ArcGIS® GeoEvent Server

Introduction Tutorial

Lesson 4 – Processors

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The Real-Time Visualization & Analytics Team strives to update product tutorials and abstracts to reflect the latest release. Depending on the version of ArcGIS GeoEvent Server you are using, there may be inconsistencies between your environment and the illustrations or specific steps in exercises or videos bundled with the abstract. The concepts outlined, however, should be applicable across different versions of GeoEvent Server.

Contents

Tutorial overview

The Introduction to ArcGIS GeoEvent Server Tutorial is one of several tutorials that introduces you to the capabilities of ArcGIS GeoEvent Server. The tutorial contains six lessons, each complementing one another by exploring different capabilities. If you are new to GeoEvent Server, you are encouraged to start with Lesson 1 and then work through the remaining lessons. If you are familiar with GeoEvent Server, you can skip to any other lesson depending on your learning objectives, you do not need to complete each lesson in order. Later lessons will assume you have some familiarity with GeoEvent Server.

The lessons include a GeoEvent Server product configuration that you will import. Each includes configured items such as inputs, outputs, GeoEvent Definitions, and GeoEvent Services that support the lesson. Carefully review the information on what is included in the configuration, as it may reset items you created as part of previous lessons and product exploration.

This tutorial does not provide information on installing, deploying, or managing ArcGIS GeoEvent Server. For information about deploying ArcGIS GeoEvent Server, see Deployment considerations.

Access the other lessons here. If you have questions, comments, or feedback on this tutorial, start a discussion on the ArcGIS GeoEvent Server Community.

Tutorial prerequisites

Before getting started with the Introduction to GeoEvent Server Tutorial, review the following prerequisites.

- ArcGIS GeoEvent Server is installed, licensed, and configured in your organization. If not, see the following topics for your operating system to install GeoEvent Server:
    - GeoEvent Server (Windows) installation guide
    - GeoEvent Server (Linux) installation guide
- A managed relational geodatabase or ArcGIS Data Store is registered to ArcGIS Server. See Register an ArcGIS Server managed database for more information.
- ArcGIS Server must be licensed with the ArcGIS GIS Server and ArcGIS GeoEvent Server licensing roles.
- Exercises in this tutorial assume GeoEvent Server is installed on a single machine with ArcGIS Server. The exercises will leverage the **Default** connection to ArcGIS Server, accessible in **GeoEvent Manager** by navigating to **Site** > **GeoEvent** > **Data Stores**.

Lesson 4 overview

Lesson 4 presents the concept of event processing with exercises that demonstrate how to add and configure different types of processors into GeoEvent Services. This lesson covers some of the basic processors used for field calculation, event enrichment, and mapping event data with different schemas.

Exercises in Lesson 4 will introduce you to some of the basic processors, while Lesson 5 introduces you to some of the more advanced processors including Incident Detector, Track Gap Detector, and GeoTagger. Lesson 6 introduces different geometry processors used to buffer event geometry, create a convex hull or envelope, compute geometric and symmetric differences, discover geometric intersections, as well as simplify and project event geometry.

Once you have completed the exercises in this lesson, you will have a solid understanding of how to use the following processors:

- **Field Calculator Processor** – Creates derivative data which can be appended to an event or used to overwrite data contained in an event. This processor has two types, one of which allows regular expressions to be applied to event data.
- **Field Enricher (File) Processor** – Retrieves data from a feature service or a system text file and appends it to the event data.
- **Field Mapper Processor** – Maps event data from one schema to another event schema. This type of processor relies heavily on GeoEvent Definitions which defines the data types of fields in event data.

Lesson 4 prerequisites

The prerequisite steps below must be completed before proceeding with the exercises in this lesson.

Prerequisite 1: Create new folders on the GeoEvent Server machine

To complete Lesson 4, you will create two new folders on the GeoEvent Server machine. One folder will be used with the file-based outputs in GeoEvent Server. The second folder will be used to enrich event data. If you already created the folder structures in previous lessons, ensure all files beneath the folders are deleted and proceed to the next prerequisite.

1. On the GeoEvent Server machine, create the folder structures below:

   `C:\GeoEvent\output`

   `C:\GeoEvent\enrichment_data`

Prerequisite 2: Import a GeoEvent Server configuration

ArcGIS GeoEvent Server stores elements and settings in a configuration file (.xml). To complete this lesson, a GeoEvent Server configuration file is included to help get your GeoEvent Server environment configured with the required elements to complete the exercises below. For more information about working with GeoEvent Server configurations, see Manage configurations.

