GeoEvent Server: A Developer's Guide

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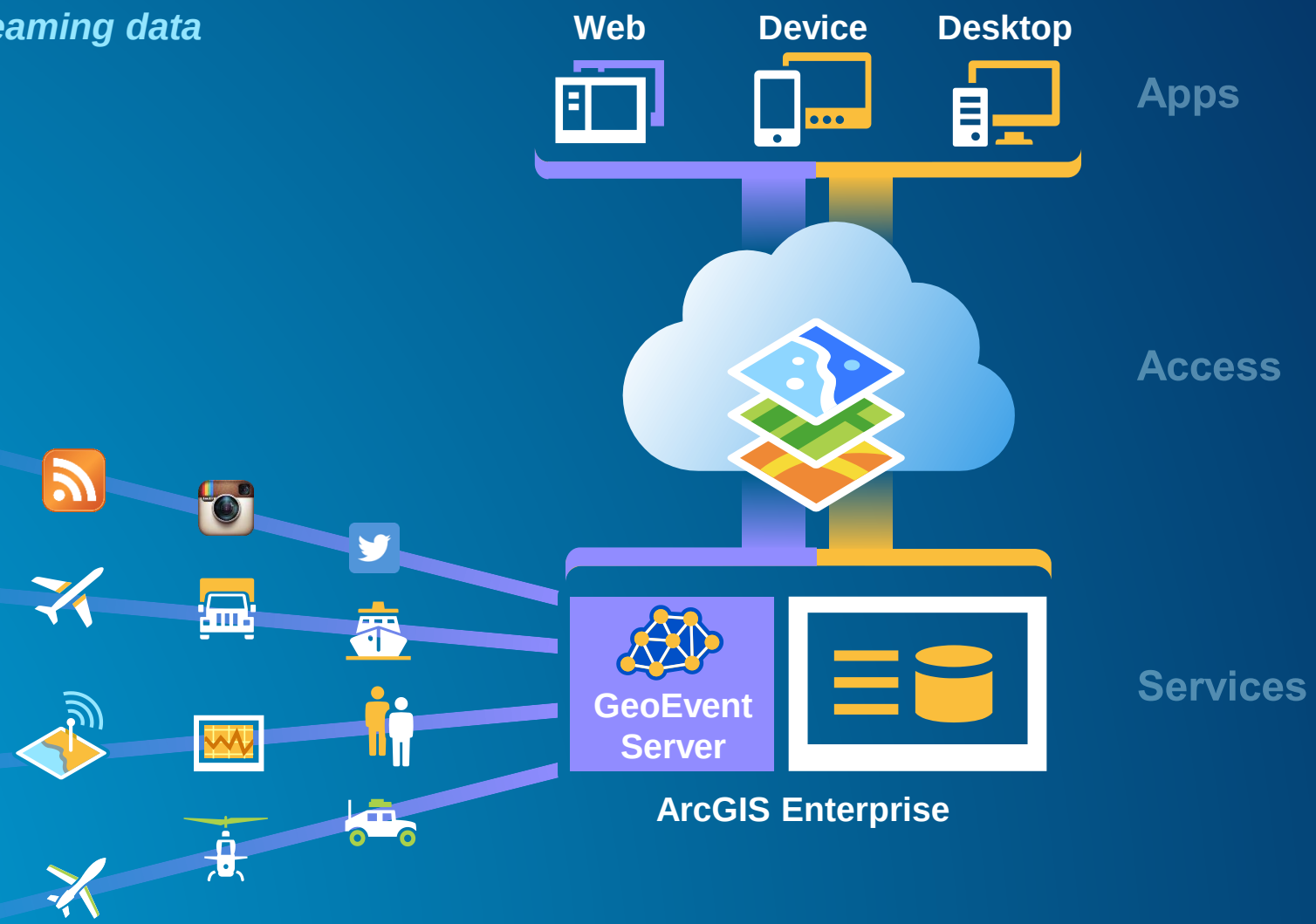
Agenda

- Connectors
  - Inbound
  - Outbound
- GeoEvent SDK
- Transports and Adapters
- Processors
- Maven
- Scripting “upstream”

Real-Time GIS

Integration and exploitation of streaming data

- Integrates real-time **streaming data** into ArcGIS
- Performs continuous **processing** and real-time **analytics**
- Sends **updates and alerts** to those who need it where they need it



Connectors

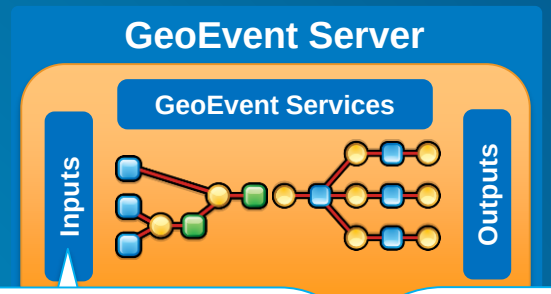
Connectors

What is a connector?

- Connectors get event data into, and out of, GeoEvent Server
- Every connector has two components
  - Transport
  - Adapter
- Transports and Adapters can be inbound or outbound:
  - Inbound transport – connects to and gets raw bytestream
  - Inbound adapter – converts raw bytestream into a geoevent
  - Outbound adapter – converts geoevent into a byte array, formatted for an output type
  - Outbound transport – accepts arrays of bytes from the adapter and transmits them

Receiving Real-Time Data

*Easily integrate real-time streaming data into ArcGIS using an **Input Connector***



You can create your own connectors.

Out of the Box

- 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

Esri Gallery

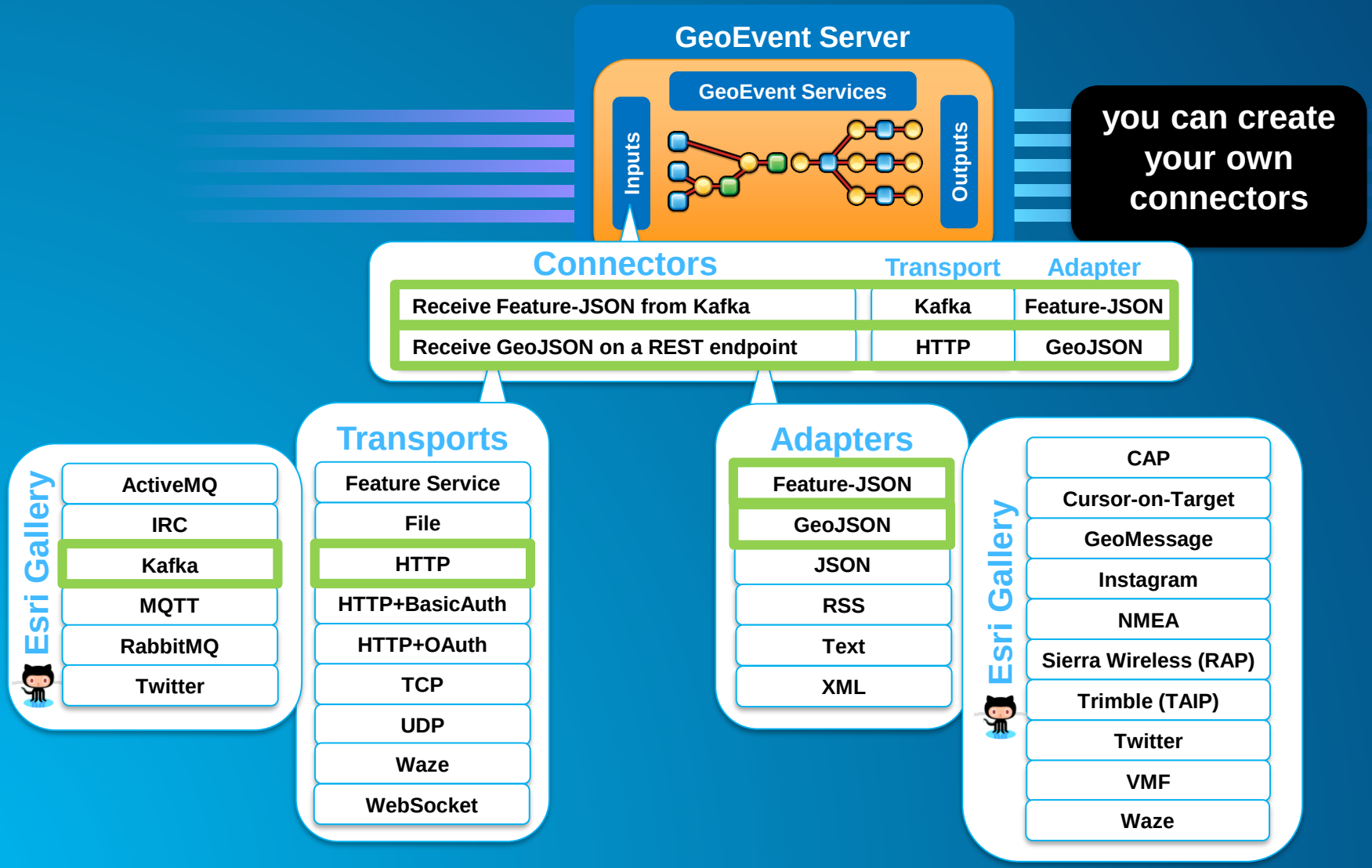
- ActiveMQ
- CAP
- Cursor-on-Target
- Exploitation Support Data
- Instagram
- KML
- Kafka
- MQTT
- NMEA 0183
- RabbitMQ
- Sierra Wireless (RAP)
- Trimble (TAIP)
- Twitter

