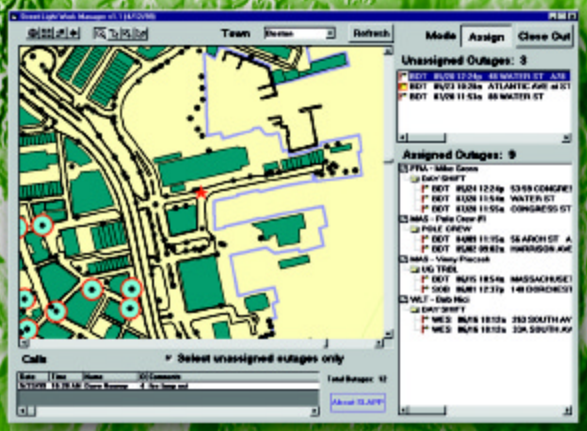
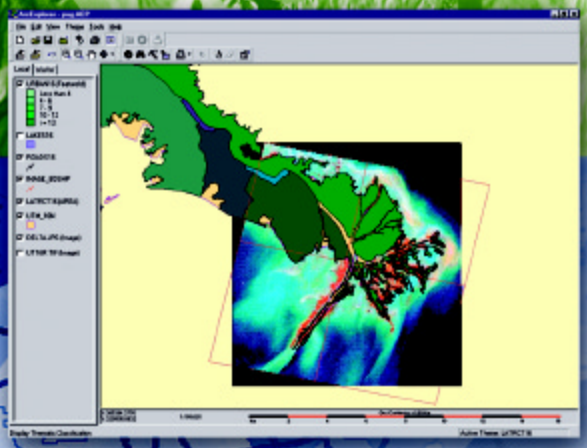




ArcSDE™

The Gateway for GIS Data in a DBMS

ArcGIS™ ESRI

ArcSDE

There is a growing volume of spatial data being developed as a result of remote sensing, surveying, widespread adoption of global positioning system (GPS) technology, and fast-scanning devices that can quickly turn paper map-based data into digital data sets. Today this spatial data is more readily available than ever before thanks to e-government initiatives and commercial spatial data vendors. Historically this data has been isolated and, to some extent, outside the information technology (IT) environment of most organizations. However, all of this is changing as advancing spatial technology now makes it possible to store and manage all of this spatial data in a standards-based relational database management system (DBMS), enabling enterprisewide data dissemination of spatial data, whether it is accessed by desktop, Web, or mobile clients.

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 an organization to move from the traditional approach of managing collections files of geographic data (also called location or vector data), raster data, and computer-aided design (CAD) data to a new integrated environment where all spatial data is managed as a continuous database that is accessible to the entire organization and easily published on the Web. This change provides the foundation that enables geographic information system (GIS) technology to be integrated within an organization's standard information technology infrastructure. As a core component of the information infrastructure, spatial data is finally available to anyone in 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 the GIS gateway that facilitates managing spatial data in a DBMS and making the data available to many kinds of applications and serving data and maps across the Internet. ArcSDE allows you to manage spatial data in one of four commercial databases (IBM® DB2®, Informix®, Microsoft® SQL Server™, and Oracle®) and to serve ESRI's file-based data with ArcSDE for Coverages. ArcSDE serves data to the ArcGIS Desktop products (ArcView®, ArcEditor™, and ArcInfo™) and through ArcIMS®, and it is a key component in managing a multiuser spatial database.

An E-Government Case Study

City of Portland's GIS Hub

The City of Portland, Oregon, solution to the problem of sharing data between a "rich mix" of GIS systems is the Enterprise Hub (GIS Hub). The GIS Hub provides for applications and data sharing between 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-enabled database hosted by Microsoft's SQL Server. The GIS Hub has been utilized 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

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

ArcSDE provides a number of key benefits, including:

Database Portability

ArcSDE provides a common model for spatial data. With ArcSDE you can move your data from one DBMS to another without loss of information through the ArcSDE data import and export utilities. This portability can help ensure your data investment because, if the need arises, you can move even the most advanced spatial database. In addition, these same utilities provide a powerful and adaptable solution for organizational data sharing.

