



What is ArcGIS™ ?

*GIS by ESRI™*

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## What is ArcGIS 8.3?

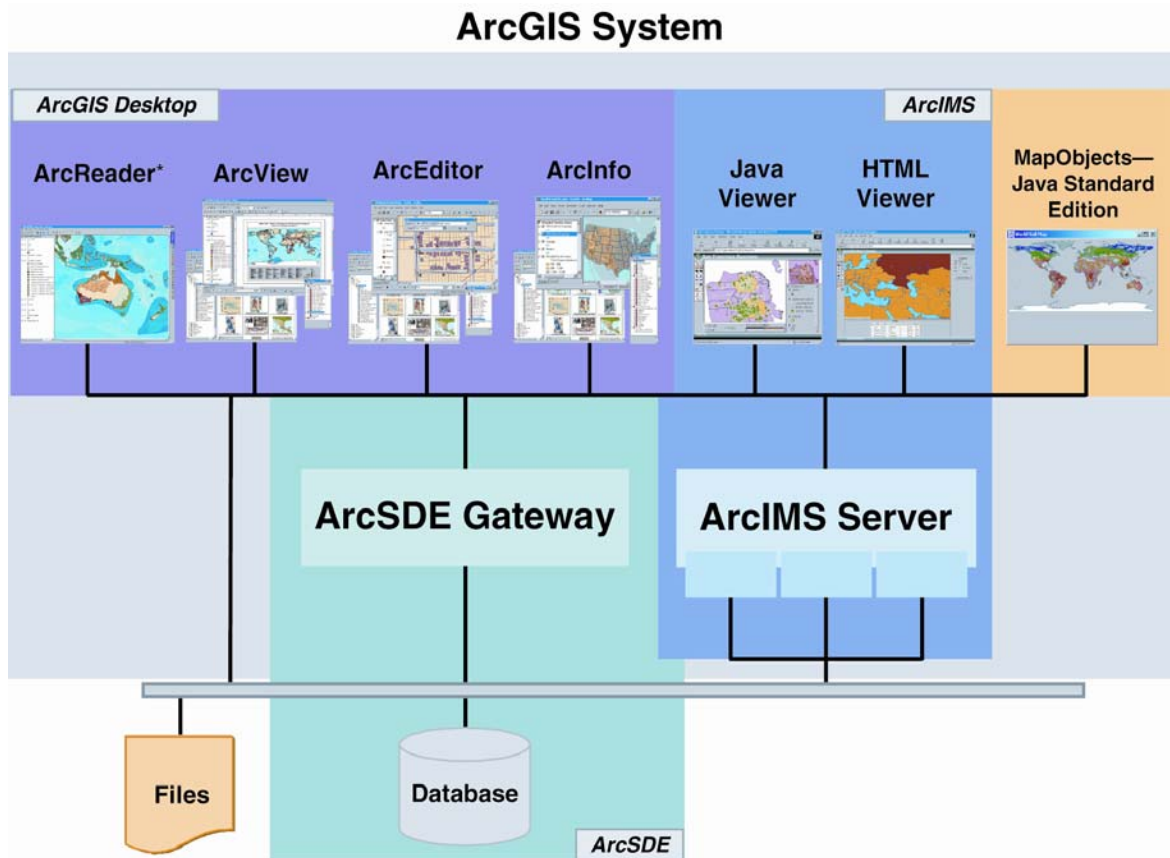
The ESRI® ArcGIS™ system is an integrated geographic information system (GIS) consisting of three key parts:

- 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 software system.



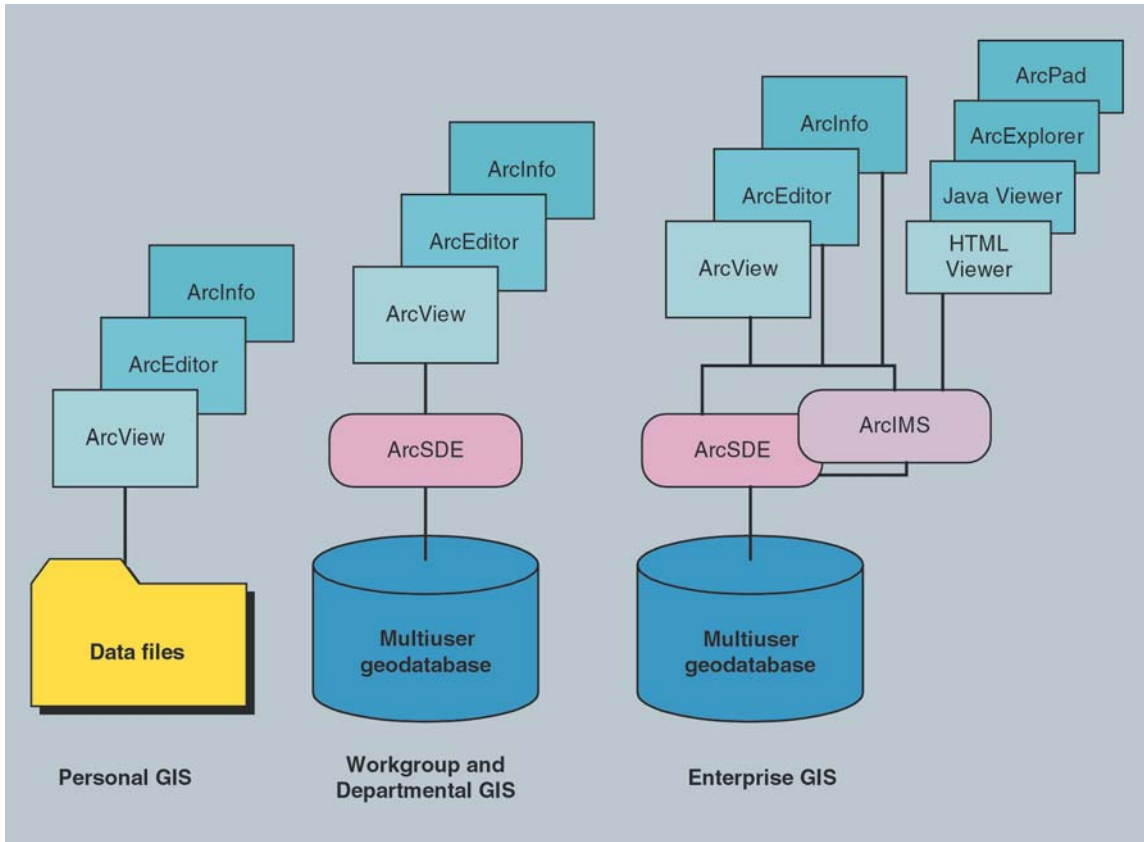
Use ArcGIS Desktop to author and use geographic information, ArcSDE to manage multiuser information in a DBMS, and ArcIMS to publish and share information on the Internet.

\* ArcReader is a free product. It ships along with the other ArcGIS Desktop products—ArcView, ArcEditor, and ArcInfo—and can be downloaded from the ESRI Web site at [www.esri.com](http://www.esri.com).

## ArcGIS 8.3 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

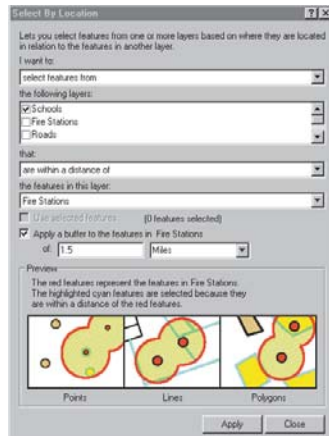
various parts of this system to implement a GIS of any size—from a single-user system to work groups and departments, for large enterprises, and for societal GIS systems.



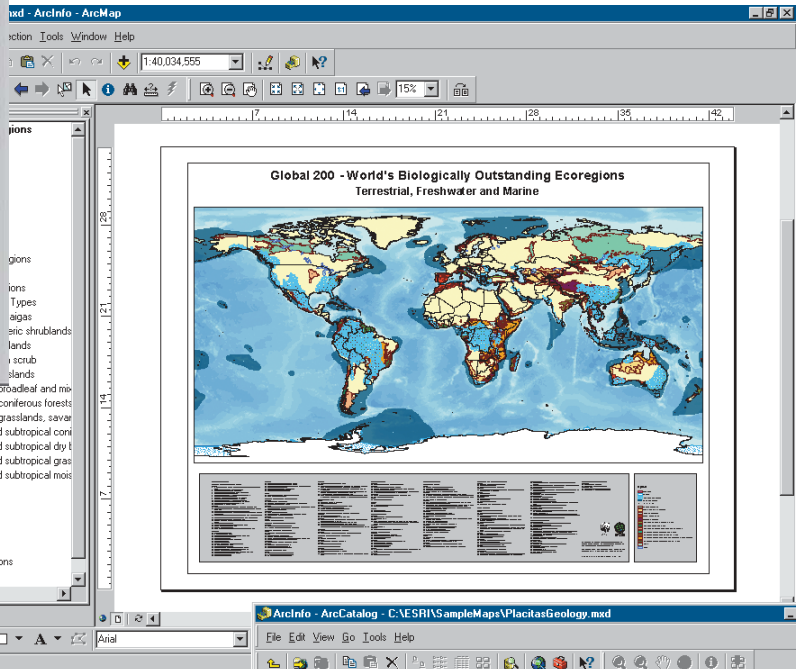
## GIS data management

ArcGIS uses intelligent GIS data models for representing geography and provides all the tools

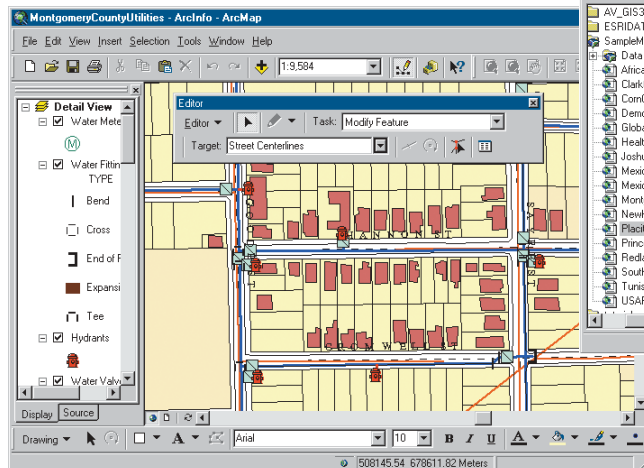
necessary for creating and working with the geographic data. This includes tools for all GIS tasks: editing and data automation, mapping and map-based tasks, data management, geographic analysis, metadata management, and deploying data and applications on the Internet.



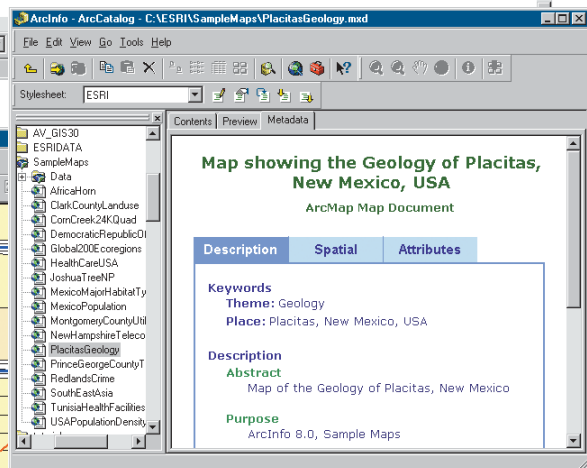
*Geoprocessing*



*Mapping and cartography*



*Editing*



*Metadata management*



## 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, geographic information in ArcGIS can be multipurpose, sharable, and standards-based. Thus, ArcGIS provides a robust platform for any GIS application.

### File-based models: coverages, shapefiles, and others

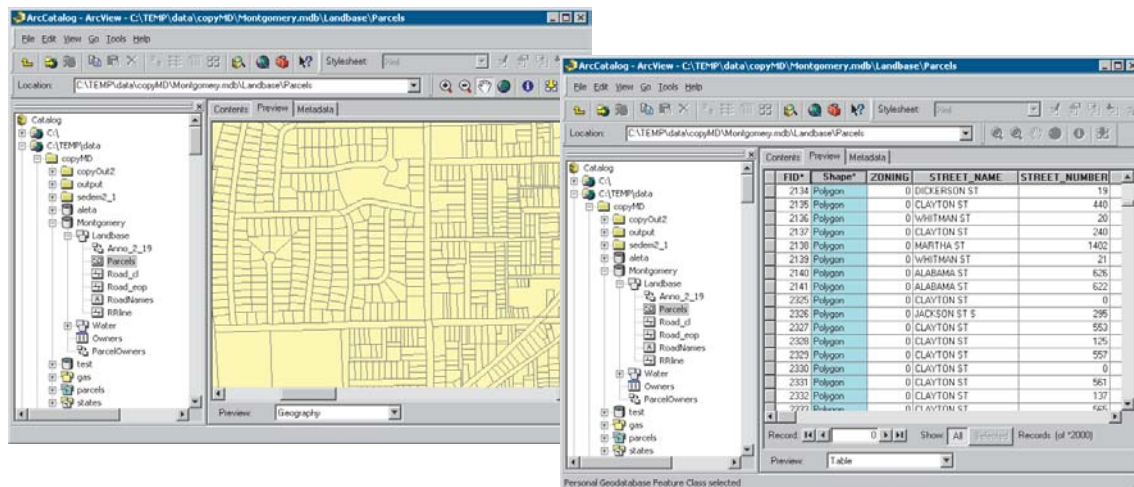
ArcGIS 8.3 supports a file-based data model of coverages, shapefiles, and attribute tables. Grids and TINs provide additional spatial support for raster data and surfaces. The

ArcGIS Desktop products—ArcReader™, 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 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. For example, geodatabases can be implemented using the spatial types delivered with Oracle® Spatial.

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. Thus, geodatabase storage and management is relational.



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.

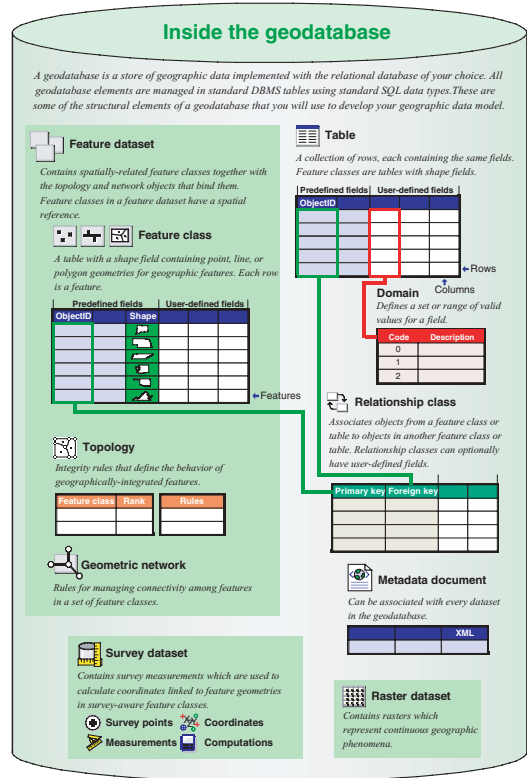


Using the geodatabase, additional integrity rules and behavior can be defined for your spatial data to model important geographic behavior, such as networks, topologies, terrains, and image catalogs. For example, you can model the integrity rules for census geography:

- 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 (that is, software components that animate the rules and behavior). The geodatabase is thus described as an object-relational data model.

## Geodatabase contents



*Examples of integrity rules that can be managed using a topology.*

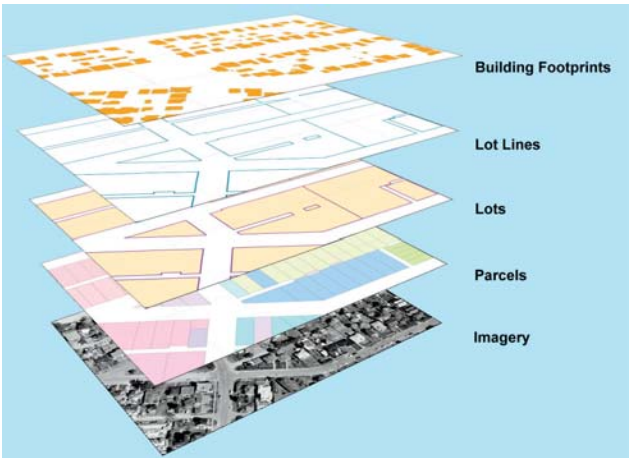
What is topology?


In ArcGIS 8.3, topology is supported in the geodatabase. This enables fundamental data modeling capabilities that are critical to GIS users in their database designs.

A topology is a set of integrity rules and software tools that defines the behavior of spatially integrated geographic features and feature classes. “County boundaries must not overlap” is an example of a simple topology rule for the polygons in a feature class of counties. Rules can also be established between two feature classes. For example, County polygons must completely cover and nest within (i.e., tessellate) the States feature class.

In the geodatabase, a topology is expressed as a series of integrity rules along with key properties: a cluster tolerance, feature class ranks for coordinate accuracy (less accurate feature geometry can be snapped to more accurate features), and any exceptions to the topology rules.

Setting up topology rules is a fundamental part of geodatabase design. In each case, users define which feature classes participate in a topology and share geometry. These shared feature classes are organized into a common feature dataset, and the topology rules that govern geometric behavior of the features are defined.





Topology ParcelFeatures

Cluster tolerance: 0.0098026437

Participating Feature class	Coordinate Accuracy Rank
Building Footprints	5
Lot Lines	1
Lots	2
Parcels	3
Imagery	-

Topology rules

Lots cannot overlap one another

Lots must completely cover Parcels

Lot Lines boundaries must be covered by Parcels

## Building on traditional database design

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.

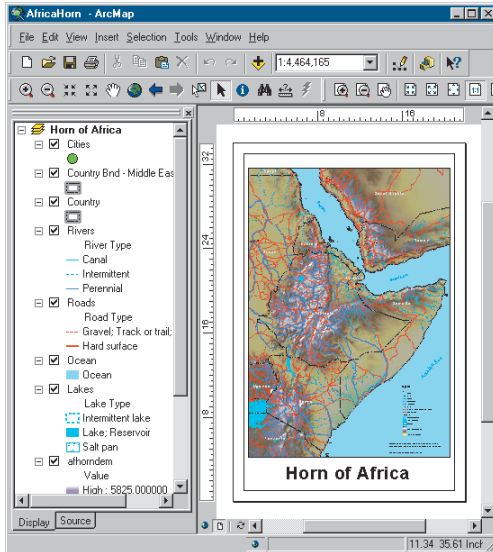


## What is ArcGIS Desktop?

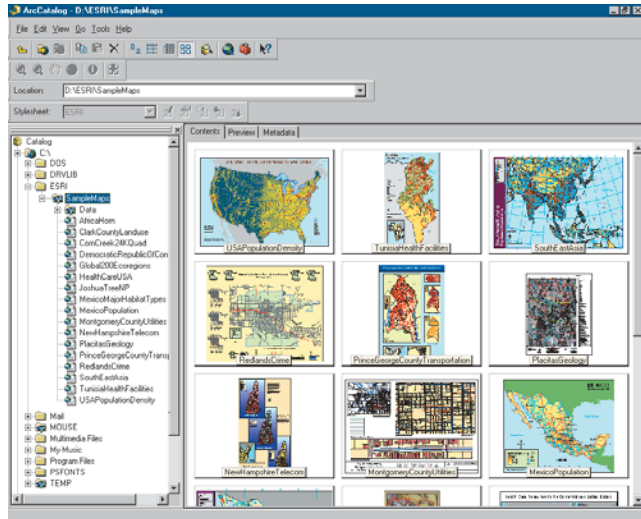
ArcGIS Desktop includes a suite of integrated applications: ArcMap, ArcCatalog, and ArcToolbox. Using these three applications together, you can perform any GIS task, simple to advanced, including mapping, data

management, geographic analysis, data editing, and geoprocessing. In addition, ArcGIS 8.3 allows you to tap into an abundance of spatial data and resources available through ArcIMS services on the Internet.

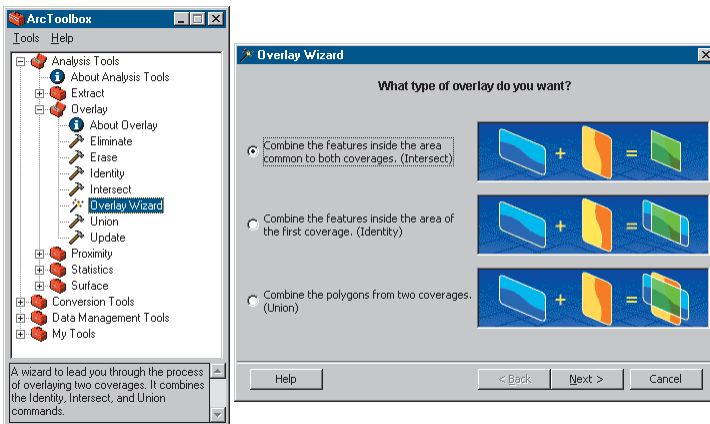
ArcGIS Desktop is a comprehensive, integrated, scalable system designed to meet the needs of a wide range of GIS users.



*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 as well as for recording, viewing, and managing metadata.*



*ArcToolbox is used for data conversion and geoprocessing.*

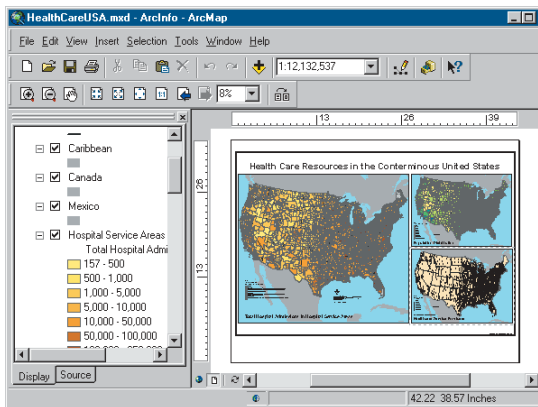
## ArcMap

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.

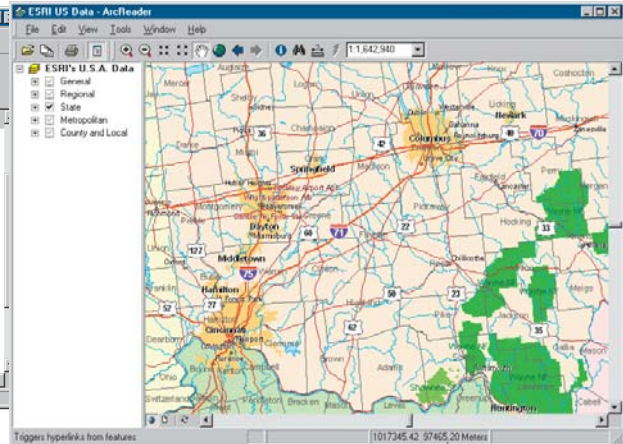
In this application, you work with maps. Maps have a page layout containing a geographic window, called a data

frame, with a series of layers, legends, scalebars, North arrows, and other elements.