Partner Gallery

- CompassLDE
- enviroCar
- exactEarth AIS
- FAA (ASDI) *
- GNIP *
- Networkfleet *
- OSIsoft *
- Valarm
- Zonar *

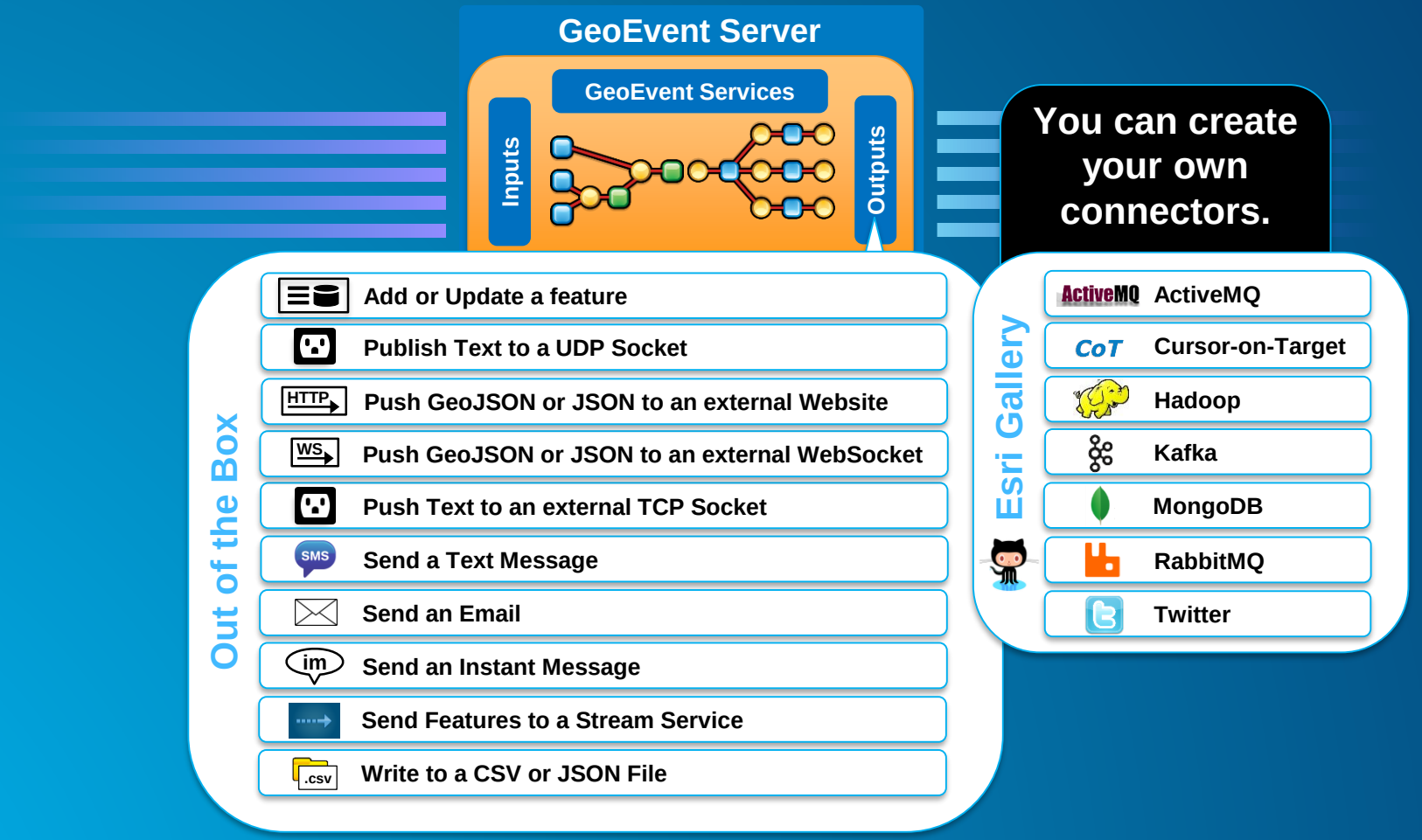
Receiving Real-Time Data

Input Connector = Transport + Adapter



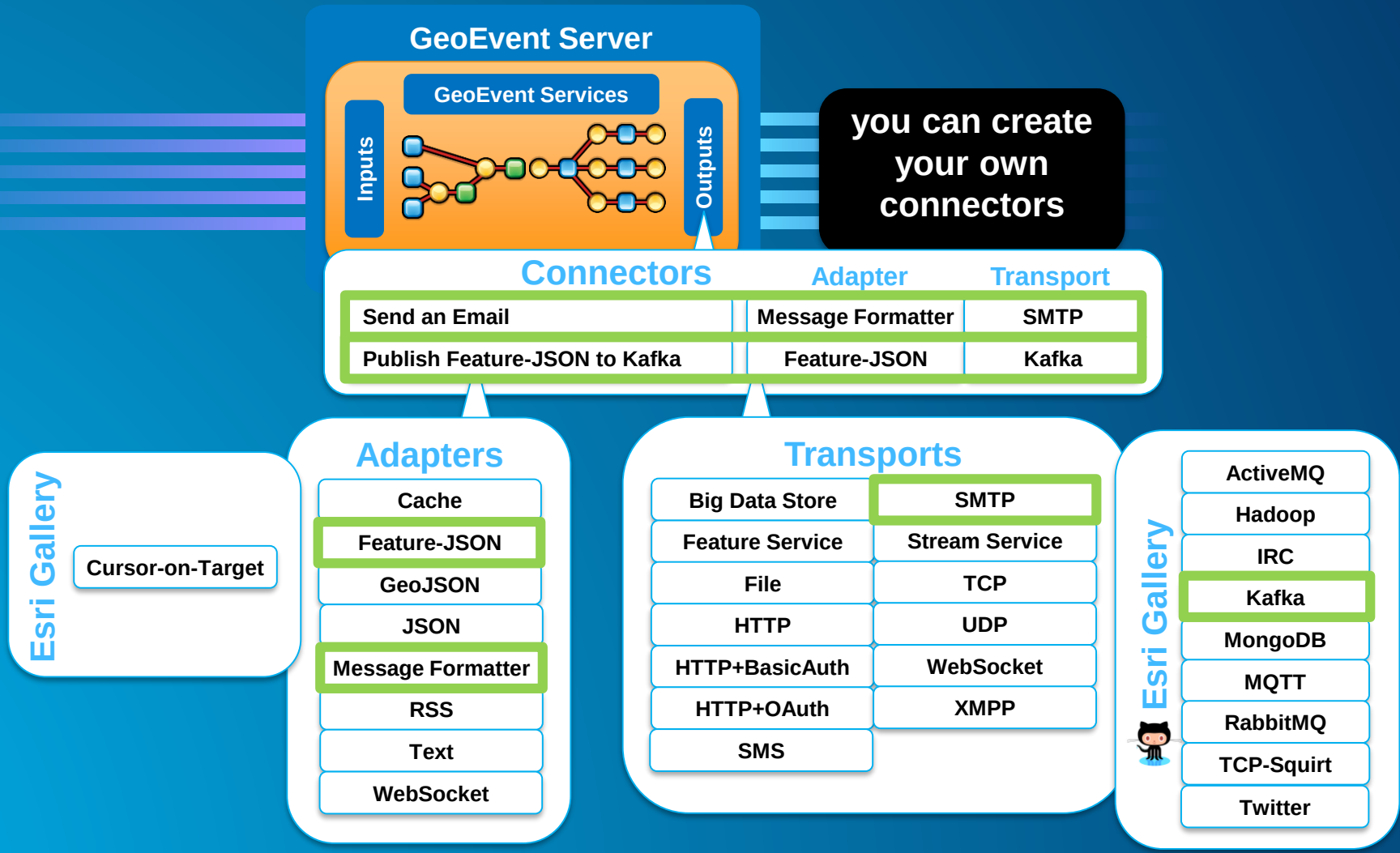
Sending Real-Time Data

*Easily disseminate notifications, alerts, and updates using an **Output Connector***



