Tracking Server 10
# Tracking Server 10

An Esri White Paper

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Tracking Server 10

Background

Tracking Server provides a solution for collecting and sending real-time data from many sources and formats to Web and desktop clients. As real-time data is received by Tracking Server, it can be logged to a geodatabase or distributed to Web and desktop clients, including the ArcGIS® Tracking Analyst extension.

Because these products have similar names, keep these definitions in mind:

- ArcGIS Tracking Analyst: An ArcGIS Desktop extension that lets you view and analyze time-based data, including real-time data from Tracking Server
- Tracking Server: An enterprise-level technology that integrates real-time data with geographic information systems (GIS)
- Tracking Viewer: A Web-based viewing application provided with Tracking Server

Some clients are view-only clients, such as Tracking Viewer, a real-time Web mapping application that can provide basic situational awareness. Others, such as ArcGIS Desktop with the Tracking Analyst extension, give advanced users the power to integrate temporal and geographic data on their desktops to perform real-time and historical data analysis. Tracking Server enables the integration of real-time data and GIS. This integration helps you make better decisions and share information quickly, easily, and efficiently.

Introduction

Tracking Server contains two functional elements: the tracking message server component and the tracking Web distribution component. These elements work together to collect and distribute data to the people who use it on Web and desktop clients.

The tracking message server component is the engine and router that receives data via data links and server connections, processes actions based on location and/or attributes, and pushes the data to various clients via data links. The tracking message server also logs data to disk—personal geodatabases or ArcSDE® databases—for later analysis.

The tracking Web distribution component consumes the output from the tracking message server component and pushes this data to end-user clients. Tracking Server Client Gateway works with Tracking Server Connector Data Link to form the tracking Web distribution component.

The following figure shows how data is received by Tracking Server and transmitted to any number of client applications. Typical client applications include ArcGIS Tracking Analyst and Tracking Viewer. Note how Tracking Server can integrate data from different types of devices and distribute it to various types of client applications.
Key Features

**Tracking Message Server Component**
- Extensible architecture via data links
  - Microsoft® Component Object Model (COM) technology for data transport and processing
  - Multithreaded design, enabling efficient use of system processors
  - Ability to run as a Windows® NT service or a COM server executable
  - Easy access to statistical information about data links, allowing administrators to monitor performance

- Interfaces to send and receive messages of all types

**Tracking Web Distribution Component**
- Distribution system built using Java™ technology allowing cross-platform deployment
- Multiple client deployment options including
  - ArcGIS applications with the Tracking Analyst extension
  - Tracking Viewer
  - Custom clients built with the Tracking Client Software Developer Kit (SDK) using technologies such as Flex™, Silverlight®, and Java
**Architecture**

Tracking Server uses an extensible architecture that allows it to receive data from new sources and transmit that data to new clients, such as a custom-built ArcGIS Engine client.

Tracking Server lends itself to a host of uses in a variety of environments. Depending on the needs of your organization, you can configure your settings to optimize your collection, display, analysis, and distribution of real-time data.

**Tracking Message Server Component**

**Overview**

The tracking message server component handles the routing of real-time data and command messages to connected systems using data links and server connections. It uses Microsoft COM technology to provide a robust, flexible architecture. This architecture allows developers to create data links to run within the process space of the server or as a separate process. Data links and server connections can be written in any language that supports multithreaded COM development, such as C++ or C#.

**Messages**

All communication in the tracking message server takes place in the form of messages. There are four types of messages: command, command response, status, and data.

- **Command messages** control and configure items within the tracking message server, such as turning a service on or off.

- **Command response messages** provide a way for the server control to communicate the results of a command message.

- **Status messages** provide information on connections.

- **Data messages** contain information relating to an event. Data links transmit these messages to clients as events.
**Message Definitions**

Data messages convey event information throughout Tracking Server. The format of these messages (which is conceptually similar to a database schema) is defined in Tracking Server Manager on the Message Definitions tab. Message definitions are at the core of how event data moves. Without a valid message definition, Tracking Server will not process event data. The Message Definition tab provides a list of all message definitions defined for Tracking Server.

**Tracking Services**

Data messages moving to and from the tracking message server component can be organized into a logical representation of data called a tracking service. The services are conveyed to and from the server via Tracking Server Connector Data Link.

A tracking service can be composed of either simple or complex events. A *simple event* uses a single message definition containing geographic feature, temporal, and other attribute information.

A *complex event* uses two message definitions: an observation message definition that provides temporal information and an object message definition that provides attribute information.

A complex event can join static information (which does not change) to a real-time (dynamic) message containing data that changes. For example, real-time messages about delivery trucks can be joined with static attributes such as the truck's model, year, and maintenance information. A complex event can also combine real-time attributes with static geographic feature information. For example, real-time traffic sensor observations may be joined with static geographic feature and attribute information.

