



Open Standards Observation Fusion, GeoSynchronization, Cross Community Interoperability

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GIS APPLICATIONS ACROSS INDUSTRY SECTORS

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The presentation is about...

- ... OGC as organisation
- ... why interoperability & open standards matter
- OGC's Interoperability Program and examples of OGC standards





What is it all about?

Making your treasures accessible & re-usable



Benefits of Standardization

- German DIN Stady: Standards promote worldwide trade, encouraging rationalization, quality assurance and environmental protection, as well as improving security and communication. Standards have a greater effect on economic growth than patents or licences.
- "Economic Benefits of Standardization"
- Benefits to German economy of 17 billion Euros in 2010!



2004 NIST report: "... the annual cost of waste due to inadequate interoperability among computer-aided design, engineering, and software systems in the construction industry to be \$15.8 billion <in the US alone>."

Strategic Significance of Standardization

- Organizations are generally unaware of the strategic significance of standardization.
- Corporate decision-makers seem hardly aware of the strategic benefits of standards. This lack of knowledge on the part of decision-makers in organizations means that the strategic potential of standards is not fully appreciated.
- To better understand and articulate the advantages of developing and using OGC standards, join OGC Business Value Committee:



http://www.opengeospatial.org/projects/groups/businessvalue https://lists.opengeospatial.org/mailman/listinfo/business.value

Standards as a business imperitive

While tactical thinking does indeed predominate in today's conservative spending climate, the lack of enterprise integration has created such a costly infrastructure that it represents an immediate and pressing mandate for standards. Compliance with standards in software development is not simply a strategic direction, but a business imperative. ("The Value of Standards" A Delphi Study (2003))



Why open standards matter: NGA

"Industry is a partner to mission success, and the commercial applications of GEOINT make it a win-win situation. Our industry partners are attuned to our evolving missions and offer solutions addressing a range of needs: from standards to ensuring communitywide interoperability of data and systems, and from integrated tools providing seamless knowledge transfer and transparency of resources and requirements, to enhanced tradecraft techniques leveraging the capabilities of current and new sensors."



Letitia Long

Director, National Geospatial-Intelligence Agency. (From an interview by Geospatial Intelligence Forum 7 October 2010)





Some facts about the OGC



http://www.youtube.com/ogcvideo

→ more videos on OGC's Youtube Channel: http://www.youtube.com/user/ogcvideo/videos

OGC at a glance

- Founded in 1994, not for profit, consensus based and voluntary
- 470+ member organisations (industry, government, academia) (Oct. 2012) http://www.opengeospatial.org/ogc/members
- 23 staff members
- 30+ adopted OGC Standards (some are ISO Standards) http://www.opengeospatial.org/standards
- Several hundred software products, implementing OGC Standards http://www.opengeospatial.org/resource/products
- Broad user community worldwide, many policy positions for NSDI based on OGC standards
- Cooperation with other standards organisations and foundations, ISO/TC 211, OSGeo, W3C, OASIS and others http://www.opengeospatial.org/ogc/alliancepartners







OGC membership



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OGC Members (government examples)

http://www.opengeospatial.org/ogc/members

- Additional Director General Military Survey (GSGS)
- Australian Bureau of Meteorology
- BRGM
- CNES
- CSIRO
- Department of Defence (Australia)
- DLR German Aerospace Center
- DSTL (Defence Science & Technology Laboratories)
- EMSA European Maritime Safety Agency
- Eurocontrol

FAA

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- European Space Agency
- European Union Satellite Centre

- Geological Survey of Finland
- Geonovum
- Geoscience Australia
- Geospatial Information Authority Japan (GSI)
- German Federal Agency for Cartography and Geodesy
- Instituto Geográfico National (ES)
- Météo-France
- Ministerio de Bienes Nationales Secretaria Ejecutiva SNIT
- Ordnance Survey
- US Airforce Weather Agency
- US Department of Defence DISA
- US Department of Homeland Security
- UN Geographic Information WG

and many more members from industry & the academic sector

Interoperability Issues



- "We can't share maps on the Web."
- "We can't deliver data to different systems easily."
- "We don't have a common language to speak about our geospatial data or our services."
- "We can't find and pull together data from our automated sensors."



So what does OGC do?

The Vision

Achieve the full societal, economic and scientific benefits of integrating location resources into commercial, institutional and organisational processes worldwide.

The Mission

To serve as a global forum for and lead the development, promotion and harmonization of open and freely available geospatial standards.



