White Paper #7

CARIS Spatial Fusion: an Internet GIS

By: Jeff Fitzgerald, CARIS-Universal Systems Ltd.

Fredericton, New Brunswick, Canada

February 4, 2000

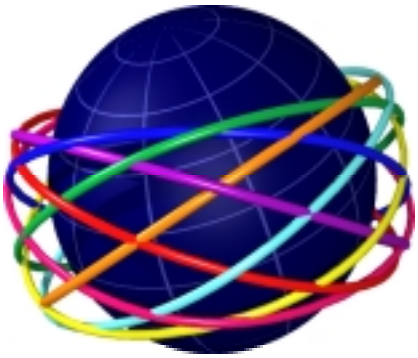
CARIS-Universal Systems Ltd.
264 Rookwood Avenue
Fredericton, NB, Canada
E3B 2M2

Phone: +1-506-458-8533
Fax: +1-506-459-3849
Email: info@spatialcomponents.com
Web: http://www.spatialcomponents.com

Introducing CARIS Spatial Fusion™

Information and the Web

The World Wide Web has had a tremendous effect on the way businesses communicate. Larger and larger amounts of information can be made available quickly and conveniently to anyone with Internet access and a web browser.



From a business' perspective, the Web lets you make your spatial information available to a wider audience. You can centralize all of your resources virtually, without having to change their physical location. This prevents any problems that might arise from maintaining or updating duplicate data sources, such as limited space or corrupt data. The Web makes it easy to provide the most up to date spatial data.

From a consumer's perspective, the Web makes information accessible anytime from anywhere. Apart from a Web browser and an Internet connection, the consumer does not need any additional viewing tools.

The Difficulties with Spatial Data

Both political and private sectors maintain a significant amount of valuable digital geographic information. However, there are a number of obstacles that prevent businesses from capitalizing on their spatial information, as well as preventing potential customers from taking advantage of the data in a timely and convenient fashion. Data is often spread out amongst different departments or organizations that offer varying levels of access and interoperability to its intended audience. Some of the problems introduced by this kind of structure include the following:

- *Incompatible file formats:* Since every GIS has its own proprietary data format, data produced by one software package cannot be opened by another. This dilemma can be solved in one of two ways, neither of which is convenient or economical. On the one hand, you can invest some money in a GIS capable of reading the file format. Or, on the other hand, you can invest a significant amount of time and money in converting the data to another format.

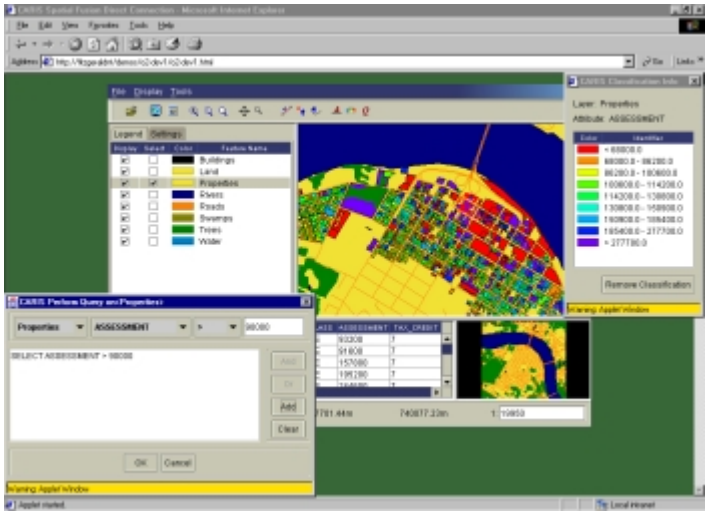
- *Inconsistent data:* As soon as you start reformatting data, you introduce the problem of maintaining multiple datasets. Two copies of the same data stored in different formats take up twice the space, without adding any additional information. Plus, duplicate datasets are difficult to keep updated. It's easy to lose track of which dataset was modified, making both of the datasets unreliable.

- *Data distribution:* Even if you have a software program that can read the data format, all of the information you need is rarely centralized, complicating any analysis of the relationships between different datasets. Without any complementary information, it is difficult to examine the data in any kind of meaningful context.

- *Incompatible projections:* Yet another problem of trying to work with multiple data sources comes from different projections or map scale. End users need seamless integration if they want to be able to navigate the map, or perform any kind of analysis.