Importing the configuration for this lesson will create the following items:

GeoEvent Definitions	Flights Sensors-In Sensors-Flat
Inputs	flights-tcp-text-in sensors-url-poll-in
Outputs	flights-file-json-out sensors-file-json-out
GeoEvent Services	Flights Sensor Monitor

NOTE: *If an element with the specified names above already exists in your environment, importing this configuration will overwrite those elements. You will reset your GeoEvent Server configuration which will remove items you created previously and import only the items necessary for this lesson.*

Follow the steps below to reset and import the GeoEvent Server configuration for Lesson 4.

1. Open **ArcGIS GeoEvent Manager** and navigate to **Site** > **GeoEvent** > **Configuration Store**.
2. Click **Reset Configuration** and click **Yes** to confirm.

   NOTE: *If you have anything else configured on your GeoEvent Server machine, resetting the configuration will delete everything from your configuration.*
3. Click **Import Configuration**.
4. Click **Choose File** and browse to the …`\configuration` folder included with this lesson and select the **Lesson_4.xml** file and click **Open** and then **Next**.
5. Click **Next**, ensure **Import Configuration** is selected, and click **Import** to import the configuration.

   NOTE: *As a best practice, you should stop any inputs, outputs, and GeoEvent Services before exporting a GeoEvent Server configuration. If an element is imported in a started state, it could begin processing event data before you are ready, contend with another running element, or import in an error state when an externally hosted socket connection for example is not yet available for a client connection. In the Lesson 4 configuration file, all elements will import in a stopped state.*
6. Navigate to the **Manager** page and click ▶ to start the **flights-tcp-text-in** input.

Prerequisite 3: Add enrichment data to folder

1. Navigate to the `data` folder included with this tutorial and copy and paste the **PilotInformation.csv** file to the `enrichment_data` folder you just created at:

   `C:\GeoEvent\enrichment_data`

Prerequisite 4: Add simulation data

In the GeoEvent Server installation directory there is an `assets` folder which can be used to simulate data coming from an API endpoint. You will put the *SensorData.json* file included with this lesson into the `assets` folder. This will be used to simulate live sensor data coming from an API endpoint.

1. On the GeoEvent Server machine, navigate to the `assets` folder at:

   `<GeoEvent Installation Directory>\ArcGIS\Server\GeoEvent\assets`

2. Copy and paste the **SensorData.json** file located in the `simulations` folder included with this lesson into the `assets` folder.

3. In **GeoEvent Manager**, on the **Manager** page, click ▶ to start the **sensors-url-poll-in** input.

   NOTE: *If for some reason your organization does not allow the machine to be accessed via localhost or the input is not incrementing, perform the following steps:*

   a. *Click to edit the **sensors-url-poll in** input.*

   b. *For the **URL** parameter, replace `Localhost` with your GeoEvent Server machine's name.*

   c. *Click **Save** to save the changes.*

Prerequisite 5: Configure GeoEvent Simulator to simulate real-time data

You will simulate real-time event data to GeoEvent Server using GeoEvent Simulator.

1. Open **GeoEvent Simulator** from the Windows **Start** menu or use the **GeoEventSimulator.exe** at: `<ArcGIS Server installation directory>\GeoEvent`.

2. Click  to connect to the TCP input over the default TCP port **5565**.

   The button changes to  indicating you are connected to the input.

3. Click  , then click  again on the next dialog and browse to the …`\simulations` folder included with this tutorial.

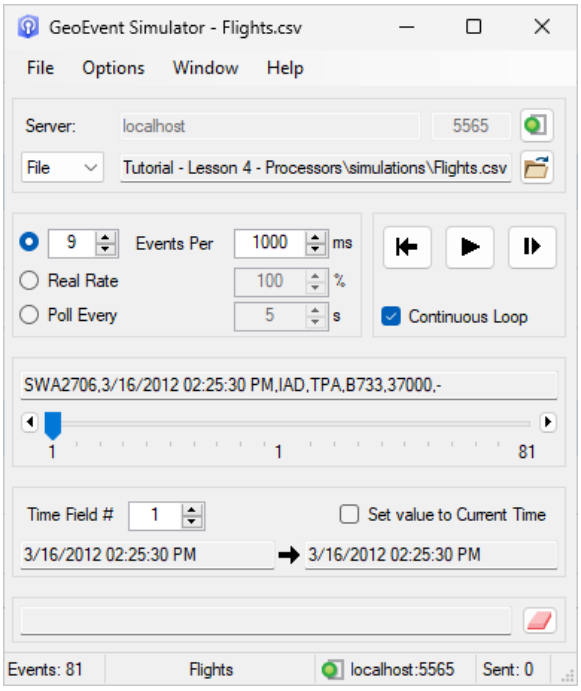
4. Select the **Flights.csv** file and click **Open**.

