



What Is Tracking Server?

An ESRI® White Paper • March 2005

Copyright © 2005 ESRI
All rights reserved.
Printed in the United States of America.

The information contained in this document is the exclusive property of ESRI. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by ESRI. All requests should be sent to Attention: Contracts and Legal Services Manager, ESRI, 380 New York Street, Redlands, CA 92373-8100, USA.

The information contained in this document is subject to change without notice.

U.S. GOVERNMENT RESTRICTED/LIMITED RIGHTS

Any software, documentation, and/or data delivered hereunder is subject to the terms of the License Agreement. In no event shall the U.S. Government acquire greater than RESTRICTED/LIMITED RIGHTS. At a minimum, use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in FAR §52.227-14 Alternates I, II, and III (JUN 1987); FAR §52.227-19 (JUN 1987) and/or FAR §12.211/12.212 (Commercial Technical Data/Computer Software); and DFARS §252.227-7015 (NOV 1995) (Technical Data) and/or DFARS §227.7202 (Computer Software), as applicable. Contractor/Manufacturer is ESRI, 380 New York Street, Redlands, CA 92373-8100, USA.

ESRI, the ESRI globe logo, ArcGIS, ArcSDE, MapObjects, ArcView, ArcIMS, ArcInfo, ArcObjects, Geography Network, and www.esri.com are trademarks, registered trademarks, or service marks of ESRI in the United States, the European Community, or certain other jurisdictions. Tracking Solution software and documentation are intellectual properties of TASC, Inc., a Northrop Grumman company. Copyright © 2005 TASC, Inc., and its licensor(s). All rights reserved. Other companies and products mentioned herein are trademarks or registered trademarks of their respective trademark owners.

What Is Tracking Server?

An ESRI White Paper

Contents	Page
Background.....	1
Introduction.....	1
Architecture.....	2
Tracking Message Server Component.....	3
Data Links.....	3
Tracking Message Server Architecture.....	3
Server Control.....	3
Message Dispatch.....	4
Data Link Management.....	4
Server Concepts.....	4
Messages.....	4
Message Definitions.....	4
Tracking Services.....	4
Actions.....	5
Tracking Web Distribution Component.....	5
Tracking Client Gateway.....	5
Tracking Server Connector Data Link.....	5
Applications and Tools.....	5
Tracking Server Author.....	6
Tracking Server Designer.....	6
Tracking Server Manager.....	6
System Requirements.....	6
Key Features.....	8
Tracking Message Server Component.....	8
Tracking Web Distribution Component.....	8

Contents	Page
Performance	8
Terminology.....	9

What Is Tracking Server?

Background 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 Tracking Server, you can log it to a file or distribute it to Web and desktop clients including ESRI® ArcGIS® Tracking Analyst.

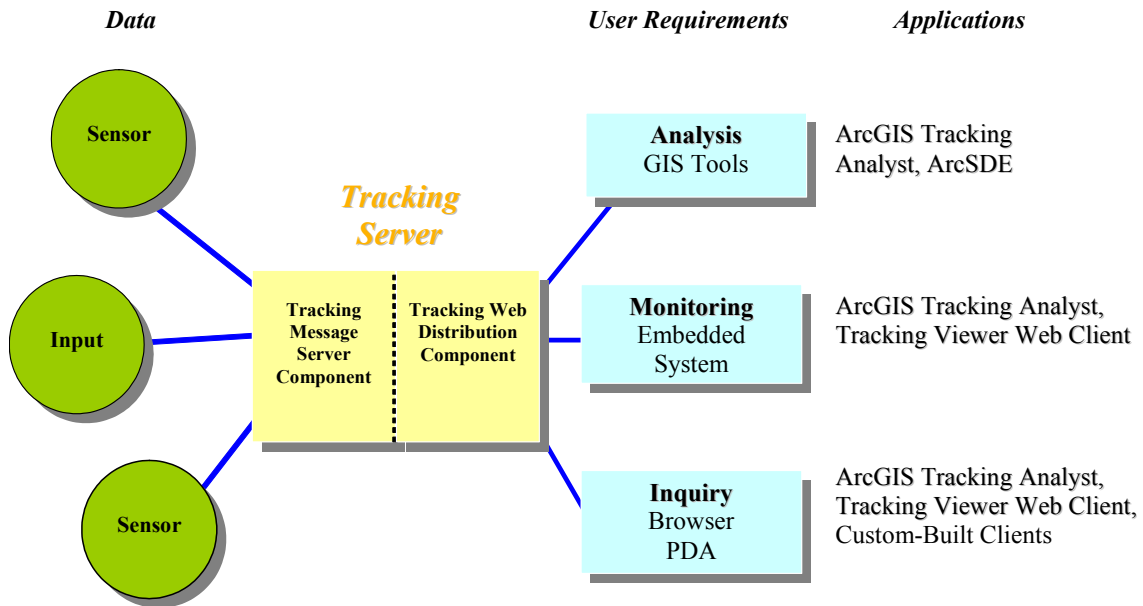
Some clients are "watch" clients, such as the Tracking Viewer, a real-time Web mapping application that can provide basic situational awareness. Other clients give advanced users the power to integrate temporal and geographic data on their desktop and perform real-time and historical data analysis using ArcGIS Desktop with Tracking Analyst. Tracking Server enables the integration of real-time data and a geographic information system (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 the Web and as desktop clients.

