GeoEvent Extension for ArcGIS for Server: A Developer's Guide

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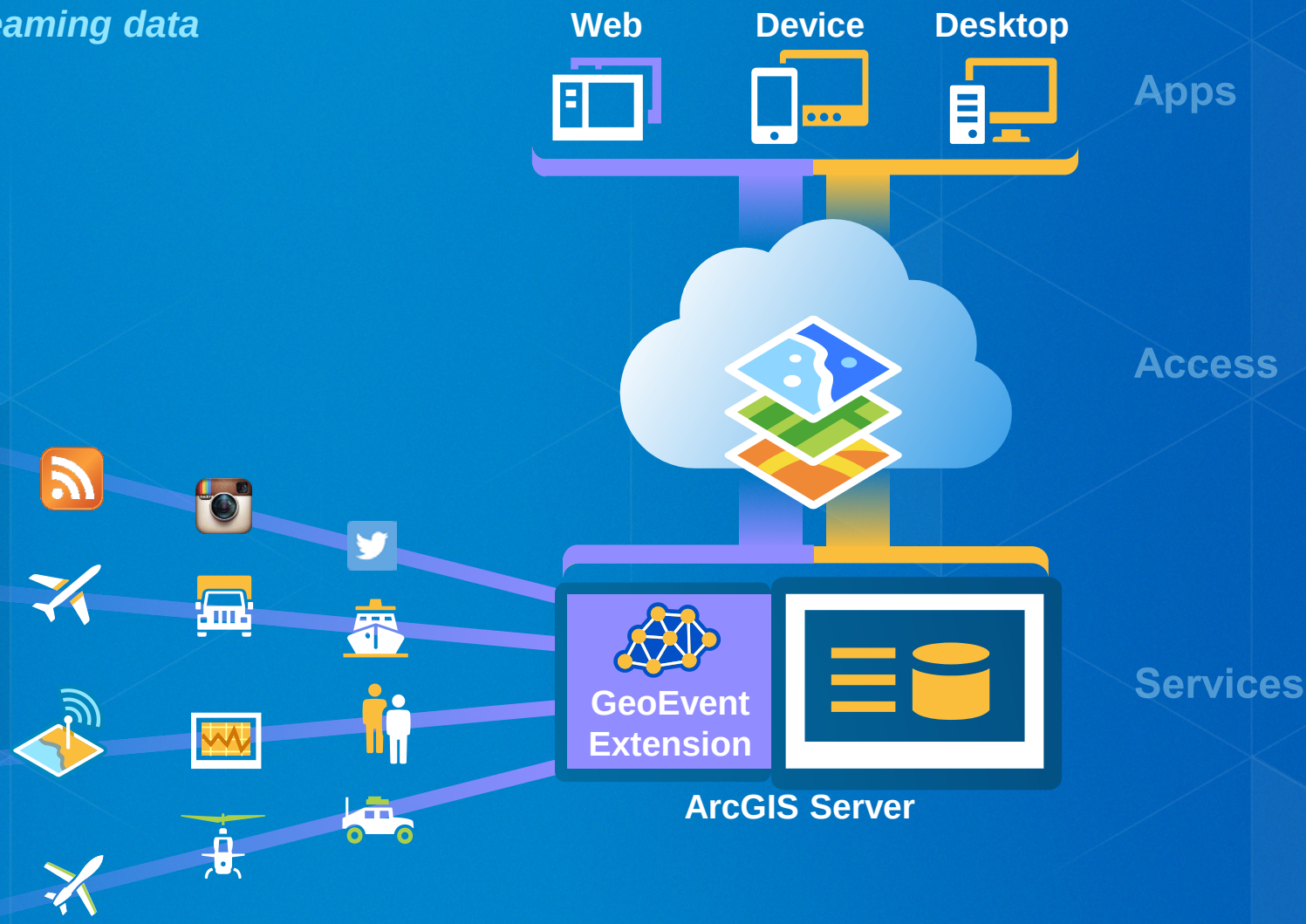
Agenda

- 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

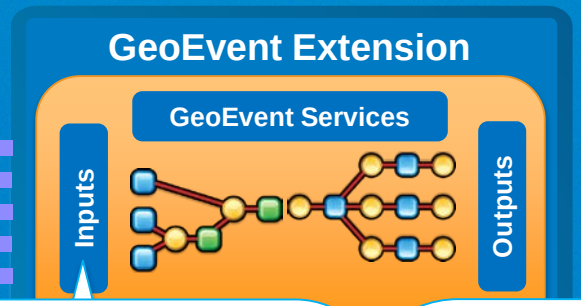
Connectors

What is a connector?

- **Connectors** are made up of two customizable components
  - **Transport**
  - **Adapter**
- Types of transports and adapters:
  - 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 to 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

