EMERGING STANDARDS: UNIVERSAL FILE FORMATS, POINTS OF INTEREST, AND THE SENSOR WEB

By George Percivall

The Open Geospatial Consortium (OGC) is an international industry consortium of 481 companies, government agencies, and universities participating in a consensus process to develop publicly available interface standards. OGC standards support interoperable solutions that "geo-enable" the web, wireless, and location-based services and mainstream IT. The standards empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. Standards are developed in a unique consensus process supported by the OGC's industry, government, and academic members to enable geoprocessing technologies to interoperate, or "plug and play".

GeoPackage

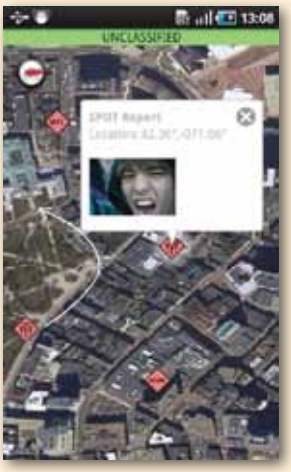
GeoPackage is a universal file format for geodata. GeoPackage is open, standards-based, and application- and platform-independent. It is the modern alternative to formats like GeoTIFF, SDTS, and shapefile. At its core, GeoPackage is simply an SQLite database schema. Users need only know SQL to use GeoPackage on any desktop or mobile operating system on the market.

GeoPackage was carefully designed to facilitate widespread adoption and use of a single, simple file format by both commercial and open-source software applications — on enterprise production platforms as well as mobile handheld devices.

GREAT FOR MOBILE

Mobile device users who require geospatial information, including active maps in disconnected or limited network connectivity environments, can benefit in several ways. GeoPackage efficiently supports download of data, cached for offline use and eventual upload of any updates to the data made while offline. A common challenge for developers of mobile apps is the limited and uncertain storage available on devices and the likelihood that each location app will require its own potentially proprietary geospatial data store. These separate application-specific data stores may contain the same geospatial data, wasting the limited storage available and requiring custom coding

for data translation, replication, and synchronization to enable different apps to share the same worldview. In addition, many existing geospatial data stores are platform-specific, which means that users with different platforms must translate data to share it. Only GeoPackage meets the requirements for a lightweight, standards-based, and vendor-neutral geodata format.



CROSS-PLATFORM SHARING

GeoPackage is built on SQLite and can therefore be used easily by a broad spectrum of software developers in a consistent way on every major mobile and desktop platform in the market. SQL-savvy programmers can easily add GeoPackage support to their apps.

GeoPackage was designed in an open manner by the geospatial developer community. The format is nearing adoption in the OGC as a standard and is open for public comment. Many companies have already implemented GeoPackage based on the draft specification.

The Sensor Web Standard

In today's world, most sensors have proprietary software interfaces defined by their manufacturers. New application programming interfaces are requested and developed for each type of sensor. This situation requires significant investment on the part of developers, with each new sensor or project involving multiple systems. It also requires investment on the part of the providers of sensors, gateways, and services where observations are used. Standardized interfaces for sensors in the Internet of Things (IoT) will permit the proliferation of new high-value services with lower development overhead and wider reach. This will also lower the cost for sensor and gateway providers.

The past decades have witnessed dramatic increases in the precision of location information (see Figure 1). Global Positioning System (GPS) was an incredible innovation in the 1990s. Prior to GPS, accurate location was determined by an intensive human survey process. Survey geo-location and GPS enabled many applications associated with region-centric and feature-centric information. Geographic Information Systems (GIS) applications enabled greater awareness and analytical capability using a feature-based modeling of environments. New consumer capabilities were established (e.g., car navigation systems with accuracy to several meters).