What is CARIS Spatial Fusion?

CARIS Spatial Fusion is an internet-based technology that lets you seamlessly integrate distributed data sources over the Web. It leverages your existing spatial data investments by supporting multiple industry standard GIS formats like CARIS, Oracle8*i* Spatial, MapInfo Mif/Mid, and ESRI Shapefiles simultaneously, regardless of where the data is stored.



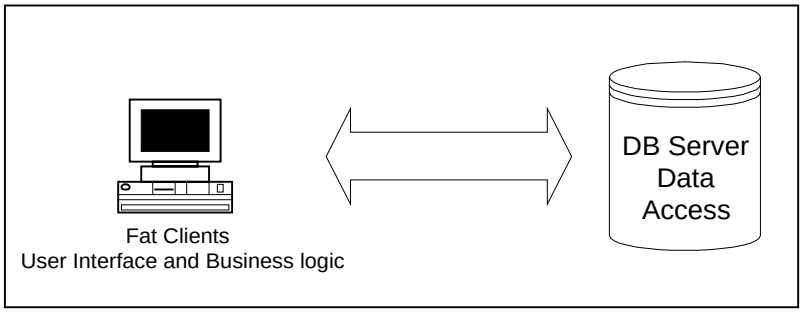
With Spatial Fusion, you can

- Create maps by merging data from CARIS files, Oracle8*i* Spatial, MapInfo MIF files, and ESRI Shapefiles
- View multiple map layers made with different projections
- Navigate through multiple map layers
- Query a layer's attributes
- Classify features within a layer by range or unique value
- Annotate features within a layer with any of its associated attributes

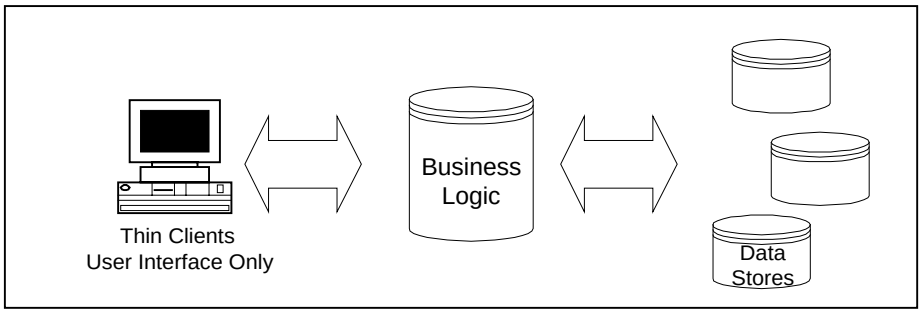
Distributed Architecture

As businesses expand, they inevitably encounter a problem with data access. How do you make your data available to other parts of the same company or other institutions? Or, more importantly, how do you share related data between different businesses or departments? You can maintain an identical dataset at each site, but duplicate datasets are difficult to keep up to date, making your data either inaccurate or unreliable.

With traditional GIS', the business logic is directly tied to the application. Whenever a new version is needed, or the business logic changes, every instance of the application must be upgraded.



With Spatial Fusion, the business logic is isolated into various Fusion Data Services, one for each supported GIS format.



Essentially, Spatial Fusion consists of two components:

- the client, a customized Java applet, built using JavaBeans and CORBA that you download from the Internet in your web browser.
- the data services, built using CORBA and the CARIS Spatial Framework, the core C++ libraries used by CARIS to build our GIS and Marine applications.

As long as it has Internet access, any machine used to store spatial data can be turned into a Spatial Fusion Data Service. All a client needs to access your data is the services' names and where to find them on the network. Data can be stored on either an internal or external server. From the client's point of view, the data is stored in the same place. Spatial Fusion's distributed architecture lets you leave your data where it is, literally.

Even more important than access for an Internet GIS is scalability. From small businesses to large corporations, Spatial Fusion lets you distribute the load evenly across multiple servers.

Multiple File Formats

One of the key features of Spatial Fusion is data independence. Its purpose is to work with your preferred GIS for data production rather than replace it. It can read the following data sources in their own format, without the need for translation:

- CARIS files
- Oracle8*i* Spatial
- MapInfo MIF Files
- ESRI Shapefiles
- GeoTiff, TIFF image with CARIS image registration file (.iga), and TIFF image with ESRI “world” file (.tfw)

With Spatial Fusion, maps can be made up of multiple data sources. The map is divided into multiple layers, or collections of spatial features that are of the same geometric type.