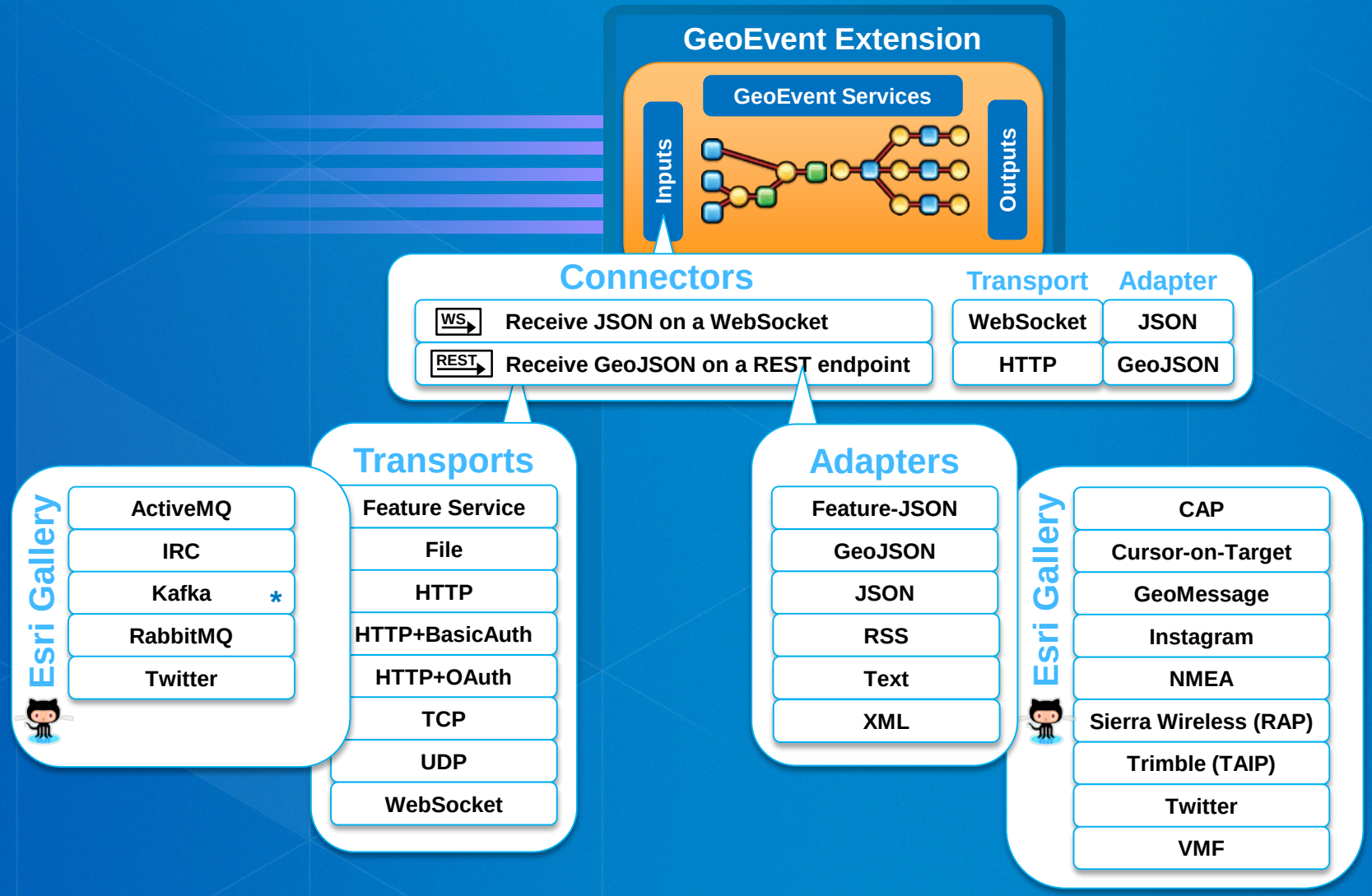
- ActiveMQ
- CAP
- Cursor-on-Target
- Exploitation Support Data
- Instagram
- KML
- Kafka *
- MQTT
- NMEA 0183
- RabbitMQ
- Sierra Wireless (RAP)
- Trimble (TAIP)
- Twitter