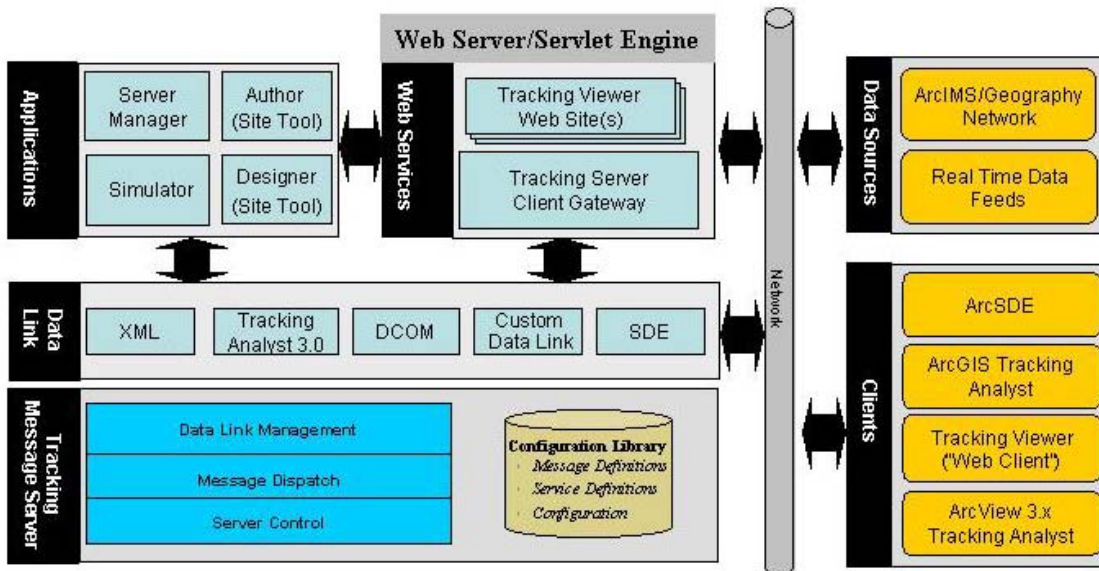
The *tracking message server component* is the engine and router that receive data via data links and server connections; process actions based on location or location and attributes; log data to disk (shapefiles, personal geodatabases, or ArcSDE® databases) for later analysis; and push the data to various 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 such as ArcGIS Tracking Analyst and the Tracking Viewer Web client. Note how various types of end user needs can be met by different client applications on different types of devices.



Architecture 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 custom-built ArcObjects™ 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

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 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.

Data Links

A data link is a component of the real-time 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 the following types:

- **Input**—Supplies data messages to the real-time 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 real-time message server, parsed according to the message definitions set in the Tracking Server Manager.
- **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.

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 real-time 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 will be required. To help developers create custom code, the Tracking Server installation also contains an Active Template Library data link wizard to create a basic data link. Programmers can customize or extend the basic data link to meet their system requirements.

Tracking Message Server Architecture

The tracking message server consists of three functional software layers: server control, message dispatch, and data link management. Each software layer plays a key role in the way the tracking message server receives and transmits data.

Server Control

The server control layer provides the basic command and control infrastructure as well as storage and retrieval for the server information. This layer processes all tracking 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 which 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 tracking message server.
- 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 link messages contain this information, which is delivered to clients as events.

Message Definitions Data messages convey event information throughout Tracking Server. The format of these messages is defined in the 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 Definition 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 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 tabular information to a real-time (dynamic) message in cases in which the message contains the real-time position and the attribution is joined from a static source. For example, 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 may be joined with static geographic feature and attribute information.

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.

Tracking Web Distribution Component

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 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 Tracking Analyst or Tracking Viewer clients will be able to connect to 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 Server Client Gateway comes and goes in the form of messages.