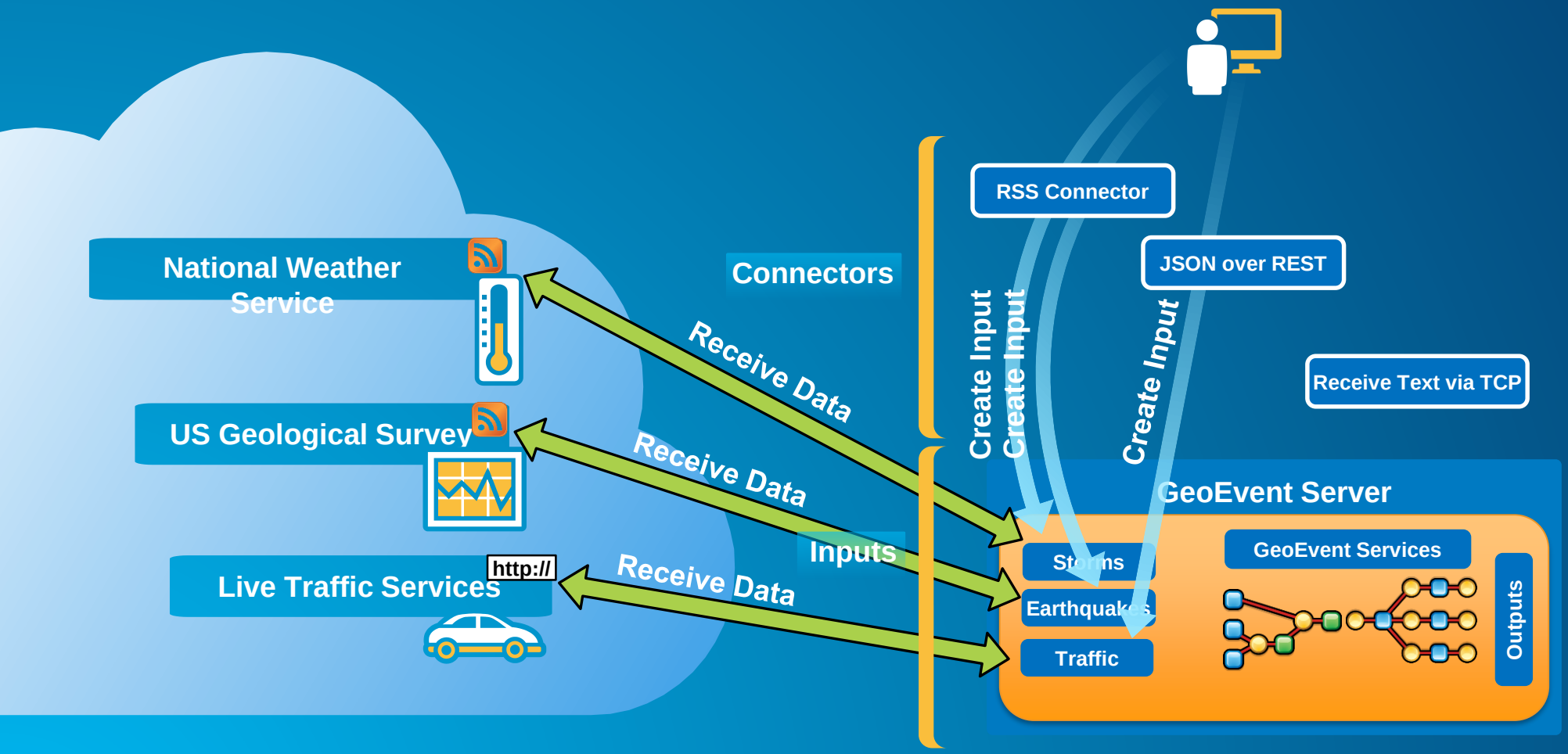
Sending Real-Time Data

*Output Connector = **Adapter** + **Transport***



Creating Inputs

Inputs are configured using Connectors

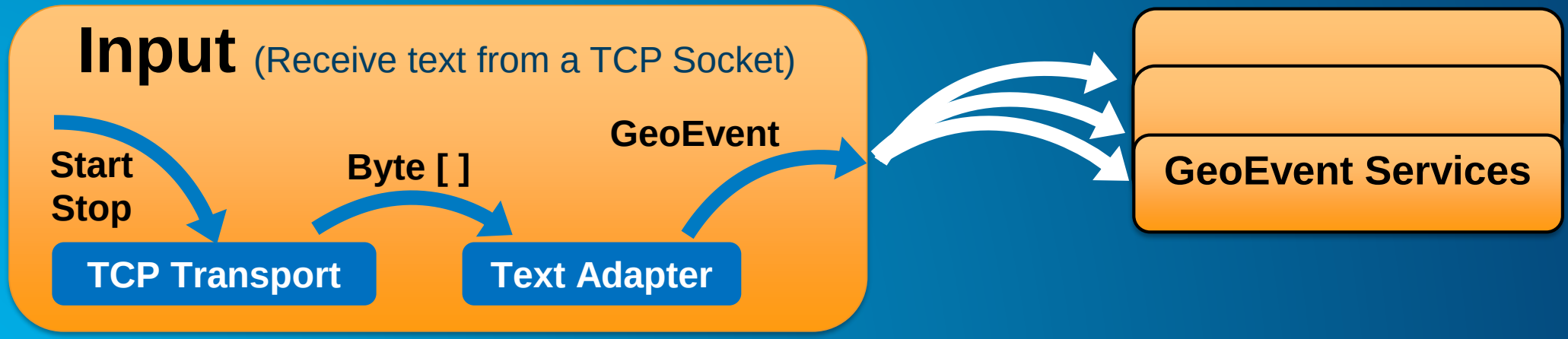


Connector

A Connector's Purpose

- By choosing a Connector, the user implicitly selects components from GeoEvent Server that know:
  - HOW to move data (Transport)
  - WHAT the data looks like (Adapter)

