What is ArcGIS™ ?

GIS by ESRI™

Contents

What is ArcGIS 8.2?

The ArcGIS™ system is an integrated geographic information system (GIS) consisting of three key parts:

- ArcGIS Desktop software, an integrated suite of advanced GIS applications

- ArcSDE™ gateway, an interface for managing geodatabases in a database management system (DBMS)

- ArcIMS® software, Internet-based GIS for distributing data and services

ArcGIS provides a framework for implementing GIS for a single user or for many users. ArcGIS can be extended with additional software such as ArcPad™ for Windows® CE devices.

This short book is intended to help you understand the various parts of ArcGIS and the role each part plays in a GIS. Whether you are new to ESRI® software or are already an experienced user, this book will help you to begin to learn and understand the various parts of this new software system.

ArcGIS System
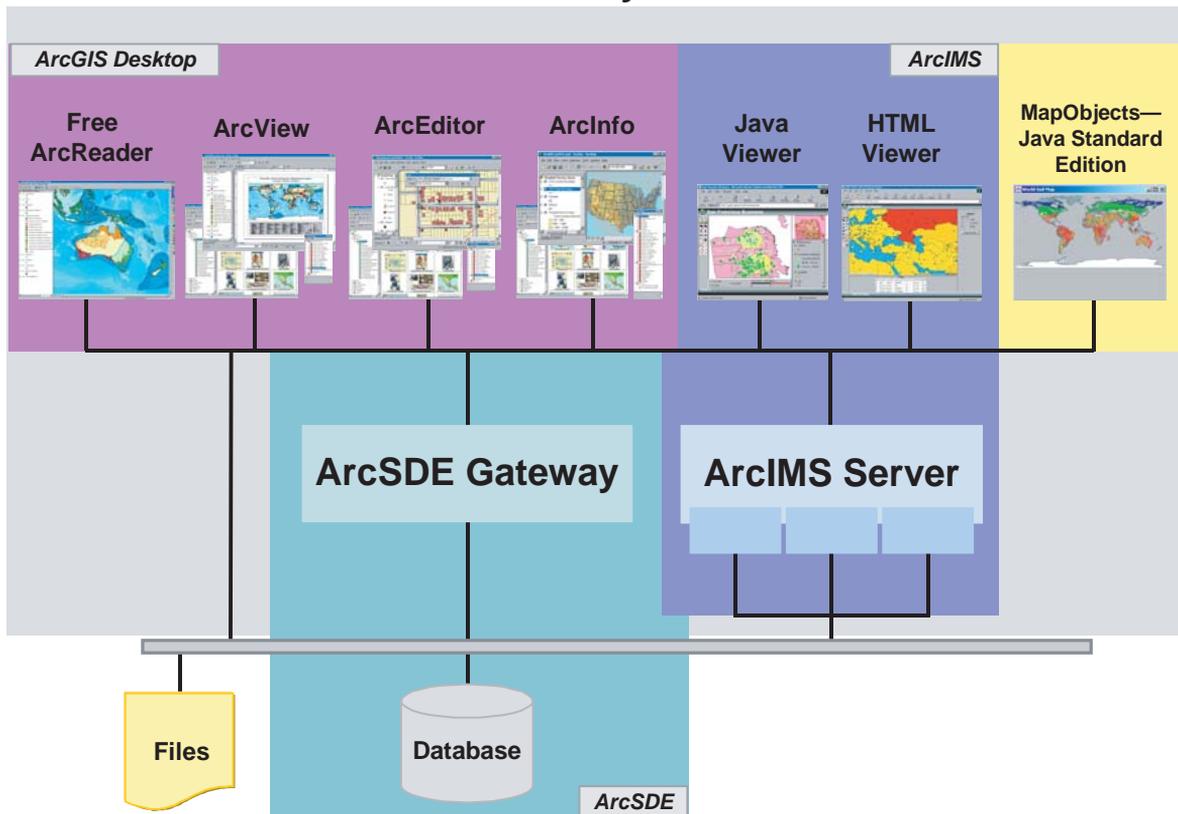
ArcGIS 8.2 is scalable

ArcGIS is a system of parts that can be deployed on a single desktop or distributed on a heterogeneous computer network of workstations and servers. Users can deploy various parts of this system to implement a GIS of any size—from a single-user system to workgroups and departments, for large enterprises, and for societal GIS systems.
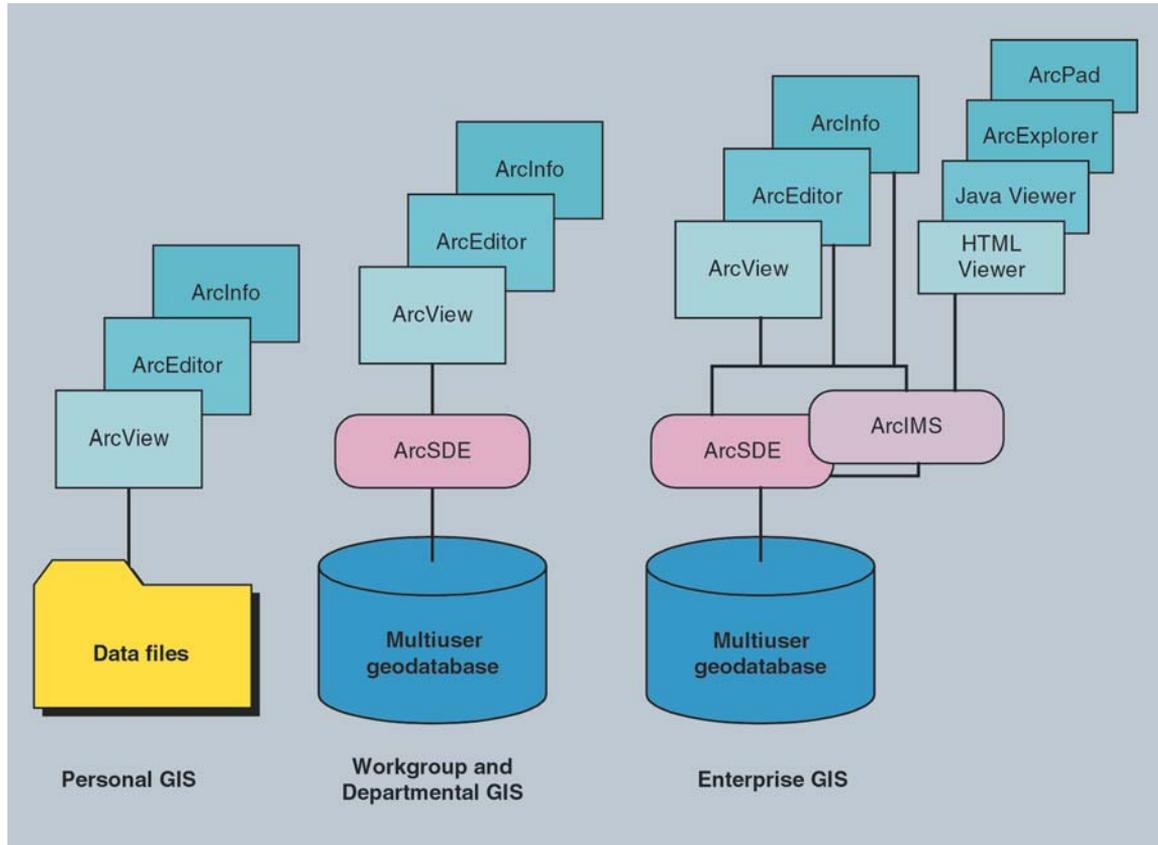
GIS data management

ArcGIS uses intelligent GIS data models for representing geography and provides all the tools necessary for creating and working with the geographic data. This includes tools for all GIS tasks: editing and data automation, mapping and map-based tasks, data management, geographic analysis, metatdata management, and deploying data and applications on the Internet.
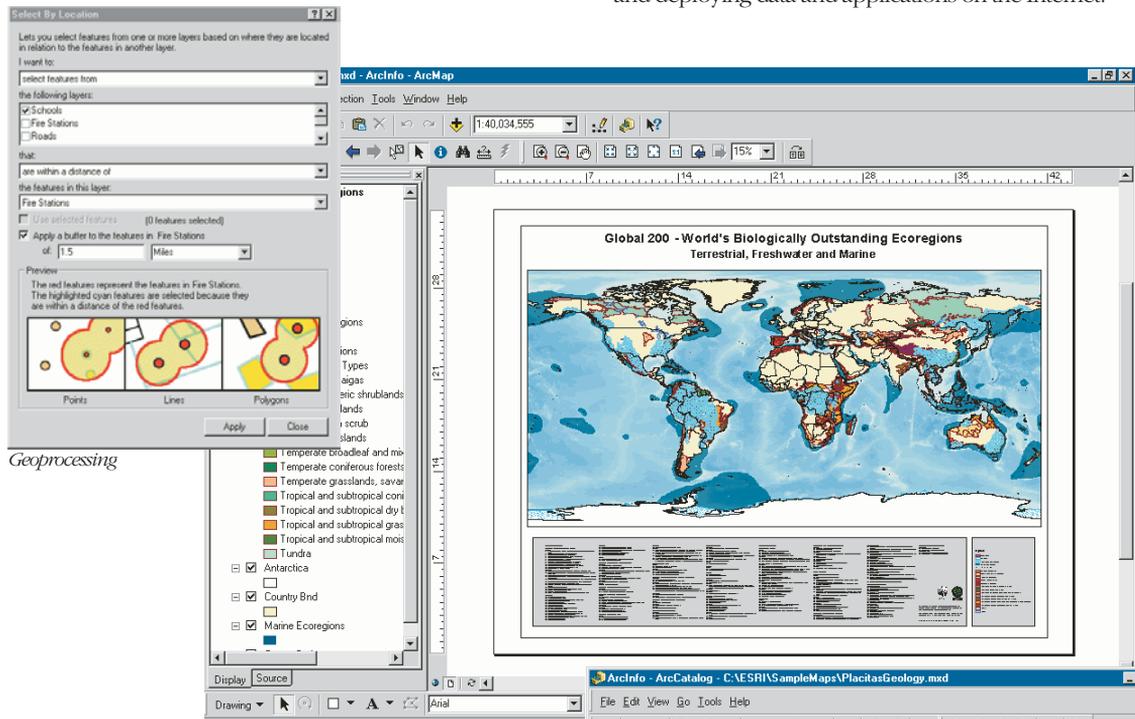
Geoprocessing

Mapping and cartography
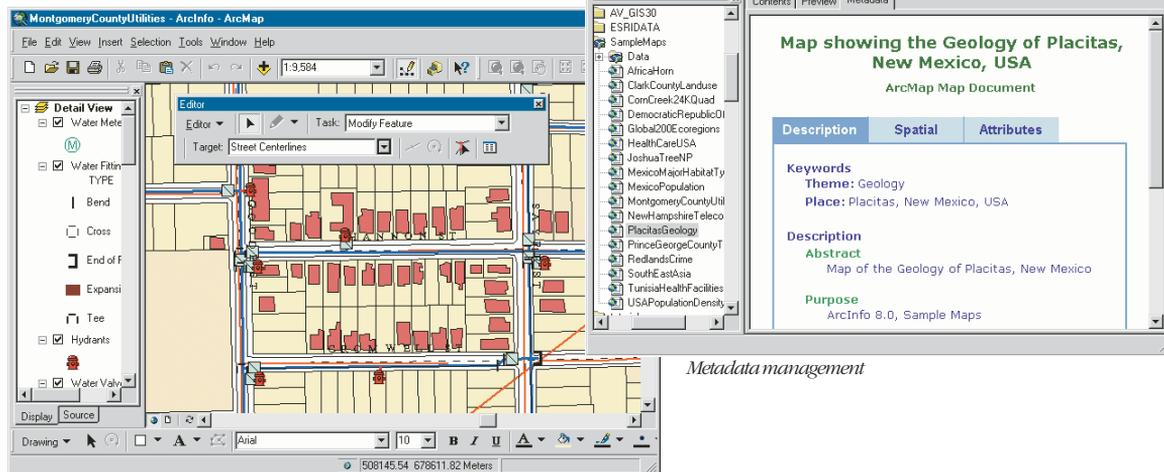
Metadata management

Editing

Geographic data models

ArcGIS has a high-level geographic data model for representing spatial information as features, rasters, and other spatial data types. ArcGIS supports an implementation of the data model for both file systems and DBMSs. The file-based models include GIS datasets, such as coverages, shapefiles, grids, images, and triangulated irregular networks (TINs). The geodatabase model manages the same types of geographic information in a DBMS, providing many of the data management benefits offered by a DBMS.

Both the file-based data models and the DBMS-based geodatabase model define a generic model for geographic information. This generic model can be used to define and work with a wide variety of different user- or application-specific models. By defining and implementing the behavior of a generic geographic data model, ArcGIS provides a robust platform for any GIS application.

File-based models: coverages, shapefiles, and others

ArcGIS 8.2 supports a file-based data model of coverages, shapefiles, and attribute tables. Grids and TINs provide additional spatial support for raster data and surfaces. The ArcGIS Desktop products—ArcView®, ArcEditor™, and ArcInfo™—include a complete set of tools for working with information in these file-based models. ArcMap™, the application for mapping and editing, works very well with all of your existing file-based data. ArcCatalog™ and ArcToolbox™, applications for managing and geoprocessing geographic datasets, also help you create and manage these file-based datasets.

The geodatabase model

ArcGIS includes the geodatabase, which is a data model for representing geographic information using standard relational database technology. The *geodatabase*—shorthand for geographic database—supports the storage and management of geographic information in standard relational database management system tables. For example, a table can be used to store a feature class where each row in the table represents a feature. Each row in the table has a shape column used to hold the geometry or shape of the feature. This fundamental relational storage model adheres to the Open GIS Consortium (OpenGIS® or OGC) and the ISO simple features specification. In addition to vector features, all other spatial data types can be managed and stored in the relational tables, allowing you the opportunity to manage all your spatial data in one DBMS.
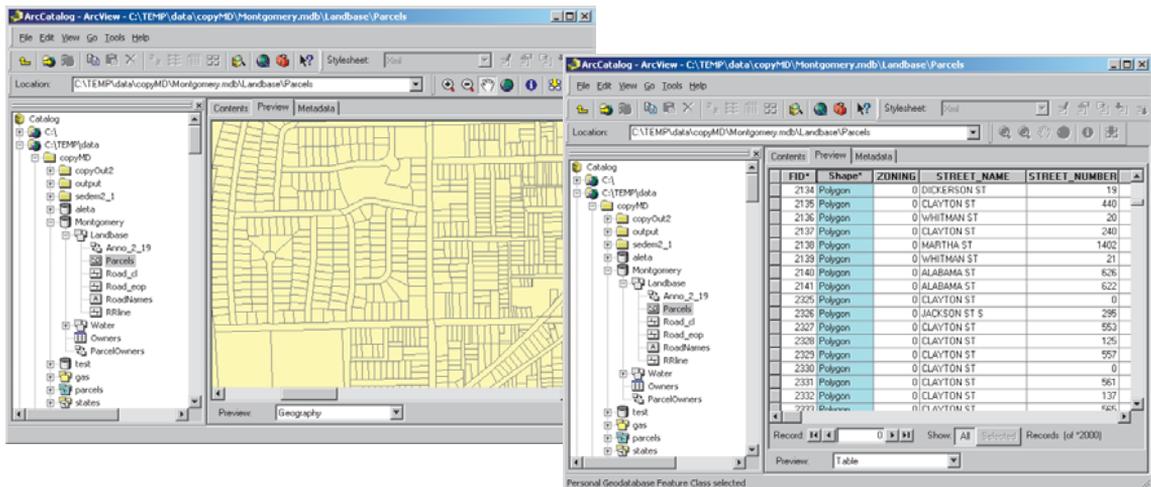
Two views in ArcCatalog of a feature class in the geodatabase. The first shows a geographic view, while the second shows the table or storage view. Each row in the table represents a feature.

Using the geodatabase, additional integrity rules and behavior can be defined for your spatial data to model important geographic objects, such as networks, topologies, terrains, and image catalogs. For example, you can model the integrity rules for census geography:

• Census Blocks cannot overlap one another.

• Census Blocks must fully cover a Census Block Group.

• Census Blocks must be contained (nest) within and share the boundaries of the Block Group.

Integrity rules and behavior are implemented on the feature tables using what are referred to as controlling or mediator *objects* (i.e., software components that animate the rules and behavior). The geodatabase is thus described as an *object-relational* data model.

Users who are familiar with coverages, shapefiles, and imagery will readily understand the geodatabase. The geodatabase builds on the same spatial data concepts as coverages, shapefiles, and grids but adds important new capabilities. For example, the geodatabase extends the coverage and shapefile models with support for advanced geometry—3D coordinates, measures, and true curves—complex networks, relationships among feature classes, planar topology, and other object-oriented features. Raster types in the geodatabase provide one common unified means for managing all raster data formats, such as multiband images, grids, and compressed raster formats.

An excellent book, *Modeling Our World,* comes with ArcInfo and ArcEditor and is a great way to learn more about geodatabases.

What is ArcGIS Desktop?

ArcGIS Desktop includes a suite of integrated applications: ArcMap, ArcCatalog, and ArcToolbox. Using these three applications together, you can perform any GIS task, simple to advanced, including mapping, data management, geographic analysis, data editing, and geoprocessing. In addition, ArcGIS 8.2 allows you to tap into an abundance of spatial data and resources available through ArcIMS services on the Internet.

