Web-based coastal mapping and sensor systems depend on open standards

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Introduction

With demand for safer and more efficient ports and terminals and for sustainable development along the world's coasts, there is an increasing need for better, more up-to-date and detailed location based information. These needs are driving requirements for information production, information sharing and interoperability between and among different information communities.

Interoperability and data sharing become much easier as standards organisations analyse the requirements specific to the ports application domain and develop open standards and as technology providers implement these standards in their products and services. As these standards or profiles of existing standards are defined, implemented, and deployed, the end users have less need to know the technical details about the sophisticated technical 'plug and play' that enables them to get the information they need when and where they need it. However, the user organisations still need to be specific in procurement language about the standards and the profiles of standards they want bidding vendors to provide.

Geospatial interoperability was the last link

A wide range of organisations produce and use information about ocean dynamics, ocean resources and hazards, the ocean floor, littoral and coastal flood zones, ocean traffic, weather and climate, and structures and operations within and around ports and terminals. All of these information sources have location elements. Therefore, these organisations' information systems must support geospatial interoperability and functionality.

In the past, geospatial capabilities fell into certain distinct categories defined by particular kinds of hi-tech information systems that often didn't communicate or 'interoperate' well. In most cases, it was difficult and expensive to combine and share information between different types of systems – Geographic Information Systems (GIS), Earth observation systems, Automated Mapping and Facilities Management (AM/FM) systems, Global Positioning System (GPS) receivers, digital seismic survey equipment and echo sounders, total stations, digital navigation systems, and sensors. And within these categories, different vendors' systems didn't work well together.

In the late 1990s, geospatial technology companies and their customers determined that the Internet and Web provided a platform for connecting heterogeneous systems. The Web works because it is based on open standards – TCP/IP, HTML, HTTP, XML and many others – that developers can use to build systems that integrate and communicate with other systems on the Web. All of these open standards are 'extensible', so other open standards can be built on top of them. Geospatial technology stakeholders have worked together in the Open Geospatial Consortium (OGC) and other open membership standards organisations to build Web-based geospatial standards. These standards have come into their own in the last few years, transforming the geospatial market just as Internet and Web standards transformed the larger ICT market. Some examples now follow.