Partner Gallery

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

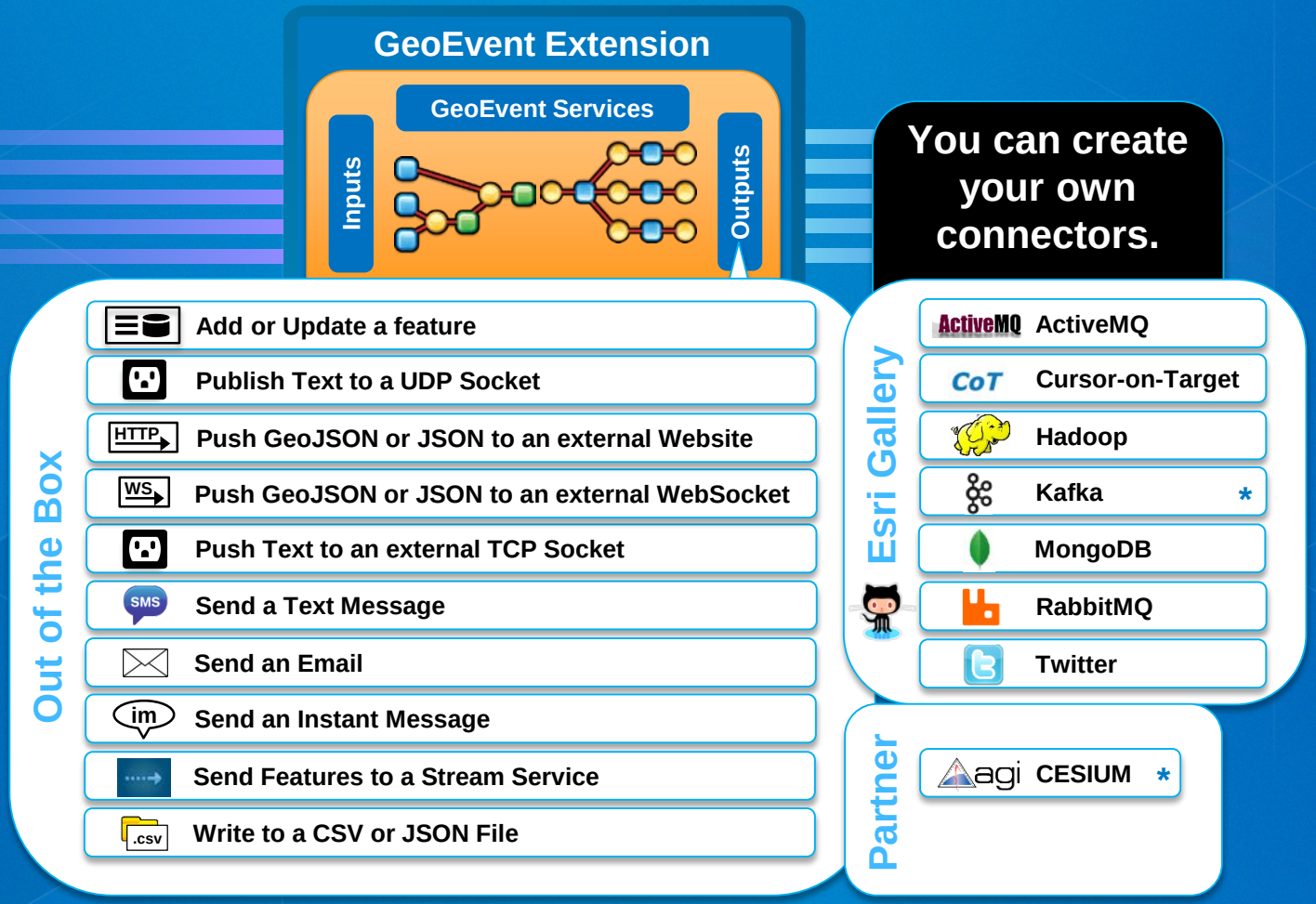
Receiving Real-Time Data

*Input Connector = **Transport** + **Adapter***



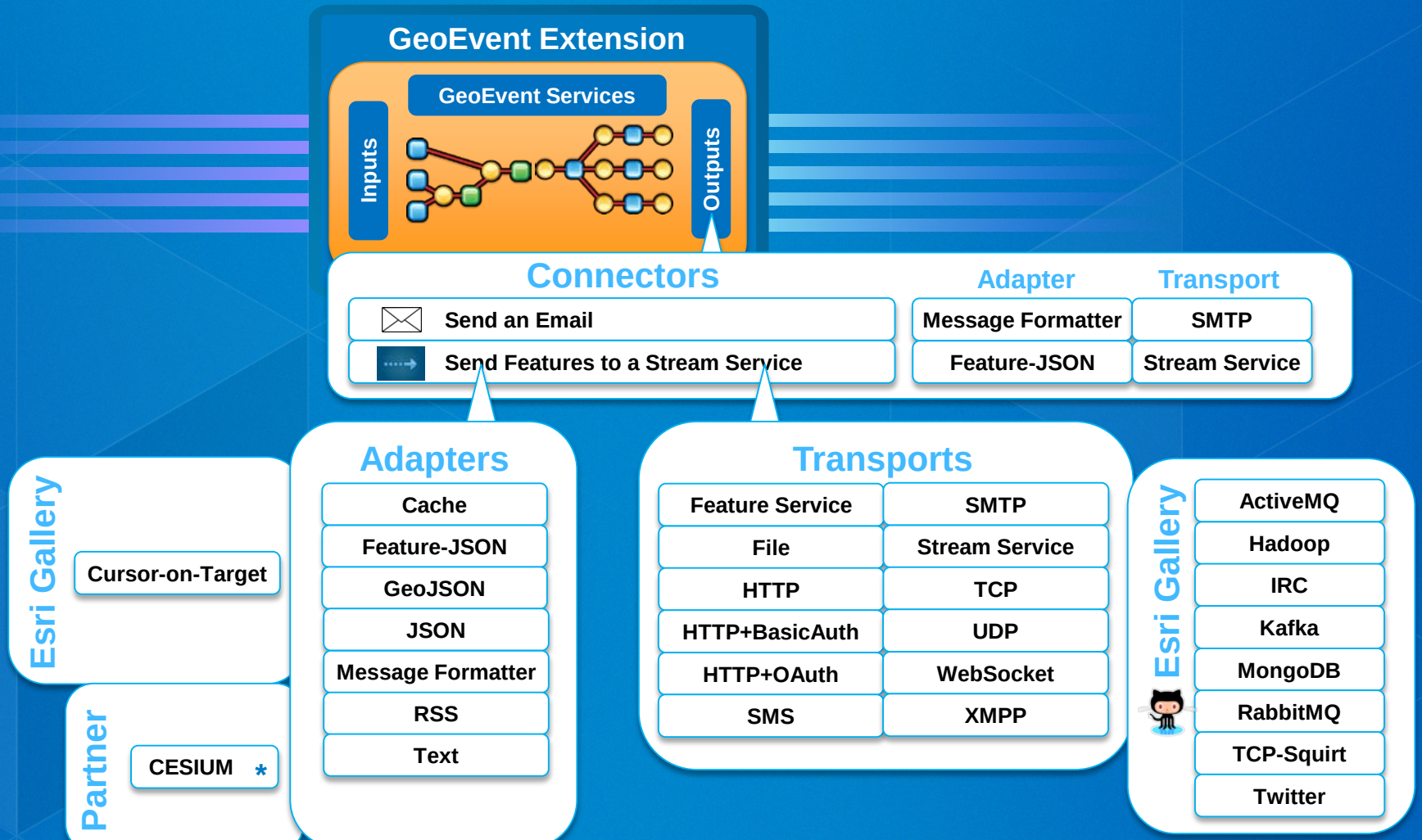
Sending Real-Time Data

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



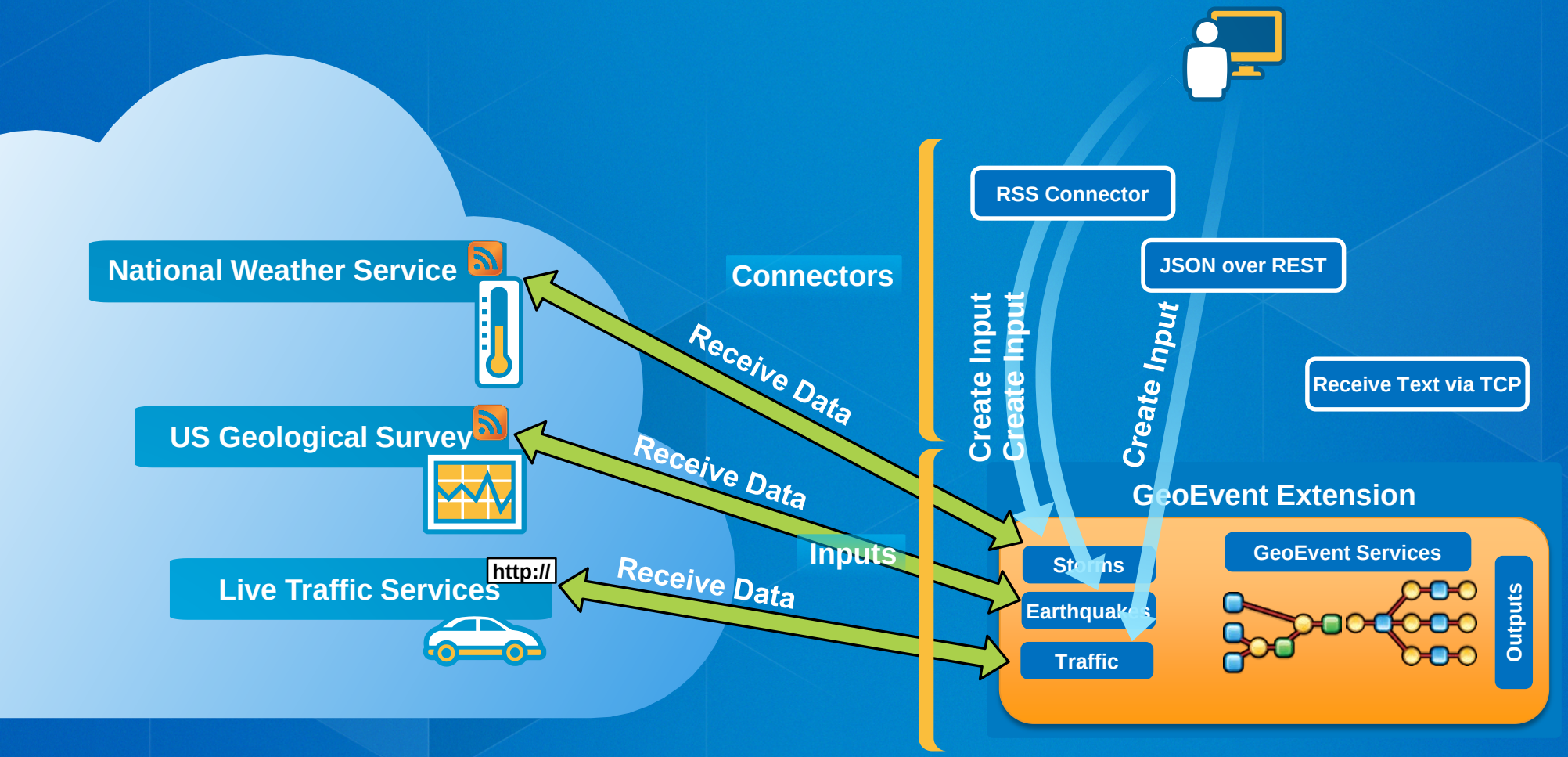
