What Is the ArcIMS® Tracking Server?

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Contents	Page

Contents   **Page**

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Background

The ESRI® ArcIMS® Tracking Server provides a solution for collecting and sending real-time data from many data sources and formats to Web and desktop clients. As real-time data is received by the ArcIMS Tracking Server, you can log it to ArcSDE® or save to a file and retransmit it in a standard format to Web and desktop clients including ArcGIS® Tracking Analyst. Some clients are "watch" clients, using a simple real-time Web mapping application. Other clients give advanced users the power to integrate temporal and geographic information system (GIS) data on their desktops and perform real-time and historical data analyses using ArcGIS Desktop with Tracking Analyst. ArcIMS Tracking Server is the integration of real-time systems and GIS. This integration helps you make better decisions and share information quickly, easily, and efficiently.

ArcIMS Tracking Server

Introduction

ArcIMS Tracking Server contains two functional elements: the Real-Time Message Server and the Real-Time Web Mapping component. These elements work together to collect and distribute real-time data to the people who use it on the Web and desktop clients.

The *Real-Time Message Server* is the engine and router that receives data via data links, processes actions based on location and/or attributes, logs data to ArcSDE for later analysis, and pushes the data to networked clients via data links.

The *Real-Time Web Mapping* component consumes the output from the Real-Time Message Server and pushes this data to end users as Web maps and services for ArcGIS. The Real-Time Web Mapping component uses ArcIMS technology to present a Java-based real-time data viewer. This component includes a set of tools for composing, designing, and publishing real-time data to Web clients.

The following figure shows how data is received by ArcIMS Tracking Server and transmitted to client applications such as ArcGIS Tracking Analyst and a Web client (Tracking Viewer).
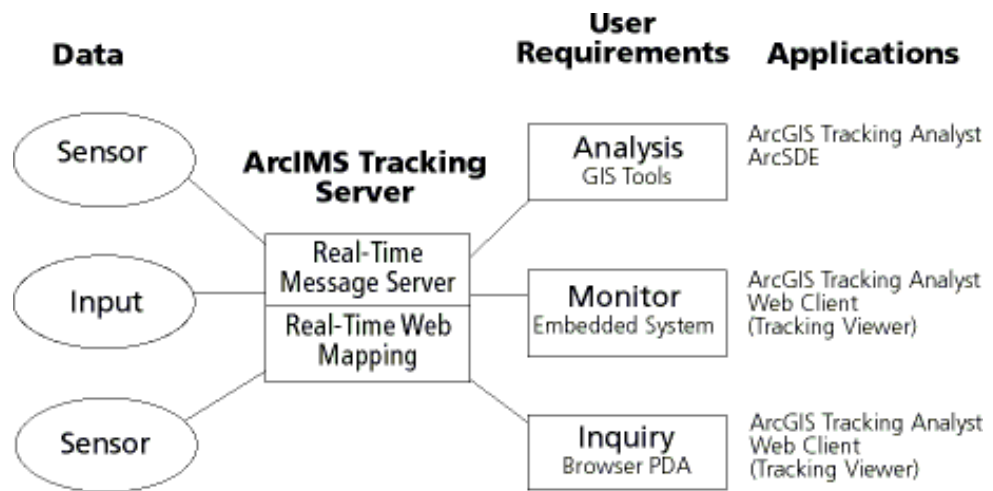
ArcIMS Tracking Server uses an extensible architecture that allows it to receive data from new sources and to transmit that data to new clients such as a MapObjects® client.
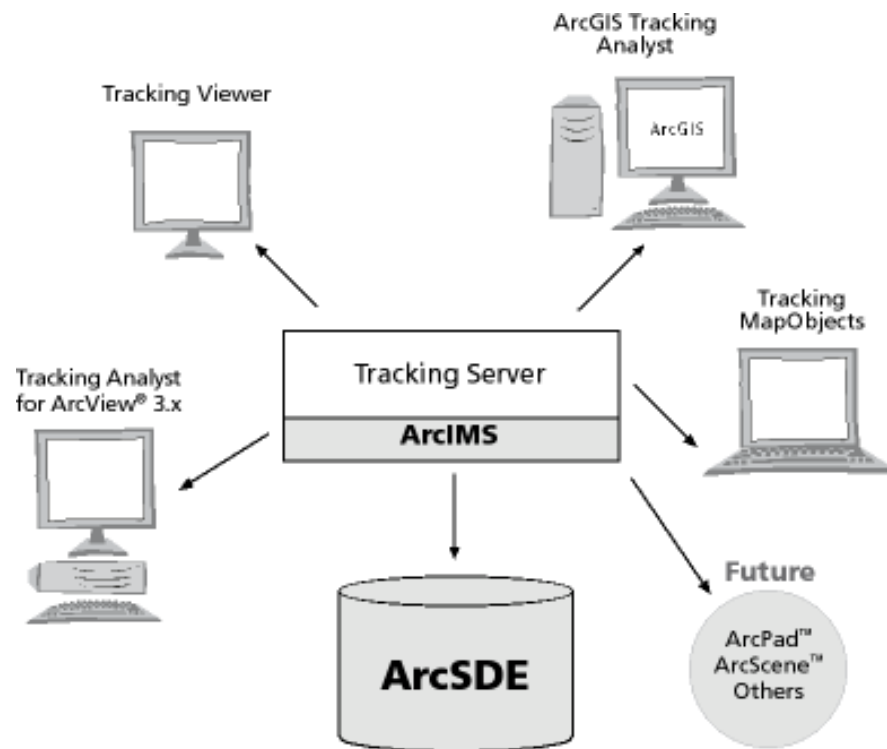
ArcIMS Tracking Server lends itself to a host of uses in a variety of environments. Depending on the needs of your organization, you can configure your settings to optimize your collection, display, analysis, and distribution of real-time data.

