

ArcSDE®

The GIS Application Server



Today, spatial data is more readily available than ever before because of e-government initiatives, commercial spatial data vendors, and improvements in technologies such as remote sensing, surveying, global positioning systems (GPS), and fast scanning devices that can quickly turn paper map-based data into digital data sets. Historically, this data has been isolated and, to some extent, outside the information technology (IT) environment of most organizations. However, this is changing. Advancements in geographic information system (GIS) technology now make it possible to store and manage spatial data in a standards-based database management system (DBMS) and enable enterprise-wide dissemination of spatial data that can be accessed from the desktop, Web, or mobile client.

GIS Data Management for the Enterprise

ArcSDE® software is part of the ESRI® ArcGIS™ family of software products that integrates geographic information query, mapping, spatial analysis, and editing within a multiuser enterprise DBMS environment. ArcSDE enables organizations to move from a traditional approach—managing a separate collection of geographic data files—to a new, integrated environment in which spatial data is managed as a continuous database that is accessible to the entire organization and easily published on the Web.

This change enables the integration of GIS technology with an organization's standard information technology infrastructure. As a core component of the information infrastructure, spatial data is finally available to every member of an organization for fundamental business

activities such as mapping customer locations, selecting sites, routing and logistics, managing and designing facilities, market research, customer services and customer care, territory planning, and spatial-based data mining.

What Is ArcSDE?

ArcSDE is an application server that facilitates storing and managing spatial data (raster, vector, and survey) in a DBMS and makes the data available to many kinds of applications. ArcSDE allows you to manage spatial data in one of four commercial databases (IBM® DB2®, Informix®, Microsoft® SQL Server™, and Oracle®). ArcSDE serves data to the ArcGIS Desktop products (ArcView®, ArcEditor™, and ArcInfo™) and through ArcIMS® and is a key component in managing a multiuser GIS.

An E-Government Case Study

City of Portland's GIS Hub

The City of Portland's (Oregon) solution to the problem of sharing data among a "rich mix" of GIS systems is the Enterprise Hub (GIS Hub). The GIS Hub provides for applications and data sharing among city bureaus, regional agencies, and the public and saves Portland money through improved processes and the elimination of redundancy.

The GIS Hub stores enterprise data within an ArcSDE software-enabled database hosted by Microsoft's SQL Server. The GIS Hub has been used in a variety of ways. For example, the GIS Hub is integrated with building permitting functions, allowing users to quickly access site maps, street layouts, development plans, and other jurisdictions' databases. In addition, more casual users of the GIS Hub are

able to use applications that permit them to get data that was not available before through the city's incompatible databases. Projects, such as map development, are now being more easily created through information sharing on the GIS Hub.

"The advantages of bringing together our different systems that use geographical reference data are

ArcSDE enables a DBMS to store and manage all of an organization's spatial data including vector, raster, address, and survey.

ArcSDE Provides a Number of Key Benefits Including

Database Portability

ArcSDE provides a common model for spatial data. Using ArcSDE data import and export utilities, you can move data from one DBMS to another without loss of information. This portability safeguards your data investment and is especially important in a heterogeneous database environment. This capability allows the most advanced geodatabase designs to be moved.

Application Portability

ArcSDE defines a single logical model for spatial data that is independent of the physical data representation in the DBMS. Because how the data is stored is transparent to the end application, applications developed with ArcObjects™ or ArcSDE C or Java™ application programming interface (API) will run with little or no modification regardless of the underlying DBMS spatial data schema.

ESRI's Data Models

GIS users need common standards to build and share data. ArcSDE supplies both a simple relational model of points, lines, and polygons and a sophisticated object model with support for intelligent features, rules, and relationships—the geodatabase. The geodatabase can be combined with the ArcGIS data models, templates for implementing GIS projects for specific industries and applications. Data

models enhance implementation of GIS solutions by streamlining data migration.

Data Integrity

ArcSDE manages the integrity of the point, line, and polygon information added to the database and will not allow ill-formed feature geometry to be inserted. In addition, you can use ArcSDE with ESRI's ArcEditor and ArcInfo client software to implement real-world behaviors for features that would not be practical to implement in the DBMS itself (e.g., connectivity rules for utility networks).

