



Geodata Interoperability: What Does it Mean for Business Geographics?

An Open GIS Consortium (OGC) White Paper

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"Interoperability" is a term that is used so often and loosely in the computer industry that it has almost lost its meaning. What I mean by "interoperability" is the freedom to mix and match components of an information system without compromise of overall success. The components of an information system include: software, hardware, networks, data, workflows, processes, human interfaces, users, and training. Of course, using this definition, interoperability does not exist in the realm of geodata, yet. It is the purpose of this article to summarize the factors that make geodata interoperability both special and important, and to point out where geodata interoperability is coming from.

1 GIS Interoperability is Still a Dream

Today, it is easy to stumble into technology gaps that render interoperability of geodata no more than a dream. For example, imagine implementing a workflow that employs GIS software modules from several different vendors. Think about viewing software from one vendor, plotting software from a second, analysis software from a third, and so on. Does it give you a headache? Or, imagine implementing a workflow that requires you to fetch geodata files from three or four different government departments and requires the immediate display the union of the files, properly registered in a single window, and requires the ability to query the union as if it were a single integrated database. Does this idea make you smirk? Or, imagine what would happen if the staff performing your geoprocessing were suddenly replaced with individuals with the same proficiency, but who have been trained on different software. Wouldn't it be chaos? These visions show that geodata interoperability is not available today. It is certainly not off-the-shelf. Not yet.

The examples above show that geodata interoperability is a technology that will emerge only with a great deal of harmonization. Geodata interoperability requires agreements between senders and receivers of information. Where do the needed agreements and the needed harmonization come from? Harmonization, agreements, and interoperability are all just other names for standards. Components of an information system never work together unless there are standards that enable them to cooperate. The status of the standardization efforts underway that will bring interoperability to geodata transactions is discussed later in this article.

2 Interoperability is Vital to Business

To understand the value to business of geodata interoperability, one should examine the benefits of interoperability in more common information types. An information "type" is a common and well-known computer representation of an item of information. Each column in a database conforms to a type. The following are well-known types:

Information Example	Well-known Type
numeric	double precision integer
text	16 character field
date	mm/dd/yy
money	\$ddd.cc

Today's software increasingly provides for the free exchange of information that is represented by well-known types. This is why, using today's software, it is easy to move most information between software applications. For example, it is trivial to move text between e-mail and word processing environments and nearly everyone can create documents that contain business graphics, bit-map images, and spreadsheet data, even when these items have been created in separate applications.

The story is different for GIS information. At this time, there are no well-known types for geographic features or GIS coverages. GIS information is represented differently by different GIS vendors, and some vendors keep their representations private. Therefore, GIS information cannot be passed between vendor environments without a careful translation. The translation can either be direct, or through a third "neutral" and open representation of the GIS information. In either case, the process is slow and tedious. Worse, the translation process is likely to be the source of information loss stemming from the difficulties encountered when one tries to express the information held in one computer representation using the structures available in another. For example, one GIS may have a special "type" to express the curve of a freeway ramp that another GIS must model with a sequence of short straight lines.

3 The World of Geodata Interoperability

Imagine a world where a family of well-known types exists for the detailed expression of GIS features. Imagine that these types were rich enough to model features using points, curves, surfaces, solids, and complex combinations of these. Imagine that the types provided for the expression of attributes, real-world coordinates, and for the modeling of relationships between features. Finally, imagine that in this world GIS vendors provided the capability to expose their GIS data using these well-known types, even if they still use their private data structures internally.

Life in this imaginary world would be different from the one we know. Not only could one receive a street map by e-mail (you can do this today, using a dumb bit-map), but the receiver could color code the streets according to their attributes. The receiver could query the map for the best route between two points. The receiver could overlay the street information on land parcel information from another source and find the parcels that intersect a 500-foot buffer around the best route. Better still, if the sender puts the information on a shared server, the receiver doesn't need to wait for mail; the receiver can fetch the information whenever it is needed. All of these capabilities are enabled by the family of well-known GIS types, even when the software services are being provided by applications from many different GIS vendors.

This vision is tightly aligned with that of the National Spatial Data Infrastructure (NSDI) that is being forwarded by the Federal Geographic Data Committee (FGDC), hosted at the U.S. Geological Survey, Reston, VA. The FGDC has articulated two fundamental enablers of the NSDI: the National Geospatial Data Clearinghouse, and the National Digital Geospatial Data Framework. The "clearinghouse" amounts to technologies for exposing the existence of GIS data

and enabling its remote access. The "framework" amounts to an emerging national policy for governmental provision of foundation data such as geodetic control, digital orthoimagery, elevation data, transportation, hydrography, government administration boundaries, and cadastral data. Clearly the clearinghouse and framework are important contributions toward geodata interoperability. It is almost impossible to describe the potential application scenarios that become possible with a fully implemented National Spatial Data Infrastructure. The NSDI promises a vast reservoir of data, constantly being enhanced, updated, and enlarged, "on tap" --available to desktop, Personal Digital Assistant, and mobile business applications.

4 However, by itself, the NSDI does not enable the imaginary world of geodata interoperability discussed above.

The FGDC has provided a file transfer standard, the Spatial Data Transfer Standard (SDTS), and additional standards for metadata content, but these amount to the "third, neutral" file formats that still require translation. The SDTS, clearinghouse and framework concepts do not provide the well-known types for geodata, those intimate implementation details for computer representations that are necessary for geodata interoperability.

5 Where Geodata Interoperability is Coming From

It is the mission of the Open GIS Consortium, Inc., (OGC) Wayland MA, to define the types necessary for representing geodata and to promulgate them until they are "well-known." The OGC is an open consortium now composed of about 40 industry, government, and academic institutions. Nearly every major GIS vendor is a member, and all members are committed to making the world of geodata interoperability a reality as quickly as possible.

The technical descriptions of the new geodata types are at the heart of the Open Geodata Interoperability Specification (OGIS), now nearing completion of its first release. The OGIS is a consensus and voluntary standard being written by OGC members. OGC has established liaison relationships with the American National Standards Institute (ANSI) and with the International Standards Organization (ISO) to ensure that the OGIS is acceptable to ANSI's X3L1 committee and to ISO's Technical Committee 211, both of which are promoting the development and promulgation of GIS standards. Before the OGIS is released to the public, it will be implemented in testbeds using at least two different environments so that implementation details can be included in the specification. The implementation environments will include the Common Object Request Broker Architecture (CORBA) being forwarded by the Object Management Group, Framingham, MA, and the Object Linking and Embedding/Component Object Model (OLE/COM), which is the application-to-application-interface technology of Microsoft Corporation, Redmond, WA.

The OGIS employs object technology to take advantage of the fact that GIS features tend to form natural class hierarchies. Through OGIS, GIS users will begin to form common mental models of GIS features and their relationships. A consequence will be the gradual evolution and convergence of user interfaces, just as has happened in the Office Automation arena.

The conclusion is inescapable: Geodata is about to enter the National Information Infrastructure on an equal footing with traditional data types, and GIS on an equal footing with office automation tools.