Tracking Server Connector Data Link

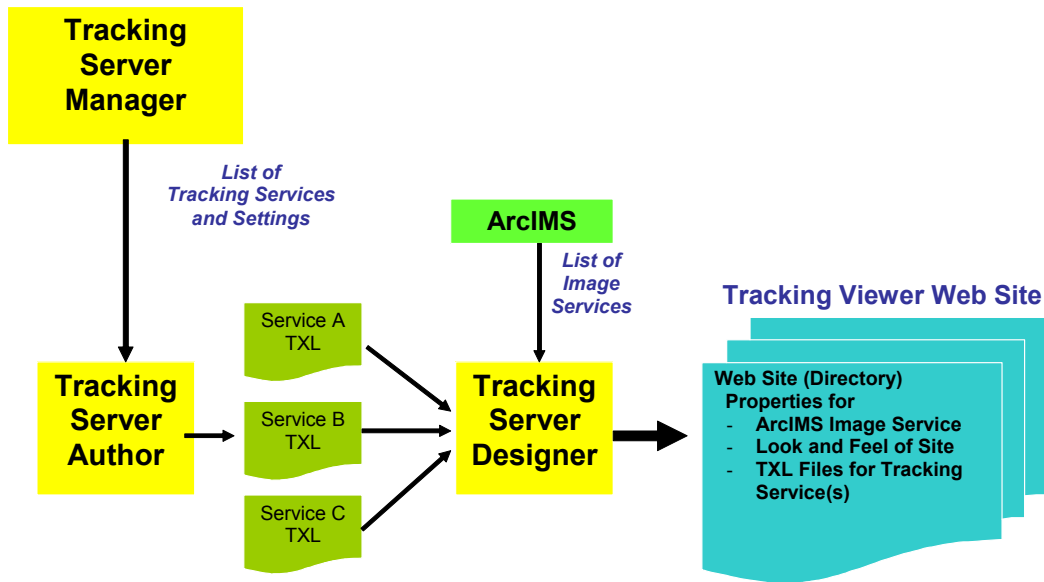
The Tracking Server Connector Data Link allows the real-time message server to connect to the Tracking Server Client Gateway. Tracking Server publishes messages for delivery to all clients including any Tracking Viewer and Tracking Analyst clients. The Tracking Server Connector Data Link must also connect to Tracking Server Client Gateway (although on a different port than end user clients) to establish the data pathway.

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

The 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 server actions are met in the dynamic data.

Tracking Server Designer

The 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

The Tracking Server Manager serves as the control center for the Tracking Message Server, where you can customize settings to tailor the server's functionality to your needs. With the Tracking Server 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 Tracking Server 1 prerelease requires or supports the following:

- Supported Platforms
 - Windows 2000, Professional, Server, and Advanced Server
 - Windows XP
 - Windows 2003 Server

- Supported Web Servers
 - Apache 2.0.46
 - Apache 2.0.4x
 - Microsoft IIS 5.0
 - Sun Java System Application Server 7.0
- Supported Servlet Engines
 - Tomcat 4.1.24 (stand alone)
 - Tomcat 4.1.24 with mod_jk2
 - Tomcat 5.0 (not fully tested)
 - ServletExec 5.0 ISAPI
 - ServletExec A/S 5.0
- J2SE Java Runtime Environments (JRE) Requirements
 - JRE with Java Plug-in required
 - JRE version 1.4.2 supported
 - JRE versions 1.4.0 and 1.4.1_05 supported
 - JRE versions 1.4.0_01 and 1.4.0_03 not supported
 - JRE versions earlier than 1.4.x not supported
- J2SE SDK (JDK) Requirements
 - JRE version 1.4.2_05 supported, with minor manual configuration required
 - JDK versions 1.4.0 and 1.4.1_05 supported
 - JDK versions 1.4.0_01 and 1.4.0_03 not supported
 - JDK versions earlier than 1.4x not supported
- 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
- Supported Web Browsers (Clients)
 - Internet Explorer 5.0, 5.5, or 6.0 with Java Plug-in 1.4.x

Note: Tracking Server cannot be installed on the same machine as ArcGIS 8.x Desktop or ArcInfo® 8.x Workstation.

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

Key Features

Tracking Message Server Component

- 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

Tracking Web Distribution Component

- Java technology
- Compatibility with several Web servers and servlet engines
- 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 Tracking Server clients—ArcGIS Tracking Analyst and the 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, 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 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 throughput.

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 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. You can also build a custom client using ArcObjects and the Tracking Analyst COM objects.

Terminology

Applet: Java application that runs in an Internet browser.

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

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

Data timeliness: The speed with which data travels from its source to Tracking Server and then on to the client or clients.

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

Legend: The panel on the left side of the 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 settings defined in the Tracking Server Manager to format data messages. You can also create and edit message definitions to include different fields from a particular data source.