J-9072

Real-Time Message Server

Overview The Real-Time Message Server is the data engine of ArcIMS Tracking Server. It handles the routing of real-time data and command messages to connected systems using a mechanism called a data link. Real-Time Message Server uses Microsoft 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 can be written in any language that supports multithreaded COM development such as C++.

Data Links A data link is a component of the Real-Time Message Server that can receive data from a source, transmit data to a client, manage Tracking Server settings, or perform a combination of these functions.

Data link connections can be categorized into three groups.

- **Input:** Supplies data messages to the Real-Time Message Server. Input data links usually connect to the data source and provide a conduit for the data coming from these external systems and devices. They are message format-specific, defined by the message definition created in the Tracking Server Manager. They will send data to the Real-Time Message Server.

- **Output:** Sends data messages from the Real-Time Message Server to clients or, in special cases, back to the Real-Time Message Server itself. This type of data link is responsible for pushing data to clients.

- **Administrator:** Provides Tracking Server management functions. The Tracking Server Manager application uses this kind of data link.

Each data link can be set up 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 Real-Time Message Server. The Real-Time Message Server uses the Microsoft Windows security and authentication model for user access.

ArcIMS Tracking Server contains several out-of-the-box data links. These data links provide a generic way for users to connect to real-time data, but in most cases custom data link development will be required. To help developers create custom data links, the product contains an Active Template Library (ATL) wizard for setting up and developing most of the basic data link components.

