ArcGIS® GeoEvent Server

Introduction Tutorial

Lesson 1 – Get Started with GeoEvent Server

esri | THE SCIENCE OF WHERE™

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

ArcGIS GeoEvent Server overview

ArcGIS GeoEvent Server extends the capabilities of your enterprise GIS with support for Real-Time Visualization and Analytics. GeoEvent Server enables real-time data streaming and analytics in your everyday GIS applications, workflows, and analyses. You can use GeoEvent Server to:

- Extend existing GIS data and IT infrastructure with support for real-time event processing.
- Incorporate data received from real-time events into your enterprise GIS workflows.
- Perform continuous processing and analysis on streaming data as it is received in real-time.
- Store large volumes of data from real-time observations in the spatiotemporal data store.
- Visualize large volumes of real-time observations using dynamic on-the-fly data aggregations.
- Notify those who need to know about patterns of interest with updates and alerts in real-time.
- Produce new streams of data that can be leveraged in ArcGIS.

Commercial organizations, transportation managers, defense and intelligence analysts – anyone with a need to leverage streaming data – can use GeoEvent Server to receive, analyze, and produce streaming data from a variety of sources including mobile devices, in-vehicle GPS devices, sensor networks, online social media, RFID tags, environmental monitors, and more.

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.

An overview of each lesson is described below:

- **Lesson 1 – Get Started with ArcGIS GeoEvent Server** – Introduces the core capabilities of ArcGIS GeoEvent Server including using ArcGIS GeoEvent Manager to create GeoEvent Definitions, inputs, outputs, and GeoEvent Services. In addition, you will explore several of the utilities which can be used to work with real-time data.
- **Lesson 2 – Visualize Real-Time Data** – Introduces how GeoEvent Server can be used to update features in a feature service, in real-time, for display in a web map. Examine importing a GeoEvent Server configuration, using GeoEvent Simulator to simulate real-time event data to GeoEvent Server, adding elements to a GeoEvent Service, and visualizing a stream service in a web map.

- **Lesson 3 – Filters** – Introduces real-time event data filtering with exercises illustrating how attribute and spatial filters are added and configured in GeoEvent Services. It examines how GeoEvent Definitions and tags are used as well as how filter expressions are logically combined.
- **Lesson 4 – Processors** – Introduces real-time event data processing with exercises illustrating how processors are added and configured in GeoEvent Services. You will explore some of the processors used for field calculation and event enrichment, processors used to simplify events by removing unwanted fields, as well as processors that map events containing different information to bridge differences between event input and output.
- **Lesson 5 – Advanced Processors** – Continues the exploration of real-time event data processing with exercises illustrating some of the more advanced processing capabilities of GeoEvent Server. Exercises include working with processors that perform incident detection, track gap detection, and geotagging to enrich events based on their proximity to geofences.
- **Lesson 6 – Spatial Processors** – Introduces the spatial processors available in GeoEvent Server. These spatial processors can be used to buffer event geometry, create a convex hull or envelope encompassing event geometry, compute a simple geometric difference, a symmetric difference, or geometric intersection as well as simplify and project event data.

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** > **Data Stores**.

Lesson 1 overview

In Lesson 1, you will learn about the basic concepts of data ingestion and dissemination in GeoEvent Server. You will explore GeoEvent Manager and learn about key features such as registering data store, creating a GeoEvent Definition, creating an input and output connector, and designing a GeoEvent Service. This lesson will also teach you how to utilize GeoEvent Simulator to simulate event data into GeoEvent Server.

Once you have completed the exercises in this lesson you should be able to:

- Add registered folders in GeoEvent Manager.
- Create a GeoEvent Definition.
- Use GeoEvent Simulator to simulate real-time data.
- Create an input and output connector.
- Create and design a GeoEvent Service to connect inputs and outputs.
- View processed event records in GeoEvent Sampler.

Lesson 1 exercises

Complete the exercises below to familiarize yourself with key capabilities of GeoEvent Server.

Exercise 1: Register a folder data store

First, you will create and register a new system folder that you will use to send event data to in a later exercise.

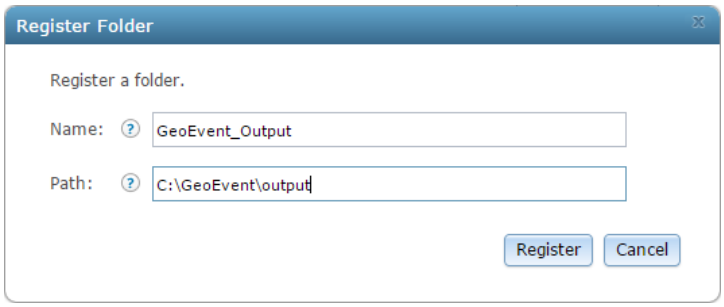
1. On the GeoEvent Server machine, create the folder below:

   - `C:\GeoEvent\output`

   With the folder created, you will now register the folder with GeoEvent Server.