For example, one department might have some transportation data stored in CARIS file format; another department might have some management unit data stored in Oracle8*i* Spatial; a third department might have some soil data stored in ESRI Shapefile format. With Spatial Fusion, these three datasets can be viewed simultaneously.

Multiple Projections

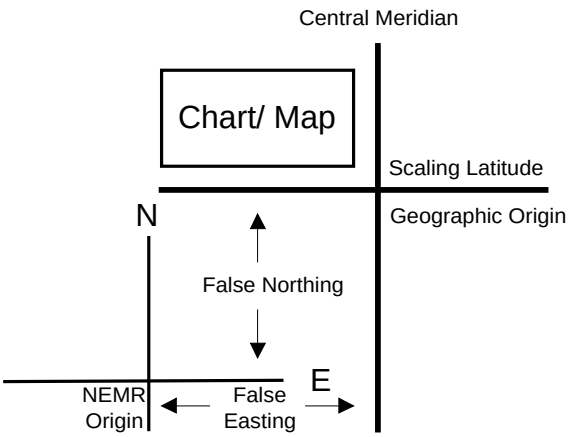
One of the problems associated with combining layers from various data sources or formats is the distortion caused by the various projections used to produce the data.

A map projection represents an area of the Earth on a flat surface. Projecting features from the irregular, three-dimensional Earth's surface onto a flat map distorts some or all of the map's features.

The degree of distortion varies from projection to projection. So, when you try to overlay data made with two different projections, the layers invariably do not line up.

Spatial Fusion lets you specify the "base" coordinate system used to display your data.

NEMR Coordinate System



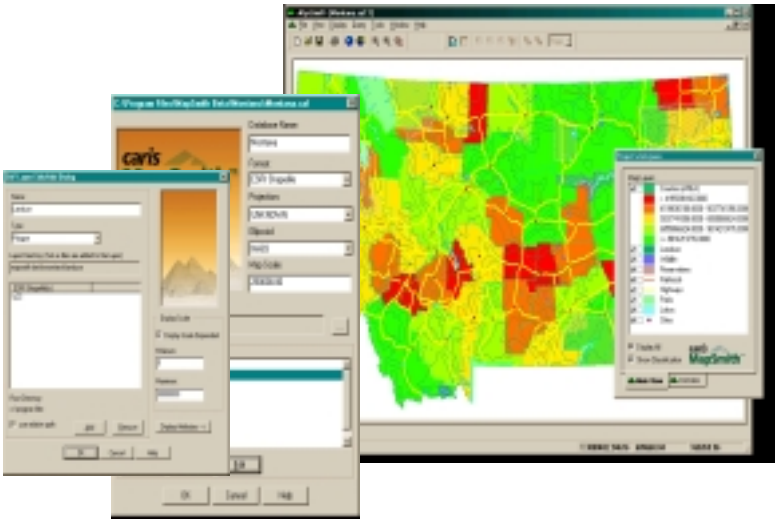
You could have a base map of the United States made with a Mercator coordinate system and individual maps made of different states using a different coordinate system. When you went to zoom in on a particular state, the map would be reprojected so that its coordinates matched the same state's coordinates on the base map.

Spatial Fusion Components

Spatial Fusion consists of a customized Java client and a number of Fusion Data Services. On the server side, Spatial Fusion is made up of the following components:

• *A Web Server:* The web server is not bundled with Spatial Fusion. You will need to have one already running on your network in order to use Spatial Fusion. Sample HTML pages are provided.

• The Orbix™ Runtime needs to be installed on every machine that hosts a Fusion Data Service. The Orbix™ Runtime lets the Spatial Fusion applet and the Data Services communicate across the Internet.