Long Transactions and Versions

Although a DBMS can provide multiuser read and write access on tables, editing GIS data in a multiuser environment requires managing concurrent access to data—access that can span hours, days, or weeks. ArcSDE supports long transaction editing as well as modeling “what if” scenarios by creating versions. Versioning lets users create multiple, persistent representations of the database without making copies of the data. More than one user can modify the same data. At the end of an editing session, edited features are merged into a target version and conflicts are reconciled.

enormous,” says Mitch Vanderperren, the City of Portland's GIS Hub manager. “The GIS Hub will help staff in our bureaus to be more responsive to our customers—the individuals and businesses that depend on city services.”



Heterogeneous IT Environments, Standards, Interoperability, and Data Sharing ●

ArcSDE enables the integration of spatial data and analysis in the mission critical business processes and workflows of the enterprise. In addition, ArcSDE facilitates data sharing and interoperability that increases an organization's return on investment in its existing GIS technology.

Open, Scalable Environments

ArcSDE works with commercial DBMSs from leading vendors including IBM, Microsoft, and Oracle. ArcSDE supports popular server hardware/operating system environments including Microsoft Windows NT® and 2000 and leading UNIX® platforms including HP-UX®, HP® Tru64™ UNIX, IBM AIX®, Red Hat® Linux®, SGI™ IRIX™, and Sun™ Solaris™. ArcSDE operates over any local area, wide area, or wireless Transmission Control Protocol/Internet Protocol (TCP/IP) network and can connect concurrently to multiple databases. It also allows access to the databases on the desktop, Web, and mobile clients.

Standards-Based

ESRI has been actively participating in the definition of spatial standards for interoperability and data sharing by working with organizations such as the U.S. Federal Geographic Data Committee (FGDC), the Open GIS Consortium (OGC), and the International Standards

Organization (ISO), particularly the SQL/MM Multimedia (Spatial) Committee and ISO TC 211, two of the primary ISO technical committees involved in spatial standards.

ESRI supported the development of the National Spatial Data Infrastructure (NSDI) and the OpenGIS® Simple Features Specification.

ESRI was the first GIS vendor to successfully complete OGC's conformance testing and become certified with products that conform to the OpenGIS Simple Features for SQL Specification (see OGC's Conforming Products Web page for more details at www.opengis.org/testing/product). The ArcSDE binary schema—the default schema used for ArcSDE for Oracle and SQL Server—is not only fully compliant with the OpenGIS Simple Features for SQL Specification's Binary Geometry but provides additional GIS data types such as z values, measures, annotation, and support for raster and survey data that extend beyond the OGC specification.

An Integrator Case Study

AQUA and Hanslik Software Laboratory

AQUA, a water company in Bielsko-Biala, Poland, offering services to more than 250,000 users, has implemented a software package based on ESRI software and designed by Hanslik Software Laboratory (HSL), an ESRI Poland business partner.

The final architecture of the system is based on ArcSDE 8, Oracle8i™, and a set of transactional GIS editing and analysis tools developed specifically for water companies by HSL.

Facilitating efficient interaction between spatial data and business data systems requires integration with

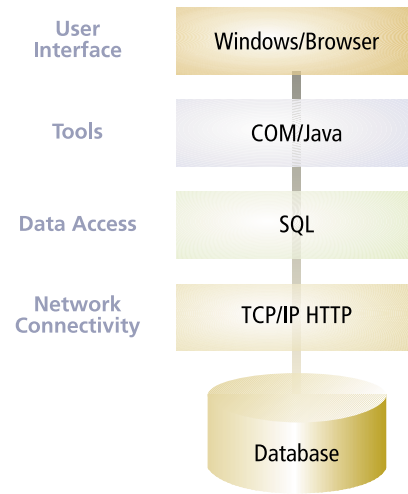
enterprise resource planning systems. AQUA's system was designed to integrate with SAP™ R/3® using ArcSDE 8 for accessing SAP functionality. The design also offers GIS viewing from the SAP system. The use of the system over the Internet also greatly facilitates access to the system among AQUA staff.

“The geodatabase data format is the best part of ArcGIS.”