2. Sign in to **ArcGIS GeoEvent Manager** (typically at: `https://gisserver.domain.com:6143/geoevent/manager/`).

3. Navigate to **Site** > **Data Stores** and click **Register folder** to register a system folder with GeoEvent Server.
4. Set the **Name** and **Path** parameters as follows:
    a. For **Name**, type `GeoEvent_Output`.
    b. For **Path**, type `C:\GeoEvent\output`.



You can specify any local system folder, just ensure the ArcGIS Server account – the system account running ArcGIS GeoEvent Server – has read and write permissions to the folder.

NOTE: *The path you specify should be a fully rooted path to an existing folder on your local machine. UNC pathnames are not supported.*

5. Click **Register** to register the system folder with GeoEvent Server.
6. Verify the newly registered folder is listed under **Registered folders**.

With the new folder created and registered with GeoEvent Server, next you will create a GeoEvent Definition that understands the schema of the data you will be ingesting into GeoEvent Server.

Exercise 2: Create a GeoEvent Definition

It is important to understand the schema of the real-time data that you want to ingest into GeoEvent Server, including the attributes and field data types. The component of GeoEvent Server that understands event data's schema is the GeoEvent Definition.

In this lesson, you will ingest data from an included CSV file with the seven attributes below:

LicPlate	VehicleType	Speed	ReportedDT	XCoord	YCoord	WKID
(String)	(String)	(Double)	(Date)	(Double)	(Double)	(Long)

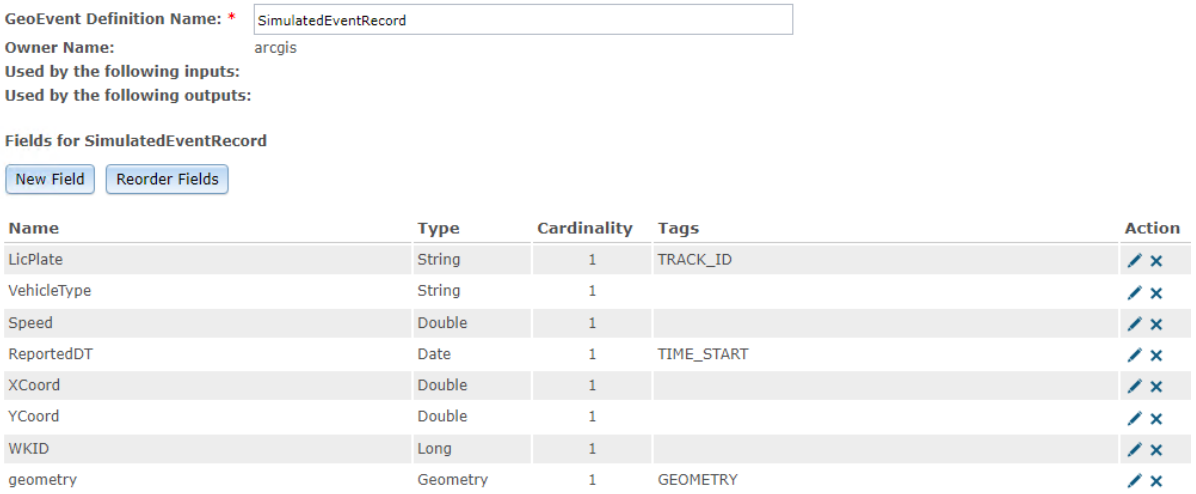
You will now create a new GeoEvent Definition that supports these attributes and field data types.

1. In **GeoEvent Manager**, navigate to **Site** > **GeoEvent** > **GeoEvent Definitions** and click **New**.
2. For **GeoEvent Definition Name**, type `SimulatedEventRecord` and click **Create**.
3. Click **New Field** and specify the parameters below:
    a. For **Field Name**, type `LicPlate`.
    b. For **Type**, select **String**.
    c. Move the **TRACK_ID** tag to the list of **Added Tags**.
4. Click **Create** to create the new field.
5. Repeat steps 3, 3a, 3b, and 4 to create the remaining six fields using the following information:
    a. **VehicleType** (String)
    b. **Speed** (Double)
    c. **ReportedDT** (Date) and add the **TIME_START** tag to the list of **Added Tags**.
    d. **XCoord** (Double)
    e. **YCoord** (Double)
    f. **WKID** (Long)

Next, you will create an additional field to support the geometry information in the event data and assign it a tag.