Application Portability

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

The ArcGIS Geodatabase Model

A geodatabase is a repository for geographic data of all types (vector, raster, address, CAD, etc.) stored in a DBMS. In ArcSDE, a geodatabase can contain a simple relational model of points, lines, and polygons as well as a sophisticated object model with support for intelligent features, rules, and relationships. The combination of the ArcGIS Desktop applications, ArcSDE, and the geodatabase provides an unparalleled collaborative environment that scales from the desktop to globally distributed networks.

Data Integrity

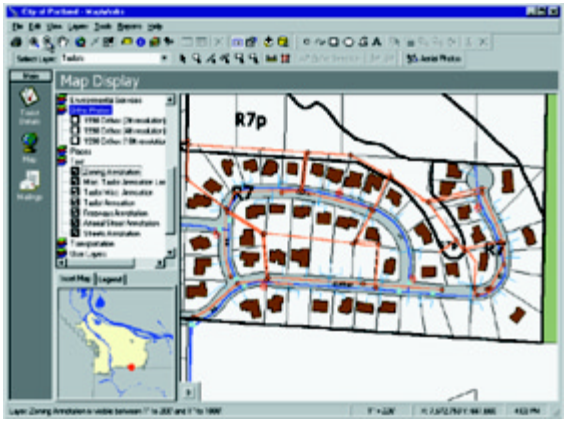
ArcSDE manages the integrity of the point, line, and polygon information added to the database and will not allow ill-formed feature geometry to be inserted. In addition, you can use the ArcSDE gateway with ESRI's ArcEditor and ArcInfo client software to implement additional integrity constraints on the data model that are not practical to implement in the DBMS itself (for example, connectivity rules for utility networks).

Long Transactions and Versions

Editing GIS data in a multiuser environment can involve complex operations that can span hours, days, or weeks (for example, designing a water, sewer, or electrical network or a large new development). In addition, "versioning" is often required to support alternative designs, "what if" analysis, etc. ArcSDE provides both long transaction and version support for your DBMS.

sharing on the GIS Hub.

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



Openness—The Key to Today's Heterogeneous IT Environments

Recognizing the heterogeneous nature of today's computing environment, ESRI is committed to open computing environments and open data access. ArcSDE software's open environment (open data access, open platforms, open standards, and open application development) gives GIS database administrators the opportunity to choose alternatives tailored for their organization and preserve their investments in data, infrastructure, and expertise.

Scalable, Open Solutions

The ability to operate in a heterogeneous environment is not just an advantage, but rather it is a requirement in today's computing environments. ArcSDE supports the leading commercial DBMS vendors including IBM DB2, Informix, Microsoft SQL Server, and Oracle. ArcSDE supports the leading client and server hardware/operating system environments. The ArcSDE server runs on Microsoft Windows NT® and Windows® 2000 and leading UNIX® platforms including Sun™ Solaris™, SGI™ IRIX™, IBM AIX®, HP-UX®, and Compaq® Tru64 UNIX. ArcSDE operates over any local area, wide area, or wireless Transmission Control Protocol/Internet Protocol (TCP/IP) network. Through its multithreaded capability, ArcSDE provides the capability to connect concurrently to multiple databases and serve users anywhere on your network.

Standards-Based

Through ESRI's work with organizations, such as the Federal Geographic Data Committee (FGDC), the OpenGIS Consortium (OGC), and the International Organization for Standardization (ISO) SQL/MM (Multimedia [Spatial] Committee), ESRI has been actively participating in the definition of spatial standards, including National Spatial Data Infrastructure (NSDI) and the OGC Simple Feature Access Specification, and in the work of the two primary ISO technical committees involved in geographic standards.

ESRI was the first GIS vendor to become certified with a product that conformed to the OpenGIS Consortium (OGC) Simple Features for SQL Specification. The ArcSDE binary schema, the default schema with Microsoft SQL Server and Oracle, is fully compliant with OGC's schema but provides additional GIS data types, such as Z values, measures, annotation, and CAD binary data, that extend OGC's specification. In addition, ArcSDE is the only solution for central DBMS-based geographic management with an openly published API.

