



GeoEvent Server: An Introduction

Josh Joyner

RJ Sunderman

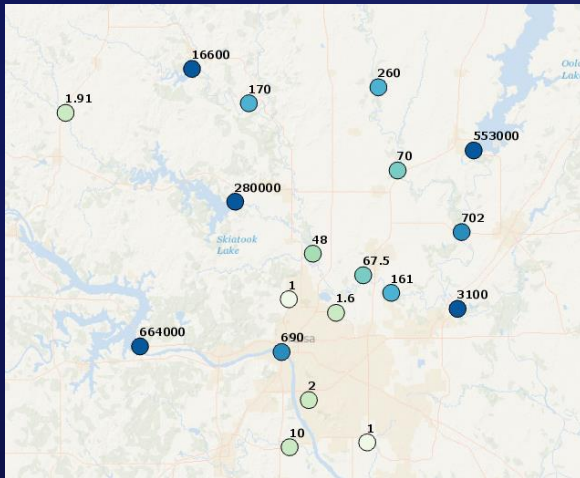
**GIS
INSPIRING
WHAT'S
NEXT**

Agenda:

- 1 Key Product Capabilities
 - 2 Working with Real-Time Data
 - 3 Demo: Vehicle Location and Alert Monitoring
 - 4 Consuming Real-Time Data
 - 5 Wrap-up
-

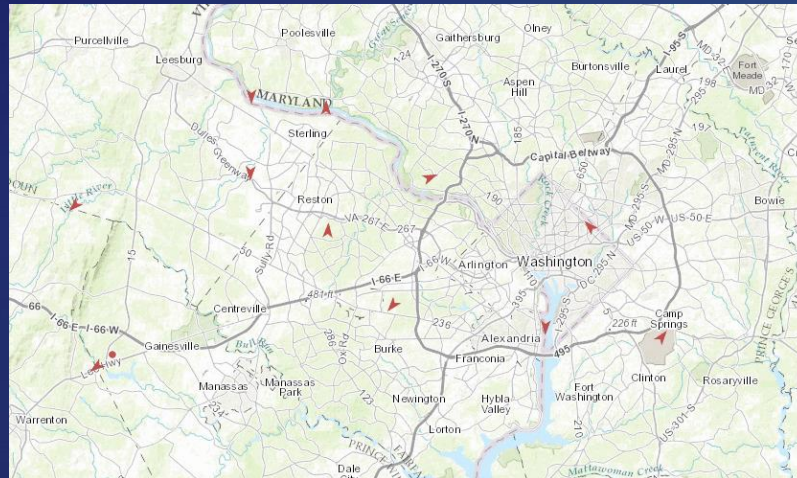
Real-Time GIS – Types of observations and data

stationary sensors...



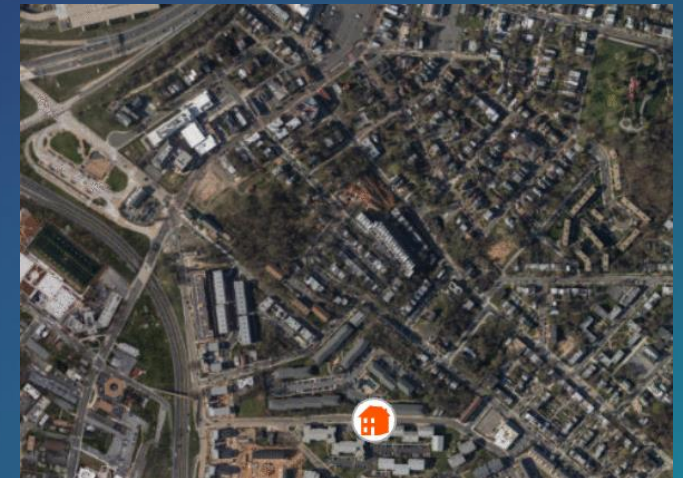
- water gauges
- weather stations
- air quality sensors
- device temperature

things that move...



- airplanes
- vehicles
- animals
- storms
- ships
- satellites
- trains
- people

things that “just happen” ...



- crimes
- lightning
- accidents
- tweets

GeoEvent Server – Key Capability #1

❖ Ingest Data: Vehicle Location



GeoEvent Server
server role



spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #1

❖ Ingest Data: Sensors and Instruments



GeoEvent Server
server role

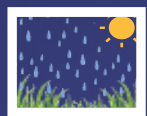


spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #1

❖ Ingest Data: Weather Monitoring




GeoEvent Server
server role



spatiotemporal big
data store


Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #1

❖ Ingest Data: Public Safety Data Feeds




GeoEvent Server
server role



spatiotemporal big
data store


Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #1

❖ Ingest Data: Commercial, Industrial, Utilities




GeoEvent Server
server role


spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #1

❖ Ingest Data: Configurable inputs for any type of data



GeoEvent Server
server role

spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #2

- ❖ Apply real-time analytics: Filtering
 - Identify event records with specified attribute values