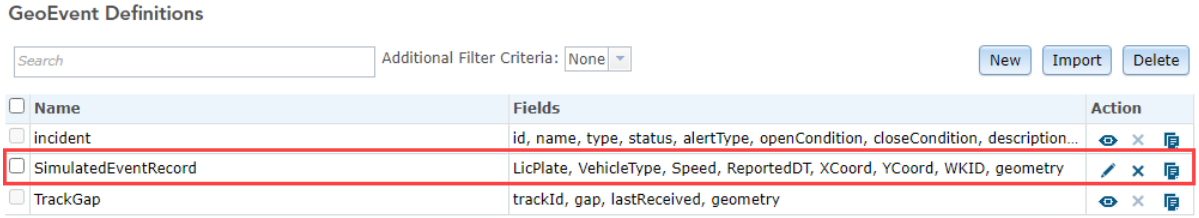
6. Click **New Field** and specify the parameters as follows:
    a. For **Field Name**, type `geometry`.
    b. For **Type**, select **Geometry**.
    c. Move the **GEOMETRY** tag to the list of **Added Tags**.
7. Click **Create** to create the new field.

    The GeoEvent Definition should look like the illustration below.



8. Click **Save** to save the new GeoEvent Definition.

   The new **SimulatedEventRecord** GeoEvent Definition should now appear in the list.

