



Tracking Server 9.3.1

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Tracking Server 9.3.1

An ESRI White Paper

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Tracking Server 9.3.1

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 file or distributed to Web and desktop clients, including ArcGIS® Tracking Analyst.

Some clients are view-only clients, such as the Tracking Viewer, a real-time Web mapping application that can provide basic situational awareness. Others, such as ArcGIS Desktop with Tracking Analyst, give advanced users the power to integrate temporal and geographic data on their desktop and perform real-time and historical data analysis. Tracking Server enables the integration of real-time data and geographic information system (GIS) technology. 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 the 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, logs data to disk—shapefiles, personal geodatabases, or ArcSDE® databases—for later analysis, and pushes the data to various clients via data links.

The *tracking Web distribution* component consumes the output from the tracking message server component and pushes this data to end-user clients. The Tracking Server client gateway works with the 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 client applications like ArcGIS Tracking Analyst and the Tracking Viewer Web client. Note how Tracking Server can integrate data from different types of devices and distribute it to various types of client applications.



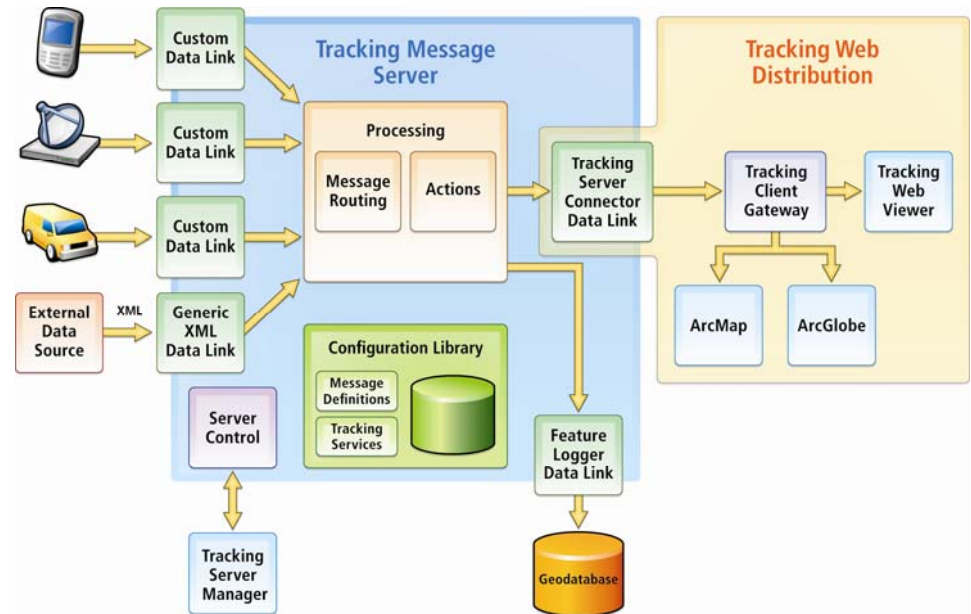
Key Features

Key features of Tracking Server are the following:

- Tracking Message Server Component
 - Extensible architecture via data links
 - ◆ Microsoft® 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
 - Java™ technology
 - Compatibility with several Web servers and servlet engines
 - Ability to create customized viewer Web sites with various options

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's Component Object Model (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. Data links and server connections can be written in any language that supports multithreaded COM development, such as C++. This is the recommended language for creating data links.

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.
- *Command response messages* provide a way for the server control to communicate back 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 is defined in Tracking Server Manager under 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 Definitions tab provides a list of all message definitions defined for Tracking Server.

Tracking Services

Data messages coming 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 the Tracking Server connector data link.

A tracking service can be composed of either simple events 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 that 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 the following functions.

Data link connections can be categorized into the following 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. Input data links are message format specific. 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 to output data for archival storage, but in most cases, custom code development is required. To help developers create custom code, the Tracking Server installation also 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 already installed that can be used by most administrators. These actions can do some basic filtering based on the location of a GIS feature or on attributes of the GIS feature. Custom actions can be created using the Tracking Server Software Development Kit (SDK), but any system resources spent on complex action processing take away from overall system performance of Tracking Server.

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 of the GIS feature 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 consumes the output from the tracking message server component and pushes it to the end-user clients. The Tracking Server client gateway works with the Tracking Server connector data link to form the tracking Web distribution component.

Tracking Server Client Gateway

All client connections go through the Tracking Server client gateway. If the Tracking Server client gateway is not in place and properly configured, or if the Tracking Server connector data link is not running and properly connected, no ArcGIS Tracking Analyst or Tracking Viewer Web clients will be able to connect to 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 the tracking gateway comes and goes in the form of messages.