**Data Links**

A data link is a component of the tracking message server that receives data from a source, transmits data to a client, manages Tracking Server settings, or performs a combination of these functions.

Data link connections can be categorized into these types:

- **Input**—Supplies data messages to the tracking message server. Usually connects to the data source and provides a conduit for the data coming from these external systems and devices. They will send data to the tracking message server, parsed according to the message definitions set in Tracking Server Manager.

- **Output**—Sends data messages from the tracking message server to clients or, in special cases, back to the tracking message server itself. This type of data link is responsible for pushing data to clients.

Data links and other server connections can be developed to filter or manipulate data messages to manage the volume and kind of data coming through. Data links also provide feedback on their status to the tracking message server. The server uses the Microsoft Windows COM security and authentication model for user access.
Tracking Server contains several out-of-the-box data links. These data links provide a basic way for users to connect to real-time data and output data for archival storage, but in some cases, custom code development is required. To help developers create custom code, the Tracking Server SDK contains an Active Template Library (ATL) data link wizard to create a basic data link. Programmers can customize or extend the basic data link to meet their system requirements.

**Actions**  
*Actions* are rule-based operations that you can build and apply to real-time data messages. Actions in Tracking Server can be used to filter or modify event data based on the message definition. For example, if you are monitoring air traffic in California, you can create and apply a filter action to exclude data from other states.

An action is a software component that is installed and run inside the tracking message server. It acts on messages as they are processed and can be used to apply business logic at the time that data is collected. This provides the benefit of allowing users or systems to respond immediately to critical events as they take place.

Tracking Server comes with some built-in actions that can be used by most administrators. These actions can do some basic filtering based on the location of a GIS feature or based on attributes of the GIS feature. Custom actions can be created using the Tracking Server SDK, but any system resources spent on complex action processing take away from the Tracking Server overall system performance.

Actions have two basic parts: a trigger and a response.

- **Trigger**—The trigger is what determines if the action will "fire." It can be based on the geographic location or the attributes of the GIS feature.

- **Response**—The response is the action that takes place when the trigger condition is met. Built-in actions can simply delete messages from the system (for filtering out unwanted data). Custom actions can perform any type of business logic that is needed.

**Tracking Web Distribution Component**

**Overview**  
The tracking Web distribution component receives the output from the tracking message server component and pushes it to the end-user clients. Tracking Server Client Gateway works with Tracking Server Connector Data Link to form the tracking Web distribution component.

**Tracking Server Client Gateway**  
All client connections go through Tracking Server Client Gateway. If Tracking Server Client Gateway is not in place and properly configured, or if Connector Data Link is not running and properly connected, no Tracking Analyst or Tracking Viewer clients will be able to connect or receive tracking data. Clients connect to the gateway using TCP/IP sockets on a port that is configurable by the system administrator. All input and output from Tracking Server Client Gateway comes and goes in the form of messages.
**Tracking Server Connector Data Link**

Tracking Server Connector Data Link allows the tracking message server to connect to Tracking Server Client Gateway. Connector Data Link publishes messages for delivery to all clients, including any Web-based clients or ArcGIS Desktop clients with the Tracking Analyst extension.

**Client Compatibility**

**ArcGIS**

ArcGIS Engine, ArcMap™, and ArcGlobe™ are all capable of connecting to Tracking Server and subscribing to services. The only requirement is a license for the Tracking Analyst extension. This extension allows the application to subscribe to real-time data feeds.

**Tracking Viewer**

Tracking Viewer is a simple Web-based map application that can be used to view data from a single Tracking Server installation. It is designed to be deployed to end users as a Web front end to the system. Tracking Viewer is based on Flex technology.

**Tracking Client SDK**

The Tracking Client SDK allows developers to create client applications in a multitude of different languages. The currently supported technologies include:

- Adobe® Flex SDK 3.4
- Silverlight 3
- Java 1.6
- .NET Framework 3.5
- .NET Compact Framework 3.5

**Applications and Tools**

The Tracking Server installation provides two tools to assist you with configuring and managing your Tracking Server installation:

- Tracking Server Manager
- Tracking Server Web Monitor

**Tracking Server Manager**

Tracking Server Manager serves as the control center for the tracking message server, where administrators can customize settings to tailor the server's functionality. With Tracking Server Manager, administrators can create and edit message definitions, data links, and tracking services. It is also possible to apply actions to incoming data, define error logging standards, and monitor connection properties.