GeoEvent Server
server role

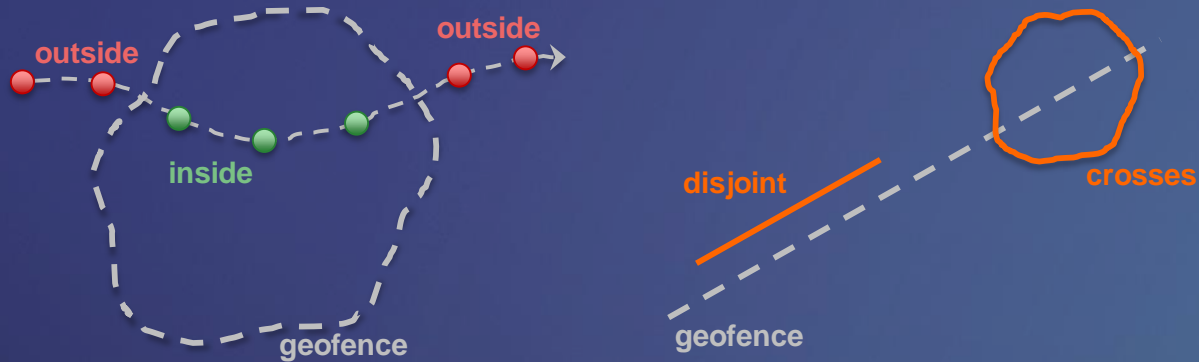

spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #2

❖ Apply real-time analytics: Filtering

- Identify event records with specified attribute values
- Determine spatial relationships with established geofences




GeoEvent Server
server role


spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #2

- ❖ Apply real-time analytics: Processing
 - Configure and use over two dozen types of processors
 - ✓ Field Calculator
 - ✓ Field Mapper
 - ✓ Buffer Creator
 - ✓ GeoTagger
 - ✓ Incident Detector
 - ✓ Track Gap Detector
 - ...



GeoEvent Server
server role

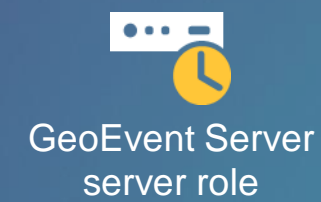
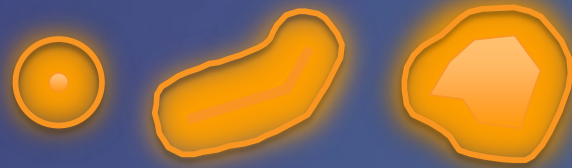


spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #2

- ❖ Apply real-time analytics: Processing
 - Configure and use over two dozen types of processors
 - ✓ Field Calculator
 - ✓ Field Mapper
 - ✓ **Buffer Creator**
 - ✓ GeoTagger
 - ✓ Incident Detector
 - ✓ Track Gap Detector
 - ...



GeoEvent Server
server role



spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #3

- ❖ Store data as feature records in a geodatabase
 - Configurable outputs enable processed events to be stored in a traditional relational geodatabase
 - When data is received at a high volume, high velocity, or is accumulated over time, a spatiotemporal big data store is an available noSQL option for enterprise storage



GeoEvent Server
server role



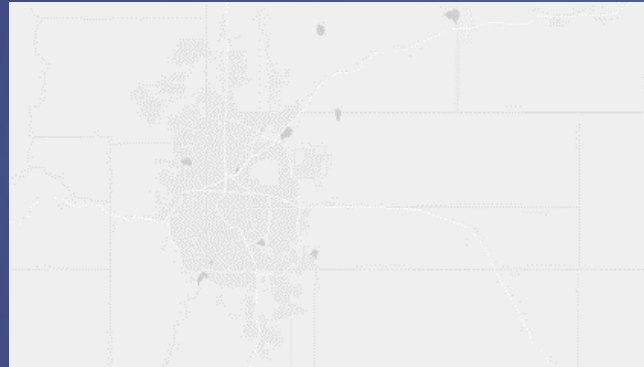
spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #4

❖ Visualize feature records

- Relational geodatabase feature services support traditional RESTful web applications and APIs
- Big data map and feature services support on-the-fly feature aggregation



GeoEvent Server
server role



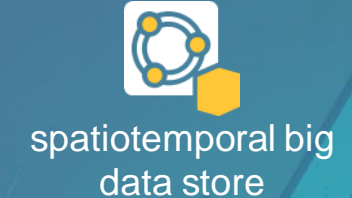
spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #4