Tracking Server Connector Data Link

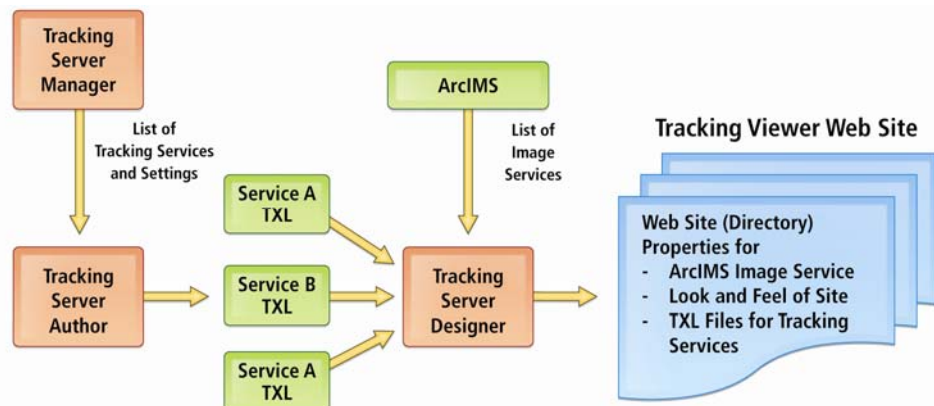
The Tracking Server connector data link allows the tracking message server to connect to the Tracking Server client gateway. The Tracking Server connector data link publishes messages for delivery to all clients, including any Web-based clients or ArcGIS Desktop clients with the ArcGIS Tracking Analyst extension.

Applications and Tools

The Tracking Server installation provides several tools to assist you with configuring your data formats and creating your customized Tracking Viewer Web sites.

- Tracking Server Author
- Tracking Server Designer
- Tracking Server Manager

If you have used ArcIMS®, you may be familiar with using the ArcIMS Author tool to create a map for an image service and ArcIMS Designer to build the Web site. The Tracking Server tools are similar, except that the Author tool is used to set up symbology instead of maps. Once a Web site is created using these applications, advanced users will be able to edit and modify settings in the XML-based files.



Tracking Server Author

Tracking Server Author allows you to create a tracking symbology file (.txl) that contains the symbology for displaying real-time tracking services. The tracking symbology file is a specially formatted XML file and is used to define size, shape, and color information for the displayed events. You can also use the Author tool to specify symbol labels, time windows and aging specifications, and specialized symbology for when specific actions are met in the dynamic data

Tracking Server Designer

Tracking Server Designer allows you to build and customize a tracking Web site by specifying the ArcIMS image service and real-time tracking services to include in the Tracking Viewer Web site. Possible custom features include site and page title, logo display, map extents, toolbars, legend options, fonts, and colors.

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.

Appendix A: System Requirements

Tracking Server 9.3.1 requires or supports the following:

- Platforms supported
 - Windows 2000, Professional, Server, and Advanced Server
 - Windows XP
 - Windows 2003 Server
- Web servers supported
 - Apache 2.0.5x
 - Internet Information Services (IIS) 5.0
 - Apache 2.0.55
 - Sun™ Java System Application Server 7.0
- Servlet engines supported
 - Tomcat 5.5
 - ServletExec 5.0 ISAPI
 - ServletExec A/S 5.0
- Web Browsers (Clients) supported
 - Internet Explorer® 5.0, 5.5, or 6.0 with Java Plug-in 1.4.x
- Java 2 Standard Edition (J2SE™) Java Runtime Environments (JRE™)
 - JRE with the Java plug-in is required.
 - JRE version 1.4.2 is supported.
- J2SE SDK (Java Development Kit [JDK])
 - JDK version 1.4.0 is supported.
- Hardware
 - 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, please refer to the official system requirements documentation on the Tracking Server Installation DVD. Future versions of Tracking Server will expand on the number of supported Web servers and other software components.

Appendix B: Performance

The performance of real-time data in the Tracking Server clients—ArcGIS Tracking Analyst and the 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 send a message every second, the bandwidth is 100 events per second. If you are tracking 100 trucks that report back 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 the 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 that is processing (filtering, alerting, etc.) in the server will also affect system performance.

From the client point of view, ArcGIS Tracking Analyst and the 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 the Tracking Viewer is a lightweight client with basic display and query capabilities.

The 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 the ArcGIS Tracking Analyst COM objects.

Appendix C: Terminology

Applet: Java application that runs in an Internet browser.

Bandwidth: The number of events per second that are 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.

Legend: The panel on the side of Tracking Viewer that displays event symbology and provides controls for toggling the display of different layers and events in the viewer.

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.

Servlet: A Java application that runs on the Web server. A servlet is conceptually similar to an applet that runs on the server side, without a user interface.

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

Tracking symbology file: Specialized XML file (.txl) formatted for the Tracking Viewer that defines symbology settings for real-time data events displayed in the viewer.

Tracking Viewer: A Web-based tool that allows you to see and identify real-time tracking data. It 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.



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Contact ESRI

1-800-GIS-XPRT (1-800-447-9778)

Phone: 909-793-2853

Fax: 909-793-5953

info@esri.com

www.esri.com

Offices worldwide

www.esri.com/locations



ESRI

380 New York Street
Redlands, California
92373-8100 USA