GeoEvent Server:
Making 3D Scenes Come Alive with Real-Time Data

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1 3D for ArcGIS
Web Scenes, Scene Layers

- **Web Scene**
  - Vehicle for cross-platform 3D capability
  - Collection of layers, environment settings, slides, *animation*
  - Essential for 3D apps on any platform or experience

- **Scene Layer**
  - Scalable cache of graphics, styles, and attributes
  - 3D Objects, 3D Points, Integrated Meshes, *Point clouds*

- **Reuse, Share, Extend**
3D Across the Platform

A new way of working in 3D
### 3D across the Esri product family

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>ArcGIS Pro</strong></td>
<td>Powerful 2D/3D desktop authoring and data management</td>
</tr>
<tr>
<td><strong>3D Analyst</strong></td>
<td>Rich analysis for advanced 3D workflows</td>
</tr>
<tr>
<td><strong>CityEngine</strong></td>
<td>Advanced editing tool for Urban Designers</td>
</tr>
<tr>
<td><strong>ArcGIS for Server</strong></td>
<td>Scalable 2D/3D enterprise content distribution and geoprocessing</td>
</tr>
<tr>
<td><strong>ArcGIS Online</strong></td>
<td>Content and services for sharing ideas in 2D and 3D</td>
</tr>
<tr>
<td><strong>ArcGIS Earth</strong></td>
<td>Easy-to-use 3D data exploration for Enterprise users</td>
</tr>
<tr>
<td><strong>ArcGIS Runtime</strong></td>
<td>Developer tools for 2D and 3D custom solutions</td>
</tr>
<tr>
<td><strong>ArcGIS Marketplace</strong></td>
<td>3rd party geospatial apps and data for the enterprise</td>
</tr>
</tbody>
</table>
3D Application Development

3D Runtime SDK
- Full 3D Runtime functions
- High performance
- Large data set
- Machine Native code
- Mobile and desktop
- Multiple codebases

JavaScript (WebGL)
- Pure browser-based
- No plugin
- Rapidly maturing
- Acceptable performance
- Works on most platforms
- One codebase
ArcGIS API for JavaScript 4.x

• One API for 2D and 3D

- Elevation
- 3D symbology
- Camera manipulation
- Animation
- Lighting/shadow
Supported Real-Time Data

- **StreamLayer** (from GeoEvent Stream Service) – JavaScript API 4.x
- **KML**
- **Feature Services from Spatiotemporal Big Data Store**
  - Very fast writing rate on add, update, delete
  - Rapid retrieval of Features
2 Real-Time GIS
Real-Time GIS and The Internet of Things

Enable real-time spatial reasoning

- Spatial reasoning is needed amongst the Internet of Things
- Performing continuous analytics closer to the things can improve their ability to sense
- When meaningful patterns are found things can send updates to those who need it
Observation data

An observation is a recording of a feature’s attribute values and location at a specific moment in time.
- Observations are immutable, they happen and are typically not edited.
- Observations can be replayed over space & time.
- Moving observations are identifiable by a unique attribute, known as a TRACK_ID.

Observations can be shown at a specific time.

Moving observations can be identified by a unique attribute.

The tracks of moving observations can be reconstructed.

Moving observation illustration for two tracks over space (X, Y) and time (T).
ArcGIS Enterprise

GeoEvent Server – Real-time and big-data capabilities

- Ingest high velocity real-time data into ArcGIS
- Perform continuous analytics on events as they are received
- Store observations in a spatiotemporal big data store
- Run batch analytics on stored observations
- Visualize high velocity & volume data:
  - as an aggregation
  - as discrete features
- Notify those who need to know about patterns of interest

GeoEvent Server is a “server role” extending the capabilities of your ArcGIS Enterprise ...
Real-Time GIS
ArcGIS 10.4

- Can ingest higher velocity real-time data into ArcGIS.
- Observations CAN now be stored in a Big Data Store.
- Can visualize high velocity and volume data - as an AGGREGATION, - as discrete FEATURES, - live & HISTORICALLY.
- Visualization CAN scale.
3 Static 3D Scene
Creating Scene Services
Making 3D Scene Comes Alive
Stream services vs. traditional feature services

Two patterns of Real-time GIS

- Feature layers **pull** from feature services
  - Web apps poll to get periodic updates

- Stream layers **subscribe** to stream services
  - Web apps subscribe to immediately receive data
  - Low latency and high throughput
Stream services vs. traditional feature services

Two patterns, two important differences

- Feature services **persist** their data in a Geodatabase
- Stream services **broadcast** their data without first persisting the data
Stream Layer
What is it?