ArcGIS Desktop is a comprehensive, integrated, scalable system designed to meet the needs of a wide range of GIS users.
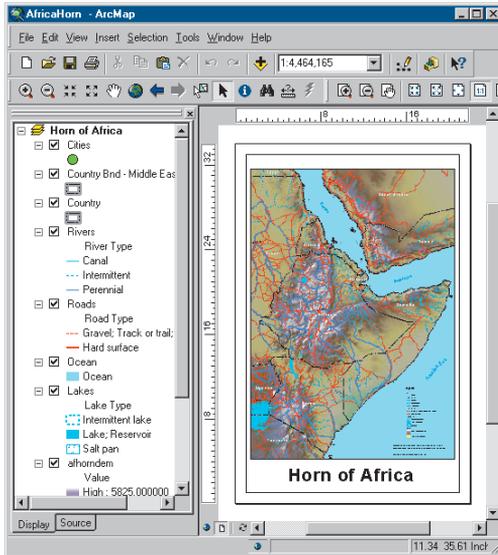
ArcMap is used for all mapping and editing tasks as well as for map-based analysis.
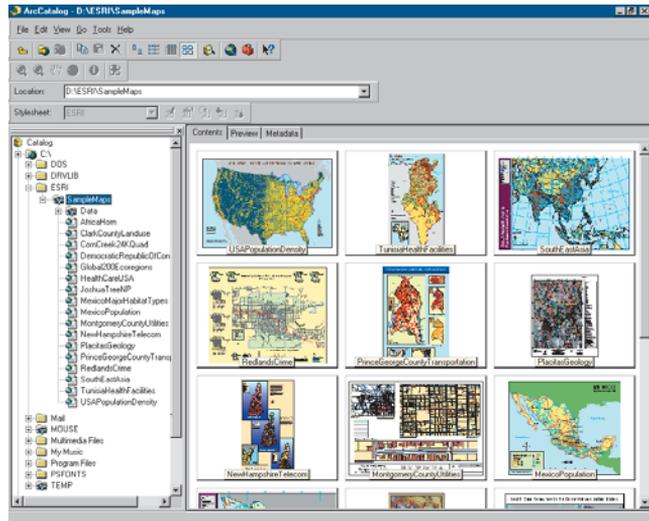
ArcCatalog is the application for managing your spatial data holdings and database designs and for recording, viewing, and managing metadata.
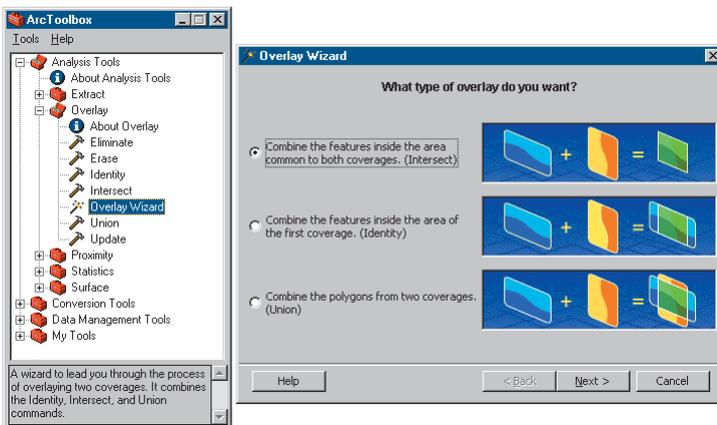
ArcToolbox is used for data conversion and geoprocessing.

ArcMap

ArcMap is the central application in ArcGIS Desktop. It is the GIS application used for all map-based tasks including cartography, map analysis, and editing.

In this application, you work with maps. Maps have a page layout containing a geographic window, or view, with a series of layers, legends, scale bars, North arrows, and other elements.

ArcMap offers different ways to view a map—a geographic data view and a layout view—in which you can perform a broad range of advanced GIS tasks.
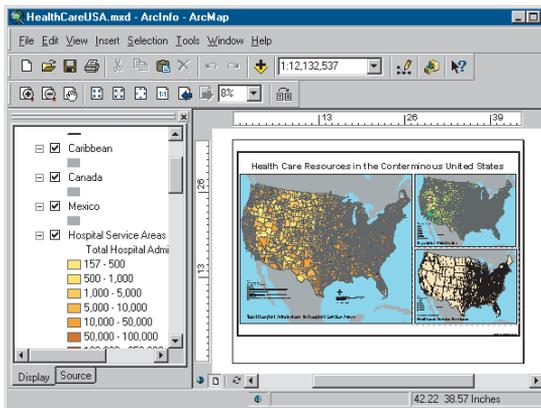
Design and create publication-quality maps.
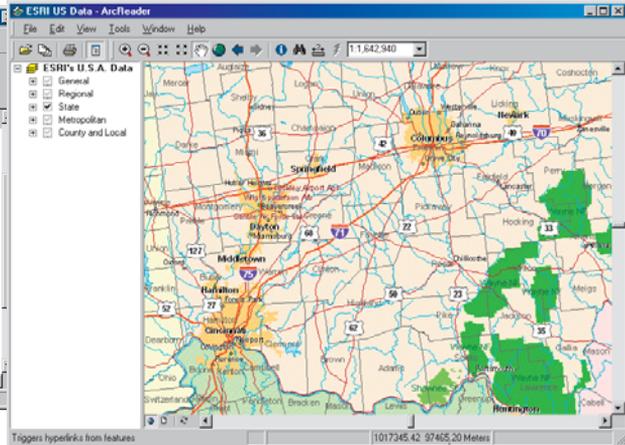
Author and share maps with ArcReader™ and the ArcIMS ArcMap Server.
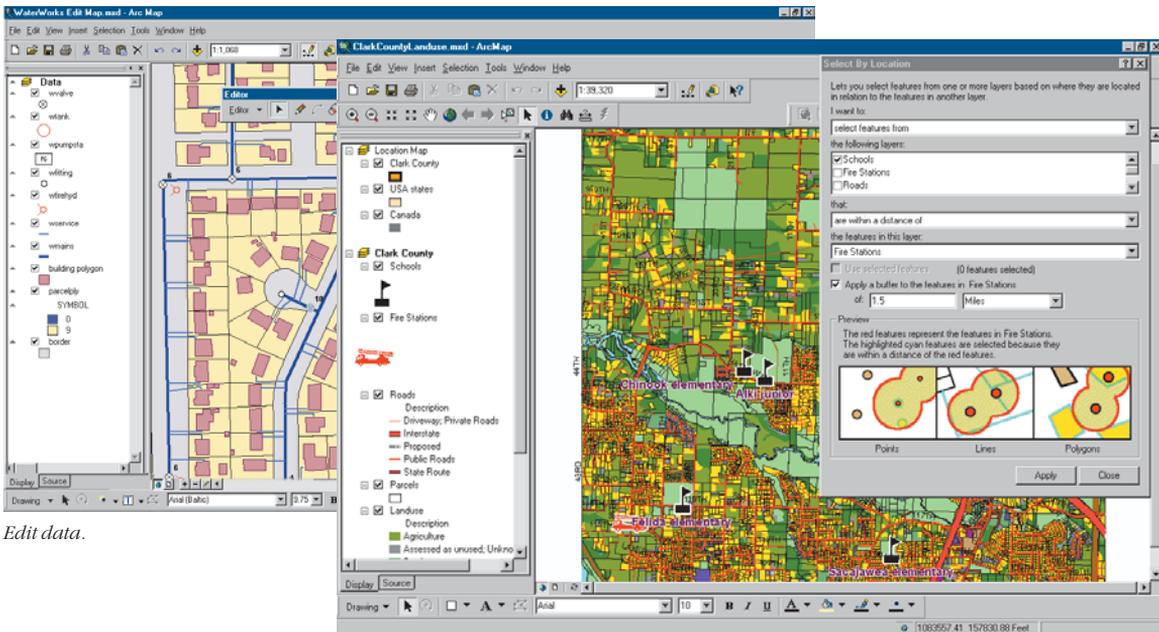
Edit data.

Analyze data.

ArcCatalog

The ArcCatalog application helps you organize and manage all of your GIS data. It includes tools for browsing and finding geographic information, recording and viewing metadata, quickly viewing any dataset, and defining the schema structure for your geographic data layers.
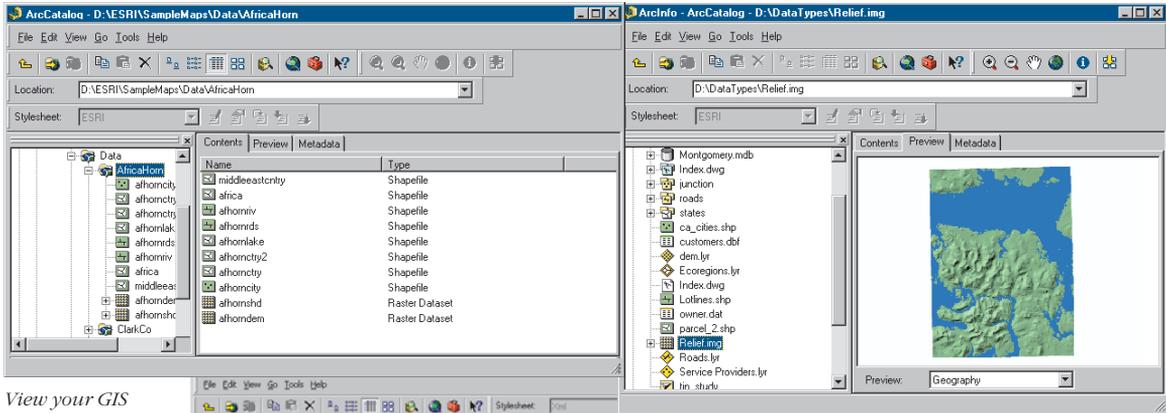
View your GIS data holdings.

Preview geographic information.
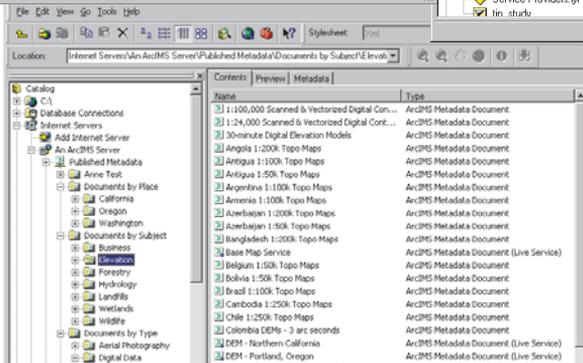
Organize and manage the Catalog in an ArcIMS Metadata Server.
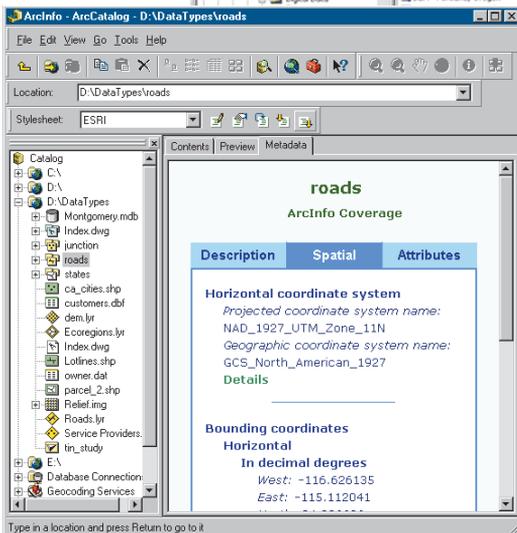
View and edit metadata.
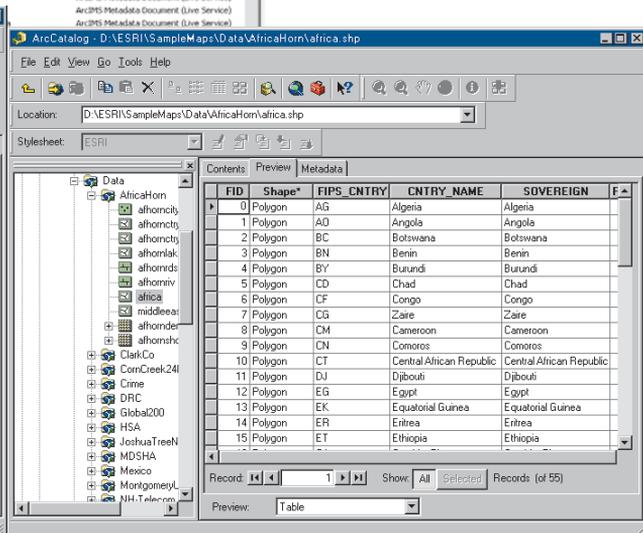
Work with tables.

ArcToolbox

ArcToolbox is a simple application containing many GIS tools used for geoprocessing. There are two versions of ArcToolbox: the complete ArcToolbox that comes with ArcInfo and a lighter version that comes with ArcView and ArcEditor software.
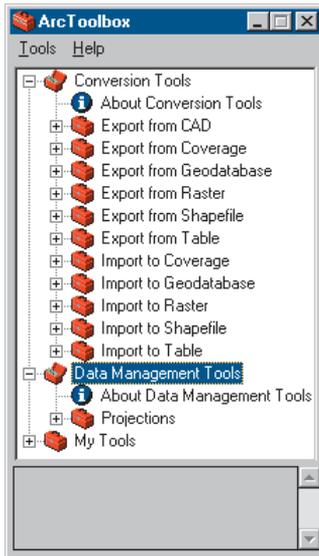
ArcToolbox for ArcView and ArcEditor contains more than 40 commonly used tools for data conversion, map projection, and data management.
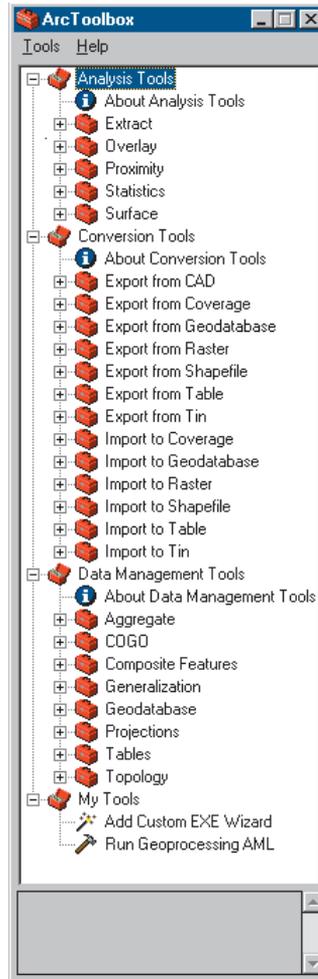
ArcToolbox for ArcInfo comes with a complete, comprehensive set of tools (well over 150) for geoprocessing, data conversion, map sheet management, overlay analysis, map projection, and much more.
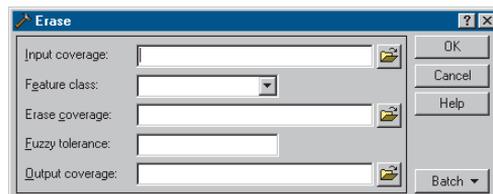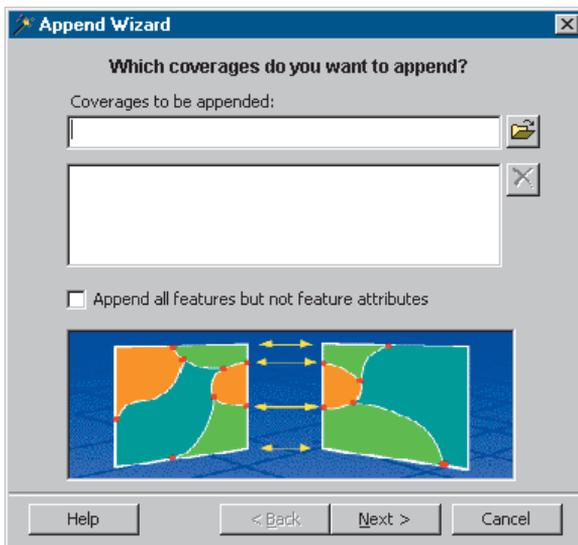
The tools and wizards in ArcToolbox make data conversion and geoprocessing easy.

Putting them all together

ArcMap, ArcCatalog, and ArcToolbox are designed to work together to perform all GIS tasks. For example, you can search for and find a map document in ArcCatalog, then open it in ArcMap by double-clicking it in the Catalog. You can then edit and enhance your data through the tools available in the ArcMap editing environment.
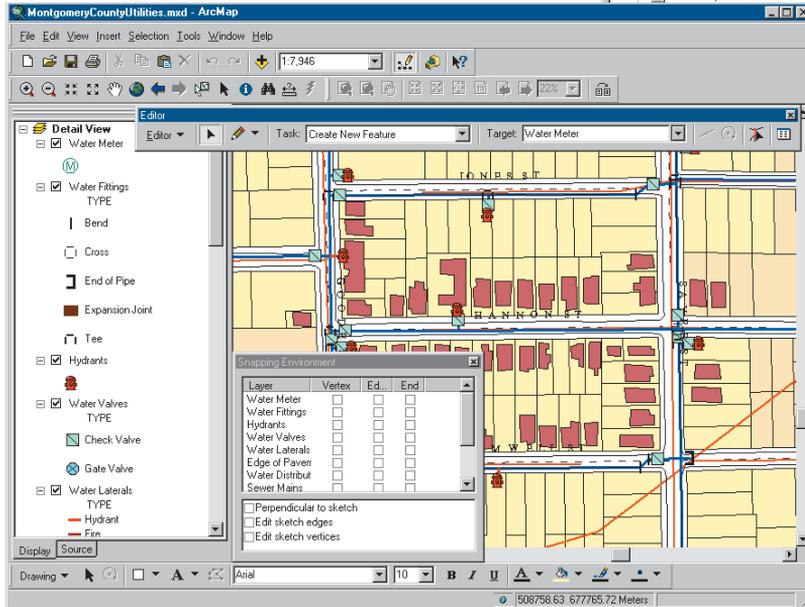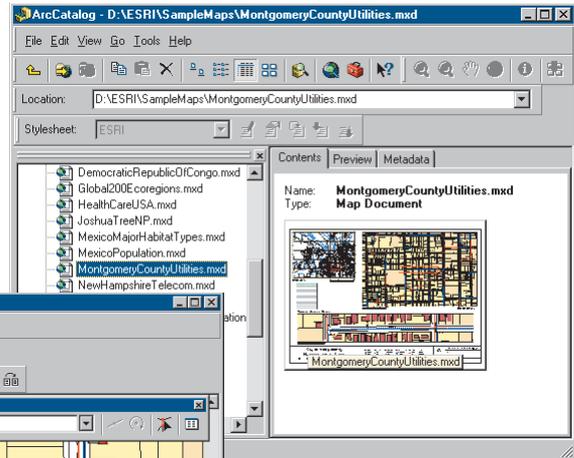
Double-clicking a map in ArcCatalog (above) opens it in ArcMap (left). The view in the ArcMap window (left) has been set to data view, and the Editor toolbar is displayed.