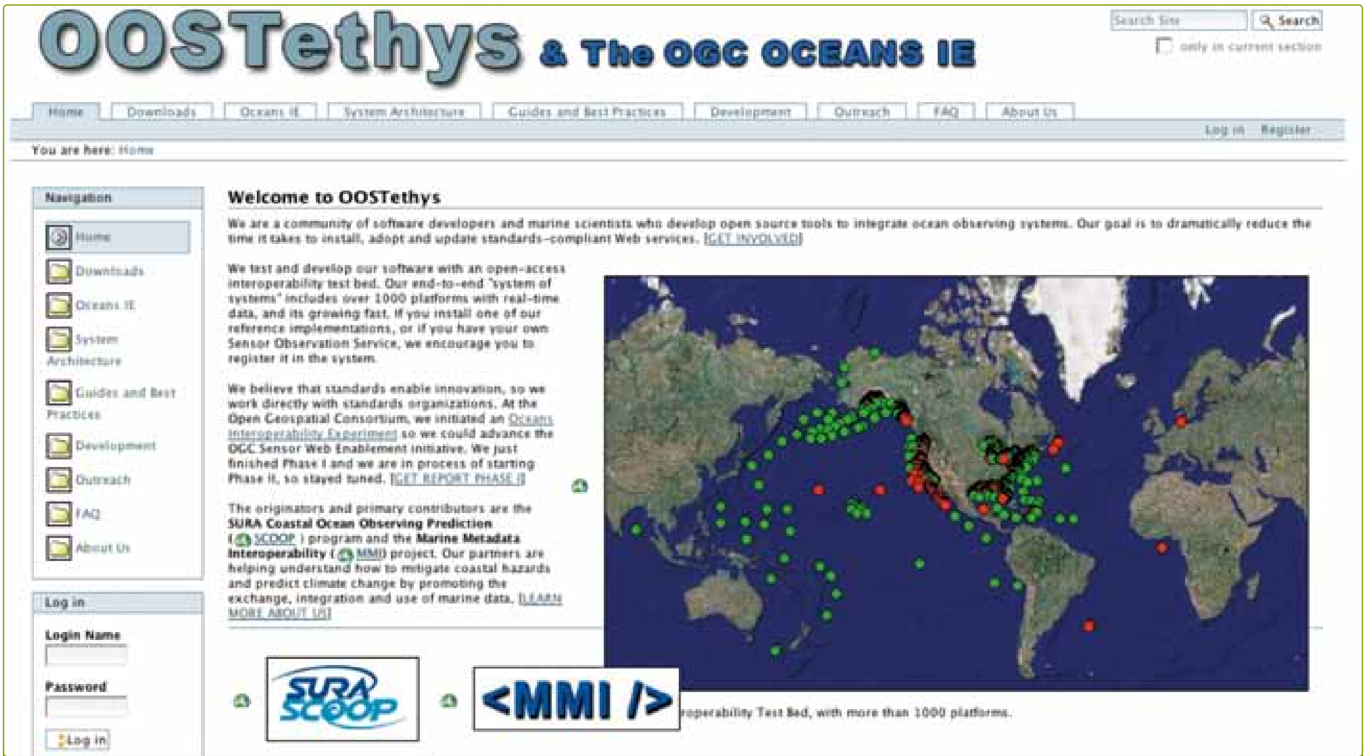

Figure 1. OOSTethys is an effort to develop cookbooks, reference materials, and open source software to enable a 'system-of-systems' of linked data providers in the marine domain based on OGC standards, with a focus on sensor webs.