Example Input

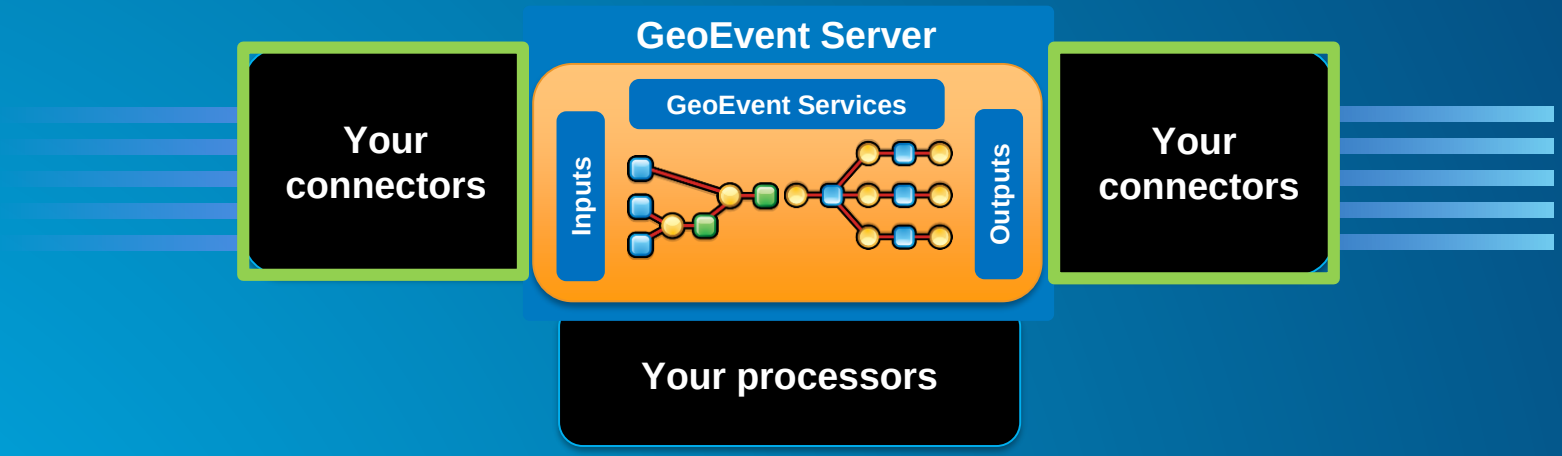


GeoEvent Server SDK

Extending GeoEvent

Software Development Kit (SDK)

You can create your own custom transports, adapters and processors using the GeoEvent Software Development Kit (SDK).

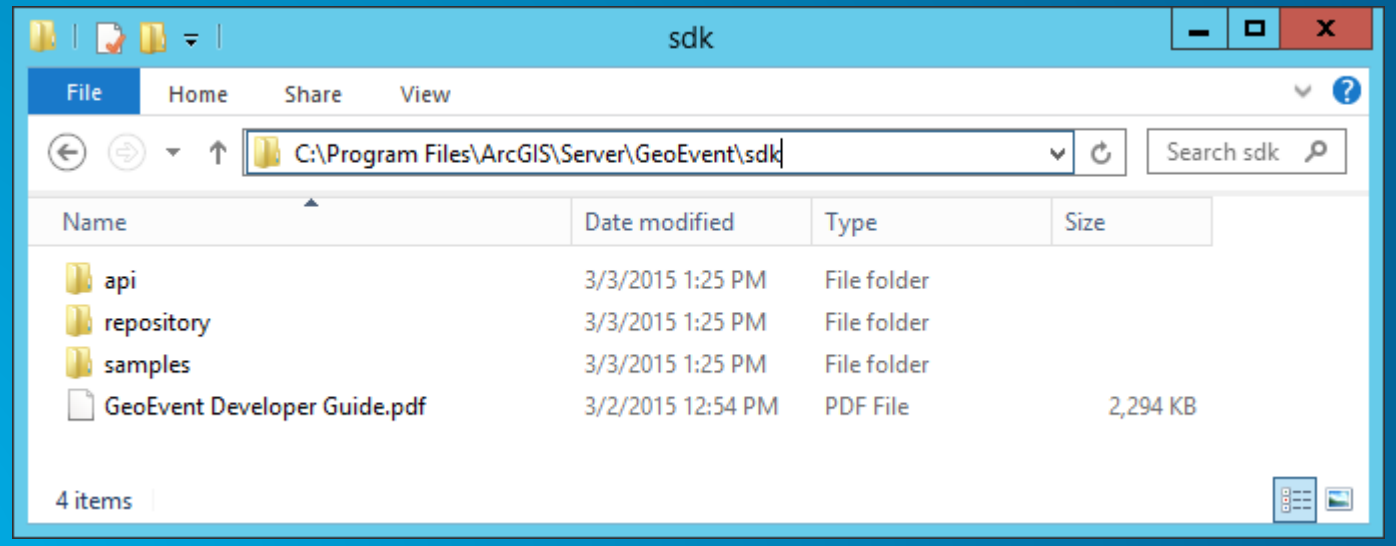


A note on semantics: the SDK is used to build *transports*, *adapters* and *processors*. Input and output *connectors* are built by pairing a transport and adapter in GeoEvent Manager.

Extending GeoEvent Server

Software Development Kit (SDK)

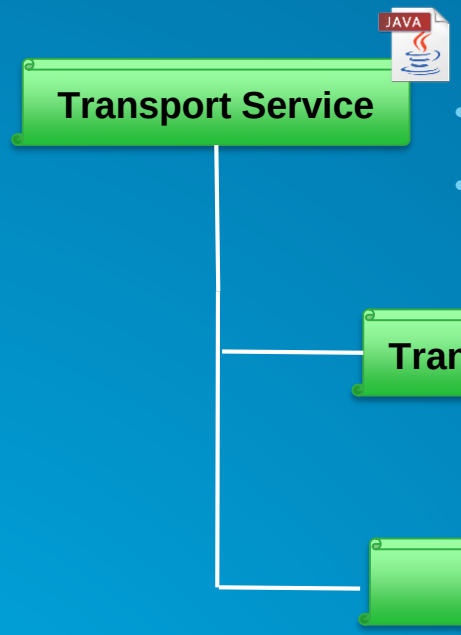
- **api:** JavaDoc content associated with GeoEvent Server SDK
- **repository:** Local maven repository
- **samples:** Sample processors, transports, adapters
- **GeoEvent Server Developer Guide**



Transports

Transport

What makes up a Transport?