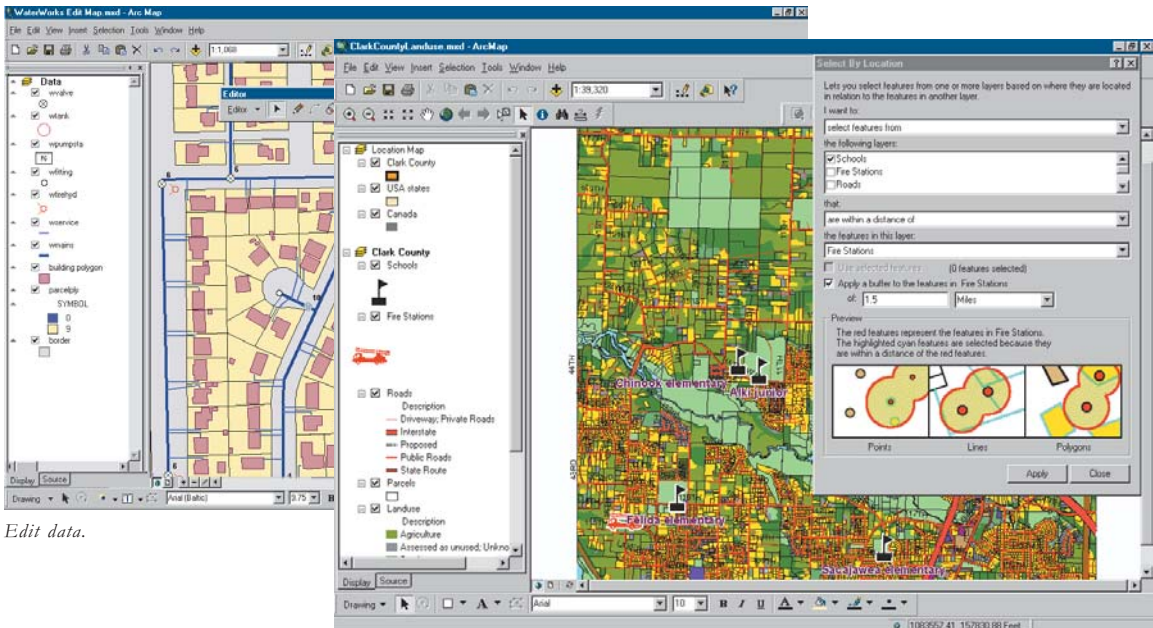
ArcMap offers different ways to view a map—a geographic data view and a layout view—in which you can perform a broad range of advanced GIS tasks.



*Design and create publication-quality maps.*



*Author and share maps with ArcReader and the ArcIMS ArcMap Server.*



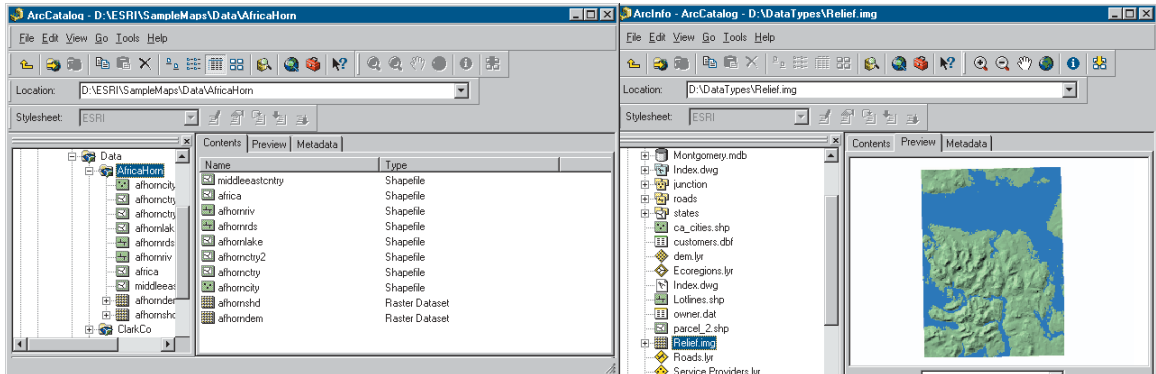
*Edit data.*

*Analyze data.*

## ArcCatalog

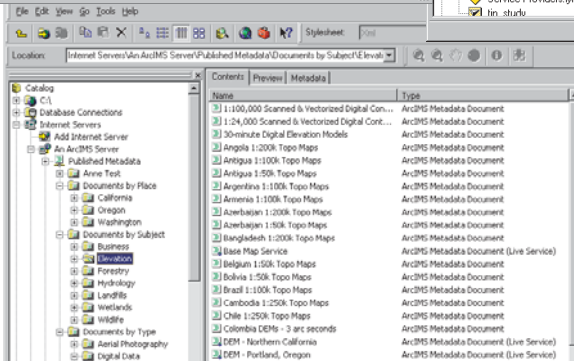
The ArcCatalog application helps you organize and manage all of your GIS data. It includes tools for browsing and

finding geographic information, recording, viewing, and managing metadata, quickly viewing any dataset, and defining the schema structure for your geographic data layers.

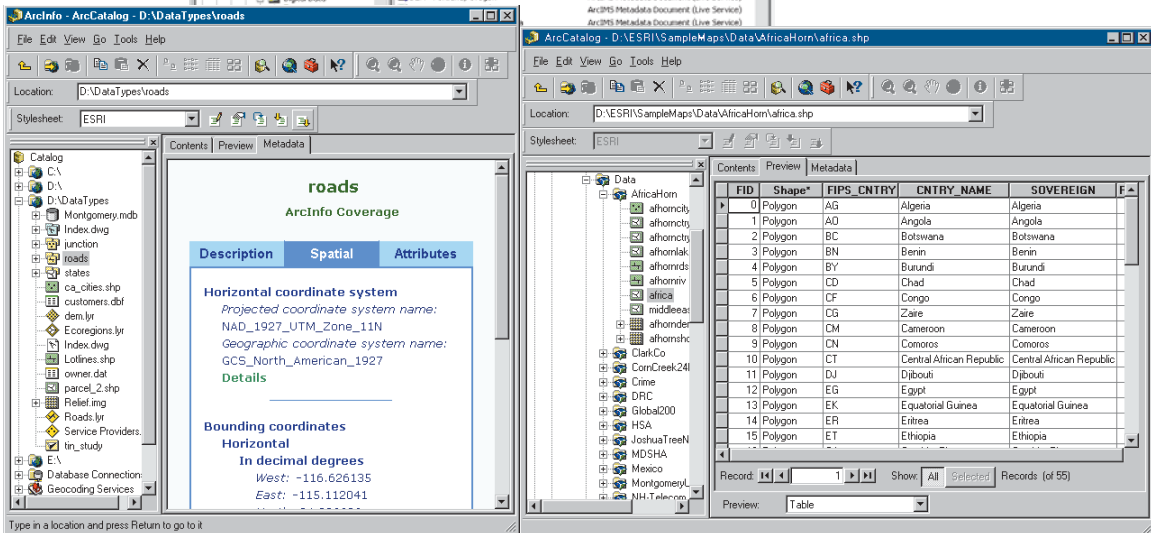


View your GIS data holdings.

Preview geographic information.



Organize, edit, and manage a metadata catalog in an ArcIMS Metadata Server.



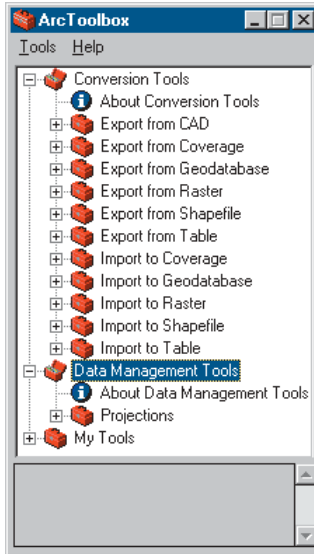
View and edit metadata.

Work with tables.

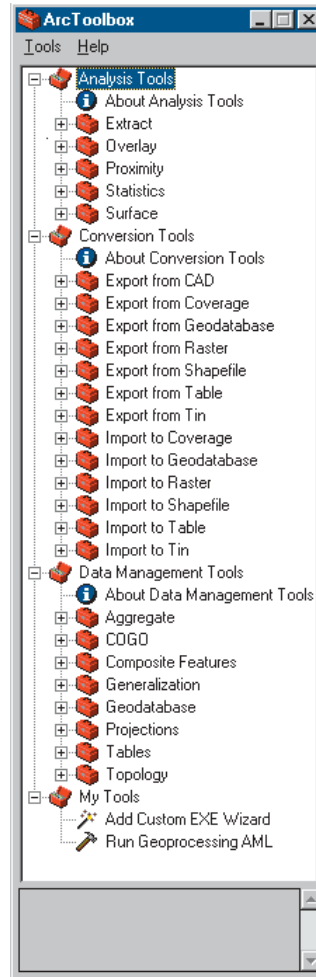


## ArcToolbox

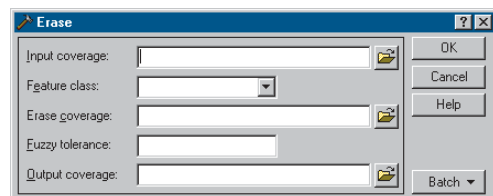
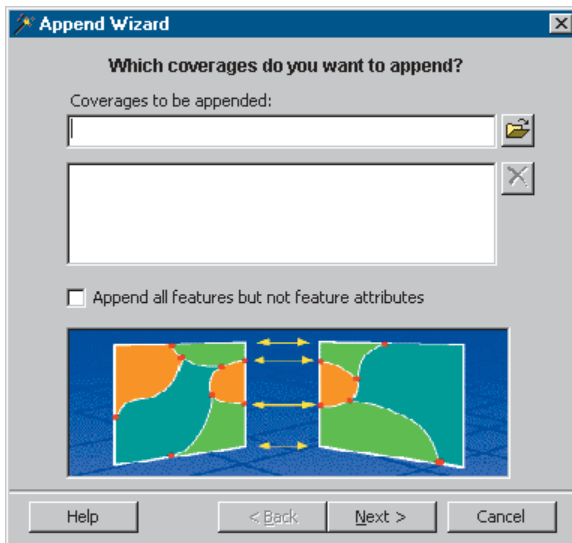
ArcToolbox is a simple application containing many GIS tools used for geoprocessing. There are two versions of ArcToolbox: the complete ArcToolbox that comes with ArcInfo and a lighter version that comes with ArcView and ArcEditor.



*ArcToolbox for ArcView and ArcEditor contains more than 40 commonly used tools for data conversion, map projection, and data management.*



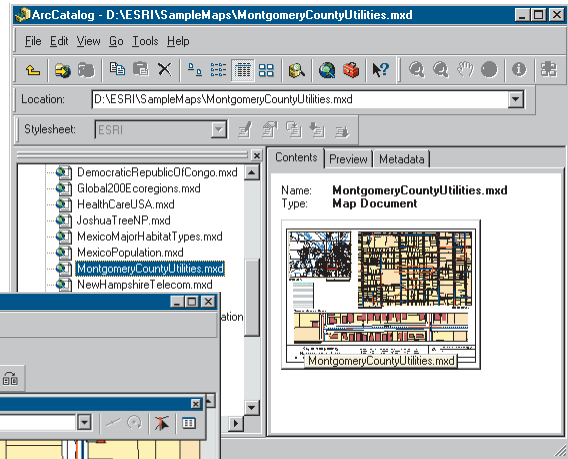
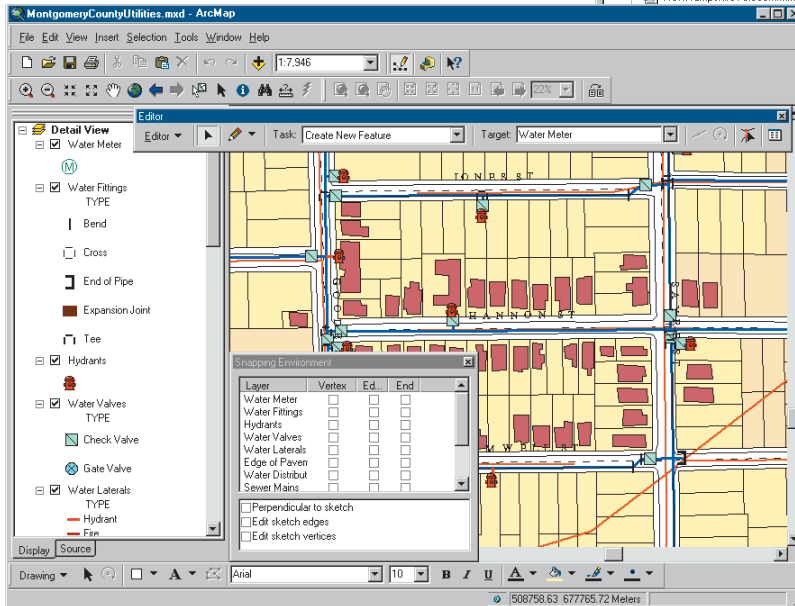
*ArcToolbox for ArcInfo comes with a complete, comprehensive set of tools (well over 150) for geoprocessing, data conversion, map sheet management, overlay analysis, map projection, and much more. It includes tools for all the Arc: prompt commands for ArcInfo Workstation.*



*The tools and wizards in ArcToolbox make data conversion and geoprocessing easy.*

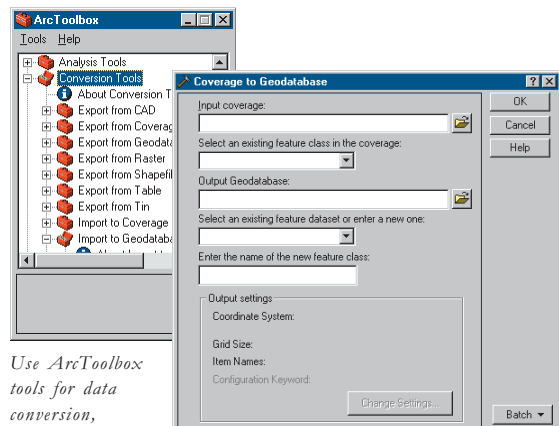
## Putting them all together

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 double-click it to open it inside ArcMap. You can then edit and enhance your data through the tools available in the ArcMap editing environment.



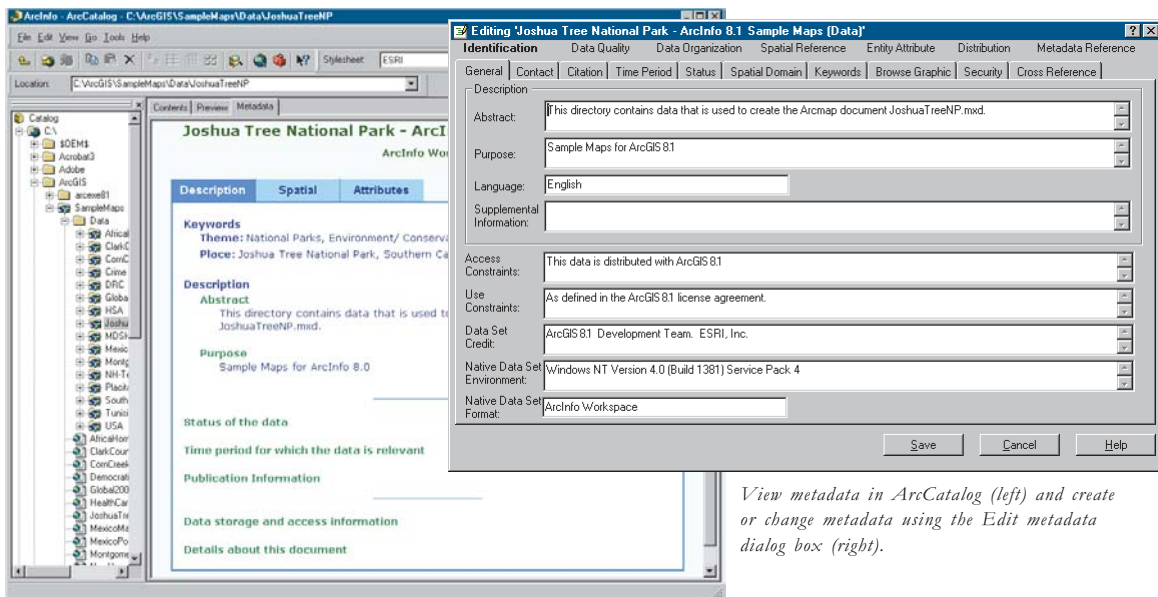
*Double-clicking a map in ArcCatalog (above) opens it in ArcMap (left). The view in the ArcMap window (left) has been set to data view, and the Editor toolbar is displayed.*

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.

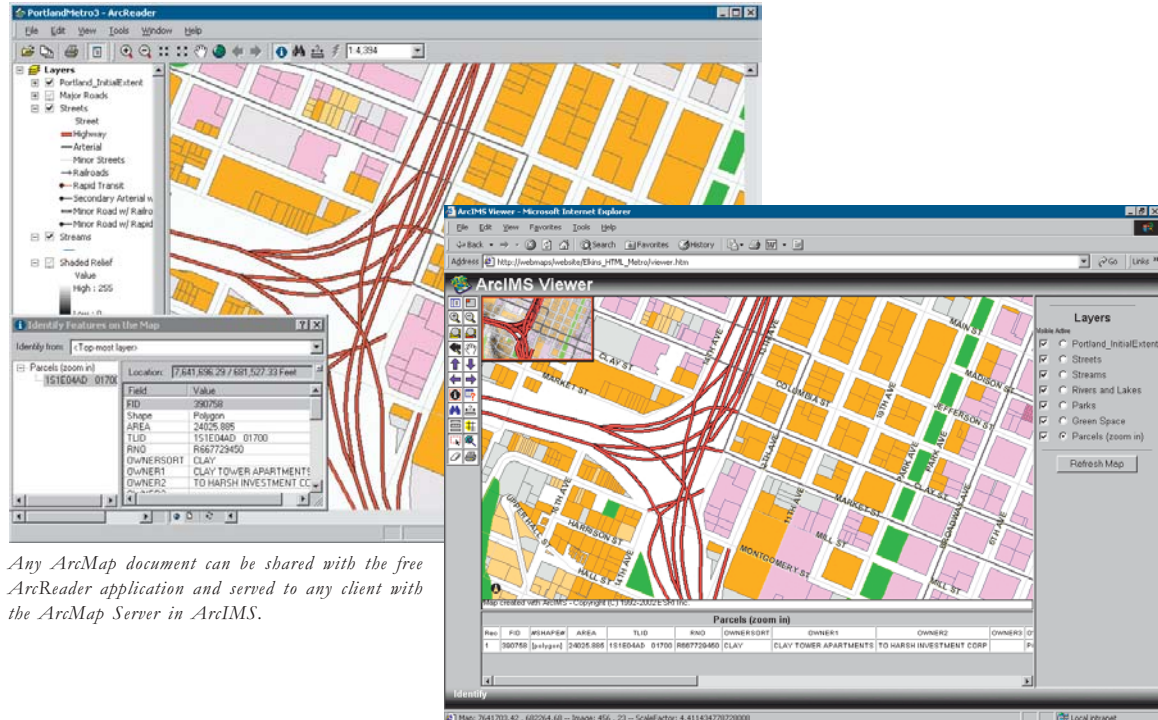


*Use ArcToolbox tools for data conversion, projection, and analysis.*

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).*



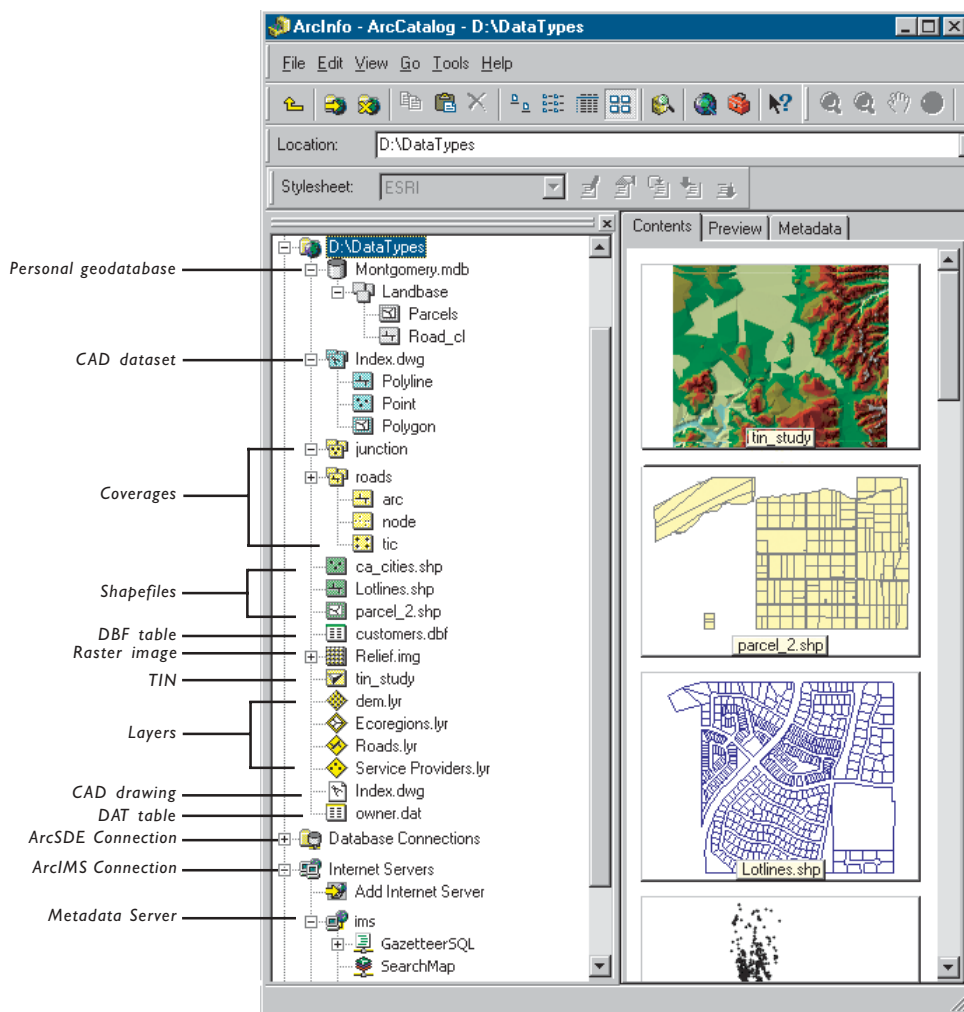
*Any ArcMap document can be shared with the free ArcReader application and served to any client with the ArcMap Server in ArcIMS.*

## 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.

One exciting capability of ArcMap and ArcCatalog is the ability to work with ArcIMS services 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) as well as to ArcIMS services, including Metadata Services.*

## What are ArcView, ArcEditor, and ArcInfo?

ArcGIS Desktop is the information authoring and usage tool for GIS professionals. It 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.