**Tracking Server Web Monitor**

Tracking Server Web Monitor is an application that gives a summary view of all data coming out of Tracking Server. It shows what services are available, how fast each service is running, how much memory is being consumed by Tracking Server Client Gateway, and other details on the running system. You can also use Tracking Server Web Monitor to set minimum expected data rates on each service, so that if a service slows below the rate you are expecting, you can take corrective action.
Appendix A: System Requirements

Tracking Server 10 requires or supports the following:

- **Supported Platforms**
  - Windows XP
  - Windows Vista®
  - Windows 7
  - Windows Server® 2003
  - Windows Server 2008

- **Hardware Requirements**
  - Web server/manager: 512 MB of RAM recommended
  - Web browser clients: 256 MB of RAM recommended
  - 2.0 GHz processor or better
  - 500 MB of free disk space
  - Standard VGA video card

For specific versions and support levels, refer to the official system requirements documentation.
Appendix B: Performance

The performance of real-time data in Tracking Server clients—ArcGIS Tracking Analyst and Tracking Viewer—depends on many factors and can be described in two primary ways: latency and bandwidth.

**Latency**—This describes the time delay from the event occurrence to the point at which it is displayed on the map by a client. Factors such as network speeds, connection types, and machine performance affect data transmission and processing speed.

**Bandwidth**—This describes the amount of information that moves through the system in a unit of time. The first question to ask when evaluating bandwidth is, How many items do I want to track? The second question to ask is, How often do I want to send an event message? If you are tracking 100 trucks that each send a message every second, the bandwidth is 100 events per second. If you are tracking 100 trucks that each report every 10 seconds, the bandwidth is about 10 events per second. In these two examples, the bandwidth drastically changes based on the change in message frequency. The third question to ask is, How big is each message? If each message from a truck carries the location of the truck and the current time, this is a small message. If each message also includes the name of the driver, the engine temperature, the current speed, and other miscellaneous data, then the message becomes much larger.

What data bandwidth can Tracking Server, ArcGIS Tracking Analyst, and Tracking Viewer handle? This part of the performance equation is based on machine and network performance, which is greatly affected by processor speed and memory. Both Tracking Server and its tracking clients store and process events in memory, so an increase in processor power and machine memory will benefit those who need higher data bandwidth. The amount of action processing (filtering, alerting, etc.) in the server will also affect system performance.

From the client point of view, ArcGIS Tracking Analyst and Tracking Viewer are designed to serve two different levels of use. ArcGIS Tracking Analyst is a large GIS-based client with advanced display, query, and analysis capabilities, while Tracking Viewer is a lightweight client with basic display and query capabilities.

Tracking Viewer can handle higher data bandwidth but provides less functionality. Both clients are affected by system processor speed and memory, so you may need to evaluate your application and user requirements to determine which client is best for your operation. You can also build a custom client using ArcObjects™ and Tracking Analyst COM objects.
Appendix C: Terminology

*Bandwidth:* The number of events per second that is transported to the end client

*Data link:* Component of Tracking Server that translates data from its source into a format that Tracking Server can send to the message queue, then on to various clients (Data links can be customized and function as plug-ins to Tracking Server.)

*Event:* The combination of a geographic feature, a time value, and attribute information that defines something that has happened in time

*Latency:* The amount of time required for data to travel from its source through Tracking Server to the client or clients

*Message definition:* Group of values defined in Tracking Server Manager to authoritatively specify the format of data messages (You can create and edit message definitions to include different fields from a particular data source.)

*Object message definition:* Static data that describes in more detail the observation messages and contains attributes and possibly geographic information

*Observation message definition:* Messages for observed events that contain the temporal information and possibly the geographic feature and attributes

*Tracking message server component:* The engine and router that collects, processes, and distributes GIS data

*Tracking Viewer:* Web-based tool that allows you to see and identify real-time tracking data; displays tracking information on top of a background map in a Web browser

*Tracking Web distribution component:* Consumes the output from the tracking message server component and pushes this data to end-user clients
About Esri

Since 1969, Esri has been helping organizations map and model our world. Esri’s GIS software tools and methodologies enable these organizations to effectively analyze and manage their geographic information and make better decisions. They are supported by our experienced and knowledgeable staff and extensive network of business partners and international distributors.

A full-service GIS company, Esri supports the implementation of GIS technology on desktops, servers, online services, and mobile devices. These GIS solutions are flexible, customizable, and easy to use.

Our Focus

Esri software is used by hundreds of thousands of organizations that apply GIS to solve problems and make our world a better place to live. We pay close attention to our users to ensure they have the best tools possible to accomplish their missions. A comprehensive suite of training options offered worldwide helps our users fully leverage their GIS applications.

Esri is a socially conscious business, actively supporting organizations involved in education, conservation, sustainable development, and humanitarian affairs.

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