Building Analysis Into Your Command and Control Systems

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agenda

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Geoprocessing
“Conclusive” Analysis
Geoprocessing: Overview

• Framework and tools for processing spatial data in ArcGIS
  - Spatial analysis e.g. Buffer, Intersect, Viewshed…
  - Data management e.g. Create Feature Class, Add Field, Add Domain…

• ArcGIS Desktop
  - >1200 built-in tools installed
  - Author custom tools/workflows using Model Builder and/or Python scripts

• Publish to ArcGIS Enterprise
  - Geoprocessing Services designed in ArcGIS Desktop
  - Provides a REST endpoint for service execution

• ArcGIS Clients/APIs
  - Execute geoprocessing tools via services (Enterprise or Local)
Geoprocessing: Framework

- ArcGIS tools
- Custom tools
Publishing Geoprocessing services

Model Builder
Python

ArcGIS Server
ArcGIS Runtime
Local Server
Demo

GP in Runtime
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) and specific requests to run (jobs)

• Build parameter objects, send to service, wait for results

• Process output parameters
  - e.g. features, tables, raster datasets, values
Geoprocessing: Local Services

- ArcGIS Runtime Local Server includes subset of tools
  - Approx. 300 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)
Demo
Authoring & Publishing
Geoprocessing: Tips for building geoprocessing tools

- Keep input data and output data small
  - Determines size of the GPK 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
Visual Analysis

“Exploratory”
Exploratory 3D Visual Analysis

- Available analyses:
  - Line of Sight
  - Viewshed
- Fast performance – GPU driven
- Results displayed on Scene, not persisted
  - *differs from traditional Geoprocessing
- Acts on resolution of data in display
Exploratory 3D Visual Analysis

• **Line of Sight**
  - Determines the visible and not visible portions of an imaginary line between a target and an observer
  - Output is a line graphic where visible areas and obstructed areas have different colors
  - 2 varieties:
    - LocationLineOfSight – calculates against 2 points
    - GeoElementLineOfSight – calculates between 2 GeoElements
      - Can attach to 2 GeoElements to auto update
  - Events triggered when target is visible
Exploratory 3D Visual Analysis

- Line of Sight

```cpp
void LineOfSightLocation::createLineOfSight()
{
    // create the observer/target points
    const Point observerPt(-73.06958032962375, -49.253112971555446, 2000, SpatialReference::wgs84());
    const Point targetPt(-73.079266999709162, -49.300457676730559, 1312, SpatialReference::wgs84());

    // create the line of sight
    m_lineOfSight = new LocationLineOfSight(observerPt, targetPt, this);
    m_analysisOverlay->analyses()->append(m_lineOfSight);

    // configure the LoS color and width
    LineOfSight::setVisibleColor(QColor("cyan"));
    LineOfSight::setObstructedColor(QColor("magenta"));
    LineOfSight::setLineWidth(2.0f);
}
```
Exploratory 3D Visual Analysis

• Viewshed
  - Determines the visible and not visible portions of a surface based on an observer point
  - Output displays visible areas and obstructed areas using different colors
  - 3 varieties:
    - LocationViewshed (Camera)
    - LocationViewshed (Point)
    - GeoElementViewshed (attach to a GeoElement)
Exploratory 3D Visual Analysis

- Viewshed

```cpp
void ViewshedLocation::createViewshed(double x, double y)
{
    const Point pt = m_sceneView->screenToBaseSurface(x, y);

    // Create the Location Viewshed
    m_locationViewshed = new LocationViewshed(pt, m_heading, m_pitch,
                                             m_horizontalAngle, m_verticalAngle,
                                             m_minDistance, m_maxDistance, this);

    m_locationViewshed->setVisible(m_viewshedVisible);

    // Add the Viewshed to the Analysis Overlay
    m_analysisOverlay->analyses() -> append(m_locationViewshed);
}
```
Summary

• ArcGIS Runtime enables several ways to perform spatial analysis in your native apps
  - Conclusive Analysis (Geoprocessing, Geometry Engine)
  - Exploratory Analysis (Visibility)

• Common to combine approaches
  - Geometry Engine > Geoprocessing > Visualization

• Local to the device
  - Offline workflows

• In your enterprise or the cloud
  - Online service-based workflows
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