ArcEditor includes advanced editing capabilities for shapefiles 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).

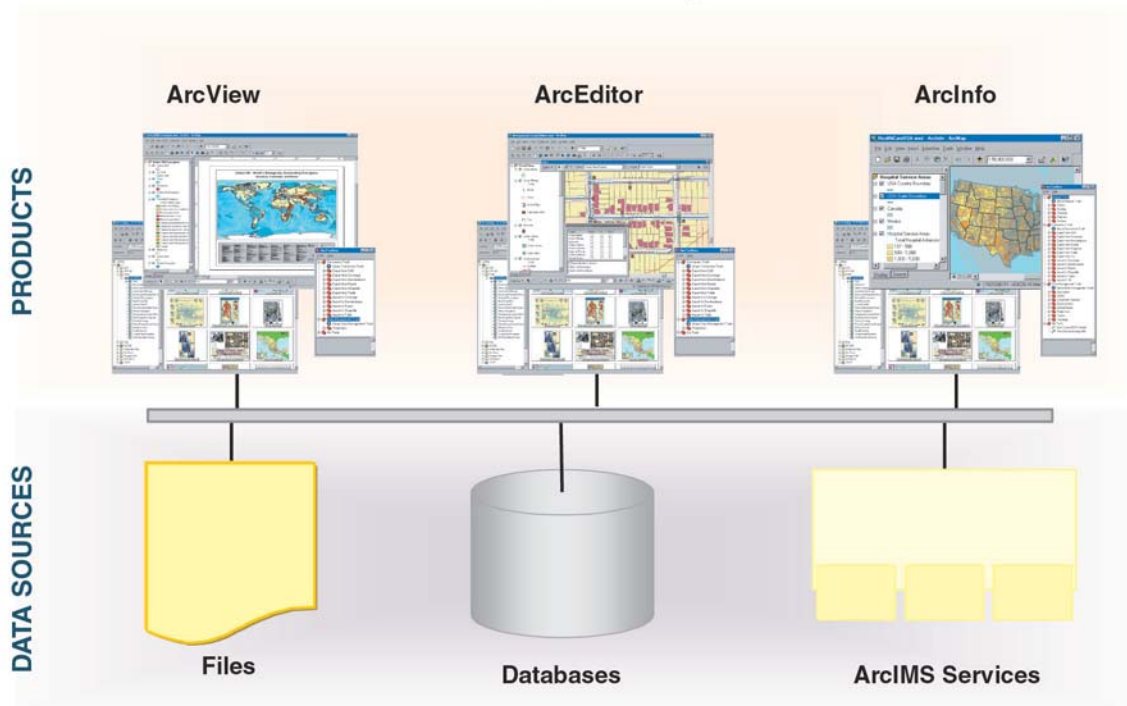
	ArcView, ArcEditor, and ArcInfo		ArcEditor and ArcInfo		ArcInfo only
<b>Data support</b>	Work with shapefiles, geodatabases, and ArcIMS services Work with Geography Network <sup>SM</sup> Work with any DBMS Work with many table formats Read access to any geodatabase Work with many raster formats	+	Full read-write and transactional access to any geodatabase Load rasters into DBMS with ArcSDE		
<b>Cartography</b>	Advanced mapping and query Map authoring Map templates Thousands of symbols and styles			+	ArcPlot: command-based mapping application
<b>Map analysis</b>	Advanced map analysis Report writing Charting and business graphics				
<b>GIS data management</b>	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)		
<b>Editing</b>	Edit shapefiles and simple, personal geodatabases	+	Edit all geodatabases Versioning tools Dimensions	+	ArcEdit: command-based coverage editing application
<b>Geo-processing</b>	Perform 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
<b>Developer tools</b>	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, map 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 ArcGIS. For more information on the extension software, see 'Optional extensions for ArcGIS Desktop' later in this section.

## ArcGIS Desktop



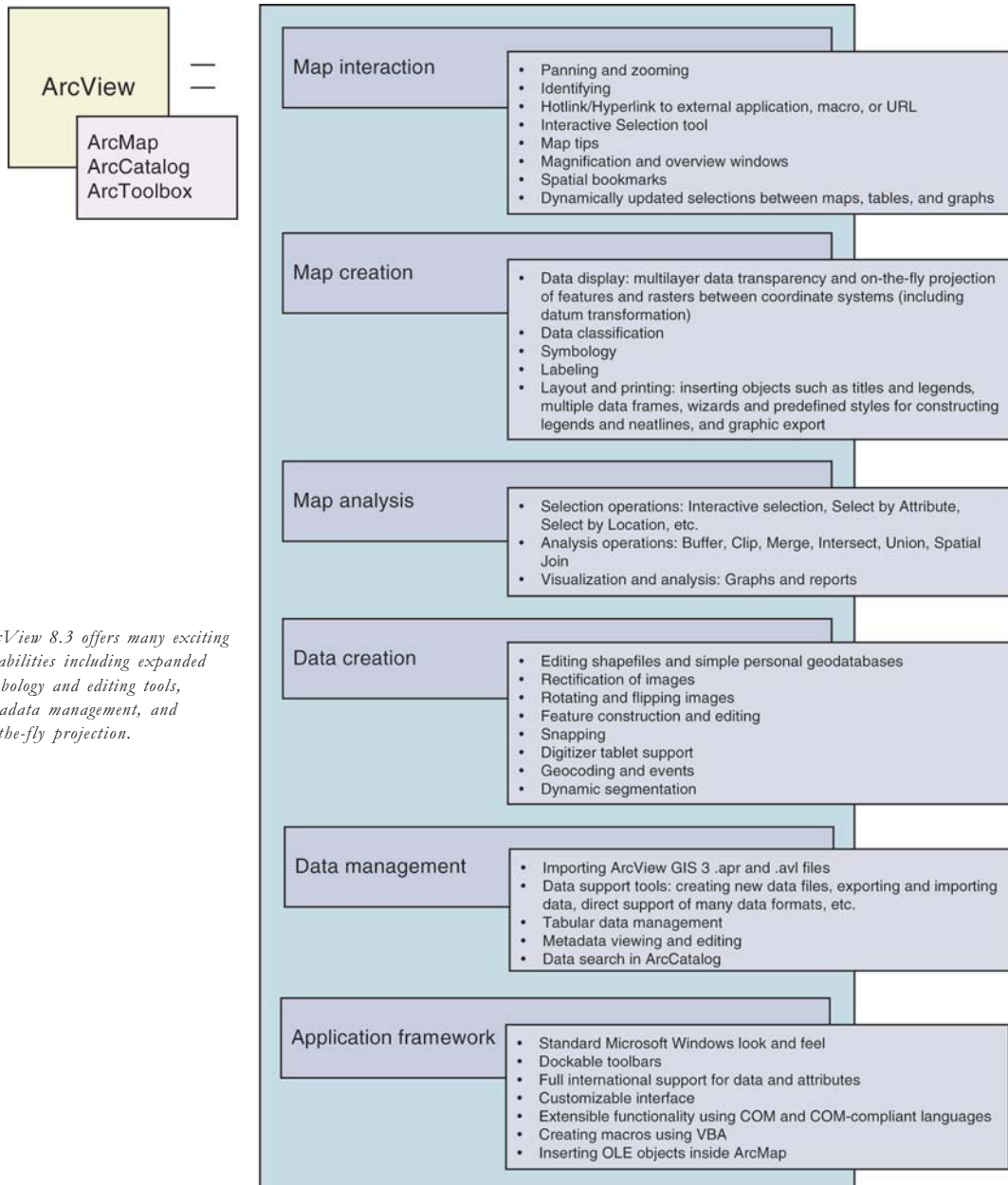
*ArcGIS Desktop is available in three options: ArcView, ArcEditor, and ArcInfo. All three share a common user interface and developer tools and work with the same data.*



## What is ArcView 8.3?

ArcView 8.3 is one of the three functional product levels at which you can use ArcGIS Desktop. ArcView 8.3 is a

suite of three applications: ArcMap, ArcCatalog, and ArcToolbox. It is a powerful toolkit for mapping, reporting, and map-based analysis.



*ArcView 8.3 offers many exciting capabilities including expanded symbology and editing tools, metadata management, and on-the-fly projection.*



ArcView 8.3 is functionally equivalent to ArcView GIS 3—tasks you performed with ArcView GIS 3 can be done with ArcView 8.3.

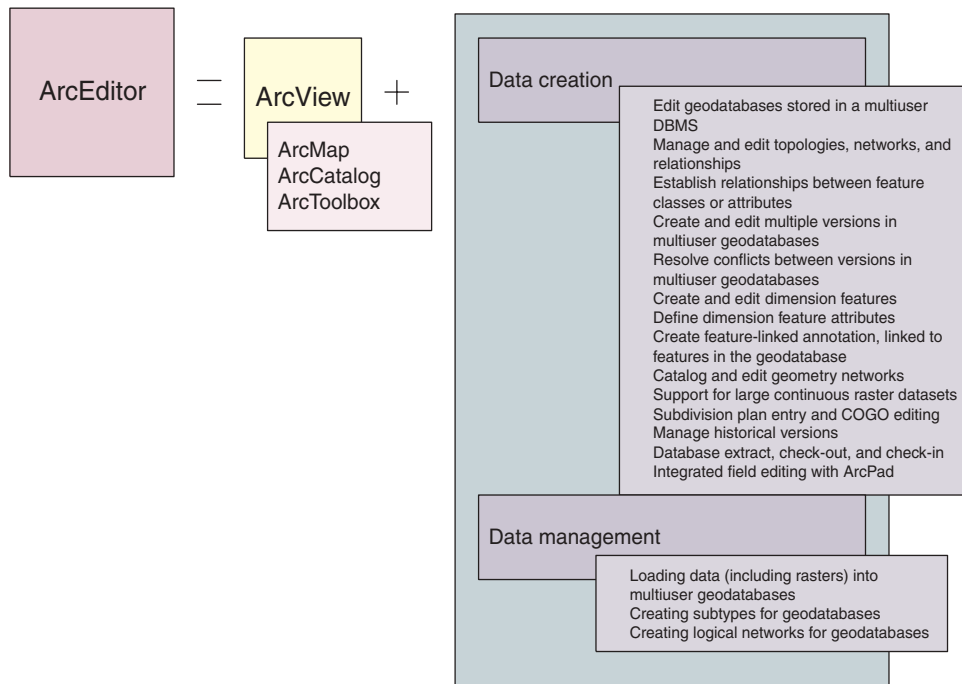
In addition, many more exciting capabilities have been added in ArcView 8.3. For example, both symbology and editing tools have been greatly expanded, and the standard Windows interface comes equipped with multiple wizards to help you create, maintain, and update your data and maps. Other additional 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 8.3 can also be customized using the industry-standard Microsoft® Visual Basic® for Applications (VBA), which is included with ArcView 8.3.

## What is ArcEditor 8.3?

ArcEditor is a GIS data automation and compilation solution for the construction and maintenance of geodatabase features and shapefiles. ArcEditor provides the ability to create geodatabase behaviors, such as topology, subtypes, domains, and geometric networks. ArcEditor also includes tools that support metadata creation, geographic data exploration and analysis, and mapping. ArcEditor provides all the capabilities of ArcView.

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?’.

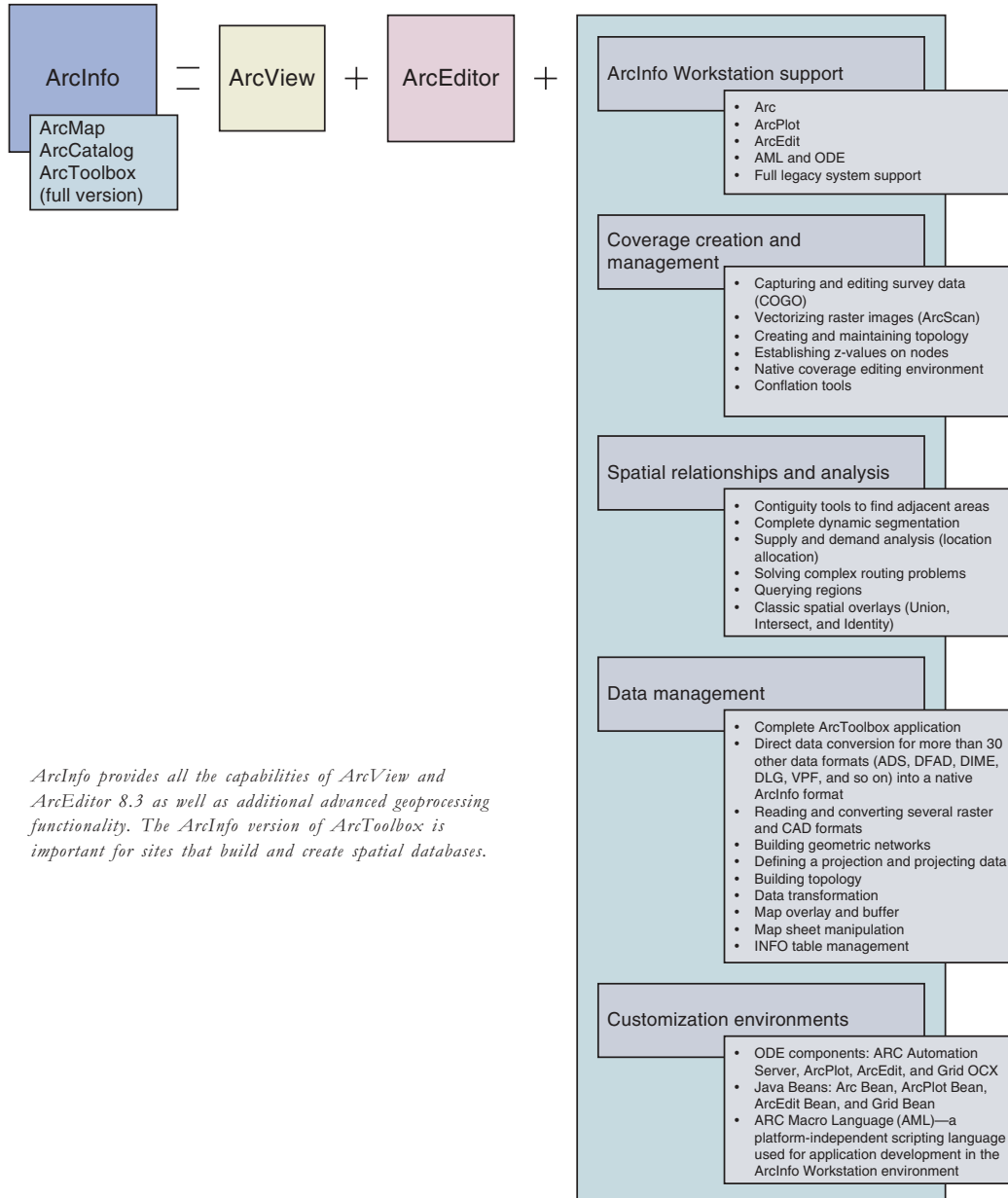


*ArcEditor offers the same three applications as ArcView 8.3—ArcMap, ArcCatalog, and ArcToolbox—but with advanced editing capabilities.*

## What is ArcInfo 8.3?

ArcInfo is the most functionally rich client in ArcGIS Desktop. The high-end ArcInfo product provides all the capabilities of ArcView and ArcEditor 8.3. 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 provides all the capabilities of ArcView and ArcEditor 8.3 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 (single use or floating), and ArcInfo (floating).

All desktop 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™—while ArcEditor and ArcInfo offer a direct read–write connection to a DBMS.

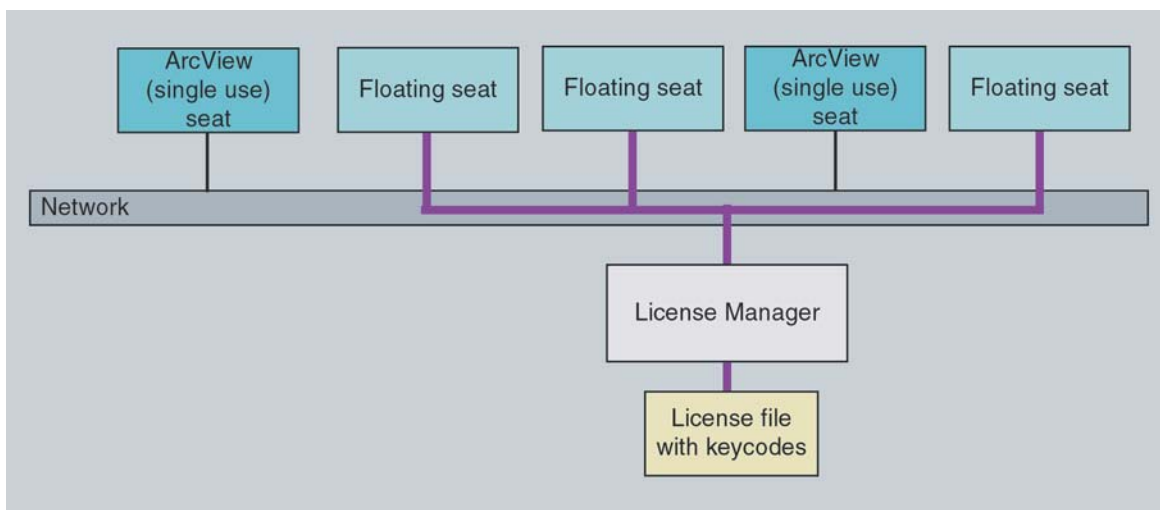
ArcView and ArcEditor are available as a single-use license. With a single-use license, you can install and use each copy of ArcView or ArcEditor on only one machine.

ArcView, ArcEditor, and ArcInfo are also available as a floating license. 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 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 a floating ArcEditor license, you choose the number of seats you want. Because you are able 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, 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 by ArcEditor. Because you have a floating license, your users can easily gain access to geodatabase editing and other



*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 and ArcEditor can be purchased in a single-use license—this means that each copy can be installed on only one fixed machine on your network.*

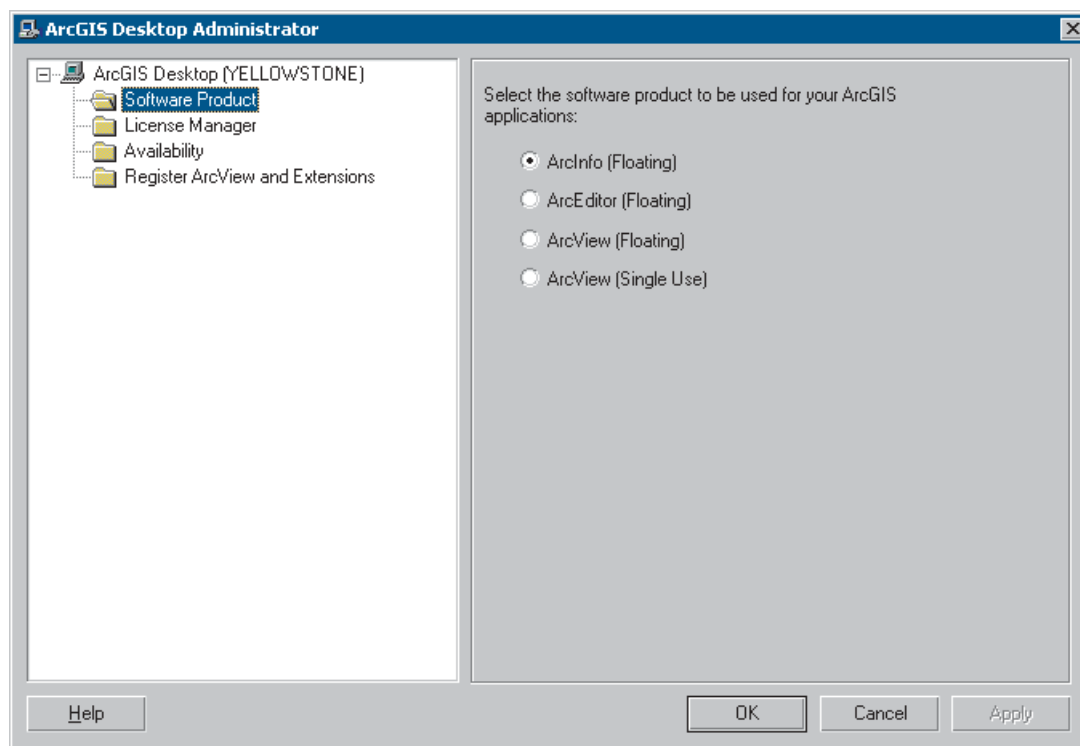
ArcEditor capabilities after you purchase an ArcEditor license and obtain an ArcEditor keycode.

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 the ArcGIS Desktop Administrator that is provided with your software (shown below).



*With the ArcGIS Desktop Administrator, which comes with your software, you can easily switch between products. The ArcGIS Desktop Administrator is accessed by clicking the Start button, pointing to Programs, pointing to ArcGIS, and clicking Desktop Administrator.*

## Optional extensions for ArcGIS Desktop

Many optional ArcGIS extensions are available with version 8.3. More will follow in future releases.

