ArcGIS 8.1

An ESRI White Paper • January 2001

ESRI 380 New York St., Redlands, CA 92373-8100, USA • TEL 909-793-2853 • FAX 909-793-5953 • E-MAIL info@esri.com • WEB www.esri.com

ArcGIS 8.1

An ESRI White Paper

Contents **Page**

J-8583

Contents **Page**

ArcGIS 8.1

ArcGIS™ is a scalable system of software for geographic data creation, management, integration, analysis, and dissemination for every organization, from an individual to a globally distributed network of people. The 8.1 release introduces a comprehensive, integrated system designed to meet the needs of a wide range of GIS users.

Background

Using substantial consultation with and feedback from our users, ESRI recognized the need to build a single, scalable architecture for its GIS software. While these software programs were interoperable at the data level, all were built on different code bases supported by separate development teams.

As technology evolved, it became apparent that this new software should be

- Easy to use—Offer generic mapping, analysis, and data management applications that are usable out of the box and yet easily customized.
- Extremely functional—Incorporate strong feature editing, advanced cartography, improved data management, and sophisticated spatial analysis.
- Scalable—Built out of modern object-based components, the range of software share the same core applications, user interface, and operating concepts.
- Web enabled—GIS clients and servers can use the Internet for data and application services.
- Developer friendly—Built using open industry standards, functionally rich, well documented, and completely customizable/extensible with common programming languages.

The ESRI family of software that was developed to meet these principles is known as ArcGIS. The ArcGIS line of software is being released in phases. The first phase occurred with the releases of ArcInfo™ 8.0.1 and ArcSDE™ 8.0.1 software that introduced new desktop GIS applications and the geodatabase model. The 8.1 release is the second major phase and includes three major developments.

- ArcView® 8.1 software, built on the same architecture as ArcInfo 8
- ArcEditor™ 8.1 software, a new release positioned between ArcView and ArcInfo
- ArcGIS Extensions that operate with ArcView, ArcEditor, and ArcInfo

ArcGIS Overview

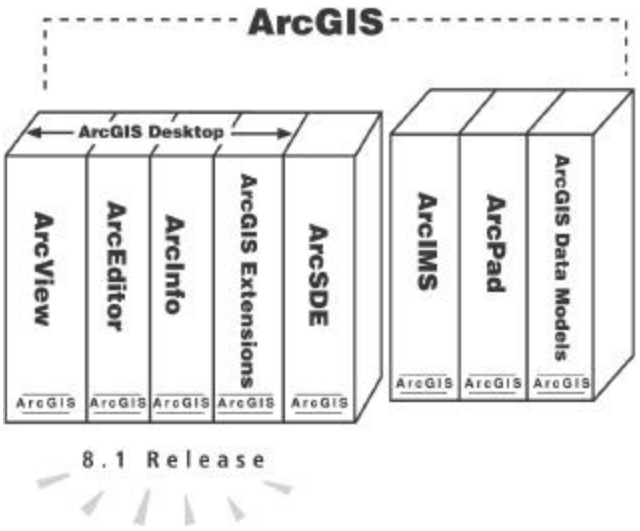
ArcGIS is a scalable system for geographic data creation, management, integration, and analysis for every organization, from the individual to the global enterprise. Built using standards such as Component Object Model (COM), Extensible Markup Language

(XML), and Structured Query Language (SQL), ArcGIS can be integrated into the core information systems infrastructure of any organization.

As GIS expands into new applications and user communities, ArcGIS meets the challenge of providing the data and services to a geographically literate world. Strong editing, analysis, and modeling, along with cutting-edge data models and management, continue to distinguish the ArcGIS software family as the leading GIS software.

The ArcGIS Desktop software is ArcView, ArcEditor, ArcInfo, and ArcGIS Extensions. Since the 8.1 release includes new versions of ArcView, ArcEditor, ArcInfo, ArcGIS Extensions, and ArcSDE, they are often collectively identified as ArcGIS 8.1.

Figure 1
The Software of ArcGIS



ArcGIS Desktop

The creation and management of geographic data is demanding. ArcGIS Desktop provides the complete set of required tools. ArcGIS Desktop is a scalable set of state-of-the-art software for geographic data creation, management, integration, analysis, and presentation. While practical and within the abilities of inexperienced GIS users, ArcGIS Desktop includes sophisticated functionality and is readily customized by advanced GIS users.

The term ArcGIS Desktop refers to ArcView, ArcEditor, ArcInfo, and ArcGIS Extensions. Although licensed separately, ArcGIS Desktop is a scalable set of software with the same core applications and user interface.

The ArcGIS Desktop core applications are ArcMap™, ArcCatalog™, and ArcToolbox™. ArcMap is used for working with spatial data and creating cartographic output. ArcCatalog is for locating and managing spatial data. ArcToolbox provides data conversion and geoprocessing tools. ArcGIS Desktop software programs share these

three applications. Additional functionality is enabled in each application as you move from ArcView to ArcEditor to ArcInfo.

As a result, ArcView and ArcInfo are now merged into a single, integrated platform built on a common architecture with an identical user interface. This dramatically increases usability and interoperability between what were two very different environments in the past.

ArcView, ArcEditor, and ArcInfo share the following core functionality:

- Advanced editing tools
- High-quality cartography
- Internet-enabled
- On-the-fly projection
- Geocoding
- Wizard-driven tools
- Support for metadata standards using XML
- COM-based customization
- Extensible architecture
- Direct read of more than 40 data formats

Figure 2
ArcGIS Desktop Software

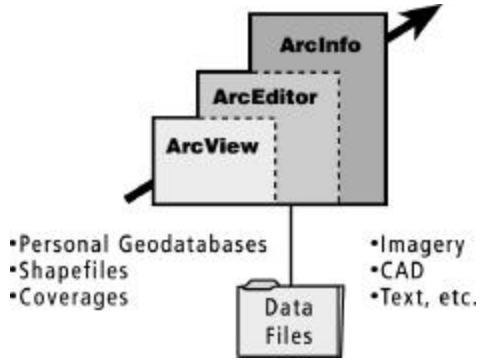


Figure 2 illustrates the scalable nature of ArcGIS Desktop. ArcView provides core mapping and GIS functionality. ArcEditor includes all the functionality of ArcView and adds the ability to edit coverages and multiuser geodatabases. ArcInfo includes all the functionality of ArcEditor and adds unsurpassed geographic database automation, maintenance, and conversion tools. Users select the software package that meets their needs depending on the required functionality. If you choose ArcView and find that your needs grow in the future, it is easy to upgrade to the next level of ArcGIS Desktop since the user interface, operating concepts, and underlying applications are identical.

In addition, this figure illustrates the use of file-based data sets. This is the most common data deployment method currently in use. When more than one user needs data access, files are either copied or mounted across a network. In work group editing situations, operational procedures have to be implemented since file-based data sets do not support joint editing. Characteristics of the file-based data set approach include

Advantages

- Easy to implement
- DBMS experience not required
- Low cost

Limitations

- Single-user editing only
- Spatial and attribute data managed in many, potentially disjointed, files
- Requires disk mounts or copies distributed on various disks
- Network performance sometimes an issue

ArcView

ArcView is the entry point into ArcGIS Desktop software and provides high-quality visualization, query, analysis, integration, and basic geographic data automation. ArcView 8.1 retains the same base functionality as ArcView GIS 3.x while adding notable improvements such as ArcCatalog for browsing and managing data, on-the-fly coordinate and datum projection, customization with built-in Visual Basic for Applications (VBA), new editing tools, support for creating annotation, and much more. ArcView allows you to create and edit shapefiles and simple features in personal geodatabases.