*Ingo Michels
WASY, Ltd.*

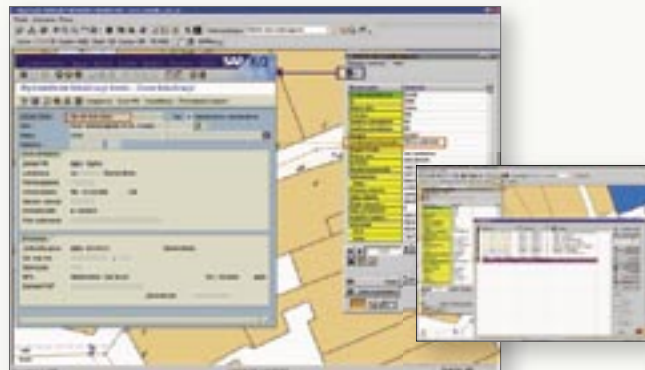
GIS Data in the DBMS

A spatial data management solution should be engineered to take advantage of the most advanced offerings from each DBMS vendor. ArcSDE manages the physical storage of spatial features using the standard data types provided by the DBMS. If the DBMS provides for native spatial types, ArcSDE will use them. The table below lists the data formats supported in each DBMS. For example, ArcSDE can read and write data using Oracle Spatial, the IBM Spatial Extender for DB2 Universal Database, and the Informix Spatial DataBlade® Dynamic Server.



DBMS	Geometry Storage	DBMS Type
Oracle	ArcSDE compressed binary Oracle8i and 9i Spatial and 9i Locator	Long Raw, BLOB SDO_Geometry
Microsoft SQL Server	ArcSDE compressed binary	Image
Informix	Informix Spatial DataBlade	ST_Geometry
IBM DB2	DB2 Spatial Extender	ST_Geometry

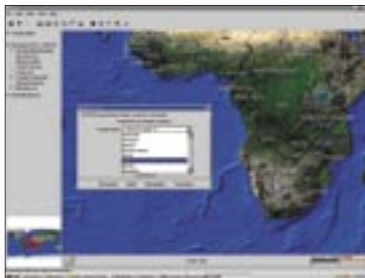
The GIS system will continue to be a strategic investment for AQUA because of its integration with not only SAP R/3 but also billing, modeling maintenance, and customer care with each of these systems related to a single spatially enabled database. This interoperability allows AQUA maximum GIS functionality amid a variety of systems.



A Broad Range of Application Solutions



Web browsers are lightweight Web clients that complement ArcGIS Desktop.