<b>ArcGIS Spatial Analyst</b>	Advanced raster modeling ArcGrid™ calculator with ArcGrid algebra VBA for raster analysis
<b>ArcGIS 3D Analyst</b>	ArcScene™: real-time interactive 3D scenes Scene views in ArcCatalog 3D Modeling tools ArcTIN™ tools
<b>ArcGIS Geostatistical Analyst</b>	Advanced kriging and surface modeling Exploratory spatial data analysis tools Probability, threshold, and error mapping
<b>ArcGIS Survey Analyst</b>	Comprehensive survey information management using the geodatabase Advanced survey computation Improved GIS data accuracy via links to survey locations
<b>ArcGIS StreetMap™ USA</b>	Complete nationwide streets database Nationwide geocoding
<b>ArcGIS StreetMap Europe</b>	European street mapping and geocoding
<b>ArcGIS Tracking Analyst</b>	Time-based map display and rendering Playback tools (Play, Pause, Forward, Rewind) Work with any time-based data (e.g., features that move/change or whose values change through time)

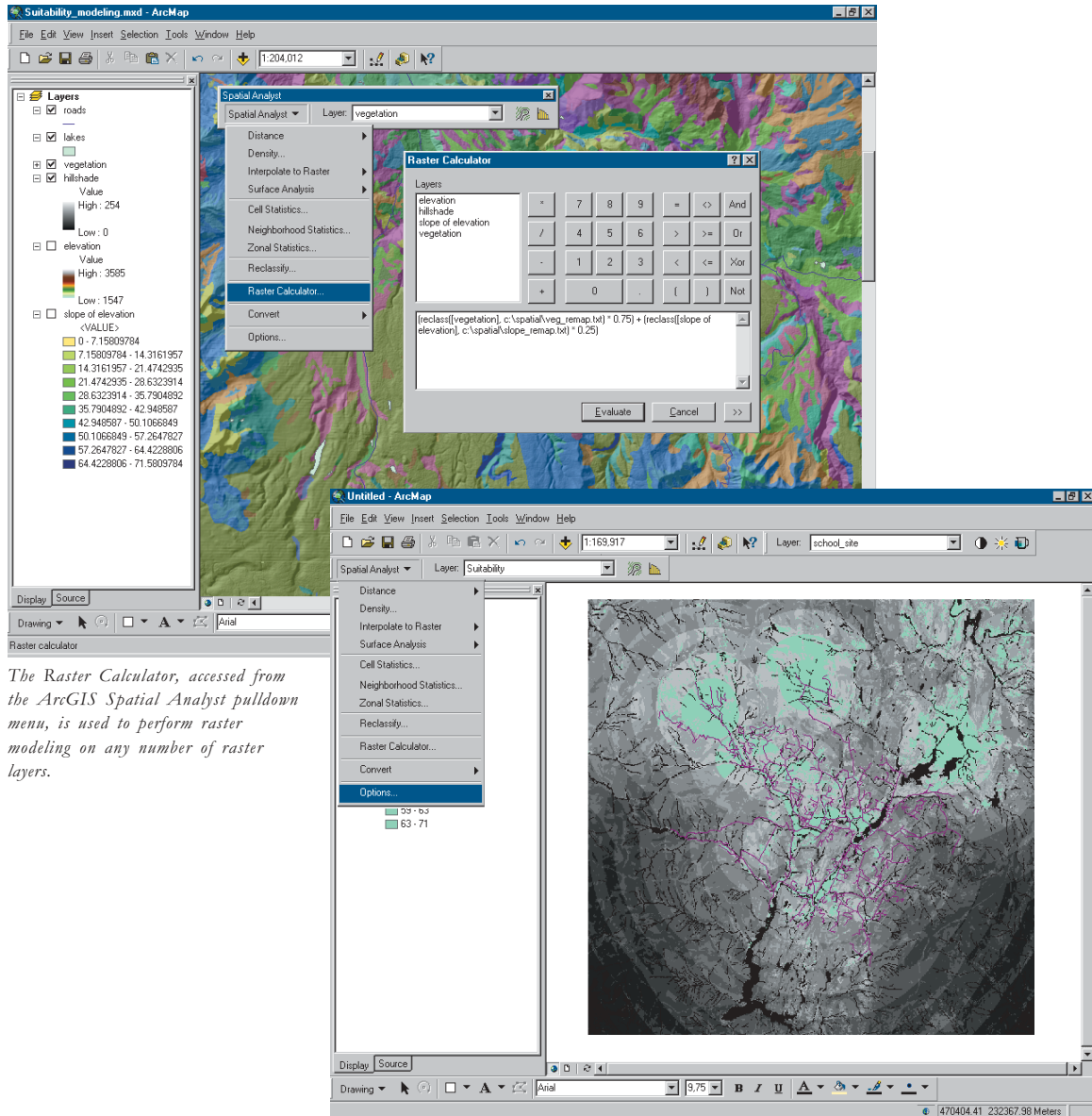
Extensions allow you to perform tasks, such as raster geoprocessing and three-dimensional analysis. All extensions can be used by each product—ArcView, ArcEditor, and ArcInfo.

<b>ArcScan™ for ArcGIS</b>	Integrated raster-vector editing Vectorize features from raster Raster snapping (Requires an ArcEditor or ArcInfo license)
<b>ArcGIS Schematics</b>	Database-driven schematic rendering and display Schematic views of GIS networks and tabular information Multiple schematic representations
<b>Maplex for ArcGIS</b>	Advanced label placement and conflict detection for high-end cartographic production Greatly simplifies the labor-intensive placement of map text
<b>ArcGIS Publisher</b>	Publish ArcMap documents as PMFs for use with free ArcReader seats Also used with the ArcMap Server extension to ArcIMS
<b>ArcPress for ArcGIS</b>	Advanced map printing
<b>MrSID® Encoder for ArcGIS</b>	Image compression and mosaicking Up to 500 megapixels
<b>TIFF/LZW Compression</b>	Right to use Unisys® patent for writing compressed data using TIFF/LZW

## 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 raster–vector 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.*

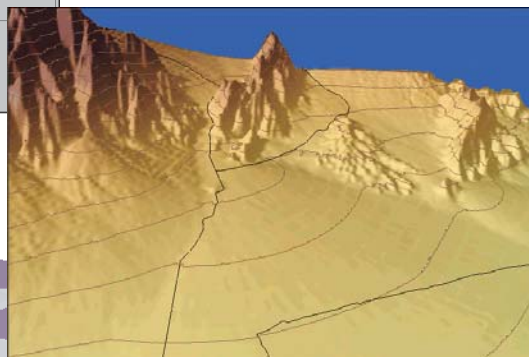
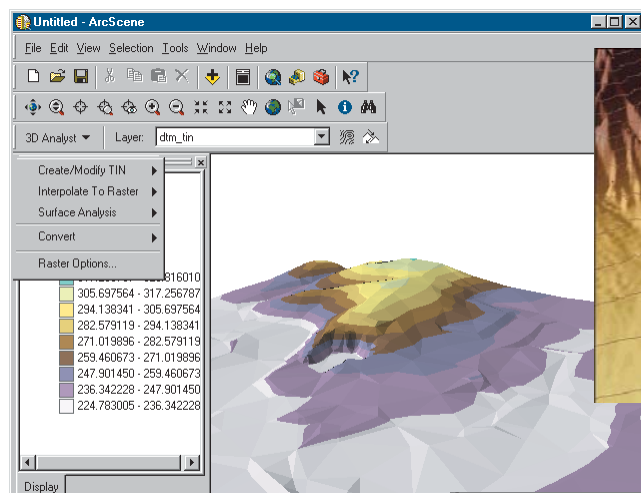


## ArcGIS 3D Analyst

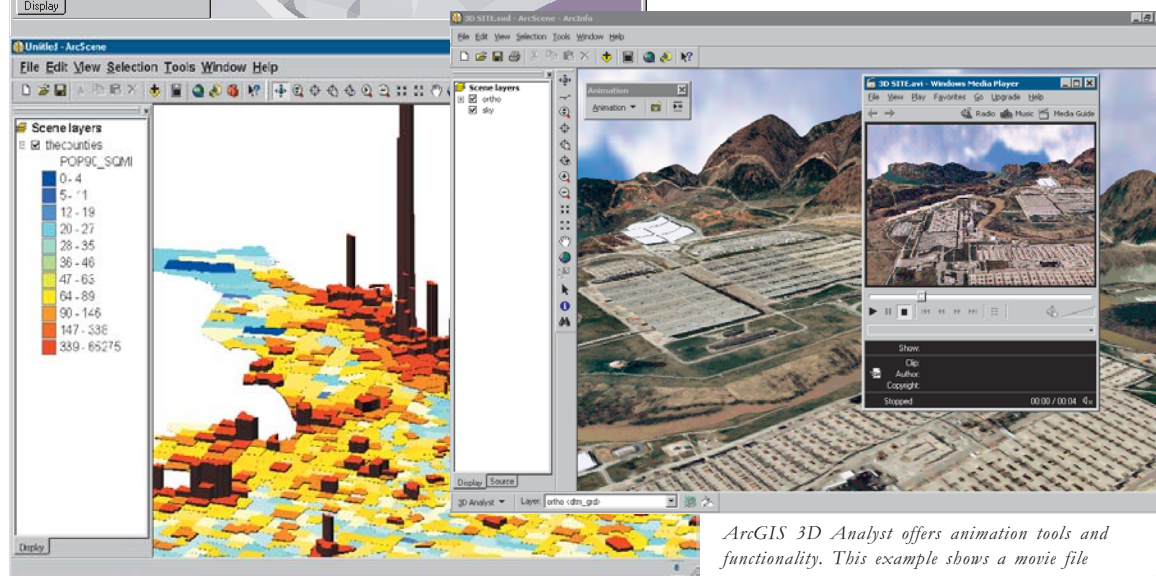
ArcGIS 3D Analyst enables users to effectively visualize and analyze surface data. Using ArcGIS 3D Analyst, you can view a surface from multiple viewpoints, query a surface, determine what is visible from a chosen location on a surface, and create a realistic perspective image by draping raster and vector 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.



*ArcGIS 3D Analyst includes three-dimensional visualization and terrain modeling capabilities.*



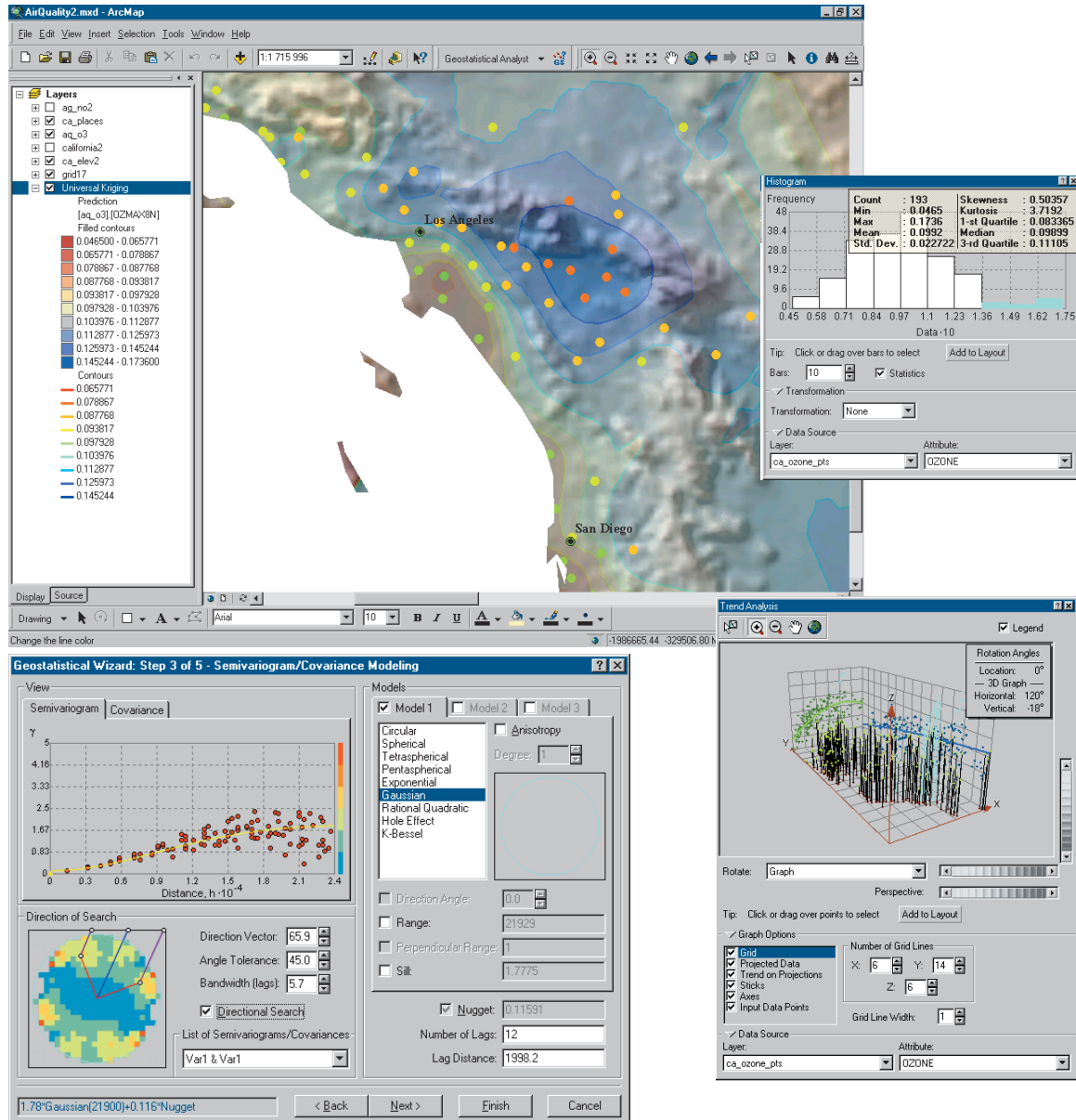
*ArcGIS 3D Analyst offers animation tools and functionality. This example shows a movie file including animation of a three-dimensional scene and objects.*

*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 Geostatistical Analyst

The power of ArcGIS Geostatistical Analyst is 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.

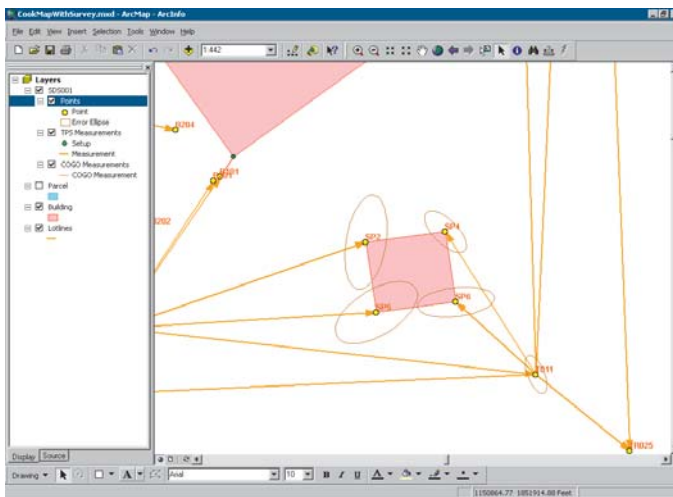
## ArcGIS Survey Analyst

For years, numerous survey professionals and GIS practitioners have longed for a means to integrate comprehensive survey information with their GIS data and to use the survey as a base to improve as well as to quantify the spatial accuracy of their GIS databases. This is precisely the goal of ArcGIS Survey Analyst.

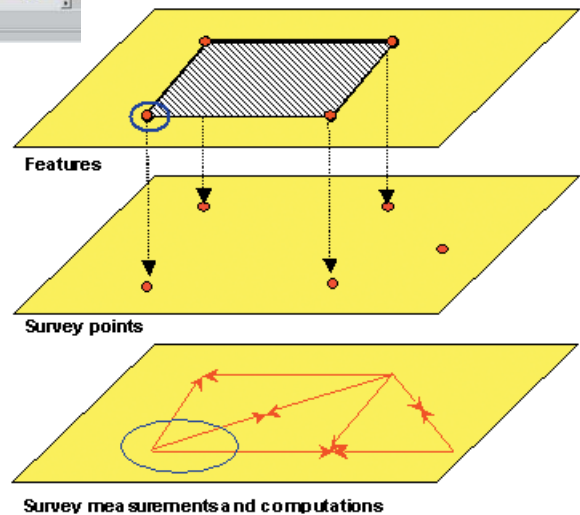
With ArcGIS Survey Analyst, users can manage a comprehensive survey database as an integrated part of their GIS, including iterative updates from new field

surveys over time. The relative accuracy and error in the survey system can be displayed for any survey location. In addition, users can associate feature locations with survey points in the survey system and can adjust feature geometry to snap to the survey locations.

The introduction of ArcGIS Survey Analyst is significant in the GIS industry. Over time, it is likely that ArcGIS Survey Analyst will be used by all GIS organizations to incrementally improve the spatial accuracy of their GIS using integrated survey information.



*Using ArcGIS Survey Analyst, comprehensive survey information can be used to represent accuracy.*

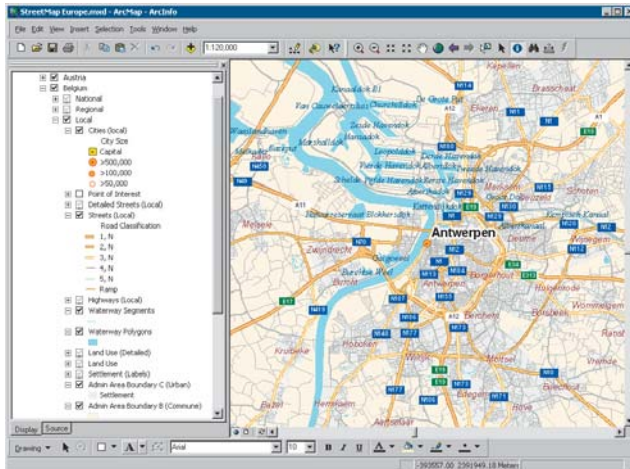


*Geographic feature geometry can be linked to survey locations in order to improve spatial accuracy.*

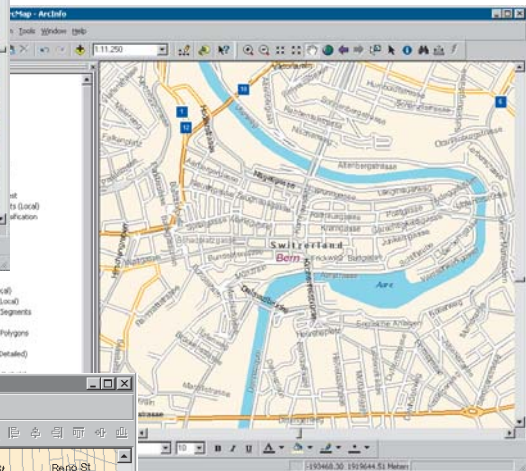
## ArcGIS StreetMap USA and StreetMap Europe

The ArcGIS StreetMap extensions provide street-level mapping and address matching for entire countries. StreetMap layers automatically manage, label, and draw

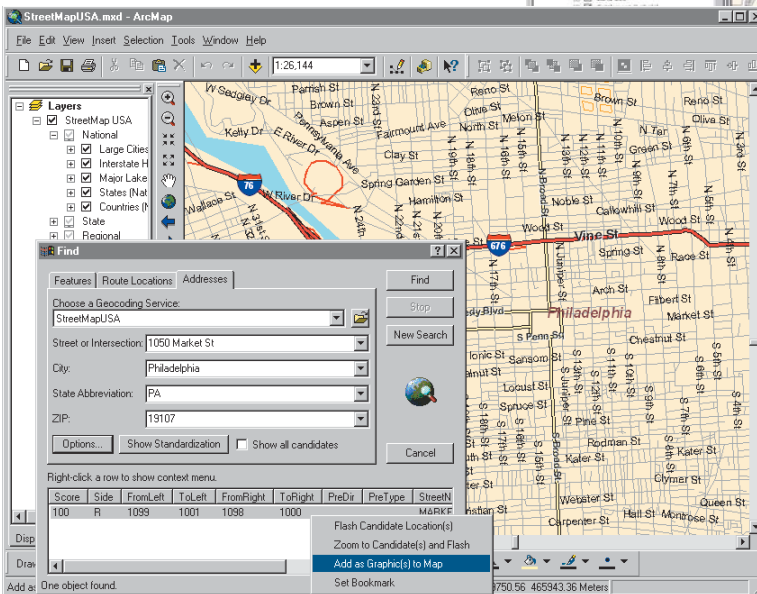
features, such as local landmarks, streets, parks, water bodies, and other features. The ArcGIS StreetMap extensions can find nearly any address in each country by interactively matching a single address or by batch matching from a file of addresses. All the data comes compressed on a small set of CD-ROMs.



Major roads in an ArcGIS StreetMap Europe display.



ArcGIS StreetMap Europe contains detailed streets and addresses for many countries in Western Europe.



The ArcGIS StreetMap extensions allow you to add a graphic to the map at a specified address. Data can be viewed at national, state, regional, and local levels, with the symbology and visibility of map features changing with each level.



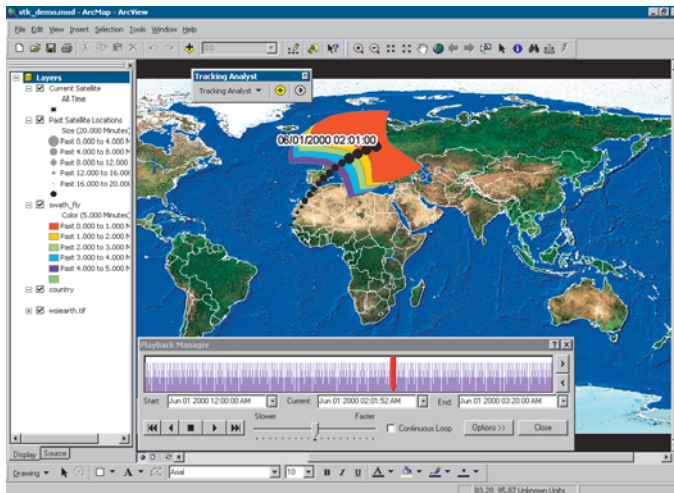
## ArcGIS Tracking Analyst

ArcGIS Tracking Analyst allows users to view and analyze temporal data to track feature movement through time as well as to track system values for locations over time.