❖ Visualize feature records

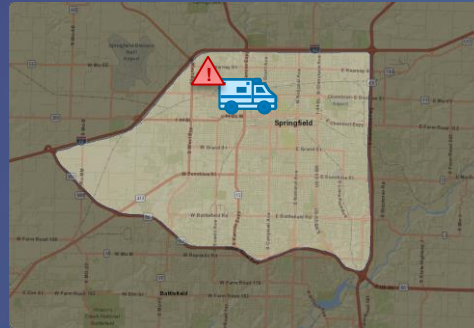
- Relational geodatabase feature services support traditional RESTful web applications and APIs
- Big data map and feature services support on-the-fly feature aggregation
- Stream Services



Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #5

- ❖ Notify stakeholders about detected patterns of interest
 - Configurable outputs provide the capability to format an e-mail or SMS text message
 - How you choose to disseminate processed event records is entirely up to you



GeoEvent Server
server role



spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise

GeoEvent Server – Key Capability #5

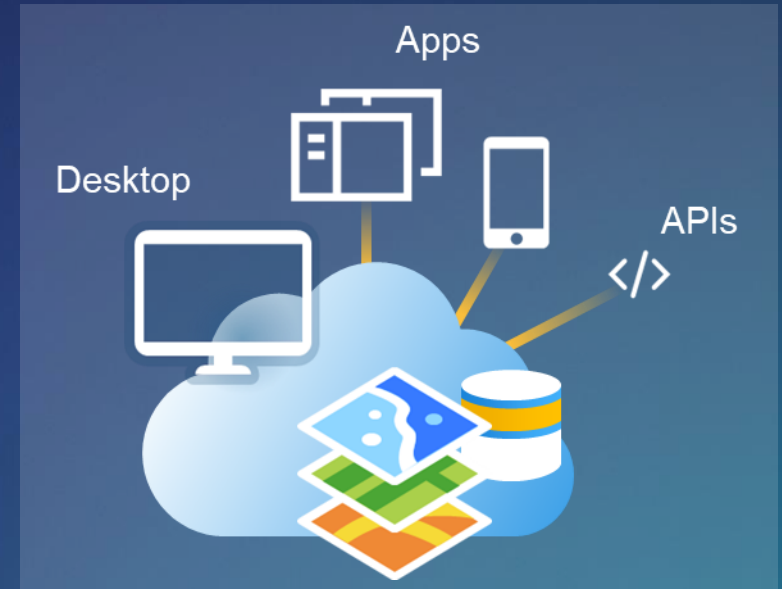
- ❖ Adjust the behavior of things in our environment through actuation




GeoEvent Server
server role


spatiotemporal big
data store

Bringing real-time and big data capabilities to your ArcGIS Enterprise




GeoEvent Server
server role



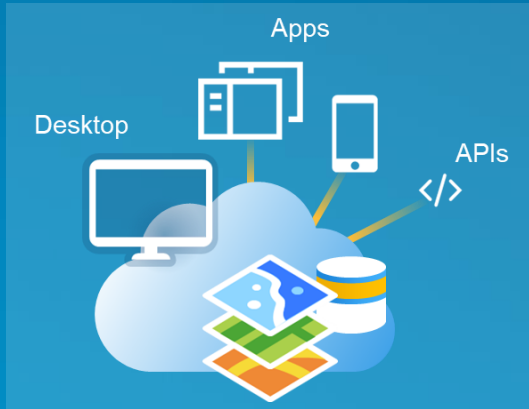
spatiotemporal big
data store





GeoEvent Server
server role


spatiotemporal big
data store





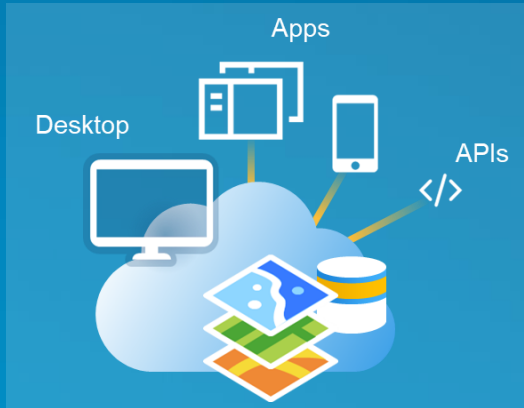

GeoEvent Server
server role



spatiotemporal big
data store



Working with Real-Time Data

Configurable Input Connectors




GeoEvent Server
server role


spatiotemporal big
data store

Out of the Box Input connectors

- Poll an ArcGIS map or feature service
- Poll an external web server or service
- Receive data records via HTTP/POST
- Receive data records via TCP / UDP socket
- Subscribe to an external web socket
- Watch a system folder for changes to a file

You can create your own custom inputs through the **GeoEvent Manager** or **SDK (Java)**

GeoEvent Gallery Samples

- FlightAware
- Verizon Connect / Telogis
- Waze
- Apache Kafka
- GeoTab Fleet Management
- ...