Sending Real-Time Data

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



Creating Inputs

Configured using Connectors

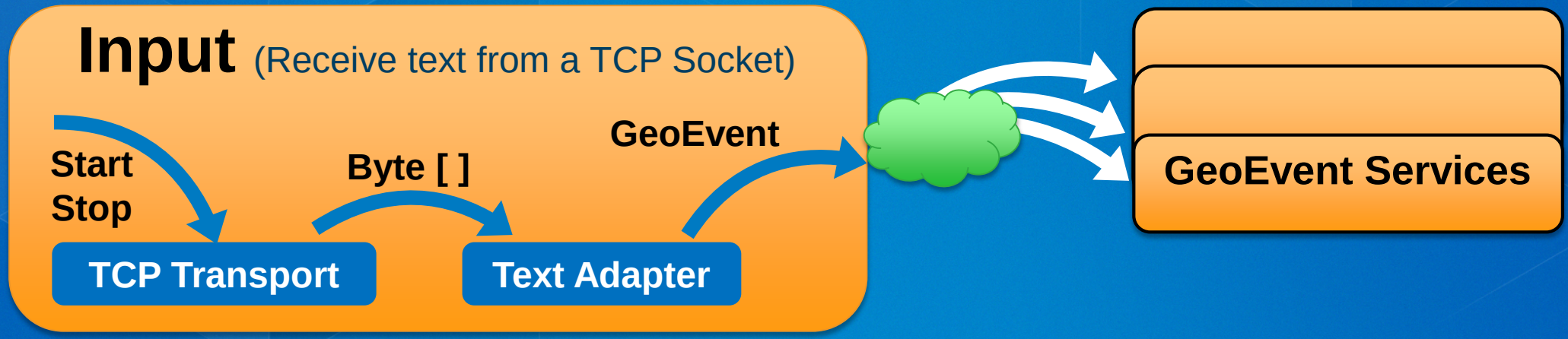


Connector

How Does it Help

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

Example Input

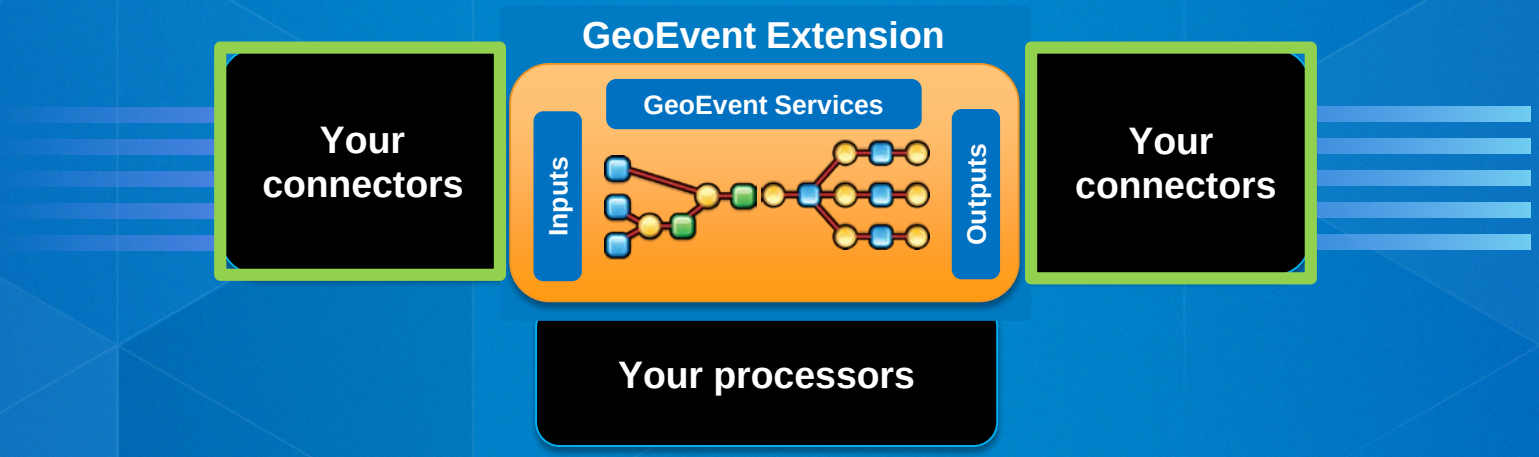


GeoEvent SDK

