ArcGIS Runtime: Analysis

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ArcGIS Runtime session tracks at DevSummit 2019

- ArcGIS Runtime SDKs share a common core, architecture and design
- Functional sessions promote common capabilities and workflows
  - An Introduction to the API and Architecture
  - Styling maps
  - Building AR and VR Experiences
  - Getting to know Arcade
  - Configuring Webmaps
  - Analysis
  - Preparing your data for offline use
  - Editing your data online and offline
  - Authenticating your applications
  - Working with maps online and offline
  - Working with ArcGIS Enterprise and Portal
  - Building 3D applications
  - Road ahead
  - Everything you wanted to know... Q&A
  - Migrating from Engine
- Product sessions promote specific development experiences
- Demo theaters highlight specific technical capabilities

Shared workflows, any platform, any device

Agenda

- Geometry operations
- Geoprocessing
- Visual Analysis
- Summary & Roadmap

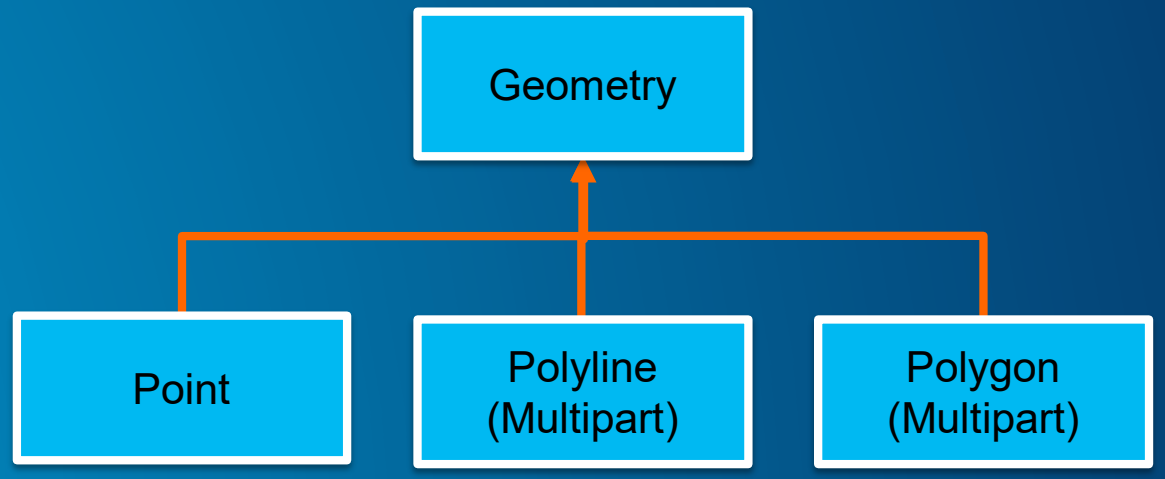
Geometry Operations

Lucas Danzinger

Geometry Engine

- Available on all Runtime SDKs
- Class with static methods for Geometry
- Input Geometries: point, line, polygon, envelope, or multipoint
- From features and graphics
- Fast, synchronous client-side processing

- 3 groups of functions
  - Geometry dimension operations
  - Geometry spatial operations
  - Building new geometries



Geometry dimension `questions`

- How long is this line?
- What is the area of this polygon?
- What is the boundary of this polygon?
- What is the distance between A and B?

Java sample

```
// get planar distance between 2 points
double planarDistance = GeometryEngine.distanceBetween(pointA, pointB);
```

- General information:
  - Results are in the unit of the spatial reference of the geometry
  - All geometries in an operation must have the same spatial reference

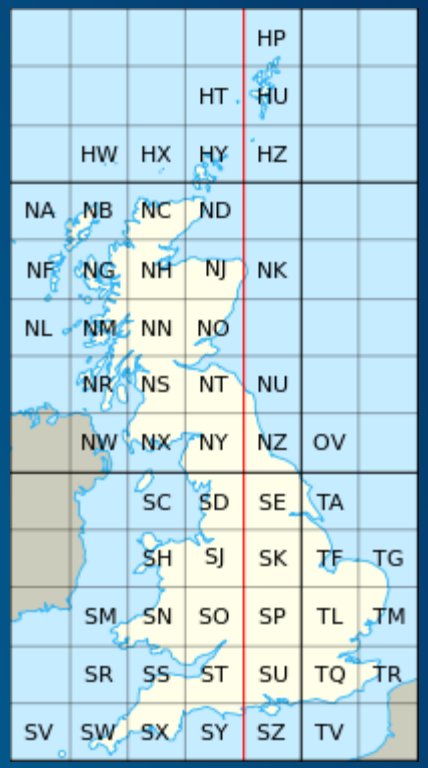
Projecting between spatial references

- Project method
- Convert from Web Mercator into a local coordinate system

Java sample

```
// create a OSGB point from a Web Mercator point
Point reprojectedGeometry = (Point) GeometryEngine.project(point, OSGB);
```

- Default transformation used to project is chosen for you
  - Or specify transformation
- TransformationCatalog class
  - Find suitable transformations



Answer spatial questions about geometries

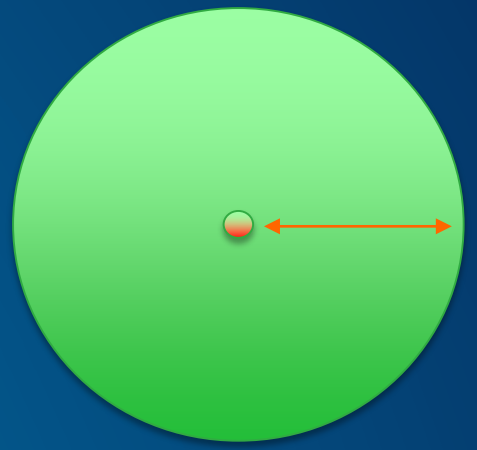
- Contains
- Crosses
- Intersects
- Nearest vertex
- Overlaps
- Touches
- Within