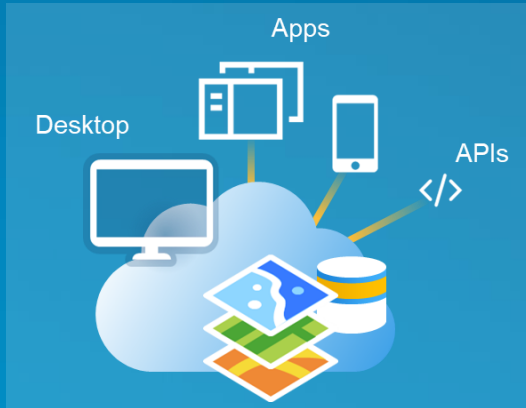
Partner Gallery connectors

- exactEarth
- Valarm
- CompassLDE
- enviroCar
- ...



Working with Real-Time Data

Configurable Output Connectors



Out of the Box Output Connectors

- Add or Update a feature
- Add or Update a spatiotemporal big data store
- Send Features to a Stream Service
- Push data records to an external website
- Push data records to an external websocket
- Send data records via TCP/UDP socket
- Send a text, email, or instant message
- Write a local file (CSV, JSON, GeoJSON)

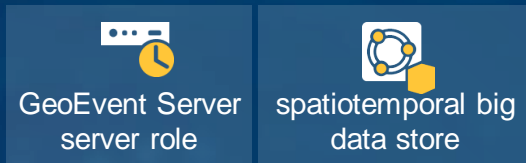
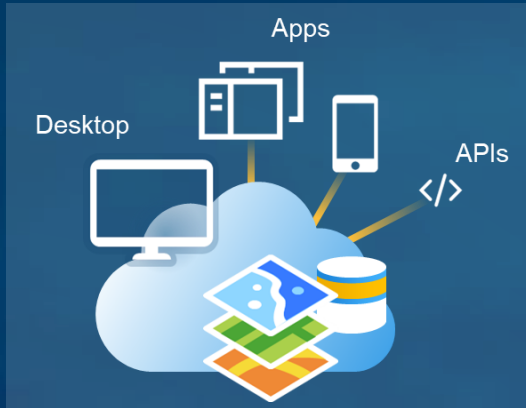
You can create your own custom outputs through the GeoEvent Manager or SDK (Java)

Gallery Components

- Amazon & Azure IoT
- Hadoop
- Kafka
- MQTT
- ActiveMQ
- RabbitMQ
- MongoDB
- Twitter
- ...