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 this project is based on ArcSDE 8, Oracle8*i*™, and a set of transactional GIS editing and analysis tools developed specifically for water companies by HSL.

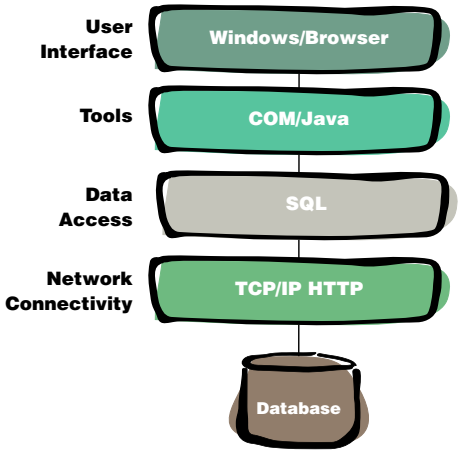
Facilitating efficient interaction between spatial data and business data systems requires integration with enterprise resource planning (ERP) systems. AQUA's system was designed to integrate with SAP™ R/3® using ArcSDE 8 for accessing SAP functionality. The design also offers GIS viewing from the SAP 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.

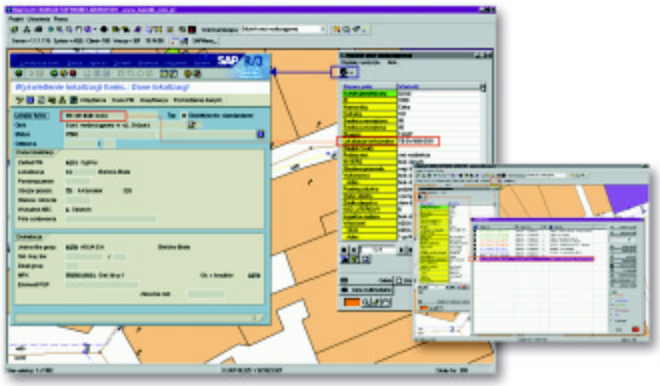
GIS Data in the DBMS

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 standard data types provided by the DBMS. If the DBMS provides for native spatial types, ArcSDE will use them. The table lists which data formats are 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. Regardless of which DBMS an organization uses, ArcSDE enables a DBMS to store all of an organization's spatial data whether it is vector, raster, or native CAD data.

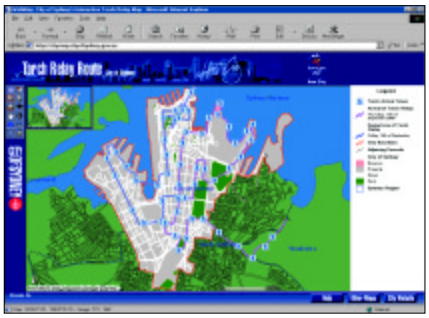


DBMS	Geometry Storage	DBMS Type
Oracle	ArcSDE compressed binary, LOB (large object)	Long raw, BLOB (binary large object)
	Oracle8*i* Spatial Object	SDO_Geometry
Microsoft SQL Server	ArcSDE compressed binary	Image
Informix	Informix Spatial DataBlade	ST_Geometry
IBM DB2	DB2 Spatial Extender	ST_Geometry

The GIS system will continue to be a strategic investment for AQUA because of its integration with not only SAP/R3 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.