Geo* and Location* on the Web



Just as http:// is the dial tone of the World Wide Web, and html / xml are the standard encodings, the geospatial web is enabled by OGC standards.



Major OGC Standards

http://www.opengeospatial.org/standards

Some examples

- Web Map Servers (WMS)
- Web Feature Servers (WFS)
- Web Coverage Servers (WCS)



As well as the:

- KML (formerly Keyhole Markup Language)
- Web Map Context (WMC)
- Geography Markup Language (GML)





Why → interoperability? → open standards?

Standards are like parachutes: they work best when they're OPEN. Mary Mc Rae, OASIS*

* "Minds, like parachutes, function better when open, but, like fists, they strike harder when closed." — L.E. Modesitt, Jr., American Author (1943 --) Source picture: http://www.all-hd-wallpapers.com/wallpapers/sports/425236.jpg

Why Open Standards?

- Prevents a single, self-interested party from controlling a standard
- Lower systems and life cycle costs
- Encourage market competition
 - Choose based on functionality desired
 - Avoid "lock in" to a proprietary architecture

"What OGC brings to the table is...everyone has confidence we won't take advantage of the format or change it in a way that will harm anyone"

> Michael Weiss-Malik, Google KML product manager

Stimulates innovation beyond the standard by companies that seek to differentiate themselves.



Source: Open Standards, Open Source, and Open Innovation: Harnessing the Benefits of Openness, April 2006. Committee For Economic Development. www.ced.org

Open Technology

"People want the government to be transparent, so why shouldn't the technology be?"

Jim Willis, Director of e-Government at the Rhode Island Secretary of State Office



What is an OGC Standard?

- A document, established by consensus, approved by the OGC membership (balance of interest, all members have an equal vote)
- Provides, rules, guidelines or characteristics
- Implementable in software
- Open standards does not mean open source software (Free Software). OGC/OSGeo Paper on Open Source Software and Open Standards: http://wiki.osgeo.org/wiki/Open_Source_and_Open_Standards
- OGC standards are
 <u>Open</u> Standards
 - Freely and publicly available
 - No license fees
 - Vendor neutral

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Standards Development is not easy!



- \rightarrow Requires understanding of differences
- \rightarrow Requires cooperation on a global basis
- \rightarrow Requires consensus by many organizations
- \rightarrow Requires give and take

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 \rightarrow Requires certified, repeatable process



Where does OGC fit in the "standards" world?

Facto OGC Software Interfaces and encodings: Instantiate **ISO/CEN** Domain and Dejure into Infrastructure Domains: Object / Abstract Models, Content, Vocabulary

OASIS/IETF / W3C

Infrastructure: WSDL, \UDDI, SOAP, XML

Domain

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Infrastructure



OGC Interoperability Program

interoperability experiments **INNOVATIVE** PROCESS pilot projects

 $\label{eq:http://www.youtube.com/user/ogcvideo/videos} \rightarrow OGC \ Interoperability \ Program \ Introduction$



How does OGC work?

http://www.opengeospatial.org/ogc/programs

- Consensus process that is reflecting a common understanding of requirements and a membership driven process.
- Formalised standards development process – based on commonly agreed, structured and well defined policies and processes (→ Standards Program
 http://www.opengeospatial.org/ogc/programs/spec).
- Making use of innovative processes for testing, verifying and documenting user
 requirements (→ Interoperability Program http://www.opengeospatial.org/ogc/programs/ip).



...plus Compliance Testing & Certification Program (http://www.opengeospatial.org/compliance) and Marketing & Communication Program (http://www.opengeospatial.org/ogc/programs/ocap).

Rapid Interface Development

Standards

Setting

Overview OGC Interoperability Program (IP)

http://www.opengeospatial.org/ogc/programs/ip

- A global, collaborative, hands-on engineering, prototyping and testing designed to rapidly deliver
 - <u>Candidate standards</u>
 - <u>"Demonstrable" implementations</u>
 - <u>Engineering Reports</u>
- Sponsors and Participants work together.
 - Sponsors provide requirements, use / business cases and funding
 - Participants work with sponsors to define and/or refine standards to solve a given interoperability problem





OGC Interoperability Program

- Proven process to rapidly develop, test, validate and demonstrate new standards based on real world use cases identified by OGC members
- Effective way for members to quickly align industry to advance standards to meet priority needs
- *Efficient and competitive process*, regularly yielding a high-level of industry participation and cooperation
- Repeatable process over 30 initiatives successfully conducted using proven policies and procedure