You can search for data in another location through the database connections in ArcCatalog. Once you have found the data you're interested in, you can drag and drop it as a layer in ArcMap. You can also drag and drop data from ArcCatalog onto tools in ArcToolbox.
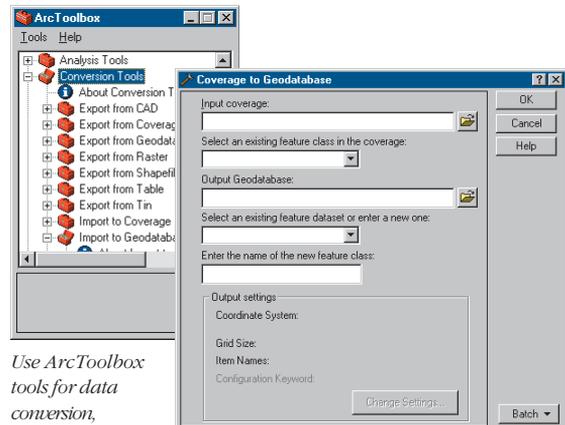
Use ArcToolbox tools for data conversion, projection, and analysis.

Once you have created new geographic information using these three applications, you can record metadata for the resulting datasets using ArcCatalog.
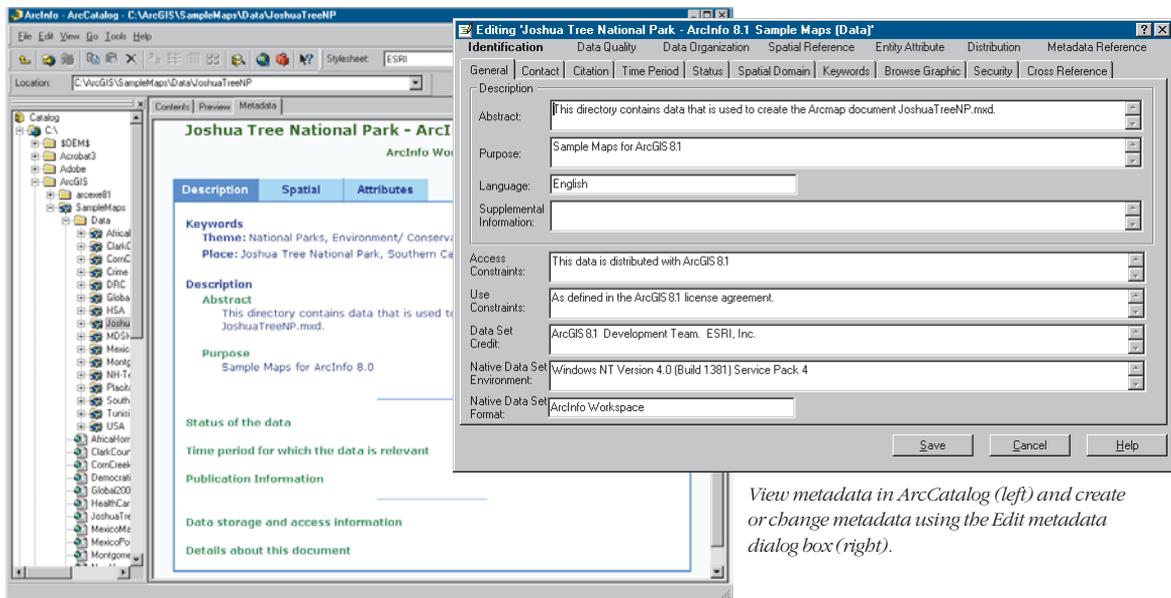
View metadata in ArcCatalog (left) and create or change metadata using the Edit metadata dialog box (right).
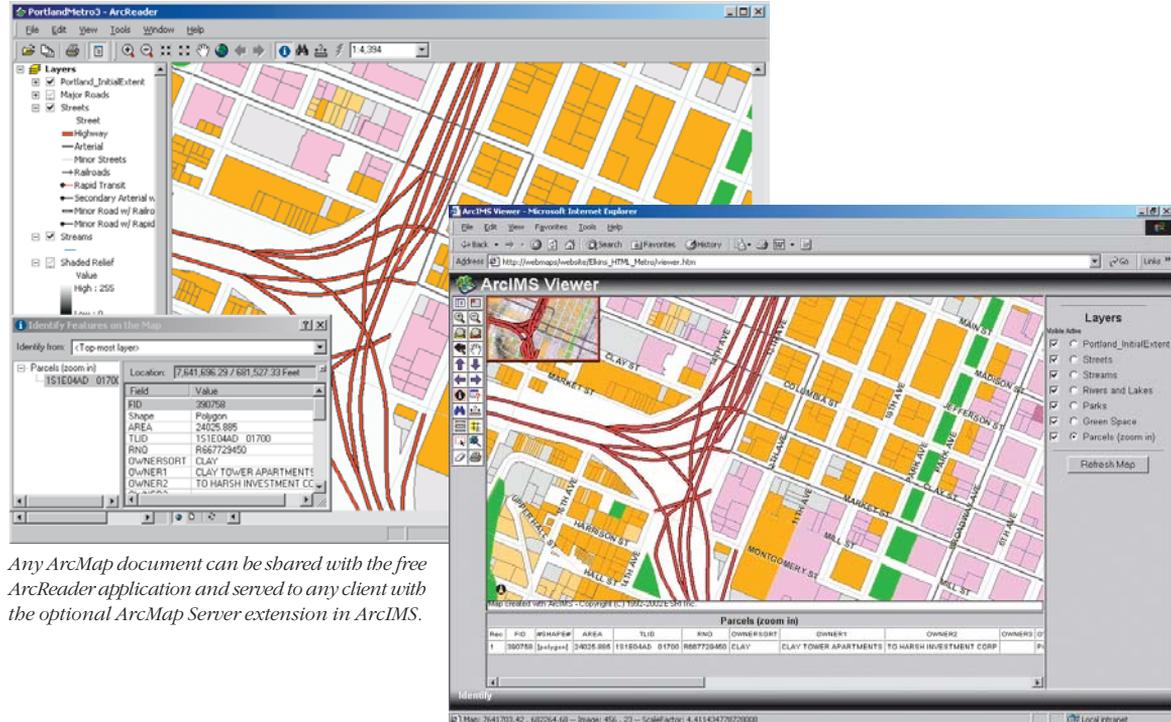
Any ArcMap document can be shared with the free ArcReader application and served to any client with the optional ArcMap Server extension in ArcIMS.

Compatible data formats

A fundamental goal of ArcGIS is the ability to work with all your file-based data and DBMS data as well as with ArcIMS services. ArcMap and ArcCatalog let you work with an extensive array of data sources, such as computer-aided design (CAD) files, numerous image and table formats, and many other data types. You can view and manage these data sources in ArcCatalog, record and manage their metadata, and search for data sources based on their content. In ArcMap, map layers can be created

from any of these data sources. You can also perform query operations, on-the-fly map projections, table joins, and map analysis on any of these data sources.

Perhaps most exciting is the ability to work with ArcIMS services in ArcMap and ArcCatalog, just as you would any other data source in your GIS. This opens up ArcMap to a whole new world of GIS on the Internet. ArcMap allows you to perform virtually any mapping or map analysis operation on an ArcIMS data source.
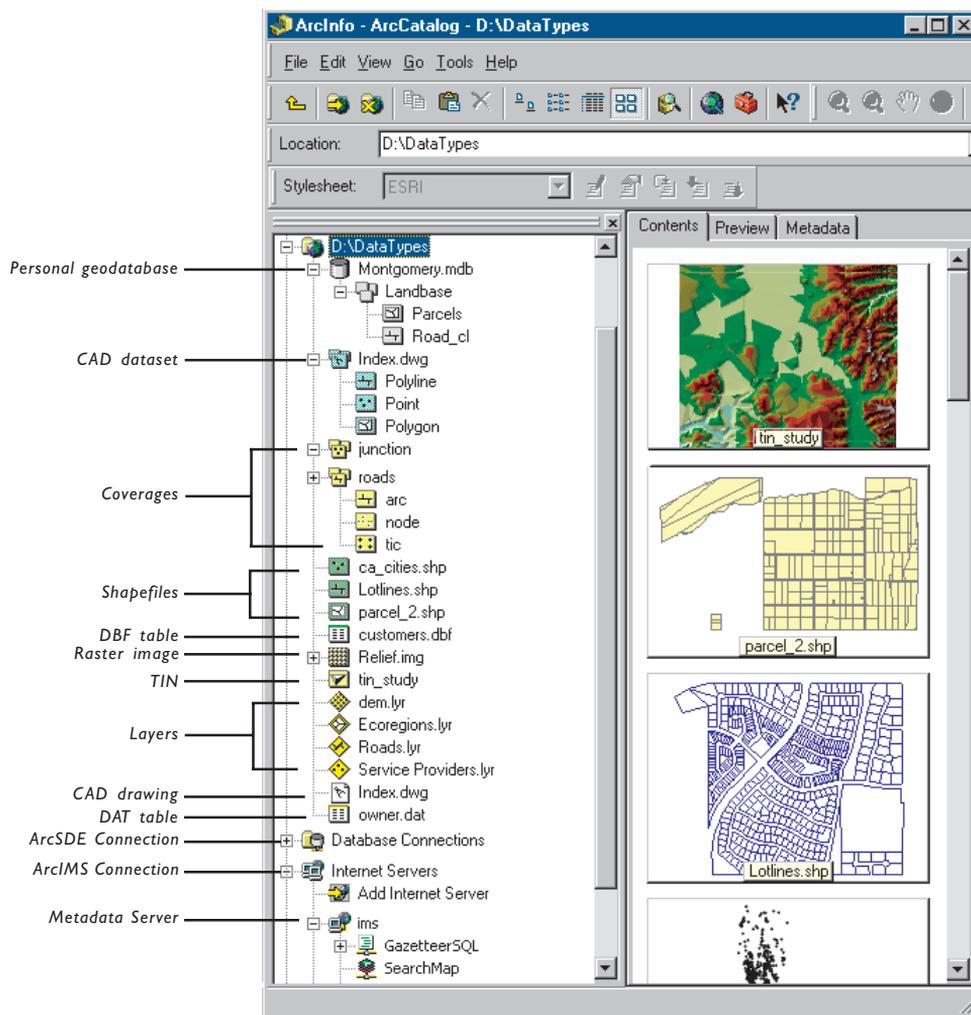
ArcView, ArcEditor, and ArcInfo can work with a wide range of data formats and connect to relational databases (via ArcSDE) to ArcIMS services including new Metadata Services.

What are ArcView, ArcEditor, and ArcInfo?

ArcGIS Desktop can be accessed using three software products, each providing a higher level of functionality.

ArcView provides comprehensive mapping and analysis tools along with simple editing and geoprocessing tools.

ArcEditor includes advanced editing capabilities for coverages and geodatabases in addition to the full functionality of ArcView.

ArcInfo extends the functionality of both to include advanced geoprocessing. It also includes the legacy applications for ArcInfo Workstation (Arc, ArcPlot™, ArcEdit™, and so on).

	ArcView, ArcEditor, and ArcInfo	ArcEditor and ArcInfo	ArcInfo only
Data support	• Work with shapefiles, coverages, geodatabases, and ArcIMS services • Work with the Geography Network℠ • Work with any DBMS • Work with many table formats • Read access to any geodatabase • Work with many raster formats	• Full read-write and transactional access to any geodatabase • Load rasters into DBMS with ArcSDE	
Cartography	• Advanced mapping and query • Map authoring • Map templates • Thousands of symbols and styles		• ArcPlot: command-based mapping application
Map analysis	• Advanced map analysis • Report writing • Charting and business graphics		
GIS data management	• New ArcCatalog application for GIS data management • Schema management for shapefiles • Metadata creation and management	• Schema management for coverages and geodatabases • Version management on any multiuser geodatabase (ArcSDE required)	
Editing	• Edit shapefiles and simple, personal geodatabases	• Edit coverages and all geodatabases • Versioning tools • Dimensions	• ArcEdit: command-based editing application
Geo-processing	• Simple geoprocessing and data conversion • Create shapefiles and simple, personal geodatabases • Load shapefile data into simple, personal geodatabases	• Create and load advanced geodatabases	• Arc: command-based application • Full geoprocessing and data conversion • Vector overlay • Managing map sheets • Map projection and coordinate management • Remote geoprocessing server
Developer tools	• Customization with VBA • ArcObjects™ COM Library • GUI customization		• AML™ & ODE in ArcInfo Workstation

Because ArcView, ArcEditor, and ArcInfo all share a common architecture, users working with any of these clients can share their work with other users. Maps, data, symbology, map layers, custom tools and interfaces, reports, metadata, and so on, can be accessed interchangeably in all three products. This means that you get the benefit of using a single architecture, minimizing the need to learn and deploy several different architectures.

In addition, maps data, and metadata created with ArcGIS Desktop can be shared with many users through the use of free ArcReader seats and advanced GIS Web services using ArcIMS.

The capabilities of all three levels can be further extended using a series of optional add-on software extensions such as ArcGIS Spatial Analyst and ArcPress™. For more information on the extension software, see 'Optional extensions for ArcGIS Desktop' later in this section.
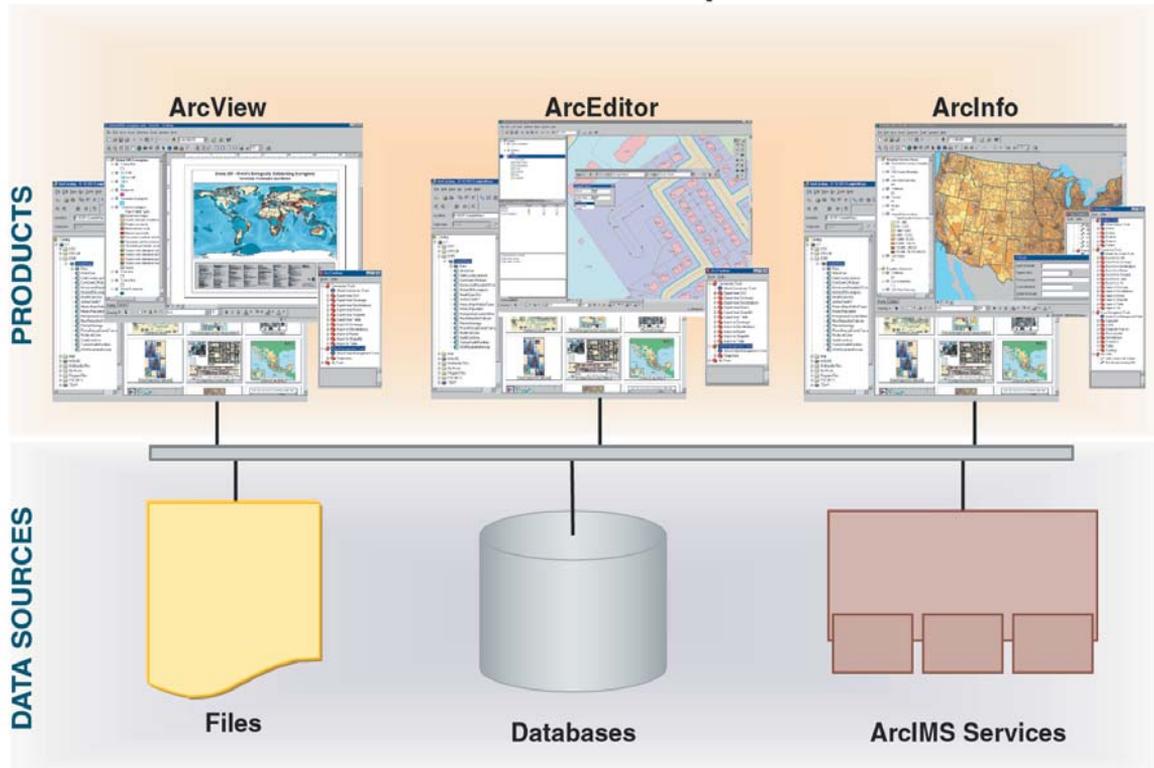
ArcGIS Desktop is available in three options: ArcView, ArcEditor, and ArcInfo. All three share a common user interface and developer tools and work with the same data.

What is ArcView 8.2?

ArcView 8.2 is one of the three functional product levels at which you can use ArcGIS Desktop. ArcView 8.2 is a suite of three applications: ArcMap, ArcCatalog, and ArcToolbox. It is a powerful toolkit for mapping, reporting, and map-based analysis.

ArcView 8.2 offers many exciting capabilities including expanded symbology and editing tools, metadata management, and on-the-fly projection.

ArcView
- ArcMap
- ArcCatalog
- ArcToolbox

Map interaction
- Panning and zooming
- Identifying
- Hotlink/Hyperlink to external application, macro, or URL
- Interactive Selection tool
- Map tips
- Magnification and overview windows
- Spatial bookmarks
- Dynamically updated selections between maps, tables, and graphs

Map creation
- Data display: multilayer data transparency and on-the-fly projection of features and rasters between coordinate systems (including datum transformation)
- Data classification
- Symbology
- Labeling
- Layout and printing: inserting objects such as titles and legends, multiple data frames, wizards and predefined styles for constructing legends and neatlines, and graphic export

Map analysis
- Selection operations: Interactive selection, Select by Attribute, Select by Location, etc.
- Analysis operations: Buffer, Clip, Merge, Intersect, Union, Spatial Join
- Visualization and analysis: Graphs and reports

Data creation
- Editing shapefiles and simple personal geodatabases
- Rectification of images
- Rotating and flipping images
- Feature construction and editing
- Snapping
- Digitizer tablet support
- Geocoding and events
- Dynamic segmentation

Data management
- Importing ArcView GIS 3 .apr and .avl files
- Data support tools: creating new data files, exporting and importing data, direct support of many data formats, etc.
- Tabular data management
- Metadata viewing and editing
- Data search in ArcCatalog

Application framework
- Standard Microsoft Windows look and feel
- Dockable toolbars
- Full international support for data and attributes
- Customizable interface
- Extensible functionality using COM and COM-compliant languages
- Creating macros using VBA
- Inserting OLE objects inside ArcMap

ArcView 8.2 is functionally equivalent to ArcView GIS 3—tasks you performed with ArcView GIS 3 can be done with ArcView 8.2.

In addition, many more exciting capabilities have been added in version 8.2. For example, both symbology and editing tools have been greatly expanded, and the standard Windows interface comes equipped with multiple wizards to help you create, maintain, and update your data and maps. Other additional capabilities include metadata management and data searching with ArcCatalog, simple geodatabase editing, annotation support, on-the-fly projection of features and rasters between coordinate systems, and the ability to connect to and use ArcIMS services. ArcView 8.2 can also be customized using the industry-standard Microsoft® Visual Basic® for Applications (VBA), which is included with ArcView 8.2.