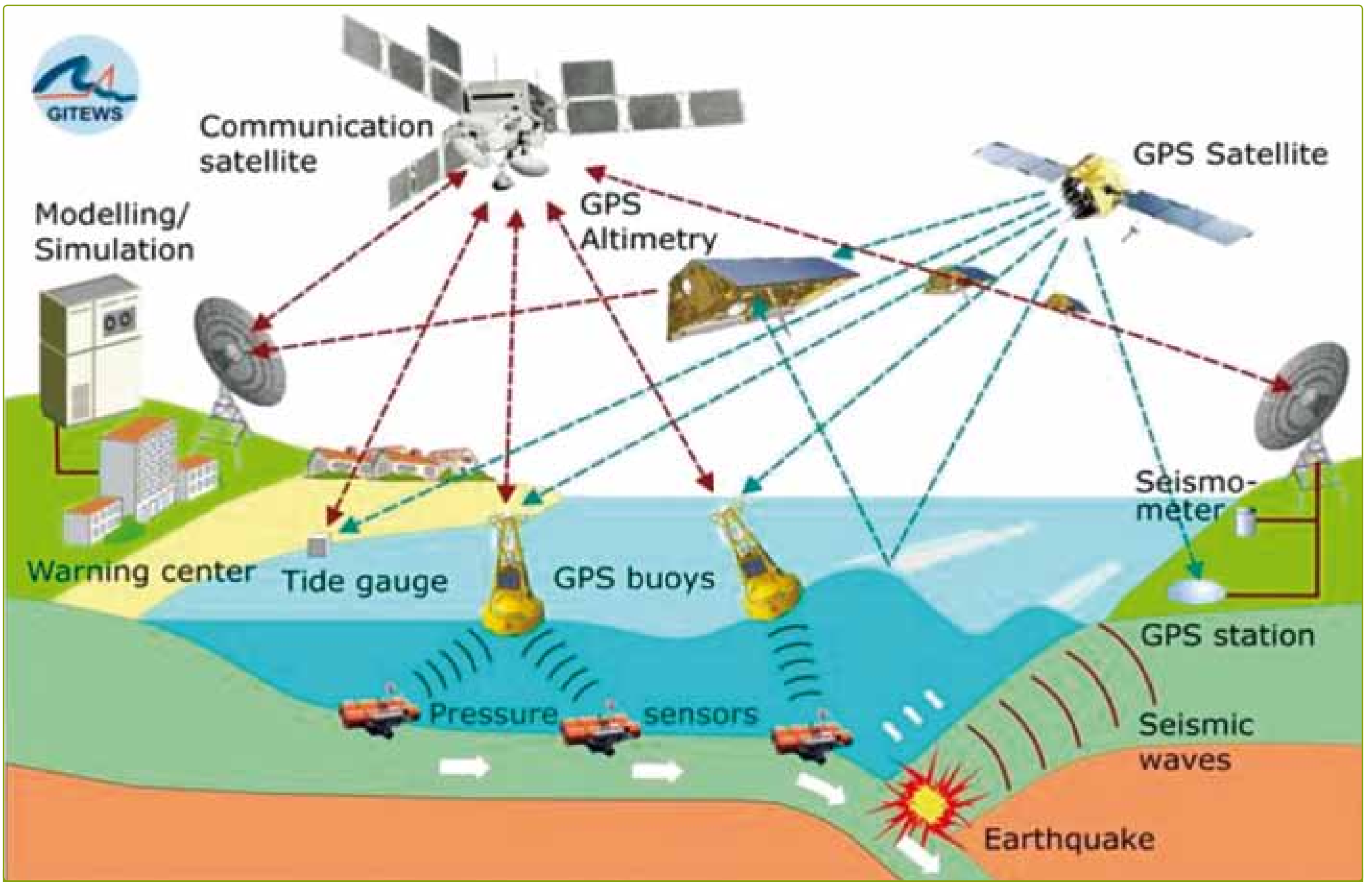

Figure 2. GITEWS will use SWE services as a front-end for sharing Tsunami-related information among the various components of the GITEWS software itself. GITEWS uses real-time sensors, simulation models, and other data sources, all of which must be integrated into a single system.

Web-based geospatial applications in coastal zones

Oceans IE: In recent years, a number of cooperating research and operational organizations have been discussing ways to share the costs of collecting ocean observations and to make more data available. In January 2007, a team of these organisations launched the 'Ocean Science Interoperability Experiment' (Oceans IE) (www.opengeospatial.org/projects/initiatives/oceansie) to study ocean implementations of OGC Web Service (OWS) standards. They developed an initial set of best practice recommendations, which were published in the Oceans IE Phase I report (www.oostethys.org/outreach/working_folder/ogcreport/ogc-oie-20080822.pdf/view). A second phase of Oceans IE is now underway. Members of the Oceans Science IE are also involved in the OOTHethsys (http://www.oostethys.org) (see Figure 1.)

The OGC 'Sensor Web Enablement' (SWE) initiative is based on the fact that every sensor – from a simple fixed rain gauge to a remotely controlled webcam to a complex imaging device on an orbiting platform – has location. In the SWE standards framework, all sensors report position; all are connected (at least sometimes) to the Web; all may send metadata along with the observations or may have metadata registered in a catalogue for easy discovery; all are readable remotely; and some are controllable remotely. SWE standards are being rapidly adopted by the Ocean Observing community.

52 North and GITEWS: The German organisation 52North (www.52north.org) provides a complete set of SWE services under GPL license (www.gnu.org/copyleft/gpl.html). This open source software is being used in a number of real-world systems, including a monitoring and control system for the Wupper River watershed in Germany and the German Indonesian Tsunami Early Warning System (GITEWS) (www.gitews.org) (Figure 2), a 35-million euro project of the German aerospace agency, DLR (www.dlr.de/en) and the GeoForschungsZentrum Potsdam (GFZ) (www.gfz-potsdam.de/index-en.html), Germany's National Research Centre for Geosciences.