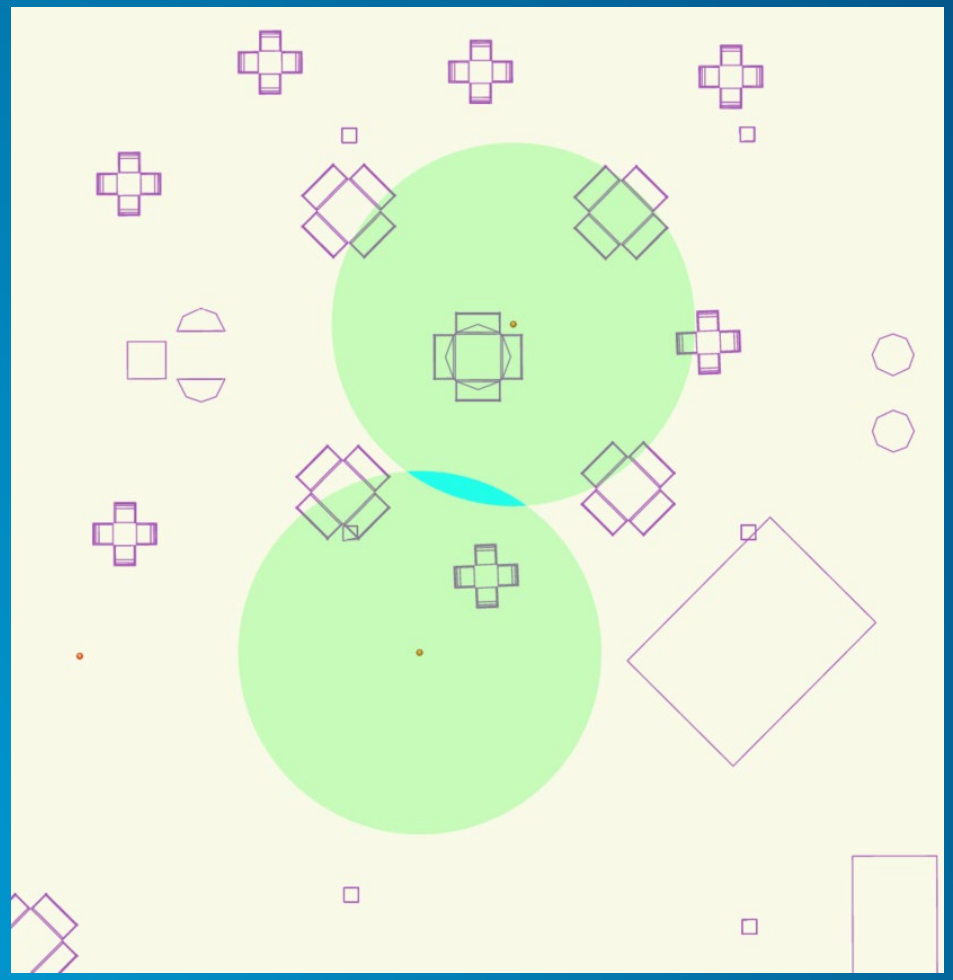
Java sample

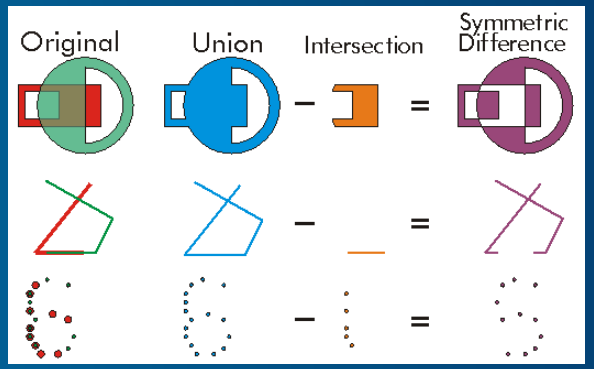
```
// does line cross polygon?
if (GeometryEngine.crosses(polyline, polygon)) {
    // color it green to say yes
    fillSymbol.setColor(0xFF00FF00);
} else {
    // color it red to say no
    fillSymbol.setColor(0xFFFF0000);
}
```