- A layer in the Javascript API
  - Available since version 3.6
- Draws data on map using client-side graphics
Support for stream services in the 10.3 and 10.3.1 product releases

What can I use to consume stream services?

- ArcGIS Online and Portal for ArcGIS Web Maps
- ArcGIS Online and Portal for ArcGIS web application templates
- Web applications built using Web AppBuilder
- Your own web apps that use the ArcGIS API for JavaScript
KML Service
How to enable KML service

- Not available out-of-box!
- Obtain the KML Connector for GeoEvent on GeoEvent Gallery (10.2.x)
  http://www.arcgis.com/home/item.html?id=8ddf65e2d9894d37ae19856671392c45
- Obtain source code from GitHub (updated to 10.4) and build it
  https://github.com/Esri/kml-for-geoevent
- Deploy the jar to GeoEvent\deploy folder
- Create Output
Demo Publishing
Real-Time Services
5 Real-Time 3D Visualization
3D Visualization Techniques
Keeping up the 3D display performance

- 3D scene contains continuous scale
  - depending on the positions of viewer and target
- Use high LOD 3D symbol to represent objects close to the viewer
- Use low LOD symbol for objects that are further away from the viewer
  - Billboard 2D graphics
  - Simple geometric shape (e.g. spheres)
- Remove objects that are too close or too far from the scene
  - Use view volume culling
  - Use fog (particle system)
3D Visualization Techniques

Make it interesting

• Animated symbol
  - Contains animation sequence
  - 2D or 3D
  - GIF animation
  - Particle System

• Multi-representation
  - Adapting to object status or condition
  - Adapting to distance to the viewer - LODs
Demo Visualization Techniques
KML on ArcGIS Explorer
KML on ArcGIS Earth (1.2)
Demo 3D Los Angeles Buses
Demo 3D Seattle Buses
Demo Esri Real-Time 3D Apps
Demo 3D Windmills in motion
Demo 3D Vehicles
Conclusions
Conclusions

• Time enabled 3D applications for mobile and web can be developed using ArcGIS components
  - 3D Web Scene, ArcGIS Explorer, ArcGIS Earth
  - GeoEvent to handle real-time data
  - JavaScript API for ArcGIS version 4
• Visualization of large volume of data in 3D needs certain techniques for good performance
• JavaScript API version 4 allows external renderer using 3rd party libraries (e.g. Three.js)
Who do you want to be?
<table>
<thead>
<tr>
<th>Session</th>
<th>Date/Time</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>GeoEvent Server: Internet of Things (IoT)</td>
<td>Tue, 1:00-2:00pm, Primrose B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri, 1:00-2:00pm, Primrose</td>
<td></td>
</tr>
<tr>
<td>GeoEvent Server: Introduction</td>
<td>Tue, 5:30pm-6:30pm, Primrose B</td>
<td></td>
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<tr>
<td>Visualizing Big Data with ArcGIS API for JavaScript &amp; WebGL</td>
<td>Tue, 2:30-3:30pm, Primrose B</td>
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<tr>
<td>GeoEvent Server: Creating Connectors using GeoEvent SDK</td>
<td>Wed, 2:30-3:30pm, Santa Rosa</td>
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<tr>
<td>GeoEvent Server: Creating Processors using GeoEvent SDK</td>
<td>Wed, 4:00-5:00pm, Santa Rosa</td>
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<td>Real-Time &amp; Big Data GIS at a Massive Scale</td>
<td>Wed, 4:00-5:00pm, Smoketree A-E</td>
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<tr>
<td>Big Data &amp; ArcGIS: Introduction to GeoAnalytics Server</td>
<td>Thu, 10:30-11:30am, Mojave Learning Center</td>
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<tr>
<td>GeoEvent Server: Applying Real-Time Analytics</td>
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<tr>
<td>GeoEvent Server: Best Practices</td>
<td>Thu, 2:15-3:15pm, Primrose C-D</td>
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<td>Developing Real-Time Web Apps with JavaScript</td>
<td>Thu, 3:00-3:30pm, Demo Theater 1, Oasis 1</td>
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<tr>
<td>Big Data: Leveraging the Spatiotemporal Big Data Store</td>
<td>Thu, 4:00-5:00pm, Catalina/Madera</td>
<td></td>
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<tr>
<td>Building Android Location Awareness with GeoEvent Server</td>
<td>Thu, 6:00-6:30pm, Mesquite C</td>
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<td>GeoEvent Server: Making 3D Scenes Come Alive</td>
<td>Fri, 8:30-9:30am, Primrose C-D</td>
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Questions / Feedback?

To learn more:
http://links.esri.com/geoevent
https://links.esri.com/geoevent-forum

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