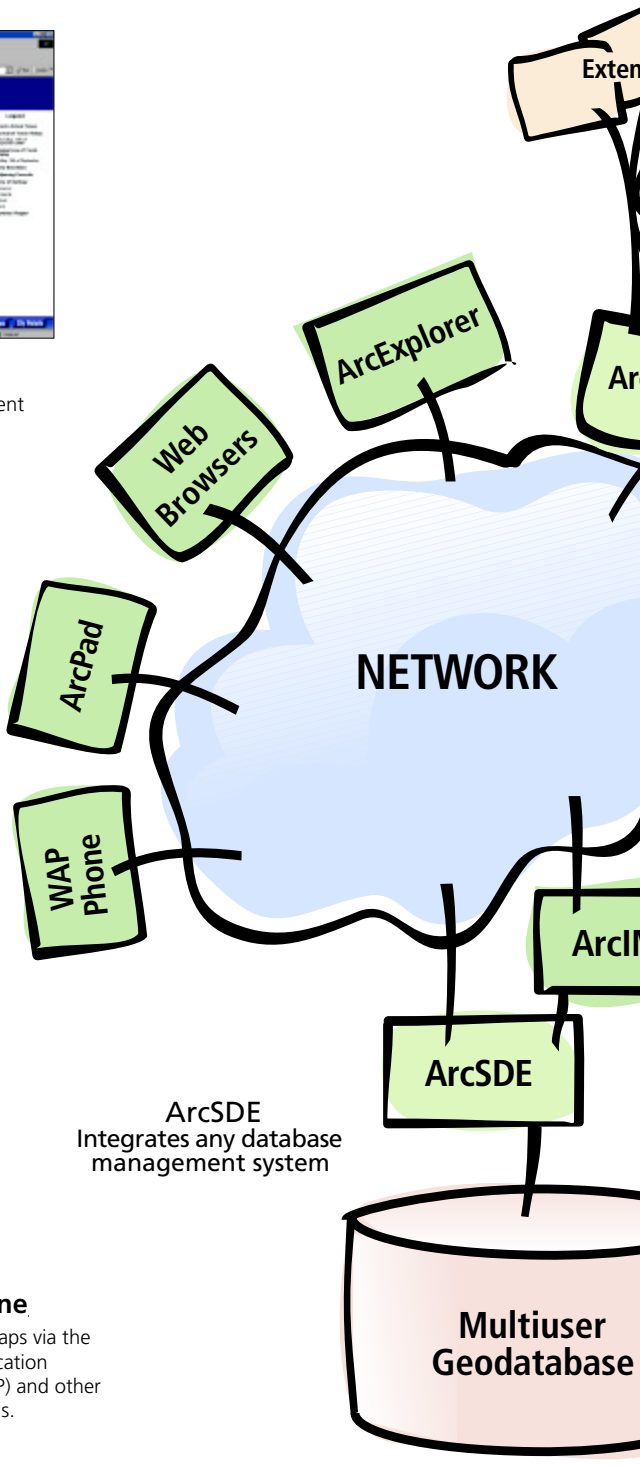
A Broad Range of Application Solutions



Web Browsers
are lightweight Web clients that complement ArcGIS Desktop.

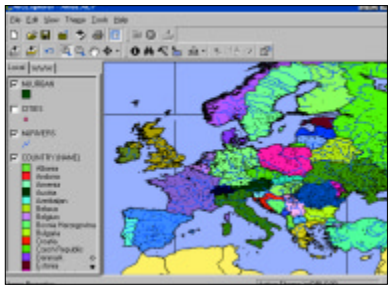
ArcPad™
is a lightweight mobile mapping solution that can retrieve maps using wireless technology.

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



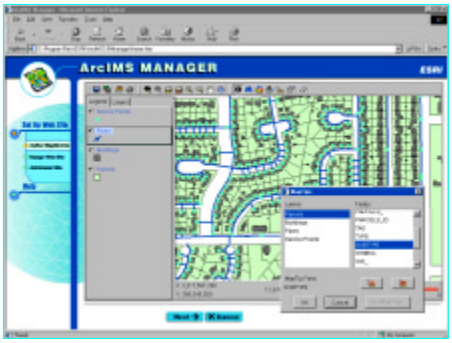
From the desktop to the enterprise, from the Internet to custom applications, ArcSDE complements ESRI's full range of client applications ensuring maximum flexibility and scalability in implementing the best solution for your needs.