Create geometries based on geometries

- Buffer
- Union
- Intersects
- Difference



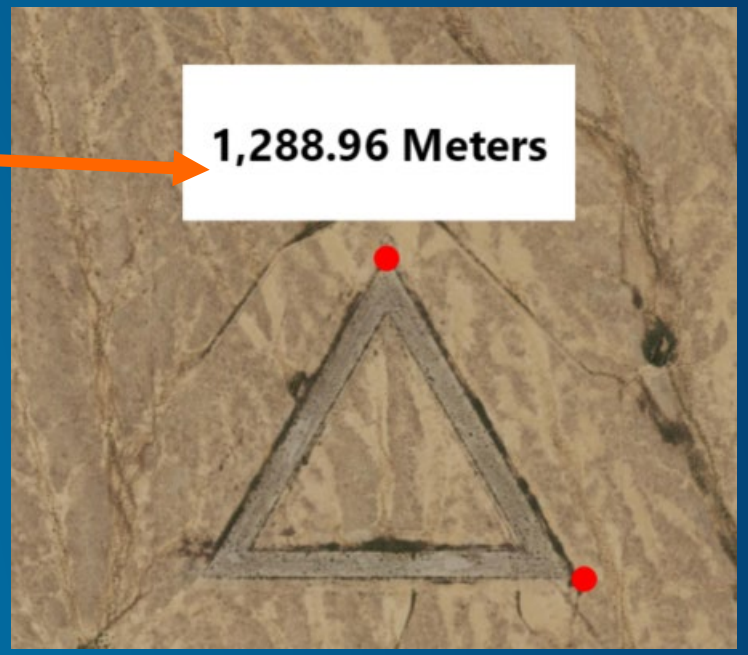


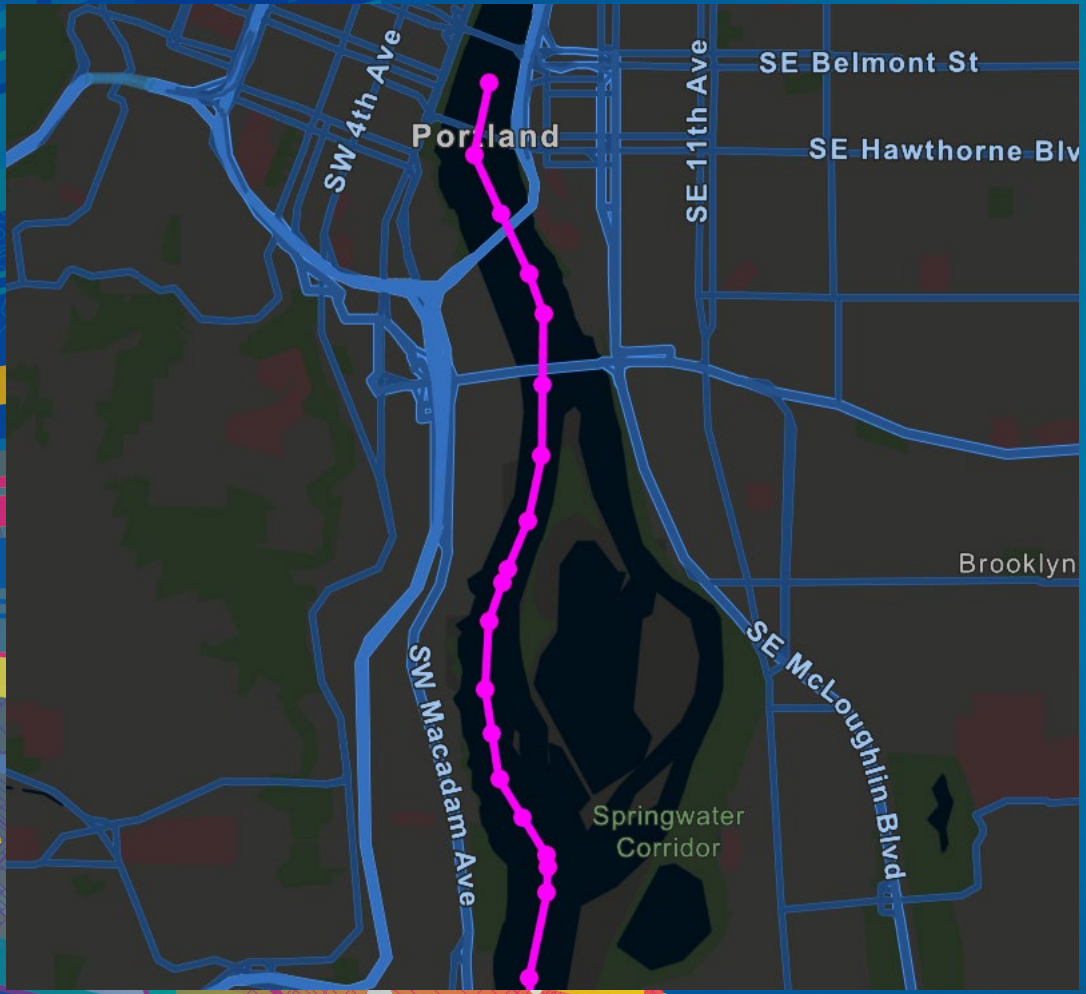


Plus many more…

- Label point

```
GeometryEngine.labelPoint(myPoly)
```





Demo: GeometryEngine

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Geoprocessing

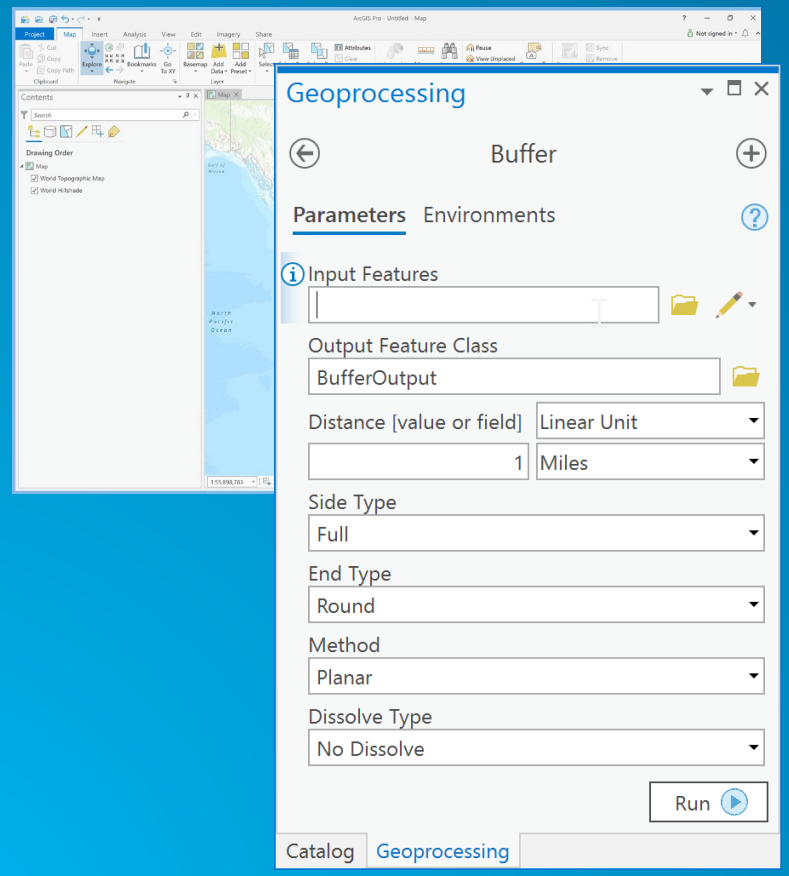
Mike Branscomb

Geoprocessing: Overview

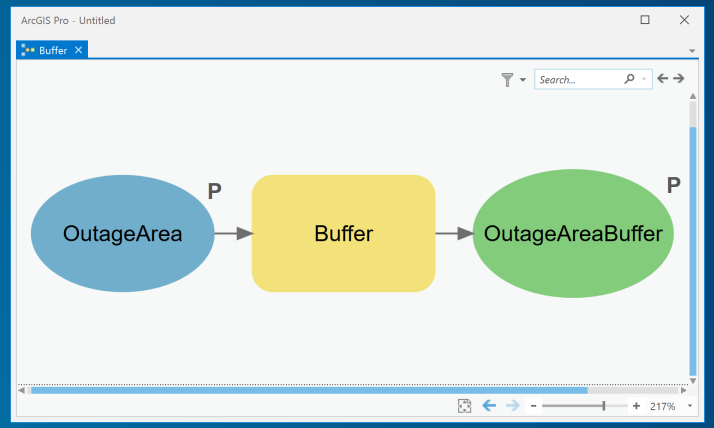
- Framework and tools for processing spatial data
  - Spatial analysis e.g. Buffer, Intersect, Viewshed…
  - Data management e.g. Create Feature Class, Add Field, Add Domain…
- More than 1200 built-in tools installed with ArcGIS Desktop
- Combined into custom tools/workflows
  - Model Builder
  - Python scripts
- Published to ArcGIS Enterprise as services
- Available `offline` as local services with ArcGIS Runtime Local Server
- Provide REST endpoint for service execution

