ArcGIS GeoAnalytics Server: An Introduction

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Agenda

- Overview of GeoAnalytics
- Analysis
- Data Management
- Setup and Administration
- Questions!
Overview
ArcGIS GeoAnalytics Server uses the power of distributed computing to quickly process and analyze large amounts of vector and tabular data with both spatial and temporal components.
Answer questions like…

• Using billions of emergency calls accumulated over the past decade, which counties have the largest number of calls per square mile?

• Which stationary pressure sensors in my pipe network have experienced abnormal events in the past 24 hours? Where are there hot spots of abnormal events?

• Where have my delivery trucks traveled and where is the highest density of unique delivery truck paths? Where do delivery trucks travel the slowest?
Why GeoAnalytics?

Answer difficult questions involving *large volumes of data* in minutes or hours instead of days or weeks.
GeoAnalytics Server | Why?

Run analysis against data that is too big for a single desktop
Five Quick Facts about GeoAnalytics at 10.6.1

1. Part of ArcGIS Enterprise (ArcGIS Server role).

2. Can read data from existing big data sources as well as GIS data.

3. Distributed computing capabilities are provided out-of-the-box.

4. Includes a set of 18 (and growing) analysis tools.

5. Results are stored in the ArcGIS Data Store and can then be used in other applications and information products.
Components of ArcGIS Enterprise

- ArcGIS Server
- Portal for ArcGIS
- ArcGIS Data Store
- ArcGIS Web Adaptor

Relational | Tile Cache | Spatiotemporal
Can be integrated with other ArcGIS products

Insights for ArcGIS
Data exploration & visualization

GeoEvent Server
Real-time data analysis
Gain insight into both spatial and temporal patterns.
How can I interact with GeoAnalytics Tools?

ArcGIS Pro
How can I interact with GeoAnalytics tools?
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ArcGIS Pro
Enterprise portal
ArcGIS API for Python
How can I interact with GeoAnalytics tools?

ArcGIS Pro
Enterprise portal
ArcGIS API for Python
ArcGIS REST API
GeoAnalytics Architecture | Inputs and Results

Use your layers through Pro, Portal, ArcGIS API for Python, or the REST API
Analysis
Analysis Overview

- Analysis capabilities patterned from ArcGIS Online Spatial Analysis
- Tools useful for big data with an emphasis on:
  - Spatiotemporal analysis
  - Summarization and aggregation
What types of tools does GeoAnalytics offer?

**Summarize Data**
- Aggregate Points
- Build Multi-Variable Grid
- Join Features
- Reconstruct Tracks
- Summarize Attributes
- Summarize Within

**Analyze Patterns**
- Calculate Density
- Create Space Time Cube
- Find Hot Spots
- Find Point Clusters

**Find Locations**
- Detect Incidents
- Find Similar Locations
- Geocode Locations

**Manage Data**
- Append Data
- Calculate Field
- Copy to Data Store
- Overlay Layers

**Use Proximity**
- Create Buffers
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**Use Proximity**
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Aggregation

- Aggregate into polygons

Target Features + Join Features → Intermediate Result → Final Result

- Aggregate into time steps
Aggregation into Space and Time

- Points into bins (square or hexagon)
Aggregation of Lightning Strikes
Time Stepping

• Three parameters to define a time step:
  - **Interval** (duration of time in a step)
  - **Repeat** (frequency of a step)
  - **Reference time** (alignment)

• Examples:
  - Hourly steps  **Interval:** 1 hour
  - Every 12th hour  **Interval:** 1 hour  **Repeat:** 12 hours
  - Every Monday  **Interval:** 1 day  **Repeat:** 1 week  **Reference:** Some Monday
Joining Features in Space and Time

- Spatiotemporal joins

<table>
<thead>
<tr>
<th>Target Features</th>
<th>Join Features</th>
<th>Intermediate Result</th>
<th>Final Result</th>
</tr>
</thead>
</table>

NOW

THEN
Aggregate Points into Tracks

- Reconstruct Tracks
  - Summarize time-enabled points into tracks
Arcade Expressions

- Can be used in 6 GeoAnalytics tools

Arcade scripts are portable. This means that scripts you author in ArcGIS Pro can be read and executed in a WebMap through a browser or in a Mobile Application.
Arcade Expressions

- **Append Data** | Optionally used to determine how values are appended
  - Append the mean($feature[“2015_Sales”], ($feature[“2016_Sales”]), ($feature[“2017_Sales”])) to a field AverageSales

- **Join Features** | Used to specify which features should be used in a join.
  - Join Features that meet the condition $target[“cost”] > $join[“annual_cost”]

- **Create Buffers** | Optionally used to calculate the buffer distance.
  - Buffer by $feature[“Blast_Radius”] * 10
Arcade Expressions

- **Reconstruct Tracks** | Optionally used to calculate the buffer distance. Can be time aware.
  - **Buffer** by $feature[“wake”]

- **Calculate Field** | Use to calculate new values. Can be time aware.
  - Calculate the values as the mean of the 3 previous values:
    \[
    \text{mean}($track.field[“speed”].history(-5, -1))
    \]

- **Detect Incidents** | Used to detect features that meet a certain condition. Can be time aware.
  - Detect features that meet the condition: \[
  \text{abs}($feature[“temperature”] - ($track.field[“temperature”].history(-1))) > 10
  \]
Build Multi-Variable Grid

- Built to aggregate multiple datasets into one by calculating:
  - Distance to nearest
  - Attributes of nearest
  - Summary of intersecting
  - Summary within a given distance

…on one or more layers of interest
Build Multi-Variable Grid – Nearest Subway Station
Build Multi-Variable Grid – Nearest Park
Build Multi-Variable Grid – Population per Sq. Mile
Build Multi-Variable Grid – Number of Complaints
What types of data does GeoAnalytics work with?