5. Leave the default values for the **Event Separator**, **Field Separator**, and **Time Field #** parameters.

6. Click **Load** to load the file's data into GeoEvent Simulator.

7. Set the simulator to 9 **Events Per** `1000` **ms**.

8. Click  to start the simulation.



In **GeoEvent Manager**, notice the count for the **flights-tcp-text-in** input is increasing, indicating that the input is receiving the simulated data.

It is recommended that you keep the simulator running to complete the rest of the lesson. You have now completed the prerequisites necessary to complete the exercises in Lesson 4.

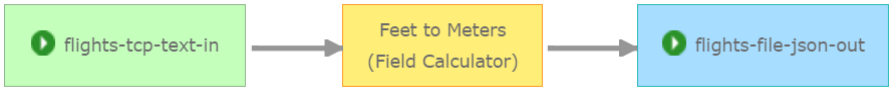
Lesson 4 exercises

Processors are another type of element in a GeoEvent Service that can process, enrich, restructure, and calculate new data values associated with event records before they are sent to outputs. You will now explore three commonly used processors; Field Calculator Processor, Field Enricher (File) Processor, and Field Mapper Processor.

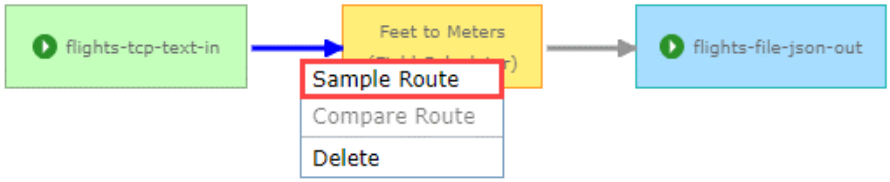
Exercise 1: Field Calculator Processor

The Field Calculator Processor allows you to evaluate an expression to produce the necessary value. The result of the calculation is either appended to the event in a new field or is written to an existing event field (overwriting the original value received in the event). You will use the Field Calculator Processor to convert the aircraft's altitude field, which is sent in meters, to feet.

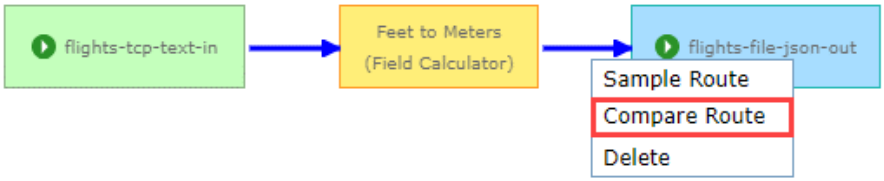
1. In **GeoEvent Manager**, from the **Manager** page, open the **Flights** GeoEvent Service.
2. Right-click the **flights-file-json-out** output and select **Start Output**.
3. From the **New Elements** menu, double-click **Processor** to add it to the service designer.
4. Specify the parameters as follows:
    a. For **Name**, type `Feet to Meters`.
    b. For **Processor**, select **Field Calculator**.
    c. For **Expression**, type `Altitude / 3.28084`.
    d. For **Target Field**, select **New Field**.
    e. For **New Field Name**, type `AltitudeInMeters`.
    f. For **New Field Type**, select **Long**.
    g. For **New GeoEvent Definition Name**, type `Flights-AltitudeInMeters`.
5. Click **OK** to create the new processor.
6. Configure the GeoEvent Service as illustrated below.