Roles in IP Initiatives

- Initiative Sponsors (OGC Members) work with a team of OGC staff and technical experts to document interoperability requirements (concept development). This process includes the development of an initiative's use cases, vision, technology objectives, and timeline. Sponsors contribute resources – funding, personnel, facilities, etc.
- In response to the sponsor's requirements, **Initiative Participants**, establish specific technical requirements for specification development or enhancement and determine the scope and agenda. Participant teams develop and document the prototype interfaces, encodings etc. and perform other technical tasks.
- OGC staff facilitates the overall process. OGC staff works with the members to: publish Requests for Technology (RFTs), Requests for Proposals (RFPs), and Calls for Participation (CFPs); manage initiatives; and provide liaison with other industry consortia and *de jure* standards organizations.



Interoperability Program - Summary

Testbeds, Pilots and Experiments

Participants work with sponsors to define and/or refine standards to solve a given interoperability problem.

- Joint actions by technology providers and users
- Driven by user community scenarios
- Produce:
 - \rightarrow Tested and validated <u>draft standards</u>
 - \rightarrow Industry technology <u>implementations</u>
 - → Architectural recommendations
 - → Live <u>demonstrations</u> to validate utility of standards in user context



OGC staff manages the entire process with policies and procedures proven to produce results.

Over 50 initiatives have been successfully completed since 1999.

Most OGC standards are advanced through this process.



Benefits

Arnaud Cauchy of Spot Image, an EADS Astrium company, explained, " (...) The AIP-3 Disaster Management Reference Scenario is a key contribution, helping participants to define efficient procedures and related GEOSS services to provide the right response at the right time to an emergency situation. The scenario demonstrates information flows involved in providing real-time updates to an evacuation plan during a flood disaster."

GEOSS Architecture Implementation Pilot (AIP) 3 http://www.opengeospatial.org/pressroom/pressreleases/1323

Navin Vembar, Aeronautical Information Management (AIM) Acquisition Lead, FAA, reported, "The (...) pilot proves that OGC Web Services can be used in concert with domain-specific information exchange standards to satisfy the operational needs of a wide variety of users. The use of the standards means that all of the stakeholders' costs decrease while the benefits of the communication are realized quickly." OGC Aviation Information Brochure

Dave Wesloh, NGA: "We are very much a supporter of the OGC Interoperability Program. It provides us with a opportunity to set our requirements out in the community." OGC Web Services (OWS) 4 demo - http://www.opengeospatial.org/pub/www/ows4/index.html



Some Examples from OWS-8



http://www.opengeospatial.org/pub/www/ows8/index.html

OWS-8 Activity Threads & Subthreads

http://www.opengeospatial.org/projects/initiatives/ows-8

Sensor / Observation Fusion

Observation Fusion: Coverages

Web Coverage Service 2.0: EO App Profile, WPS/WCPS, Compliance Tests

Observation Fusion: Motion

Moving Objects in Motion Imagery: Detecting & tracking objects, and setting bookmarks

Thread Architects: Observation Fusion – Raj Singh Geosync – Michy Maynard CCI – Luis Bermudez Aviation – Nadine Alameh

OGC^(B) Making location count.

Feature Fusion / Portrayal

Gsync

Geodata Bulk Transfer with Synchronization: Content management across SDI

CCI: Mediation

Cross-Community Interoperability: Semantic mediation across heterogeneous data models

CCI: Schema

Schema Automation: UML-GML enhancements, Schematron support for SWE (O&M) schema

CCI: Portrayal

Portrayal Enhancements: Registries for symbols and rules (incl. DGIWG), FPS with SE + KML

Aviation / Weather

Aviation: Architecture

AIXM 5.1: Metadata, GML Profile, Performance

Aviation: Portrayal

FPS, SLD: ICAO symbol libraries for AIXM, WXXM

Aviation: Events

Digital NOTAM: Events spec, AIXM event schema, validation

Aviation: Security

Authoritative AIXM Services: Authentication (PDP), Authorization (PIP), Gatekeeper (PEP)

Aviation: Weather

WXXM 1.1: WCS conversion, probabilistic TAF, distributed UoM

http://www.opengeospatial.org/projects/groups/geosyncswg





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http://www.opengeospatial.org/projects/groups/geosyncswg





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http://www.opengeospatial.org/projects/groups/geosyncswg



