Issue Date: March - 2007, Posted On: 3/9/2007

Move the Discussion from Interoperability to Infrastructure

# Building the GeoWeb

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**T**he "watchword" of many information-technology (IT) standards organizations, notably the Open Geospatial Consortium (OGC) and ISO TC/211, has been "interoperability": to get this to work with that. And use of this word has continued, despite the fact that interoperability, in terms of the ability of one vendor's software to read the data format of another, was long ago achieved, and there are diminishing numbers of different and important geographic formats.

Interoperability is, at best, an ill-defined objective, and I believe it's time to focus our energies in a different direction: "infrastructure." This isn't to say that the standards activities of OGC and ISO have been misplaced, but that they will benefit from a change in focus.

This column focuses on the systems that capture, process, use and disseminate geographic information. Focusing only on interoperability, we're led to look at interfaces and encodings that facilitate information transfer among components, but we have no means to determine what components are necessary. And there's no way to determine which components, interfaces and encodings are strategic, and which are not.

## Water, Wine and Fruit Juice

When using the word infrastructure, people naturally think of physical civil infrastructure, such as water-supply, sewage or electrical-distribution systems. But I'm referring to information infrastructure the distributed producers and consumers that the analogy implies.

Perhaps the major difference between information infrastructure and its more physical counterpart is that, in the case of information, there are many producers and consumers. Furthermore, the nature of information products, which "flow" in the infrastructure, is more varied, as if a fluid network. Some customers are to be supplied with water, others with wine and still others with various flavors of fruit juice.

Information infrastructures are concerned with information about the real physical world, which includes a significant percentage of all information. However, they're only concerned with such information when it needs to be looked at from the perspective of a location on Earth, or in relation to things identified or named in the physical environment.

## Talking About Geography

Models, or representations of real-world objects of interest, are generally referred to as features, which can be concrete things such as people, vehicles or mountain peaks as well as more abstract ideas such as parcel boundaries, logging tenures or national frontiers. Although it's often

difficult to define what a feature is, it’s generally viewed as being more than a location or geometric region, within or above Earth's surface.

A point could be identified as being within the confluence of two rivers, but the confluence is understood as an entity quite apart from that location, and it may move from one season to another. Therefore, a feature-centric view of information focuses on the things that matter in a particular region, to a particular group of people or to a particular application domain. This is a "vocabulary" for those people (or the application domain) to talk about or express particular aspects of the world.

Another important notion is coverage, which describes the distribution of some quantity or quality across a region of Earth, possibly also in time. The region in question may be restricted to Earth’s surface, or it may be a section of atmosphere, ocean or the Earth itself.

The quantity or quality involved can vary, ranging from numerical values such as temperature or salinity (e.g., the distribution of temperature on an ocean surface or the distribution of salinity as a function of ocean depth) to qualitative values such as crop type, rock type or birth rate.

The geometry on which a coverage is defined is in general arbitrary and defined by the coverage itself. A coverage sometimes is connected with a geographic feature, but this isn’t necessary.

A remotely sensed image or aerial photograph is a perfectly respectable coverage, because it provides the distribution of a quantity, such as radiance or reflectivity, over a region of Earth’s surface at some point or during some interval of time. But a coverage doesn’t measure anything, and it has no natural time associated with it, so observations are needed.

Observations complement coverages and features. They model the "act of observing," meaning that they’re not what results from the observing, but capture the observing itself. An observation may result in a coverage (e.g., aerial photograph) or provide a value for the property of a feature (e.g., number of lanes on a highway, flow capacity of a river, geometry of a lakeshore boundary segment).

Observations aren’t features, but they can be used to construct features through "authorization," meaning the agreement of a group or official body that represents a group. A national mapping agency, for example, takes numerous observations and creates a set of features that are an official (according to that body) representation of a region of Earth, based on their observations and vocabulary of feature types.

Features, coverages and observations have emerged as the key concepts for modeling geographic information, and they can be expected to continue as the basic currency for information infrastructures.

**Infrastructure Types**

The world is inextricably interconnected. As a result, when dealing with geographic information, it often has to be aggregated and integrated. This may be to provide information to others (e.g.,

Google Earth or Microsoft Virtual Earth) or use it as the basis for some sort of service (e.g., forest-harvest planning, real estate purchasing, traffic management, fish-habitat protection, etc.).

Such systems depend on bringing together diverse types of information, from as close to the information source as possible, as quickly as possible. This seems like a supply chain for physical goods, so it makes sense to label it a geographic information supply chain. Such a supply chain will be concerned with the features, coverages or observations of various types as well as with their acquisition, processing, treatment and movement from source to point of aggregation.

Closely connected with any system focused on aggregation and integration will be a system for distribution. To provide a complex service (e.g., forest planning), there may be many points for data collection and relatively few points for distribution.

A system that aggregates information about the political mood in a country, however, may have relatively few points of data collection and hundreds of thousands or millions of data consumers. Other systems may have many collection points and consumers. The analogy of a distribution system for physical goods again makes sense.

Not all information infrastructures, however, are supply chains or distribution systems. Some have more characteristics of a community of suppliers and consumers, and they can be called geographic information communities. The most obvious example arises in the context of an urban community, with the needed information exchanges among the numerous organizations that plan, build and manage a community (e.g., city hall, police, utilities, post office, telecommunications, etc.).

An information infrastructure provides the means by which these organizations transparently provide information to one another. A parcel of land is rezoned, for example, and all of the community subscribers are automatically made aware of it. The water company doesn’t need to maintain a separate directory of postal codes; they share it with the post office.

A "geographic community" makes sense at any level of society, and it can be applied to any group of corporations, government agencies and citizens. The notion has a far-reaching impact on "governing" as well as the relationships among such institutions and each another.

This column only begins the infrastructure discussion, and it will continue its exploration and elaboration during the coming months. Interoperability is a useful concept, but let’s move the discussion to infrastructure.