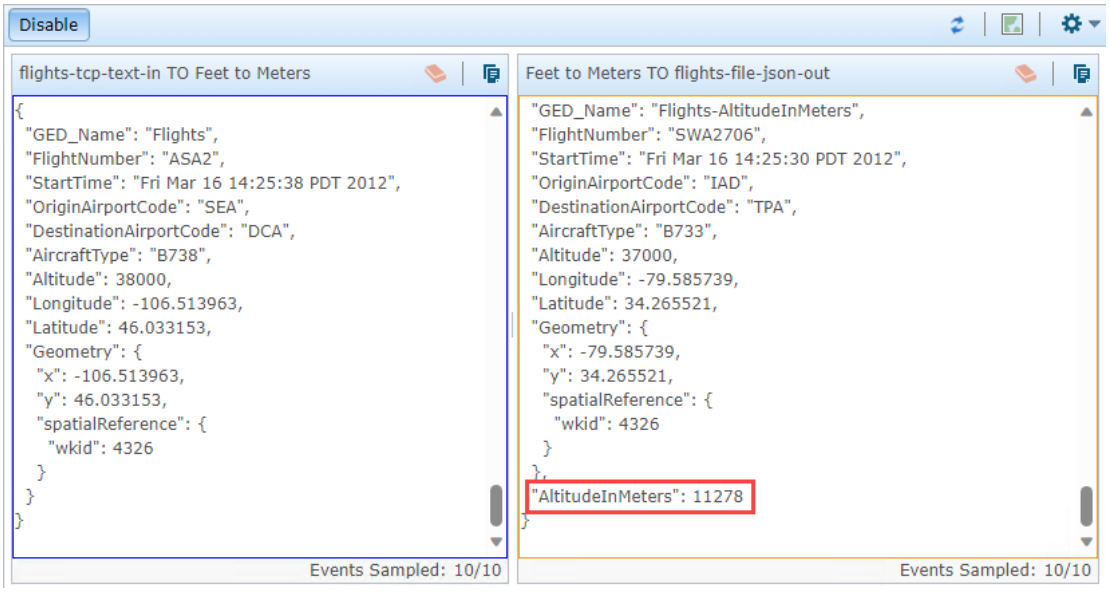
7. Click **Publish** to publish the GeoEvent Service.
8. Click ▶ to start the GeoEvent Service.
9. Right-click the route between the input and the processor and select **Sample Route**.



10. Right-click the route between the processor and the output and select **Compare Route**.



11. In **GeoEvent Sampler**, review the two sampled routes.



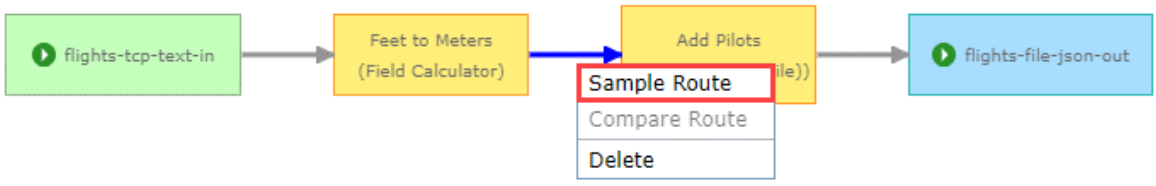
You can see the sampled data before being processed on the left and the data after being processed by the processor on the right. Notice that there is now a field called `AltitudeInMeters` that is included in the event data on the right. Because the processor is modifying the event's schema by creating a new event field, a new GeoEvent Definition was created, called `Flights-AltitudeInMeters` as seen in the `GED_Name` field in the illustration above on the right. Recognizing that the event data was modified, and now has an associated GeoEvent Definition, will be important when sending event data to an output which expects a certain schema such as an Update a Feature output.

Exercise 2: Field Enricher (File) Processor

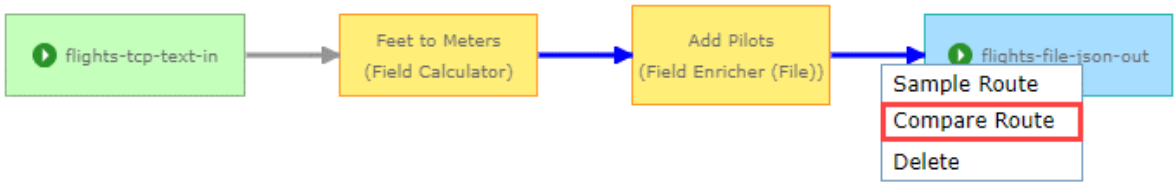
The Field Enricher (File) Processor can be used to retrieve data from an external table and add that data to an event being processed, essentially enriching the event with additional data. This is accomplished by joining the two data tables temporarily on-the-fly. You will enrich the flight event data with pilot information from a CSV file.