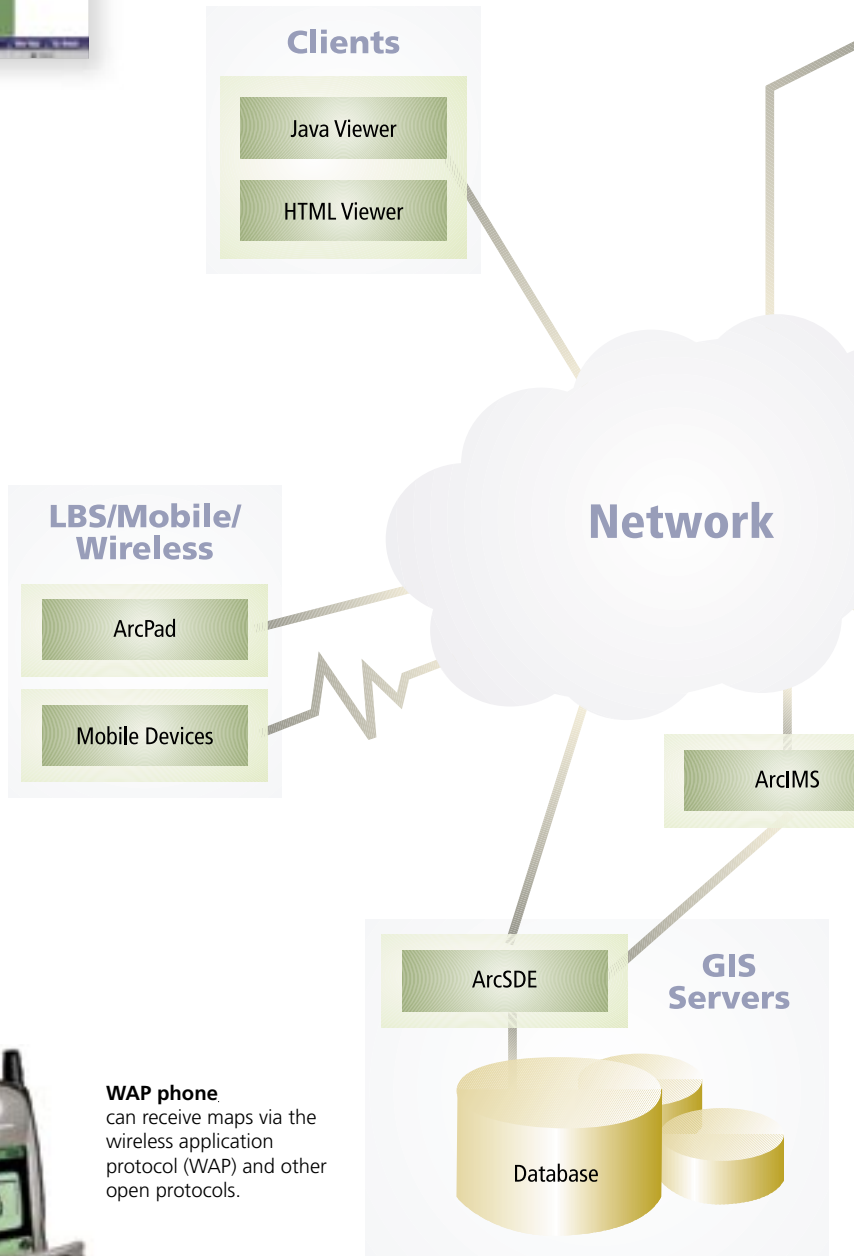
MapObjects®—Java Standard Edition is an easy-to-use suite of more than 900 Java developer components that you can use to build custom, cross-platform GIS applications or applets.



ArcPad® is a lightweight, mobile mapping solution that can retrieve maps using wireless technology.



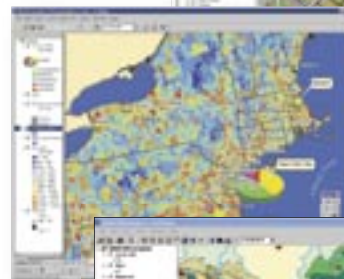
WAP phone can receive maps via the wireless application protocol (WAP) and other open protocols.



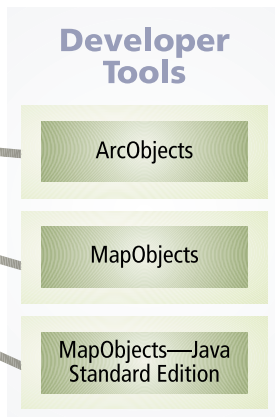
From the desktop to the enterprise, from the Internet to custom applications, ArcSDE complements ESRI's full range of client applications ensuring maximum flexibility and scalability in implementing the best solution for your needs.



ArcExplorer™ is a free geographic data browser that lets you display, query, and retrieve GIS data.



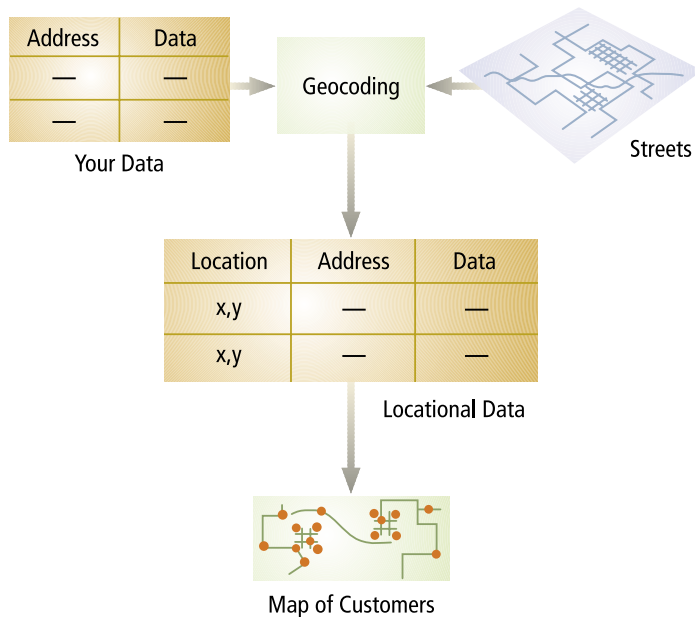
ArcReader™, ArcView, ArcEditor, and ArcInfo are collectively known as ArcGIS Desktop and are a scalable suite of software for geographic data creation, integration, and analysis.