OWS-8 demo video (2:35 to 4:47 minute): http://www.youtube.com/watch?v=p_UG7U8C_SA



http://www.opengeospatial.org/projects/groups/geosyncswg

- content provider organizations need to deliver current, timely and verified data over the World Wide Web.
- Cooperation with outside entities
 - Municipal, state, federal agencies to synchronize their data with closest-to-source providers
 - Crowd-sourcing of data production or supporting volunteer geographic information (VGI)
- A GeoSynchronization service allows data collectors to submit new data or make modifications to existing features without directly affecting the features in the provider's data store(s) until validation has been applied
- Based on Canadian Geospatial Data Infrastructure (CGDI) Interoperability Pilot project and OWS-7 (→ http://www.opengeospatial.org/projects/initiatives/cgdipilot)



Fusion Observation, Object/Feature, Decision

Process of combining data and information to improve detection, identification, and characterization of entities.



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Fusion

Observation, Object/Feature, Decision

- Making new connections using existing data
- Powerful method to gain understanding of the world
- Not a new topic. New technology, data sources and computing approaches provide new opportunities.
- Data fusion increasingly takes place in distributed information environments
- The problem is "data silos": data stores and data streams that can be used only for specific purposes or by specific groups because of technical or institutional barriers.
- Standards are the key to communication and sharing between data silos. Communication means "transmitting or exchanging through a common system of symbols, signs or behavior." Standardization means "agreeing on a common system."



Cooperation: Command and Control

Real time access, integration, and fusion of static and real time assets in support of the Warfighter. From Empire Challenge 2008. Operations in a Coalition Environment





Role of geospatial standards

- Associations based on location and time are primary.
- Observation Fusion:
 - Fusing information from different sensors of the same physical phenomenon, such as image intelligence (IMINT)
 - Fusing information from sensors of different phenomena, such as fusing laser imaging detection and ranging, hyperspectral (images recording visible plus infrared and/or ultraviolet light), and overhead persistent infrared.



Categories of fusion



Cross Community Interoperability

OGC Standards & Meteorology Workshops

Present solutions, requirements, and discuss issues. Feeds into the OGC Met/Oceans and Aviation Domain Working Groups. Issues such as time, time series, performance, etc.





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Disaster management



Business development

Urban planning

Radio network planning

Facility management

CityGML for 3d city models

Kaufhof

Springfield Leffers

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Noise immision mapping

Stapelfeldt GmbH

Munsterplatz Navigation

Source: Kolbe, 2011

ekturwerkstatt SenStadt Berlin

Architecture

CCI for Actionable Situational Awareness Via Common Standards Baseline

Alerts from real-time, taskable sensors: fixed and mobile Responses to radiation event, Deploy a temporary hospital, Route and track victims Standards-based

Decision Support Services supporting Actionable Situational Awareness

Web based integration of geospatial data from multiple distributed sources



OGC Web Services Phase 4 Testbed PANYNJ EOC and Port Newark

CRH CRV FDS ENS MCM

TLT

rde rie

Fusion of Building Information Models and

other engineered information

OGC Web Services Testbed – Phase 9

http://www.opengeospatial.org/projects/initiatives/ows-9

- OWS-9 builds on the outcomes of prior OGC initiatives
- Sponsors:
 - AGC (US Army Geospatial Center)
 - CREAF-GeoViQua-European Commission
 - EUROCONTROL
 - FAA (US Federal Aviation Administration)
 - GeoConnections Natural Resources Canada
 - Lockheed Martin Corporation
 - NASA (US National Aeronautics and Space Administration)
 - NGA (US National Geospatial-Intelligence Agency)
 - UK DSTL (UK MoD Defence Science and Technology Laboratory)
 - USGS (US Geological Survey)
- Contact:
 - Nadine Alameh (nalameh at opengeospatial.org)
 - George Percivall (gpercivall at opengeospatial.org)



OWS-9 Activity Threads

http://www.ogcnetwork.net/ows-9

NGA & LMCO FAA & Eurocontrol NGA Security and Services Aviation Interoperability (SSI) Compliance • AIXM and WXXM Security Management (CITE) • Discover, Retrieve, Portray • UML-GML Schema Tools • WMS 1.3 Server Geometry Processing Web Services Façade • Transmission to Aircraft • WMS 1.3 Client • Architecture Profiles • WFS 2.0 Conceptual Mapping Tool • Bulk Data Transfer • GML 3.2.1 • OWS Context 1.0 NGA, AGC, UK DSTL, USGS,