ArcEditor

ArcEditor includes all the functionality of ArcView and adds the power to edit features in a multiuser geodatabase or coverage. Additional functionality includes support for multiuser editing, versioning, custom feature classes, feature-linked annotation, dimensioning, and rasters in a multiuser geodatabase. ArcEditor allows you to create and edit all ESRI-supported vector data formats including shapefiles, coverages, personal geodatabases, and multiuser geodatabases.

ArcInfo

Within the ArcGIS software family, ArcInfo is the most comprehensive GIS available. It includes all the functionality of ArcView and ArcEditor and adds the advanced geoprocessing and data conversion capabilities that make ArcInfo the de facto standard for GIS. ArcInfo is the complete GIS data creation, update, query, mapping, and analysis system. ArcInfo is composed of ArcInfo Desktop and ArcInfo Workstation.

ArcInfo Desktop includes all the functionality of ArcEditor and adds a complete set of data management, analysis, and conversion tools to the ArcToolbox application. With these tools, you can perform data conversion, generalization, aggregation, overlays, buffer creation, statistical calculations, and much more. Each of these tools has a menu-driven interface with wizards where appropriate. ArcInfo Desktop operates on Windows NT and Windows 2000.

ArcInfo Workstation provides geoprocessing via the classic user interface (ARC, ARCEDIT™, ARCPLOT™, ARC Macro Language [AML™], and more). In addition to providing the user environment familiar to many ArcInfo users and found in countless existing GIS applications, ArcInfo Workstation includes fundamental and matchless geoprocessing functionality. ArcInfo Workstation operates on Windows NT, Windows 2000, and several UNIX platforms.

J-8583

ArcView, ArcEditor, and ArcInfo Compared

Table 1 compares the major features and functions of ArcView, ArcEditor, and ArcInfo.

Table 1
ArcGIS Desktop Software Compared

	ArcView	ArcEditor	ArcInfo
View shapefiles and coverages	✓	✓	✓
View geodatabases	✓	✓	✓
Create/Edit shapefiles	✓	✓	✓
Create/Edit coverages		✓	✓
Create/Edit personal geodatabases	✓[1]	✓	✓
Create/Edit multiuser geodatabases		✓	✓
Create/Edit feature-linked annotation		✓	✓
View feature-linked annotation	✓	✓	✓
Direct support of many raster formats	✓[2]	✓[2]	✓[2]
Data conversion and management	✓[3]	✓[3]	✓[3]
Includes ArcInfo Workstation			✓
License type	Single-use and floating	Floating only	Floating only
Operating Systems	Windows NT and Windows 2000[4]	Windows NT and Windows 2000	ArcInfo Desktop supports Windows NT and Windows 2000. ArcInfo Workstation adds UNIX support.

1 ArcView supports simple features (points, lines, polygons, and static annotation) in a personal geodatabase, not rules and relationships.

2 ArcView and ArcEditor support more than 25 raster formats. ArcInfo supports more than 30 raster formats.

3 ArcToolbox in ArcView and ArcEditor contains 21 basic data conversion tools. ArcToolbox in ArcInfo contains 167 data management, analysis, and conversion tools.

4 ESRI has a two-phased release schedule for ArcView 8.1. The initial release of ArcView 8.1 runs on Windows NT and Windows 2000. A subsequent release of ArcView will support Windows 98 and Windows Me.

Software licenses are either single-use (previously known as fixed) or floating (sometimes known as concurrent use). Single-use licenses permit software operation on one computer and do not call for a license manager. Floating licenses are controlled by a license manager operating on an organization's network and can be shared by any computer on the network. One license manager can administer the different floating ESRI® software.

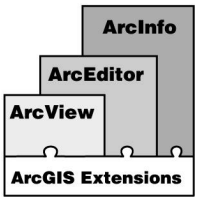
ArcView is available as either a single-use or a floating license. Regardless of the license type, the functionality of ArcView is identical. ArcEditor and ArcInfo are only available as floating licenses.

Separate from licensing issues, all the ArcGIS Desktop software can be installed on a single computer—ArcView single-use, ArcView floating, ArcEditor, and ArcInfo. ESRI provides Desktop Administrator tool for controlling which software is operational on that machine and listing additional floating licenses available on the network. This strategy

gives flexibility to individuals and organizations. Users can easily switch between software depending on their role or daily tasks.

ArcGIS Extensions

The 8.1 release introduces a new set of extensions built on the same architecture. ArcGIS Extensions add functionality to the core capability of ArcView, ArcEditor, and ArcInfo. ESRI reengineered the extensions to incorporate the best features of the earlier ArcView and ArcInfo extensions.



One of the key features of these extensions is that they operate with the entire line of ArcGIS Desktop software. Prior to the 8.1 release, if ESRI users needed to perform raster analysis they licensed different software depending on their core GIS software. They used ArcView Spatial Analyst with ArcView or ARC GRID™ with ArcInfo. In contrast, ArcGIS Spatial Analyst 8.1 can operate with ArcView 8.1, ArcEditor 8.1, or ArcInfo 8.1. This feature significantly reduces training, operating, and acquisition costs.

Table 2 lists the extensions available at the 8.1 release. Additional extensions are planned for the future.

Table 2
ArcGIS Extensions Available at the 8.1 Release

Name	Features
ArcGIS Spatial Analyst	Surface creation, raster analysis, and grid algebra; combines the capabilities of ArcView Spatial Analyst and ARC GRID
ArcGIS 3D Analyst™	Three-dimensional visualization and analysis; combines the capabilities of ArcView 3D Analyst and ARC TIN™
ArcGIS Geostatistical Analyst	A new extension for advanced surface interpolation and exploratory spatial data analysis
ArcGIS StreetMap™	Family of software for street display and geocoding of different geographical areas. (United States and Europe are available first.)
ArcPress™ for ArcGIS	Graphics metafile rasterizer that improves color output control and printing speed; combines ArcPress for ArcInfo and ArcPress for ArcView GIS
MrSID Encoder for ArcGIS	Produces MrSID images from input images up to 500 MB; mosaics MrSID images
TIFF/LZW Compression for ArcGIS	Right to use TIFF/LZW compression technology patented by UNISYS

ArcGIS Extensions are licensed as either single-use or floating. The host determines the type of license required. Single-use extensions only operate with the single-use version of ArcView. Floating extensions operate with ArcInfo, ArcEditor, and the floating version of ArcView. This feature adds a new degree of flexibility because ArcGIS Extensions can either be licensed to operate with a single-use version of ArcView or shared on a network.

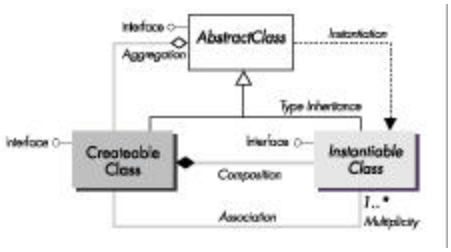
Some of the extensions add capabilities to ArcInfo Workstation. For instance, ArcGIS Spatial Analyst adds ARC GRID and ArcGIS 3D Analyst adds ARC TIN, while ArcPress for ArcGIS and TIFF/LZW Compression for ArcGIS both add commands and tools in ArcInfo Workstation.

ArcObjects

ArcGIS Desktop is built on a technology framework known as ArcObjects™. ArcObjects is a collection of software components with GIS functionality and programmable interfaces. ArcObjects technology is based on the COM protocol. Customization is performed using the built-in VBA scripting capabilities or a COM-compliant programming language such as Visual Basic, Visual C++, or Delphi.