What is ArcEditor 8.2?

ArcEditor is a relatively new product that adds advanced editing. Its capabilities fall between those of ArcView and ArcInfo.

ArcEditor contains all the capabilities that you find in ArcView 8.2. Plus, it adds schema management capabilities for all geodatabase models in ArcCatalog and advanced geodatabase and coverage editing in ArcMap.

When you have access to a DBMS via ArcSDE, multiuser geodatabases can be edited and maintained with complete version management in ArcEditor. This includes advanced tools for version management—for example, version merging tools to identify and resolve conflicts.

For more information on ArcSDE, see the section 'What is ArcSDE?'.

ArcEditor = ArcView +

ArcMap
ArcCatalog
ArcToolbox

Data creation
- Editing coverages
- Editing geodatabases stored in a multiuser DBMS
- Editing geodatabases participating in networks and relationships
- Establishing relationships between feature classes or attributes
- Creating and editing multiple versions in multiuser geodatabases
- Resolving conflicts between versions in multiuser geodatabases
- Creating and editing dimension features
- Defining dimension feature attributes
- Creating feature-linked annotation, linked to features in the geodatabase
- Catalog and editing geometry networks

Data management
- Loading data (including rasters) into multiuser geodatabases
- Creating subtypes for geodatabases
- Creating logical networks for geodatabases

ArcEditor offers the same three applications as ArcView 8.2—ArcMap, ArcCatalog, and ArcToolbox—but with advanced editing capabilities.

What is ArcInfo 8.2?

ArcInfo is the most functionally rich client in ArcGIS Desktop. The high-end ArcInfo product provides all the capabilities of ArcView and ArcEditor 8.2. In addition, it includes the complete ArcToolbox application that supports advanced geoprocessing and polygon processing as well as the classical workstation applications and capabilities such as Arc, ArcPlot, and ArcEdit. By adding advanced geoprocessing, ArcInfo is the complete GIS data creation, update, query, mapping, and analysis system.
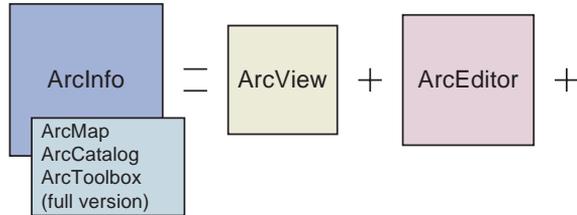
ArcInfo	=	ArcView	+	ArcEditor	+	

ArcInfo
ArcMap
ArcCatalog
ArcToolbox
(full version)

ArcInfo Workstation support
- Arc
- ArcPlot
- ArcEdit
- AML and ODE
- Full legacy system support

Coverage creation and management
- Capturing and editing survey data (COGO)
- Vectorizing raster images (ArcScan)
- Creating and maintaining topology
- Establishing z-values on nodes
- Native coverage editing environment
- Conflation tools

Spatial relationships and analysis
- Contiguity tools to find adjacent areas
- Complete dynamic segmentation
- Supply and demand analysis (location allocation)
- Solving complex routing problems
- Querying regions
- Classic spatial overlays (Union, Intersect, and Identity)

Data management
- Complete ArcToolbox application
- Direct data conversion for more than 30 other data formats (ADS, DFAD, DIME, DLG, VPF, and so on) into a native ArcInfo format
- Reading and converting several raster and CAD formats
- Building geometric networks
- Defining a projection and projecting data
- Building topology
- Data transformation
- Map overlay and buffer
- Map sheet manipulation
- INFO table management

Customization environments
- ODE components: ARC Automation Server, ArcPlot, ArcEdit, and Grid OCX
- Java Beans: Arc Bean, ArcPlot Bean, ArcEdit Bean, and Grid Bean
- Arc Macro Language (AML)—a platform-independent scripting language used for application development in the ArcInfo Workstation environment

ArcInfo provides all the capabilities of ArcView and ArcEditor 8.2 as well as additional advanced geoprocessing functionality. The ArcInfo version of ArcToolbox is important for sites that build and create spatial databases.

Managing ArcGIS Desktop

As explained earlier in this chapter, you can use ArcGIS Desktop at any of three product levels: ArcView, ArcEditor, and ArcInfo. You can purchase the following ArcGIS Desktop software licenses: ArcView (single use or floating), ArcEditor (floating), and ArcInfo (floating).

All products have the same data access, extensions, developer tools, and user interface. They also have a direct read-only connection to a DBMS—for example, to Oracle® and Microsoft SQL Server™.

ArcView is the only ArcGIS Desktop software product available as a single-use license. With a single-use license, you can install and use each copy of ArcView on only one machine.

ArcView is also available as a floating license, as are ArcEditor and ArcInfo. A floating license offers ArcGIS Desktop users a large amount of flexibility. The license manager that you get with a floating license allows you to install your ArcGIS Desktop software on as many machines as you want. The license manager, installed on the network, notes the number of copies of the software that can be run simultaneously. This means that more users can have the software installed than will actually be using it at one time. This is very helpful for organizations that have several users who don't use the software on a full-time basis. Plus floating seat users can share the use of ArcGIS Desktop extensions (e.g., ArcGIS Spatial Analyst, ArcGIS 3D Analyst™).

For example, suppose several users in your organization need ArcEditor. When you purchase an ArcEditor license, you choose the number of seats you want. Because you are free to install the software on as many machines as you want, many different users can have access to the software at various times.

The number of licenses you purchase determines the number of people who can use the software simultaneously. The license manager keeps track of the available licenses. Once a user starts ArcEditor on his machine, the license manager checks out a seat license. When the user exits ArcEditor, the license is checked back in.

A floating seat is flexible in another respect as well. Suppose you purchase a floating license of ArcView for the main purpose of performing simple feature editing. With this license, you get a license file with an ArcView keycode. Later, your users may need to edit multiuser geodatabases, a capability supported
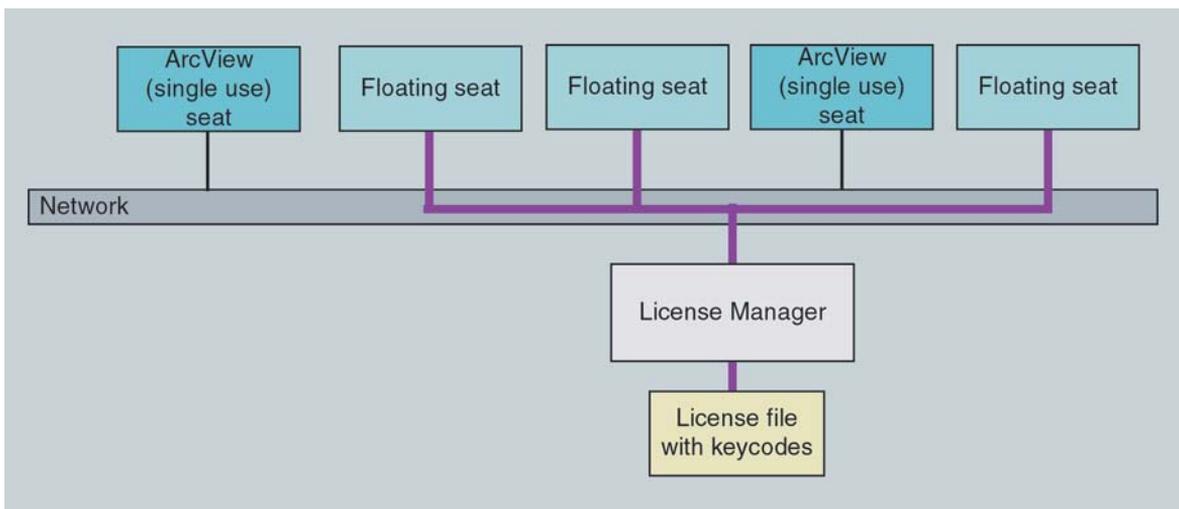
The license manager that you get with a floating license of your ArcGIS Desktop software allows you to install the software on as many machines as you want. The number of seats in your floating license file determines the number of copies of the software that can be run simultaneously. In addition, ArcView can be purchased in a single-use license—this means that each copy can be installed on only one fixed machine on your network.

by ArcEditor. Because you have a floating license, your users can easily gain access to geodatabase editing and other ArcEditor capabilities after you purchase an ArcEditor license and obtain an ArcEditor keycode.

In another scenario, your organization has a floating license of ArcEditor but eventually needs some of the workstation capabilities of ArcInfo. Purchasing an ArcInfo license enables access to these capabilities.

Floating licenses allow an organization to install and use multiple copies of ArcGIS Desktop. Users can set their access of ArcGIS Desktop at any of the three functional levels—ArcView, ArcEditor, and ArcInfo—as long as they have the appropriate license and have installed their corresponding keycodes.

You can switch between products using a simple setting in ArcGIS Desktop Administrator that is provided with your software (shown below).
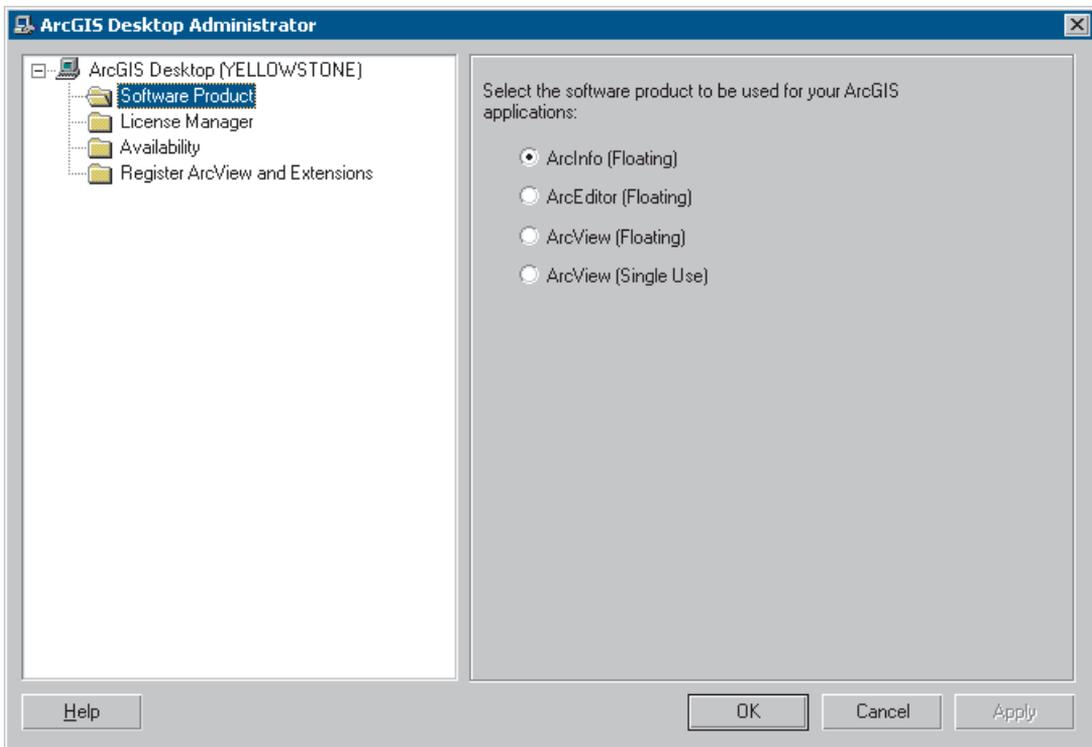
With ArcGIS Desktop Administrator, which comes with your software, you can easily switch between products. ArcGIS Desktop Administrator is accessed by clicking on the Start button, clicking on Programs, clicking on ArcGIS, and choosing Desktop Administrator from the menu.

Optional extensions for ArcGIS Desktop

Many optional ArcGIS extensions are available with version 8.2. More will follow in future releases.

Extensions allow you to perform tasks such as raster geoprocessing and three-dimensional analysis. All extensions can be used by each product—ArcView, ArcEditor, and ArcInfo.

	ArcView, ArcEditor, and ArcInfo		ArcInfo only
ArcGIS Spatial Analyst	• Advanced raster modeling • ArcGrid calculator with ArcGrid algebra • VBA for raster analysis	**+**	• ArcGrid program in ArcInfo Workstation • ArcGrid commands in Arc program
ArcGIS 3D Analyst	• ArcScene™–real-time interactive three-dimensional scenes • Scene views in ArcCatalog • Three-dimensional modeling tools • ArcTIN tools	**+**	• ArcTIN™ commands in Arc program • Surfacescene command
ArcGIS Geostatistical Analyst	• Advanced kriging and surface modeling • Exploratory spatial data analysis tools • Probability, threshold, and error mapping		
ArcGIS Publisher	• Publish ArcMap documents as PMFs for use with free ArcReader seats • Also used with the ArcMap Server extension to ArcIMS		
ArcPress for ArcGIS	• Advanced map printing	**+**	• ArcPress commands and tools in ArcInfo Workstation
ArcGIS StreetMap™ USA and StreetMap Europe	• Complete nationwide streets database • Nationwide geocoding		
MrSID® Encoder for ArcGIS	• Image compression and mosaicking • Up to 500 MB		
TIFF/LZW Compression	• Right-to-use Unisys® patent	**+**	• TIFF/LZW support in ArcInfo Workstation

ArcGIS Spatial Analyst

ArcGIS Spatial Analyst provides a broad range of powerful spatial modeling and analysis features that allow you to create, query, map, and analyze cell-based raster data. ArcGIS Spatial Analyst also allows you to perform integrated vector–raster analysis. Using ArcGIS Spatial Analyst, you can derive information about your data, identify spatial relationships, find suitable locations, and calculate the accumulated cost of traveling from one point to another.
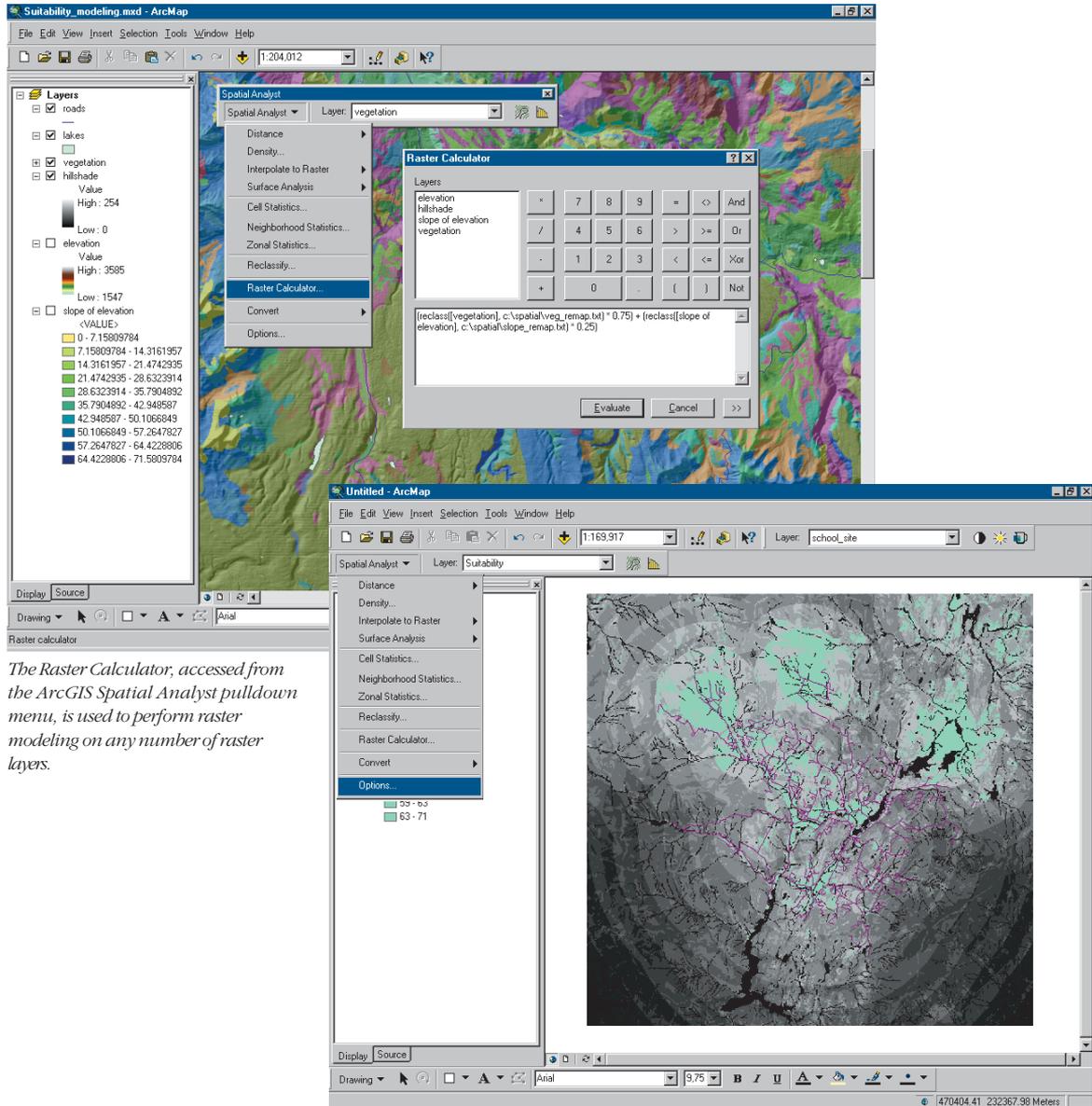
The Raster Calculator, accessed from the ArcGIS Spatial Analyst pulldown menu, is used to perform raster modeling on any number of raster layers.

ArcGIS Spatial Analyst provides tools for determining the suitability of locations. Above, the most suitable locations are shown in green.

ArcGIS 3D Analyst

ArcGIS 3D Analyst enables users to effectively visualize and analyze surface data. Using ArcGIS 3D Analyst, you can view a surface from multiple viewpoints, query a surface, determine what is visible from a chosen location on a surface, and create a realistic perspective image by draping raster and vector data over a surface. The core of the ArcGIS 3D Analyst extension is the ArcScene application. ArcScene provides the interface for viewing multiple layers of three-dimensional data and for creating and analyzing surfaces.