Real-Time Message Server Architecture The Real-Time Message Server is a server process that allows clients to connect via data links. Once connected, clients can send and receive messages to the server process. The following figure illustrates this concept.
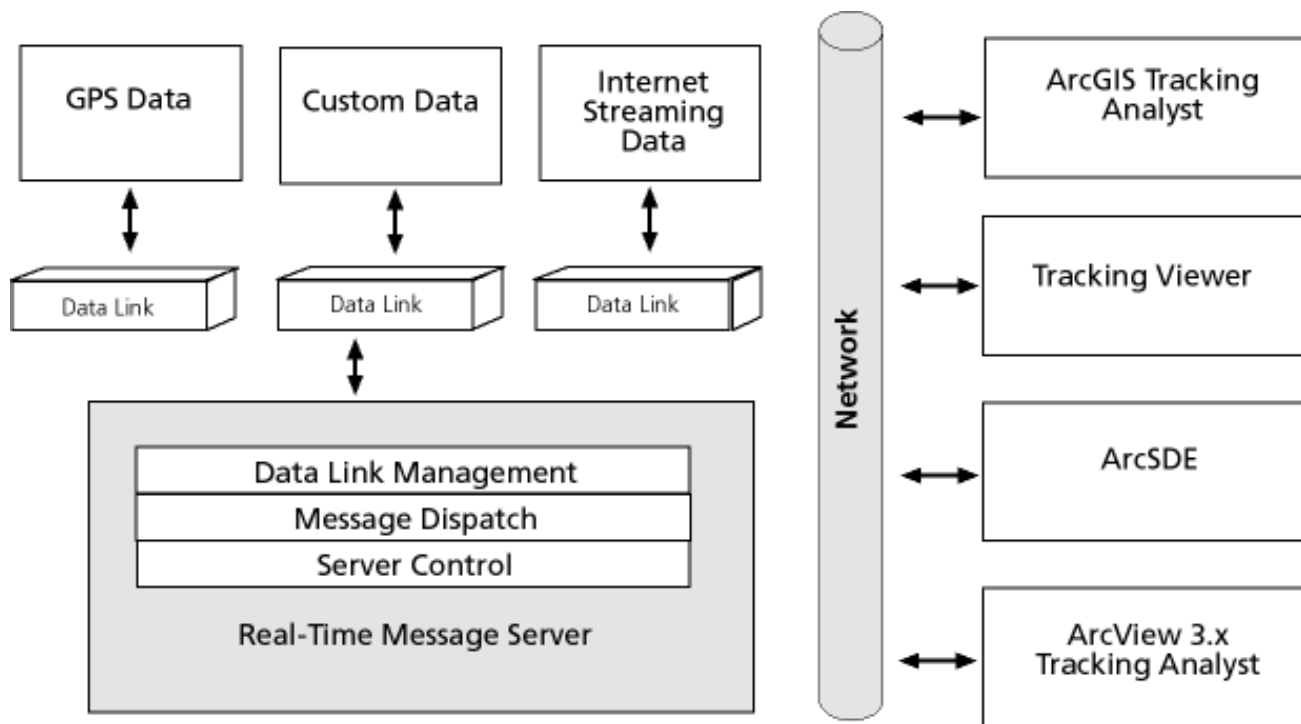
There are several layers that make up the real-time data process: server control, message dispatch, and data link management. Each layer plays a key role in the way the Real-Time Message Server transmits to and receives data from clients.

Server Control
The server control layer provides the basic command and control infrastructure and also provides storage and retrieval for the server information. This layer processes all Real-Time Message Server command messages and dispatches response messages to those commands. The server control layer manages requests as they arrive in a queue.

Message Dispatch
The message dispatch layer controls who receives messages and how they are posted to the server control layer and other data links. This layer also provides for the processing of server-based actions on messages as they are posted to the message dispatch layer.

Data Link Management
The data link management layer controls what data links are connected and provides for the retrieval and storage of their configuration data. It also provides the interface between the message dispatch and server control layers.

Server Concepts
There are several concepts that are used to describe the data and processing with the Real-Time Message Server.

Messages
All communication in the Real-Time 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 Real-Time 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 data link connections.

- *Data messages* contain information relating to an event. Data link messages contain this information, which is delivered to clients as events.

Message Definitions

Data message formats are defined in the Real-Time Message Server using the Tracking Server Manager. The message definition specifies the structure for the data message that the data link will use, thus allowing it to parse the data into a record-like object with various fields containing attributes.

Tracking Services

The real-time data coming through the Real-Time Message Server can be organized into a logical representation of data called a tracking service. The service, via its message definition, defines which messages are presented to users as real-time data streams in ArcGIS Tracking Analyst and ArcIMS Tracking Server applications such as Tracking Author.