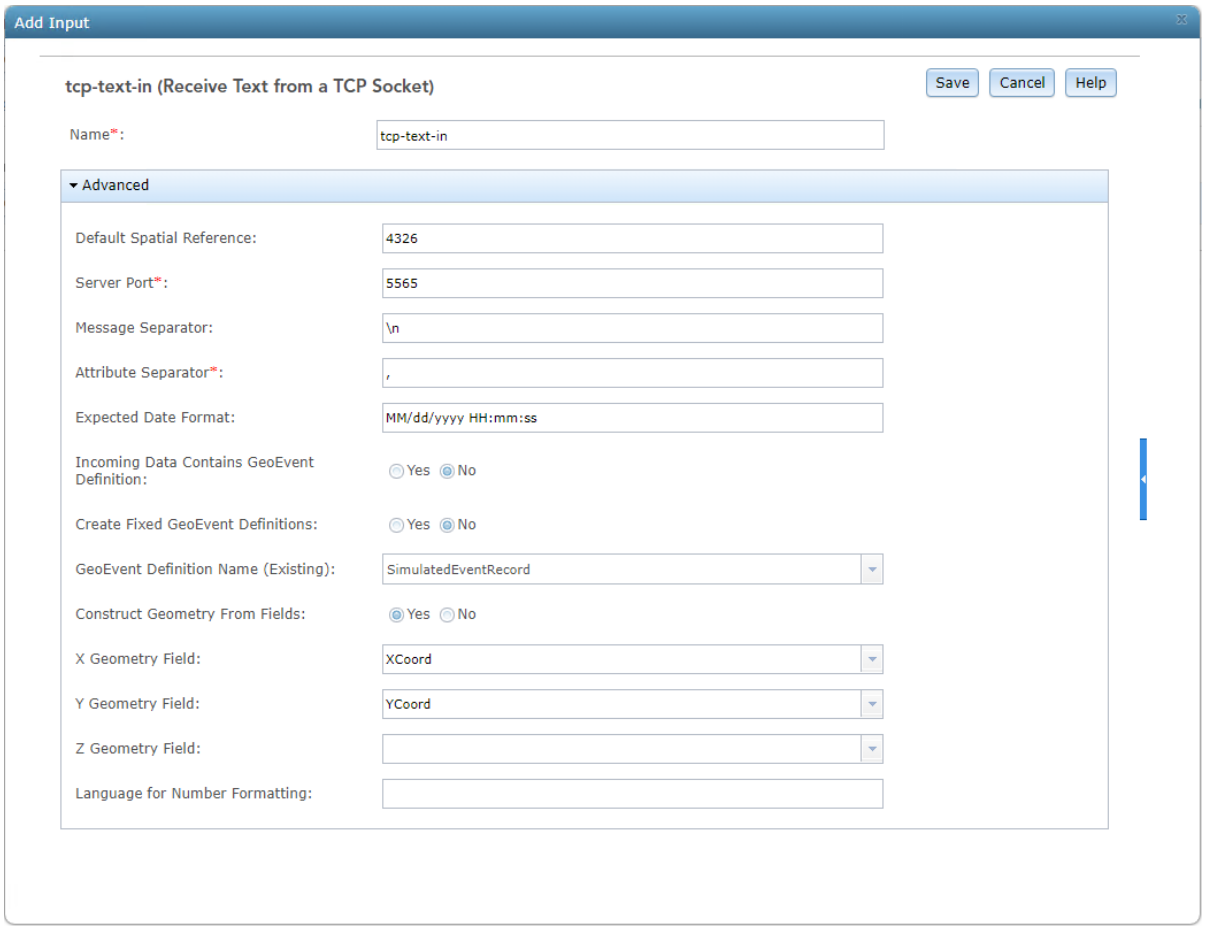


Exercise 3: Add an input connector

With the GeoEvent Definition created, you will now add and configure a new input connector capable of receiving simulated event data as delimited text via a TCP socket.

1. In **GeoEvent Manager**, navigate to the **Manager** page and click **Add Input**.
2. In the search box, type TCP to filter the list of input connectors.
3. Select the **Receive Text from a TCP Socket** Input Connector and specify the parameters as follows:
   a. For **Name**, accept the default **tcp-text-in**.
   b. For **Default Spatial Reference** (expand **Advanced**), type 4326.
   c. For **Expected Date Format**, type `MM/dd/yyyy HH:mm:ss`.
   d. For **Incoming Data Contains GeoEvent Definition**, select **No**.
   e. For **Create Fixed Event Definition**s, select **No**.
   f. For **GeoEvent Definition Name (Existing)**, select **SimulatedEventRecord**.
   g. For **Construct Geometry From Fields**, select **Yes**.
   h. For **X Geometry Field**, select **XCoord**.

i. For **Y Geometry Field**, select **YCoord**.



4. Click **Save** to save the new input.

5. On the **Manager** page, click ▶ to start the **tcp-text-in** input.

The configuration above specifies that string values which match the pattern **MM/dd/yyyy HH:mm:ss** should be converted to date values (when the GeoEvent Definition specifies the field be handled as a date). This is consistent with how the simulation data represents date and time values as illustrated below:

```
LicPlace,VehicleType,Speed,ReportedDT,XCoord,YCoord,WKID
AR921BFF,Coupe,42.6,03/08/2017 08:46:46,-90.401309,39.247178,4326
SF722HUP,SUV,51.5,03/08/2017 08:46:46,-88.271645,40.16318,4326
TG892PRY,Sedan,38.9,03/08/2017 08:46:46,-90.677421,40.001274,4326
```

The **Incoming Data Contains GeoEvent Definition** parameter was set to **No** since the sample data does not contain the name of a GeoEvent Definition. If you had accepted the default of **Yes** for this parameter, as well as for the **Create Unrecognized Event Definitions** parameter, the input would have used the first attribute field `LicPlate` as the GeoEvent Definition name and would create a unique

GeoEvent Definition for each vehicle in the fleet. Since is not desired, you set the parameter to **No** and the input was configured to use the **SimulatedEventRecord** GeoEvent Definition.

You also specified the input should attempt to create a point geometry using data retrieved from the event data's `XCoord` and `YCoord` attribute fields. The simulated event data expresses coordinate values in decimal degrees of latitude and longitude. The **Default Spatial Reference** parameter allows the input to assume the well-known identifier (WKID) **4326** for the geometry's spatial reference (WGS 1984 – Geographic Coordinate System).