1. In **GeoEvent Manager**, open the **Flights** GeoEvent Service.
2. From the **New Elements** menu, double-click **Processor** to add a new processor and specify the parameters as follows:
   a. For **Name**, type `Add Pilots`.
   b. For **Processor**, select **Field Enricher (File)**.
   c. For **Registered Folder**, select **GeoEvent_EnrichmentData**.
   d. For **File Name**, type `PilotInformation.csv`.
   e. For **File Join Field**, type `id`.
   f. For **Target Fields**, select **New Fields**.
   g. For **Enrichment Fields**, type `PilotName,PilotPhone`.
   h. For **New GeoEvent Definition Name**, type `Flights-AddPilots`.
   i. For **GeoEvent Join Field**, click the **Field** menu and select **TRACK_ID** under the **TAGS** category.
3. Click **OK** to add the new processor.
4. Configure the GeoEvent Service as illustrated below.

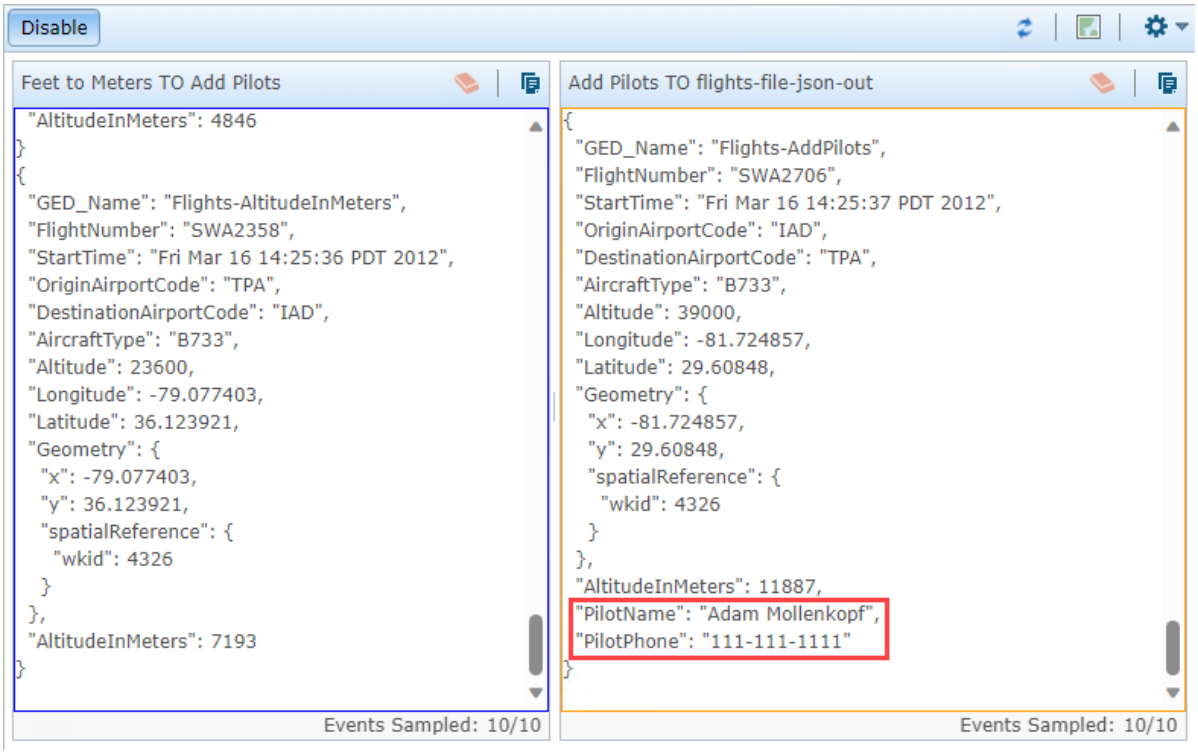
5. Click **Publish** to publish the GeoEvent Service.
6. Right-click the highlighted route illustrated below and select **Sample Route**.



7. Right-click the highlighted route and select **Compare Route**.



Notice the `PilotName` and `PilotPhone` fields were joined to the incoming event records.