Extending GeoEvent

Software Development Kit (SDK)

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

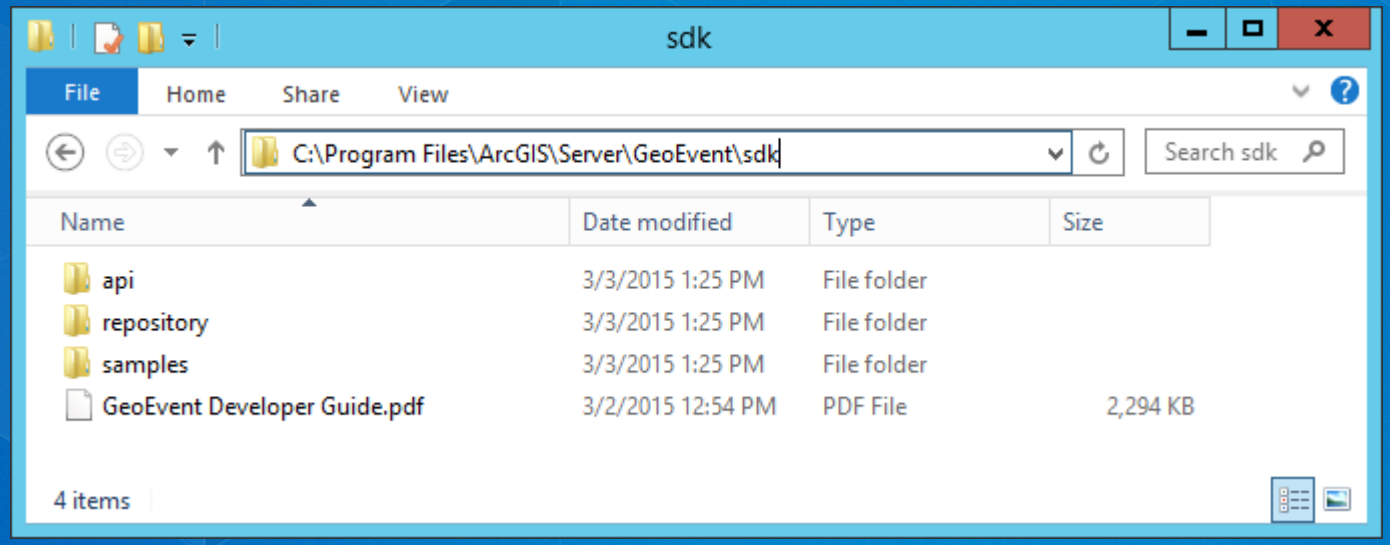


- A note on semantics: the SDK is used to build *transports*, *adapters* and *processors*. Input and output *connectors* are built by pairing a transport and adapter in GeoEvent Manager.