Geoprocessing: Framework

- ArcGIS tools



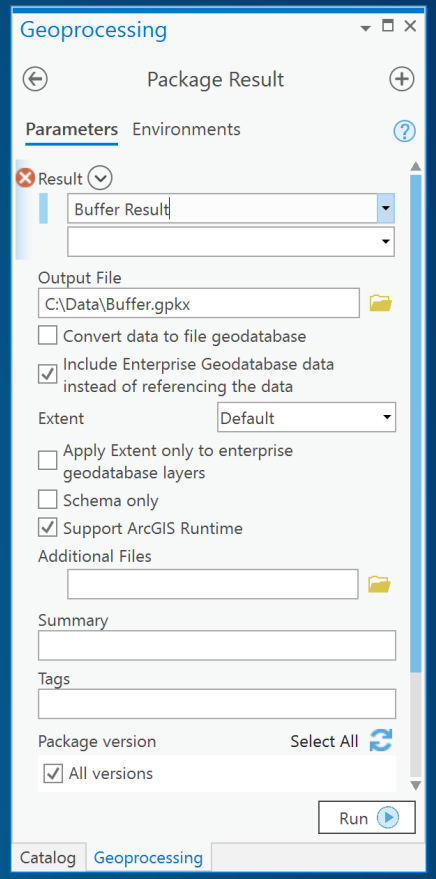
- Custom tools




```python
import os
import arcpy

# Set the workspace for ListFeatureClasses
arcpy.env.workspace = "c:/base"

# Use the ListFeatureClasses function to return a list of
#  shapefiles.
featureclasses = arcpy.ListFeatureClasses()

# Copy shapefiles to a file geodatabase
for fc in featureclasses:
    arcpy.CopyFeatures_management(
        fc, os.path.join("c:/base/output.gdb",
                         os.path.splitext(fc)[0]))
```

Geoprocessing: Services

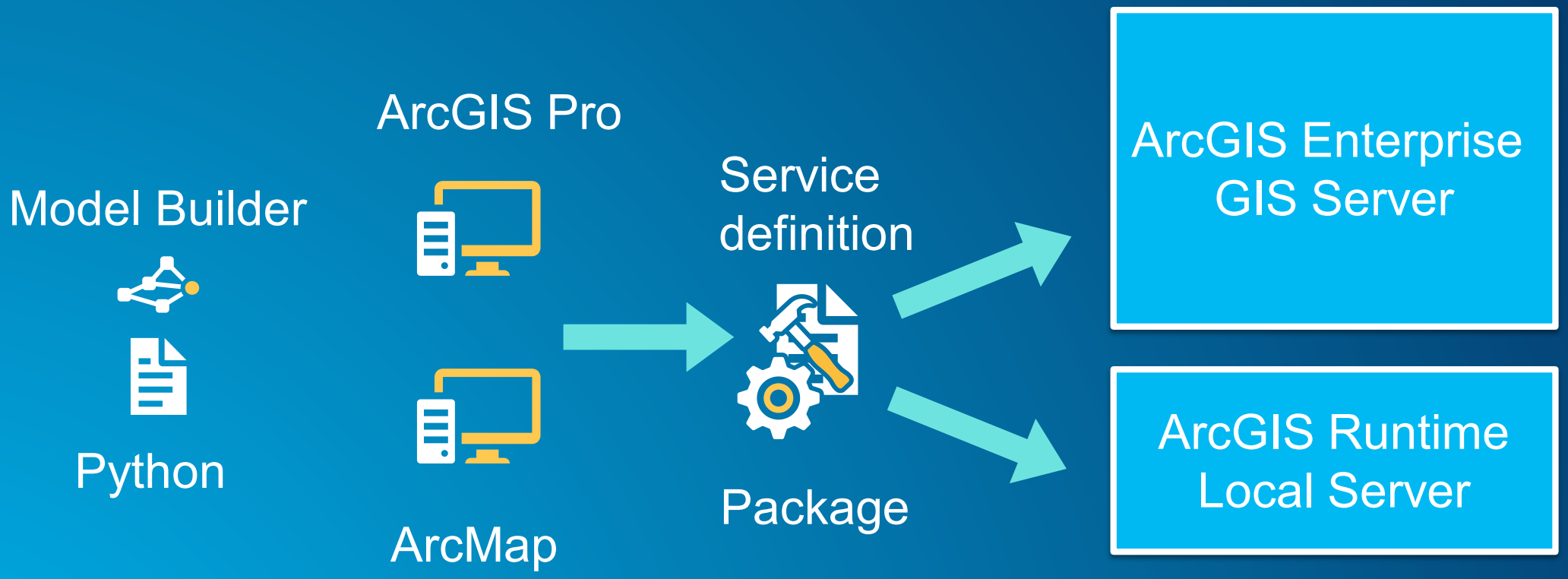
- Must run tool in ArcGIS Desktop before publishing
  - Validates inputs, processing and outputs
- Publish result to ArcGIS Enterprise
  - Result includes input data, output data, project data
- Runtime API provides types to represent geoprocessing
  - Service (task)
  - Specific requests to run (jobs)
- Build parameter objects, send to service, and await results
- Process output parameters
  - e.g. features, tables, raster datasets, values