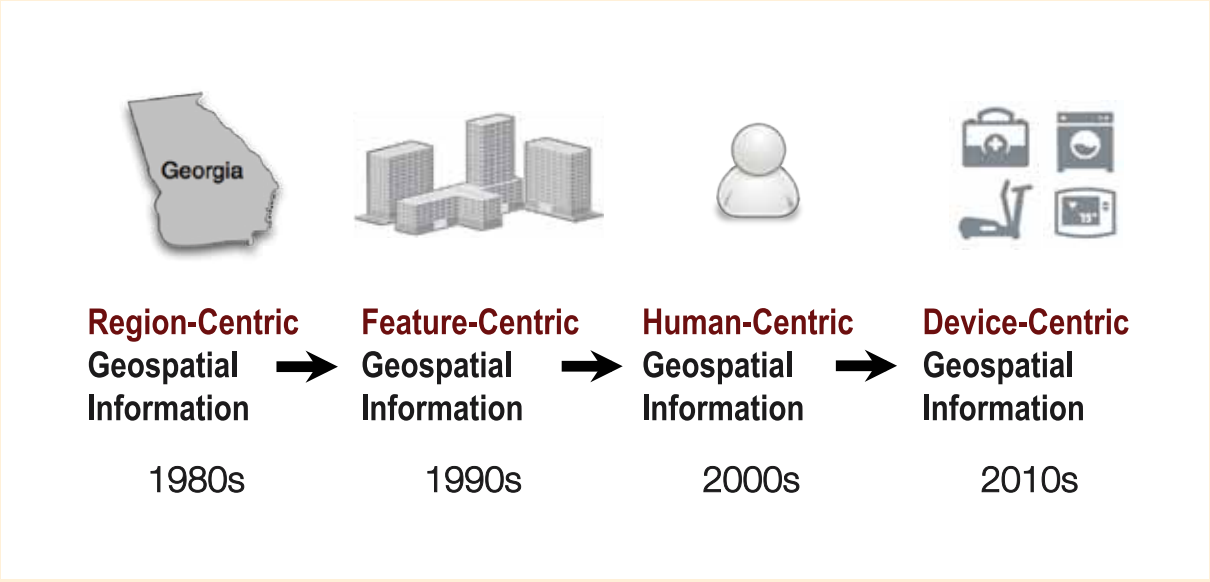
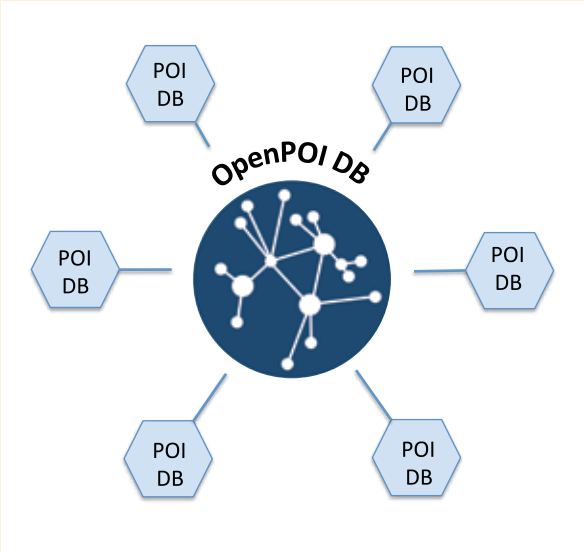


Figure 1 | Progression of geospatial information



Shortly after the turn of the millennium, smartphones combined GPS with other location positioning methods to increase the usability of location at a human-centric level. The most notable addition to the positioning method was the use of Wi-Fi signals fused with GPS to provide a quicker fix and higher accuracy through the use of multiple sensors. In order to achieve the anticipated benefits of IoT, location accuracy will again need to undergo a leap of innovation in positioning technology. Not only will the precision of the location need to be higher, but orientation will become more critical (which way am I looking?), as will the need to provide a widespread and common approach to identifying indoor location.

In preparation for sensor web, OGC created a new standard working group (SWG). The goal of the Sensor Web SWG is to develop one or more standards based on existing IoT protocols while also leveraging the existing and proven OGC Sensor Web Enablement (SWE) family of standards.