- feature
- tabular
- imagery
- real-time
GeoAnalytics Server and your Data

- Use your GIS data
  - Works with layers already in your Web GIS

- Use your own big data sources: big data file shares

- Output:
  - Hosted feature service
    - By default, results are stored in the spatiotemporal data store
  - Local NetCDF file (Create Space Time Cube)
GeoAnalytics Server and Big Data File Shares

Read directly from:
- File shares (local or network directories)
- HDFS – Hadoop Distributed File System
- Hive
- Cloud Stores
  - AWS S3
  - Microsoft Azure Blob container
  - Microsoft Azure Data Lake

Supported file types:
- Delimited files (.csv, .tsv, .txt)
- Shapefiles
- Parquet files
- ORC files

Input:
Big Data File Share
– references your source data

Output:
Hosted feature layer
Registering a Big Data File Share
Setup and Administration
Components Required for GeoAnalytics Server

- Portal for ArcGIS
- ArcGIS for Server
- ArcGIS Web Adaptor
- ArcGIS Data Store
  (relational and spatiotemporal)
Step 1: Set up a Base Enterprise Deployment

1. Install Portal for ArcGIS
2. Install ArcGIS Server (license as standard or advanced GIS server)
3. Install ArcGIS Data Store and register relational data store with Server
4. Install and configure Web Adaptors (WA) for Server and Portal
5. Federate Server with Portal and configure as the Hosting Server
Step 2: Install and Configure Spatiotemporal Data Store

1. Install ArcGIS Data Store
2. Configure a spatiotemporal data store with the hosting server
Step 3: Set up a GeoAnalytics Server

1. Install ArcGIS Server (licensed as a GeoAnalytics Server)
2. Install and configure a Web Adaptor for the Server
3. Federate the server with the Portal and configure as the GeoAnalytics server
Deployment patterns | Simple deployment

Base Deployment (Machine 1)

Hosting Server

Portal for ArcGIS

ArcGIS Relational Data Store

ArcGIS Spatiotemporal Data Store (Machine 2)

Spatiotemporal Data Store (Machine 2)

GeoAnalytics Server

Big Data File Share

GeoAnalytics Server (Machine 3)
Deployment patterns | Multi-machine deployment

- **Base Deployment (Machine 1)**
  - Hosting Server
  - Portal for ArcGIS
  - ArcGIS Relational Data Store

- **ArcGIS Spatiotemporal Data Store (multi-machine)**

- **ArcGIS GeoAnalytics Server (multi-machine)**
  - WA (GeoAnalytics)
  - WA (Portal)

- **GeoAnalytics Server**
  - WA (Server)

- **Big Data File Share**
What can I run GeoAnalytics on?

- Supported on Windows and Linux platforms
  - On-premises
  - Amazon (easy to configure with Amazon Cloud formation templates)
  - Azure (easy to configure with Azure Cloud Builder)
System Requirements

- **Base ArcGIS Enterprise deployment:**
  - Minimum 4 cores and 16 GB RAM

- **ArcGIS Spatiotemporal Big Data Store:**
  - Minimum 16 GB RAM for each machine (32GB Recommended)
  - Fast disk/sufficient disk space for data

- **ArcGIS GeoAnalytics Server:**
  - Minimum 4 cores and 8 GB RAM for each machine (16GB+ Recommended)
  - Sufficient temp space for compute
Summary

**Integrated**: Works with your existing big data storage AND/OR existing GIS data.

**Spatiotemporal**: Tools are designed to analyze data in space and time.

**Accelerated**: Speeds up analytical processing time using built-in distributed compute.

**Actionable**: Able to crunch through large volumes of data to generate actionable insights and intelligence. Enabling organizations to visualize & react to large amount of data in a clearer and more meaningful way.
Other Resources

- GeoAnalytics Technical Workshop, 2017
- Flight demo, 2017
- Financial Transaction demo, 2016

- ArcGIS GeoAnalytics Server: DevSummit 2018 FAQs
- Esri Australia blog post on maritime safety
- Esri Australia with distributed cloud computing
- Geocoding at 10.6
- Leveraging Distribute Computing
- Fix for Create Space Time Cube for 10.5 + 10.5.1
- Discovering GeoAnalytics
Please Take Our Survey on the App

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Select the session you attended

Scroll down to find the feedback section

Complete answers and select “Submit”