ArcGIS 3D Analyst also provides advanced GIS tools for three-dimensional modeling such as cut–fill, line of sight, and terrain modeling.
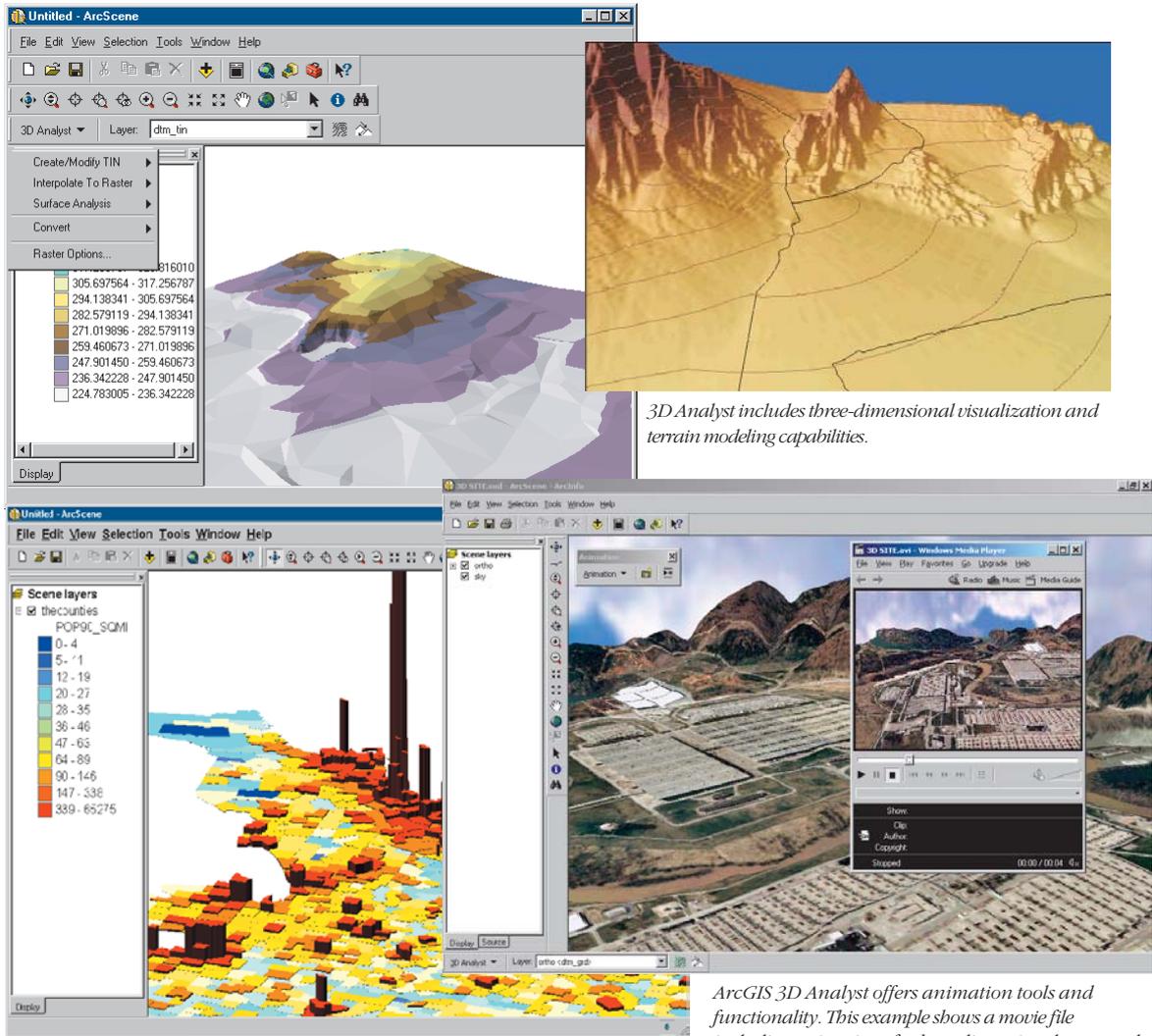
3D Analyst includes three-dimensional visualization and terrain modeling capabilities.

ArcGIS 3D Analyst provides effective tools for illustrating differences between adjoining areas or regions on a map. In this example, the third dimension of each of the northeastern U.S. counties shown represents population density. The taller the column representing the county, the greater the population density.

ArcGIS 3D Analyst offers animation tools and functionality. This example shows a movie file including animation of a three-dimensional scene and objects.

ArcGIS Geostatistical Analyst

The power of ArcGIS Geostatistical Analyst lies in its ability to create a continuous surface from sparse measurements taken at sample points.

ArcGIS Geostatistical Analyst helps you reliably predict values for surfaces using kriging. In addition, ArcGIS Geostatistical Analyst includes tools for statistical error, threshold, and probability modeling.
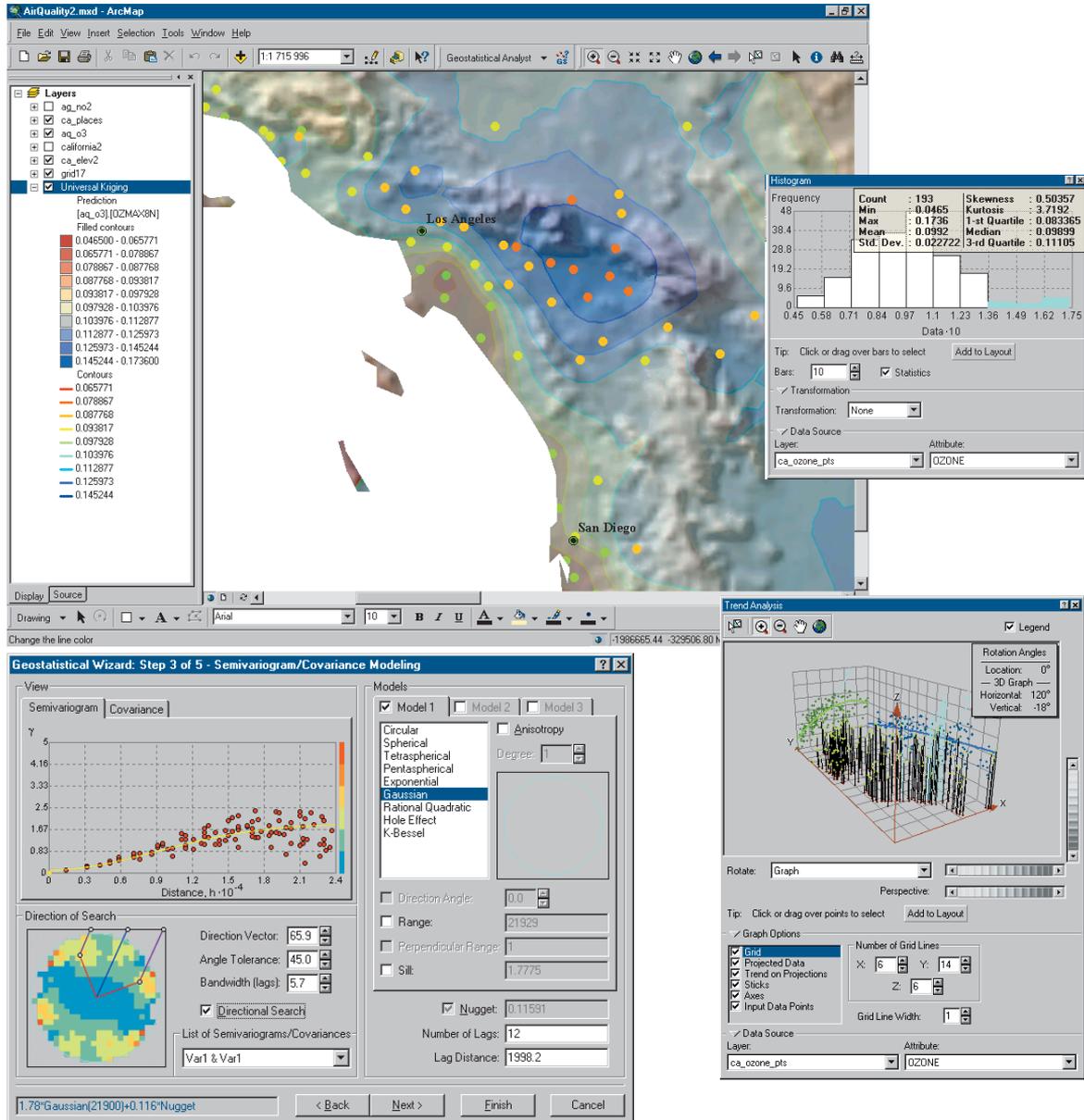
With ArcGIS Geostatistical Analyst, you can quickly and easily generate summary statistics, analyze trends, and graphically represent statistical data.

ArcGIS StreetMap USA and StreetMapEurope

The ArcGIS StreetMap extensions provide street-level mapping and address matching for entire countries. StreetMap layers automatically manage, label, and draw features, such as local landmarks, streets, parks, water bodies, and other features. StreetMap can find nearly any address in each country by interactively matching a single address or by batch matching from a file of addresses. All the data comes compressed on a small set of CD–ROMs.

StreetMap USA

StreetMap Europe
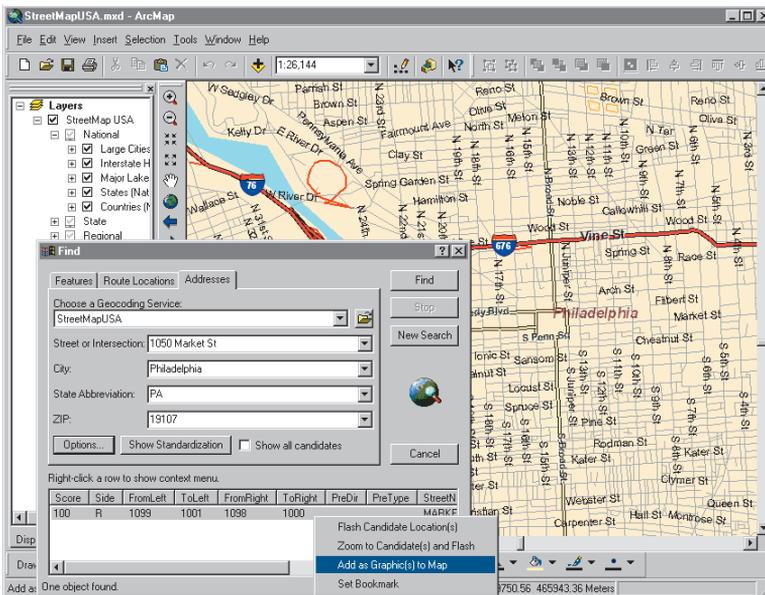
StreetMap allows you to add a graphic to the map at a specified address. StreetMap data can be viewed at national, state, regional, and local levels, with the symbology and visibility of map features changing with each level.

ArcGIS Publisher

ArcGIS Publisher enables the creation of a published map file format (PMF) for any ArcMap document. PMFs are used in the free ArcReader application and allow you to share your ArcMap documents with any number of users. The PMF format can also be used to deploy your map over the Web or Intranet through the ArcMap Server extension for ArcIMS.

Adding a copy of ArcGIS Publisher to your ArcGIS Desktop allows you to open up access to your spatial information to many users. Use ArcMap to author interactive maps. Publish them with ArcGIS Publisher. And share them with many users via ArcReader and the ArcMap Server extension for ArcIMS.

ArcPress for ArcGIS

ArcPress is the map printing extension for ArcView, ArcEditor, and ArcInfo. As ESRI's raster image processor (RIP), ArcPress renders standard graphics exchange formats and native printer language print files for printing on industry-standard wide-format and desktop printers.

Large-format GIS maps may include vast data volumes, complex symbology, and extremely large images that are often difficult or time consuming to print on off-the-shelf printers. The role of ArcPress in a GIS environment is to render high-quality maps on a printer quickly, without requiring the addition of extra onboard memory or hardware. Instead, ArcPress turns your computer into a print processor, allowing your printer to print continuously without the need for expensive hardware upgrades.

MrSID Encoder for ArcGIS

MrSID is a high-quality, high-performance compression methodology for reducing the size of very large images. The MrSID Encoder extension gives you the ability to use ArcToolbox to compress and mosaic images from 50 to 500 MB in size. Images smaller than 50 MB can be encoded without this extension. The raster file size limit is not based on file storage size, but instead on the number of pixels. The 500 MB size rule will be evaluated as follows:

50 million < Image Width * Image Height * Number of Bands < 500 million

The MrSID Encoder is developed by LizardTech, Inc. Additional products are available from LizardTech that allow you to compress images of a larger size.

TIFF/LZW compression

One of the methods available for image compression is the TIFF/LZW compression mechanism, a patented process owned by Unisys Corporation. While reading TIFF/LZW compression is included with ArcGIS, the process of creating these image types requires a right-to-use license from Unisys. Any user wishing to create images in this form must first purchase a right-to-use license from Unisys. ESRI will provide the TIFF/LZW compression keycode as an optional extension to enable this capability in ArcGIS Desktop and ArcInfo Workstation.

What is ArcReader?

ArcReader is a free application to view and use maps created with ArcMap and the optional ArcGIS Publisher extension. ArcReader works on maps in PMF format.

Because ArcReader is free, any user can install it on their Windows computer and have access to maps you generate with ArcGIS. ArcMap documents contain access to many data types—shapefiles, coverages, geodatabases, CAD files, tables, imagery, ArcIMS services, and so on, and provides advanced symbology and map behavior, such as scale-dependent themes and projection on the fly. Any ArcMap document can easily be converted to the PMF format using the ArcGIS Publisher extension and subsequently shared with ArcReader users.

ArcReader helps you deploy your GIS in new ways. It opens up access to your GIS data, enables you to present information in high-quality professional maps, and provides ArcReader users the ability to interactively use and print maps.

ArcSDE is the GIS gateway to relational databases. It allows you to manage geographic information in your chosen DBMS and serve your data openly to ArcGIS Desktop, ArcIMS, and other applications. ArcSDE is a key component in a multiuser ArcGIS system. It provides an open interface to relational database management systems and allows ArcGIS to manage geographic information on a variety of different database platforms including Oracle, Microsoft SQL Server, IBM® DB2®, and Informix®.

ArcSDE acts as the gateway between the rest of ArcGIS and your relational database. When you need a very large, multiuser database that can be edited and used simultaneously by many users, ArcSDE adds the necessary capabilities to your ArcGIS system by enabling you to manage your shared, multiuser geodatabase in a DBMS. It does this by adding a host of fundamental GIS capabilities.

ArcSDE allows you to:

- Manage and maintain your geodatabase in the DBMS of your choice.

- Have multiple users edit and maintain the geodatabase. ArcSDE provides long transaction and version support for your DBMS.

- Serve multiple ArcGIS users anywhere on your network. Centralizing your DBMS server significantly enhances performance for large multiuser systems.

- Open your ArcGIS geodatabase to other users who use MapObjects®, ArcView GIS 3, and CAD applications.

- Serve your data openly using ArcIMS Web services.

- Build Open GIS Consortium (OGC)-compliant applications that work with features in your geodatabase.

- Build SQL applications that work with the tables and rows in the geodatabase.
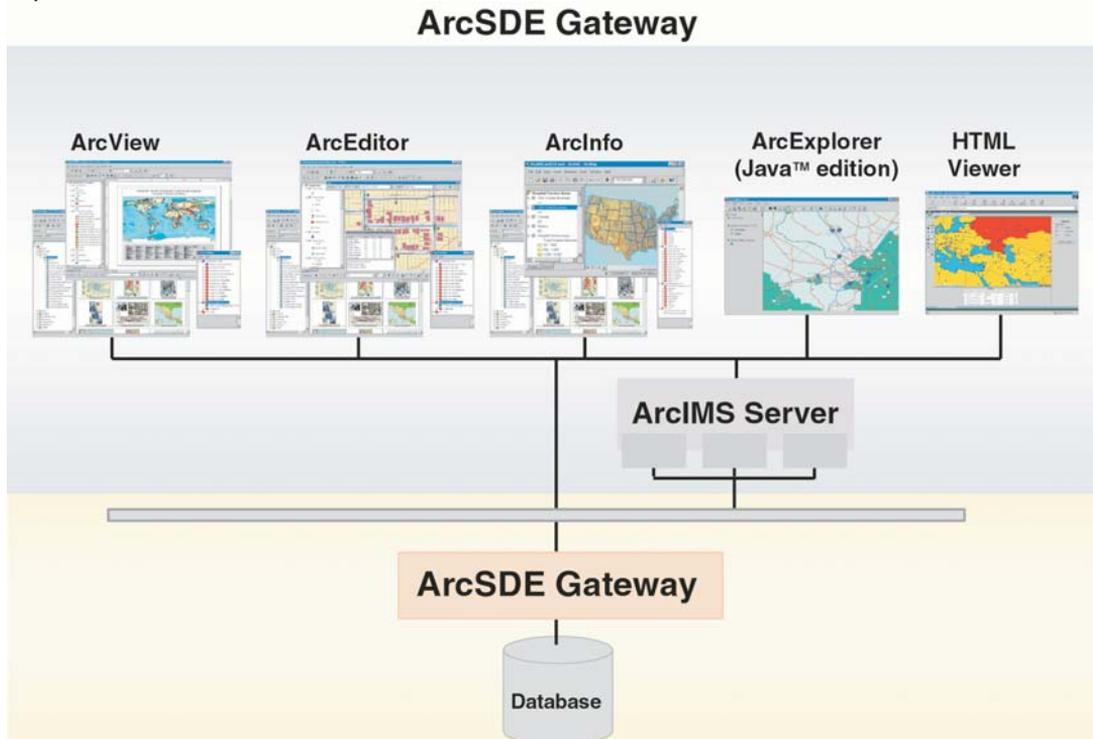
ArcSDE acts as the gateway between ArcGIS and your relational database.

ArcSDE fundamental capabilities

Open DBMS management	ArcSDE allows you to manage geographic information in any one of four DBMSs: Oracle, Microsoft SQL Server, Informix, or IBM's DB2.
Long transaction support	ArcSDE provides long transaction and version support for the DBMS. When you want multiple editors to maintain your DBMS, ArcSDE provides the mechanism to directly edit the spatial database that integrates into your organization's work flow.
High performance and open data access	ArcSDE leverages DBMS, allowing you to manage fully continuous spatial databases of any size.

ArcSDE plays an important role in a multiuser GIS by providing these three fundamental capabilities.

Why would you use a DBMS?

Multiuser GIS requires DBMS and strong GIS tools to work with the geographic data. As your organization evolves, your spatial database will grow in size and in number of users. Using a DBMS is a practical means for sharing and protecting your data investments.

Admittedly, the use of DBMS in GIS today is not widespread. For years file formats have been used to manage and share information using coverages, shapefiles, grids, TINs, CAD drawings, and many raster formats. There were some clear advantages to doing this. First, it was easy and inexpensive. Everyone could edit and manage their file-based data. No DBMS investment was necessary. Plus, DBMSs lacked the ability to manage the larger, more complex data types and support for operations required by GIS (for example, to execute a single query to fetch a few thousand features for display in a particular map extent or to edit features using a long transaction that can last for many days and even weeks).

As DBMS has evolved into more powerful technology that could support complex data objects, larger queries, and stronger transactional support, the use of DBMS for geographic data management has become much more practical. Most multiuser GIS systems today manage their tabular data in a DBMS, and many are beginning the migration of their geographic information into a DBMS.

Like other information resources in an organization, GIS data can benefit from DBMS use. It makes good business sense to manage your GIS information resource as part of your relational database. Some of the reasons to use relational databases are as valid for GIS as they are for other information:

- A single data store

- Concurrency management in a multiuser environment

- Standard data management practices such as backup, recovery, and replication

- Performance for any number of users

- The need for managed and organized data

- Scalable data volumes with no size limitations

- Centralized systemwide or companywide access to the data

- Data maintenance over long time periods, spanning personnel changes and hardware/software upgrades

- System failure/recovery mechanisms

- Industry-standard client/server and Internet architectures (e.g., Web Services)

Why use ArcSDE?

If you need a DBMS and you have spatial data, then you also need ArcSDE to:

- Gain all of the benefits of using a DBMS.

- Store all geographic information in the DBMS, not just the attributes.

- Allow multiple, simultaneous editors.

- Manage a GIS database of unlimited size.

- Manage spatial data using standard DBMS tables (adhere to ISO and Open GIS Consortium spatial standards).

- Have a continuous and seamless (that is, not tiled) database.

- Model complex features and behavior required by GIS.

- Manage long transactions and versions.

- Apply the powerful ArcGIS tools on data stored in a DBMS.

To fit GIS into a coherent IT strategy

Many GIS users require that their GIS fits into a coherent information technology (IT) strategy for their organization. Simply put, their GIS must adhere to IT standards; the GIS data should be managed as an integral

Computer   Computer   Computer   Computer

Any ArcGIS Client

ArcSDE Gateway

DBMS

Multiuser geodatabase

Computer

Any ArcGIS Client

Personal DBMS

Personal geodatabase

Geodatabases can scale from small, single-user personal databases to very large enterprisewide multiuser databases. ArcSDE enables DBMSs of any scale to be shared by many users.
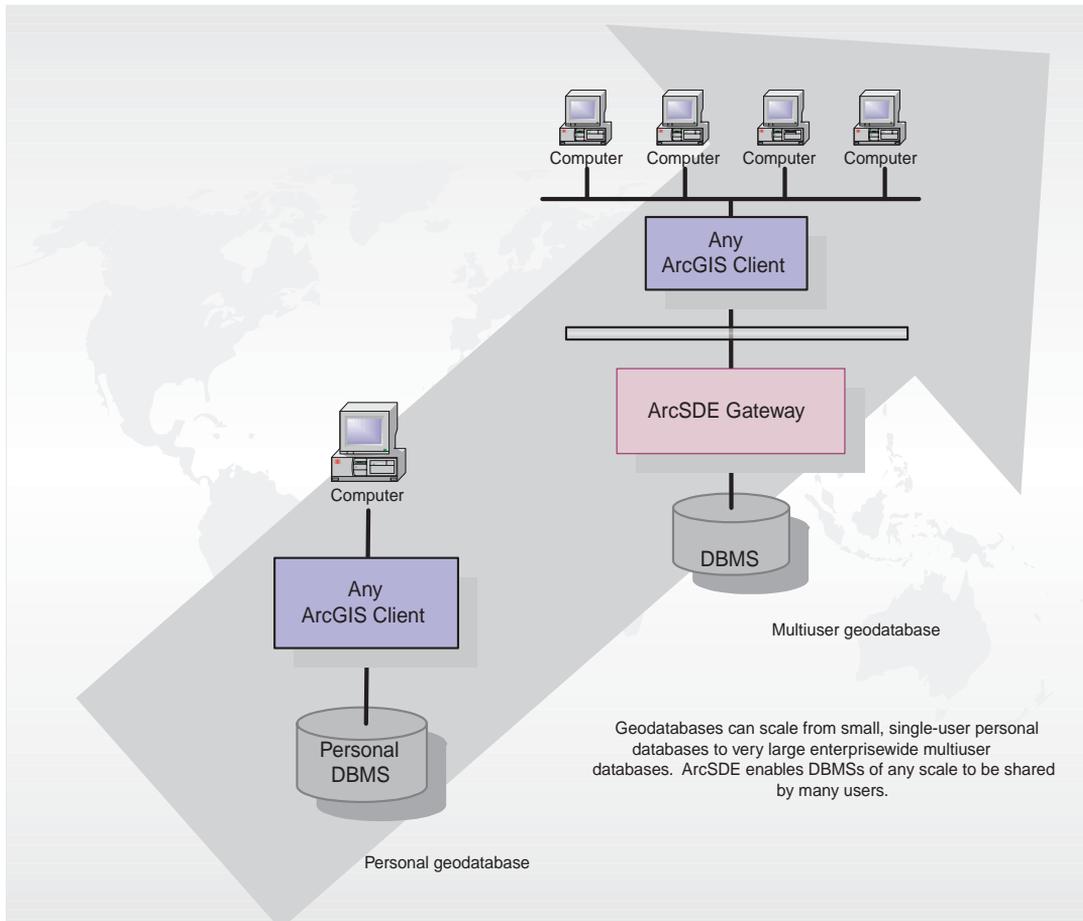
part of the organization's data holdings, and access to this data must be open and easy. The main role of ArcSDE and the geodatabase is to manage the integration between a GIS and a DBMS.

To grow your GIS

Geodatabases can scale from small, single-user databases to very large enterprisewide multiuser databases. The primary role of ArcSDE is to enable your geodatabase to be shared by many users across any network and to scale its size to any level necessary to meet your requirements.

ArcSDE connection configuration options

When configuring ArcGIS for a workgroup, department, or enterprise, you will need to implement a central multiuser geodatabase. ArcGIS seats—ArcReader, ArcIMS clients, ArcView, ArcEditor, and ArcInfo—will be distributed throughout your organization, and perhaps beyond. ArcGIS users will access shared data managed in a central geodatabase through ArcSDE.

ArcSDE can be configured to connect client applications to a DBMS directly or to run as an application server near the DBMS. There are advantages to each configuration, depending on your needs.

Direct connection configuration

ArcSDE can be configured to use direct connections. The client applications connect directly to the DBMS without using an application server. Each ArcGIS and ArcIMS client has the ArcSDE direct connection capability built in. For example, ArcEditor and ArcInfo will look for an ArcSDE keycode to enable editing and manipulation of the central geodatabase.

The direct connection configuration is often easier to install and administer. There is no need for installing and administering the ArcSDE application server. This configuration allows for increased scalability because it offloads work from the server to each connected client.

Application server configuration

Currently, the most common ArcSDE configuration includes an ArcSDE Application Server. The application server allows you to serve geographic data from a large, central geodatabase on UNIX®, Linux®, and Windows

servers to many users across a standard network. The ArcSDE Application Server is typically located on the same hardware platform as your DBMS. The application server configuration can offer performance advantages; during editing, it may be faster due to the intelligent ArcSDE client/server architecture.
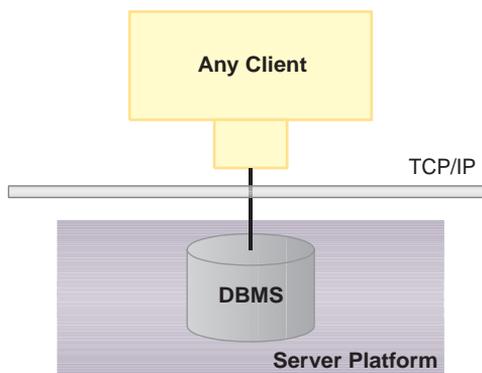
Direct Configuration
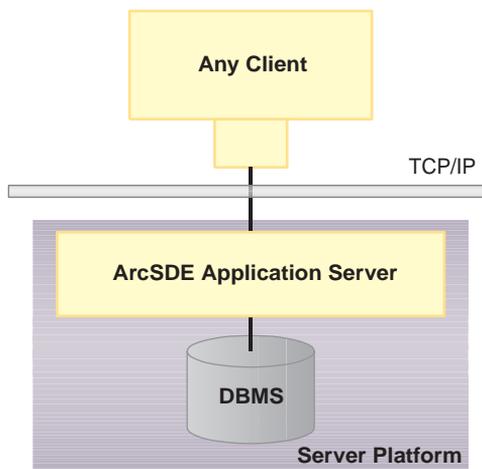
Application Server Configuration

ArcSDE has both a direct connection configuration and an application server configuration.

ArcIMS is an Internet-based GIS that allows you to centrally build and deliver a wide range of GIS maps, data, and applications to users in your organization as well as outside of your organization on the World Wide Web. ArcIMS includes both client and server technology. It extends a Web site by enabling it to serve GIS data and applications. Free HTML and Java viewers are included with ArcIMS, but ArcIMS can also work with a wide range of clients such as ArcGIS Desktop, ArcPad, wireless devices, and the new MapObjects for Java clients.

Why use ArcIMS?

Expand your GIS. Disseminating GIS data and services on the Internet allows you to meet the GIS needs of many users. ArcIMS includes a set of HTML and Java viewers that may be freely distributed to your users. These viewers provide significant GIS functionality.

ArcIMS also caters to advanced GIS users. ArcIMS significantly improves the GIS experience of users working with ArcReader, ArcView, ArcEditor, and ArcInfo. With the exception of editing tools, virtually all ArcMap tools can be used with ArcIMS feature layers.

Integrate data from multiple sources. ArcIMS makes it possible for users to combine data from any number of ArcIMS Web sites. It also enables the integration of local GIS data with ArcIMS layers. Users can access your data and services, then quickly and simply integrate them with data from many other Internet and local sources.

Scale your system to meet your needs. Whether your server receives 10 or 10,000 map requests an hour, ArcIMS can be scaled to fit your needs. Then, as your site grows and map requests increase, ArcIMS can be easily extended to meet new demands.

Provide access to GIS data and Location Services. ArcIMS allows you to determine how and to whom GIS data and services are delivered. You control whether your data holdings are accessible publicly on the Web, on a secure network, or within your organization on a local area network (LAN).

ArcIMS is well suited for delivering Location Services and is already used by many key businesses. For example, ArcIMS is used in Location Services to find nearby ATMs and restaurants, generate trip plans and driving directions,

provide real-time navigation information and emergency services directly to drivers in their vehicles, and explore new homes and their surrounding neighborhoods, schools, and parks.
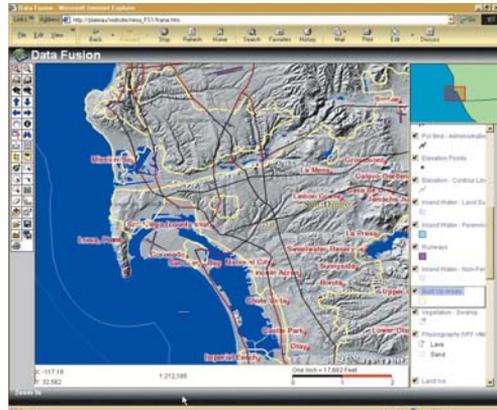
San Diego data layers in the Java Custom viewer included with ArcIMS.
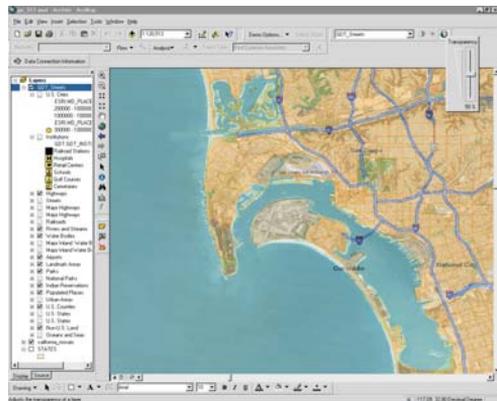
ArcMap, the advanced mapping application included with ArcView, ArcEditor, and ArcInfo.

ArcIMS Web sites can be accessed from a wide range of clients. Map data from the same ArcIMS Web site is displayed (above) in three clients: the free Java viewer included with ArcIMS; the powerful ArcMap application included with all ArcGIS Desktop seats; and ArcPad, ESRI's mobile GIS application.
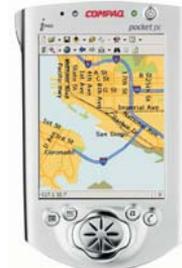
ArcPad, ESRI's mobile GIS application, runs on Microsoft Windows CE.

The ArcIMS architecture

ArcIMS runs in a distributed environment and consists of both client and server components. The ArcIMS server components allow you to extend an Internet Web site by including GIS capabilities. Your ArcIMS Web site can deliver GIS data, maps, and applications.

With ArcIMS, you design and author a GIS Web site. Many types of client applications can connect to and use your ArcIMS Web site over the Internet, ranging from the free HTML and Java viewers included with ArcIMS to more advanced ArcGIS Desktop applications.

The ArcIMS architecture is highly scalable. Many concurrent users can access your Web site, and many requests can be processed at one time. With ArcIMS, you can expand your server over time to accommodate growth in demand. Because of its scalable architecture, ArcIMS is as good a choice for small organizations serving dozens of maps a day as it is for large organizations serving hundreds of thousands of maps a day.
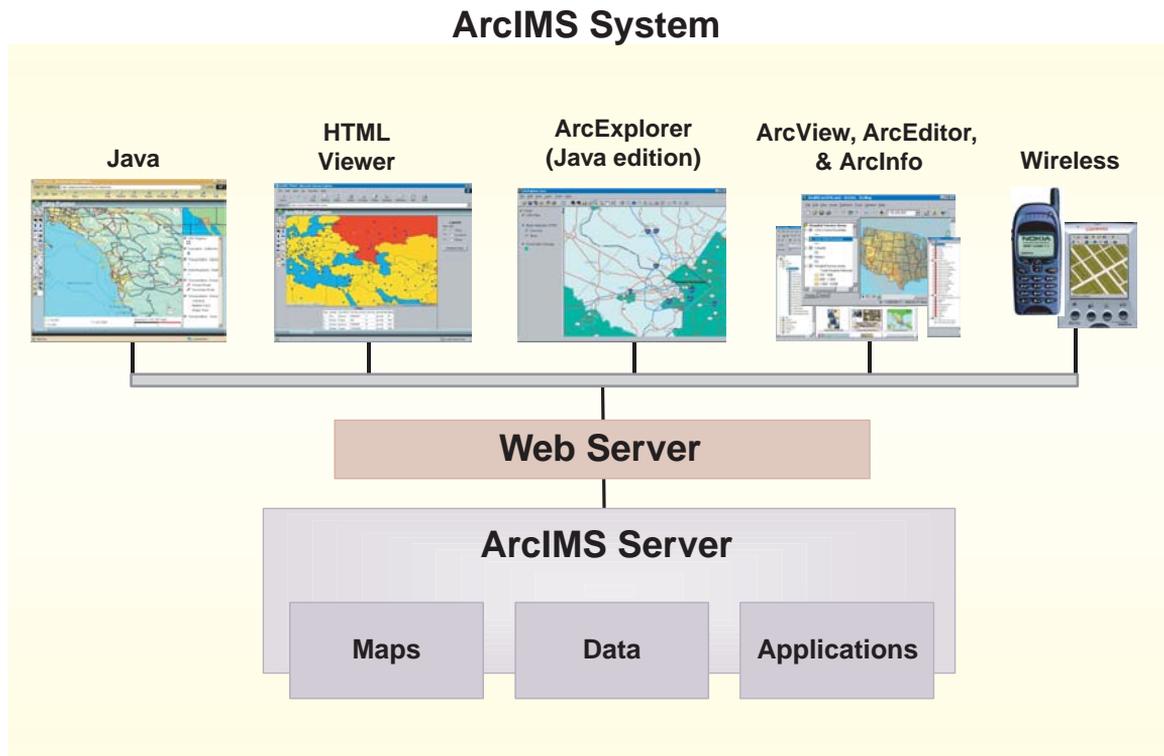
ArcIMS System

The ArcIMS system consists of a series of clients (Java Viewer, HTML Viewer, and so on) that access GIS functionality and services provided by an ArcIMS server. Client/Server connections are made over the Internet.

```
                    ┌──────┐  ┌──────┐  ┌──────┐  ┌──────┐
                    │ Web  │  │ Web  │  │ Web  │  │ Web  │
                    │Client│  │Client│  │Client│  │Client│
                    └──────┘  └──────┘  └──────┘  └──────┘
```

Web Server

ArcIMS works with most standard Web servers such as Microsoft Internet Information Server, Apache, and iPlanet™.

ArcIMS Manager

The ArcIMS Manager is used to author, design, and manage a complete ArcIMS Web site.

ArcIMS Server

ArcIMS Application Server

| Maps | Data | Applications |

The ArcIMS Application Server handles incoming requests, load balancing, and service management.

The GIS services do the work requested by the client from the ArcIMS server. Results are packaged as ArcXML messages and delivered to the client.

Files   **Database**

ArcIMS works with all of your file-based and DBMS-based GIS data.

The server architecture is the heart of the ArcIMS system. It is composed of three main parts: the Web server, the ArcIMS server, and the applications used to build and manage your Web site (Author, Administrator, Designer, and Manager).

ArcIMS services

When an ArcIMS client sends a request to a server, the ArcIMS server processes and responds to the request. Typical ArcIMS requests generate maps or retrieve geographic data for a given map extent. A wide range of GIS services are available through ArcIMS. The most common ArcIMS services deliver interactive maps to many types of clients.

When you create a map for your Web site, you determine the data layers to be included and the way in which map features will be rendered. You define symbology, add labels, set scale factors, and so on. When a client sends a request for a map, it is generated on the server based on your specifications. The map is delivered to the client in any of three ways: as an image, as streamed features, or as an ArcMap Image Service.

An Image Service uses the ArcIMS image rendering capabilities to deliver a snapshot of your map to the requesting client. The snapshot is sent as a compressed JPEG, PNG, or GIF file. A new map image is generated each time the client requests new information. The Image Service can also deliver compressed raster data to clients.

A Feature Service streams compressed vector features to the requesting client. Feature streaming enables more advanced clientside tasks such as feature labeling, feature symbolization, map tip creation, and spatial selection of features. This functionality allows the user on the client side to change the appearance of the map.

An ArcMap Image Service streams images from an ArcMap document to the requesting client. A new ArcIMS extension product—ArcMap Server—adds this capability to ArcIMS. This service enables you to deliver maps that use the advanced cartographic and open data access capabilities of ArcMap. Virtually any information and graphic representations that you create in ArcMap can be served using the ArcMap Server.

GIS capabilities in ArcIMS

Depending on your organization's objectives and the audience for whom you are building your application, you may want to incorporate additional GIS capabilities into your Web site. The following is a list of key GIS capabilities available with ArcIMS.

Image rendering. Image rendering takes a snapshot of the view that you created when you authored your map and delivers it to the client as a compressed JPEG, PNG, or GIF file. This capability can also be used to serve raster datasets to your users.

Feature streaming. Feature streaming involves streaming vector features to clients, enabling a number of clientside tasks: feature labeling, map tip creation, spatial selection, and more. Feature streaming is only available with thicker ArcIMS clients including ArcExplorer™, Java Edition, ArcMap, and the ArcIMS Java viewers. Streamed features from one ArcIMS site can be integrated with streamed features from other ArcIMS sites as well as with local data and used together in analysis.

Querying data. You can build new queries or run predefined queries to derive specific information about the data. The client submits the query to the server, and the server returns query results to the client.

Data extraction. You can request real geographic data from the server. The server responds to a request for data by sending zipped shapefiles to the client. The user who receives the data is then able to extract the zipped shapefiles to a local hard drive.

Geocoding. Geocoding functionality allows you to submit a partial or complete address and view a map showing that location. Based on your input, the server either returns an exact match to the address or a list of candidate matches.

Metadata catalog. A catalog that references your data holdings and information sets can be created using ArcGIS, ArcIMS, and ArcSDE and published as a search service using ArcIMS. This allows you to provide an open search mechanism for users to find and access GIS information at your Web site. You can create a clearinghouse and your users can participate in a Spatial Data Infrastructure.

ArcMap Server (optional extension). This optional extension to ArcIMS enables you to serve ArcMap documents openly as an ArcIMS service.

Author maps with ArcMap and serve them with ArcIMS.

Routing (optional extension). The optional ArcIMS RouteServer extension provides a countrywide navigation street database to support optimal routing and geocoding services on the street data.

ArcXML: the common language for ArcIMS

ArcXML is the language used to communicate between client viewers and ArcIMS servers. ArcXML is a specification of XML, a metamarkup language that allows you to create structured messages. All client requests and server responses are coded in ArcXML.

Since standard XML protocols are used, any client that can speak ArcXML will work with ArcIMS.

Extending your ArcIMS application

The sophisticated ArcIMS architecture allows direct customization at all levels. At the client level, custom HTML and JavaScript™ can be used to modify the look and feel of the viewer. At the server level, ArcXML can be used to modify map configuration files—to project data, change the appearance of map features, and so on. It is also possible to incorporate custom and advanced services and tools.

ArcIMS supports a number of Internet developer tools including Active Server Pages (ASP) for Microsoft developers, and JavaServer Pages™ (JSP™) to build Web applications using Java 2 Platform, Enterprise Editor (J2EE™), and ColdFusion®.

Authoring and managing an ArcIMS Web site

ArcIMS is based on standard Internet technology that users employ to author and manage GIS Web sites. ArcIMS Web sites are authored using standard HTML and Java tools, making the process similar to building any other Web site. The ArcIMS process is unique because tools are also provided for authoring the GIS capabilities of your Web site.

ArcIMS Web sites are authored using a series of applications—Author, Administrator, and Designer—or using Manager, a single wizard-driven application that takes you through the entire Web site creation process.

Create your maps and set layer properties.
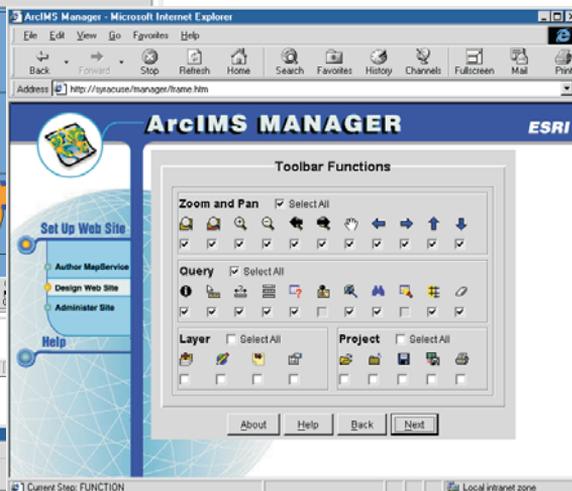
Design the look, feel, and functionality of your Web site's map viewer.

Use Author to create your maps, Designer to design your Web site, and Administrator to manage your ArcIMS services. Use Manager to do all three if you want to create your Web site in one quick and simple process.

Start, stop, and monitor your ArcIMS services. When demand increases, add more server instances using the ArcIMS administrative tools.

ArcIMS clients

A number of different clients can connect to and work with ArcIMS services. Some clients are shipped with ArcIMS, while others have the ability to connect to and use ArcIMS Web sites. The set of possible ArcIMS clients includes:

- HTML and Java viewers delivered with ArcIMS

- ArcGIS Desktop: ArcView, ArcEditor, and ArcInfo

- ArcExplorer Java Edition

- Metadata Explorer

- MapObjects—Java Standard Edition (a new Java developer kit to build applications for ArcIMS and ArcGIS)

- ArcPad

- Wireless appliances such as cellular phones and personal digital assistants (PDAs)

The HTML viewer

The HTML viewer is used for accessing image-based maps and tabular data. It is a lightweight viewer—the simplest and fastest ArcIMS viewer to implement. You interact with maps and attribute displays through a simple, yet powerful, set of GIS tools. The HTML viewer can be embedded in any HTML Web site to create a dynamic, focused, interactive map for your users. This viewer gives the site manager more control over what users can access and do with GIS.

The HTML viewer does not support some GIS tools, nor does it support data integration with local data. Despite being a lightweight client, however, the HTML viewer is highly customizable and has the widest browser support.

The Java viewer

ArcIMS comes with two Java viewers. The Java Custom viewer affords greater flexibility and functionality through customization and is therefore very useful to an end user needing substantial GIS power. The Java Standard viewer offers a standard interface requiring no customization and wider browser support.

Both Java viewers are thicker clients containing rich sets of GIS tools. Both support feature streaming, which enables a number of advanced GIS capabilities. For

example, simple editing notes and map notes can be added by your users and collected by site administrators. With the Java viewers it is also possible to combine GIS data from many different local and Internet sites.

ArcIMS also contains a JavaServer Pages connector for Java 2 Platform, Enterprise Edition developers to build server applications.
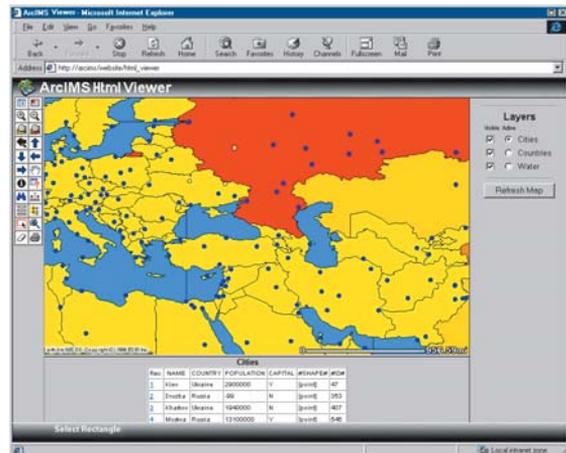
The HTML viewer included with ArcIMS is a lightweight viewer with a small, yet powerful, set of GIS tools. The HTML viewer is highly customizable and has the widest browser support.
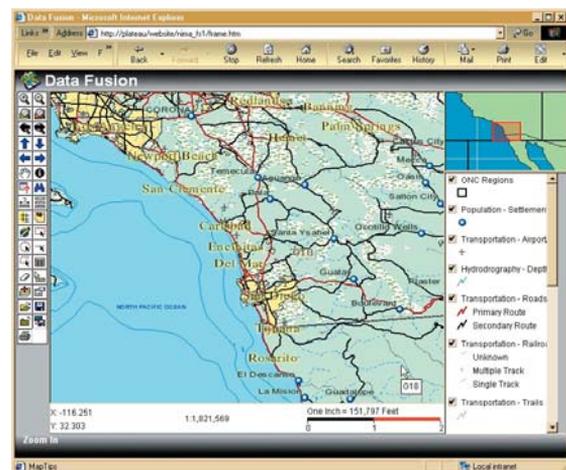

The Java Standard and Java Custom viewers included with ArcIMS are thicker clients with many GIS tools. Both support feature streaming and a number of advanced GIS capabilities. The toolset and appearance of the Java Custom viewer (above) can be customized according to your preferences.

ArcExplorer Java Edition

The Java edition of ArcExplorer has much in common with the Java viewers. What distinguishes it from the Java viewers is the way it is implemented. ArcExplorer works as an independent standalone application—not inside your Web browser. ArcExplorer can integrate layers from a variety of sources, both local and on the Internet. ArcExplorer can be freely downloaded from ESRI's Web site at *www.esri.com*.

Metadata Explorer

This ArcIMS client is a search tool that allows users to query your metadata catalog and find and access GIS information.
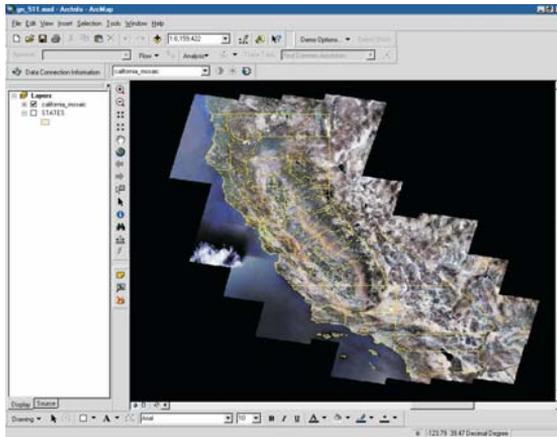
ArcMap (part of ArcGIS Desktop) works with ArcIMS layers and can integrate data from multiple sources. Most advanced ArcMap tasks can be performed on ArcIMS layers.
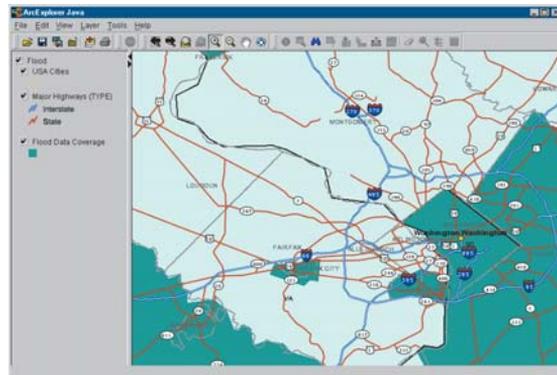

The Java edition of ArcExplorer can integrate ArcIMS layers with data from a variety of sources.

MapObjects—Java 2 Standard Edition

This rich software developer's kit can be used with any integrated developer environment for Java to build Java clients as well as server-based applications. MapObjects—Java contains a highly functional collection of developer components that can be used to build custom Java clients that run on any platform supporting Java.

ArcGIS Desktop

The best clients for working with ArcIMS are the ArcGIS Desktop products: ArcReader, ArcView, ArcEditor, and ArcInfo. The ArcMap application within ArcGIS Desktop offers the fullest functionality of all possible clients. In ArcMap, you can work equally well with shapefiles, coverages, geodatabases, and ArcIMS layers. With the exception of editing, even the most advanced ArcMap tasks can be performed on ArcIMS layers. The ability to integrate local data with geographic information from virtually anywhere in the world is a major GIS breakthrough.
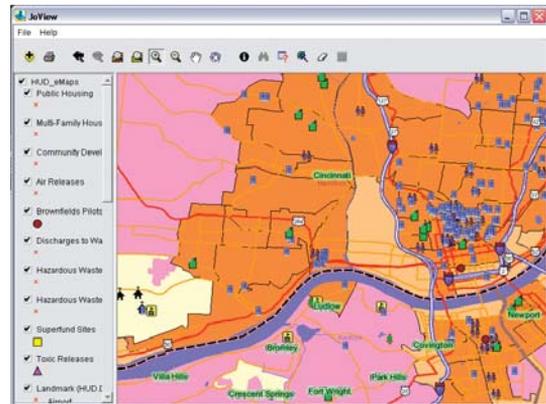
A custom Java application built with MapObjects—Java, the new Java Developer Kit from ESRI

Any wireless client, such as ArcPad, can work with ArcIMS as long as communications are in ArcXML and are handled via WAP.
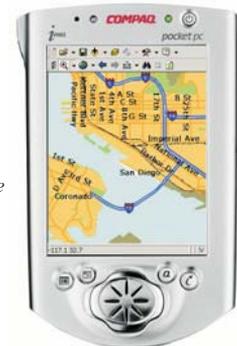
ArcPad

ArcPad is ESRI's Windows CE-based mobile mapping and GIS application. ArcPad connects as an ArcIMS client through wireless technology standards. You can download an image or a map layer to ArcPad as well as through a TCP/IP connection using WAP on a wireless local area network, cellular phone, or modem.

Wireless clients

Any wireless client can work with ArcIMS as long as it meets two requirements:

- Communications are handled via wireless application protocols—such as WAP—for wireless devices.

- The wireless device can communicate in ArcXML.

Custom clients

It is easy to build your own custom ArcIMS client. The only major requirement is that communication between the client and the ArcIMS server is made via ArcXML. ArcIMS enables this communication by providing several different connectors that translate requests from your ASP, ColdFusion, or JSP client into ArcXML.

What is G.net?

Background

There is widespread recognition that the data layers and tables in most GIS implementations come from multiple organizations. A GIS organization will develop some, but not all, of their data content. At least some of the layers will be from external sources. Thus GIS data management, by its very nature, is distributed among many users.

Because GIS users are hungry for quality geographic information, there is a fundamental need for users to share their data. Vast resources of information are available, but the task of finding exactly what you need and knowing the quality and currency of the information can be daunting. GIS users need a mechanism to efficiently catalog and search for available geospatial information.

The NSDI and GSDI vision

The NSDI, or National Spatial Data Infrastructure, is a concept developed by the United States and other national, state, and local governments. NSDI and Global SDI (GSDI) promote the vision of a framework for GIS users to openly share geographic information with one another.

The SDI concept describes requirements for computer technologies, policies, and people necessary to promote the sharing of geospatial information throughout all levels of government, private industry, nongovernmental organizations, and the academic community. The Spatial Data Infrastructure (SDI) interconnects GIS nodes across the Internet—and, in many cases, over secure networks—to share information with one another openly (i.e., based on standards).


G.net: SDI building blocks from ESRI

G.net is how ESRI users participate in a Spatial Data Infrastructure with other users, regardless of their GIS technology platform. G.net describes how ArcGIS, ArcIMS, ArcSDE, and other ESRI tools are used. Any GIS organization wishing to participate will benefit from using these technologies.

A Spatial Data Infrastructure is built from three fundamental building blocks:

1. GIS users who search for useful geographic information and connect to GIS portals for information access.

2. Metadata catalog servers that describe and reference geographic information sets at various GIS portals. These are often referred to as clearinghouse nodes.

3. GIS portals that provide access to geographic information. The information can be delivered in many forms such as FTP downloads, online maps, reports, Internet GIS services, data streaming services, and online maps.
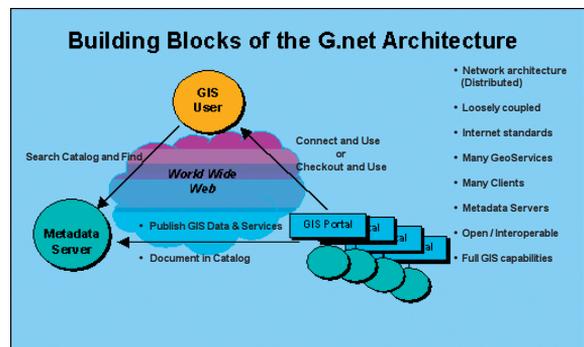
At its most basic level, a Spatial Data Infrastructure is realized through catalogs holding metadata about available data and services. This is similar in function to the role of the card catalog in a library that references and organizes all library holdings.

As the number of participating organizations and users grows, so will the numbers of entries and complexity of the various metadata catalogs. The need for a metadata server and search tools becomes more critical.

In practice, the G.net building blocks can be assembled in many ways using ArcGIS, ArcSDE, and ArcIMS technology. Each GIS site would provide one or more of the three SDI capabilities. For example, a city might provide a catalog referencing the available data and services at its Web site along with a series of data and mapping services. A small GIS shop would be able to access and use those services in ArcView seats across the Internet.

In another case, a state government might provide a Metadata Catalog service that describes its available ArcIMS services as well as data and services at other GIS portals within the state. The state might also publish a set of HTML Web pages to publish various Internet Map and Data Services.

How is ArcGIS used for SDI?

ArcGIS tools can be used in an SDI in the following ways:

- Client access. ESRI provides many client applications for many user types that can connect to and use standards-based Metadata Servers and GIS portals. These clients include ArcReader, ArcView, ArcEditor, ArcInfo, MapObjects—Java, ArcPad, ArcIMS clients, and wireless client interfaces.

- Create, manage, and serve metadata. With ArcGIS, users can create and update Federal Geographic Data Committee and ISO-compliant metadata. Using the standards-based ArcIMS Metadata Server and ArcSDE, users can manage and serve metadata catalogs on a local network, a secure network, or the World Wide Web. The ArcIMS Metadata Server can be accessed through standards-based ArcIMS services and through interfaces such as Z39.50.

- Create, manage, and serve GIS information. GIS users can openly serve data, metadata, online maps, and other information using ArcIMS. ArcIMS services can be accessed with a wide range of clients via GIS and XML-based Web Services standards.

How to participate in a Spatial Data Infrastructure

SDI concepts play an important role at a number of levels in the GIS community. Following are some of the possibilities for participation by your organization.

1. Be a user.

From your GIS seat, you will be able to discover and connect to Metadata Servers to search for important spatial information and services, which can subsequently connect you to GIS portals providing critical data and services.

2. Build a GIS portal by publishing data and services.

Your GIS shop can publish an ArcIMS Web site with access to data files (e.g., FTP services), online maps, and other GIS services on the Internet. ArcGIS can be used to implement these portals as well as to provide a metadata service to advertise the GIS data and services at your site.

3. Build a clearinghouse node.

Metadata servers that reference various information collections to serve users regardless of the GIS software they employ can be built using ArcGIS and ArcIMS.

Many GIS users want to provide metadata catalog portals for a collection of GIS data and services. A few clearinghouse sites want to provide a catalog of information sets published by many user sites (in addition to their own data and services).

4. Participate in the Geography Network.

One way to create and share your geographic information is to register your data and services with the Geography Network portal at *www.geographynetwork.com*.

5. Build a GIS community by creating your own geography network.

Using the new Metadata Server in ArcIMS 4, you can collaborate and implement the same building blocks to build your own GIS search portal like the Geography Network. Many focused GIS user groups want to collaborate on information sharing between the members in their community. These user groups can create community-based portals to publish and share geographic information with one another. This may take the form of a loosely coupled collection of GIS portals or a single central portal.

Comparing ArcView GIS 3 to ArcView 8.2

You'll notice many differences between ArcView GIS 3 and ArcView 8.2. We've tried to use what we learned from ArcView GIS 3 in building ArcView 8.2. Many of the available tasks are done differently in ArcView 8.2. In addition, many new tools and options are available.

ArcView 8.2 shares a common architecture with ArcEditor 8.2 and ArcInfo 8.2. This common architecture makes it easy for users of different ArcGIS Desktop products to share work with one another.

While transitioning from ArcView GIS 3 to ArcView 8.2, the most obvious differences are in the look of the software. Two new applications—ArcCatalog and ArcToolbox—provide additional functionality. This additional functionality is described in the books *Using ArcCatalog* and *Using ArcToolbox*. ArcMap, on the other hand, may be familiar to you. The look and feel of ArcMap is similar to the previous release of ArcView. This section will provide you with an overview of the key differences between ArcView GIS 3 and ArcView 8.2.

The book *Getting Started with ArcGIS* is included in your ArcView box. It contains an excellent series of tutorials to help you start learning the new application suite of ArcMap, ArcCatalog, and ArcToolbox.
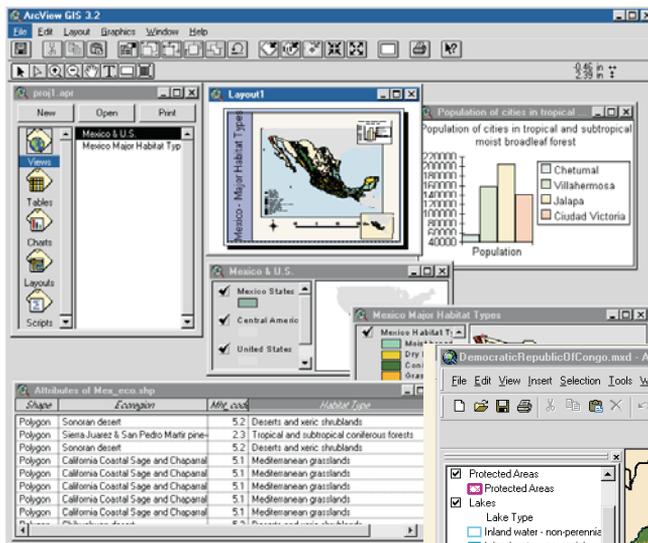
ArcView GIS 3 has a single application with a multidocument interface. ArcView GIS 3 works with projects. A project is a file that organizes your information into multiple documents. Views, tables, charts, layouts, and scripts are examples of documents. Each type of document has related menus and buttons that are displayed only when the document is active.

By contrast, ArcView 8.2 is a suite of integrated applications: ArcMap, ArcCatalog, and ArcToolbox. ArcMap is similar to ArcView GIS 3 in its look and feel. ArcMap works with map documents. A map document stores information about your work as a disk-based representation of a map.
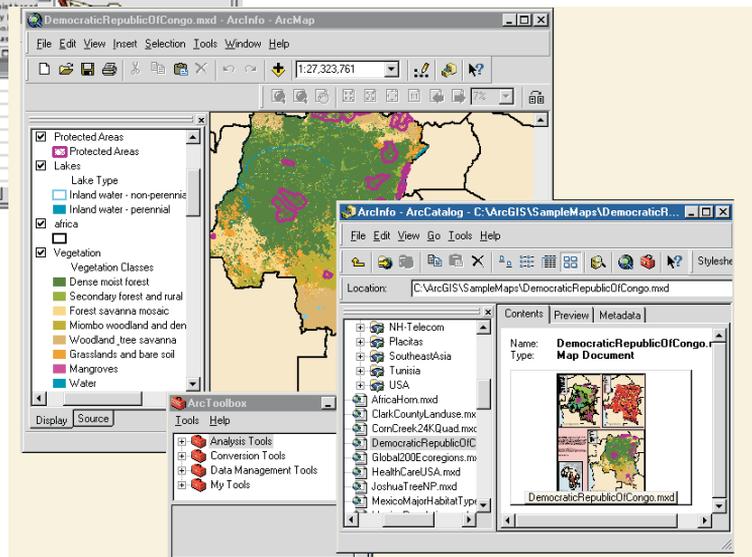
Organization of ArcView GIS 3

Many of the elements of an ArcView GIS 3 project are similar to elements of an ArcView 8.2 map document. The following diagram illustrates the key components of an ArcView GIS 3 project. ArcView 8.2 equivalents are presented in a similar diagram on the following page.

Menus and toolbar buttons change when switching between document types. The active document is a layout; therefore, the tools shown here are layout tools.

A layout is a page on which you organize views, scale bars, North arrows, legends, and other map elements to create a presentation-quality map.

A chart is a graphic representation of data in a table. ArcView charts are dynamically linked to ArcView map data.

All of the documents in your ArcView session—views, tables, charts, layouts, and scripts—are conveniently stored in one file called a project (.apr extension). The project window's scrolling list of icons allows you to choose the document with which you want to work. Clicking on Tables in the scrolling list results in a list of tables, on Views a list of views, on Layouts a list of layouts, and so on. Double-clicking an an item in the list opens it in a new window.

A view is a collection of themes displayed in an interactive map window.

A view has a table of contents that lists the themes in their display order as layers displayed in that view. A theme is a set of related features (streets, soil types, cities, and so on).

Tables contain descriptive (attribute) information about map features.

Organization of ArcView 8.2

ArcView 8.2 is a suite of integrated applications: ArcMap, ArcCatalog, and ArcToolbox. ArcMap is the primary application, with a similar look and feel to ArcView GIS 3, yet different in some fundamental characteristics. In ArcMap, you work with maps saved as map documents. A map document, like a project, is a file used to store information such as data frames, graphs, tables, and page layouts. ArcMap differs from ArcView GIS 3 in its organization. In ArcView 8.2, the multiple document interface has been replaced by a single document interface. Graphs, tables, geographic data views, and other map features are stored as elements of a map rather than as separate components of a project.

An important concept in ArcMap is the data frame, which is similar to a view. A data frame contains a set of features to be displayed together, as does a view. A data frame, however, is listed in the map's table of contents and is displayed in the map's display area.

In ArcView 8.2, sets of features are called layers, rather than themes, but serve essentially the same purpose. The advantage of using layers lies in a

layer's ability to exist independently of a data frame or map layout (ArcView GIS themes exist only within their parent project). Layers can be saved and shared with other users through ArcCatalog, and you can drag and drop layers onto maps.

An ArcMap map document can be viewed in either data view or layout view. Both views allow you to explore, display, edit, and query your data. Data view is better for more focused analysis, as it displays the contents of only one data frame and hides map elements, such as North arrows, titles, and legends. Layout view is better suited to laying out your map page. Multiple data frames and all map elements can be displayed in layout view.

In ArcMap, you work with a map that has a page layout. The layout contains one or more geographic views and other map elements such as scale bars and North arrows. All parts of the map layout are "live".

*Maps, graphs, tables, and VBA macros are stored in a map document.*

The table of contents lists data frames and layers.

Layers are sets of features of the same type (streets, vegetation, soils, and so on). They are like themes in ArcView GIS 3.

A data frame groups layers that are to be displayed together on a map, like views in ArcView GIS 3.

Toggle between layout view and data view by clicking the view buttons.

Add a layer by clicking the Add Data button.
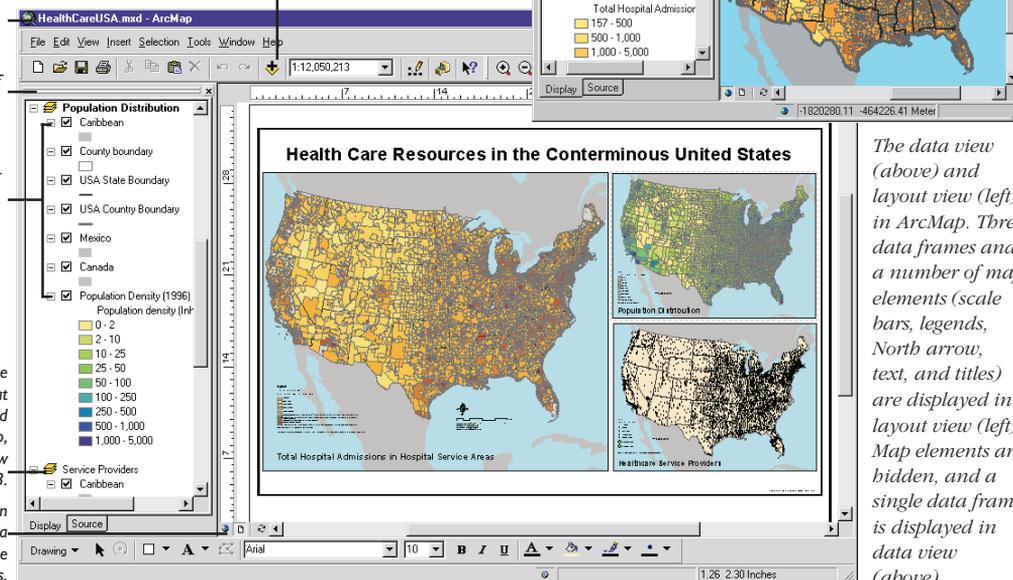
The data view (above) and layout view (left) in ArcMap. Three data frames and a number of map elements (scale bars, legends, North arrow, text, and titles) are displayed in layout view (left). Map elements are hidden, and a single data frame is displayed in data view (above).

Tables and charts in ArcView 8.2 are similar to tables and graphs in ArcView GIS 3, but with enhanced appearance and function.

Visual Basic for Applications has replaced Avenue™ as the language used for customization and macro creation. VBA provides a well-known standard interface with a rich set of programming (coding and debugging) tools.

Comparison of key concepts

Many of the terms have changed from ArcView GIS 3 to ArcView 8.2. In most cases, however, equivalent features and functionality exist. Key concepts in ArcView GIS 3 are listed in this section beside their equivalents in ArcView 8.2. For a more extensive comparison of concepts, please see the online topic 'ArcView terminology' in the 'Transitioning from ArcView GIS 3 to ArcView 8.2' book of the ArcGIS Desktop Help system.

ArcView extensions at 8.2

Functionality formerly available through extensions (geoprocessing and image support for a variety of image formats) is now included in ArcView 8.2. As described earlier, optional extensions, including 3D Analyst, ArcPress, and ArcGIS Spatial Analyst are still available and are built into the ArcGIS Desktop core functionality.

ArcView GIS 3	**ArcView 8.2**
KEY FEATURES	
Multiple document interface	**Single document interface**
Project (.apr) Organizes and stores information as views, tables, charts, layouts, and scripts.	**Map Document (.mxd)** Disk-based representation of a map that stores your maps, graphs, tables and macros.
View Groups sets of features (themes) that are displayed together. Has its own table of contents and display area.	**Data Frame** Groups sets of features (layers) that are displayed together. Listed in the main table of contents and displays in the main display area.
Table of Contents Lists themes in a particular view.	**Table of Contents** Lists data frames with the layers they display.
Theme Represents a set of features of the same type, such as streams, lakes or highways. Exists only within the parent project.	**Layer** Represents a set of features of the same type, such as streams, lakes or highways. Persists independent of the data frame and can be shared with other users.
Chart Graphic representation of information about map features and the relationships between them. Common types are line, bar, and pie charts.	**Graph** Graphic representation of information about map features and the relationships between them. Common types are pie, line, and bar graphs.
Layout Arrangement of views and map elements on a page. Geographic analysis tools can't be used on a layout because map elements are not "live". Multiple layouts are supported.	**Map in Layout View** Arrangement of data frames and map elements on a page. Geographic analysis tools can be used because map elements are "live". Layouts can be dynamically altered using map templates. Only one layout is supported.
Avenue Script A macro written using Avenue.	**VBA Macro** A macro written using Visual Basic for Applications (VBA)
TYPICAL ACTIONS	
Select by Theme Selects features based on their location in relation to features of other themes.	**Select by Location** Selects features based on their location in relation to features of other layers.
SQL Select Selects features based on their attributes.	**Select by attribute** Selects features based on their attributes.
Convert to Shapefile Exports selected features as a new shapefile.	**Data>Export** Exports selected features as a new layer.
Add theme Adds a new theme to the active view.	**Add Data** Adds a new data layer to the active data frame.
Promote Moves selected records to top of the table.	**Show Selected** Shows only the selected records in a new table.

Importing ArcView GIS 3 projects and legends into ArcMap

ESRI has included transitioning tools in ArcMap to aid in the migration from ArcView GIS 3 to ArcView 8.2. ArcView 8.2 no longer uses the .apr file format to store project information. However, you can import most of the items from an ArcView GIS 3 project into an ArcMap map document using the Import from ArcView project menu command.
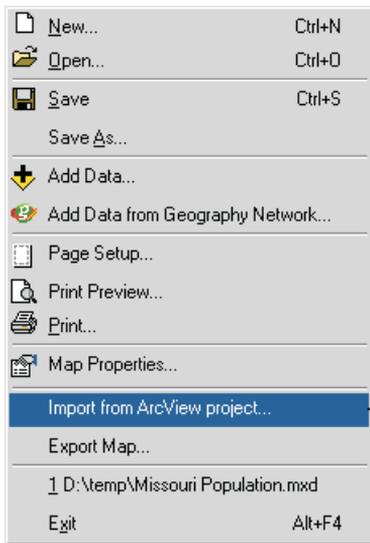
Choose Import from ArcView project from the ArcMap File menu to import an ArcView GIS 3 project.
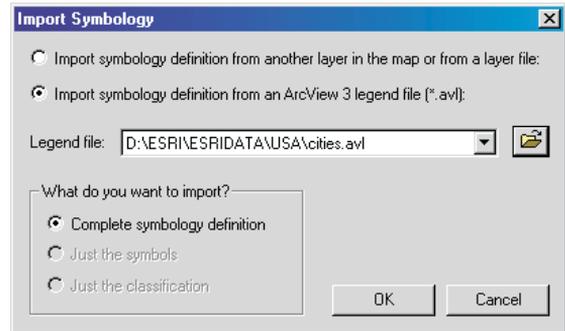
It is important to note that only one layout is possible in ArcMap. Therefore, if you have an ArcView GIS 3 project with multiple layouts, you will either need to select one to import or import each into a separate map document. Map templates can be used in ArcMap to dynamically alter your layouts.

For more information and to get step-by-step instructions, please see the online topic 'Importing an ArcView GIS 3 legend into ArcMap' in the 'Transitioning from ArcView GIS 3 to ArcView 8.2' book of the ArcGIS Desktop Help system.

Similarly, you can import ArcView GIS 3 legend symbology into ArcMap using the Import symbology definition from an ArcView GIS 3 legend file (*.avl) option on the Import Symbology dialog box.

New features and functionality beyond ArcView GIS 3

Managing data with ArcCatalog and editing data with the ArcMap editing tools are only two examples of the new functionality offered by ArcView 8.2. Improvements to tools used in map interaction, map creation, data classification and symbolization, and map analysis are all presented in a friendlier, Windows-based interface.

Highlights of the new features and functionality include:

- Map tips that pop up when you pause the mouse pointer over a feature, displaying an attribute of that feature

- Magnifier window that allows you to see a magnified view of a small area without changing the extent of your view

- Overview window that allows you to see the full extent of the data

- Spatial bookmarks identifying particular geographic locations at particular scales that can be saved and referred to later

- Very rich core raster data display

- Raster georeferencing

- Advanced legend classification tools

- Multilayer data transparency that allows you to see layers underneath transparent layers

- On-the-fly projection of features and rasters between coordinate systems

- Enhanced labeling capabilities including multifield labeling and splined labels

- Extensive collection of predefined styles for legends, North arrows, scale bars, scale text, neatlines, and graticules

- Tool for exporting maps in a number of graphic formats (.emf, .jpg, and .pdf)

- Tool that allows you to verify SQL statements before execution

- Editing tools for constructing and editing features, creating features from existing features, and setting the snapping environment

- Tools for importing coverages and shapefiles to personal geodatabases or rasters to MrSID

- Tools for exporting vector layers to personal geodatabases or rasters to TIFF, IMG, or GRID file format

- Tools for creating, editing, importing, and exporting metadata as one of four metadata styles: ESRI Web Style, FGDC FAQ Style, FGDC Report Style, and XML Data Style

- OLE containers for OLE objects inserted inside ArcMap

- Industry-standard application development with VBA, VB, VC++, Delphi™, and other ActiveX languages

- Customization tools for extending the application and creating macros

- Tight integration with ArcEditor and ArcInfo

- Strong ArcIMS support

Only a few of the added features and functionality of ArcView 8.2 have been highlighted here. For a complete list of new features and functionality, please see the online topic 'New features and functionality beyond ArcView GIS 3' in the 'Transitioning from ArcView GIS 3 to ArcView 8.2' book of the ArcGIS Desktop Help system.