InterRisk: The EU's InterRisk project (Interoperable GMES Services for Environmental Risk Management in Marine and Coastal Areas of Europe) (http://interrisk.nersc.no) addresses the need for better access to information for risk management in Europe, both in cases of natural hazards and industrial accidents. GMES is the EU Global Monitoring for Environment and Security program (www.gmes.info). The overall objective is to develop a pilot system for interoperable GMES monitoring and forecasting services for environmental management in marine and coastal areas. The InterRisk pilot will consist of an open system architecture based on established GIS and web services protocols. The InterRisk pilot system and services will be validated by users responsible for crisis management in case of oil spills, harmful algal blooms and other marine pollution events, in Norwegian, UK/Irish, French, German, Polish and Italian coastal waters.

SeaDataNet and MOTIIVE: SeaDataNet, a Pan-European project to provide Infrastructure for Ocean & Marine Data Management (www.seadatanet.org) and the UK Met (Meteorology) Office's DEWS (Delivering Environmental Web Services) project (www.dews.org.uk) is also using OGC standards. The EUCC (EU Coastal Union) (www.eucc.nl) promotes standards-based interoperability and facilitates stakeholder involvement in MOTIIVE (the EU Marine Overlays on Topography for Annex II Valuation and Exploitation) (www.motiive.net). MOTIIVE and the Australian Oceans Portal project (www.aodc.gov.au/index.php?id=34) are collaborating on a registry to deliver OGC standards-driven query models, presentation resources and processing chains.

IOOS: The US Integrated Ocean Observing System (IOOS) program (http://ioos.noaa.gov) is embracing open standards