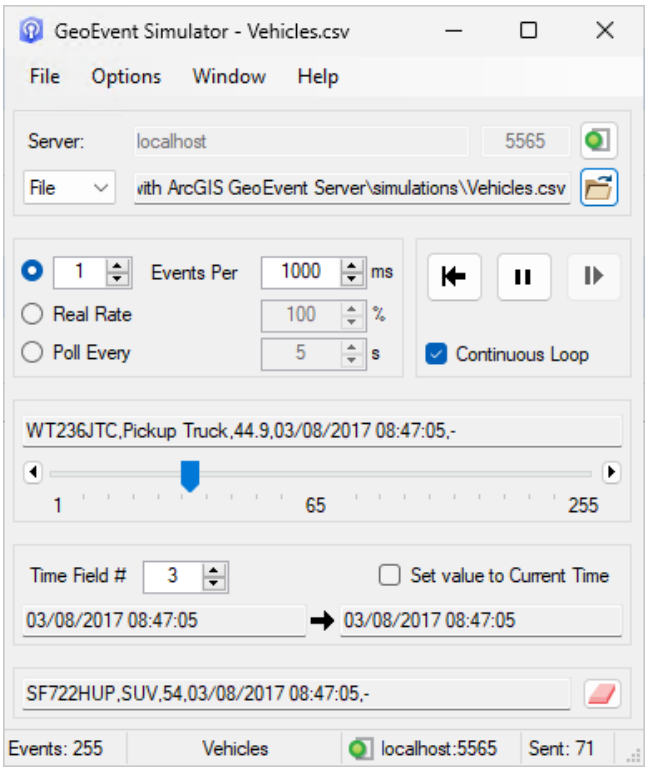
Exercise 4: Simulate real-time data

Next, you will simulate real-time data to GeoEvent Server using the GeoEvent Simulator. This Windows application makes a client connection to a TCP socket hosted by the Receive Text from a TCP Socket input you configured above. You will use GeoEvent Simulator to send a few event records to the input. Note that GeoEvent Simulator is a utility used for simulation and testing purposes, it is not typically used to support production use cases.

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 port **5565**.

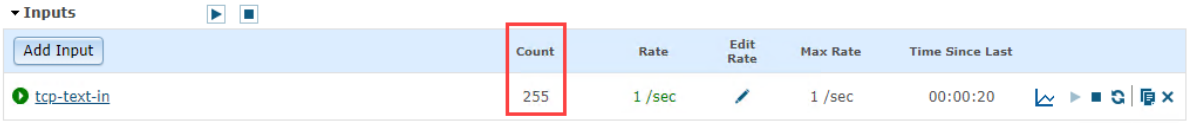
   The button changes to  , indicating you are connected to the input.
3. Click  , then click  again on the next dialog and browse to the `…\simulations` folder included with this tutorial.
4. Select **Vehicles.csv** file and click **Open**.
5. Leave the default values for the **Event Separator** and **Field Separator** parameters.
6. For **Time Field #**, choose **3**.
7. Check the **Skip the First 1 Lines**.

   This will skip the first row of the CSV file which contains the field names.
8. Click **Load** to load the file's data into GeoEvent Simulator.
9. Uncheck the **Continuous Loop** checkbox.
10. Set the simulator to 4 **Events Per** `1000` **ms**.
11. Click  to start the simulation.



12. In **GeoEvent Manager**, navigate to the **Manager** page.

    The text-text-in input's event count should be increasing as event records are received.



Note that while you successfully used GeoEvent Simulator to send simulated event data to your input, you have not yet configured an output connector to disseminate the event data. You have also not configured a GeoEvent Service to define the flow of event data from the input to an output.

Having confirmed the input is receiving event data, in the next few exercises you will add an output, GeoEvent Service, and use GeoEvent Sampler to view the event data as it flows in the service.

Exercise 6: Add an output connector

Event records ingested and processed by GeoEvent Server are not automatically persisted in a data store. GeoEvent Server provides many options, using output connectors, to disseminate your event data to a desired location.

In this exercise, you will create a simple output – one that does not have prerequisites such as registering a connection to an ArcGIS Server, publishing a feature service, or opening a web map to visualize feature records as they are updated. In *Lesson 2 - Visualize Real-Time Data*, you will walk through adding a stream service output and adding the stream service to a web map as well as optionally persisting the data to a feature service.

Follow the steps below to add and configure a new output that will write the ingested event data directly to a CSV file in a system folder.

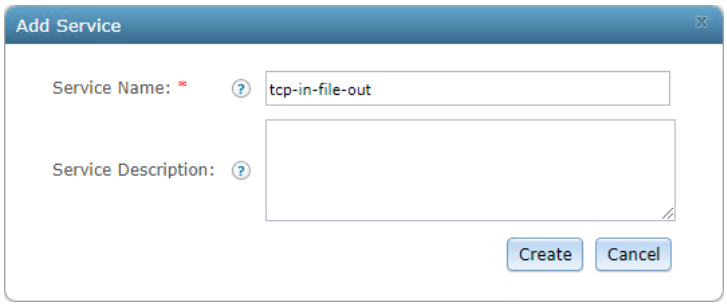
1. In **GeoEvent Manager**, navigate to the **Manager** page and click **Add Output**.
2. Search for CSV to filter the list of output connectors.
3. **Select** the **Write to CSV** Output Connector.
4. For **Folder**, select **GeoEvent_Output** from the menu.
5. Click **Save** to save the new output.
6. Click ▶ to start the new output.

