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Intergalactic Geoprocessing Middleware

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The logo for this column depicts geoprocessing interoperability. Ten years ago, the circular network backbone in this picture would have been a straight line, with a database server below and GIS workstations above, heralding the promise of hierarchical client/server computing for GIS users. Now client/server computing is in its late adolescence and doing well, but it's atomizing! Not only can any of the computers in the diagram be both client and server to the other computers, but the software and data on and among the computers are being packaged in libraries of "objects" which individually request and/or provide limited, well-defined services and/or data across their standard interfaces.

Network diagrams once showed lines for local and wide area networks. Now more and more network diagrams (and distributed software architecture diagrams) show a cloud, sometimes with the word "intergalactic," as in "intergalactic software bus" and "intergalactic client/server resources." The cloud-connected "galaxies" include any digital computer network or device. The cloud symbolizes a complex communication system containing the Internet (or private networks) plus other software, largely "middleware."

Middleware, very generally, is software that isolates its users from the details of layers of software below it. More commonly and more particularly, middleware describes software that helps clients and servers communicate in heterogeneous distributed computing environments. Middleware is in its infancy, but it is growing fast, and it will reveal over the next few years why NetScape stock is overpriced. Last May, when HotJava was still in beta test, a researcher attending an OGIS Project Technical Committee meeting used Mosaic (the NetScape precursor) to visit a Web page that displayed an image of Chicago. He selected a small region and downloaded that region's data along with a HotJava viewing application that enabled him to select any house lot and show an image of the house located on the lot. Anyone with Netscape and Java (on a MacOS, Microsoft Windows, or Unix/X Window System platform) could have accessed these images and geoprocessing resources at that Web site. Pretty neat, indeed, but just a beginning.

General interoperability whets our appetite for interoperable geoprocessing: Get into NetScape Navigator and, under Net Search, select Alta Vista, an index to 8 billion words held in 16 million home pages. Enter a query string that contains solely the word "middleware" and in about three seconds a powerful server will return the first ten out of 6,000 abstracts. Narrow the search with AND, OR, NOT, and NEAR. Download and read any of the articles. Can a similarly powerful index for spatial data (perhaps as part of FGDC's Clearinghouse) be far off?

It will take some work. We need a collection of middleware that will give us a windowing user interface, access to diverse and finely queryable spatial databases, and access to geoprocessing tools on some of the database servers. NetScape is neat, but all html-based browsers are limited to a hyperlink and scrolling page mode of operation. They have niether the innate capability nor the companion middleware to support the rich windowing graphics we find so useful. As an example of intergalactic geoprocessing, NetScape (even with Java) points to the future, but it's a pointer, and not the geoprocessing future itself. We will be closer when we have a Java implementation of OGIS (likely to be done by OGC members) and/or a mapping between Java and CORBA IDL, which will complete the Java connection between your desktop and CORBA-based geodata/geoprocessing servers.

Geodata access middleware is being defined by some GIS and database vendors as an interface that provides a more open relationship between *one* geoprocessing system (with its proprietary geodata model) and multiple database management systems. The middleware uses the relational model in the databases to implement storage and querying of geodata in that particular geodata model. The products are useful, but commercial versions don't yet include OGIS interfaces that will make them interoperable with other OGIS-enabled systems.

In the OGIS Project Testbed, programmers working with pre-release versions of OGIS are constructing interfaces to enable real-time transactions between dissimilar software systems. OGIS interfaces will be an essential ingredient in all kinds of geoprocessing products, including middleware products that will, for example, enable users to use precise queries to view and extract data from many diverse OGIS-interfaced data servers, perhaps via an encyclopedic spatial data clearinghouse. Off the shelf and custom applications will reside on top of such middleware, giving users just the tools they need to make use of all that on-line geodata.

OGC and its members are building the bridge between geoprocessing and intergalactic computing. OGC builds bridges at the human level: vendor<>vendor, vendor<>user, GIS community<>remote sensing community, and commercial sector<>standards community. OGC's OGIS Project Technical Committee builds *bridge plans* at the technical level, specifications which OGIS Project Testbed members have already begun to apply in building software interfaces: application<>database, application<>middleware, GIS<>imaging, user application<>user application, site<> site, and Information Community<>Information Community. By these efforts, your request for a marvelous, specific digital model of things on the Earth will come through the cloud as you touch your keyboard or remote control, or as you speak to a software resource in your dashboard or cellular phone.
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