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

Tracking message server component: The engine and router that receive data via data links and server connections; process actions based on location or location and attributes; log data to disk (shapefiles, personal databases, or ArcSDE databases) for later analysis; and push the data to various clients via data links.

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: Web-based tool that allows you to see and identify real-time tracking data. Displays tracking information on top of an ArcIMS 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.



For more than 35 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

ESRI
380 New York Street
Redlands, California
92373-8100, USA
Telephone: 909-793-2853
Fax: 909-793-5953

For more information
on ESRI, call

1-800-447-9778

(1-800-GIS-XPRT)

or contact an ESRI value-added
reseller near you.

Send e-mail inquiries to

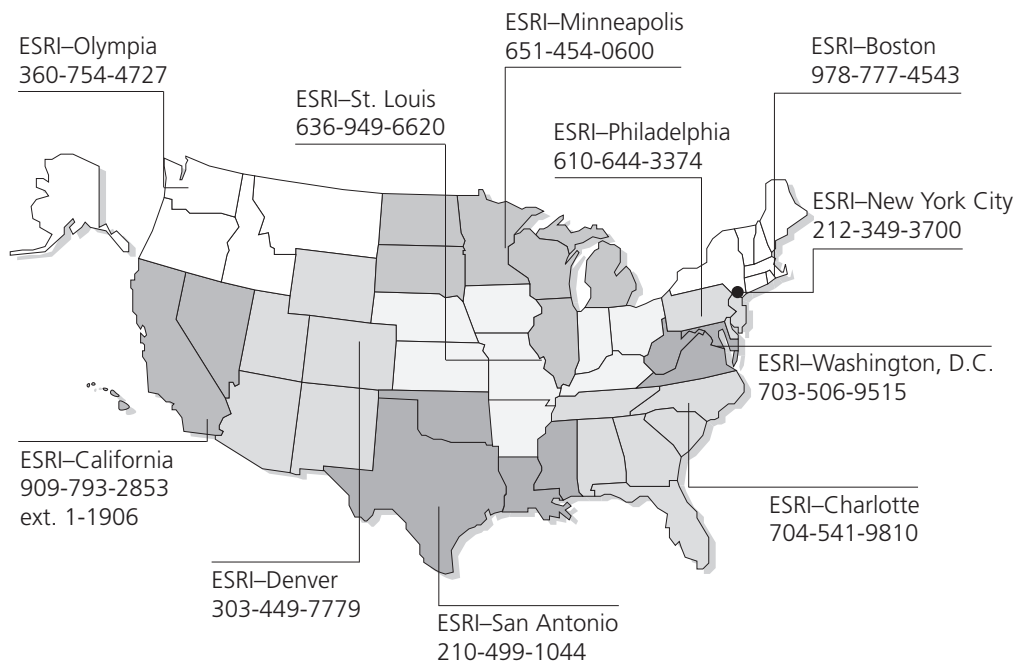
info@esri.com

Visit ESRI's Web page at

www.esri.com

Outside the United States,
contact your local ESRI distributor.
For the number of your distributor,
call ESRI at 909-793-2853,
ext. 1235,
or visit our Web site at
www.esri.com/international

Regional Offices



International Offices

Australia
www.esriaustralia.com.au

Finland
www.esri-finland.com

Italy
www.esriitalia.it

Romania
www.esriro.ro

Belgium/Luxembourg
www.esribelux.com

France
www.esrifrance.fr

Japan
www.esrij.com

Singapore
www.esrisa.com

Bulgaria
www.esribulgaria.com

Germany/Switzerland
www.esri-germany.de
www.esri-suisse.ch

Korea
www.esrikr.co.kr

Spain
www.esri-es.com

Canada
www.esricanada.com

Hungary
www.esrihu.hu

Netherlands
www.esrinl.com

Sweden
www.esri-sweden.com

China (Beijing)
www.esrichina-bj.cn

India
www.esriindia.com

Poland
www.esripolska.com.pl

Thailand
www.esrith.com

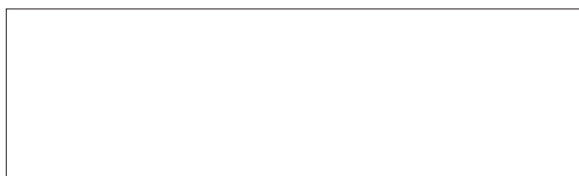
China (Hong Kong)
www.esrichina-hk.com

Indonesia/Malaysia
62-21-527-1023
603-7874-9930

Portugal
www.esri-portugal.pt

United Kingdom
www.esriuk.com

Venezuela
www.esriven.com



Place ESRI business partner or distributor address here.



No. GS-35F-5086H