Working with Real-Time Data

Configurable Filters & Processors



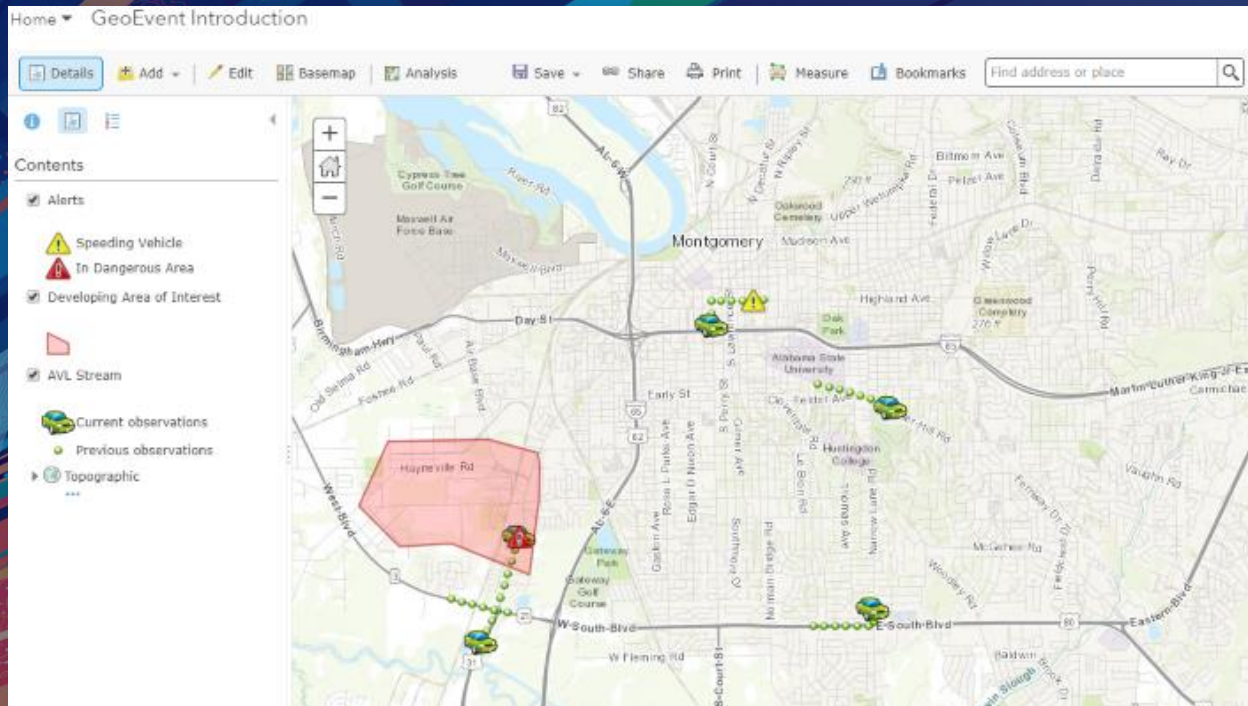
Out of the Box Output Geoprocessing

- Attribute & Spatial Filtering
- Buffer Creator
- Convex Hull Creator
- Difference Creator
- Envelope Creator
- Field Calculator
- Field Enricher
- Field Mapper
- Field Reducer
- Geotagger
- Incident Detector
- Intersector
- Projector
- Simplifier
- Symmetric Difference
- Track Gap Detector
- Union Creator

Sample Add-on Processors

- Add XYZ
- Event Volume Control
- Motion Calculator
- Range Fan
- Reverse Geocoder
- Service Area Creator
- Track Idle Detector
- ...

You can create your own custom processors through the GeoEvent Manager or SDK (Java)



Vehicle Location and
Alert Monitoring
Using GeoEvent Server to build a
common operational display

Vehicle Location and Monitoring (Demo)

ArcGIS GeoEvent Manager Services Site Logs

Monitor Inputs **GeoEvent Services** Outputs

AVL Receiver Publish Back

Receive and report established AVL alerting conditions (DevSummit2018)

Status	In/Out	Count	Rate (over last 5 mins)	Edit Rate	Max Rate	Time Since Last	View Graph	Action
STARTED	In	0	0 /sec		0 /sec	00:00:00		
	Out	0	0 /sec		0 /sec	00:00:00		

```
graph TD; AVR[AVL_Receiver] --> SS[Stream Schema (Field Mapper)]; AVR --> IDA{In Dangerous Area}; AVR --> VS{Vehicle Speeding}; SS --> AS[AVL_Stream]; IDA --> GIA[Get Area Identifier (GeoTagger)]; GIA --> DAFS[DangerousArea_Alert Feature Schema (Field Mapper)]; DAFS --> SADC[Set Alert Code: Danger (Field Calculator)]; SADC --> DAAFU[DangerousAreaAlert_FeatureUpdate]; VS --> SVAFS[SpeedingVehicle Alert Feature Schema (Field Mapper)]; SVAFS --> SASC[Set Alert Code: Speed (Field Calculator)]; SASC --> SVAFU[SpeedingVehicleAlert_FeatureUpdate];
```

Vehicle Location and Monitoring (Demo)

ArcGIS GeoEvent Manager Services Site Logs

Monitor Inputs **GeoEvent Services** Outputs

AVL Receiver Publish Back

Receive and report established AVL alerting conditions (DevSummit2018)

Status	In/Out	Count	Rate (over last 5 mins)	Edit Rate	Max Rate	Time Since Last	View Graph	Action
STARTED	In	0	0 /sec		0 /sec	00:00:00		
	Out	0	0 /sec		0 /sec	00:00:00		

Vehicle Location and Monitoring (Demo)

ArcGIS GeoEvent Manager Services Site Logs

Monitor Inputs **GeoEvent Services** Outputs

AVL Receiver Publish Back

Receive and report established AVL alerting conditions (DevSummit2018)

Status	In/Out	Count	Rate (over last 5 mins)	Edit Rate	Max Rate	Time Since Last	View Graph	Action
STARTED	In	0	0 /sec		0 /sec	00:00:00		
	Out	0	0 /sec		0 /sec	00:00:00		

```
graph TD; AVL_Receiver[AVL_Receiver] --> StreamSchema[Stream Schema (Field Mapper)]; StreamSchema --> AVL_Stream[AVL_Stream]; AVL_Receiver --> VehicleSpeeding{Vehicle Speeding}; VehicleSpeeding --> SpeedingAlert[SpeedingVehicle Alert Feature Schema (Field Mapper)]; SpeedingAlert --> SetAlertSpeed[Set Alert Code: Speed (Field Calculator)]; SetAlertSpeed --> SpeedingAlert_Update[SpeedingVehicleAlert_FeatureUpdate]; VehicleSpeeding --> InDangerousArea{In Dangerous Area}; InDangerousArea --> GetAreaIdentifier[Get Area Identifier (GeoTagger)]; GetAreaIdentifier --> DangerousAreaAlert[DangerousArea_Alert Feature Schema (Field Mapper)]; DangerousAreaAlert --> SetAlertDanger[Set Alert Code: Danger (Field Calculator)]; SetAlertDanger --> DangerousAreaAlert_Update[DangerousAreaAlert_FeatureUpdate];
```