- Provides a Transport Definition
- Instantiates new Transports
- Defines transport metadata and properties
- Implements transport application logic

Transport Behavior

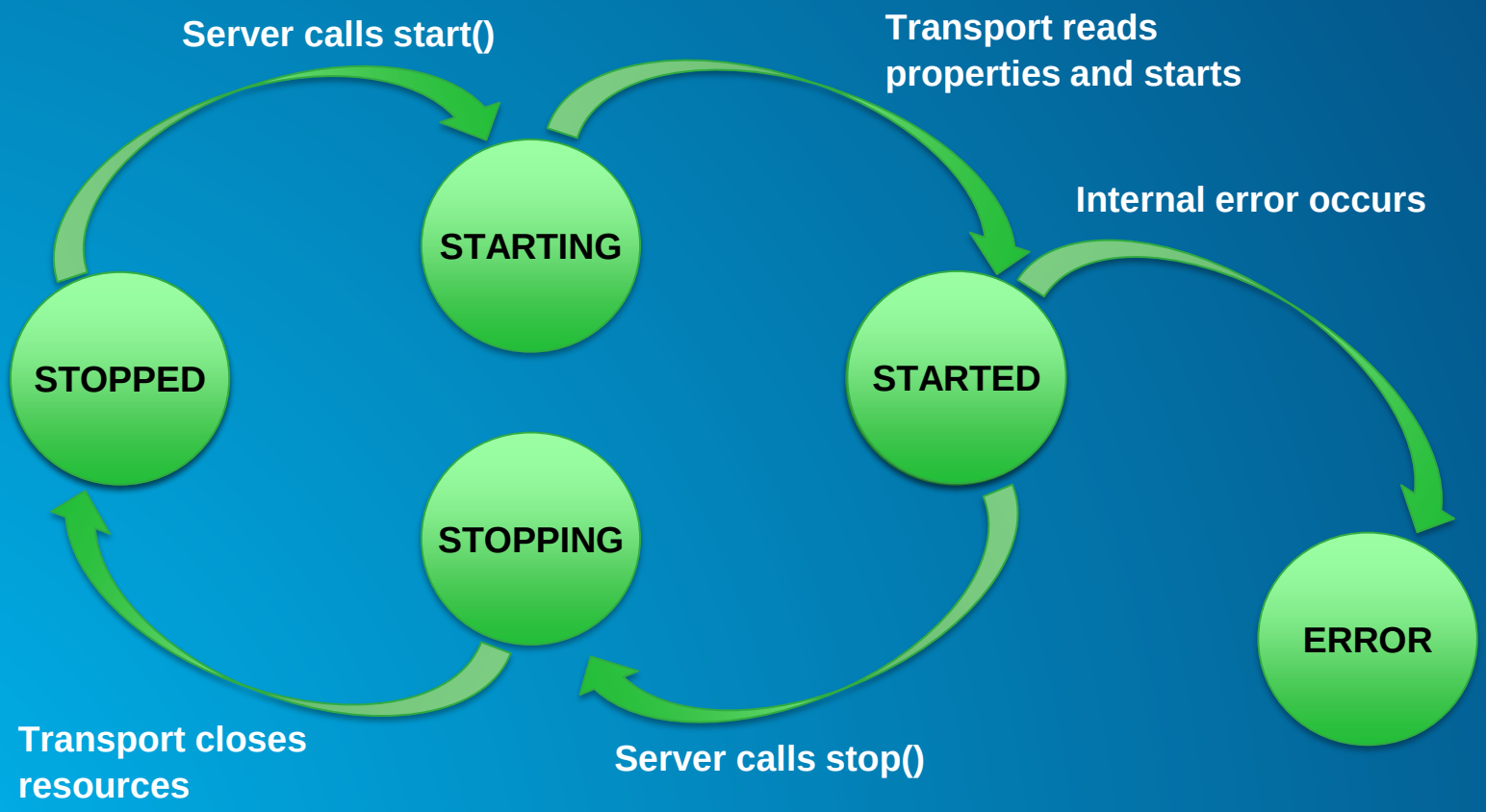
Transports

- Transports are given
  - Properties that define behavior
  - A “ByteListener” where bytes should be sent
- Transport is started by the server and it sends bytes to the receiver
- Transport is stopped by the server and it stops sending bytes

Transport Lifecycle

Transports

Transports have a lifecycle that determines if they are producing data



Outbound Transports

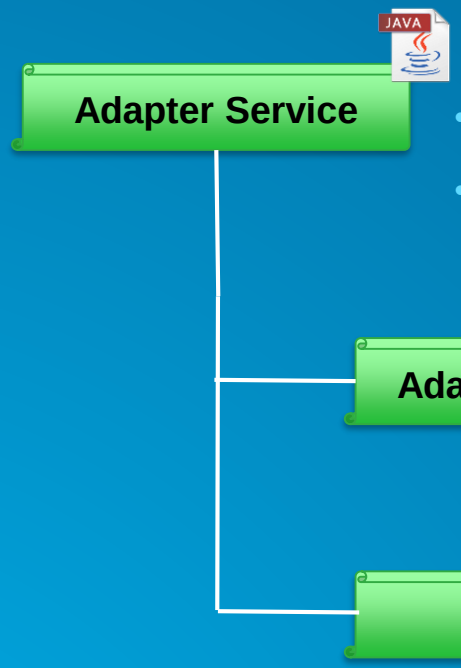
Transports

- Outbound Transports accept arrays of bytes from the Adapter and transmit them.
- Occasionally the destination for the bytes depends on content in the GeoEvent.
  - The Transport has the option of “looking back” at the GeoEvent that generated the bytes, and using it to route the data.

Adapters

Adapter

What makes up an Adapter



- Provides an Adapter Definition
- Instantiates new Adapters

- Defines adapter metadata and properties

- Implements adapter application logic

Adapter Behavior

Adapters

- Adapters are given
  - Properties that define behavior
  - A “GeoEventListener” where the GeoEvents should be sent
- Adapters are DATA DRIVEN
  - No start/stop calls
  - The adapter is handed a byte array and pushes any generated GeoEvents to the Listener

Custom Connectors

Custom Connectors *With* Development

Transport + Adapter

- **Use SDK to build transports or adapters**
- **Custom connector made by pairing transport with an adapter**
- **Both transport and adapter can be custom, or custom transport only or custom adapter only**