Figure 3
ArcObjects Features and Sample Diagram Key

- Well-documented data model
- Unlimited extensibility
- Highly scalable
- Easy to interface
- More than 1,200 unique COM-based components



The ArcObjects components that make up ArcView, ArcEditor, ArcInfo, and the geodatabase data model are open to users and developers. You can add new tools or work flows to the ArcGIS Desktop applications without purchasing an additional Software Development Kit (SDK). In addition, ArcObjects allows you to extend the geodatabase data model by creating custom feature types and building a schema for your geodatabase design.

Geodatabase

Although the 8.1 release operates with existing data formats, ArcGIS is fundamentally based on a new data model called the geodatabase (short for geographic database). ESRI introduced the geodatabase with ArcInfo 8.0.1, and its use is strengthened in the 8.1 release.

The geodatabase has two major concepts. First, a geodatabase is a physical store of geographic information inside a DBMS. Second, a geodatabase has a data model that supports transactional views of the database (versioning) and also supports objects with attributes and behavior. Behavior describes how an object can be edited and displayed.

Behavior includes, but is not limited to, relationships, validation rules, subtypes, and default values. Three key features of a geodatabase are

1. Centralized management of a wide variety of geographic information in a DBMS
2. Versioning that allows simultaneous editing by multiple editors and transactional views of the geodatabase
3. Custom (or intelligent) features that have behavior, editing rules, and relationships

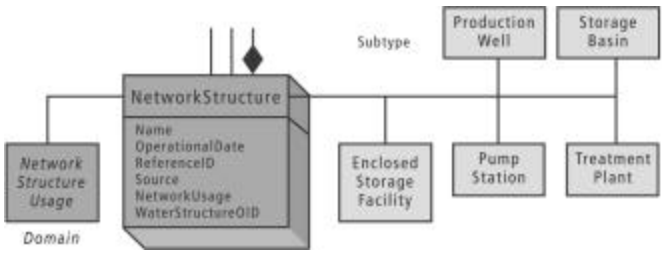
Versioning allows simultaneous editing by multiple users and also allows transacted views of the geographic database. This framework lets you create versions of a geodatabase for the states of a project, reconcile differences between versions, and update the master version of a geodatabase with the design as-built. Custom features can be enhanced with properties including behavior, editing rules, and relationships. As a result, they can more closely resemble real-world objects such as parcels, buildings, and transformers.

The chief purpose of the geodatabase data model is to make it easier and more intuitive to use GIS across many applications. As such, the geodatabase is sometimes referred to as the next-generation coverage. It is that, and much more. The geodatabase data model centralizes data management and opens up the use of GIS to applications that were not feasible before. See Appendix C for more information on the geodatabase.

ArcGIS Data Models

The geodatabase data model allows the creation of common or essential data models for specific industries and applications. ArcGIS data models provide ready-to-use nonproprietary frameworks for modeling and capturing the behavior of real-world objects in a geodatabase. They are built on the accepted standards in each field and provide data models that can be configured and customized using ArcEditor or ArcInfo. Data migration is the longest and most expensive part of a GIS project. These data models provide "quick start" solutions that optimize performance and establish industry standards that improve data sharing.

Figure 4
A Small Portion of the ArcGIS Water Facilities Model



ESRI has initiated a series of programs to facilitate creating these data models in close collaboration with our user groups for each industry. These data models involve the development of a series of books with CDs that provide each industry or application discipline a standardized collection of data classifications and object models.

ArcGIS Water Facilities Model was the first data model released. It provides an industry standard for modeling and managing water network systems and comes with a manual, a graphical model, a physical database design, and a test database. Other data models in development include hydrology, land parcel, roads/transportation, energy networks, conservation, environmental facilities, telecommunications, forestry, and defense data models. These efforts allow GIS users to spend less time designing and developing data models.

ESRI's goal is to make these data model extensions open and widely available. In some cases, we are cosponsoring their development. The ArcGIS Water Facilities Model is an example and can be downloaded from the ESRI Web site.

ArcGIS Application Services

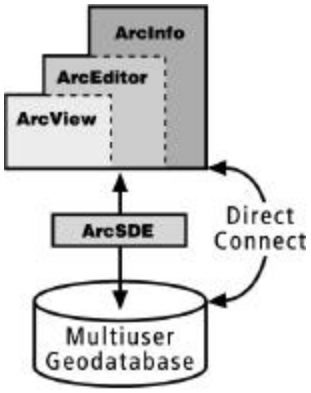
The rich offering of ArcGIS Desktop is complemented by two application services: ArcSDE software, for storing and managing data in a multiuser environment, and ArcIMS software, for distributing GIS data and services across the Internet. These two application services are server based and are designed to operate on both UNIX and Windows.

ArcSDE

ArcSDE is the gateway for storing and managing a multiuser geodatabase stored in a database management system. By allowing concurrent multiuser editing and providing transacted views of a geodatabase, ArcSDE plays a fundamental role in collaborative GIS systems. ArcSDE 8.1 supports Oracle, Microsoft SQL Server, IBM DB2, and Informix.

ArcSDE is tightly integrated with ArcEditor and ArcInfo for designing, creating, implementing, and sharing multiuser geodatabases. In a collaborative GIS environment, ArcView acts as a client for viewing and analyzing geographic data.

Figure 5
Collaborative GIS with ArcSDE



ArcSDE 8.1 uses a compressed binary format for storing geographic data. This binary format was developed to work with multiple DBMS platforms. In addition, ArcSDE can use the extended spatial types of a spatially enabled DBMS to store and manage feature geometry. In this manner, ArcSDE supports the major functions and capabilities of Oracle Spatial, IBM's DB2 Spatial Extender, and Informix's Spatial DataBlade. In these cases, the geometry is also directly accessible via the SQL implementation of the specific

DBMS (an Oracle-specific SQL implementation for Oracle Spatial and SQL 3 Multimedia for IBM DB2 and Informix).

It is important to note that a multiuser geodatabase is not stored in a proprietary structure but is stored in standard tables managed by the DBMS. As a result, users can access a multiuser geodatabase through the ArcSDE gateway or through any standard DBMS access methodology.

The 8.1 release introduces a new direct connect capability between clients and the geographic information stored in the DBMS. Prior to 8.1, clients had to first connect to the ArcSDE application server, which then connected to the host database. With the new direct connect drivers included with 8.1, clients can connect directly to the database. The direct connection option requires an ArcSDE license but does not require the installation of the ArcSDE server. At 8.1, this direct connect capability is supported on Oracle8*i* and Microsoft SQL Server 7. Direct connect support for IBM DB2 and Informix is planned for a later release.

Regardless of whether the system is configured with the application server, direct connect drivers, or a mixture of the two, the client applications have the same functionality. The direct connect option adds a new level of flexibility for system design and configuration. On one hand, it is easier to administer since an ArcSDE server process does not have to be established and administered. Conversely, the direct connect option increases network traffic and moves server functionality to the desktop. As a result, the ArcSDE application server option is generally 20 to 40 percent faster and is recommended when performance is critical.

ArcIMS

ArcIMS is a powerful Internet mapping system that provides a framework for centrally building and deploying GIS services and data. Using ArcIMS, you can deliver focused, lightweight GIS applications and data to many concurrent users, both within your organization and externally on the World Wide Web. ArcIMS works with data files or a multiuser geodatabase managed with ArcSDE.

ArcIMS includes a suite of spatial services and Web clients. The spatial services include the following: map services, feature services, geocoding, database queries, and data extraction or clipping. The Web clients complement the ArcGIS Desktop software and include browser-based viewers (HTML and Java) and stand-alone ArcExplorer™ viewers (Windows and Java). In addition, ArcPad™ software, ESRI's mobile mapping solution, can retrieve maps from ArcIMS using wireless technology.