Extending GeoEvent Processor

Software Development Kit (SDK)

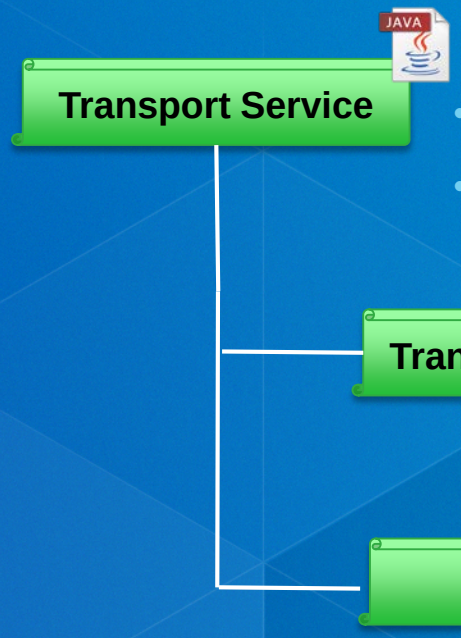
- **api:** **JavaDoc content associated with GeoEvent Processor SDK**
- **repository:** **Local maven repository**
- **samples:** **Sample processors** (and connectors)
- **GeoEvent Processor Developer Guide**



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

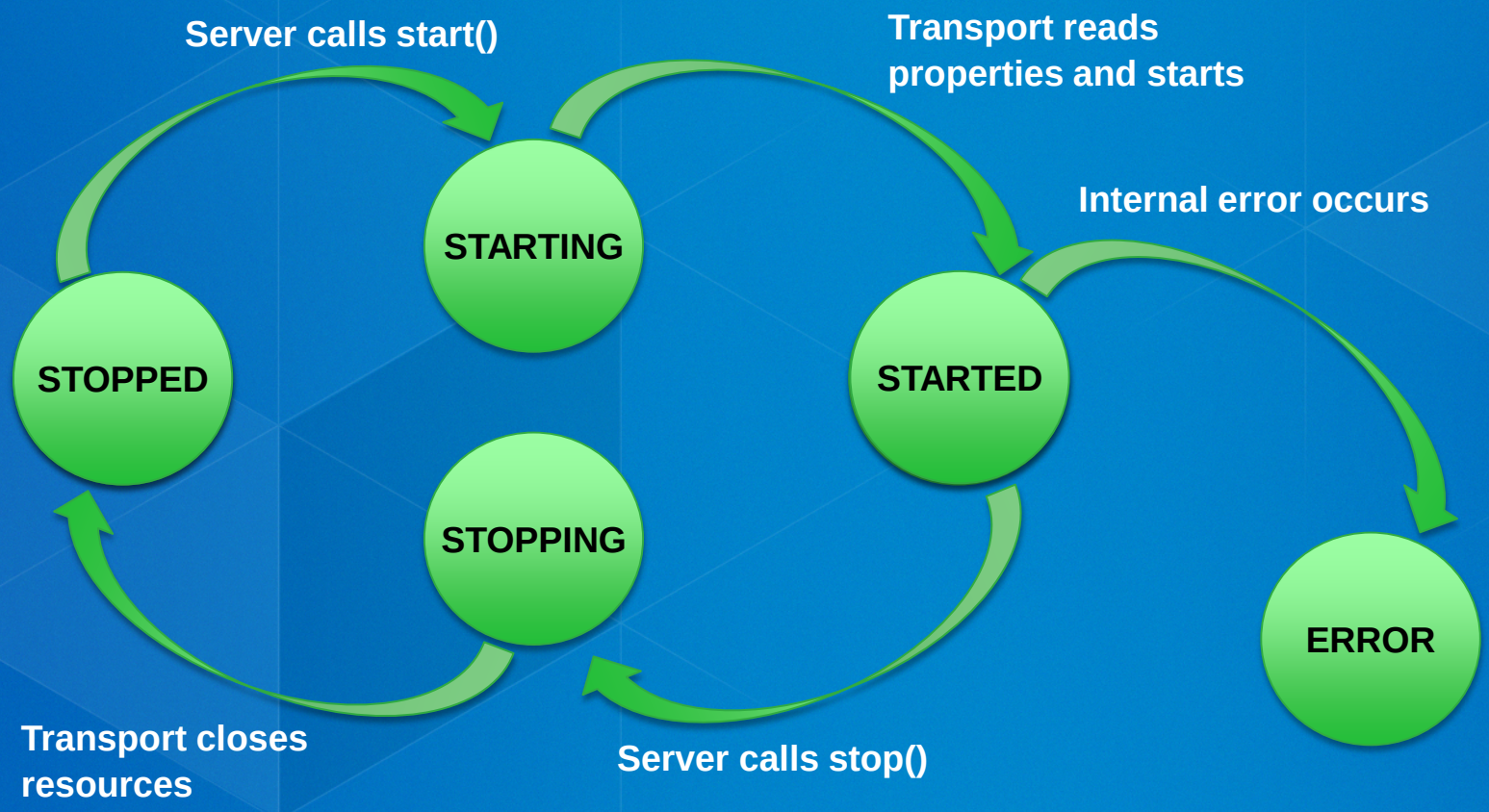
Transports

- 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

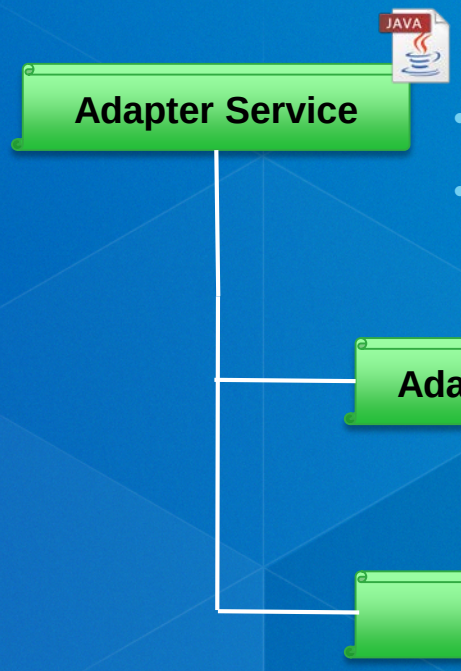
Transports

- 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