ArcIMS is a powerful Internet mapping system that works with standard Internet server technology.

Spatially Enable the Enterprise •

Four emerging trends are increasing the demand for greater access to spatial data. First, there is a growing realization that location is central to how people organize and relate to their world. Second, the convergence of the Internet and GIS is facilitating data sharing and distribution to a degree that was unimaginable a few years ago. Third, commercial organizations are beginning to use spatial location in the integration of their core business data and in business processes for applications such as location-based services, enterprise resource planning, and supply chain management. Finally, many government agencies are under pressure to provide increased public access to geographic data.



Leverage Your GIS With DBMS-Based Data Management

Managers and users of geographic data have long recognized that interorganizational collaboration requires that people share spatial information. Centralized storage and management of spatial data can provide cost-effective data management by reducing data duplication and enhancing accuracy. ArcSDE meets the key goal of managing spatial data in a DBMS by allowing you to enter the data once while enabling access to the data by many users. ArcSDE, operating in the client/server and distributed computing environments, provides a scalable, multiuser solution that uses a single data model to store vector, raster, and survey data. In addition, ArcSDE maintains a continuous database (i.e., not tiled) that can model features and real-world behaviors and supports long transactions and versioning.

A Business Partner Case Study

Network Engineer From Telcordia Technologies, Inc., an SAIC Company

Using ESRI's industry-standard GIS platform, Telcordia Technologies, in conjunction with MESA Solutions, has designed and developed Telcordia Network Engineer, a revolutionary engineering and facilities management solution for the communications industry. This solution is ideal for professional network engineers,

combining the most advanced network design and management functions with an architecture for enterprisewide access to data and tools.

Telcordia Network Engineer allows users to integrate administrative network design, documentation, and maintenance with physical location. Geography, network attribution, and connectivity information can be stored in the same industry-

standard database. Integration of communication network facilities and customer data provides an excellent source of intelligence for customer care, sales support, decision support, and other "downstream" applications.

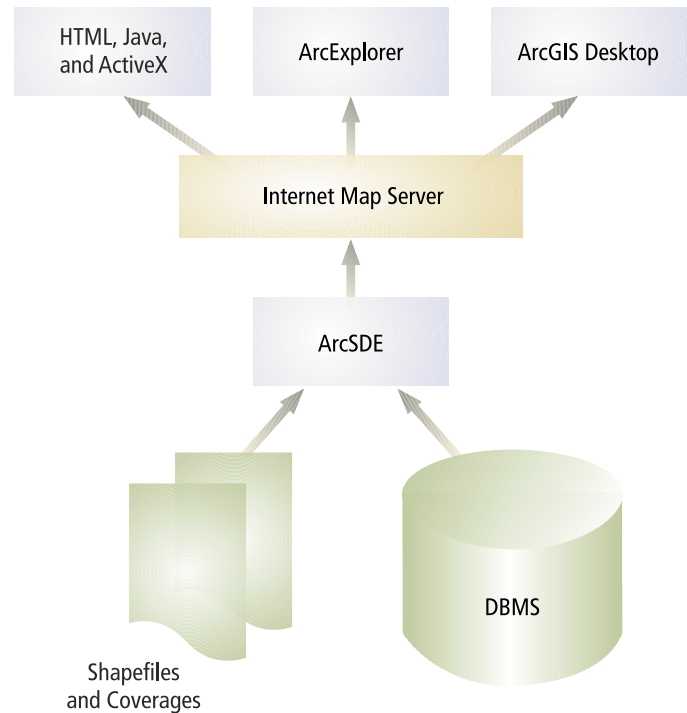
Network Engineer is workflow-centric. The program's data storage and distribution engine, ArcSDE, can incorporate a wide variety of data sources, such as capacity planning,

“The ability to perform direct editing of the geodatabase using ArcSDE is extremely appealing to us. Versioned editing and long transactions could fit very well into our map revision process.”