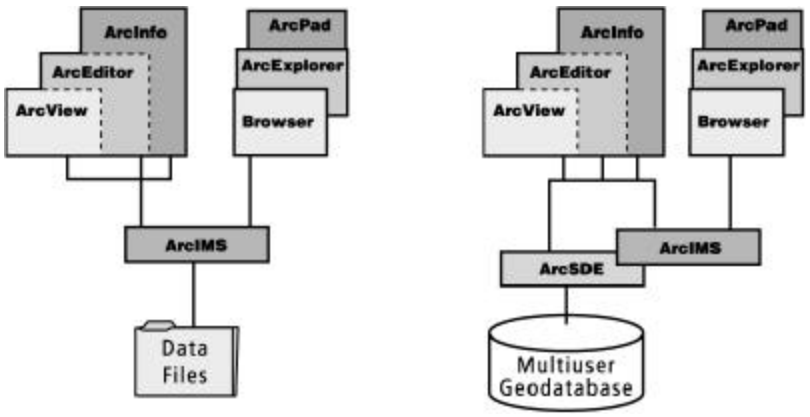
With GIS on the Internet, I feel like we have just invented the printing press for maps.

–Jack Dangermond President, ESRI

ArcIMS map services and feature services are distinguished by what is transmitted to the client. Map services create and send cartographic map images in a raster format. Feature services stream vector features as shapefiles and attributes to the client. An important new capability at 8.1 is that ArcGIS Desktop software can connect to map and feature services. These new layer types behave as if they are local data and can be symbolized, mapped, queried, edited, and analyzed. In addition, streamed vectors and attributes can be saved locally for later use.

J-8583

Figure 6
Distributed GIS with ArcIMS



ArcIMS allows a new and dramatic architecture supporting dynamic integration of loosely coupled (Intranet/Internet) GIS clients and servers. This architecture allows clients to integrate local GIS data with ArcIMS layers served from multiple Web sites. This "data fusion" is revolutionizing the use, scope, and impact of GIS. Geographic data providers using ArcIMS to publish live maps, downloadable data, and geoservices can register their sites on the Geography Network℠. For more information visit www.geographynetwork.com.

Summary

The 8.1 release of ArcGIS meets the ESRI plan for a single, scalable software architecture. As a result, ArcView and ArcInfo have merged into a single, integrated platform with a new deployment option known as ArcEditor positioned between them. This release contains a common architecture, common code base, common extension model, and single development environment for ArcView and ArcInfo. This is something that ESRI and its users have wanted for many years.

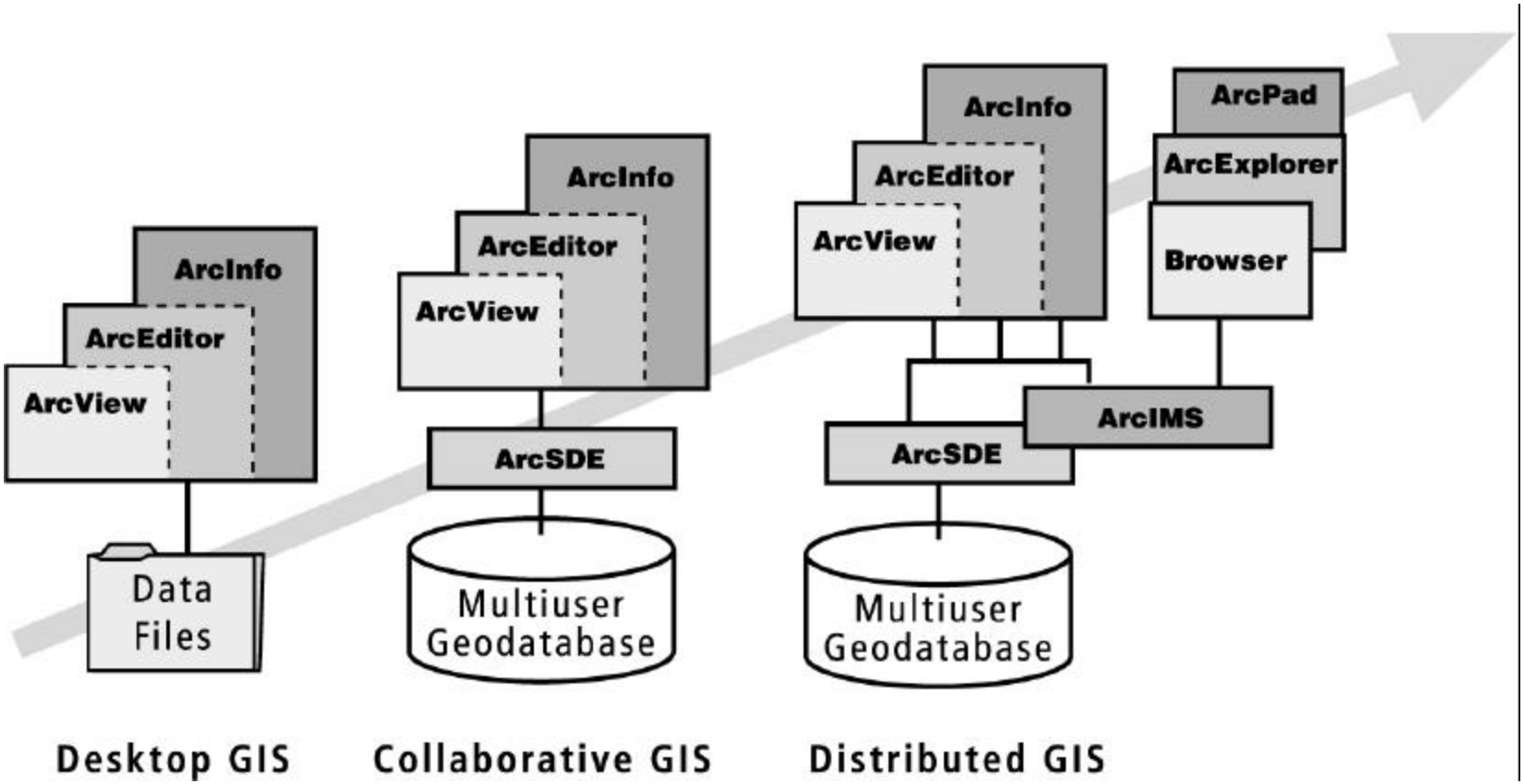
Scalability—How well a solution to some problem will work when the size of the problem increases

Furthermore, the ArcGIS system is designed to interoperate with existing enterprise technology, applications, and databases. Through the use of standards like COM, XML, and SQL, ArcGIS can integrate with enterprise databases, Web servers, and complementary applications for enterprise resource management, customer relationship management, and land management.

In summary, the 8.1 release is a major breakthrough in the GIS field. ArcGIS is a comprehensive, integrated scalable system designed to meet the needs of a wide range of GIS users. Organizations deploy multiple ArcView, ArcEditor, ArcInfo, and ArcSDE/ArcIMS application servers in a configuration appropriate for their GIS needs. For more information, visit the ESRI Web site at www.esri.com/arcgis.

J-8583

ArcGIS is Scalable



Appendix A—Glossary

ArcEditor includes all the functionality of ArcView and adds the power to edit features in a multiuser geodatabase or coverage.

ArcGIS is a scalable system of software for geographic data creation, management, integration, analysis, and dissemination for every organization, from an individual to a globally distributed network of people.

ArcGIS Data Models provide a ready-to-use framework for modeling and capturing the behavior of real-world objects in a geodatabase.

ArcGIS Desktop refers to ArcView, ArcEditor, ArcInfo, and ArcGIS Extensions.

ArcGIS Extensions add functionality to the core capability of ArcView, ArcEditor, and ArcInfo.

ArcIMS provides the foundation for disseminating high-end GIS and mapping services via the Internet.

ArcInfo includes all the functionality of ArcView and ArcEditor and adds the advanced geoprocessing capabilities that make it the most comprehensive GIS available.

