Real-Time GIS: GeoEvent Extension

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Agenda

1. What is Real-Time GIS?
2. Working with Real-Time Data
3. Applying Real-Time Analytics
4. Real-Time in Web Apps
5. Wrap-up
1 What is Real-Time GIS?
GIS Data

*What has happened, what is happening, what will happen*

*The ‘current’ snapshot is outdated almost as soon as it’s created…*
Real-Time GIS Data

Continuous stream of events flowing from a data feed

Each event represents the latest state of the sensor…
Real-Time Analytics

What fishing vessels are inside designated ‘no fishing’ zones?

Requirement #2

Continuous Analysis

Inside Boundary

Features

Vessel

Alert

Applications

Alert!

Incident: Inside No Fishing zone
Time: 1:23pm PST on 3/3/2024
Type: Commercial vessel
Operator: Robert Smith
Vessel ID: WVA-00200020
Real-Time Notifications and Alerting

Tell a parent when their child leaves school property

Requirement #3

Continuous Analysis

Outside Boundary

Features

Child

Applications

SMS

Requirement #3

Tell a parent when their child leaves school property.
Real-Time Capability

ArcGIS 10.4

- 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
- Visualize high velocity and volume data:
  - as an aggregation
  - as discrete features
- Notify those who need to know about patterns of interest in real-time
2 Working with Real-Time Data
Working with Real-Time Data

Making features come alive

• Connect an output to your feature/stream service
• Import the schema of your feature as a GeoEvent Definition
• Configure an input to receive real-time data
• Author and publish a GeoEvent Service
• Visualize your real-time features
Making Features Come Alive
Tracking Snow Plows
Ingesting real-time data into ArcGIS

Input connectors

You can create your own connectors.

**GeoEvent Extension**

GeoEvent Services

**Inputs**

- Poll an ArcGIS Server for Features
- Poll an external website for GeoJSON, JSON, or XML
- Receive Features, GeoJSON, JSON, or XML on a REST endpoint
- Receive GeoJSON or JSON on a WebSocket
- Receive RSS
- Receive Text from a TCP or UDP Socket
- Subscribe to an external WebSocket for GeoJSON or JSON
- Watch a Folder for new CSV, GeoJSON, or JSON Files

**Outputs**

- **ActiveMQ**
- **CAP**
- **Cursor-on-Target**
- **Exploitation Support Data**
- **Instagram**
- **Kafka**
- **MQTT**
- **NMEA 0183**
- **RabbitMQ**
- **Sierra Wireless (RAP)**
- **Trimble (TAIP)**
- **Twitter**

**Out of the Box**

- **REST**
- **HTTP**
- **WS**
- **WS**
- **WS**
- **HTTP**

**Esri Gallery**

- ActiveMQ
- CAP
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**Partner Gallery**

- CompassCom
- CompassLDE
- CompassEarth
- exactEarth AIS
- FAA (ASDI)
- GNIP
- GNIP
- Networkfleet
- OSIsoft
- Zonar
- Valarm
- Zonar

**Key**

- *: Available
- ·: Not available
- *: Special notes
Storing real-time data in ArcGIS and alerting

**Output connectors**

You can create your own connectors.

GeoEvent Extension

GeoEvent Services

**Inputs**

**Outputs**

**Out of the Box**

- Add or Update a feature
- Publish Text to a UDP Socket
- Push GeoJSON or JSON to a external Website
- Push GeoJSON or JSON to an external WebSocket
- Push Text to an external TCP Socket
- Send a Text Message
- Send an Email
- Send an Instant Message
- Send Features to a Stream Service
- Write to a CSV, GeoJSON, or JSON File
- Add a Feature to a Spatiotemporal Big Data Store
- Update a feature in a Spatiotemporal Big Data Store

**Esri Gallery**

- ActiveMQ
- Hadoop (HDFS)
- Kafka
- MongoDB
- MQTT
- RabbitMQ
- Twitter
3 Applying Real-Time Analytics
Applying Real-Time Analytics

*GeoEvent Services*

- **A GeoEvent Service** defines the flow of GeoEvents
  - The **Filtering** and **Processing** steps to perform
  - what input(s) to apply them to
  - and what output(s) to send the results to

---

Diagram: Ambulance Monitor

- Monitors vehicles by updating a vehicle feature layer with current information including, alerting when speeding violations are detected, when vehicles enter dangerous areas, and when vehicles are in close proximity to an item of interest.

- Flowchart diagram showing inputs and outputs:
  - Input: ambulance-tcp-text-in
  - Outputs:
    - ambulance-fs-out
    - alert-fs-out
    - sms-text-out
    - email-text-out

- Interconnected with other monitors:
  - Speed Monitor
  - Dangerous Area Monitor
  - Hospital Proximity Monitor
Applying Real-Time Analytics

**GeoEvent filtering**

- A **Filter** eliminates GeoEvents based on an expression
Filtering
Attribute, Spatial, and Combination Expressions
Performing continuous analytics in ArcGIS

**Processors**

- You can perform continuous analytics on events as they are received using a **processor**.