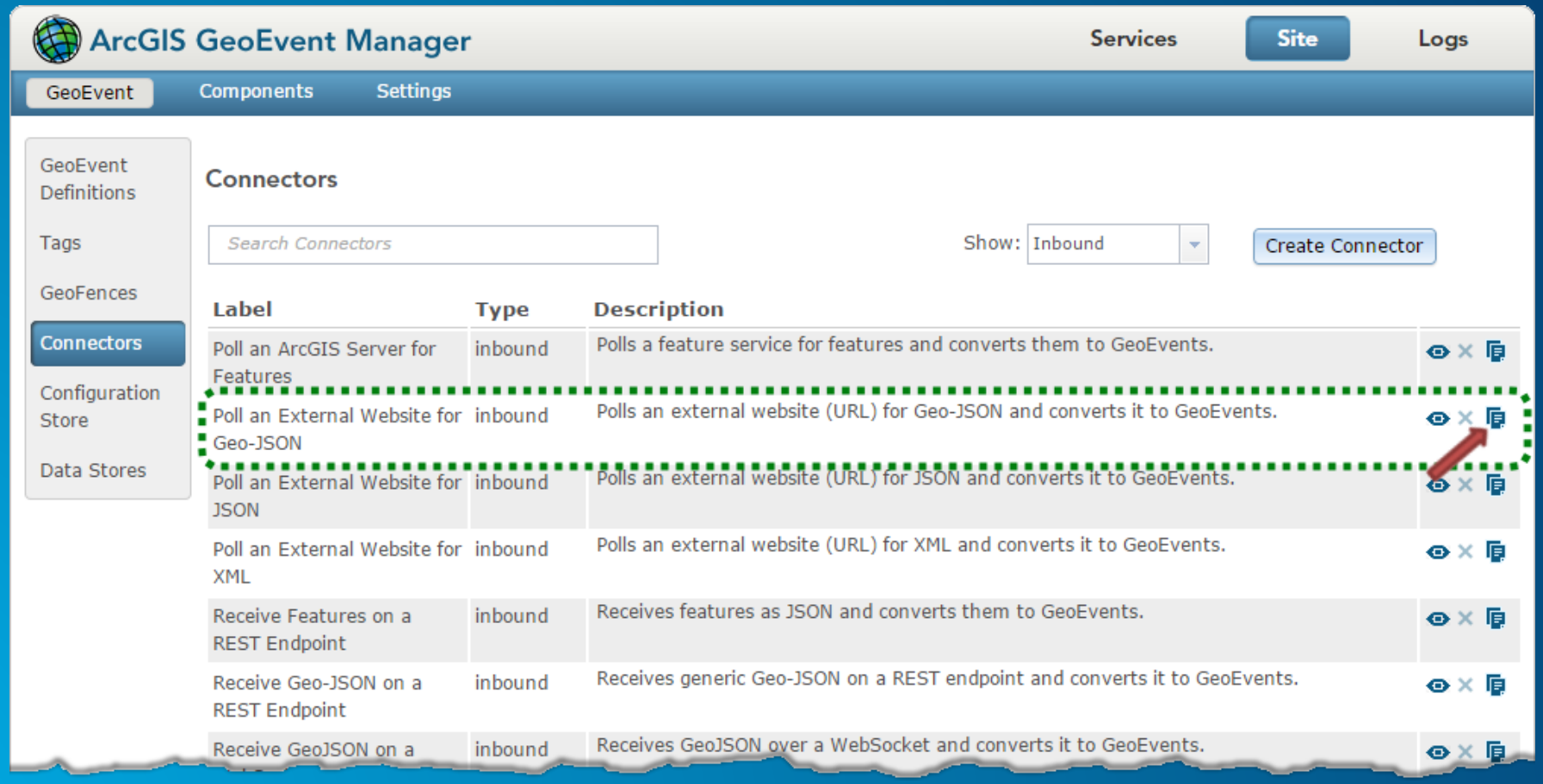
Custom Connectors *Without* Development

Transport + Adapter

- You actually may not need the SDK to make a custom connector
- Familiarize yourself with all out-of-box transports and adapters
- Out of box connectors do not cover all unique permutations of adapter and transport pairings
- You may already have all building blocks to make your “custom” connector

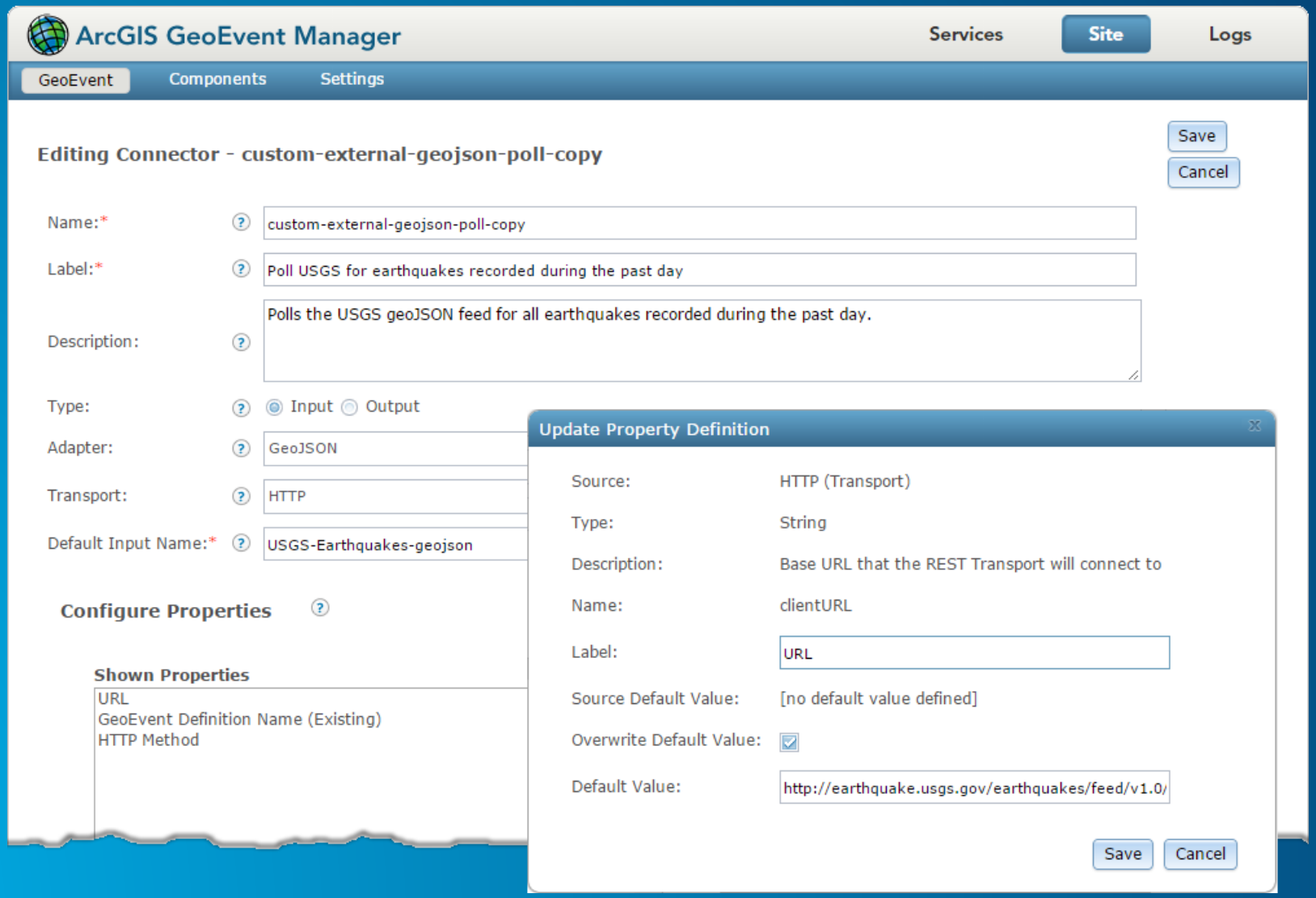
Custom Connectors *Without* Development

Clone an existing connector & tailor it's properties to make a more specific connector



Custom Connectors *Without* Development

Clone an existing connector & tailor it's properties to make a more specific connector



More Options on the GeoEvent Gallery

Extend GeoEvent Server by downloading additional transports, adapters and processors

http://links.esri.com/geoevent-gallery

solutions-geoevent-java

The solutions-geoevent-java repository includes custom connectors for use with ArcGIS GeoEvent Extension for Server.