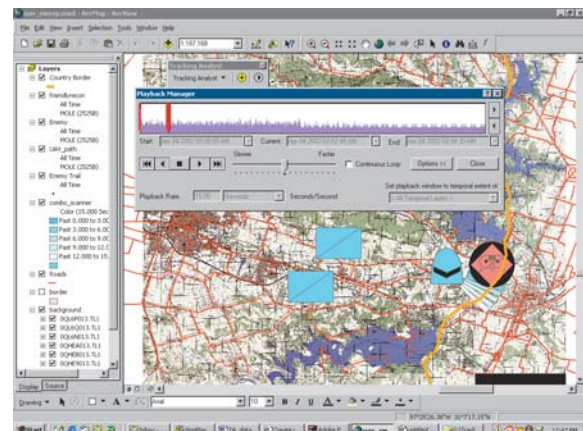
ArcGIS Tracking Analyst includes the following:

- Display point and track data (real time and fixed time)
- Symbolize time by color (show the aging of data)
- Interactive playback manager
- Actions (based on attribute or spatial queries)

- Highlight
- Suppression
- Support for lines and polygons
- Temporal histogram in playback
- Additional temporal symbology renderers
- Layer-based time windows to manage many temporal layers
- Temporal offset for comparisons of temporal events
- Animation files
- Data clock for additional analysis



*In ArcGIS Tracking Analyst, an interactive playback manager (Start, Stop, Pause, Rewind) is included to view future-time windows (for mission planning) or past-time windows (for historical data analysis).*

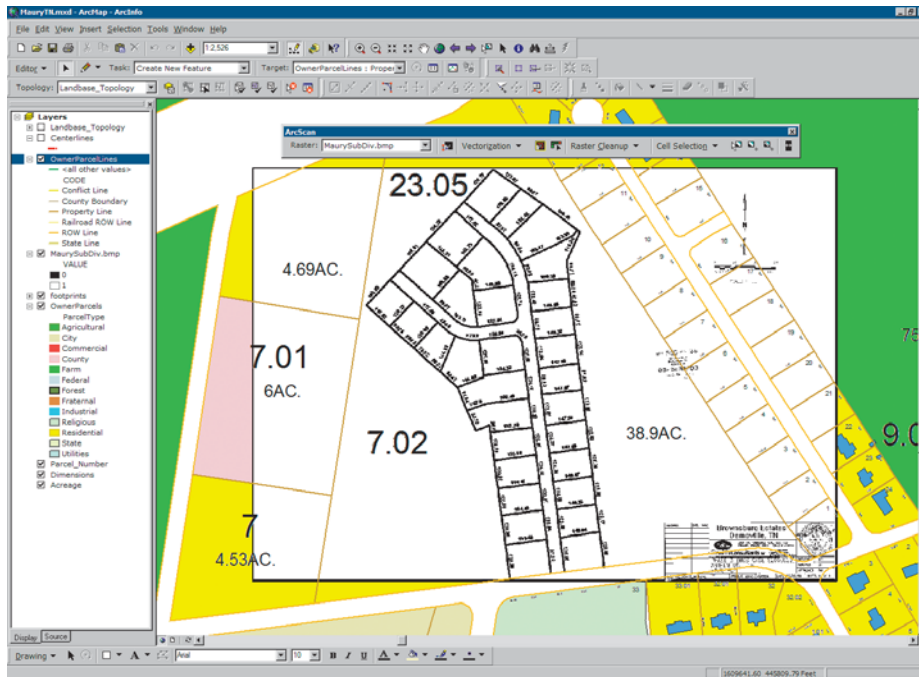


## ArcScan for ArcGIS

ArcScan for ArcGIS adds raster editing and scan digitizing capabilities to the editing capabilities in ArcEditor and ArcInfo. It is used to generate data from scanned vector maps and manuscripts. It simplifies the data capture workflow of editing workstations using ArcGIS.

Using ArcScan for ArcGIS, you can perform raster-to-vector conversion tasks including:

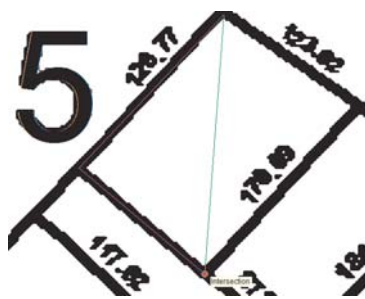
- Raster editing
- Raster snapping
- Manual raster tracing
- Batch vectorization



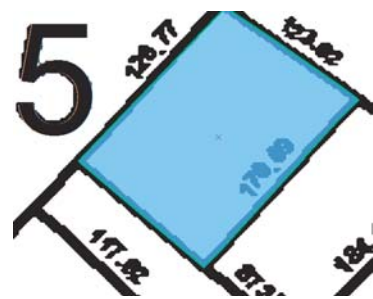
*ArcScan for ArcGIS is used to automate and streamline the digitizing process by capturing vector features from scanned raster images.*



*Raster editing and cleanup*



*Interactive tracing*



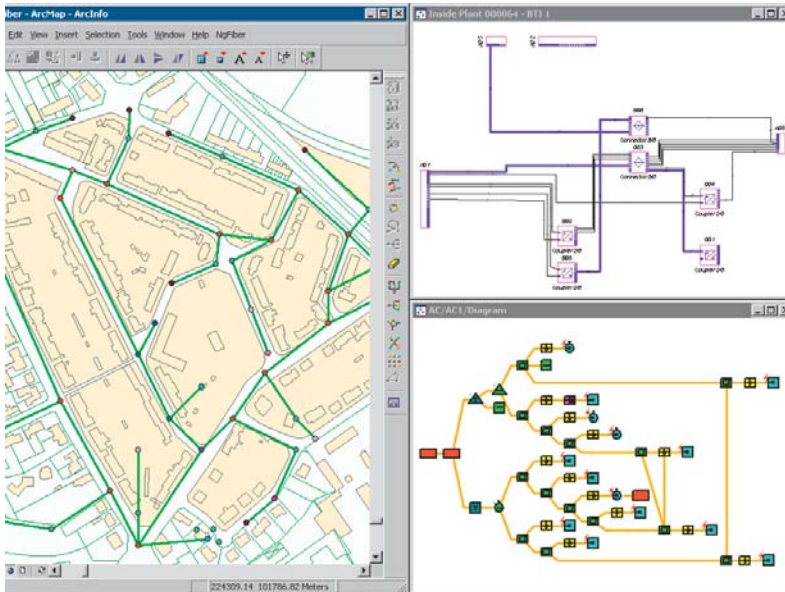
*Feature extraction*

## ArcGIS Schematics

### Automatic Schematic Generation for ArcGIS

ArcGIS Schematics (formerly known as NG Spatial) automates database-driven schematic and geoschematic

graphical representations. Regardless of the network (electrical, gas, telecommunications, or tabular networks), ArcGIS Schematics generates on-demand network graphs and schematics. The following schematic representations were made using ArcGIS Schematics.

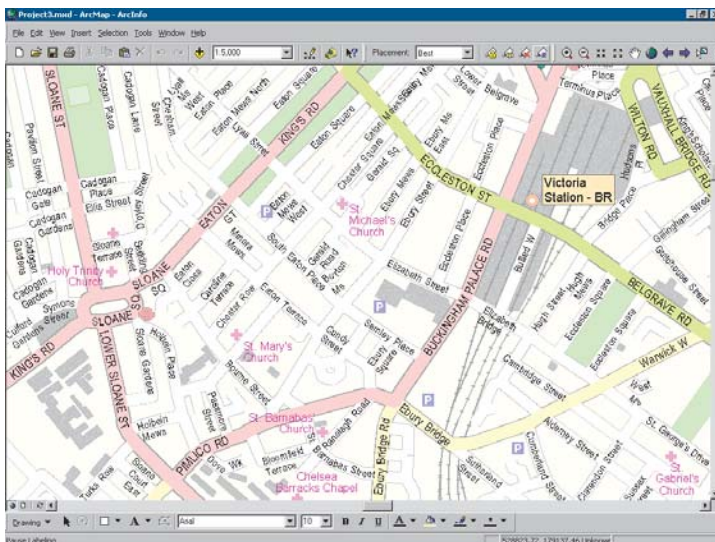


*These are schematic representations of a Telco network, with an inside plant schema shown in the top-right graphic.*



Maplex for ArcGIS adds advanced label placement and conflict detection to ArcMap. Maplex for ArcGIS can be used to generate text that is saved with map documents as well as to generate annotation that can be incorporated in a comprehensive GIS database for reuse.

*Close-up view of two maps with their initial map text displays. The map on the top would require manual editing to edit many text placements. It was labeled using default text placement in ArcMap. The text on the bottom map was generated using Maplex for ArcGIS. While some additional map text placement editing will be required, you can readily see that the time savings are quite dramatic.*



## ArcGIS Publisher

ArcGIS Publisher enables the creation of a published map file (.pmf) format 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 megapixels in size. Images smaller than 50 megapixels 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 megapixels size rule will be evaluated as follows:

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

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.

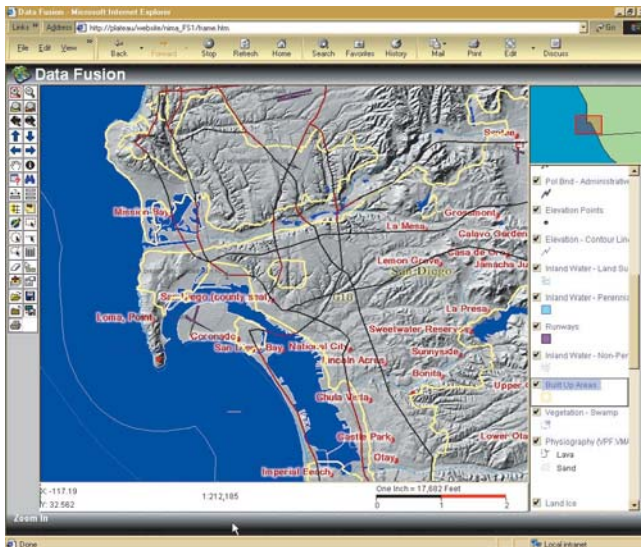
## What is ArcReader?

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.

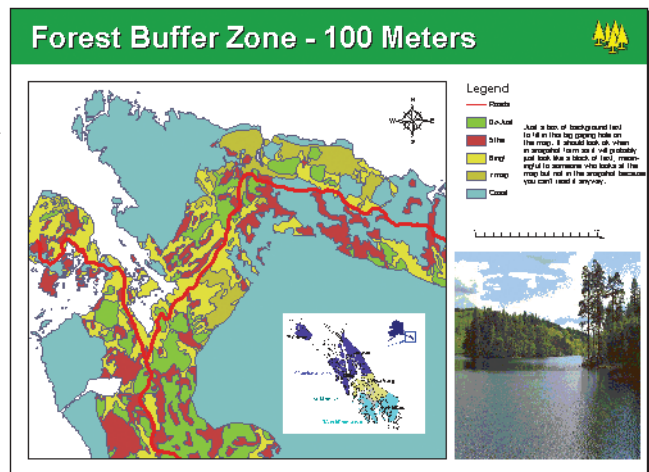
Because ArcReader is free, any user can install it on their Windows computer and have access to maps you generate with ArcGIS. ArcMap documents contain access to many data types—shapefiles, coverages, geodatabases, CAD files, tables, imagery, ArcIMS services, and so on—and provide advanced symbology 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. Many ArcIMS sites (such as the Geography Network) provide PMF maps for ArcReader.



*ArcReader allows GIS users to easily publish and share electronic maps locally, over networks, or via the Internet. Published map files (.pmfs) created with ArcGIS Publisher are used with ArcReader, a free downloadable map use application.*





## WHAT IS ARCSD E?

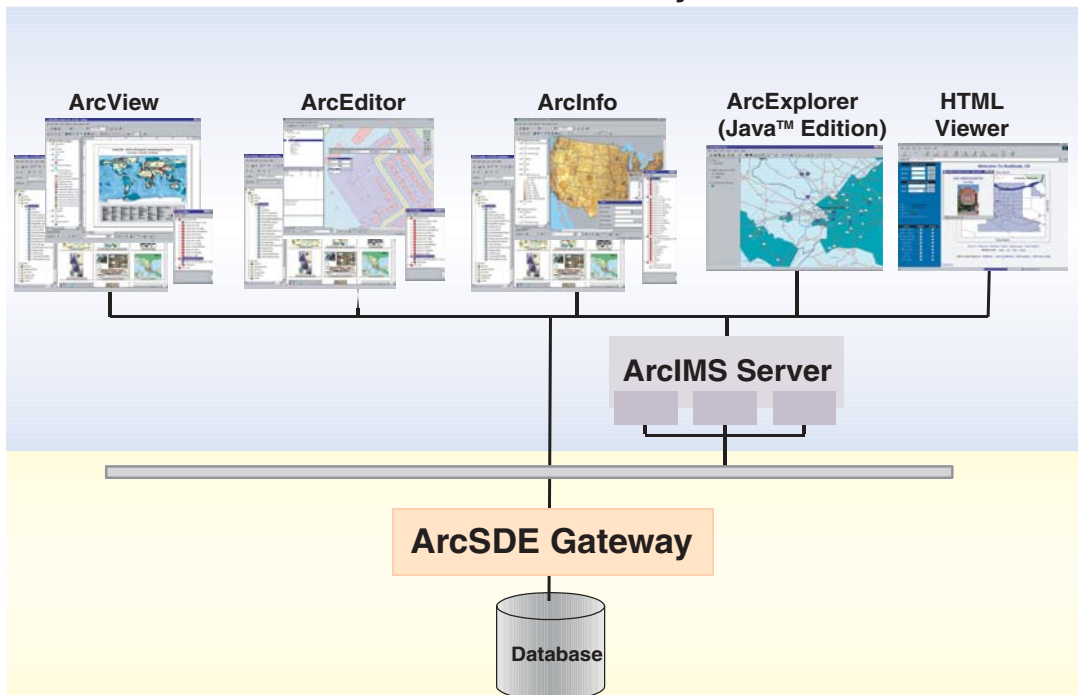
ArcSDE is the GIS gateway to relational databases. It allows you to manage geographic information in your chosen DBMS and serve your data openly to ArcGIS Desktop, ArcIMS, and other applications. ArcSDE is a key component in a multiuser ArcGIS system. It provides an open interface to relational database 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 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.
- Provide long transaction and version support for your DBMS, allowing support for many GIS data management work flows.
- 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 services.
- Build OGC-compliant applications that work with features in your geodatabase.
- Build SQL applications that work with the tables and rows in the geodatabase.

### ArcSDE Gateway



*ArcSDE acts as the gateway between ArcGIS and your relational database.*

## ArcSDE fundamental capabilities

<b>Open DBMS management</b>	ArcSDE allows you to manage geographic information in any one of four DBMSs: Oracle, Microsoft SQL Server, Informix, or IBM DB2.
<b>Long transaction support</b>	ArcSDE provides long transaction and version support for the DBMS. Data management work flows, such as multiuser editing, history, check-out/check-in, and loosely coupled replication rely on a long transaction and versioning.
<b>High performance and open data access</b>	ArcSDE provides a high-performance application server that optimizes specialized spatial queries and feature behavior.

*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 yet widespread. For years file-based 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 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 capability 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?

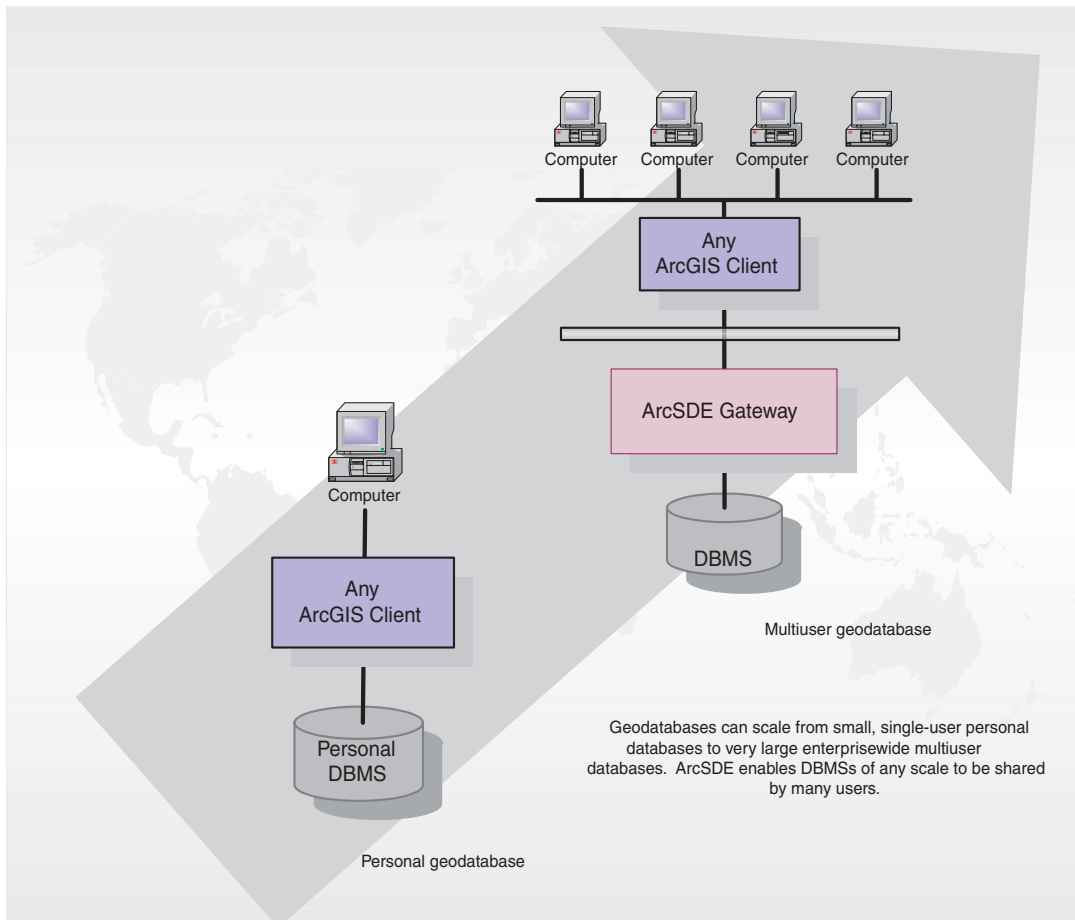
If you need a DBMS and you have spatial data, then you can use ArcSDE to

- 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 history.
- Manage a GIS database of unlimited size.
- Manage spatial data using standard DBMS tables (adhere to ISO and OGC spatial standards).

- Maintain 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.
- Manage large raster and terrain data.

## 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 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 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 work group, 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

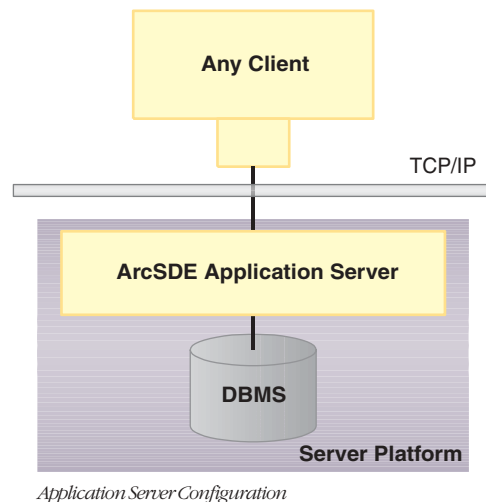
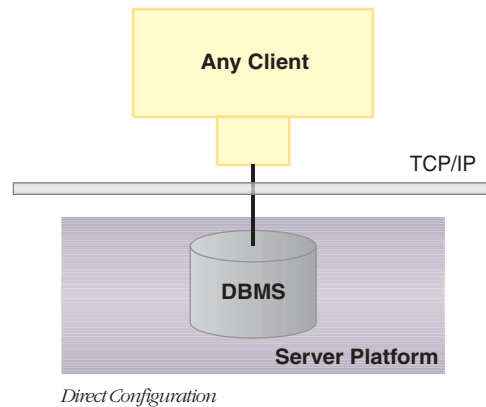
ArcSDE can be configured to use direct connections. The client applications connect directly to the DBMS without using an application server. Each ArcGIS and ArcIMS client has the ArcSDE direct connection capability built in. For example, ArcEditor and ArcInfo will look for an ArcSDE keycode to enable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



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

## WHAT IS ARCIMS?

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 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.

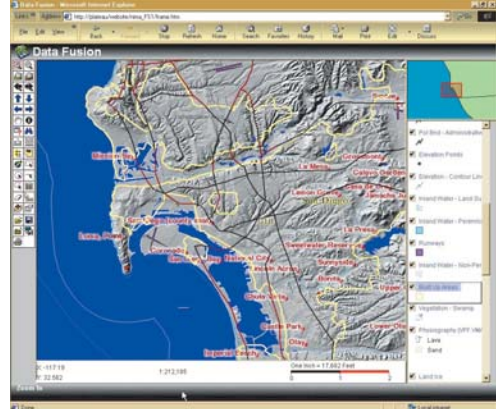
**Scale your system to meet your needs.** Whether your server receives 10 or 10,000 map requests an hour, ArcIMS can be scaled to fit your needs. Then, as your site grows and map requests increase, ArcIMS can be easily extended to meet new demands.

## Provide access to GIS data and Location Services.

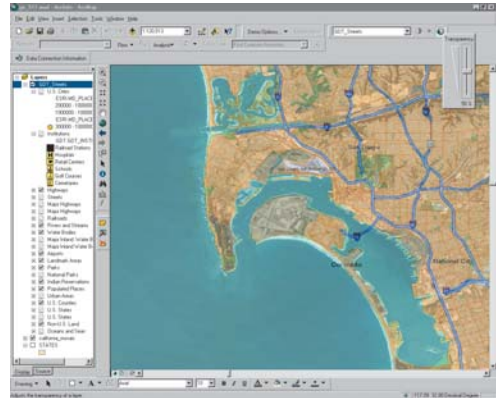
ArcIMS allows you to determine how and to whom GIS data and services are delivered. You control whether your data holdings are accessible publicly on the Web, on a secure network, or within your organization on a local area network (LAN).

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,

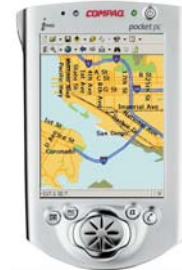
provide real-time navigation information and emergency services directly to drivers in their vehicles, and explore new homes and their surrounding neighborhoods, schools, and parks.



*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.*

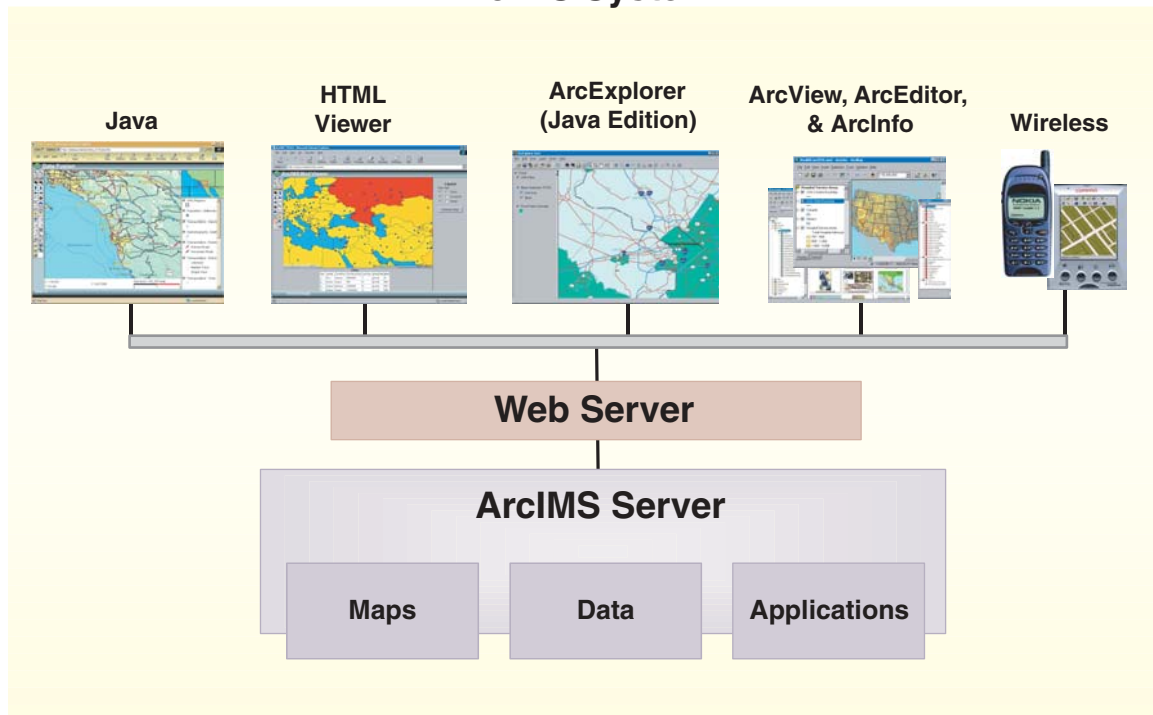
## The ArcIMS architecture

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.