Vehicle Location and Monitoring (Demo)

ArcGIS GeoEvent Manager
Services Site Logs

Monitor
Inputs
GeoEvent Services
Outputs

AVL Receiver Publish Back

Receive and report established AVL alerting conditions (DevSummit2018)

Status	In/Out	Count	Rate (over last 5 mins)	Edit Rate	Max Rate	Time Since Last	View Graph	Action
STARTED	In	0	0 /sec		0 /sec	00:00:00		
	Out	0	0 /sec		0 /sec	00:00:00		

```

graph TD
    AVR[AVL_Receiver] --> SS[Stream Schema Field Mapper]
    SS --> AS[AVL_Stream]
    AVR --> IDA{In Dangerous Area}
    IDA --> GIA[Get Area Identifier GeoTagger]
    GIA --> DAS[DangerousArea_Alert Feature Schema Field Mapper]
    DAS --> SACD[Set Alert Code: Danger Field Calculator]
    SACD --> DAFAU[DangerousAreaAlert_FeatureUpdate]
    AVR --> VS{Vehicle Speeding}
    VS --> SVAS[SpeedingVehicle Alert Feature Schema Field Mapper]
    SVAS --> SASC[Set Alert Code: Speed Field Calculator]
    SASC --> SVFAU[SpeedingVehicleAlert_FeatureUpdate]
    subgraph DashedBox [ ]
        VS
        SVAS
        SASC
        SVFAU
    end
            
```

Vehicle Location and Monitoring (Demo)

ArcGIS GeoEvent Manager Services Site Logs

Monitor Inputs **GeoEvent Services** Outputs

AVL Receiver Publish Back

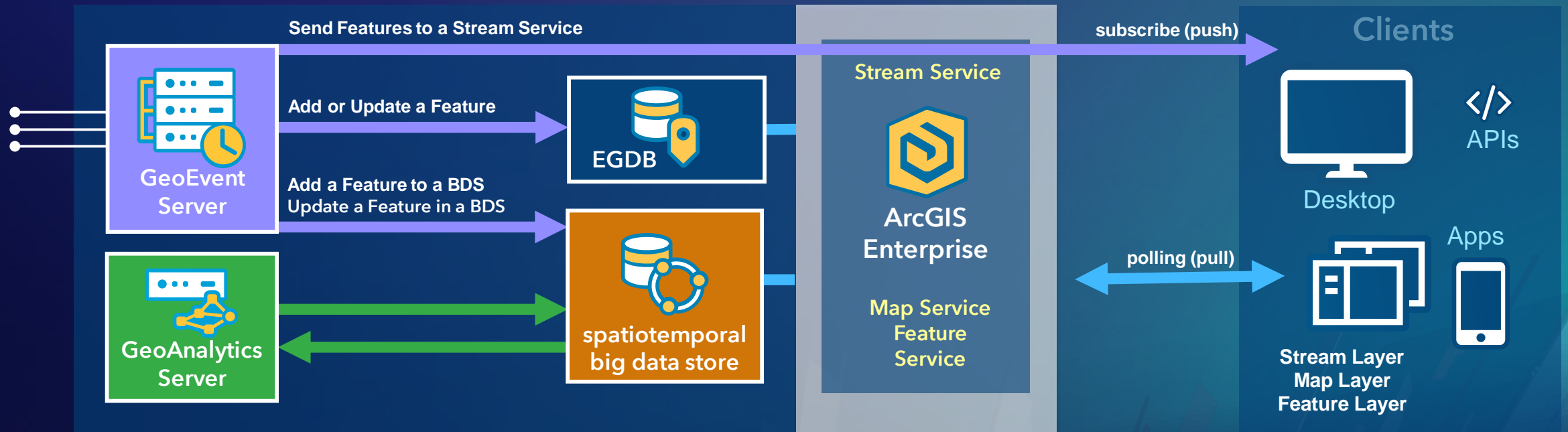
Receive and report established AVL alerting conditions (DevSummit2018)

Status	In/Out	Count	Rate (over last 5 mins)	Edit Rate	Max Rate	Time Since Last	View Graph	Action
STARTED	In	0	0 /sec		0 /sec	00:00:00		
	Out	0	0 /sec		0 /sec	00:00:00		

```
graph TD; AVR[AVL_Receiver] --> SS[Stream Schema (Field Mapper)]; AVR --> IDA{In Dangerous Area}; AVR --> VS{Vehicle Speeding}; SS --> AS[AVL_Stream]; IDA --> GIA[Get Area Identifier (GeoTagger)]; GIA --> DASA[DangerousArea_Alert Feature Schema (Field Mapper)]; DASA --> SADC[Set Alert Code: Danger (Field Calculator)]; SADC --> DAAU[DangerousAreaAlert_FeatureUpdate]; VS --> SVAS[SpeedingVehicle Alert Feature Schema (Field Mapper)]; SVAS --> SASC[Set Alert Code: Speed (Field Calculator)]; SASC --> SVAFU[SpeedingVehicleAlert_FeatureUpdate];
```