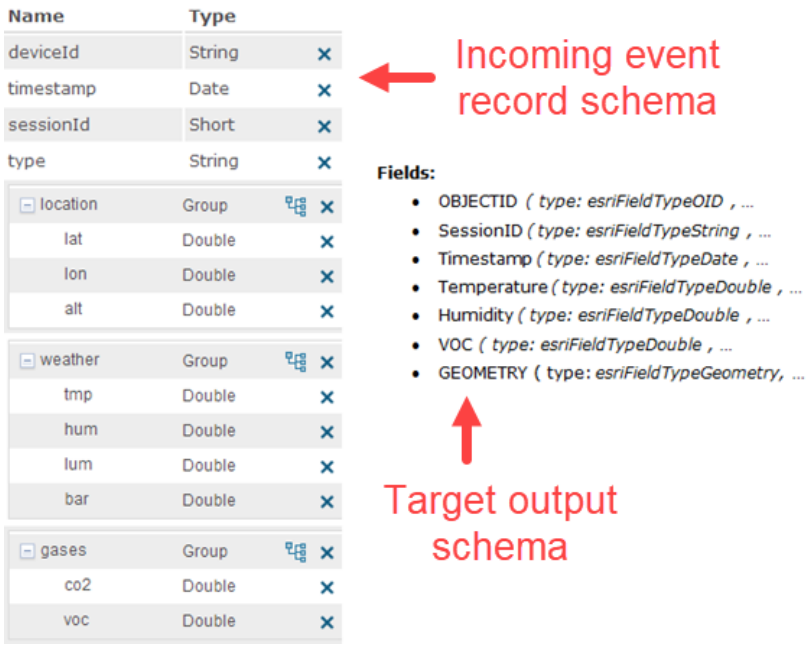


The key fields for the join are the `id` field from the system file and the event field tagged `TRACK_ID`. The appropriate `PilotName` and `PilotPhone` attributes are retrieved from the data file and appended to the event record being processed.

Exercise 3: Field Mapper Processor

The Field Mapper Processor is used to map data from one event record's schema to another. A common use case is when the schema of the event data received does not match the schema of a feature service layer. A Field Mapper Processor can be used to map the fields from one to the other.

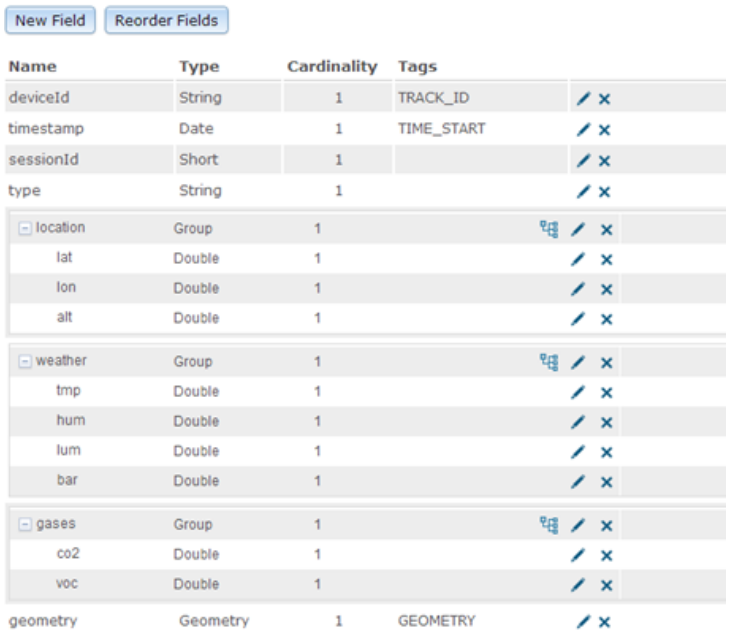
In the illustration below, notice the structure of the incoming sensor report includes data in separate groups. Atmospheric data such as temperature and humidity are reported in a group named `weather`, while data on different gases is reported in a group named `gases`. Notice also that the sensor's location (latitude, longitude, and altitude) is reported in a third group named `location`.



Follow the steps below to configure a Field Mapper Processor to both reduce and map an event record's GeoEvent Definition to another. Note that GeoEvent Simulator is not able to model cardinal lists and groups, common in JSON and RSS data, so you will use sample sensor data included with this lesson instead.

1. In **GeoEvent Manager**, navigate to **Site** > **GeoEvent** > **GeoEvent Definitions**.
2. Open and review both the **Sensors-In** and **Sensors-Flat** GeoEvent Definitions without making any changes.