GeoConnections NRCan, FAA, CREAF-GeoViqua-EC

Cross-Community Interoperability (CCI)

- Semantic mediation
- Query results delivery
- Data provenance & QA
- Single Point of Entry Global Gazetteer

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NGA, NASA, UK DSTL, CREAF-GeoViqua-EC

OWS Innovations

- Geo Mobile Apps
- Web Mapping
- Coverage Access
- GPS Messages

Thread Architects: Aviation– Johannes Echterhoff CCI– Luis Bermudez CITE – Luis Bermudez Innovations– Raj Singh SSI – Jenn Harne

• SWE

• WCS-EO 1.0

• TEAM Engine

OWS-9 Participants (40)

52North Atmosphere **Botts Innovative** Research The Carbon Project **CNR-EC/JRC** Compusult Comsoft Con terra CubeWerx Development Seed Envitia EU Satellite Center

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Galdos GIS.FCU GMU Harris Corporation IDS iGSI Interactive instruments Intergraph Latlon LISAsoft LMCO Luciad **NOAA NWS** OPeNDAP

OpenGeo PYXIS Rasdaman/EOX/CNR/MEEO Secure Dimensions Snowflake Speed Squared Terradue Terrapixel Triagnosys **UAB-CREAF** Uni Münster-IfGI Uni Bundeswehr Uni Reading



In the end...

🚣 Source: http://matchangler.blogspot.co.uk/2010_01_01_archive.html 🥤

IP Programme - Return on Investment

- Participants in OGC testbeds and pilot initiatives contribute more in inkind contributions (labor, software, infrastructure etc.) than is provided in Sponsor funding.
- For every one Euro or Dollar in sponsorship funding, the following initiatives have yielded:

—	Web Mapping Testbed I (1999)	4 times
-	OGC Web Services 3 Testbed	3 times
_	OGC Web Services 4 Testbed	3.5 times
-	OGC Web Services 5 Testbed	3.3 times
-	OGC Web Services 6 Testbed	3.1 times
-	OGC Web Services 7 Testbed	2.5 times

 Why? Vendors want early influence in specification development, early skill building, visibility, and opportunity for early market deployment of standards.



Disaster Prediction and Warning Feng Chia University

"The success of our programs to monitor, detect, warn and respond to emergencies and natural disasters in Taiwan depends heavily on OGC standards.

We use OGC Web Services and Sensor Web Enablement standards to rapidly mobilize monitoring, forecasting and warning networks, and to implement a diversity of sensor assets as part of these systems. This saves time, money and lives."

Tien-Yin Chou, Director of the GIS Research Center Feng Chia University





Communication & Participation in our work

Defence & Intelligence DWG

http://www.opengeospatial.org/projects/groups/dandidwg

- Purpose
 - to provide a forum for the defense and intelligence community
 - exchange information on geospatial requirements, standards, and compliance to facilitate the development and implementation of software solutions
- The DIDWG will facilitate information exchange and collaboration between agencies and industry in order that OGC SWG develop standards that meet military requirements.
- Open to non-OGC members

While membership in the defense component of the community is relatively clear, the intelligence component requires further definition. The intelligence component for this Domain Working Group (DWG) relates to defense intelligence, including geospatial intelligence in a defense context.



OWS-10 planning

- Preliminary schedule
 - December 2012: Call for sponsors and invitation to first sponsor meeting
 - January 2013: First sponsor meeting (after the OWS-9 demo at the OGC TC meeting)
 - September 2013: Kickoff March
 - 2014: Demonstration at TC
- OWS-10 initial ideas
 - OWS-9 ++
 - Model interoperability
 - Linked data

- Workflow with provenance
- Location privacy
- Data policies and pricing



Summarizing

- Lack of interoperability is lowering value of data
- need for cross boundary & cross community communication and cooperation
- OGC standards enable the geospatial web
- OGC → membership & huge network of colleagues and experts
- communication is key



Some last thoughts...

"Interoperability seems to be about the integration of information. What it's really about is the coordination of organizational behavior."

David Schell Chairman and Founder OGC





Really last thoughts...

\rightarrow Contribute, cooperate – and avoid "consuming attitude"

\rightarrow Don't re-invent the wheel: benefit from other's experiences – share your own!

"The conventional view serves to protect us from the painful job of thinking" (John Kenneth Galbraith, economist)



Thank you for your attention and questions?

Athina Trakas

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