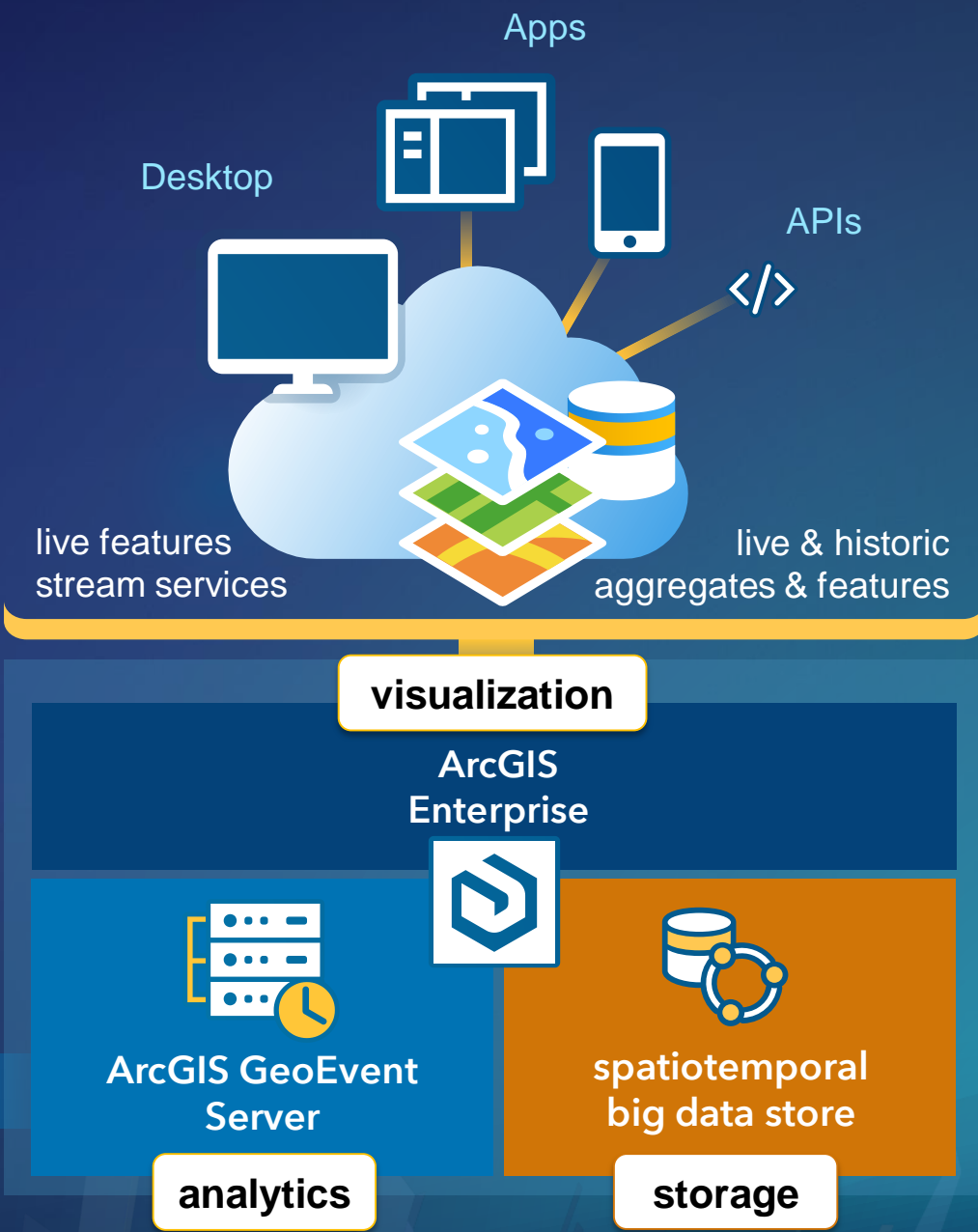
Consuming Real-Time Data

- Stream layers in apps **subscribe** to stream services to immediately visualize observations
 - does not require storage, low latency, no playback
- Map & Features layers in apps periodically **poll** to visualize most current observations
 - backed by an enterprise geodatabase (EGDB) or a spatiotemporal big data store (BDS)
 - history can be retrieved & queried for playback