   Sensors-In GeoEvent Definition:

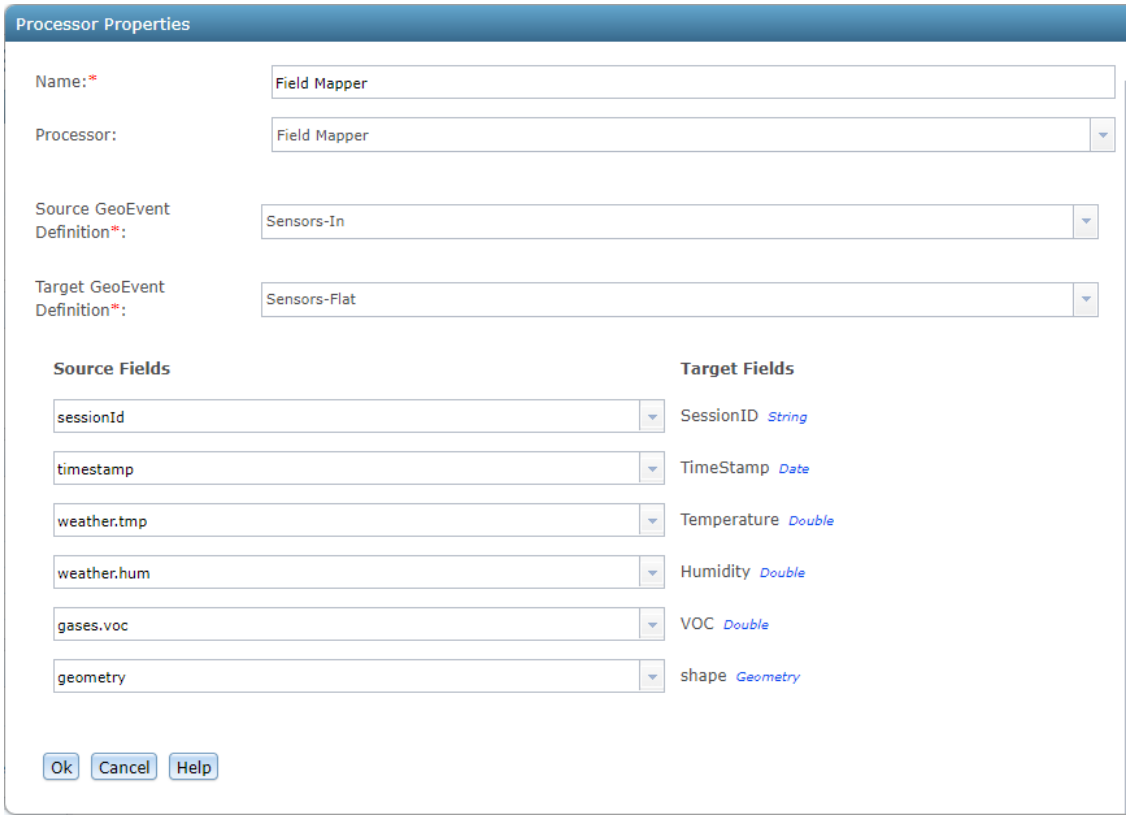


Sensors-Flat GeoEvent Definition:

In the illustrations above, note the following:

- `Sensors-In` has a hierarchical structure with some fields contained in groups, whereas `Sensors-Flat` has a flat structure which is supported by feature services.
- The two GeoEvent Definitions have different field names for their geometry field (`geometry` versus `shape`).
- In the received data, `sessionId` is handled as a short integer, while the `SessionID` information sent out is specified as a string.

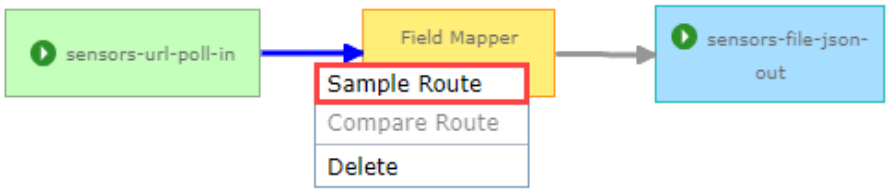
3. Navigate to the **Manager** page and open the **SensorMonitor** GeoEvent Service.
4. Right-click the **sensors-file-json-out** output and select **Start Output**.
5. From the **New Elements** menu, double-click **Processor** and specify the parameters as follows:
   a. For **Name**, type `Field Mapper`.
   b. For **Processor**, select **Field Mapper**.
   c. For **Source GeoEvent Definition**, select **Sensors-In**.
   d. For **Target GeoEvent Definition**, select **Sensors-Flat**.
   e. For **Source Fields**, select the source fields as illustrated below:



