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

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ArcGIS Runtime

- Family of SDKs for multiple platforms
  - Consistent capabilities
- Native to the platform
  - For building great apps
- Lightweight and fast
- Powerful
- Easy
Outline

- Data sources
- Data Visualization
- Simple Analysis
- Editing
- Advanced Analysis
- What’s next
Data Sources

- **Online**
  - ArcGIS for Server
  - OGC (WMS)
  - Bing
  - OpenStreetMap
  - KML

- **Local**
  - Tile packages
  - Map packages
  - Locator packages
  - Geoprocessing packages

- **GPS**
Data Sources

- Graphics
  - Graphic – an entity containing a geometry, symbol
  - GraphicsLayer to add custom graphics

```javascript
new Point(0, 0)
```

```javascript
graphicsLayer.addGraphic(new Graphic(point, symbol));
```
Data Sources

• Graphics
  - contains optional attributes
  - Features fetched from Feature Service are represented as graphics
  - Advanced symbology – MIL2525C, APP6B
Data Visualization

- **JMap**
  - Swing control to view data as map
  - Add data as layers
  - Internal projections for heterogeneous data

```java
JMap jMap = new JMap();

// tiled layer (Spatial Reference - 102100)
ArcGISTiledMapServiceLayer tiledLayer = new ArcGISTiledMapServiceLayer(
    "http://services.arcgisonline.com/ArcGIS/rest/services/World_Topographic_Map/MapServer");
jMap.getLayers().add(tiledLayer);

// feature layer (Spatial Reference - 4326)
ArcGISFeatureLayer featureLayer = new ArcGISFeatureLayer(
    "http://sampleserver6.arcgisonline.com/arcgis/rest/services/SaveTheBay/FeatureServer/0");
jMap.getLayers().add(featureLayer);
```
Data Visualization

- Temporal data

```java
TimeAwareLayer layer = new ArcGISDynamicMapServiceLayer("http://...");

JTimeSlider jTimeSlider = new JTimeSlider();
jTimeSlider.setTitle("Hurricane Paths");
jTimeSlider.addLayer(layer);
jTimeSlider.setTimeMode(TimeMode.TimeExtent);
jTimeSlider.setTimeExtent(new TimeExtent(
    new GregorianCalendar(1851, 6, 25),
    new GregorianCalendar(2007, 12, 16)),
  10,
  Units.Years);

jTimeSlider.setTimeInterval(new TimeExtent(
    new GregorianCalendar(1851, 6, 25),
    new GregorianCalendar(1861, 6, 25)));```

Data Visualization

- **Popups**
  - Attribute view

```java
97  // create a layer
98  ArcGISFeatureLayer featureLayer = new ArcGISFeatureLayer(URL_BLOCK_POINTS);
99
100 // create a overlay
101 InfoPopupOverlay infoPopupOverlay = new InfoPopupOverlay();
102 infoPopupOverlay.setPopupTitle("Feature");
103
104 // Set title to be used for selected items
105 infoPopupOverlay.setItemTitle("Block: {BLOCK}");
106
107 // associate the infopopup overlay to the feature layer
108 infoPopupOverlay.addLayer(featureLayer);
109
110 // add the infopopup overlay to the map
111 jMap.addMapOverlay(infoPopupOverlay);
```

- As WebMap images and charts

- **Maptip**
  - Shows attributes on mouse over
Simple Analysis

- On Geometry

- Buffer
- Difference
- Intersect (equals, within, contains, crosses, touches)
- Union
- Project
- Shortest Distance
- Line Length
Simple Analysis

- On Features and their Attributes
  - Query
  - Find
  - Identify
  - Geocoding
- Synchronous and asynchronous pattern
- Online and offline
- Can accept input in one spatial reference, and output in another
Simple Analysis

Basic flow

- **Execute Sync Vs Execute Async**
  - Sync is a blocking call
  - Async preferred when called from Swing’s UI thread
  - Handle Async result using callbacks
    - `Operation.executeAsync(parameters, <callback>);`
Simple Analysis

- **Query**
  - Search for features that meet some conditions
  - SQL-like syntax
  - Non-spatial filter
    - E.g. query cities where population > 1000000
  - Spatial filter
    - E.g. query cities in selected area
Simple Analysis

- **Find**
  - Searches attributes of features for a given text
  - Can search multiple layers
  - Useful for free-form search
    - E.g., Find features with “Mississippi”
      - Returns cities in Mississippi, river, state
Query & Find
Elise Acheson
Simple Analysis

- On features and attributes
  - Query
  - Find
  - Identify
  - Geocoding
Simple Analysis

- **Identify**
  - Searches all features at a given geometry
  - Can identify on multiple layers
  - e.g., clicking on Palm Springs can return the city of Palm Springs, and its state California.
Simple Analysis

- **Geocoding**
  - Works with a geocoding service online or a locator package
  - Input single line or address fields
  - Batch geocoding
  - Reverse-geocode
Identify
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Editing

- Create, Edit, Delete features
- Edit attributes of a feature
- Using API – for fine-grained control
- Using Toolkit – for rapid development
- Performed on a feature layer
  - Unit of work – Graphic
- Online and local
Editing – using API

• Feature layer’s method for CRUD operation

```java
public void applyEdits(
    Graphic[] adds,
    Graphic[] deletes,
    Graphic[] updates,
    CallbackListener<FeatureEditResult[][]> callback) {
}
```

```java
private class MyCallback implements CallbackListener<FeatureEditResult[][]> {
    @Override
    public void onCallback(FeatureEditResult[][] objs) {
        // process after applyEdits is completed
    }
    @Override
    public void onError(Throwable e) {
        // process failures in applyEdits
    }
}
```
Editing – using toolkit

- **Features**
  - **Template Picker**
    - Creates templates of features; can be used to add new features
  - **Drawing Overlay**
    - Helps in creating different geometries on map
  - **Editing Toolbar**
    - Provides option to select, edit, delete features
Editing – using toolkit

- **Attributes**
  - Popup

- **Attachments**
  - Attachment Editor
    - View, add, delete attachments
Editor tracking

• FeatureLayer can have editing info
  - Creator
  - Time of creation
  - Last Editor
  - Time of last edit

• Track editing info on a feature

• Enforces permissions
Editing
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Editorial Demo

- Company X has a couple of restaurants near San Francisco. They are planning to expand and open another one nearby.

- Criteria to select:
  - Least amount of overlap with existing locations (to avoid revenue cannibalization).

- Data Collector
  - Is offline
  - Adds potential sites
  - Hands over data to Data Analyzer
Advanced Analysis

• Geoprocessing
  - Set of tools included in the ArcGIS System to perform GIS analysis
  - Custom script tools implemented using ModelBuilder or Python
  - Available
    - Online - hosted as a geoprocessing service by ArcGIS server, or
    - Offline - local geoprocessing packages (GPK)
  - Execute the service as a task from the API
Editing Demo

• Company X has a couple of restaurants near San Francisco. They are planning to expand and open another one nearby.

• Criteria to select:
  • Least amount of overlap with existing locations (to avoid revenue cannibalization).

• Data Collector
  • Is offline
  • Adds potential sites
  • Hands over data to Data Analyzer

• Data Analyzer
  • Is online
  • Analyzes data to make a decision
Geoprocessing

Vijay Gandhi
Advanced Analysis

- Network Analysis
  - Tasks
    - Routing
    - Closest Facility
    - Service Areas
  - Use with online services
  - For offline usage, can be consumed as local geoprocessing service
  - Same pattern as other analysis tasks
Advanced Analysis

• Routing
  - Uses route service
  - Option to set stops, preserve order, add barriers

• Closest Facility
  - Find routes to closest facility
    - E.g., find routes to closest hospital from an accident

• Service Area
  - Calculate service areas of facilities
    - E.g., calculate area that can be reached in 5 minutes from a hospital
Network Analysis
10.2 - Using your map offline

- Provide functionality that supports disconnected use of the ArcGIS platform
  - Viewing and querying maps
  - Editing features
    - Synchronization
  - Performing spatial analytics with the map
    - Finding places
    - Get directions
  - Planned for all Runtime SDKs
From ArcGIS Online and Portal
From Desktop

- Author Map
- Package
- Deploy
- Check In
- Edit
Developer workflows

• Take map offline
  - Viewing
  - Editing
  - Sync

• Perform offline tasks
  - Routing
  - Geocoding
  - Query

• Create your own layer
  - Define the layer and symbology
  - Persist it to the device
Developer building blocks

- **Webmap**
  - Work with a map offline
- **Local item manager**
  - Manage local items on device
- **Feature cache**
  - Represents the local data storage
  - Provides sync capabilities
- **Local layers and tasks**
  - For features, basemaps, querying, routing, etc
Next sessions

• Wed 5:30pm – 6:30pm, Mesquite C

*Best Development Practices and Patterns*

• Thurs 10:00am-11:00am, Primrose B

*Road Ahead for ArcGIS Runtime SDKs*
Thank you!

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Understanding our world.