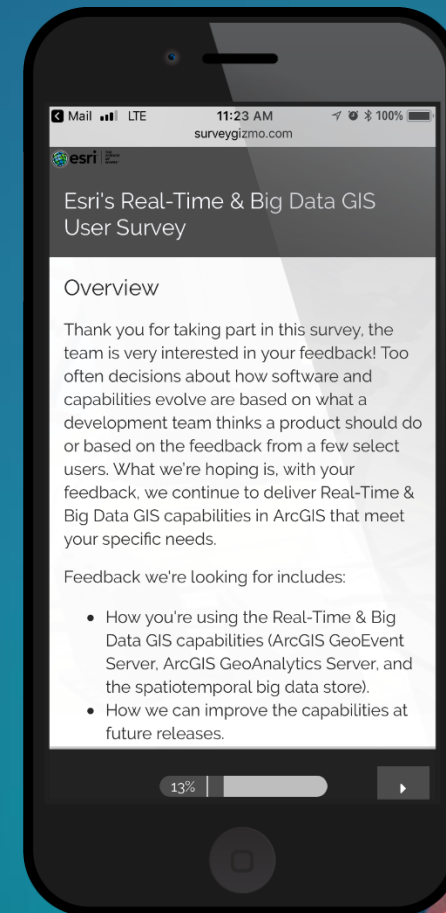
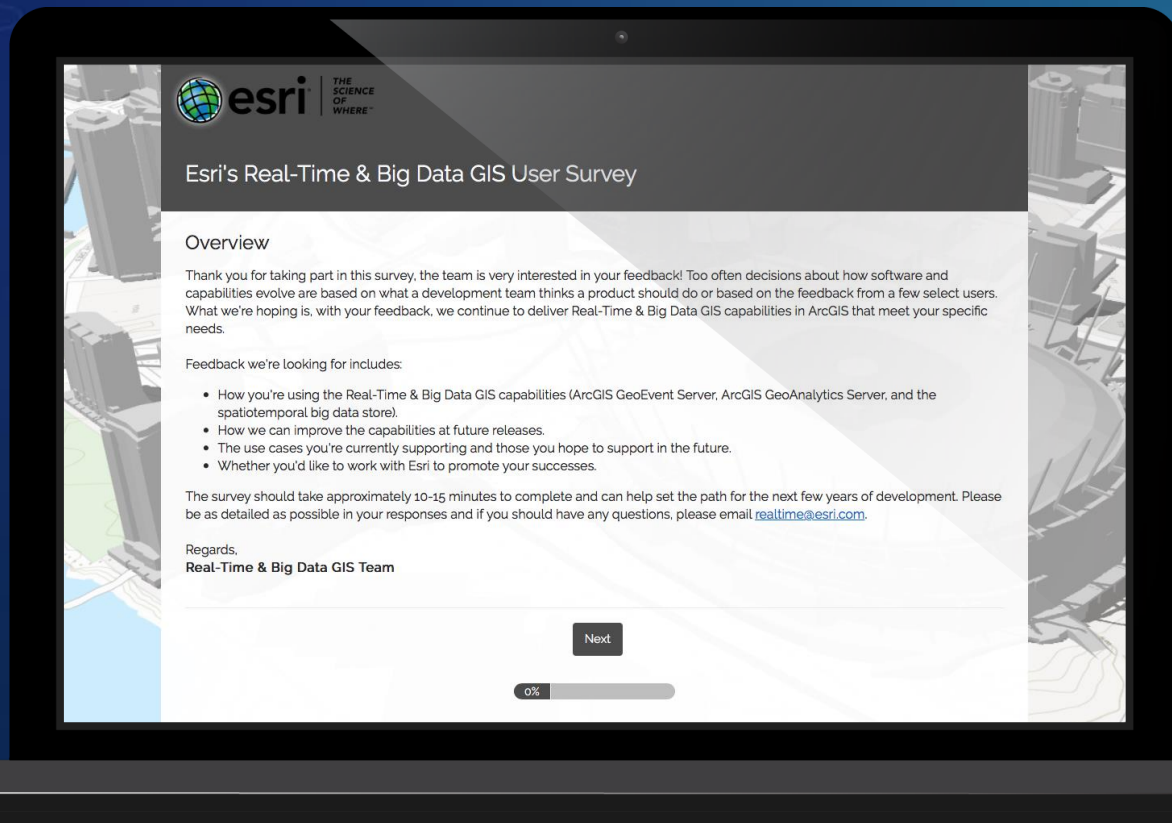
ArcGIS GeoEvent Server

summary



Help us improve the Real-Time & Big Data GIS Capabilities

<http://esriurl.com/RealTimeSurvey>



Questions / Feedback?



Josh Joyner
ArcGIS GeoEvent Server
Product Manager
jjoyner@esri.com



RJ Sunderman
ArcGIS GeoEvent Server
Product Engineer, Esri
rsunderman@esri.com



esri

**THE
SCIENCE
OF
WHERE**