ArcObjects is a collection of software components with GIS functionality and programmable interfaces.

ArcSDE is the gateway for storing and managing a multiuser geodatabase stored in a database management system.

ArcView is the entry point into ArcGIS Desktop software and provides high-quality visualization, query, analysis, integration, and basic geographic data automation.

Behavior describes how an object can be edited and displayed. Behavior includes, but is not limited to, relationships, validation rules, subtypes, and default values.

Coverage is a file-based vector data storage format for storing the location, shape, and attributes of geographic features with topology.

Custom features are intelligent and may have behavior, editing rules, and relationships.

Floating License (also known as concurrent-use license) is controlled by a license manager operating on an organization's network and can be checked out by any computer on the network.

Geodatabase (short for geographic database) is composed of two major concepts. First, a geodatabase is a physical store of geographic information inside a DBMS. Second, a

geodatabase has a data model that supports transactional views of the database (versioning) and also supports objects with attributes and behavior (intelligent features). Behavior describes how an object can be edited and displayed. Behavior includes, but is not limited to, relationships, validation rules, subtypes, and default values.

The **Geography Network** is a global community of data providers who are committed to providing immediate access to the latest maps, data, and related services.

A **shapefile** is a file-based vector data storage format for storing the location, shape, and attributes of geographic features without topology.

Single-Use License (previously known as fixed license) permits software operation on one computer and does not call for a license manager.

Versioning allows simultaneous editing by multiple editors and transactional views of the geodatabase.

J-8583

Appendix B—What's New at 8.1

This appendix lists an overview of the major new features included in the 8.1 release.

ArcView 8.1

The following are major new features of ArcView 8.1:

- Internet-enabled, operates as a client to ArcIMS
- On-the-fly, layer-level projection and datum transformation (vector and raster)
- Enhanced editing tools
  - Ability to edit in either map space or layout view, edit multiple layers simultaneously, support three-dimensional coordinates with dynamic segmentation measures, and undo and redo edit operations
  - Advanced feature construction including bearing and distance, parallel to segment, intersection, parametric curves, and polygon autocomplete
  - Improved feature editing including extend, flip, divide, and scale and improved vertex editing
- Support for the creation and management of static annotation
- Improved map interaction
  - Spatial bookmarks, map tips, magnification window, overview window, and identification of works across data layers
- Exceptional map production
  - Map templates, map rotation, transparent layers, multifield labeling, and splined labels on the fly
- Metadata creation and reporting
- New image tools including rectification, rotation, and flip
- Ability to produce MrSID images from input images of up to 50 MB
- New export graphic formats including PDF, EMF, and TIF

- COM-based customization
- OLE container (insert OLE objects within ArcMap)
- Standard Windows look and feel
- Import ArcView GIS 3.x APR and AVL files

ArcEditor 8.1 ArcEditor is a new software release positioned between ArcView and ArcInfo. Including all the functionality of ArcView, ArcEditor adds the power to edit features in a multiuser geodatabase or coverage.

ArcInfo 8.1 The following are major new features of ArcInfo 8.1:

- Internet-enabled, operates as a client to ArcIMS
- Single address or batch address geocoding
- Clean and build coverages within ArcMap
- Three-dimensional coordinates with dynamic segmentation measures
- Dimensions as a new multiuser geodatabase feature class
- Storage of raster data in a multiuser geodatabase
- Improved tabular data management
    - On-the-fly dynamic joins between different databases, many-to-one and one-to-many joins or links, and view joined data tables
    - Charts and reports for tables, statistics on tables, and ability to save results as a table/file and export tables respecting the selection
    - Ability to show selected records, edit tables, add a table to the layout, and create charts and reports for tables
- New image tools including rectification, rotation, and flip
- Ability to produce MrSID images from input images of up to 50 MB
- Charts dynamically linked to table and map selections
- Includes Seagate Crystal Reports
- OLE container (insert OLE objects within ArcMap)
- Enabled to import ArcView GIS 3.x APR and AVL files

J-8583

ArcGIS Extensions

The 8.1 release introduces a new set of extensions built on the same architecture. ArcGIS Extensions add functionality to the core capability of ArcView, ArcEditor, and ArcInfo. The extensions available at the 8.1 release are

- ArcGIS Spatial Analyst
- ArcGIS 3D Analyst
- ArcGIS Geostatistical Analyst
- ArcGIS StreetMap
- ArcPress for ArcGIS
- MrSID Encoder for ArcGIS
- TIFF/LZW Compression for ArcGIS

ArcSDE

The following are major new features of ArcSDE 8.1:

- Support for IBM DB2 and Informix added to the previous support of Oracle and Microsoft SQL Server
- Ability to support a direct connection option allowing ArcGIS Desktop clients to connect directly to the geographic information stored in the DBMS
- Three-dimensional coordinates with dynamic segmentation measures
- Dimensions as new geodatabase feature class
- Integrated with ArcEditor and ArcInfo for the storage of raster data in a multiuser geodatabase
- Serverside geocoding services (U.S. nationwide geocoding included at no additional charge.)

Appendix C—The Geodatabase

ArcGIS is fundamentally based on a new data model called the geodatabase (short for geographic database). The geodatabase has two major concepts. First, a geodatabase is a physical store of geographic information inside a DBMS. Second, a geodatabase has a data model that supports transactional views of the database (versioning) and also supports objects with attributes and behavior (intelligent features). Behavior describes how an object can be edited and displayed. Behavior includes, but is not limited to, relationships, validation rules, subtypes, and default values.

Three key features of a geodatabase are

1. Centralized management of a wide variety of geographic information in a DBMS
2. Versioning that allows simultaneous editing by multiple editors and transactional views of the geodatabase
3. Custom (or intelligent) features that have properties, behavior, and relationships

Centralized GIS Data Management

The first key feature of the geodatabase is the centralized storage of a wide variety of geographic information in a DBMS. This is the natural solution for handling the growing amount of digital spatial data and also meets the need to leverage this data among the growing numbers of GIS users. The geodatabase supports multiple formats of spatial data including

- Simple features such as shapefiles
- Custom features with business logic and editing rules
- Attribute data
- Metadata
- Images
- Raster/Grid data
- CAD data

Versioning

The second key feature of the geodatabase is *versioning*. Versioning allows simultaneous editing by multiple users and also allows transacted views of the geographic database. This framework lets you create versions of a geodatabase for the states of a project, reconcile differences between versions, and update the master version of a geodatabase with the design as-built. Versioning is not supported by the personal geodatabase. For more information on versioning, download the white paper titled *Managing Workflow with Versions* from the ESRI Web site at www.esri.com/library.

Intelligent Features

The third key feature of the geodatabase is that you can add intelligence to features in the form of behavior, editing rules, and relationships. In addition to modeling generic

features such as points, lines, and areas, you can create features that more closely resemble real-world objects such as parcels, buildings, and transformers. Features with relationships and rules are known as custom features. Custom features can be created without any programming using ArcEditor or ArcInfo. Optionally, you can use computer-aided software engineering (CASE) tools to create custom features and a geodatabase schema from a Unified Modeling Language (UML) diagram. The essential idea is that an intelligent database contains business rules and business objects. As a result, GIS applications require less customization and programming.