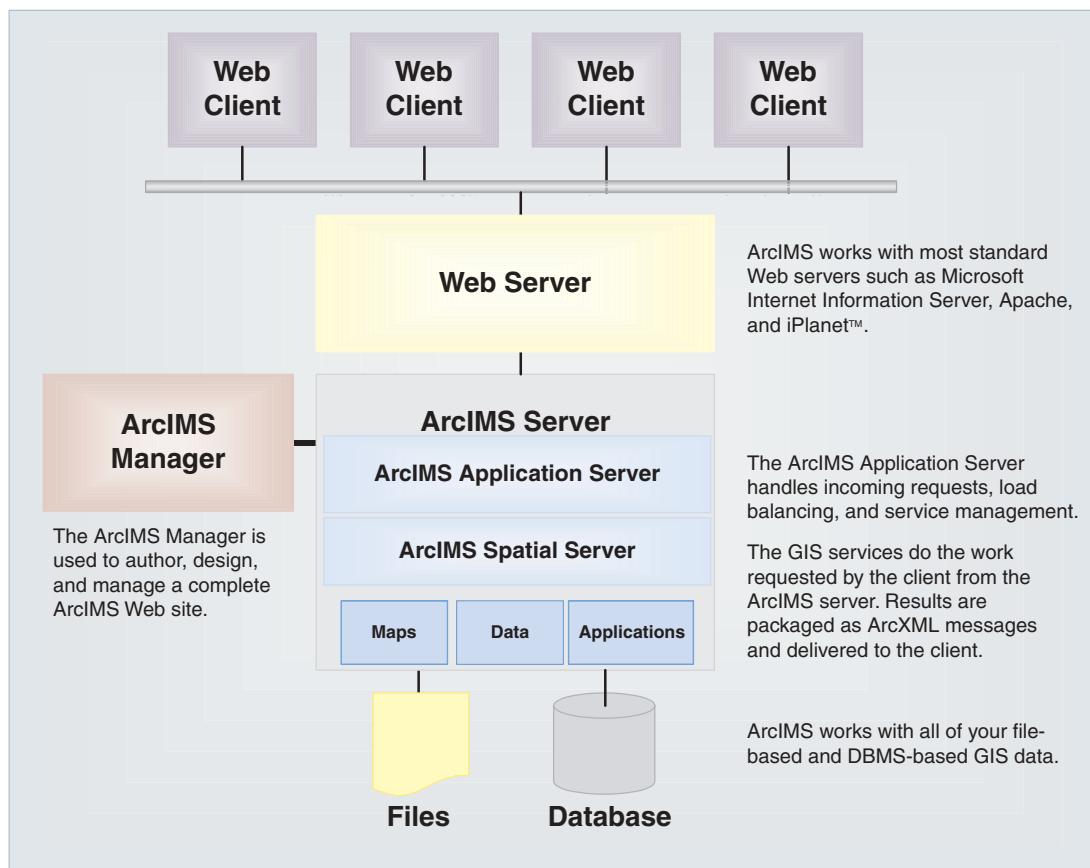
With ArcIMS, you design and author a GIS Web site. Many types of client applications can connect to and use your ArcIMS Web site over the Internet, ranging from the free HTML and Java viewers included with ArcIMS to more advanced ArcGIS Desktop applications.

The ArcIMS architecture is highly scalable. Many concurrent users can access your Web site, and many simultaneous requests can be processed. With ArcIMS, you can expand your server to accommodate growth in demand over time. 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.*



*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.

A new ArcMap Service streams images from an ArcMap document to the requesting client. 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.

A Feature Service streams compressed vector features to the requesting client. Feature streaming enables more advanced client-side 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 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.

### **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 that can be served openly using various industry-standard protocols (WFS, WMF, Z39.50, AXL, SOAP, and so on). 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 client-side 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.

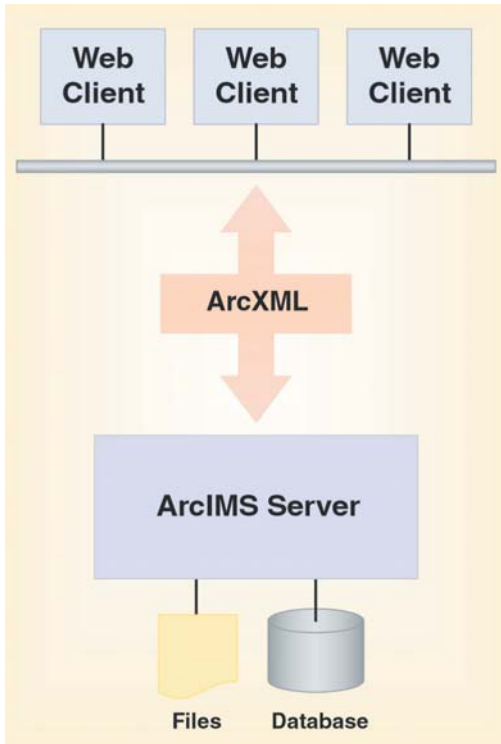
**Metadata catalog.** A catalog that references your data holdings and information sets can be created using ArcGIS, ArcIMS, and ArcSDE and published as a search service using ArcIMS. This allows you to provide an open search mechanism for users to find and access GIS information at your Web site. You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

**ArcMap Server.** This is the first of many ArcGIS services that will be added to ArcIMS over time. Use ArcGIS to author your maps, then serve them using ArcIMS.

**Route Server (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, the markup 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.

Over time, new ArcIMS services will be based on Web Services standards and the SOAP specification will be used for XML communication.

## 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 Edition (J2EE™), and ColdFusion®.

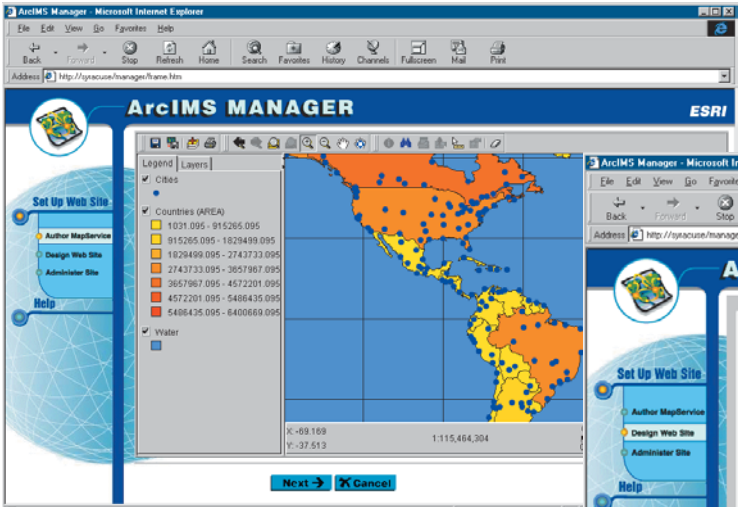


# Authoring and managing an ArcIMS Web site

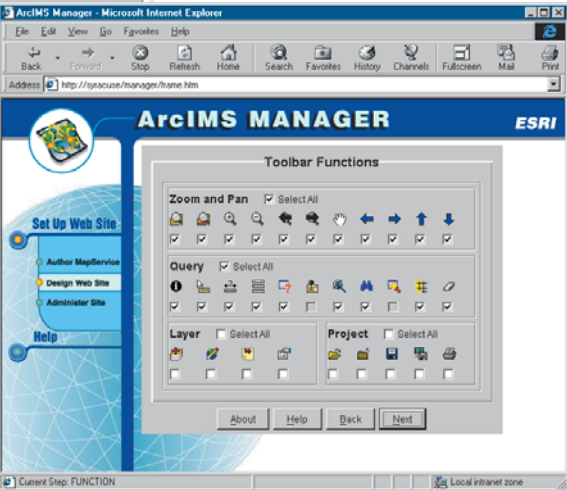
ArcIMS is based on standard Internet technology that users employ to author and manage GIS Web sites. ArcIMS Web sites are authored using standard HTML and Java tools, making the process similar to building any other Web site. The ArcIMS process is unique because tools are

also provided for authoring the GIS capabilities of your Web site.

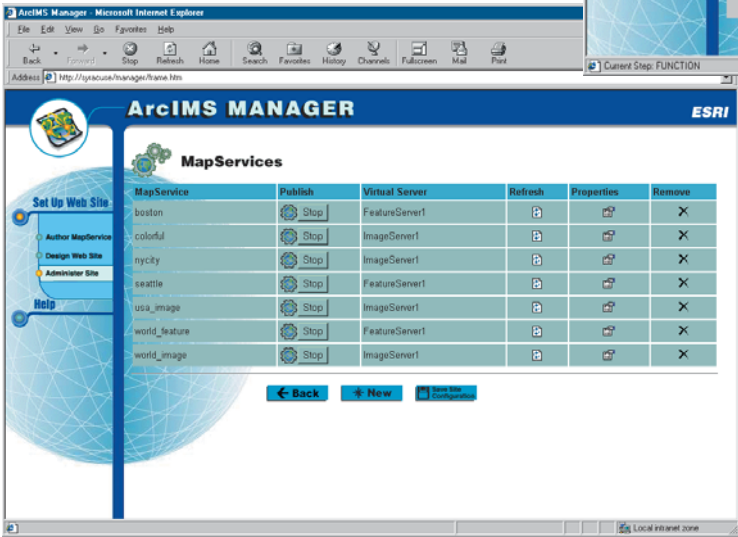
ArcIMS Web sites are authored using a series of applications—Author, Administrator, and Designer—or using Manager, a single wizard-driven application that takes you through the entire Web site creation process.



Create your maps and set layer properties.



Design the look, feel, and functionality of your Web site's map viewer.



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

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.



## 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: ArcReader, 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)
- .NET and Java Web tier applications

### 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.

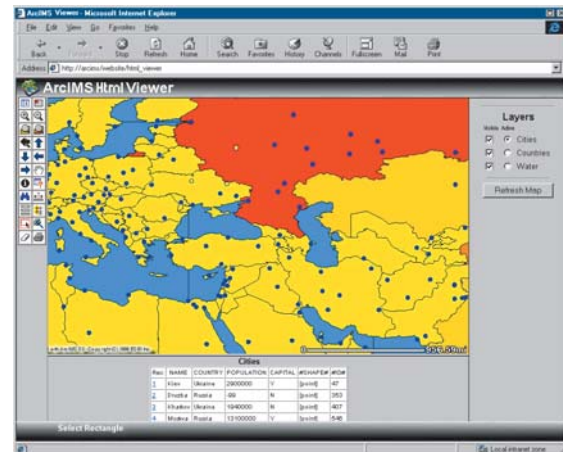
### The Java viewers

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.

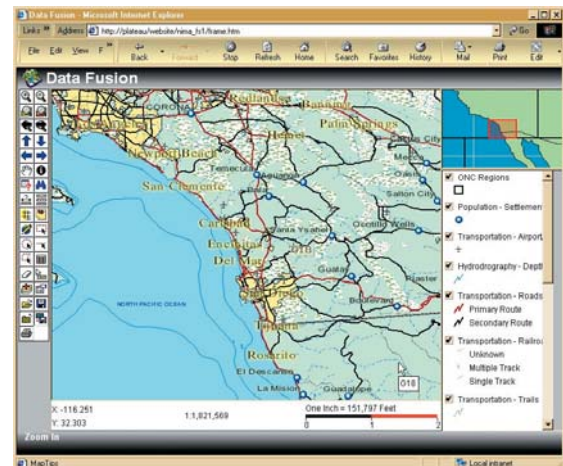
Both Java viewers are thicker clients containing rich sets of GIS tools. Both support feature streaming, which

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.*



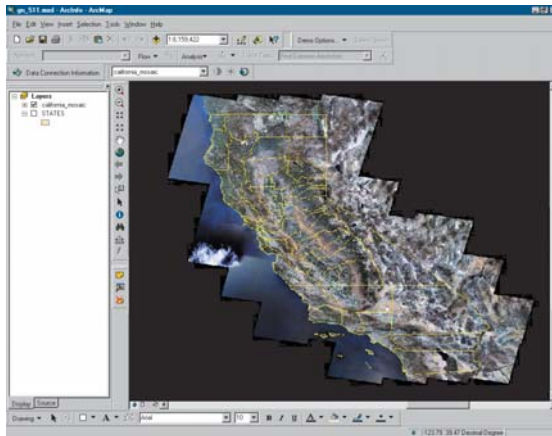
*The Java Standard and Java Custom viewers included with ArcIMS are thicker clients with many GIS tools. Both support feature streaming and a number of advanced GIS capabilities. The toolset and appearance of the Java Custom viewer (above) can be customized according to your preferences.*

## ArcExplorer—Java Edition

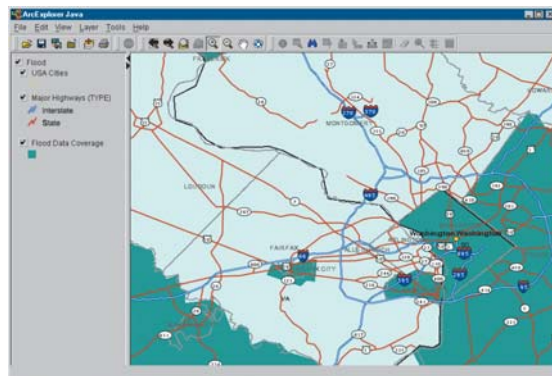
The Java edition of ArcExplorer has much in common with the Java viewers. What distinguishes it from the Java viewers is the way it is implemented. ArcExplorer works as an independent standalone application—not inside your Web browser. ArcExplorer can integrate layers from a variety of sources, both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



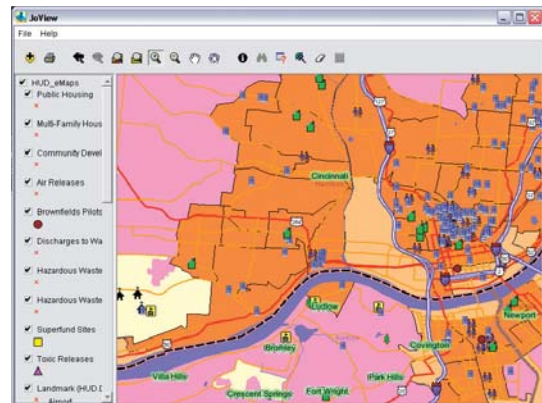
*The Java edition of ArcExplorer can integrate ArcIMS layers with data from a variety of sources.*

## MapObjects—Java 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.

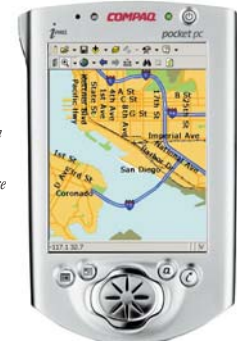
## ArcGIS Desktop

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 Edition, 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 standards-based. ArcIMS enables this communication by providing several different connectors that translate requests from your ASP, ColdFusion, JSP, and so forth.

## 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 its 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 federal government and other 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).

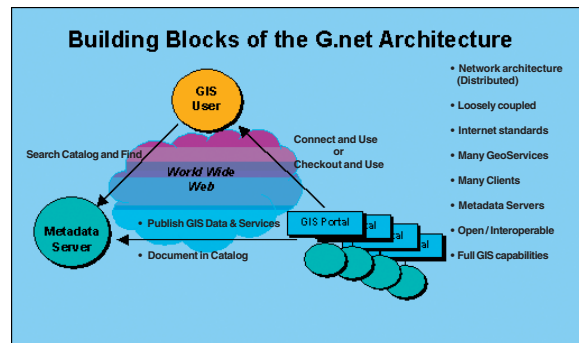


### g.net: SDI building blocks from ESRI

g.net is how ESRI users participate in an SDI 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.

An SDI 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, an SDI 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 Open GIS protocols, 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 an SDI

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](http://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.





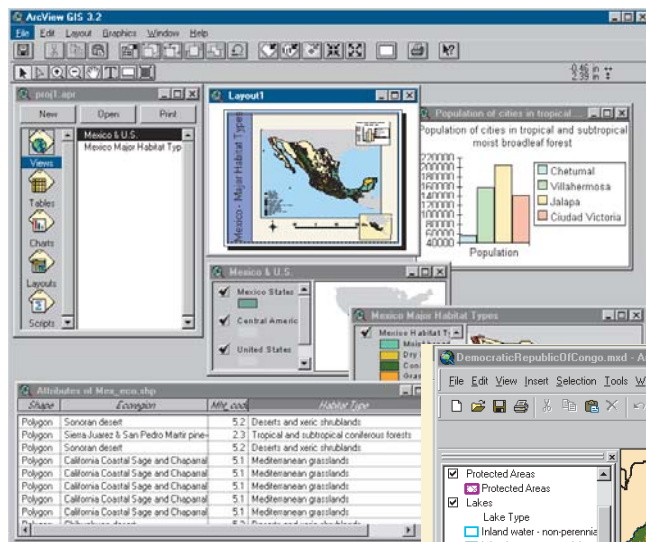
## Comparing ArcView GIS 3 to ArcView 8.3

You'll notice many differences between ArcView GIS 3 and ArcView 8.3. We've tried to use what we learned from ArcView GIS 3 in building ArcView 8.3. Many of the available tasks are done differently in ArcView 8.3. In addition, many new tools and options are available.

ArcView 8.3 shares a common architecture with ArcEditor 8.3 and ArcInfo 8.3. This common architecture makes it easy for users of different ArcGIS Desktop products to share work with one another.

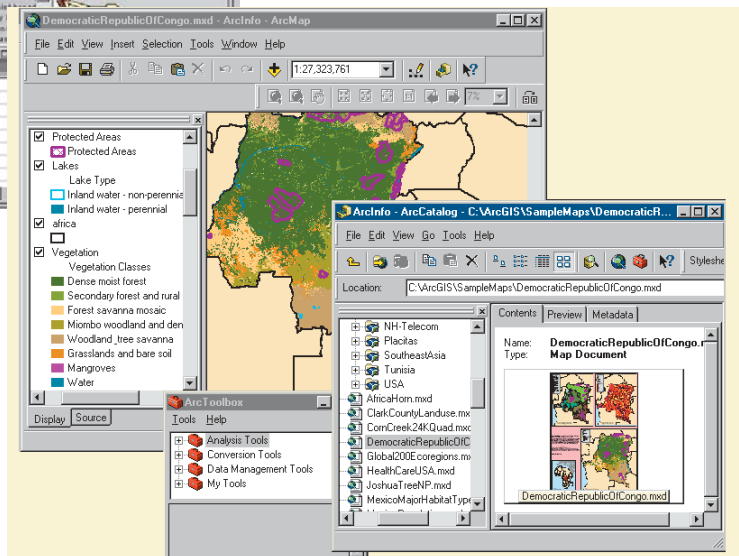
While transitioning from ArcView GIS 3 to ArcView 8.3, the most obvious differences are in the look of the software. Two new applications—ArcCatalog and ArcToolbox—provide additional functionality. This additional functionality is described in the books *Using ArcCatalog* and *Using ArcToolbox*. ArcMap, 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 8.3.

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 8.3 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.*

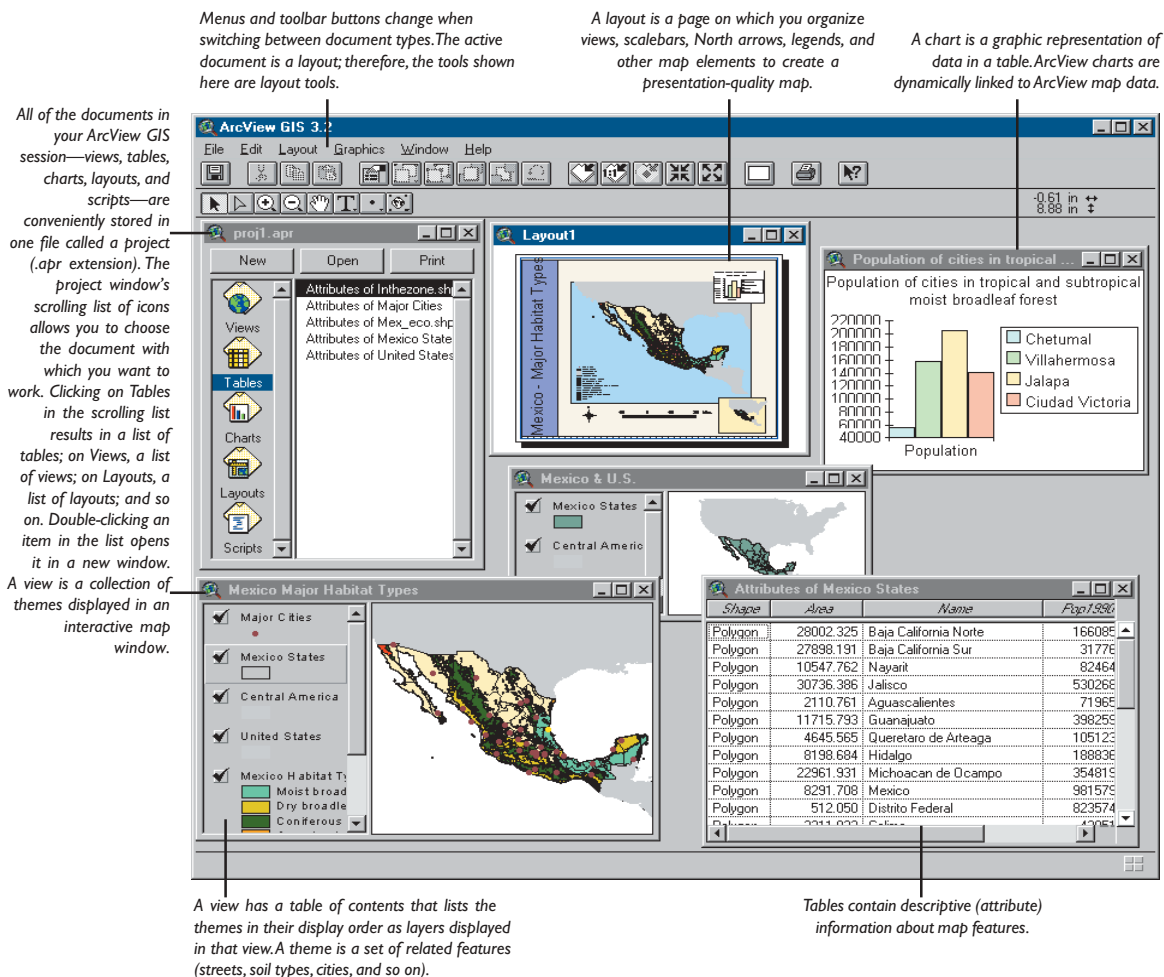




## Organization of ArcView GIS 3

Many of the elements of an ArcView GIS 3 project are similar to elements of an ArcView 8.3 map document.