Adapters

- Common Alert Protocol (CAP) Adapter
- CoT Adapter
- Exploitation Support Data (ESD) Adapter
- Geomessage Adapter
- regex Text Adapter

Transports

- IRC Transport
- TCP Squirt Transport

Processors

- Add XYZ Processor
- Bearing Processor
- Buffer Processor
- Ellipse Processor
- Event Volume Control Processor
- Event Joiner Processor
- Extract Point from Line
- Extract Point from Polygon
- Query Report Processor
- Range Fan Calculator
- Spatial Query Processor
- Symbol Lookup Processor
- Unit Converter Processor
- Update Only Processor
- Visibility Processor

https://github.com/esri/solutions-geoevent-java

DEMO

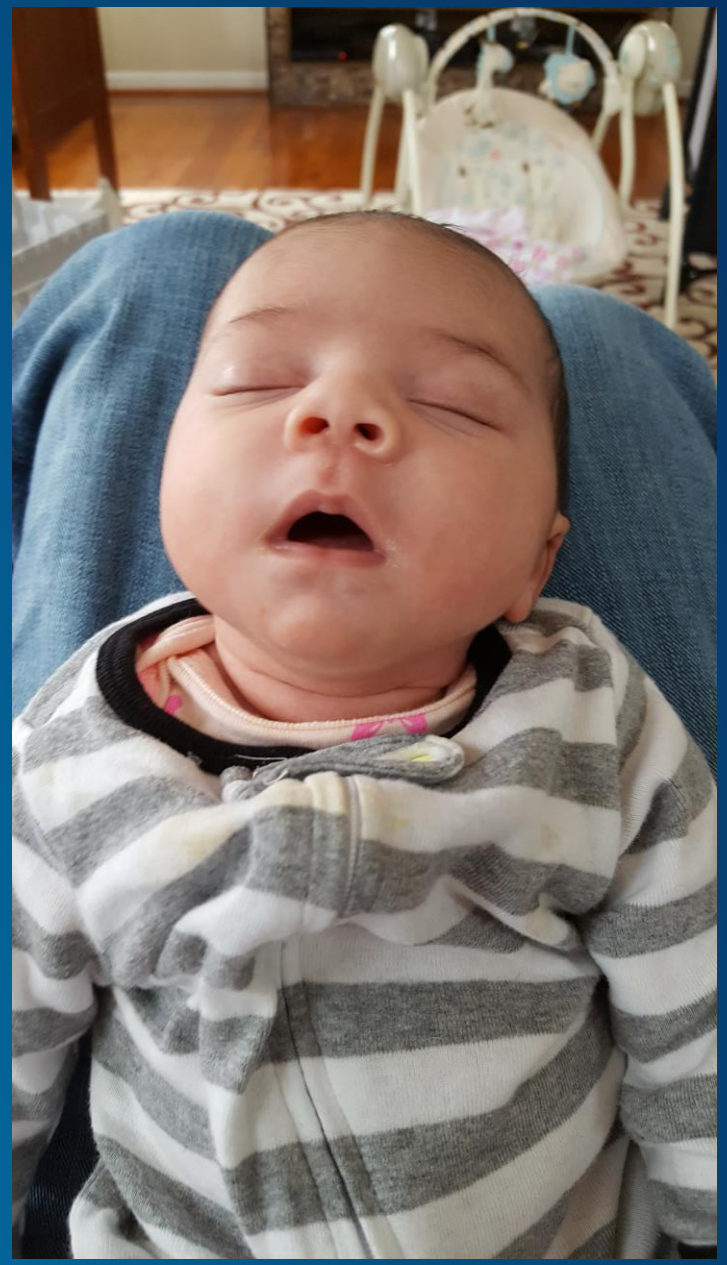
Custom Adapter: regexText-adapter

…developed using SDK

DEMO

Custom Connector: XML over TCP

…no development required

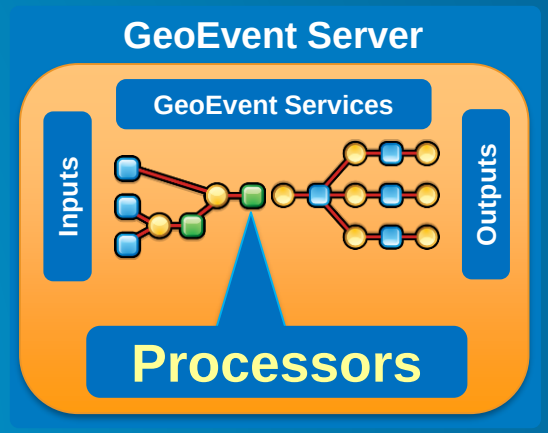


Processors

Processors

What is a processor?

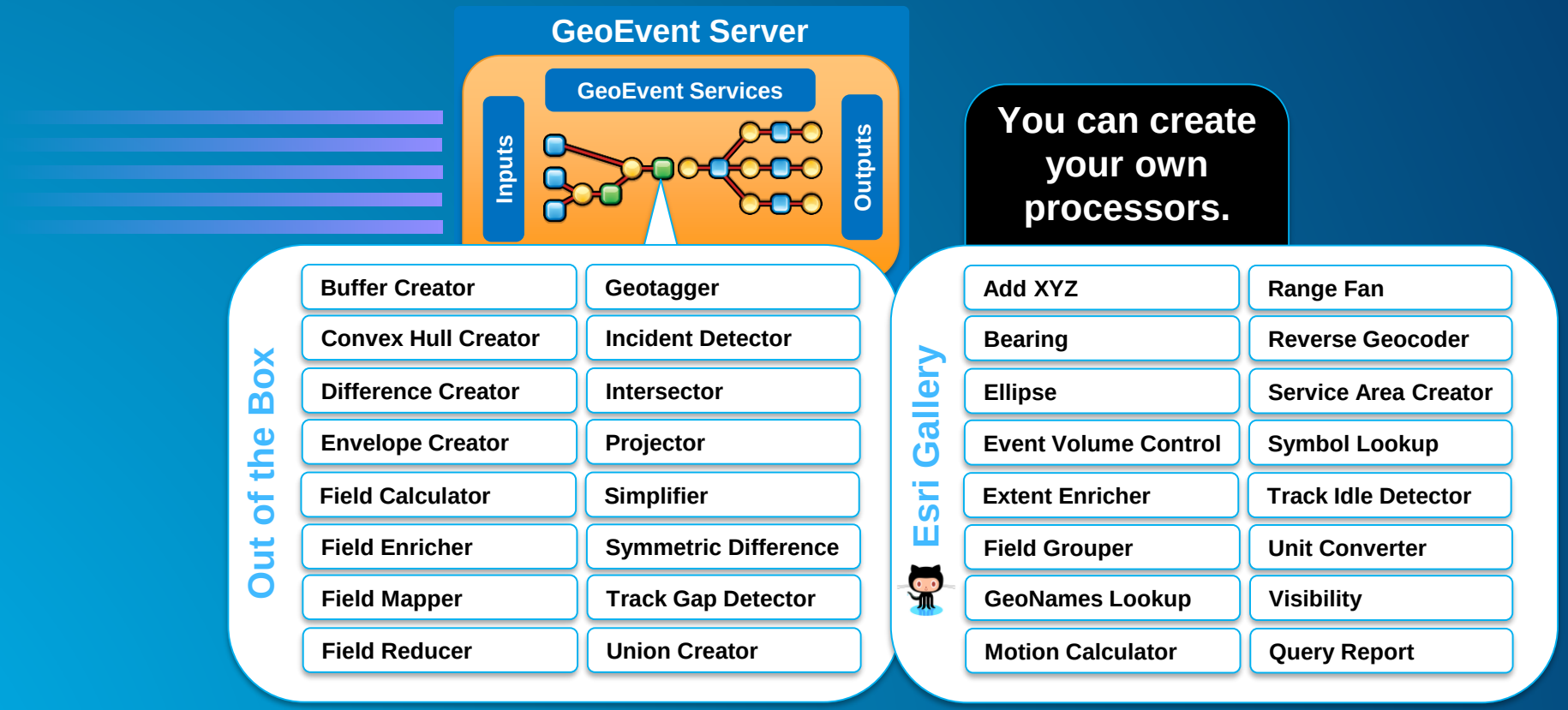
- **Processors** perform some action on each GeoEvent passed to it
- **Processors** can be used to:
  - Modify existing fields or the geometry
  - Add new fields
  - Filter
  - Create new GeoEvent(s)
  - Perform GeoFencing