You can create your own processors.

**GeoEvent Extension**

- GeoEvent Services

**GeoEvent Services Inputs**

- Buffer Creator
- Convex Hull Creator
- Difference Creator
- Envelope Creator
- Field Calculator
- Field Enricher
- Field Mapper
- Field Reducer

**GeoEvent Services Outputs**

- Geotagger
- Incident Detector
- Intersector
- Projector
- Simplifier
- Symmetric Difference
- Track Gap Detector
- Union Creator

**Out of the Box**

- Add XYZ
- Bearing
- Ellipse
- Event Volume Control
- Extent Enricher
- Field Grouper
- GeoNames Lookup
- Motion Calculator
- Range Fan
- Reverse Geocoder
- Service Area Creator
- Symbol Lookup
- Track Idle Detector
- Unit Converter
- Visibility
- Query Report

**Esri Gallery**

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Processing
Detecting Events of Interest

- Truck 4 is currently idle. Started at 6/25/16 7:02 PM
- Truck 5 is speeding, ended at 6/25/16 7:01 PM and lasted for 20 seconds.
- Truck 1 has entered a steep slope zone. Occurred at 6/25/16 7:01 PM
### Additional Real-Time Spatial Analytics

**Spatial filtering**

- **Spatial operators:**

<table>
<thead>
<tr>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter</td>
<td>Exit</td>
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<tr>
<td>Intersects</td>
<td>disjoint</td>
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<tr>
<td>Touches</td>
<td>Contains</td>
</tr>
<tr>
<td>Crosses</td>
<td>Equals</td>
</tr>
<tr>
<td>Overlaps</td>
<td>Within</td>
</tr>
</tbody>
</table>

![Spatial Filtering Diagrams](image-url)
Additional Real-Time Spatial Analytics

Example – Impending weather notifications
Additional Real-Time Spatial Analytics

Example – Convoy separation alerting
Additional Real-Time Spatial Analytics

*GeoFence scope*

- Specify a GeoFence scope: Any or All
- Any GeoFence
- All GeoFences
Additional Real-Time Spatial Analytics

Example – Territory adherence alerting
4 Real-Time in Web Apps
Getting Real-Time Data into Web Apps

Two patterns

- **Feature layers pull from feature services**
  - Web apps poll to get periodic updates
  - Must be backed by an enterprise geodatabase (EGDB)

- **Stream layers subscribe to stream services**
  - Web apps subscribe to immediately receive data
  - Low latency and high throughput
Real-Time GIS
Stream Services

Stream Layer
- Web
- Device
- Desktop

Stream Service
- GeoEvent Extension
- Spatiotemporal Big Data Store

ArcGIS Server
Real-Time In Web Apps
Using Web App Builder
5 Wrap-up
Summary
Real-Time GIS: GeoEvent Extension

• ArcGIS is a dynamic system that enables continuous analytics and real-time visualization for better understanding of our world.

• The Real-Time GIS capabilities allow you to:
  - know what is happening, as it happens
  - react and make smarter decisions faster
  - be notified when events of interest occur
Where to learn more

Resources

• Step by step illustrated tutorials, free to download:
  - [http://links.esri.com/geoevent](http://links.esri.com/geoevent)
    - Introduction
    - Notifications
    - Stream Services
    - Spatiotemporal Big Data Store
    - RSS, HTTP, Files
    - REST Admin API

• Ask questions on the GeoEvent space on GeoNet:
  - [http://links.esri.com/geoevent-forum](http://links.esri.com/geoevent-forum)
Real-Time GIS

Other sessions

• Real-Time GIS: GeoEvent Extension
  Wed 10:15-11:30am, Room 14B

• Real-Time GIS: Leveraging Stream Services
  Wed 8:30-9:45am, Hilton Sapphire Ballroom A/D

• Real-Time GIS: Applying Real-Time Analytics
  Tue 1:30-2:45pm, Room 14A
  Wed 10:15-11:30am, Room 15B

• Real-Time GIS: Archiving & Visualizing Observation Data
  Wed 10:15-11:30am, Room 08
  Thu 10:15-11:30am, Room 07A/B

• Real-Time GIS: Best Practices
  Thu 8:30-9:45am, Room 14A

• Real-Time GIS: The Internet of Things
  Wed 1:30-2:45pm, Room 05B

• Road Ahead: Real-Time GIS
  Thu 1:30-2:45pm, Room 10

• Real-Time 3D GIS: Making Scenes Come Alive
  Wed 3:30-4:15pm, Demo Theater 5
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