   The output in this case will write event data to a CSV file in the `GeoEvent_Output` folder you created above.

Exercise 7: Add a GeoEvent Service

Next, you will add and configure a GeoEvent Service that will route the event records received by the input to the output.

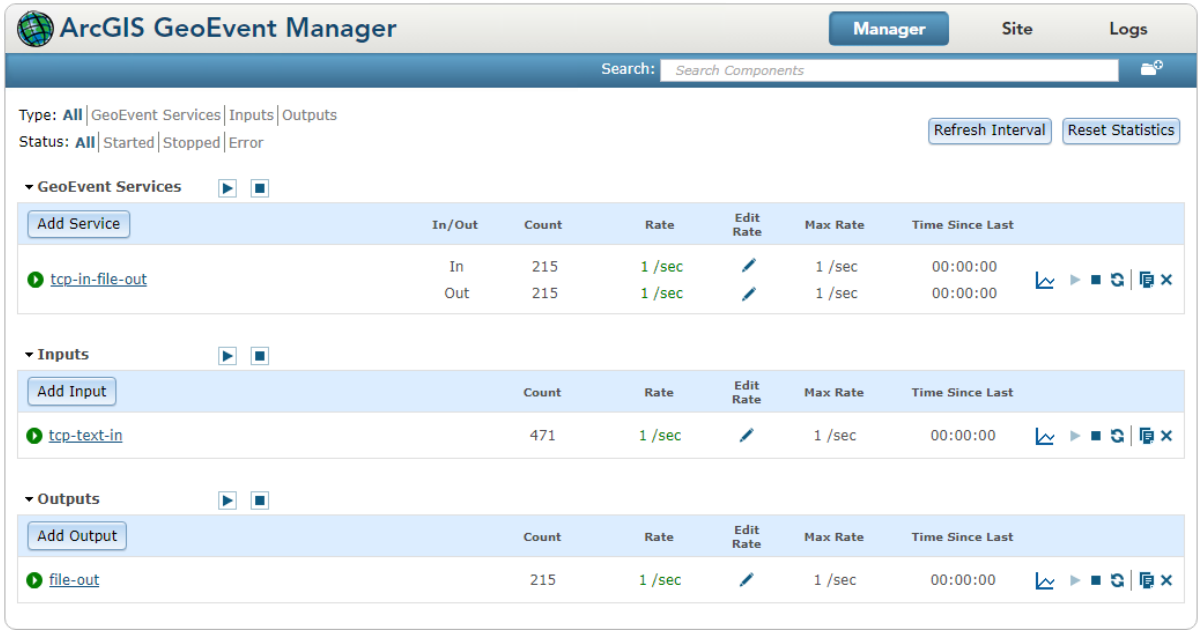
1. In **GeoEvent Manager**, navigate to the **Manager** page and click **Add Service**.
2. For **Service Name**, type `tcp-in-file-out` and click **Create**.



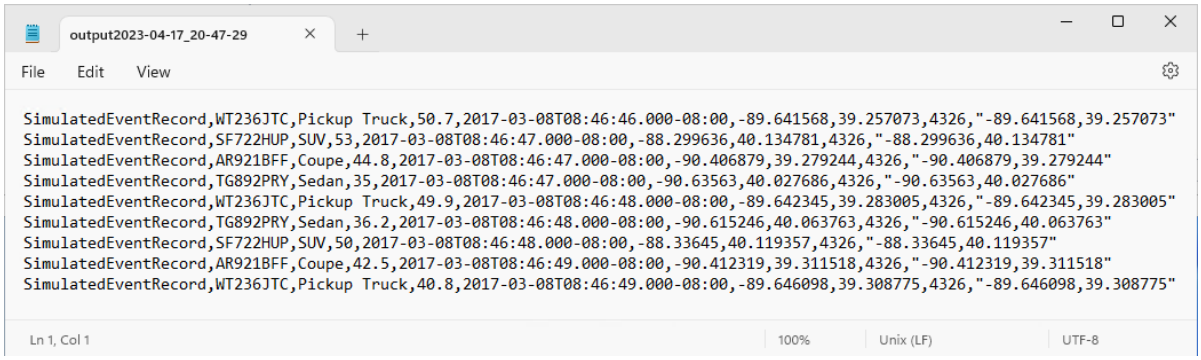
3. Drag and drop or double-click the **tcp-text-in** input and the **file-out** output onto the service designer and connect the input to the output.

4. Click **Publish** to publish the GeoEvent Service.
5. In **GeoEvent Simulator**, click ▶ to send event data to the input if it is not already running.