SWE standards are the only ones that focus on the meaning of sensor measurements and on making the sensor observations useful to end user applications. SWE standards allow users to assess the fitness for use of observations and allow accurate processing to create derived information suitable to the user's needs.

In much the same way that HTML and HTTP standards enabled the exchange of any type of information on the web, the OGC SWE standards enable the discovery of sensors and corresponding observations, exchange, and processing of sensor observations, as well as the tasking of sensors and sensor systems.

The OGC's OpenPOI Database Project

OpenPOI is a very large, freely available database containing points of interest (POIs) and links to other commercial, governmental, and academic POI databases. Not counting the POIs in the linked databases, the OGC's database contains the names and point locations for over 8 million businesses and civic places.

The OGC is looking for developers and POI publishers to participate in creating the largest system of linked geospatial data on the web. OGC's OpenPOI database provides a reference implementation of a POI encoding standard moving toward adoption in OGC.

The POIs currently in the OpenPOI database have been collected from many sources, including GeoNames (which includes U.S. Geological Survey, U.S. National Geospatial-Intelligence Agency, CIA World Factbook, hotels.com, and over a hundred sources), Factual, OpenStreetMap, and the Harvard China Biographical Database. More POI datasets are coming online every month.

This unique new service offers application developers a single point of entry to all of these data sources. If enough people — data developers, software developers, and their users — find the OpenPOI database useful, this service could organize the world's information geographically. It is intended to be a widely used public resource governed by policies similar to other open source data initiatives, such as Wikipedia.

WHY CREATE YET ANOTHER POI DATABASE?

Most POI databases are meant to provide rich, detailed information about the places in their database. In contrast, the OpenPOI database is meant to provide a comprehensive registry of links to other POI databases that contain the actual information about the places. Any organization can add to it and anyone can use it.

The database can be queried by bounding box or by name via simple requests that implement the OGC Web Feature Service (WFS) Interface Standard. Each POI also has a concise, permanent, and unique RESTful URL.

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All queries return data in either XML or JSON format. Considering how ubiquitous the need for POI information is, it is surprising that international standardization efforts have been few. In many ways, one could consider POIs a fundamental requirement of any spatial data infrastructure. POIs are also important in the commercial sector in personal navigation and social networks. For example, several social media outlets have made location such an integral part of their data model that almost every activity a user engages in can be tagged with location, weaving places of interest seamlessly into the fabric of their social platform.

The OGC's vision is the realization of the full societal, economic, and scientific benefits of integrating electronic location resources into commercial and institutional processes worldwide. The OGC's mission is to make this vision a reality based on developing publicly available geospatial standards. OpenPOI will advance the POI standard and implementations.

The OGC's vision and mission, experience with legal and organizational issues involved in openness, and rich connections to the world's providers and users of geospatial data and technology put it in a unique position to launch and host a resource such as the OpenPOI database.

Attracting collaboration partners is proving to be an achievable goal for the not-for-profit OGC. Wikipedia is an exemplar of previous success in this model. If Wikipedia were not a neutral provider, and had not been seeded with a large amount of useful data free of onerous licensing terms, it probably would never have succeeded as it has. Because the OGC is recognized and respected in the information technology world and organized to perform outreach, it is positioned to build the OpenPOI database brand in the web and mobile market space as few other initiatives could do. Q

George Percivall *is an accomplished leader in geospatial information systems and standards. As Chief Engineer of the Open Geospatial Consortium (OGC), he is responsible for the OGC Interoperability Program and the OGC Compliance Program. Prior to joining OGC, Percivall held senior positions at NASA and the GST's Geospatial Interoperability Group. Previously, he led developments in Intelligent Transportation Systems with the U.S. Automated Highway Consortium and General Motors Systems Engineering. He holds a BS in Engineering Physics and an MS in Electrical Engineering from the University of Illinois at Urbana.*