*Byron Taylor
USDA Forest Service*

ArcSDE works with ESRI's ArcGIS Desktop clients (ArcView, ArcEditor, and ArcInfo) and ArcIMS, ESRI's technology for Internet mapping and distributed GIS, to provide a single, integrated, scalable, secure, standards-based family of solutions. ArcSDE works with the ArcPublisher extension, providing dynamically updated, high-quality maps that can be read by anyone with ArcReader, a free map viewer. This comprehensive framework lets organizations of all sizes effectively create, manage, and share spatial information over private Intranets or the Internet.

ArcSDE and ArcIMS provide the foundation for e-government and e-commerce based portals. This architecture has proven ability to handle the hit rates of large commercial Web sites and is the basis for ESRI's own Geography Network™. ArcIMS supports ArcGIS Desktop, Web browser clients, and the free ArcExplorer data viewer.

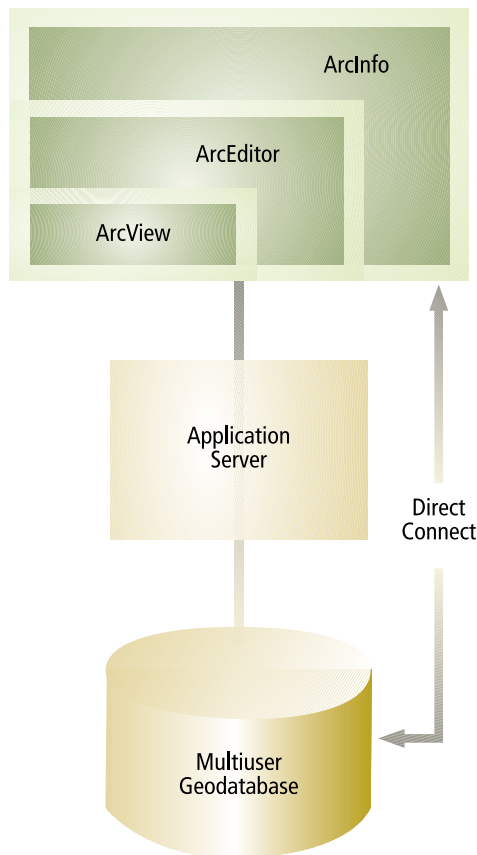


market segmentation, and legacy CAD data, as design input. Moreover, Network Engineer can be easily put to use on every desktop in the enterprise. ESRI's easily deployed thin clients and Internet mapping technologies ensure that everyone can take advantage of Network Engineer's facilities database. Moreover, as this is a shared database, all desktops have access to the latest, most accurate data.



Spatial Dimension for Everyday IT

ArcSDE is a core component of ESRI's vision of an integrated scalable GIS platform that meets all of an organization's spatial data needs. It stores data in a common data model, leverages industry standards, and uses a loosely coupled distributed architecture that can serve data to any client. ArcSDE allows the storage of vector GIS data, raster data, and survey data within the leading commercial DBMSs, which results in simple database design and administration. By conforming with industry standards, ArcSDE ensures interoperability, facilitates data distribution, and promotes data sharing.



Integrated With the Enterprise

Spatially enabled data stored in a DBMS benefits businesses by allowing spatial query, aggregation, and display of information in tabular databases (i.e., geometric searches on records that have spatial coordinate association). Adding location information to existing business applications reveals patterns and trends in the data that might otherwise have been missed. Linking location to information (or bringing “the where” to bear on “the what”) is a process that applies to many aspects of business such as choosing a site, targeting a market, drawing up sales territories, or allocating resources.

ArcSDE allows users to query, analyze, and view various geographic layers using different client software programs. ArcSDE is also critical to applications in the telecommunications market where operators and network managers need to provide location services in association with other telecommunication or Internet services and in transportation and logistics for the optimization of the flow of goods and services across a geographic network.

Flexible Architecture

N-tier environment support provided by ArcSDE allows connection to the host DBMS through an application server (three-tier architecture) or through a connect driver where the client application is connected directly to the DBMS (two-tier architecture).