Geoprocessing: Local Services

- ArcGIS Runtime Local Server includes subset of tools
  - Approx. 500 tools (data management, analysis, extensions)
- Result must be packaged
  - Geoprocessing Package (.gpk / .gpkx)
- Package includes all data required for execution of tool as a service
  - Input data, project data, output data
- LocalServer API includes administration
  - e.g. LocalGeoprocessingService.StartAsync(ServiceType.Asynchronous)

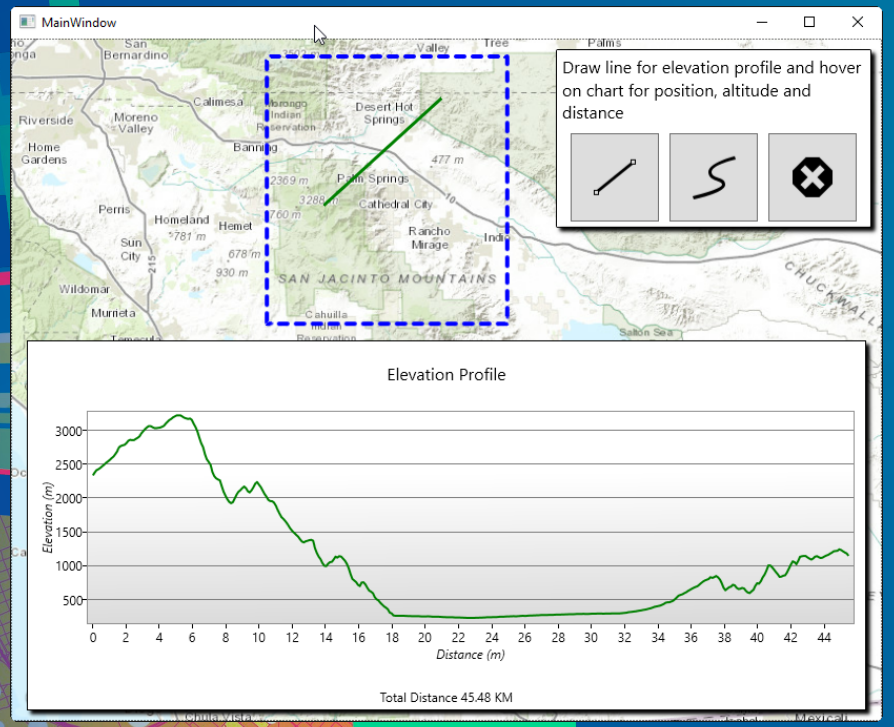
Publishing Geoprocessing services



Geoprocessing: Tips for building geoprocessing tools

- Keep input data and output data small
  - Determines size of the .gpk/.gpkx or Service Definition
- Use local data to ArcGIS Server / LocalServer
- Write intermediate data to memory
- Add attribute and spatial indexes
- Avoid unnecessary coordinate transformations
- Reduce data size

Server Help > Performance Tips for Geoprocessing Services



Demo: Geoprocessing

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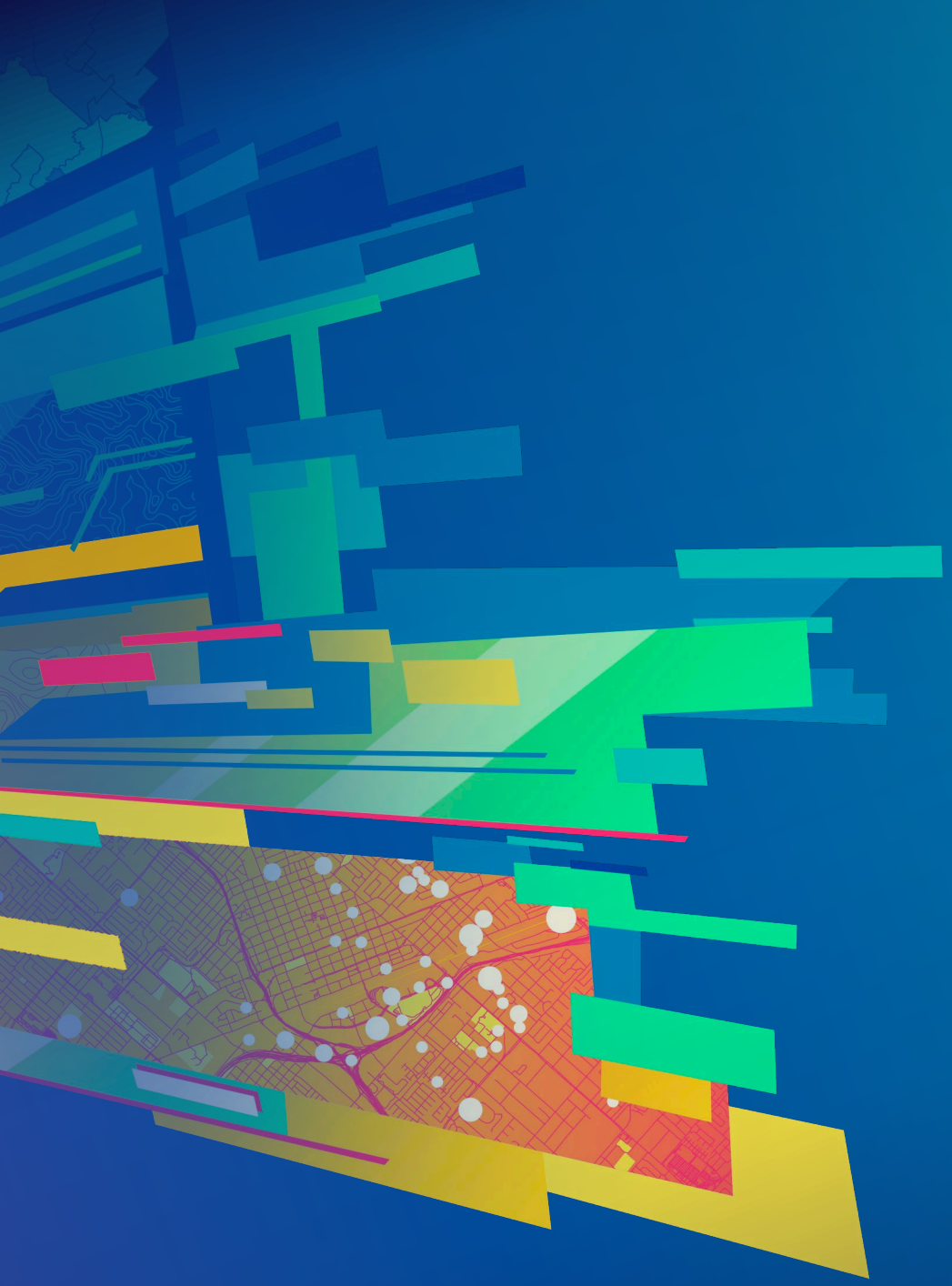
Interactive Visual Analysis