The following diagram illustrates the key components of an ArcView GIS 3 project. ArcView 8.3 equivalents are presented in a similar diagram on the following page.



## Organization of ArcView 8.3

ArcView 8.3 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 8.3, 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.

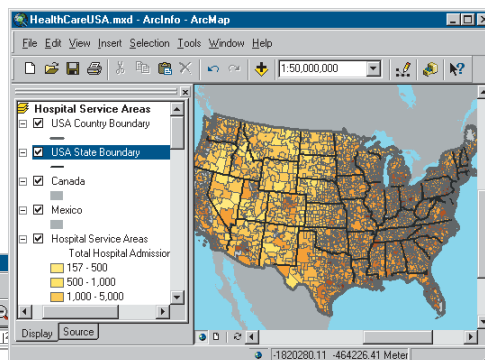
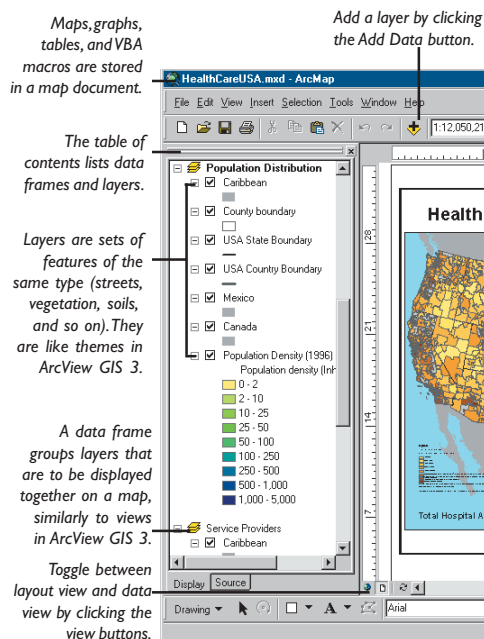
In ArcView 8.3, sets of features are called layers, rather than themes, but serve essentially the same purpose. The advantage of using layers lies in a layer's ability to exist independently of a data frame or map layout (ArcView themes exist only within their parent project). Layers can

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 scalebars and North arrows. All parts of the map layout are "live".

Tables and charts in ArcView 8.3 are similar to tables and graphs in ArcView GIS 3, but with enhanced appearance and function.



The data view (above) and layout view (left) in ArcMap. Three data frames and a number of map elements (scalebars, 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).

VBA 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 8.3. 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 8.3. For a more extensive comparison of concepts, please see the online topic 'ArcView terminology' in the 'Transitioning from ArcView GIS 3 to ArcView 8.x' section of the ArcGIS Desktop Help system.

## **ArcView extensions at 8.3**

Functionality formerly available through extensions (geoprocessing and image support for a variety of image formats) is now included in ArcView 8.3. As described earlier, optional extensions, including ArcGIS 3D Analyst, ArcPress for ArcGIS, and ArcGIS Spatial Analyst, are still available and are built into the ArcGIS Desktop core functionality.

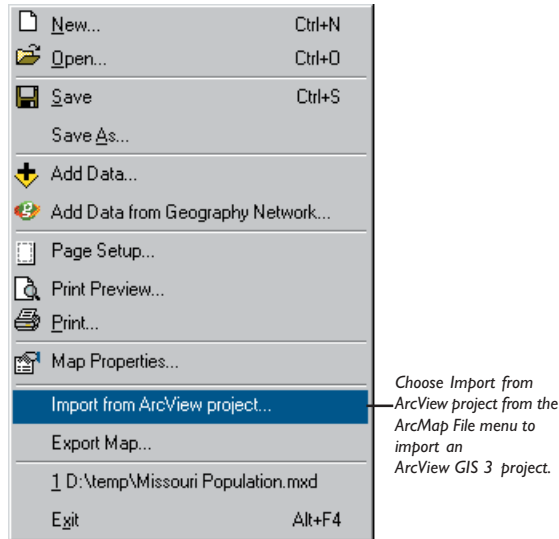
## Importing ArcView GIS 3 projects and legends into ArcMap

ESRI has included transitioning tools in ArcMap to aid in the migration from ArcView GIS 3 to ArcView 8.3.

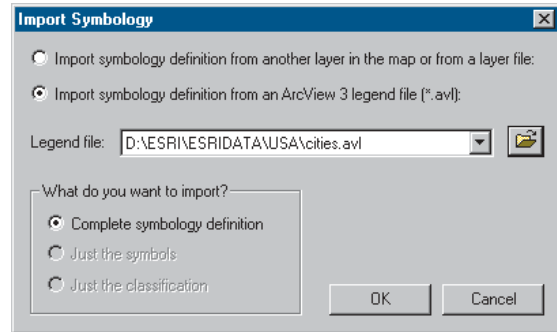
ArcView 8.3 no longer uses the .apr file format to store project information. However, you can import most of the items from an ArcView GIS 3 project into an ArcMap map document using the Import from ArcView project menu command.

ArcView GIS 3		ArcView 8.3	
KEY FEATURES	<b>Multiple document interface</b>	→	<b>Single document interface</b>
	<b>Project (.apr)</b> Organizes and stores information as views, tables, charts, layouts, and scripts.	→	<b>Map Document (.mxd)</b> Disk-based representation of a map that stores your maps, graphs, tables, and macros.
	<b>View</b> Groups sets of features (themes) that are displayed together. Has its own table of contents and display area.	→	<b>Data Frame</b> Groups sets of features (layers) that are displayed together. Listed in the main table of contents and displays in the main display area.
	<b>Table of Contents</b> Lists themes in a particular view.	→	<b>Table of Contents</b> Lists data frames with the layers they display.
	<b>Theme</b> Represents a set of features of the same type such as streams, lakes, or highways. Exists only within the parent project.	→	<b>Layer</b> Represents a set of features of the same type such as streams, lakes, or highways. Persists independently of the data frame and can be shared with other users.
	<b>Chart</b> Graphic representation of information about map features and the relationships between them. Common types are line, bar, and pie charts.	→	<b>Graph</b> Graphic representation of information about map features and the relationships between them. Common types are pie, line, and bar graphs.
	<b>Layout</b> 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.	→	<b>Map in Layout View</b> 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.
TYPICAL ACTIONS	<b>Avenue Script</b> A macro written using Avenue.	→	<b>VBA Macro</b> A macro written using Visual Basic for Applications.
	<b>Select by Theme</b> Selects features based on their location in relation to features of other themes.	→	<b>Select by Location</b> Selects features based on their location in relation to features of other layers.
	<b>SQL Select</b> Selects features based on their attributes.	→	<b>Select by Attribute</b> Selects features based on their attributes.
	<b>Convert to Shapefile</b> Exports selected features as a new shapefile.	→	<b>Data&gt;Export</b> Exports selected features as a new layer.
	<b>Add theme</b> Adds a new theme to the active view.	→	<b>Add Data</b> Adds a new data layer to the active data frame.
	<b>Promote</b> Moves selected records to the top of the table.	→	<b>Show Selected</b> Shows only the selected records in a new table.

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.



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 8.3' section of the ArcGIS Desktop Help system.

## 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 8.3. 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
- 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, scalebars, 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

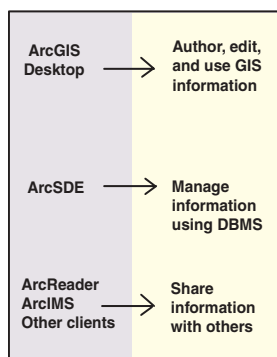
Only a few of the added features and functionality of ArcView 8.3 have been highlighted here. For a complete list of new features and functionality, please see the online topic 'New features and functionality beyond ArcView GIS 3' in the 'Transitioning from ArcView GIS 3 to ArcView 8.3' section of the ArcGIS Desktop Help system.





Many users are interested in migrating their GIS work from ArcInfo Workstation to ArcGIS. There are many facets to implementing a migration plan, but before you begin, it is important to gain some understanding through hands-on experience with ArcGIS.

The purpose of this section is to draw some comparisons between the two architectures and to provide a useful framework in which you can begin to think about and plan your migration. While many of the terms have changed, a common set of GIS concepts and practices provides the foundations for both systems. These concepts will be important to understand in your migration plans to ArcGIS. Throughout this section, we will compare and contrast the system implementations for many of these key concepts.



*Each part of the ArcGIS product line has a clear role.*

ArcGIS Desktop lets you author and use information (such as data, maps, metadata, analyses, and applications). Advanced data editing is performed with ArcEditor and ArcInfo. Map-based analysis, simple editing, metadata capture, modeling, and analysis can be performed with ArcView seats.

ArcSDE lets you manage information and data in a DBMS.

ArcReader, ArcIMS, and other clients allow you to publish and share information with others.

## When to migrate

Any migration plan should be founded on the expectation that there will be clear benefits in making the move. While there are clear benefits to migrating, you should determine your own migration time frame. Your existing GIS systems will continue to work so you can make the move when you are ready to do so.

## Ensure you have the proper hardware and operating systems

Before you begin planning your migration, your first step will be to verify that you have the proper hardware, operating systems, and computer networks in place. ArcGIS Desktop requires a modern PC running the Windows operating system and a recommended 512 MB of RAM. In addition, ArcIMS and access to ArcSDE databases across a network will require good network bandwidth and performance. Detailed information about system requirements for each part of ArcGIS can be obtained at <http://support.esri.com>. Look under the System Requirements choice for each product to access up-to-date information about each.

If your computer systems are older and you cannot migrate to the required hardware and operating system, it will be appropriate to continue to use your existing implementations of ArcInfo Workstation, ArcView GIS 3, and so forth. These are good systems and will continue to work well for you until you are able to begin your migration.

## Migration stages

Migrating to ArcGIS can be organized into three broad stages. The first stage involves directly using existing data for mapping, analysis, and sharing using ArcIMS. The second stage involves migrating your main data holdings to the geodatabase. The third stage involves implementing the new geoprocessing framework, due to ship with ArcGIS 9.0.

<b>Stage 1</b>	<b>Direct use of existing data</b>	Use ArcGIS Desktop, ArcReader, and ArcIMS to access and use existing file-based datasets for mapping, analysis, GIS dissemination, metadata capture, and so on.
<b>Stage 2</b>	<b>Move to the geodatabase for data management and editing</b>	Migrate data management from file-based coverages to DBMS, including direct editing of the geodatabase. Many implementations will be possible using free personal geodatabases. However, most large, multiuser systems will require use of ArcSDE and a commercial DBMS.
<b>Stage 3</b>	<b>Convert geoprocessing to use ArcGIS 9.0</b>	At ArcGIS Desktop 9.0, a new geoprocessing framework will be released. This will mainly affect ArcInfo users and will provide a comprehensive substitute for all the geoprocessing commands in ArcInfo Workstation.

*Three-stage migration to ArcGIS from ArcInfo Workstation*

## Stage 1: Data use: Use ArcGIS and ArcIMS with existing data

ArcGIS supports all traditional file-based data types (in addition to the newer geodatabases and other DBMS data sources). Thus, the initial migration step would be to use ArcGIS for data use. You can deploy data access tools, such as ArcView 8, ArcReader, and ArcIMS, to work with existing GIS data, regardless of its format. The impact of this strategy is that you will continue to use ArcInfo Workstation to edit and maintain coverage data during the first stage of migration. Over time, you can begin to investigate data migration to the geodatabase and editing using ArcEditor and ArcInfo.

Multiuser data access and data sharing are key requirements of any GIS, and numerous strategies are used to share GIS information. In ArcInfo Workstation, a common practice is to build data using coverages and map libraries and to share data by converting it into shapefiles. Users deploy various software seats to access this data, including ArcView GIS 3 and ArcExplorer. Another common distribution mechanism gaining wide and rapid acceptance is Internet access using ArcIMS.

In the first stage of migration, you will continue to edit and maintain data with ArcInfo Workstation and begin to migrate your data using applications from ArcView GIS 3, ArcExplorer, and so on, to ArcView 8, ArcReader, and ArcIMS.

## Data-sharing strategies

ArcInfo Workstation	ArcGIS Desktop	Notes
Convert to shapefiles and share copies of shapefiles	Can support direct use of (and conversion to) any open format (shapefiles and so on)	In ArcInfo Workstation, most data-publishing strategies require data conversion to a direct-use, open format, such as shapefiles or ArcSDE feature classes. This often requires that tiled coverage data be joined, converted to the desired format (for example, shapefiles), and shared as copies. This same strategy can be pursued with ArcGIS because it supports all supported formats of ArcInfo Workstation for data use.  Out-of-date copies can become an issue.
Load into continuous ArcSDE feature classes	Direct use of multiuser geodatabases	
	Direct use of personal geodatabases	
	Use of ArcIMS to distribute file-based datasets as well as geodatabases	

*A comparison of the data-sharing strategies between ArcInfo Workstation and ArcGIS Desktop.*

## Data use benefit: One application framework

An application framework is the environment in which a focused application is delivered. It includes the user interface, data support, the customization and programming environment, and so forth. In addition to ArcInfo Workstation, users must work with a series of independent and distinctly different applications for GIS deployment, such as ArcView GIS 3, MapObjects, ArcExplorer, and ArcIMS. Each deployment method is developed independently. Customizations, GUIs, map

layouts, and so forth, are not sharable between these systems (although data is).

By contrast, ArcGIS is designed as a complete, integrated system with many levels of deployment all built on a single, integrated architecture with common user interfaces, data support, and shared document types (maps, data, metadata, layers, 3D scenes, customizations, and so on).

ArcGIS Desktop is Windows-based. Customization is simple and familiar to Windows software users. Standard procedures and developer tools, such as Visual Basic, VBA, .NET, and Visual C++®, are used for customizing ArcGIS Desktop. ArcInfo Workstation is customized using AML.

Because ArcGIS Desktop is a standard Windows application, it is easy to learn and use. The required level of customization when moving to ArcGIS is reduced

because of the range of functionality included in the ArcGIS Desktop user interface. Many additional tasks are supported over existing systems (for example, ArcView GIS 3, ArcInfo Workstation, and MapObjects). These earlier systems required more customization programming and applications development (using AML, Avenue, and so on) to complete many common work tasks.

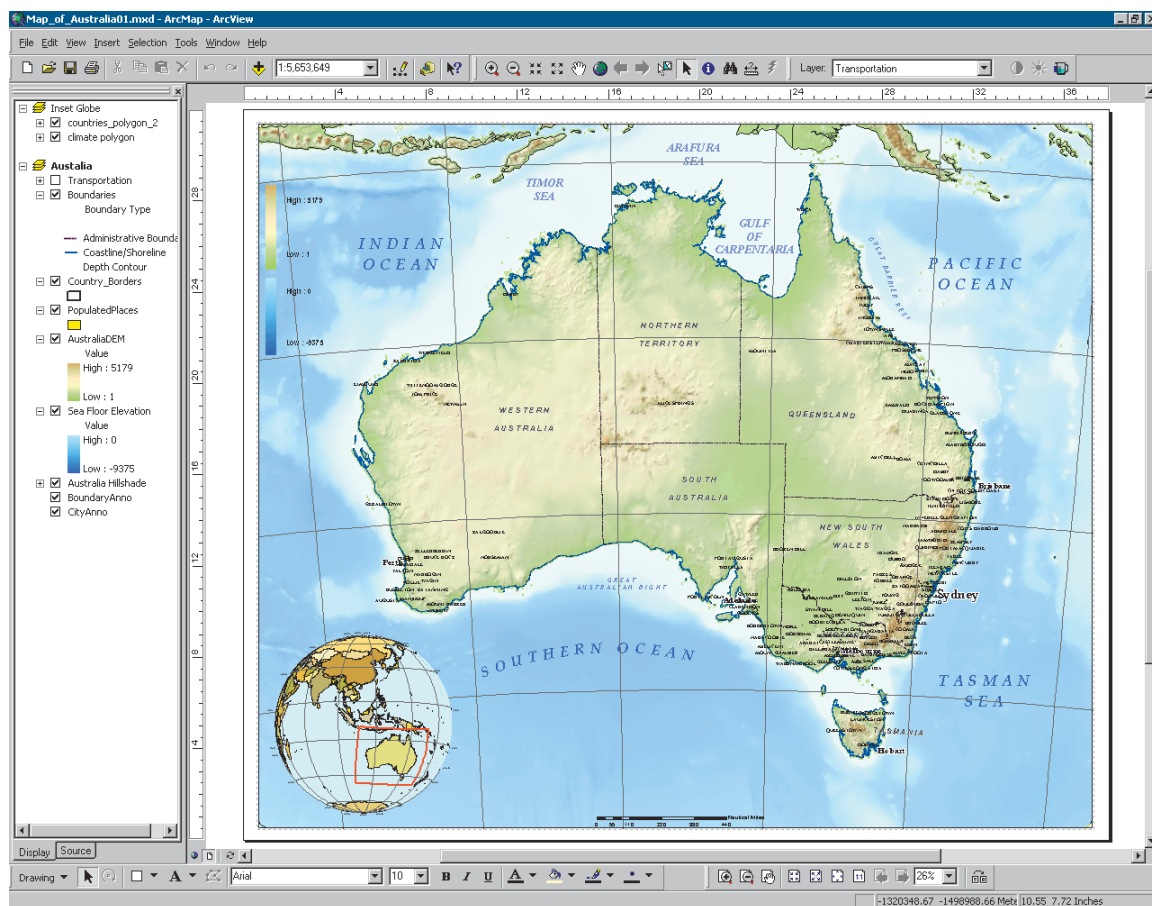
Application framework	
ArcInfo Workstation	ArcGIS Desktop
Not tightly integrated with other applications (ArcView GIS 3 and so on), but can use common datasets	Collection of Integrated Windows Desktop applications, including ArcScene, ArcToolbox, ArcCatalog, and ArcMap
Individual programs (Arc, ArcEdit, ArcPlot, ArcGrid, and so on)	
Command-based	Windows-based user interface
Automate work flows and custom GUIs using AML and ODE	Productive user interface supporting most common GIS tasks. When necessary, custom work flows and tools are built using COM-compliant Windows developer tools, such as VBA, VB, VC++, .NET, and so on.
UNIX and Windows support	Windows only
ArcInfo Workstation users require different systems to deploy GIS in their organizations (for example, ArcView and MapObjects). Each product has an independent user interface, data support, and customization tools.	

Comparison between the ArcInfo Workstation and ArcGIS Desktop application frameworks

In ArcGIS 8.3, ArcView, ArcEditor, and ArcInfo Desktop are all based on the same application framework and share a common user interface, as well as common maps, layers, custom tools, and extensions. When you learn ArcView, you are learning to use ArcInfo Desktop and so on. When you build maps in ArcView 8, they can be reused in ArcInfo Desktop, ArcEditor, ArcReader, and ArcIMS. You can also share custom applications because customization is the same between ArcView 8, ArcEditor,

and ArcInfo Desktop. Support for data use is the same between all three products. ArcEditor and ArcInfo are the advanced editing seats.

The same GUIs, customization, data support, and documents (maps, symbols, layers, metadata, 3D scenes, and so on) exist between ArcView, ArcEditor, and ArcInfo Desktop.



*Interactive mapping and cartography are a benefit of using ArcGIS Desktop.*



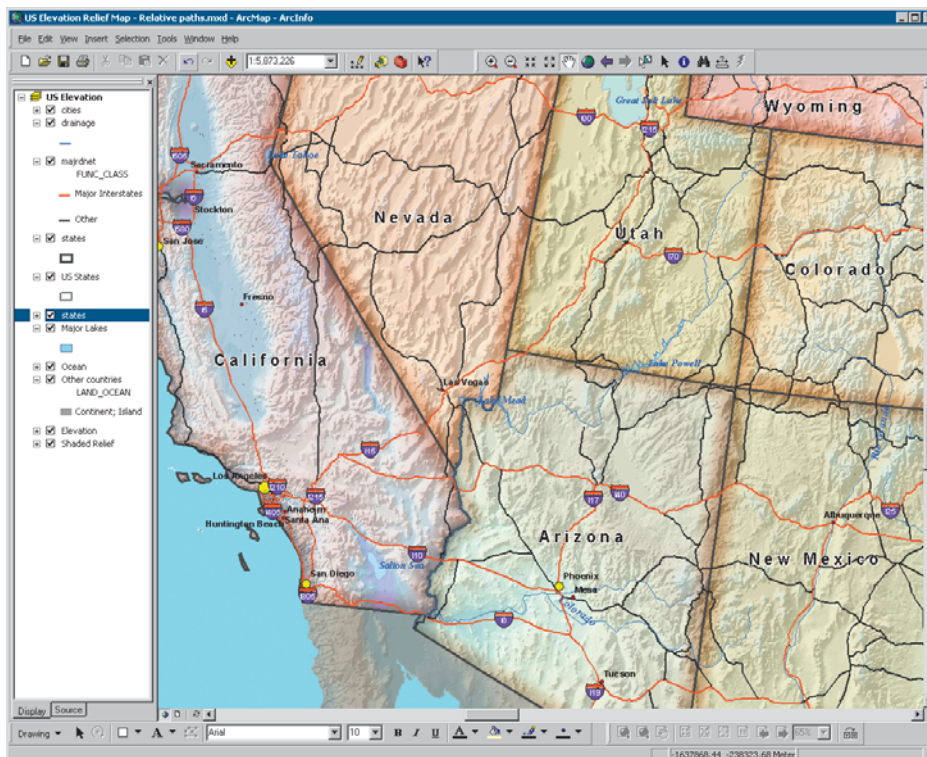
## Data use benefit: Interactive mapping and cartography

Some of the mapping and cartography advantages in ArcGIS Desktop are readily apparent for many ArcInfo Workstation users. This is especially true for GIS deployment seats in their organizations (such as with ArcView, ArcReader, and ArcIMS maps) because work built with the ArcGIS Desktop can be readily shared. Some key capabilities that aid in migration include:

- **Symbology:** all ArcInfo Workstation symbols (plus many more) are available through style sets. A symbol converter is also available for converting custom ArcInfo symbol sets.
- **Legend generation** is quick and easy.
- **Layers:** map layer specifications are easy to generate and share. They can be saved and shared independently of the map. This allows users to standardize the drawing of many map layers in their GIS. Advanced layers can be scale-dependent, can be in many coordinate systems

that are projected on the fly, can participate in grouped layers, and can be used in geoprocessing operations.