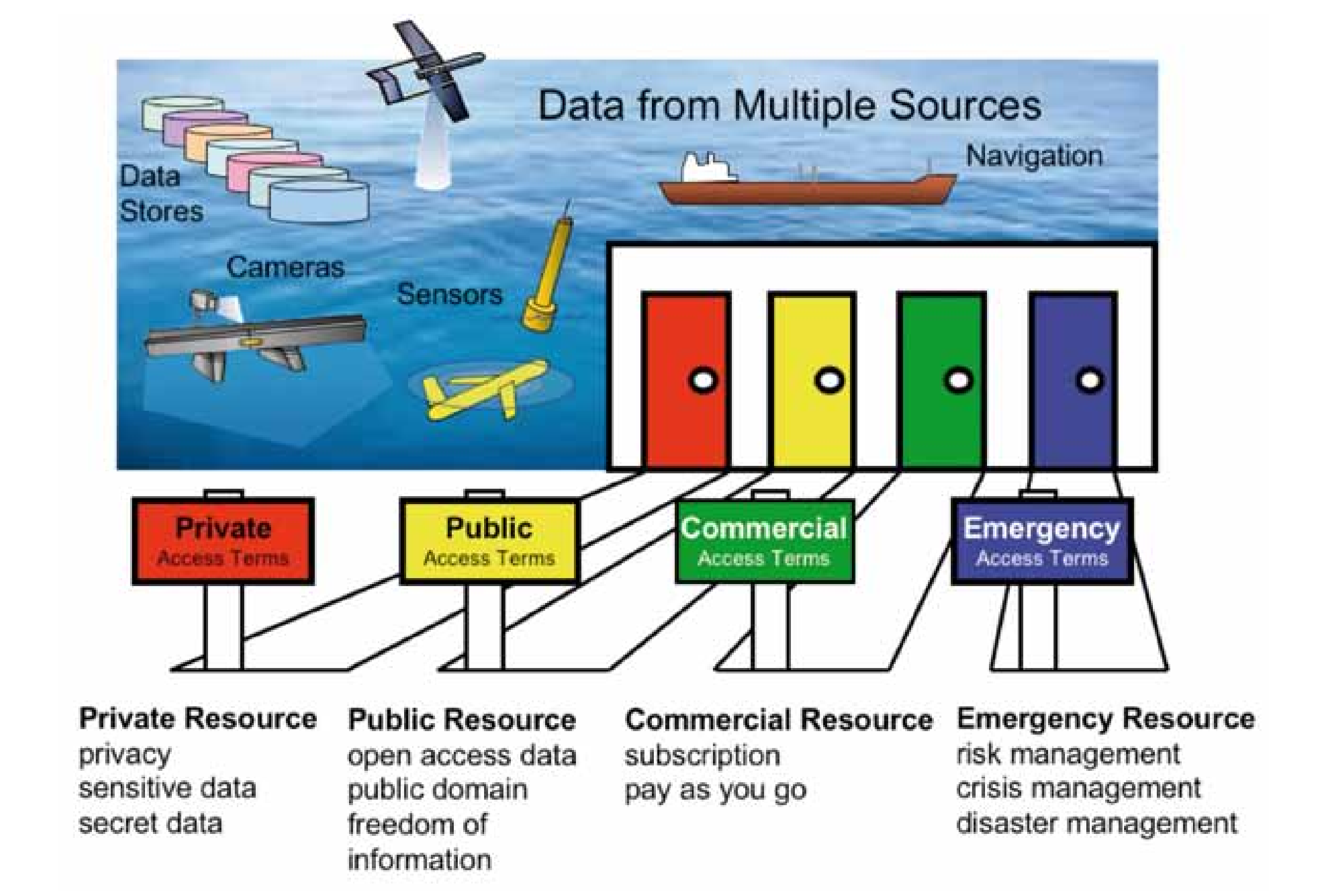

Figure 3. Geospatial Rights Management (GeoRM) standards will make it easier for organizations to establish data access policies. (Figure OGC).

including geospatial and SWE standards of the OGC as part of its technical architecture to improve sharing across federal to local organisations involved in ocean observation. Cooperating organisations have also advanced an Open IOOS project (www.openioos.org) that leverages OGC geospatial and SWE standards.

Debris Flow Disaster Information System: The Debris Flow Disaster Information System developed by the GIS Center at Feng Chia University, Taiwan, for the Taiwan Committee of Agriculture's Soil and Water Conservation Bureau supports debris flow disaster management and response using commercial and custom software implementing EDXL, CAP, and OGC standards.

Future standards work

Progress toward interoperability among port and coastal information systems continues. For example, the standards that govern how geospatial digital rights management will operate in a Web services environment are moving forward in the OGC's Geospatial Rights Management (GeoRM) Working Group (www.opengeospatial.org/projects/groups/geormwg). GeoRM standards will help companies, agencies and institutions resolve many of the non-technical issues that impede wider sharing of data.

Also, the 3D Information Management (3DIM) Working Group (www.opengeospatial.org/projects/groups/3dimwg) is facilitating the creation of new software solutions that enable infrastructure owners, builders, emergency responders, community planners, and the travelling public to better manage and navigate complex built environments. Through the cooperation of diverse geospatial and CAD industry stakeholders in activities such as the AECOO Testbed, (www.opengeospatial.org/projects/initiatives/aecoo-1), integration of infrastructure information systems will be achieved.

ABOUT THE AUTHOR

Sam Bacharach joined the Open Geospatial Consortium, Inc., in April 2000. He was a user of mapping data for many years as an Army officer, and then supervised terrain analysis and mapping production as a Topographic Officer before retiring from the service. He spent 5 1/2 years in the industry and became convinced that open standards, specifically those from the OGC's open consensus process, were a requirement for geospatial knowledge to ever make its way out of the basement to full integration with information and communication technology. He holds a Bachelor of Science degree and a Master of Science, Geography, from the University of Idaho.

ABOUT THE ORGANISATION

The **Open Geospatial Consortium, Inc.** (OGC) is a non-profit, international, voluntary consensus standards organisation that is leading the development of standards for geospatial and location based services. Through our member driven consensus programmes, OGC works with government, private industry, and academia to create open and extensible software application programming interfaces for geographic information systems (GIS) and other mainstream technologies.

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