Table C-1
Personal Geodatabase and Multiuser Geodatabase Comparison

	Personal Geodatabase with ArcView	Personal Geodatabase with ArcEditor or ArcInfo	Multiuser Geodatabase
Editors	One	One	Many
Create and edit simple features (points, lines, areas, static annotation)	✓	✓	✓
Define and use attribute domains	✓	✓	✓
Set database schema	✓[1]	✓	✓
Versioning (long transactions)			✓
Store images, raster/grid			✓
Create and edit features with subtypes or dimension features		✓	✓
Establish behavior (relationships, geometric networks, feature-linked annotation, etc.)		✓	✓
Create and edit custom features		✓	✓
Database size	≤ 250K features[2]	≤ 250K features[2]	Unlimited
Requires ArcSDE			✓
Supported databases	Microsoft Jet	Microsoft Jet	Oracle Microsoft SQL Server IBM DB2 Informix

1 Limited to simple features in a personal geodatabase.

2 This is an approximate limit affected by two factors—file size and computer memory. Microsoft Jet 4.0 used by the personal geodatabase has a 2 GB file size limit. In addition, a personal geodatabase is a single file that is loaded into computer memory. Therefore, performance can become unacceptable even for file sizes less than 2 GB. The recommended 250,000 feature limit is based on ESRI's experience with typical GIS data sets stored in a personal geodatabase.

Personal Versus Multiuser

Geodatabases can be implemented as personal or multiuser. The first key difference between the two is the data format. A personal geodatabase uses the Microsoft Jet format and is stored in a Microsoft Access file. Multiuser geodatabases are stored in a DBMS

managed by ArcSDE. The second key difference is that versioning is not supported in the personal geodatabase. The third key difference is that the personal geodatabase cannot store images.

Of special note is that ArcView cannot create custom features or establish behavior in a personal geodatabase, while ArcEditor and ArcInfo contain that functionality. Table C-1 summarizes the differences between a personal geodatabase created with ArcView, a personal geodatabase created with ArcEditor or ArcInfo, and a multiuser geodatabase.

Geodatabase Topology

The geodatabase maintains topology in feature data sets. Feature data sets are collections of feature classes—this is similar to the coverage concept. ESRI's initial emphasis has been on building capability to support network topology (one-dimensional). Geometric networks are used to model the distribution of goods and services, the delivery of resources and energy, and the communication of information. Geodatabase support for network topology is well understood.

Geodatabases at the 8.0 and 8.1 releases also support planar topology (two-dimensional) through shared features. Users identify the set of feature classes that share planar geometry and organize them in a common feature data set. The "integrate" command is available in ArcEditor and ArcInfo to create clean geometry between the feature classes within a feature data set. The shared edge edit tool within ArcMap is used to edit the shared edges between features in a feature class. As a result, the corresponding geometry in the other feature classes is automatically updated.

For example, feature classes of states (area), counties (area), and rivers (line) may all be organized into one feature data set. In this case, when you update the river line, you might also want the shared state and county boundaries updated as well. After these boundaries have been integrated with the "integrate" command, the shared geometry tool can be used to edit the river location. The corresponding geometry in the states and counties feature classes updates automatically.

Two major improvements are planned for planar topology support in future releases. First, users will be able to define topology rules that govern the behavior of each feature class. Second, more topology editing tools will be added, and improved renderers will indicate common boundaries in a feature data set.

J-8583

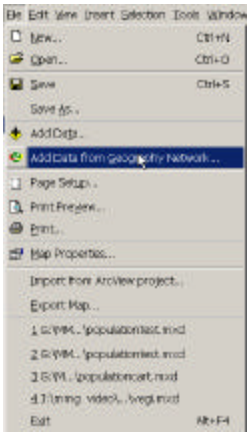
Appendix D—ArcGIS Desktop and ArcIMS

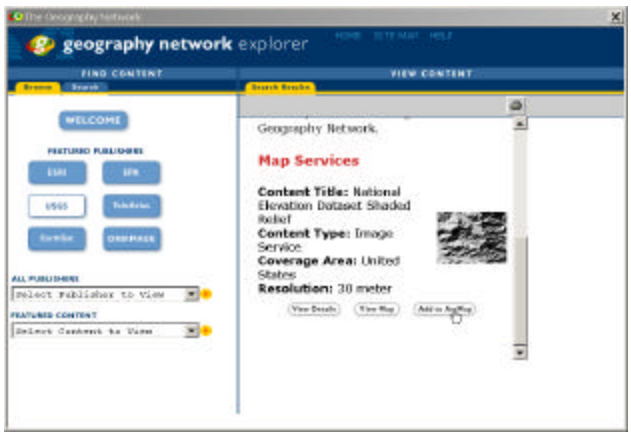
ArcView 8.1, ArcEditor 8.1, and ArcInfo 8.1 operate as clients to ArcIMS services allowing you to work with data served over the Internet like any other data source. All ArcIMS services fall into two broad categories: MapServices and GIS services.

An ArcIMS MapService delivers a map to the client as either an image or as streamed features. An Image MapService delivers a snapshot of the map to the client as a compressed JPEG, PNG, or GIF file. A new map image is created each time the client requests new information. A Feature MapService streams compressed vector features to the client. This enables tasks such as feature labeling, feature symbolization, map tip creation, and spatial selection of features. ArcIMS GIS services include geocoding, database queries, and data extraction or clipping.

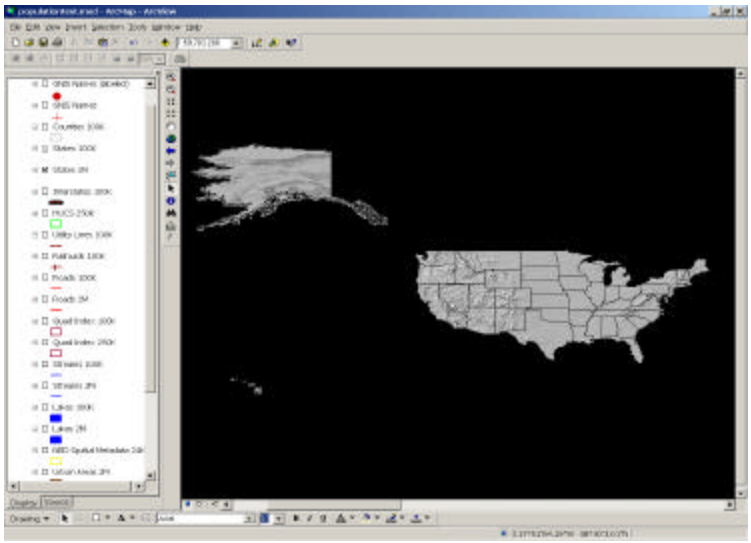
The standard toolbar allows you to easily add Internet servers and browse the available MapServices. In addition, many data providers register their ArcIMS services on the Geography Network. The Geography Network (www.geographynetwork.com) is a portal for immediate access to maps, data, and related geographic services over the Internet.

ArcGIS Desktop easily accesses data from the Geography Network with a few simple commands. **Add Data from Geography Network** is a new feature in the 8.1 release. This command opens the Geography Network explorer and lets you browse and access MapServices offered by various data publishers.

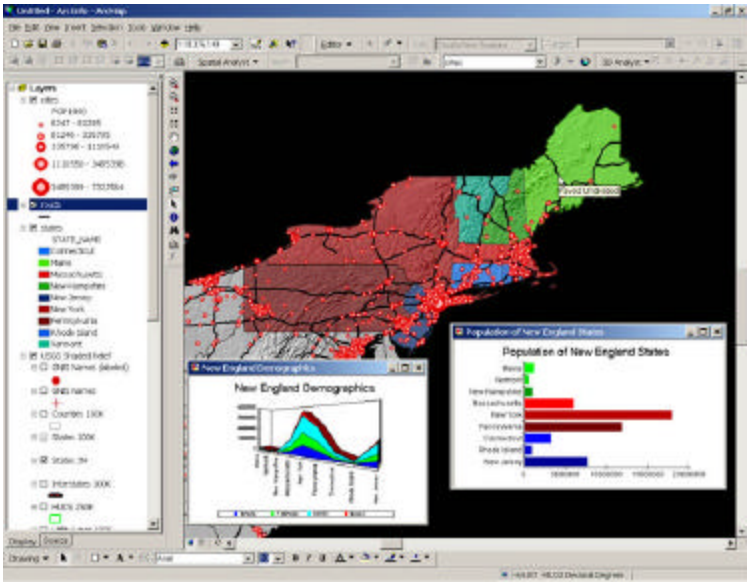




In this case we accessed an Image MapService provided by the U.S. Geological Survey (USGS). A snapshot of the map is displayed within ArcView, ArcEditor, or ArcInfo.