- 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

DEMO

Custom Adapter: regexText-adapter

…developed using SDK

DEMO

Custom Connector: XML over TCP

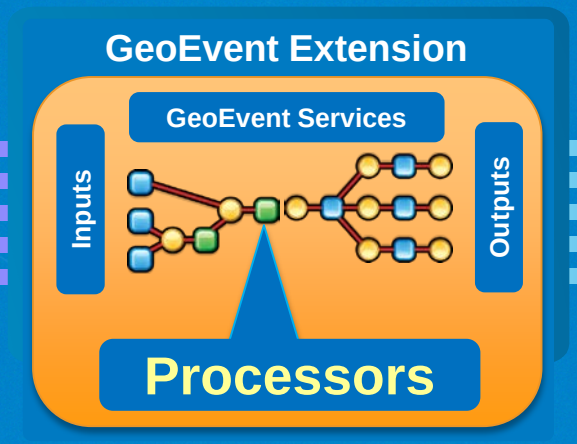
…no development required

Processors

Processors

What is a processor?

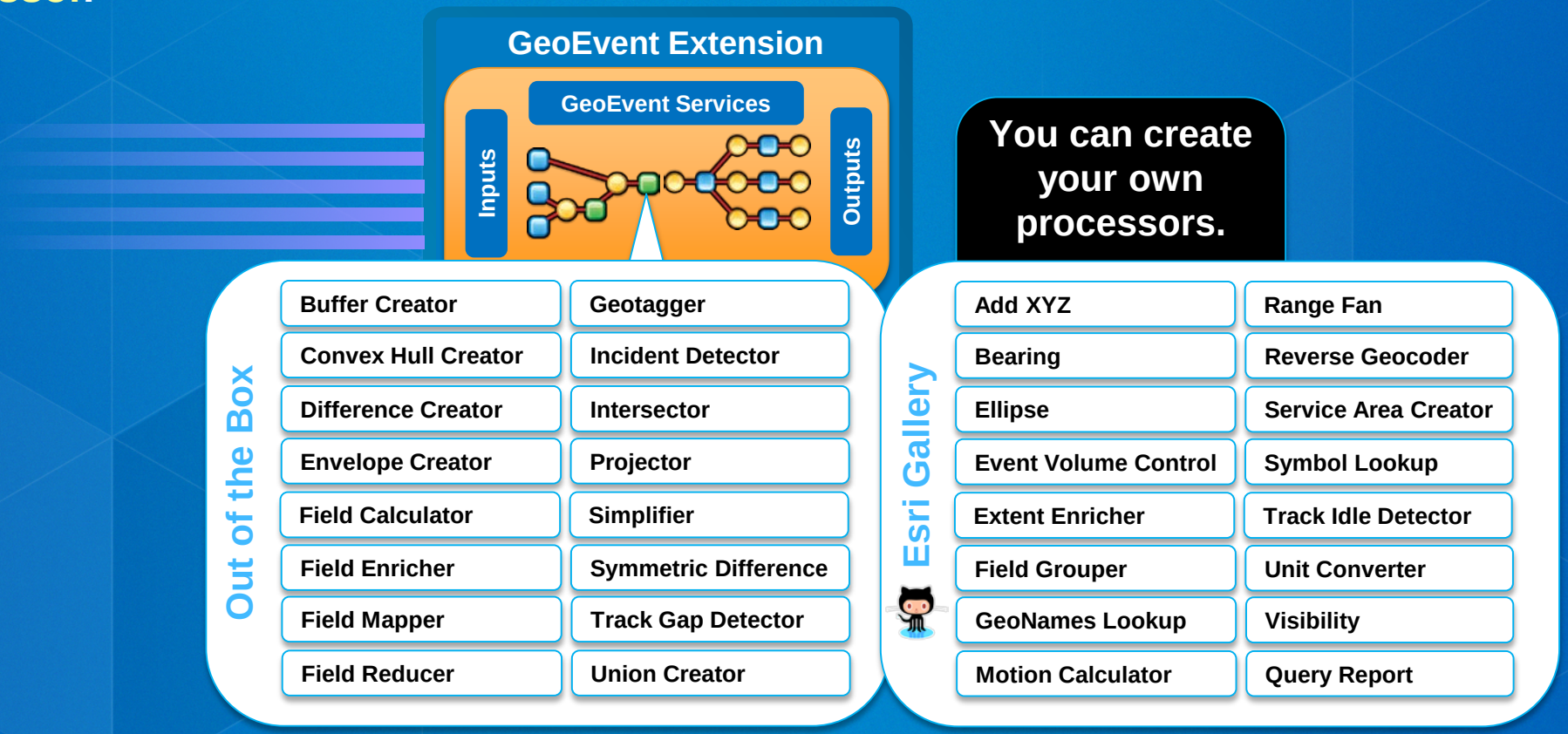
- **Processors** perform some action on each GeoEvent passed to it
- **Processors** can be used to:
  - Modify existing fields or the geometry
  - Add new fields
  - Filter
  - Create new GeoEvent(s)
  - Perform GeoFencing