Mike Branscomb

Interactive Visual Analysis

- Available analyses:
  - Line of Sight
  - Viewshed
  - Location Distance Measurement
- Fast GPU-based operations
- Acts on current visible resolution of data
- Results are displayed in SceneView
- Contrasts with geoprocessing
  - Acts on full resolution of data
  - Results persisted as new datasets



Demo: Line of Sight

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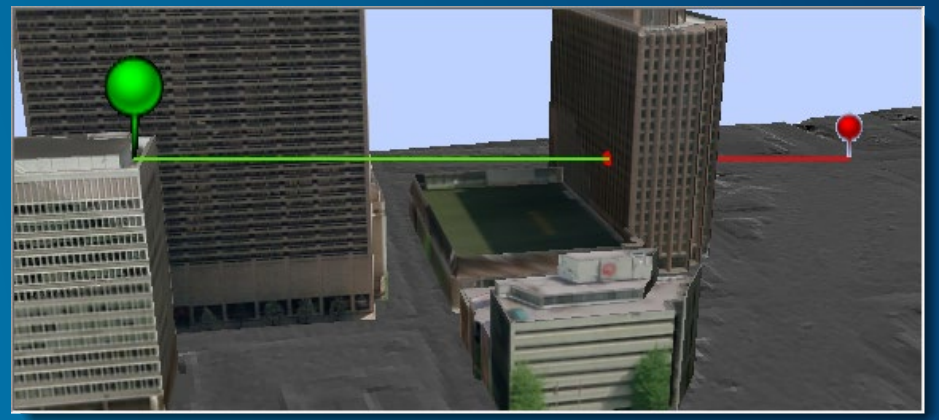
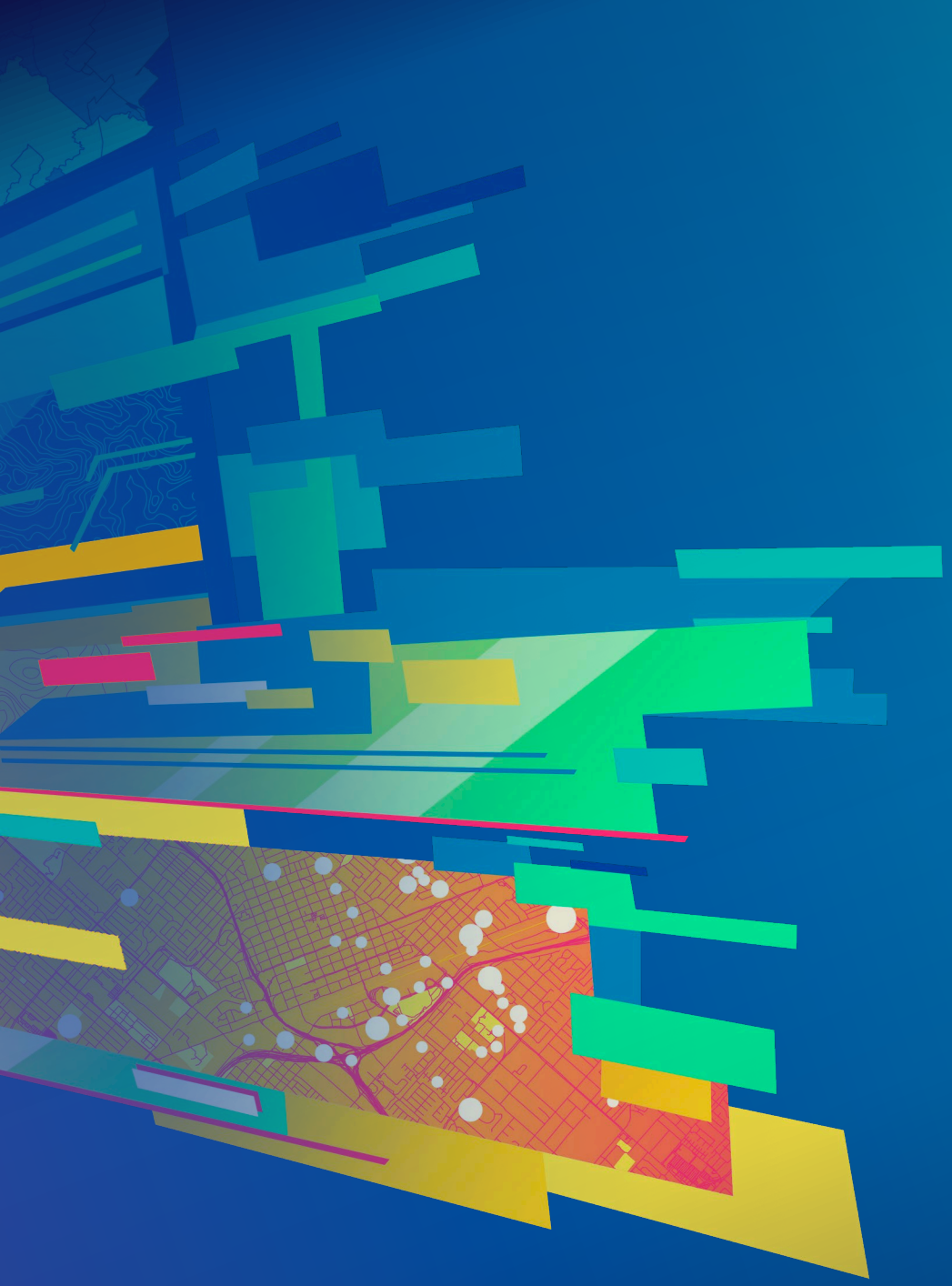
Line of Sight – Interactive Visual Analysis