Geodatabase
Supports business logic for versioning and intelligent features



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

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



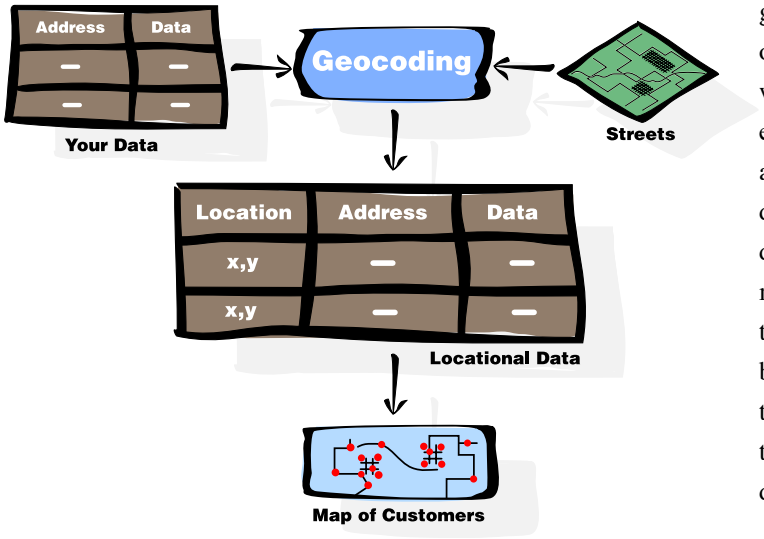
ArcIMS
is a powerful Internet mapping system that works with standard Internet server technology.

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 to integrate their core business data and in their business processes for applications such as location-based services, enterprise resource planning, and supply change 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 people throughout an organization must share spatial information to enable interorganizational collaboration and that centralized storage and management of spatial data can provide cost-effective data management by reducing data duplication and increasing accuracy. ArcSDE meets the key goal of managing your GIS in a DBMS—enter data once and allow access by many. ArcSDE, coupled with the client/server and distributed computing environments and DBMS technologies, provides a scalable, multiuser solution that utilizes a single data model to store vector, raster, and native CAD data. In addition, ArcSDE makes it possible to maintain continuous database (that is, not tiled) that can model features and behaviors required by GIS (with the geodatabase) and provides long transaction and version support for organizations that require multiple editors to maintain their database.



A Business Partner Case Study

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

Using ESRI's unique, 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.

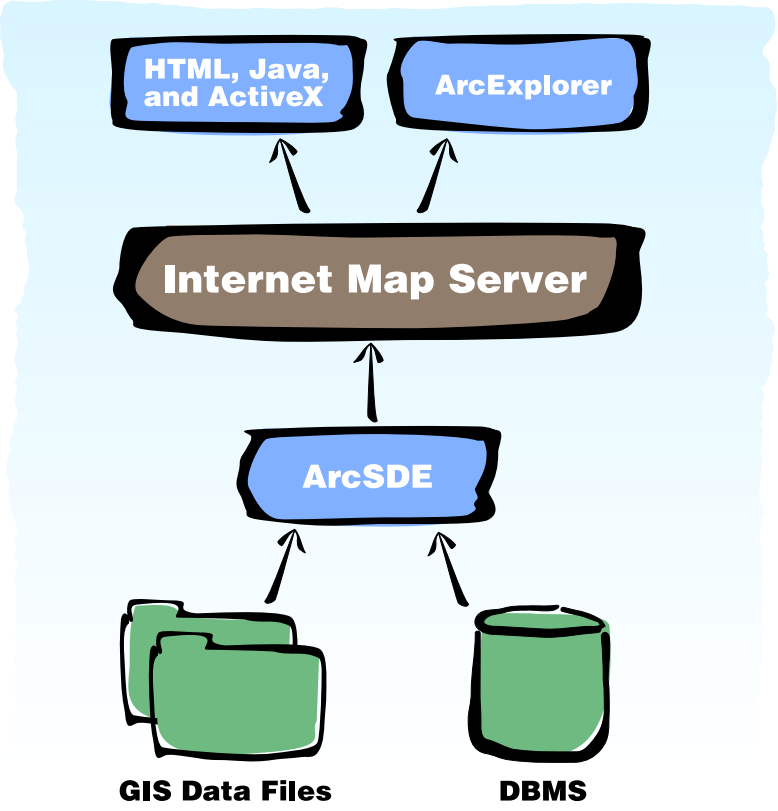
Network Engineer is "work flow centric." The program's data storage and distribution engine, ArcSDE software, can incorporate a wide variety of data sources, such as capacity planning data, market segmen-