   Notice the event count in both GeoEvent Simulator and the GeoEvent Service are both increasing.



6. Let the simulator run for some time and then click ⏸ to pause the simulation.
7. In a file explorer, browse to the `output` folder (`C:\GeoEvent\output`) and open any of the CSV files created by the output in a text editor to view the event data.

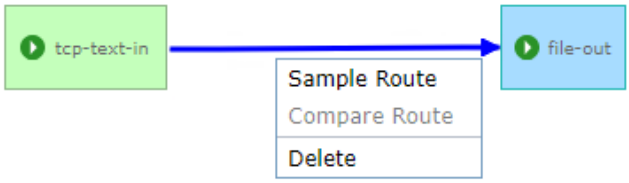


The GeoEvent Service you configured is one of the simplest possible, it has an input and an output, which are both required. The input receives the event data from GeoEvent Simulator and sends it directly to the output which writes the event data to CSV files in the `output` folder. This GeoEvent Service does not have any filters or processors that perform processing and analysis on the streaming data, you will explore those capabilities in later lessons.

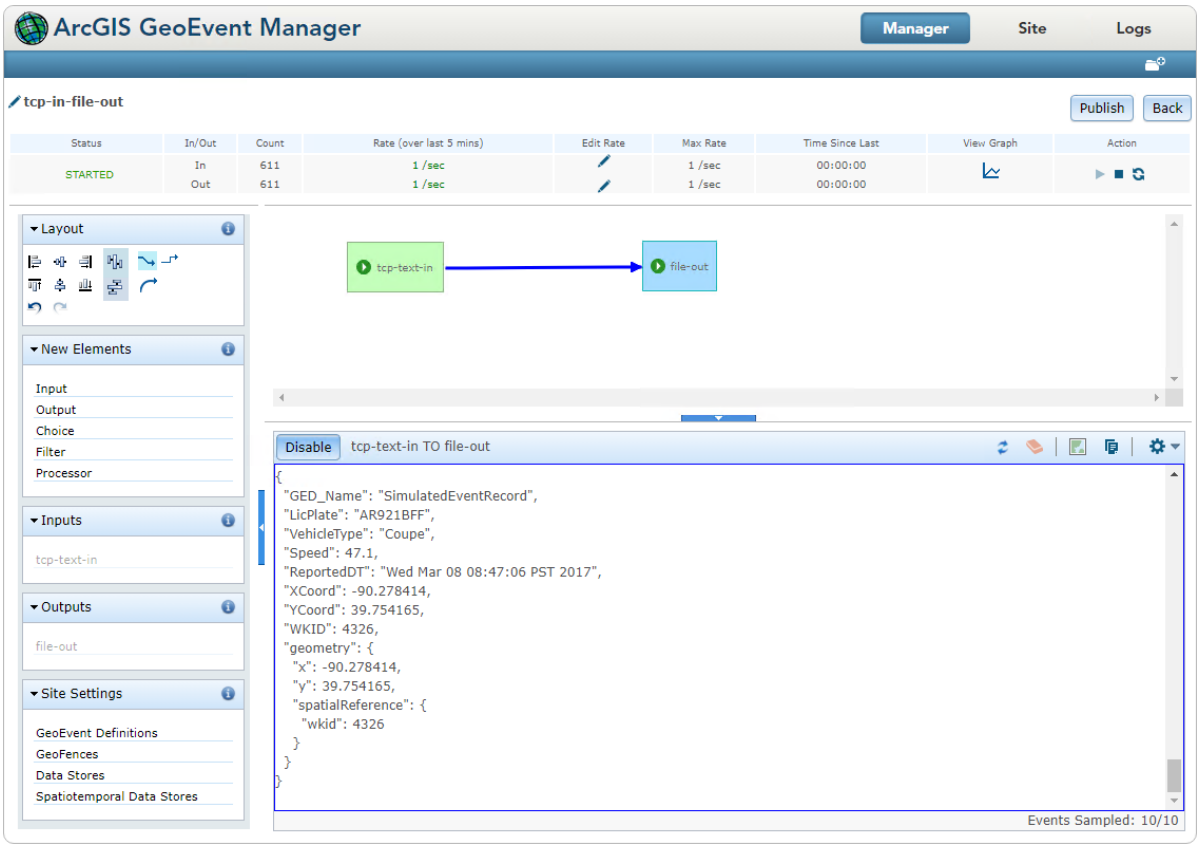
Exercise 8: View the event data in GeoEvent Sampler

You will now use GeoEvent Sampler to sample and view the event data as it is processed in the GeoEvent Service.