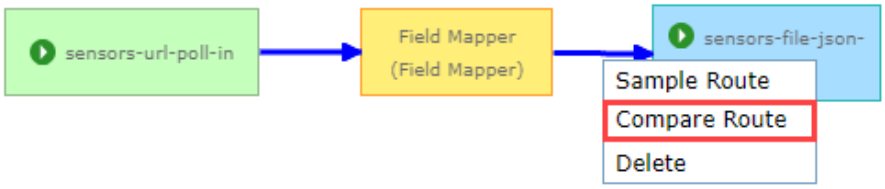
NOTE: *When working with nested JSON fields, you need to specify the parent and child field when identifying a field. Recall the Sensors-In GeoEvent Definition, it contains a weather group field with child fields including tmp, hum, lum, and bar. To specify a field in a group, you need to specify the parent and child, separated by a period (.), for example, weather.tmp and weather.hum.*

6. Click **OK** to add the new processor.
7. Configure the GeoEvent Service as illustrated below.

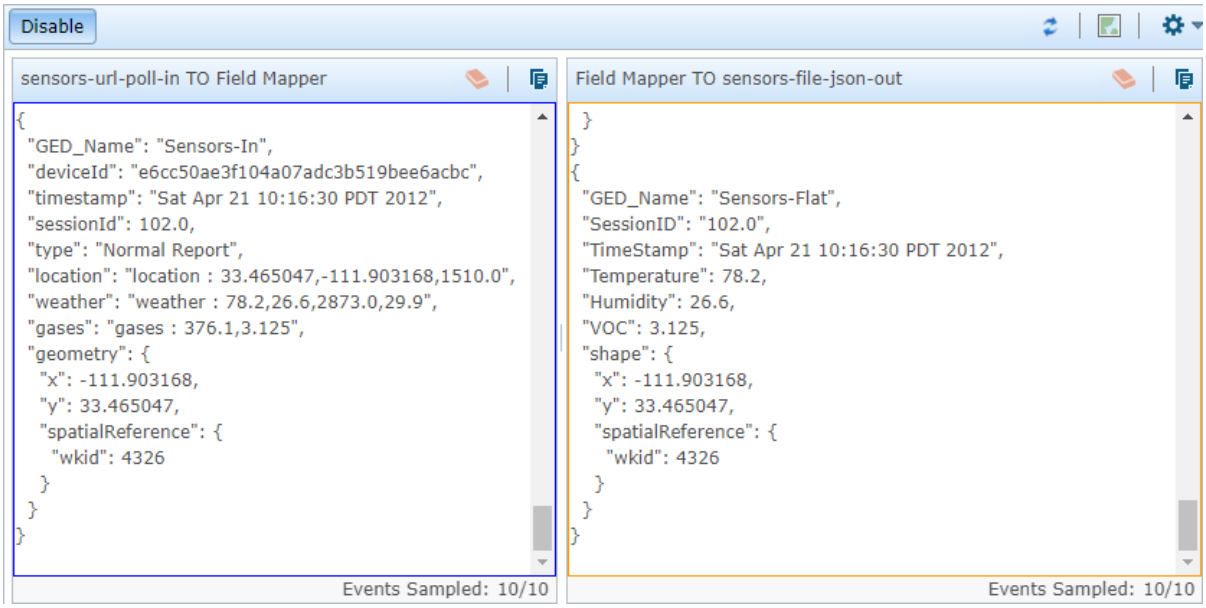
8. Click **Publish** to publish the GeoEvent Service.
9. Click ▶ to start the GeoEvent Service.
10. Right-click the highlighted route and select **Sample Route**.



11. Right-click the highlighted route and select **Compare Route**.



12. In **GeoEvent Sampler**, review the two sampled routes.



Notice that the grouped fields were successfully remapped to the flattened fields.

Lesson clean-up

With the lesson complete, you can now perform the following tasks to clean-up your GeoEvent Server machine, if necessary.

- Reset your GeoEvent Server configuration in **GeoEvent Manager** by navigating to **Site** > **GeoEvent** > **Configuration Store** and click **Reset Configuration**.
- Delete the **SensorData.json** file located in:

  `<GeoEvent Installation Directory>\ArcGIS\Server\GeoEvent\assets`
- Delete the folders and files in the directories below:

  `C:\GeoEvent\output`

  `C:\GeoEvent\enrichment_data`

Summary

By completing the exercises in this lesson, you explored several of the processors available in GeoEvent Server. You learned how the Field Calculator Processor can be used to calculate and derive new data values from received event data, how the Field Enricher (File) Processor can be used to enrich received event data from a file, and how the Field Mapper Processor can be used to match the schema of received event data to a target GeoEvent Definition. In this lesson, you sent the event data to a file on the system, explore all the other output connectors available in GeoEvent Server including one to update features in a feature service which can then be visualized in a web map.