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

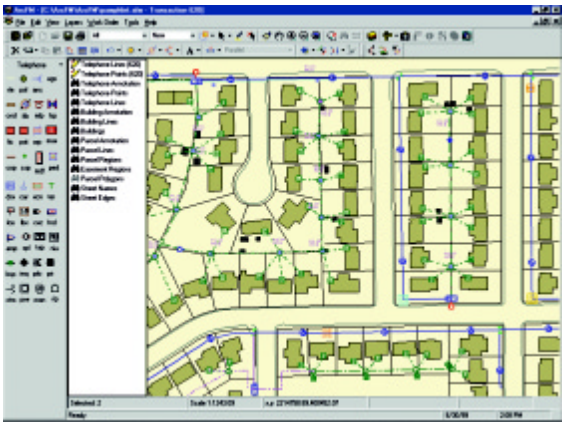
Byron Taylor
USDA Forest Service

ArcSDE works with ESRI's ArcGIS Desktop clients (ArcView, ArcEditor, and ArcInfo) and ArcIMS, ESRI's gateway for Internet mapping and distributed GIS, to provide a single integrated, scalable, database-oriented solution using a common data model and leveraging industry standards. ArcSDE also works with MapObjects® and the leading CAD applications via the ArcSDE CAD client interface. The combination of ArcSDE, ArcIMS, and ESRI's desktop client applications provides a comprehensive framework for creating, managing, sharing, and using spatial information.

Futhermore, ArcSDE works with ESRI's ArcIMS technology to provide a scalable, multitier, database-oriented solution for Internet mapping sites. This architecture has proven its ability to handle the large hit rates of busy Web sites. ESRI's ArcIMS software supports HTML, Java, and ActiveX® Web browser clients. In addition, the free ArcExplorer data viewer works with ArcIMS.



tation data, 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.



ArcSDE Includes Spatially Enabling Your DBMS

ArcSDE is a core component of ESRI's vision of an integrated scalable GIS platform where all of an organization's spatial data can be stored in a common data model, leveraging industry standards and utilizing a loosely coupled distributed architecture to serve data to any client. It is a true gateway that allows the storage of vector GIS data, raster, and CAD data within the leading commercial DBMS. This results in simple database design, administration, and data distribution. Conformance with industry standards ensures interoperability, data distribution, and data sharing.

Integrated with IT

A spatially enabled DBMS is making a major impact on the business community because it allows basic spatial query on tabular databases (i.e., geometric searches on records that have spatial coordinate association). This means that spatially enabled records can be spatially searched, aggregated, and displayed. Relating location to other core organizational data provides additional meaning and value for a broad array of business applications.

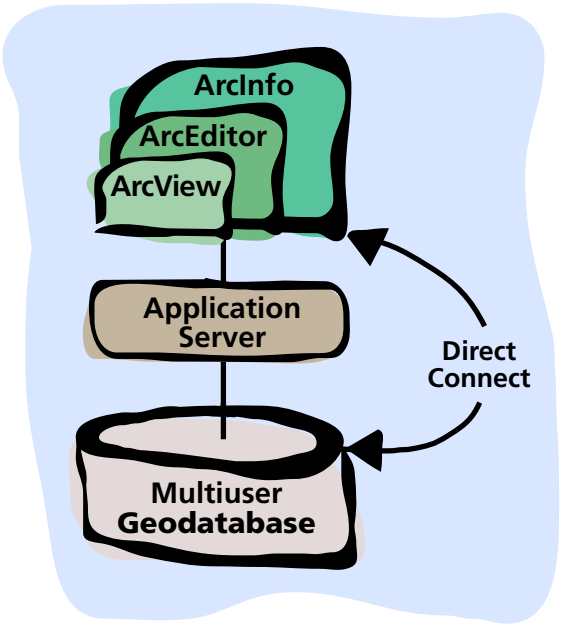
Adding spatial location to existing business applications can enable the detection of patterns and trends in the data that may otherwise have been missed. Examples of this are instances of point events for customer management and facility management. Other emerging application interactions are in the telecommunications market where there is a lot of interest by operators and network providers in providing "location services" in association with other telecommmunication or Internet services or in transportation and logistics or optimization of the flow of goods and services across a geographical network. A good way to understand this application is to consider typical consumer questions such as "Where am I?", "Where is it?", and "How do I get there?"