- Determines the visible and not visible portions of an imaginary line between a target and an observer
- Output is a line graphic symbolized by visible areas and obstructed areas
- LocationLineOfSight – calculates against 2 points
- GeoElementLineOfSight – calculates between 2 GeoElements
  - Can attach to 2 GeoElements to auto update
- Events triggered when target is visible





Demo: Viewshed

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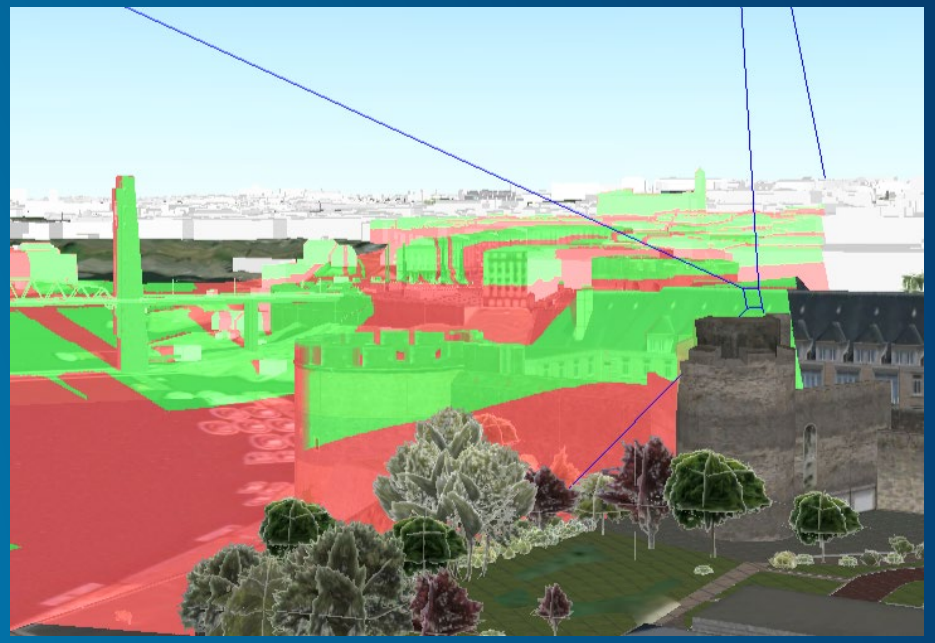
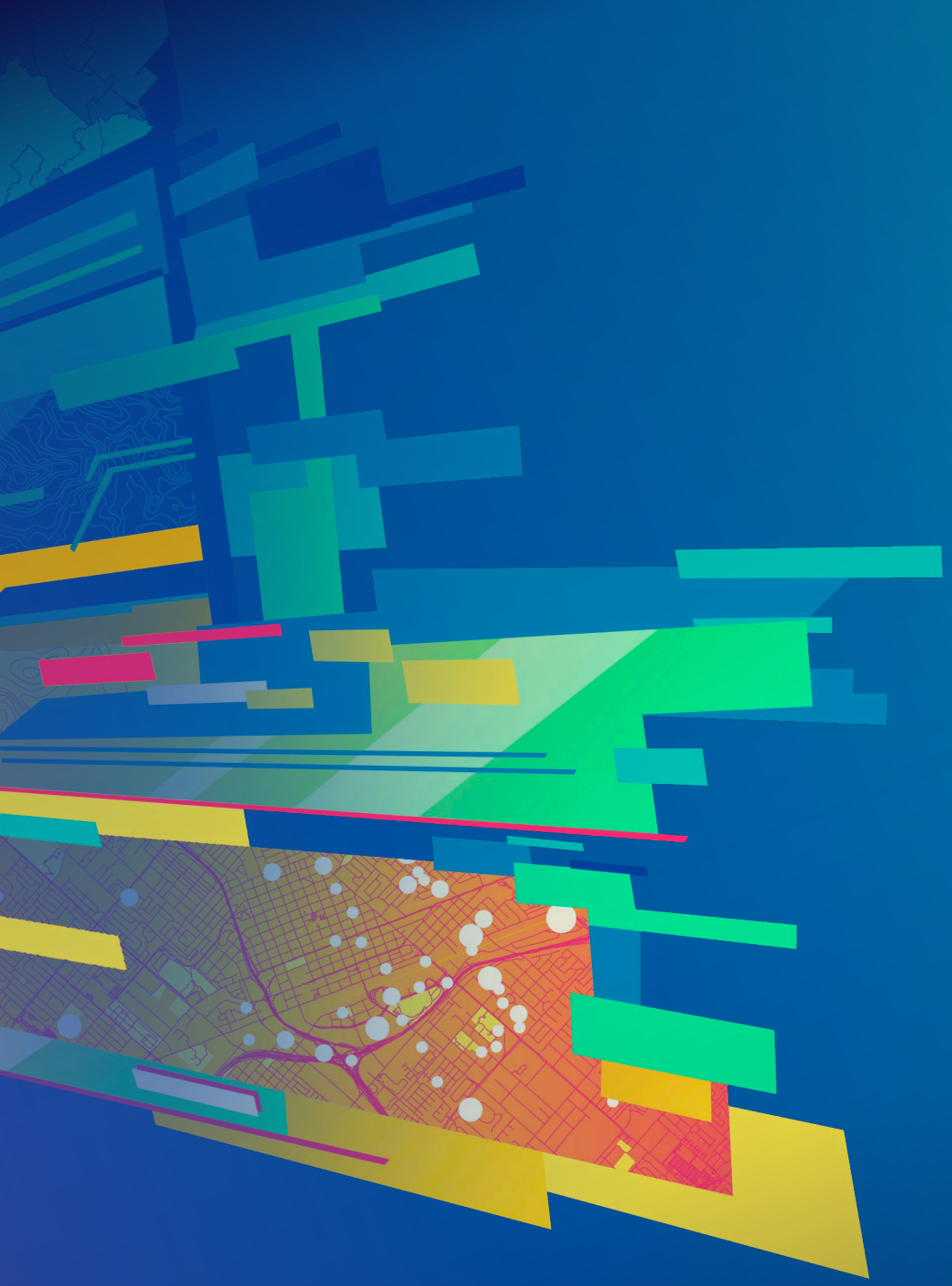
Viewshed – Interactive Visual Analysis