Applying real-time analytics

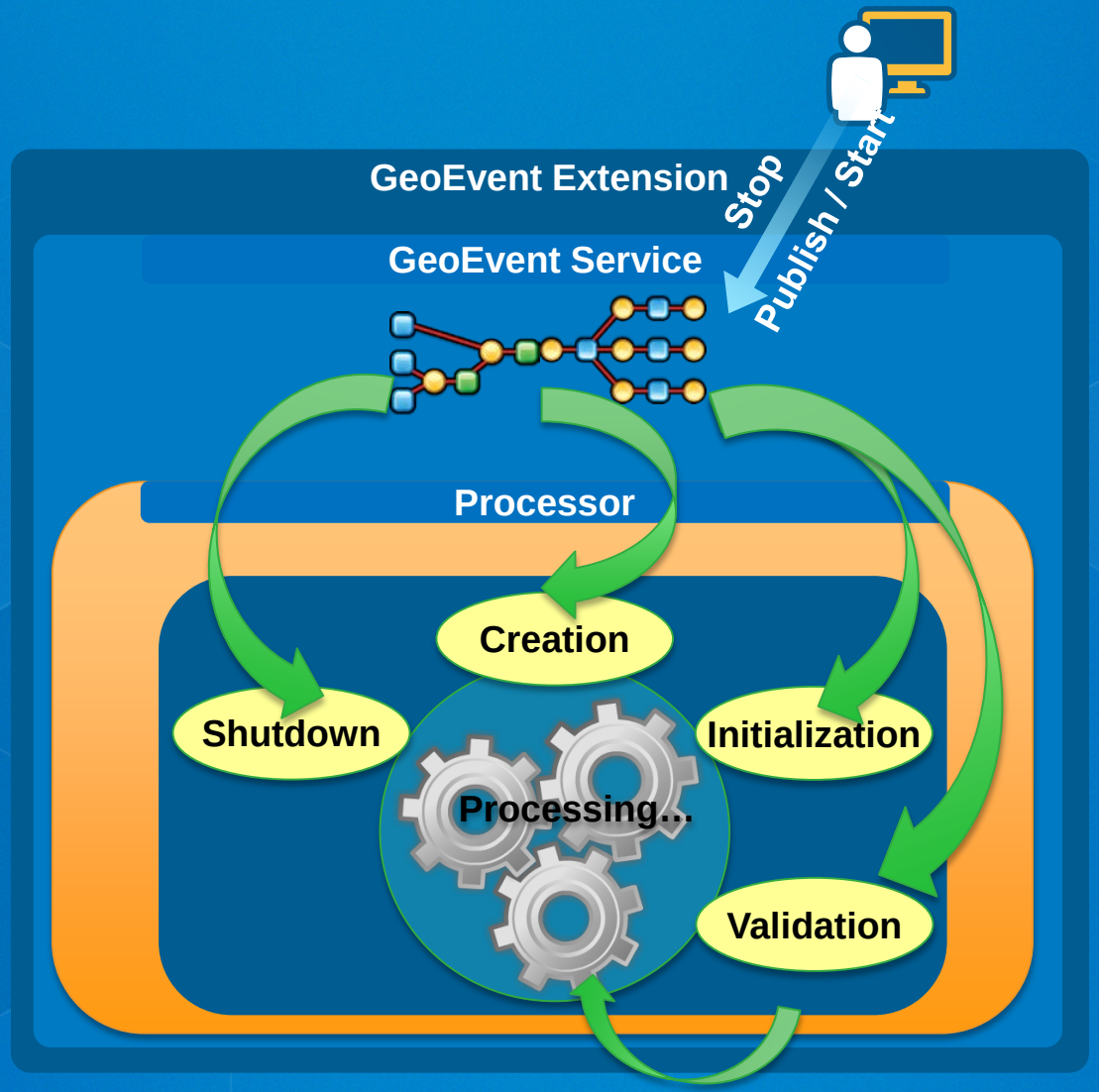
GeoEvent Processing

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



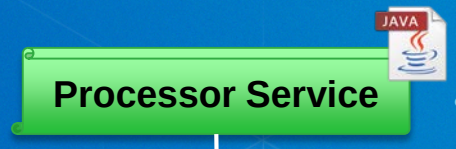
Processor

Lifecycle Review

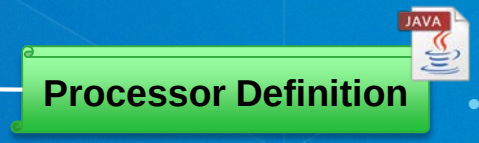


Anatomy of a Processor

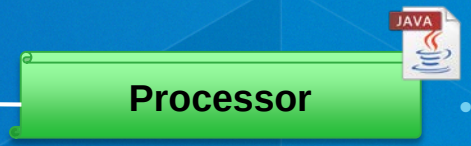
What makes up a Processor?



- 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

DEMO

Custom Processor: Logger

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 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 central Connecticut
  - http://www.cttransit.com/about/developers/gtfsdata/
- GTFS is not native to GeoEvent
  - Customer had no Java developers

DEMO

Python for CT Transit GTFS-rt

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