Applying real-time analytics

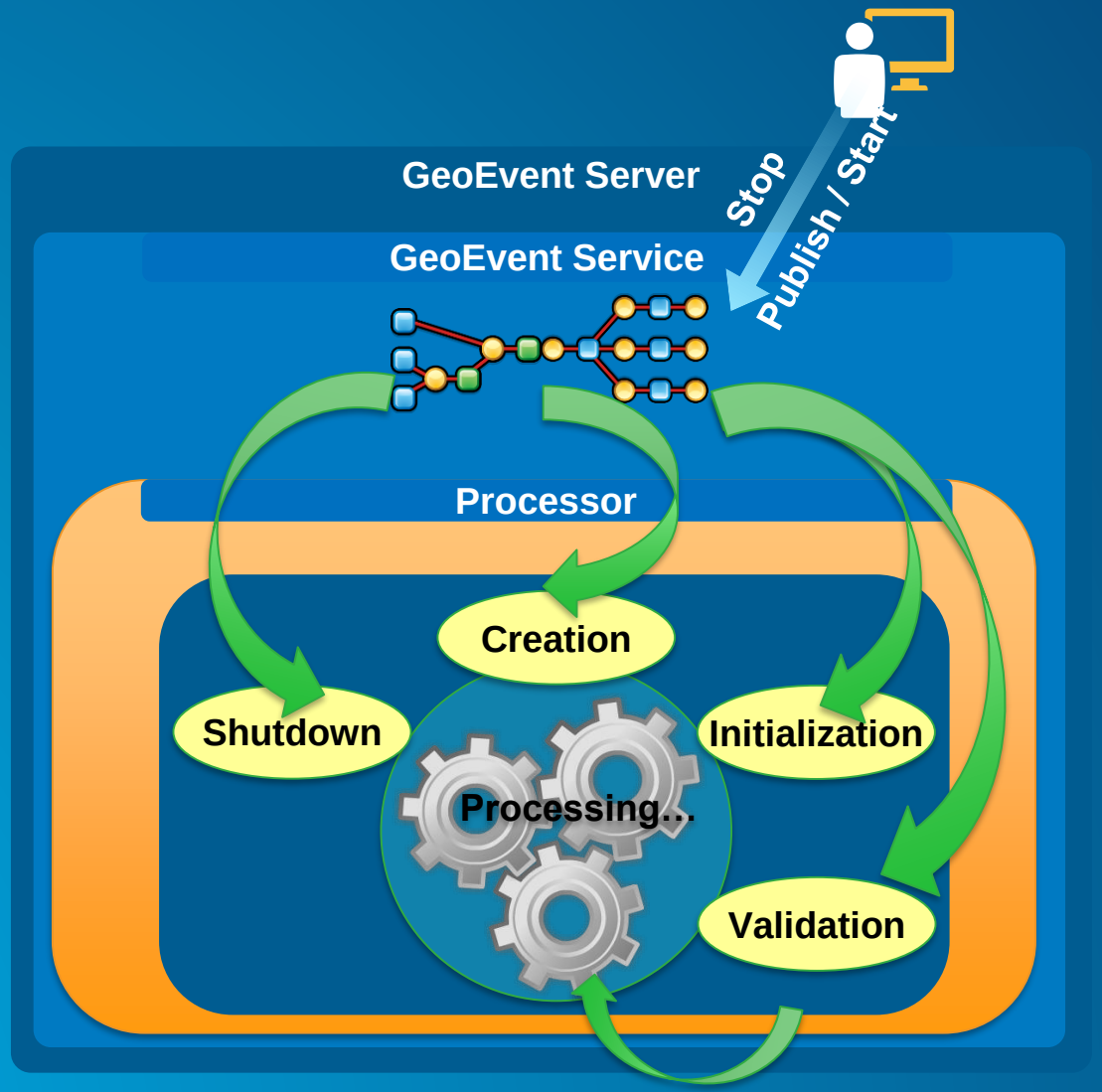
GeoEvent Processing

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



Processor

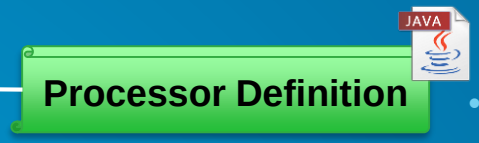
Lifecycle Review



Anatomy of a Processor

What makes up a Processor?

- Instantiates processor definition, processor and applies configuration



- Defines processor metadata, properties and GeoEvent Definition(s)

- Implements processor lifecycle

- Defines processor, it's dependencies and metadata

Maven

For those of us in closed, secure environments…

Maven

- Maven is an Apache project for automated software building, dependency management, and testing
- Using Maven in secure environments raises some unique and potentially extremely frustrating challenges
  - Internet connectivity is at the core of most Maven installations
- All of the GeoEvent SDK samples are Maven projects
  - Recommended you start with an existing sample
- Using the GeoEvent SDK means using Maven
  - It is possible set up a GeoEvent project without Maven, but it can be very very frustrating!

For those of us in closed, secure environments…

Maven

- So with all this caution, why and how would I even do this?
- It's not that bad, just know these things:

- Read the Developer Guide, especially:
  - "Overview of the Sample Projects"
  - "Using Eclipse to Edit and Build Custom Components"
  - "Starting a New Project"
  - "Building and Deploying the Sample Projects"
  - At least one sample in "The Sample Projects"

- Continued…

For those of us in closed, secure environments…

Maven

- Build outside your work environment, where you have internet connectivity
  - Use one of the samples in the SDK to get started – one from the Developer Guide
  - This downloads dependencies to your local machine
- Burn your entire .m2 folder to CD
  - Hidden by default
  - `C:\Users\username\.m2` on Widows
  - `/root/.m2` on Linux
- Place .m2 in equivalent location in secure environment
- Create .m2/settings.xml file and point to local repository

For those of us in closed, secure environments…

In-house Maven

- Find out if your agency or department has a repository manager
  - Artifactory
  - Sonatype
  - Archiva
- If so, deploy the artifacts to the repository manager
- Update your local /.m2/settings.xml to reference the repository manager

Scripting “Upstream”

Scripting “upstream”

Alternate pattern for ingesting real-time data

- What if I don’t know Java?
- What if I don’t have time to learn a new SDK?
- What if I don’t want to (maybe) have to re-compile my connector at each new GeoEvent version?

Scripting “upstream”

Alternate pattern for ingesting real-time data

- Possible and easy to write your own app
- Runs “upstream” from GeoEvent
- Consumes real-time feed
- Parses and transforms data
- Sends data to GeoEvent in easy out-of-box form, like csv

Scripting “upstream”

CTfastrak

- GTFS = General Transit Feed Specification
  - Common format for public transportation schedules
- GTFS-realtime
  - Trip updates
  - Alerts
  - Vehicle positions
- CTfastrak
  - Bus Rapid Transit system in Connecticut
  - http://www.cttransit.com/about/developers/gtfsdata/
- GTFS is not native to GeoEvent

DEMO

Python for CT Transit GTFS-rt

https://github.com/Esri/public-transit-tools/tree/master/send-GTFS-rt-to-GeoEvent

Summary

- Connectors get data in and out of GeoEvent.
- Connectors pair a transport and an adapter.
- You can develop your own transports and adapters.
- You can configure your own connectors by pairing transports and adapters (custom developed or out-of-box).
- Processors perform analytics on geoevents.
- You can build your own processors, as well.
- Maven is a key component to development with the GeoEvent Server SDK.
- You can also employe alternate tactics for custom GeoEvent development, such as writing scripts that send data to GeoEvent.

Questions?