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

A *complex event* uses two message definitions: one that provides geographic feature information and the other providing attribute information. In this case two messages are combined using a "join" operation. To define a complex event, the messages must contain an identification field on which a join operation is performed. Also, one of these two messages must contain the temporal information.

The complex event can join static tabular information to a real-time (dynamic) message in which the message contains the real-time position and the attribution is joined in from a static source. Real-time messages about delivery trucks can be joined with static attributes such as truck driver, 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 are joined with static geographic feature and attribute information.

Actions

Actions are rule-based operations that can be built and applied 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.

Real-Time Web Mapping Component

Overview

The Real-Time Web Mapping component is a collection of applications and technologies that allow real-time data to be streamed to a Java-based Tracking Viewer client application.

Real-Time Web Mapping Architecture

The general architecture allows clients to connect to real-time services from ArcIMS Tracking Server over a network—either Internet or local area network. The figure below illustrates this concept. Real-time messages travel between ArcIMS Tracking Server and various clients—including ArcGIS Tracking Analyst—using the data pathways depicted here.
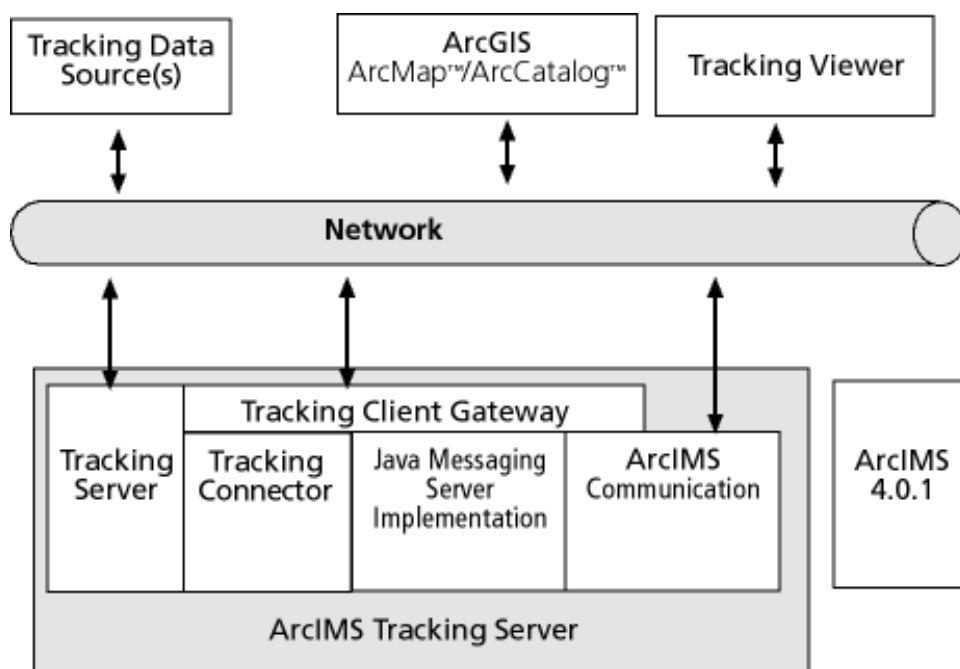
ArcIMS Communication

The ArcIMS Communication component of ArcIMS Tracking Server allows Tracking Viewer to communicate with ArcIMS to retrieve map images and metadata. Because the ArcIMS Communication component is implemented as a Java servlet that resides on the same Web host as the Web site with Tracking Viewer, the viewer can easily request information from an ArcIMS server on a remote machine while still maintaining security. The ArcIMS Communication servlet serializes objects representing the ArcIMS images and metadata and sends the objects back to Tracking Viewer. The viewer can then correctly interpret and display the objects.

Tracking Server Connector

The Tracking Connector allows the Real-Time Message Server to connect to the Java Messaging Server (JMS). The connector consists of two parts: the Connector Data Link and Connector Servlet. The Connector Data Link allows communication over a socket between the Real-Time Message Server and the Real-Time Web Mapping components.

J-9072

The Connector Servlet receives formatted messages from that data link and publishes these messages to the JMS for delivery to the Tracking Viewer and Tracking Analyst clients.