- Determines the visible and not visible portions of a surface based on an observer point
- Output is a raster symbolized by visible areas and obstructed areas
- LocationViewshed
  - Camera
- LocationViewshed
  - Point
- GeoElementViewshed
  - Attach to a GeoElement





Demo: Location Distance Measurement

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Location Distance Measurement – Interactive Visual Analysis

- Interactive distance measurements between two locations in a SceneView
- Input locations are 3D points
- Measure between locations on, above, or below the surface
- Measurements are planar
  - Accurate for relatively short distances
  - Terrain not considered in measurement
- Direct distance
  - Straight-line distance between start and end locations
- Horizontal distance
  - Planar distance between the start and end locations as projected onto the surface of the earth
- Vertical distance
  - The difference in elevation (z-value) between the start and end locations

Summary & Roadmap

Mike Branscomb

Summary

- ArcGIS Runtime enables spatial analysis in your native apps
- Common to combine approaches
  - Geometry Engine > Geoprocessing > Visualization
- Local to the device
  - Offline workflows
- In your enterprise or the cloud
  - Online service-based workflows

Roadmap for analysis in ArcGIS Runtime 100.x (Dev Summit 2018)

- ✓ Geoprocessing additional tools for Local Server
- ✓ More 3D exploratory analysis tools e.g. 3D distance
- ✓ Local Server support for ArcGIS Pro packages
- ✓ Local Server support for ArcMap 10.6 packages

- 2019: ArcGIS Runtime: Road Ahead
  - Thursday March 7th 5:30 pm - 6:30 pm
  - Primrose B

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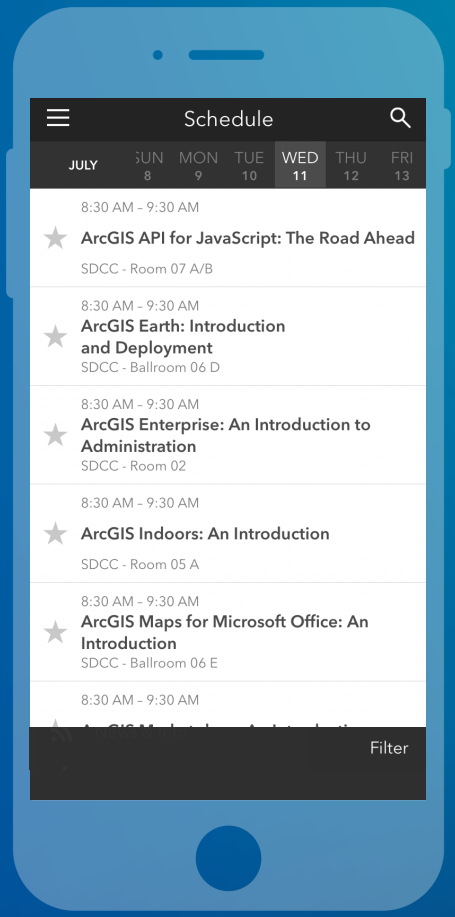
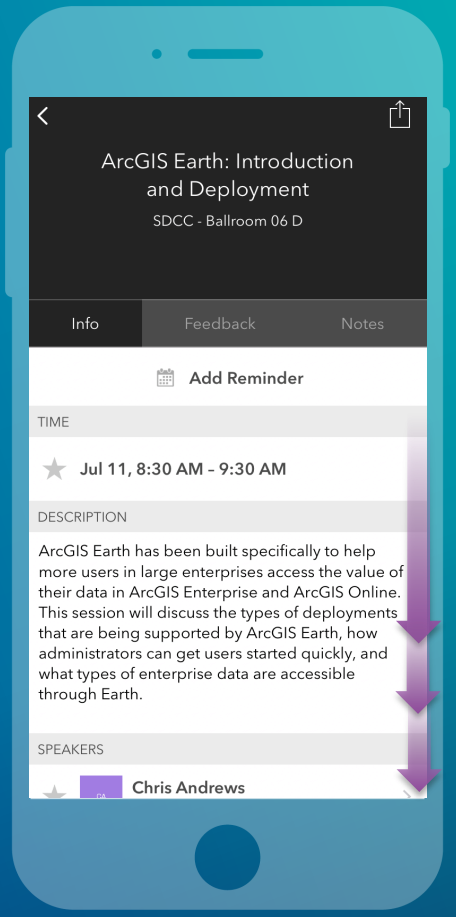
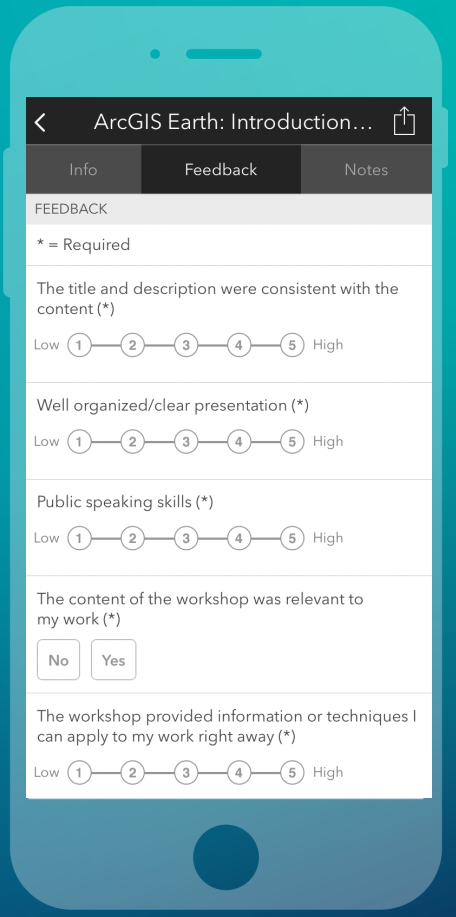


Scroll down to find the feedback section



Complete answers and select “Submit”



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