The spatial analysis requires the ability to associate spatial location to existing data such as customer records. ArcSDE provides serverside geocoding that assigns geographic coordinates to street addresses. This allows map query, visualization, and spatial analysis to be performed on standard DBMS data. These combined can also be analyzed and aggregated relative to other map data (e.g., districts/territories) to derive and calculate new information. ArcSDE allows users to query these data sets using various client software programs to analyze and view the various geographic layers.

Flexible Architecture

ArcSDE has been designed to allow client applications to either be connected through an application server, which then connects to the host DBMS (a three-tier architecture), or through a direct connect driver where the client application is connected directly to the DBMS (a two-tier architecture).

The two- and three-tier configurations are designed to work separately or together, giving a database administrator maximum flexibility in system design to 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.



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 to any application developed with ArcObjects or MapObjects. 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 a variety of options for creating new applications or adding ArcSDE support into existing applications. Developers can use ArcObjects, the ArcGIS Microsoft Component Object Model (COM) API. Developers can also use MapObjects to build custom applications or add spatial functionality to existing applications utilizing 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.

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 the high growth in the use of GIS, means an abundance of opportunities for application developers.

ArcSDE Support

To ensure the success of your investment in ArcSDE, ESRI provides the following:

- 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

For more information, download the ArcSDE white paper at

www.esri.com/arcsde

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 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

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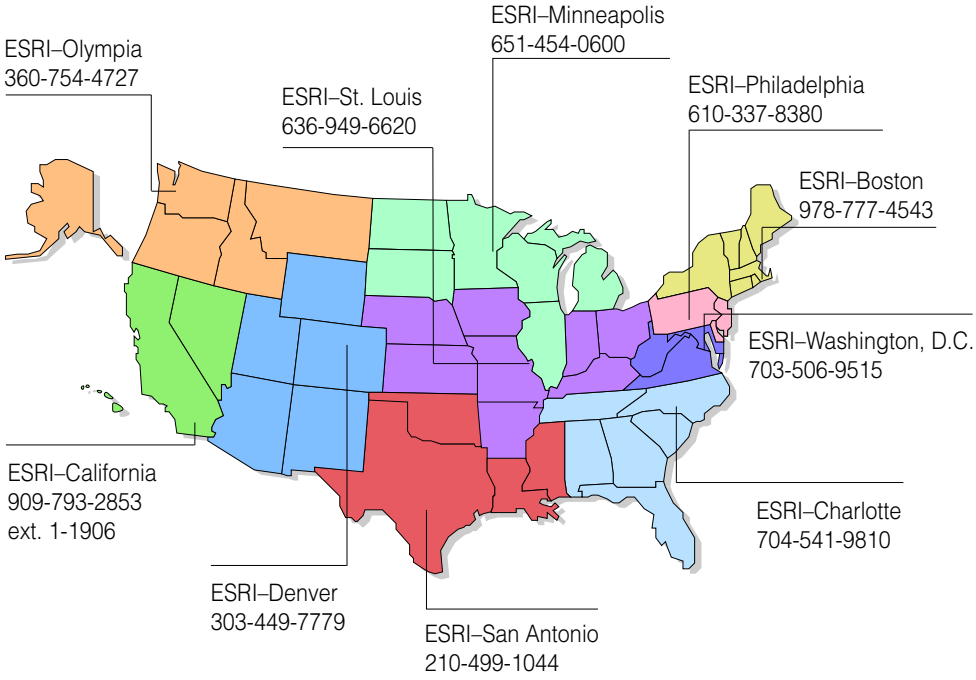

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