Java Messaging Server

JMS is a generic message queue that handles the distribution of data messages. Data can be routed to specific users or sets of users based on a publisher–subscriber paradigm. JMS allows different types of clients to connect to the Real-Time Message Server to receive data. Because JMS standard defines methods for configuring topic and queue management, data security and access control can be maintained even in this distributed architecture. Most JMS implementations are designed to provide the communications infrastructure for low-latency, high-throughput message distribution. Various JMS implementations are supported by Tracking Server.

Tracking Client Gateway

The Tracking Client Gateway allows communications between Tracking Viewer and JMS. All input and output from the tracking gateway comes and goes in the form of JMS messages.

Tracking Viewer

Tracking Viewer is the ArcIMS Tracking Server Web client. It allows users to view real-time data on a map display. Tracking Viewer is a Java applet embedded into a Web site that receives and displays information from the Real-Time Message Server according to the symbology specifications set up by Tracking Server Author. The viewer contains several tools for map display manipulation, such as pan and zoom, and data query such as the identification tool. You can customize the Web site and viewer tools using the Tracking Server Designer.

Applications

You will use several applications to build and administer your tracking Web site or sites.

- Tracking Server Author
- Tracking Server Designer
- Tracking Server Web Administrator
- Tracking Server Manager

These applications are very similar to their sister applications found in ArcIMS. Once a Web site is created by these applications, advanced users will be able to edit and modify settings in the XML-based files.
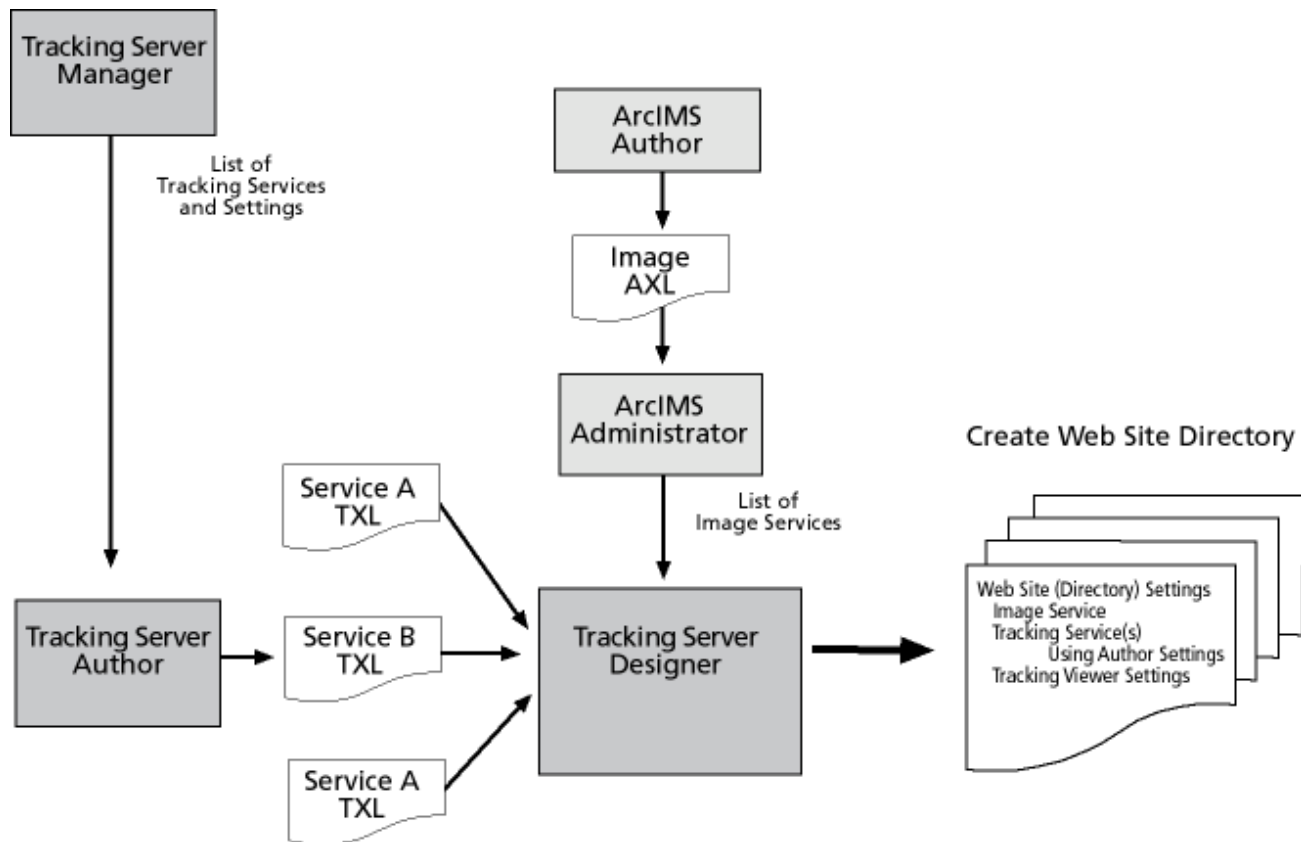
Tracking Server Author