- Raster and vector layers can have transparent fills.
- Chart mapping is supported.
- On-the-fly map projection and datum conversion is supported, including International Dateline support.
- Building a map layout is simple with the graphical user interface. Sophisticated map layouts can be saved and shared as map templates.
- Works on all existing datasets.
- Maps built in ArcView 8 can be shared and used with ArcEditor and ArcInfo Desktop (as well as ArcReader and ArcIMS).
- Map designs can be shared as map templates.
- Custom tools are available for printing map series.



*ArcView 8 maps can be reused in ArcInfo Desktop, ArcEditor, ArcReader, and ArcIMS.*

## Data use benefit: Common ArcGIS extensions

The ArcGIS Desktop products (ArcView, ArcEditor, and ArcInfo) share the same optional extensions and cover the capabilities provided by the ArcInfo Workstation extensions. (Please note: Although not yet available, ArcGIS Network Analyst will be shipping with a future ArcGIS release). ArcInfo Workstation users who have optional extensions have access to (that is, are licensed to

use) the corresponding ArcGIS Desktop extensions by keeping their annual maintenance up to date.

There are also several additional extensions not found in ArcInfo Workstation that are available for ArcGIS Desktop. They include ArcGIS Geostatistical Analyst, ArcGIS Survey Analyst, ArcGIS Tracking Analyst, Maplex for ArcGIS, ArcGIS StreetMap USA, ArcGIS StreetMap Europe, ArcGIS Schematics, and MrSID Encoder for ArcGIS.

## Migrating your extensions

ArcInfo Workstation	ArcGIS Desktop	Notes
GRID	Spatial Analyst	Existing ArcInfo GRID users have access to both Workstation GRID and ArcGIS Spatial Analyst.
TIN	3D Analyst	Existing ArcInfo TIN users have access to both Workstation TIN and ArcGIS 3D Analyst.
Network	Network Analyst (not available at version 8.3)	Existing ArcInfo NETWORK users have access to both Workstation Network and ArcGIS Network Analyst.
ArcPress	ArcPress	Existing ArcInfo ArcPress users have access to ArcPress tools for both ArcInfo Workstation and ArcGIS Desktop.
ArcScan	ArcScan for ArcGIS	Existing ArcScan for ArcGIS users have access to ArcScan tools for ArcInfo Workstation, ArcEditor, ArcInfo on ArcGIS Desktop, and ArcView.
ArcStorm™	ArcSDE	ArcStorm is used for tile-based coverage management in ArcInfo Workstation for multiuser editing. ArcStorm users will typically migrate to using ArcSDE and the geodatabase.
COGO	Core ArcEditor and ArcInfo Desktop functions	COGO users apply traverse and other coordinate geometry tools to edit coverages in ArcEdit. These capabilities are now supported as core editing operations in ArcEditor and ArcInfo. More advanced survey management tools are included with ArcGIS Survey Analyst, which is freely available as an upgrade to all COGO users.

*Migrating extensions from ArcInfo Workstation to ArcGIS Desktop*

## Data use benefit: Full, standards-based metadata support

Since a limited number of essential metadata capabilities are supported in ArcInfo Workstation, perhaps one of the easiest migration decisions will be to use ArcGIS Desktop (ArcView, ArcEditor, and ArcInfo) to document and publish metadata catalogs.

ArcGIS supports all of the metadata content standards (FGDC, ISO, and so on). In ArcGIS, the ArcCatalog application is a highly productive tool for editing and managing metadata. You can use ArcCatalog to document all information sets with easy-to-use editors. This is highly productive because ArcCatalog will automatically populate many of the metadata content fields inherent in your datasets for you simply by pointing ArcCatalog metadata tools at your datasets. The interview style of the ISO editor also makes sense of an overwhelming amount of metadata content and properties. Quite simply, it's a productive environment in which to capture detailed documentation about your information holdings.

ArcGIS Desktop users can also choose to publish a comprehensive metadata catalog using ArcSDE and to serve it openly as an ArcIMS Metadata Catalog Service. This service can be searched using tools provided with ArcIMS, using ArcCatalog, and even through Z39.50 protocols. Users can employ ArcGIS to author, manage, and publish a standards-based clearinghouse node or to establish their own geography network.

## Getting started with data use

Before you begin migration, make sure that you have the proper hardware and operating systems on which to deploy ArcGIS. It does require a more modern Windows machine and version of the Windows operating system than do ArcView GIS 3 and ArcInfo Workstation. Ensure your hardware will support your migration. For more information, view the system requirements at <http://support.esri.com>.

### Starting points for beginning migration:

Begin data and map use applications using ArcGIS Desktop.

Work with existing data.

Begin to document your data holdings using the Metadata Editor in ArcCatalog.

Share ArcMap documents with ArcReader, ArcIMS, and other ArcView, ArcEditor, and ArcInfo Desktop users.

Publish standard cartographic layers for your ArcGIS users.

Migrate map production to ArcMap.

Migrate extension use to ArcGIS Desktop.

Begin Internet deployment using ArcIMS.

*When you begin migration, consider these options for data use and deployment.*

## Stage 2: Data management and editing using the geodatabase

The second stage of migration is the most complicated of the three migration phases. Thus, a major decision point in your migration plan to ArcGIS will be to determine when the appropriate time will be to move from the coverage-based data model used in ArcInfo Workstation to the geodatabase model of ArcGIS for managing your vector datasets. This migration stage also presents many new opportunities to extend your GIS. The geodatabase design phase will require prototype implementations of the geodatabase to zero in on the most appropriate database design. This should be followed by a pilot project in which the planned system architecture is used. The goal of the pilot project is to determine a working system configuration to deploy data editing applications.

Data editing and automation also represent some of the more sophisticated work flows to maintain data integrity during editing and maintenance tasks. Thus, these migration tasks are more likely to include application customization.

In this section, we will discuss some of the key data concepts as well as some critical data modeling procedures to follow.

## Data management and editing benefit: All GIS data in the DBMS

In ArcInfo Workstation, the primary GIS data focus is on file-based data managed in a set of workspaces or file folders. A workspace contains a set of file-based GIS datasets, such as coverages, shapefiles, grids, TINs, and other image files. The Info directory in each workspace holds tables. Users often manage related tables in a SQL DBMS (such as Oracle or Microsoft SQL Server). In ArcInfo Workstation, coverages are used as the primary vector data format for data management because they support topology and other integrated geometry.

In ArcGIS, the focus is increasingly on GIS data in a relational database, referred to as the geodatabase. The geodatabase storage model is based on the standard relational model of tables containing rows and columns. There is one central repository to hold both the spatial and attribute information. All geodatabase information is held in standard DBMS tables.

The charts on the next three pages outline data in ArcInfo Workstation versus ArcGIS Desktop.

**Comparison of data support in ArcInfo Workstation and ArcGIS Desktop**

ArcInfo Workstation	Data in ArcGIS	Notes
Workspace	Geodatabase	An ArcInfo <i>workspace</i> is a file-system folder holding a collection of file-based datasets (coverages, Info files, and so on). A geodatabase is a DBMS instance holding a collection of table-based datasets.
Coverage	Feature dataset	A coverage is a collection of feature classes with a very strict specification of topological relationships. A <i>feature dataset</i> is a collection of feature classes with user-defined spatial relationships and topologies.
Coverage Attribute Tables	Geodatabase tables	The coverage's attribute tables (PAT, AAT, and so on) in the INFO database are maintained separately from the geometry. In the geodatabase, geometry and attributes are maintained in a single DBMS table (one per feature class).
INFO tables DBMS table via DBI	Text files INFO tables dBASE tables DBMS tables Any OLE DB data source	ArcGIS supports the same tables supported in ArcInfo Workstation plus many more formats.
Grids Images Image Catalogs	Raster dataset Images Raster catalogs	Supports full raster operations on numerous raster formats in addition to grids: JPEG, ERDAS IMAGINE, TIFF, and so on, are supported for storage and management in the geodatabase. In ArcGIS, all geodatabase rasters (as well as file-based raster datasets) can have multiresolution pyramids for efficient data use at various map scales. You can manage large raster datasets in the geodatabase (for example, greater than 100 GB). They can either be tiled or mosaicked in a single large, continuous coverage.
COGO arcs COGO points	Lines with COGO attributes Points with COGO attributes  Survey dataset	COGO coverages hold arc and point feature classes that contain specific COGO attributes (such as traverse and curve properties) in the AAT and PAT. Similar properties can be maintained on Line and Point feature classes in the geodatabase.  ArcGIS users who have Survey Analyst can manage a comprehensive survey dataset that holds survey points, coordinates, measurements, and computations for managing all survey information as an integral part of the GIS. This also includes the ability to incrementally add new survey information over time. Feature geometry can be linked to survey point locations and adjusted.

Comparison of coverages and feature datasets

ArcInfo Workstation	Data in ArcGIS	Notes
Coverage feature classes:	Geodatabase feature classes:	<p>* The spatial extent and coordinate system are defined as part of the dataset's spatial reference. The tics could optionally be managed as a point feature class.</p> <p>** With topological relationships to other line and polygon feature classes.</p> <p>*** A label location with a topological association to its polygon.</p> <p>**** The best strategy is to use generic feature classes whenever possible to ensure support for open, multipurpose, standards-based data. However, the geodatabase is extensible and it is possible to add custom feature classes.</p>
Tic	Point *	
Bnd	*	
Arc	Polyline	
Node	Point **	
Point	Point	
Polygon	Polygon	
Polygon label	Point***	
Route System	Line with measures	
Region	Polygon	
Annotation	Annotation	
NA	Dimension	
NA	Custom features ****	

ArcInfo Workstation and ArcGIS Desktop each have a different geometry model. Coverage feature classes can have x,y coordinate pairs. Geodatabase feature classes can have xy, xyz, xym, or xyzm coordinates (the z's are used to hold elevation and the m's are used to hold measures for linear referencing).

Geodatabase feature classes can hold true curves and parametric geometry.

Coverages can only have one tic, arc, node, and polygon feature class. Feature datasets can hold any number of feature classes of any supported type.

Feature classes in the geodatabase can have subtypes.

Columns in geodatabase tables can be associated with a domain (a set or range of valid values).

Both data models can have relationships. ArcInfo Workstation uses the RELATE command to join rows between tables. A geodatabase can have relationships defined as part of its data model. On-the-fly joins, much like RELATES, are also supported in ArcGIS.

In a coverage, overlapping and multipart polygon features that share geometry must be modeled with a set of region feature classes. In the geodatabase, these would be organized into a set of polygon feature classes with topology rules that define if (and how) polygons can overlap.

In coverages, multiple, integrated line feature classes are modeled as route systems. In the geodatabase, these would be organized into a number of line feature classes and integrated using a topology.



**Data management and editing benefit: Strong editing of richer, more flexible data models**

In ArcInfo Workstation, the coverage data model has strict topology rules and mechanisms to maintain topological integrity. These are based on the use of topological pointers—internal feature IDs (often referred to as the cover #) for each feature class in the coverage. ArcEdit is the application that works closely with commands, such as BUILD, CLEAN, and RENODE, to maintain this strict topological data and internal ID structure. Topological editing, not simple feature editing (such as shapefile editing), is the focus in ArcEdit. Thus, data must always be edited as coverages in ArcEdit.

In ArcGIS, the fundamental method for managing a feature class is based on the OGC and ISO simple features specification: a feature class is managed as a standard DBMS table where each row holds all information for a single feature. One of the columns holds the geometry (that is, shape) of the feature. This enables ArcMap editing to work with many multipurpose, open data models, such as shapefiles and feature classes from any geodatabase (personal and multiuser). While ArcGIS can use and consume coverages effectively, it cannot edit coverages with any degree of consistency. Thus, coverage editing is not supported in ArcGIS 8.3.

ArcInfo Workstation focuses on coverage editing with latent support for editing some additional data types. ArcEdit is built around the coverage's topological data model and maintaining its integrity (internal cover # IDs, arc-node lists, polygon-arc lists, and so on).

Editing in ArcMap is based on the OGC/ISO simple feature data model (complete feature geometry in simple, standard tables) and includes a comprehensive topological editor that implements the specific user-defined topology rules for each dataset. Thus, ArcMap is not a coverage editing environment but works well for most open vector data models that adhere to standards. This includes the editing of shapefiles and feature classes in any geodatabase.

The target seats for ArcGIS editors are ArcEditor and ArcInfo.

**Editing in ArcInfo Workstation and ArcGIS Desktop**

ArcInfo Workstation	ArcGIS Desktop
Coverages	No coverage editing
No shapefile editing	Shapefile editing
Some simple ArcSDE feature classes	Personal geodatabases Multiuser geodatabases
Info tables	Info tables dBASE Access Text files RDBMS OLE DB
Rasters (via GridEdit and ArcScan)	Rasters (via ArcScan)
No Survey dataset support	Survey datasets (via Survey Analyst)

**Data management and editing benefit: Standard and open data models**

ESRI, in concert with numerous user groups, has been developing a series of ArcGIS Data Models for numerous applications. Some of the key goals have been to build designs that are open, multipurpose, standards-based, and readily sharable. The goal is to build data models that would readily support migration from existing coverage designs and also make the designs flexible and extensible. Helpful sample data models, along with implementation guidance, diagrams, user documentation, and tools, are available at <http://support.esri.com>.

**Data management and editing benefit: Strong multiuser data management**

In ArcInfo Workstation, the most common file-based method for data editing and maintenance is to tile the data into manageable chunks and allow only one user at a time to edit any tile. File-based editing in ArcEdit always operates on the coverage data model. Most often, the data is shared by converting it to shapefiles and other direct use formats (for example, ArcSDE layers).

In ArcGIS, users edit and maintain a relational database—the geodatabase. Users directly interact with and edit the same database as is used for other purposes in their GIS. No conversion is required. The multiuser geodatabase (which requires the use of ArcSDE) can reach any size; it is always continuous (that is, not tiled).

ArcInfo Workstation has a series of options for how a large, continuous vector database is managed. All involve the use of the coverage data model and tiles to manage large collections. Editing is performed against coverage copies and often joined-and-clipped tiles.

The geodatabase is continuous. Data maintenance involves directly editing the large, multiuser geodatabase. No data conversion or copies are necessary (unless dictated by the work flow). Multiuser editing typically requires the use of ArcSDE.

ArcInfo Workstation	ArcGIS Desktop
Three alternatives can be used for multiuser data management:  - Tiled workspaces - Map libraries - ArcStorm libraries (using the ArcStorm extension)	One strategy: Multiuser geodatabases (uses ArcSDE and a DBMS such as Oracle, SQL Server, IBM DB2, or Informix):  - Continuous, not tiled - Direct use, not converted for editing or shared use

**Data management and editing benefits: Support for multiuser editing and other critical GIS work flows**

There are a number of key data management work flows in GIS. ArcInfo Workstation directly addresses only one of these work flows for tile-based editing. The other data management work flows (for example, history management) must be built as comprehensive AML applications on the base system.

In ArcInfo Workstation, for disconnected, multiuser editing (where tile-based data is checked, or copied, out and the tiles are joined), the check-out data copy is edited and, once completed, checked back into the multitile repository. The edited copy wholly replaces the check-out data.

By contrast, the goal of the multiuser geodatabase using ArcSDE and ArcGIS is to address any number of key GIS data management work flows. The set of work flows that are currently supported at ArcGIS 8.3 include:

- Multiuser editing
- Persistent design alternatives (for example, “as-planned” and “as-built” versions)
- Disconnected editing (check-out, check-in)
- Synchronized field editing with ArcPad
- Version-based history management

For good technical white papers on how to implement history, refer to the Technical Papers at <http://support.esri.com>.

All of these GIS work flows are based on versioning. At its simplest level, versioning records and tracks updates and changes as standard rows in tables. All of the work flows described here are built using versioned geodatabases.

ESRI’s versioning implementation is open for access and use by all other DBMS applications.

Over time, ESRI plans to add support for additional work flows in ArcGIS and ArcSDE. For example, in an upcoming ArcGIS release, we will add support for loosely coupled replication, allowing users to share synchronized updates between remote geodatabases in any DBMS (Oracle, SQL Server, and so on).

Editing work flows

ArcInfo Workstation	Data in ArcGIS	Notes
Check-out/ Check-in editing work flow	<p>Supports check-out/ check-in plus additional version-based GIS work flows (via ArcSDE):</p> <ul style="list-style-type: none"><li>1) Multiuser editing</li><li>2) Persistent design alternatives</li><li>3) Feature history and revision info (metadata)</li><li>4) Disconnected editing</li><li>5) Integrated field editing via ArcPad</li><li>6) Loosely coupled replication (coming in a future ArcGIS release)</li></ul>	<p>In ArcInfo Workstation, multiuser editing requires one copy of the features to be edited by each user. The typical mechanism for this is to tile the GIS dataset and to have a single user edit one or more tiles of data at any point in time. Workstation users often employ map libraries (using Map Library or ArcStorm) to manage the check-out/check-in process.</p> <ul style="list-style-type: none"><li>1) Check-out and join.</li><li>2) Edit coverage copy.</li><li>3) Check-in edited data copy.</li></ul> <p>In ArcInfo Workstation, checkouts can be made against ArcSDE datasets but must be converted to coverages for editing in ArcEdit.</p> <p>In ArcGIS, multiuser editing requires the use of ArcSDE and a DBMS to manage and store the multiuser geodatabase. The geodatabase is not tiled; it is continuous. Any number of editors can simultaneously edit against the multiuser geodatabase. No data conversion is required like in ArcInfo Workstation; the edits are made directly on the multiuser database. Editors work with their own version (that is, only with their changes, not everyone's changes). Multiple versions can be reconciled against other versions and the changes can be posted to a common version (sometimes called the default version).</p> <p>In ArcGIS, versioned databases can support numerous other critical GIS work flows, such as history tracking and management.</p>

## Starting points for stage 2 migration: Data management and editing

### Begin to learn, understand, and prototype your use of geodatabases:

Begin to experiment with and use personal geodatabases. Load some sample datasets into a personal geodatabase.

Try migrating some coverage data into feature datasets with topologies. Learn how to model your geographic information. Experiment with topologies in ArcCatalog and ArcMap. ArcEditor and ArcInfo 8.3 include very good editing and data management tools as well as strong documentation for this.

Begin to prototype your geodatabase data models. Define feature classes, topologies, and other geodatabase elements in a prototype personal geodatabase and begin to experiment with that data model using ArcGIS Desktop.

Seek consistency, simplicity, and openness in your geodatabase design. Start with your existing coverage designs and reuse the best concepts in their designs. Experiment with sample ArcGIS data models. Helpful real-world data model implementations, diagrams, user documentation, and tools are available at <http://support.esri.com>.

### Plan your long-term data migration strategy:

Determine the best data architecture for your GIS. Should you use a small collection of personal geodatabases? Perhaps this will be appropriate if you have a few focused editors and smaller data volumes. There have been acceptable performances on personal geodatabases containing 100,000 to 500,000 features and less than 1 GB in size (Microsoft Access [MDB] database file limits are 2 GB). Some users can organize their GIS layers into a series of personal geodatabases (one for each layer) for use.

Once you prototype your data model with personal geodatabases, you should pilot the same architecture you plan on deploying to test your database architecture. Test your complete system design. Use representative data volumes. Adjust your design to work on real-world scenarios.

While your implementation costs may increase, it is still strongly recommended that you implement ArcSDE and a DBMS for large multiuser systems. All supported DBMS architectures will work and perform quite well with ArcGIS.

Data migration often requires some custom application development for data entry and management work flows.

Stage 3: Migrating your advanced geoprocessing work to ArcGIS

One of the key roles of ArcInfo Workstation has been to provide a comprehensive geoprocessing toolset that is used for:

- Database creation, import, construction, and conversion/export
- Analysis and modeling
- Advanced cartography, including map sheet manipulation, generalization, and feature processing for symbology
- Data management

The command-based geoprocessing framework and the use of AML is one of the key advantages of ArcInfo Workstation.

ArcGIS Desktop 8.3 provides access to the same geoprocessing tools accessed from the Arc: prompt in ArcInfo Workstation plus a few additional tools. In ArcGIS Desktop 9.0, a major focus will be the release of a comprehensive geoprocessing toolkit. Plus, ArcGIS Desktop 9.0 will add support for an integrated and modern ArcToolbox that will work within any ArcGIS application (ArcCatalog, ArcMap, and ArcScene). Tools will work with all data including geodatabases, map layers, coverages, shapefiles, grids, TINs, and all other supported GIS formats. Models can be built and shared. Open support to integrate any external operators and models into ArcToolbox and ModelBuilder™ will be supported as well. Commands and scripting will also be supported.

Since the new geoprocessing support will be released soon after ArcGIS 8.3, you can begin to plan for its migration in the coming months.

Geoprocessing

ArcInfo Workstation	ArcGIS Desktop 8.3	ArcGIS Desktop 9.0
Numerous commands at the Arc: prompt that take various data types (for example, coverages and Info files) as inputs and create new information.  AML is used for customizing and scripting.	Supports all Arc: prompt commands for geoprocessing  Runs existing AML scripts  Geoprocessing at ArcGIS 8.3 is a hybrid system. It executes ArcInfo Workstation commands plus a small set of new commands that work on geodatabases.  Data would require conversion to coverages for many geoprocessing operations in ArcInfo Workstation (for example, from a map library), as well as in ArcGIS Desktop 8.3.  ArcGIS 9.0 will fully modernize all geoprocessing in ArcInfo Desktop.	Comprehensive set of new tools.  Includes all existing functions.  Works with existing AML scripts and commands.  Will work on all file-based and geodatabase data as well as map layers.  ModelBuilder for graphically composing scripts and data flows.  Open, industry-standard scripting support in Python, Perl, VB Script, JavaScript, and Active X programming tools.  Easily extensible with custom scripts, commands, and programs.  Any external program can be incorporated as a tool.