Integrate GIS data stored locally with data from the Geography Network and other ArcIMS servers as illustrated below.



Appendix E—Frequently Asked Questions

General Questions

Q. Is ArcGIS comparable to Microsoft Office?

A. Yes and no. Like Microsoft Office, ArcGIS is a tightly integrated family of software. Unlike Microsoft Office, the various software of ArcGIS are licensed separately.

Q. What operating systems are required for ArcView 8.1, ArcEditor 8.1, and ArcInfo 8.1?

A. ArcView, ArcEditor, and ArcInfo Desktop operate on Windows NT and Windows 2000. ArcInfo Workstation operates on Windows NT, Windows 2000, and several UNIX platforms. A subsequent release of ArcView is planned for Windows 98 and Windows Me.

Q. What are the recommended hardware requirements for ArcView 8.1, ArcEditor 8.1, and ArcInfo 8.1?

A. Use an appropriately configured PC for best performance.

- A fast Pentium processor (450+ MHz)
- A minimum of 128 MB RAM (256 MB RAM recommended)
- Fast disks (SCSI as opposed to IDE)
- True color monitor with a minimum of 16 MB video card

Q. Can I evaluate the ArcGIS Extensions?

A. Users can evaluate the following ArcGIS Extensions at no charge: ArcGIS Spatial Analyst, 3D Analyst, and Geostatistical Analyst. Installing the evaluation unlocks the complete functionality of these extensions for a fixed number of days. The ArcGIS Desktop software (ArcView, ArcEditor, and ArcInfo) includes the media for the ArcGIS Extensions and instructions for evaluation and purchase.

Q. I want to develop an application with ArcObjects using a COM-based language such as Visual Basic or C++. How do I acquire the Software Development Kit (SDK)? How do I deploy my applications?

A. There is not a separate ArcObjects SDK. ArcView, ArcEditor, and ArcInfo users and developers can access the underlying ArcObjects components. Extensive instructions with samples are provided in the documentation, help, and Web-based help. Of special note is a new book titled *Exploring ArcObjects* that is a comprehensive guide to programming and customizing ArcGIS. *Exploring ArcObjects* is provided with the 8.1 release as an Adobe Acrobat PDF file and is also available separately in printed format.

Deploying custom tools and extensions that operate with licensed ArcGIS software as a host does not require a unique deployment license. If you want to deploy stand-alone ArcGIS applications, run-time licenses of ArcView, ArcEditor, and ArcInfo are available to ESRI business partners.

Q. Do I need ArcIMS installed at my organization to access data over the Internet?

A. No. ArcView, ArcEditor, and ArcInfo are Internet-enabled out of the box and can operate as a client to ArcIMS services available on the Internet.

Q. Does ArcEditor include the ARCEDIT subsystem from ArcInfo?

A. No, ARCEDIT remains part of ArcInfo Workstation.

Licensing Questions

Q. What are the licensing options for ArcGIS Desktop software (ArcView, ArcEditor, and ArcInfo)?

A. Software licenses are either single-use (previously known as fixed) or floating (sometimes known as concurrent use). Single-use licenses permit software operation on one computer and do not call for a license manager. Floating licenses are controlled by a license manager operating on an organization's network and can be checked out by any computer on the network. A license manager can administer all the different floating software. Multiple license managers can be installed on a network.

ArcView is available as either a single-use or a floating license. Either way, the functionality of ArcView is identical. ArcEditor and ArcInfo are only available as floating licenses.

The ArcGIS Extensions are available as single-use or floating. Single-use extensions only operate with the single-use version of ArcView. Floating extensions operate with ArcView floating, ArcEditor, and ArcInfo.

Separate from licensing, all the ArcGIS Desktop software can be installed on a single computer—ArcView single-use, ArcView floating, ArcEditor, and ArcInfo. ESRI provides a Desktop Administrator tool for controlling which software is operational on that machine and listing additional floating licenses available on the network. Users can easily switch between software depending on their role or daily tasks.

Q. Can I operate floating ArcGIS Extensions with ArcView fixed? For example I have three ArcView fixed licenses in my organization and want to share one ArcGIS Spatial Analyst among them. Is this technically possible?

A. No. The licensing for the extensions must match the licensing of the core software. Otherwise, the core software cannot recognize the extension. For example, ArcView single-use does not recognize floating extension licenses. If you want to operate floating extensions, you need to install floating core software (ArcView floating, ArcEditor, or ArcInfo).

Q. How would I configure a laptop computer to operate ArcGIS Desktop software (ArcView, ArcEditor, and ArcInfo)?

A. Installing ArcView single-use is the most apparent choice. This permits operation of ArcView whether or not connected to the network.

If you require ArcEditor or ArcInfo functionality only while connected to the network and not when mobile, install ArcView single-use and ArcEditor/ArcInfo on your laptop computer. Use the Desktop Administrator tool to switch between ArcView single-use, ArcEditor, or ArcInfo depending on the task at hand and whether mobile or not. When mobile, operate ArcView single-use. When connected to the network, you may choose between ArcView single-use, ArcView floating, ArcEditor, or ArcInfo depending on your task and available floating licenses.

If you require ArcEditor or ArcInfo functionality when mobile, install a license manager with hardware key on your laptop computer. This allows you to operate ArcEditor or ArcInfo when mobile. While connected to the network, the ArcEditor/ArcInfo license installed on the laptop computer would be available for use by others on the network when not utilized by the laptop user.

These are typical examples. The licensing options allow flexibility for operating ArcView, ArcEditor, ArcInfo, and the ArcGIS Extensions.

Migration Questions for Existing Users

Q. The 8.1 release introduces many new concepts. Is training available?

A. Yes. Instructor-led training, Web-based training, and new self-study workbooks are available. Of special interest is a free Web-based course for migrating to ArcView 8.1. Since the interface and operating concepts are identical between the ArcGIS Desktop software, this course is also relevant for ArcEditor and ArcInfo users. For more information about training, go to www.esri.com/training.

Q. I am aware that there is no longer an ArcInfo box. What will ESRI ship ArcInfo 8.0.2 users with current maintenance?

A. ESRI will ship ArcInfo 8.0.2 users the ArcGIS 8.1 package, which is the same package that new users of ArcEditor 8.1 and ArcInfo 8.1 receive. The ArcGIS 8.1 package is a set of boxes that includes a complete set of documentation and software media for ArcInfo, ArcEditor, ArcView floating, and ArcGIS Extensions floating. You can install and operate the software that you have licensed. This packaging method reflects the new common architecture between the ArcGIS Desktop software.

Q. How is ArcGIS software packaged?

A. In addition to the full ArcGIS package described in the previous question, there are separate boxes for ArcView single-use, ArcView floating, the ArcGIS Extensions (single-use and floating), ArcSDE, ArcIMS, and ArcPad.

Q. Will my existing ArcInfo 8.0.2 extensions work with ArcGIS 8.1?

A. ArcInfo extension users with current maintenance will automatically receive floating extensions that operate with ArcGIS 8.1. ARC GRID users will receive ArcGIS Spatial Analyst that operates with ArcInfo 8.1 Desktop and includes an updated ARC GRID that operates with ArcInfo 8.1 Workstation. ARC TIN users will receive ArcGIS 3D Analyst that operates with ArcInfo 8.1 Desktop and includes an updated ARC TIN that operates with ArcInfo 8.1 Workstation. ArcPress for ArcInfo users will receive a floating version of ArcPress for ArcGIS. Other ArcInfo extension users (ARC COGO, ARC NETWORK, ArcScan, and so forth) will receive updated extensions that operate with ArcInfo 8.1 Workstation.