Tracking Server Author allows you to create a tracking configuration file that contains the symbology and settings for displaying real-time tracking services. The configuration file is a specially formatted XML file and is used to define size, shape, and color information for the displayed events.

Tracking Server Designer

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

Tracking Server Web Administrator

The Tracking Web Administrator allows you to monitor and change settings for host, port, time-out, and tracking services.

Tracking Server Manager

Tracking Server Manager is the nerve center for the Real-Time Message Server. Using the manager, you can create and edit message definitions, data links, and tracking services; apply actions to incoming data; define error logging standards; and monitor connection properties.

System Requirements

The initial release of ArcIMS Tracking Server will require the following items installed and working with ArcIMS.

- Platforms

  - Windows NT
  - Windows 2000
  - Windows XP

- Web Servers

  - Apache
  - Microsoft IIS

- Servlet Engines

  - Tomcat
  - Servlet Exec
  - Jrun

- Java Messaging Servers

  - Swift MQ Router
  - IBus Message Bus

- Java Runtime Environments

  - JRE/JDK 1.3.1 or 1.4

For specific versions and support levels, please refer to the official system requirements documentation. Future versions of ArcIMS Tracking Server will expand on the number of supported Web servers and other software components.

Key Features

Real-Time Message Server

- Extensible architecture via data links

- Microsoft COM technology

- 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

- Transport of COM objects within data messages

- Interfaces to send and receive messages of all types

Real-Time Web Mapping Component

- Java technology

- Compatibility with several Web servers, servlet engines, and JMS implementations

- Ability to create new viewer Web sites with various options

- Ability to view real-time data from any computer with access to the appropriate network—either Intranet or Internet

Performance

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

Data timeliness 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 all affect data transmission and processing speed. Data timeliness is also affected by data throughput.

Data throughput describes how many items can be tracked. The number of tracked items depends first on the data and second on machine and network performance. The first question to ask when evaluating throughput 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 data throughput is 100 events per second. If you are tracking 100 trucks that report back every 10 seconds, the data throughput is about 10 events per second. In these two examples the throughput drastically changes based on the change in message frequency.

What data throughput can ArcIMS 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 throughput rates.

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. Because of its advanced functionality and resultant memory usage, ArcGIS Tracking Analyst may not be best suited to applications that require heavy data throughput.

Tracking Viewer can handle higher data throughput but at a loss of some 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. As an alternative, you can also build a custom client using ArcObjects™ and the Tracking Analyst COM objects.

J-9072

Terminology   *Applet:* The Java application viewed in a Web browser.

Data throughput: The number of events displayed in the end client.

Data timeliness: The speed with which data travels from its source to ArcIMS Tracking Server and then on to the client(s).

Event: The combination of geographic feature and attribute information defining something that has happened in time.

Object message definition: Message or static data that describes the event in more detail 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 can almost be thought of as an applet that runs on the server side, without a face.