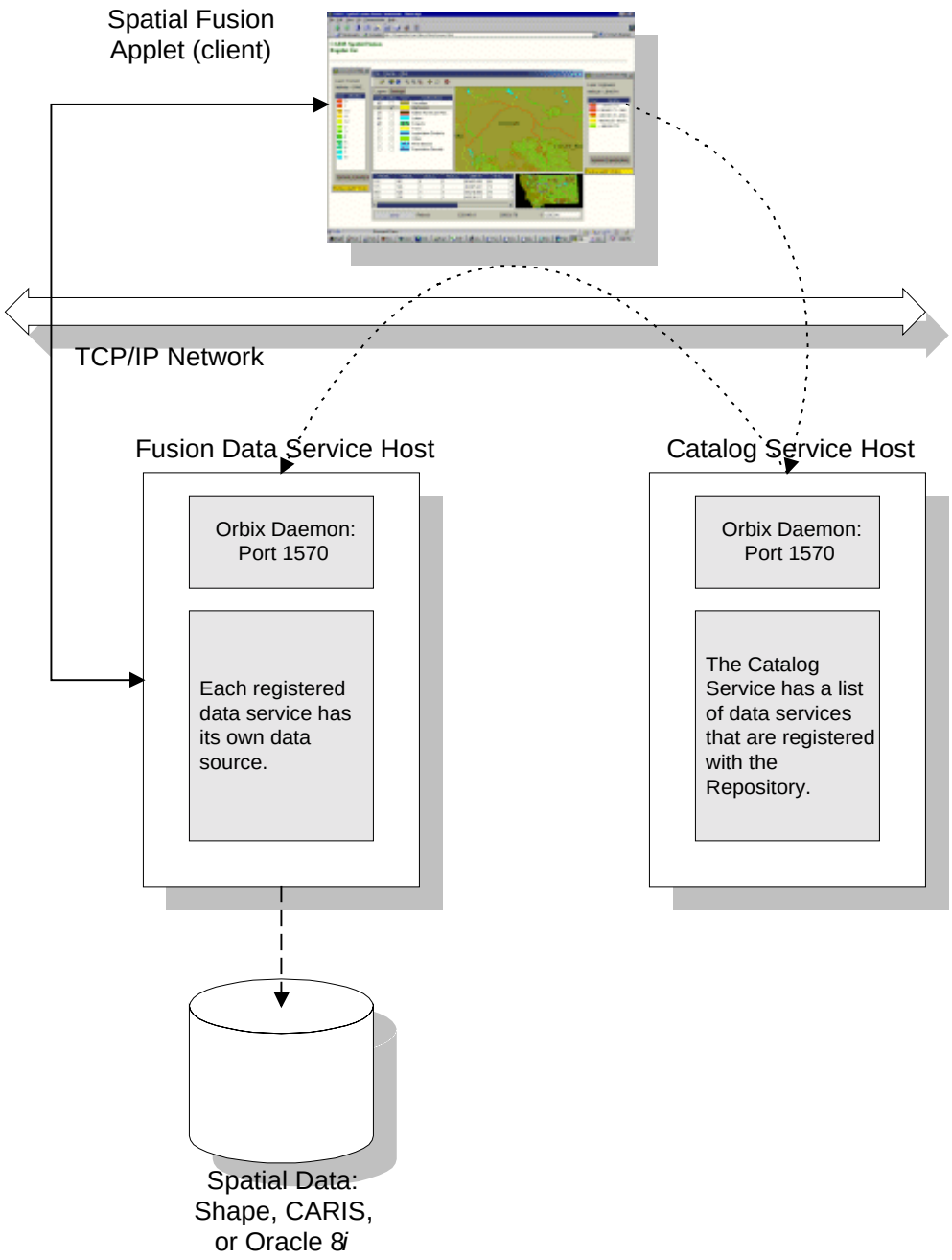


• *Catalog Service:* This service lists all of the available Fusion Data Services.

• *Fusion Data Services:* These services must be registered with the OrbixWeb™ Implementation Repository. Each service has an accompanying configuration file that contains the name used to register the service with the daemon and the location of the data source.

• *Configuration Utilities:* CARIS MapSmith™ and CARIS *db*Maps™ are provided to help customize the display of your CARIS, Oracle8*i* Spatial, or Shapefile data.

The Spatial Fusion Solution



The client browses the HTML page on your server that contains the Spatial Fusion applet, which downloads the applet into their web browser. The HTML page contains additional information, such as the name and IP address of the Catalog Service.

The applet uses the information contained in the web page to establish a connection to the Catalog Service, which provides a list of all of the available data services. When the client selects a data source from the list, it gets a new name and IP address, which it uses to find the data service you selected.

Once the client applet is connected to the data service, it has access to all of the functionality provided by Spatial Fusion.

Notes: