync(query);

resultsGraphicsLayer.Graphics.AddRange(queryResult.FeatureSet.Features);
```
Road Ahead – 10.2

• Enhancements to Offline map use
  - Take maps and data offline... and synchronize
  - Take network / geocode / search offline
    - Without the RuntimeLocalServer

• Better Performance with millions features in GraphicsLayer & FeatureLayer

• Security: OAuth, SAML

• Simplification of API

• New online Analysis services for ArcGIS Online
Road Ahead – Resources

10.1.1 10.2

http://resources.arcgis.com  http://developers.arcgis.com
Beyond 10.2

- Geotriggers / geofencing
- More offline analysis
- Improved direct local data support
- 3D visualization

- Deprecating support for:
  - .NET 4.0
  - Visual Studio 2010
  - Windows XP
  - Windows Vista
Where next?

- **Best Development Practices and Patterns**
  - Wed 2:30pm *Demo Theater 2 - Oasis 1*

- **Extending the Operations Dashboard**
  - Thu 10:00am Primrose C/D

- **Software Development and Design Using MVVM**
  - Wed 10:30am Primrose C/D

- **Developing Mapping Applications for the Windows 8 Store**
  - Thu 8:30am Catalina/Madera (Renaissance Hotel)

- **Road Ahead for ArcGIS Runtime SDKs**
  - Thu 10:00am Primrose B
Questions?

Please complete a survey
http://esriurl.com/survey
Offering ID: 257

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Demo code available GitHub:
https://github.com/ArcGIS/tips-and-tricks-wpf