Q. Will my existing ArcView extensions work with ArcGIS 8.1?

A. No, the existing ArcView extensions operate with the ArcView 3.x architecture. ArcView users with current maintenance for ArcView Spatial Analyst, ArcView 3D Analyst, and ArcPress for ArcView will automatically receive the corresponding ArcGIS Extension (single-use license). ArcView users without current maintenance can upgrade to the corresponding ArcGIS Extension.

Q I use ArcView Image Analysis and see that it is not on the list of extensions available at the 8.1 release. What image tools are available in ArcGIS 8.1?

A. ArcView, ArcEditor, and ArcInfo can register images, project images on the fly, convert image formats, and control image display including stretch, classification, contrast, brightness, and transparency.

Q. I use ArcView GIS 3.2 and have additional questions about migrating to ArcView 8.1, where can I find more information?

A. For complete ArcView migration information, go to www.esri.com/arcview.

Appendix F—Supported Data Formats

ArcGIS Desktop supports a wide variety of GIS data formats.

Supported Data Formats in ArcView, ArcEditor, and ArcInfo

ArcView, ArcEditor, and ArcInfo directly support the following data formats:

- Shapefiles
- Geodatabase
- ArcInfo Coverages
- ArcIMS Feature Services
- ArcIMS MapServices
- Geography Network Connections
- PC ARC/INFO Coverages
- SDE Layers
- TIN
- DXF
- DWG
- DGN
- VPF

ArcView, ArcEdit, and ArcInfo support the following raster formats:

- ESRI GRID
- ESRI SDE Raster
- ESRI Raster catalogs (Image Catalogs)
- ERDAS IMAGINE (.img)
- ERDAS 7.5 LAN (.lan)
- ERDAS 7.5 GIS (.gis)
- ERDAS Raw (.raw)
- ESRI Band Interleaved by Line (.bil)
- ESRI Band Interleaved by Pixel (.bip)
- ESRI Band Sequential (.bsq)
- ESRI GRID Stack (<directory>)
- ESRI GRID Stack File (.stk)
- Windows Bitmap (.bmp)
- Controlled Image Base (CIB) (.cib)
- Compressed ARC Digitized Raster Graphics (CADRG) (.crg)
- DTED Level 1 and 2 (.dt1)
- ER Mapper (.ers)
- Graphic Interchange Format (GIF) (.gif)
- ADRG Image (.img)
- ADRG Overview (.ovr)
- ADRG Legend (.lgg)

- JPEG File Interchange Format (JIFF) (.jpg)
- National Image Transfer Format (NITF) (.ntf)
- Portable Network Graphics (.png)
- LizardTech MrSID (.sid)
- Tagged Image File Format (TIFF) (.tif)

ArcView, ArcEditor, and ArcInfo convert data from

- Any vector layer to shapefile
- Any vector layer to geodatabase[1]
- Event table to geodatabase[1]
- Shapefile to DXF
- Shapefile to AGF
- E00 to coverage
- Any raster layer to TIFF, IMG, GRID, or MrSID
- SDTS to raster

[1] ArcView can create personal geodatabases only. ArcEditor and ArcInfo can create personal and multiuser geodatabases.

Additional Supported Data Formats in ArcInfo

ArcInfo supports direct data conversion to coverage for more than 30 other data formats including

- ADS
- DFAD
- DIME
- DGN
- DLG
- DWG
- DXF
- Etak
- GIRAS
- IGDS
- IGES
- MicroStation
- MOS
- S-57
- SDTS
- SLF
- Shapefile
- TIGER (thru v2000)
- VPF

ArcInfo reads and converts several additional raster formats including

- ADRG
- BIL
- BIP
- BSQ

- BMP
- DTED
- ERDAS
- GRID
- GRASS
- IMAGINE
- JFIF
- RLC
- Sun Raster
- TIFF

For more than 30 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI® GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

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

For more information
on ESRI call

1-800-447-9778

(1-800-GIS-XPRT)

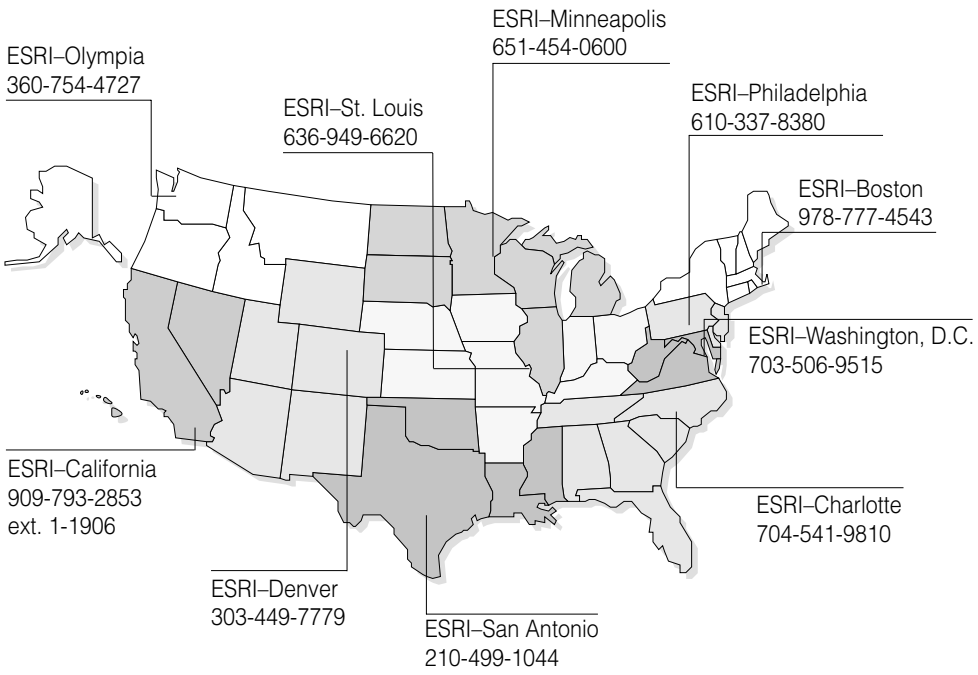
Send e-mail inquiries to

info@esri.com

Visit ESRI's Web site at

www.esri.com

Regional Offices



International Offices

Australia
61-89-242-1005

Belgium/Luxembourg
32-2-460-7480

Bulgaria
359-2-560-871

Canada
416-441-6035

France
33-1-46-23-6060

Germany and Switzerland
49-8166-677-0
41-1-360-2460

Hong Kong
852-2730-6883

Hungary
361-428-8040

India
91-11-620-3802

Indonesia and Malaysia
62-21-570-7685
603-7874-9930

Italy
39-06-406-96-1

Korea
82-2-571-3161

Netherlands
31-10-217-0700

Poland
48-22-825-9836

Portugal
351-2-1-781-6640

Romania
40-1-231-13-81

Singapore
65-742-8622

Spain
34-91-559-4375

Sweden
46-23-755-400

Thailand
66-2-678-0707

United Kingdom
44-1296-745-500

Venezuela
58-2-285-1134

Outside the United States,
contact your local ESRI distributor.
For the number of your distributor,
call ESRI at 909-793-2853,
ext. 1-1235,
or visit our Web site at
www.esri.com/international

GSA Federal Supply Schedule
No. GS-35F-5086H

Printed in USA