Two- and three-tier configurations can work separately or together providing maximum flexibility in system design. A database administrator can choose between centralized management or distributed processing load. ArcSDE can also easily be combined with ArcIMS for applications requiring stateless Web deployment of Web-based mapping and distributed GIS.

According to the META Group, the database market will become a \$12.7 billion industry by the year 2004. This, combined with the universal spatial server concept of ArcSDE and high growth in the use of GIS, means an abundance of opportunities for application developers.

Whether you configure your system with an application server, direct connect drivers, or a mixture of the two, the same client functionality is available with all of ESRI's core client applications or any application developed with ArcObjects or MapObjects software. In addition, all of ESRI's core client applications are delivered with out-of-the-box capability for a read-only direct connection to an existing spatial database.

Developer Opportunities

ESRI provides developers with many options for creating new applications or adding ArcSDE support to existing applications. Developers can use ArcObjects, the ArcGIS C++ Object Component API. Developers can also use MapObjects and MapObjects—Java Standard Edition to build custom applications or add spatial functionality to existing applications using advanced development environments such as Visual Basic®, Visual C++®, PowerBuilder®, or Delphi™. In addition, ArcSDE provides organizations with open, high-level C and Java APIs for querying and processing spatial data and GIS functions for advanced application development.

The ESRI Business Partner Program offers a variety of software and services to help you implement GIS. Within the United States, please send information about your company, including a mailing address, to buspartner@esri.com. Outside the United States, please contact your local distributor.

ArcSDE Support

To ensure you get the most from your investment in ArcSDE, ESRI provides the following support services:

- End user and developer technical support from a team of trained personnel with years of experience in database management systems and implementing enterprise GIS
- Training for database administrators and developers
- Start-up consulting support for both end users and developers
- Web-based self-help including the Knowledge Base and a user support forum at support.esri.com

For more information, download the ArcSDE white paper at

www.esri.com/arcscde

Demonstration

For a demonstration of ArcSDE, call your U.S. regional office or international distributor.



For more than 30 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.

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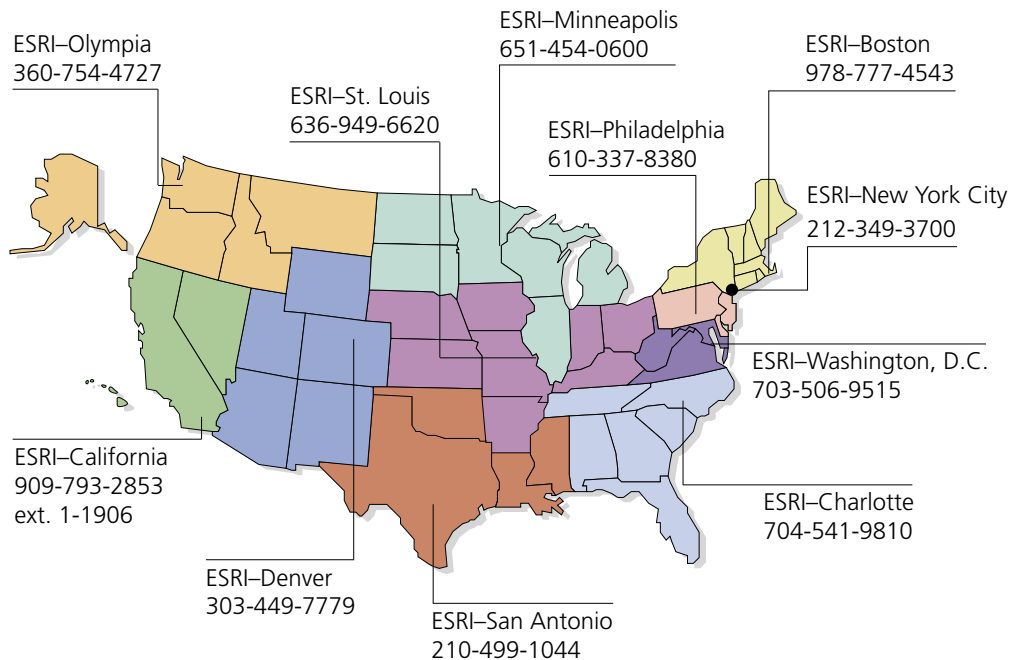
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