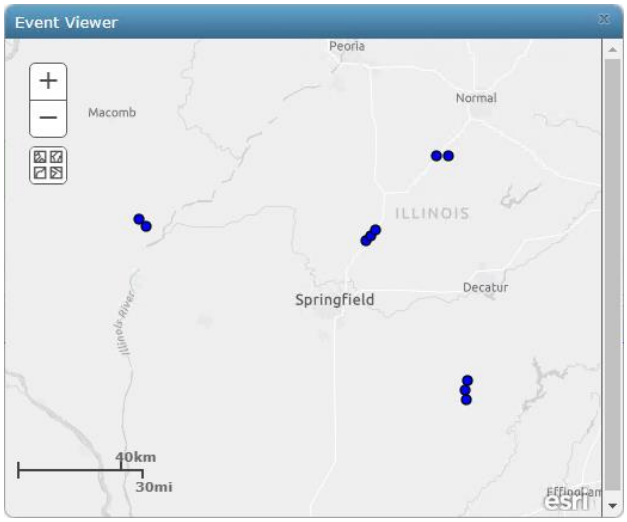
1. In **GeoEvent Simulator**, click ▶ to start the event simulation again.
2. In **GeoEvent Manager**, navigate to the **Manager** page and open the **tcp-in-file-out** GeoEvent Service.
3. Right-click the route between the input and the output and select **Sample Route**.



Notice the sampler window populates with a JSON representation of 10 sampled event records sent on that route.

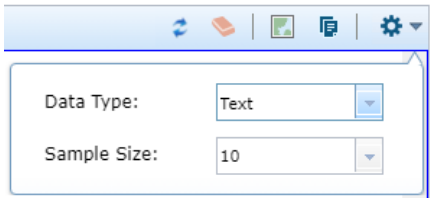


4. Click  to open the **Event Viewer** to visualize the sampled event data in a web map.



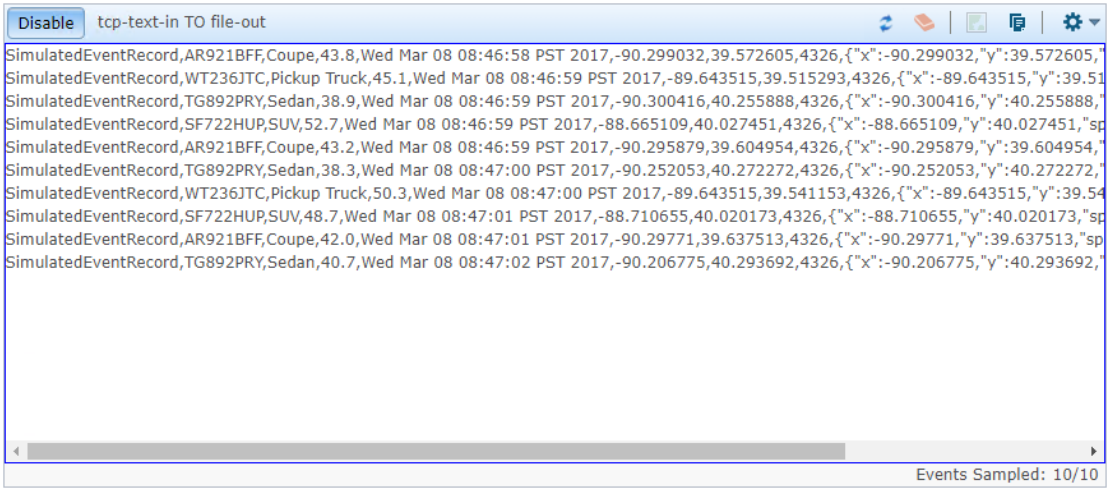
By viewing the event data on a web map, you can visually verify the data is as expected and in the correct geographic location.

5. Click  and change the **Data Type** parameter to **Text**.



6. Click  to clear the previously sampled event records.

7. Click  to sample another 10 event records in a text representation.



Lesson clean-up

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

- In **GeoEvent Simulator**, click  to pause the simulation.
- Reset your GeoEvent Server configuration in **GeoEvent Manager** by navigating to **Site** > **Configuration Store** and click **Reset Configuration**.
- Folder and files under the following directory:

  `C:\GeoEvent\output`

Summary

By completing Lesson 1, you now have a basic understanding of how to ingest real-time data into GeoEvent Server using an input and how to send event data to a destination using an output. In the next lessons you will explore some exciting use cases that highlight the real-time analysis and visualization capabilities of GeoEvent Server.