OGC: community contribution to the Interoperability Program – and benefits for the community

GIC, 28th Annual Conference – Open Conference
Orléans, FRANCE – 3rd June 2013

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With support from *Nadine Alameh* and other OGC colleagues.

The presentation is about ...

- ... interoperability & open standards
- … OGC as an organisation
- … the Interoperability Program

Introduction

OGC and Open Data

http://www.opengeospatial.org/ogc/faq#11

Q: What is the OGC's position on "Open Data"?

The OGC embraces open data as well as other models for data distribution and access. The OGC standards framework must support a broad range of policy positions on the access to and distribution of geospatial data, and **we are supportive of all models for open access, licensed data, secure distribution, etc.** Policies on access and distribution of geospatial and other forms of data are constantly in flux. Data sets restricted for distribution by security and/or pricing / licensing, may be opened up for free access at another time. Changing market forces and organizational policies determine the rules for data access and distribution. Open standards, including those of the OGC, support the full range of business models, and **a common open standards framework is vital to the overall geospatial data marketplace.**

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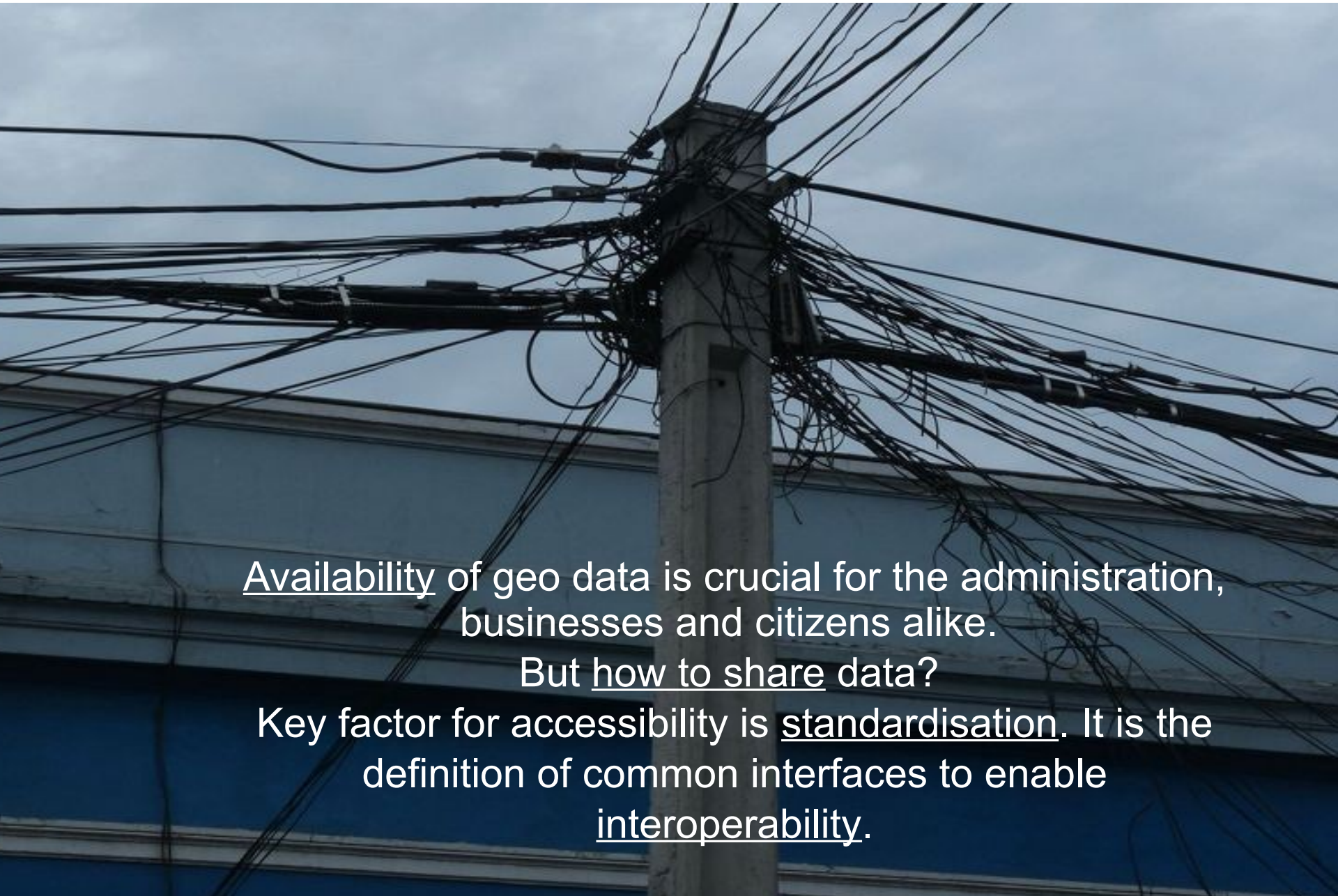
Standards, Interoperability & Data Access

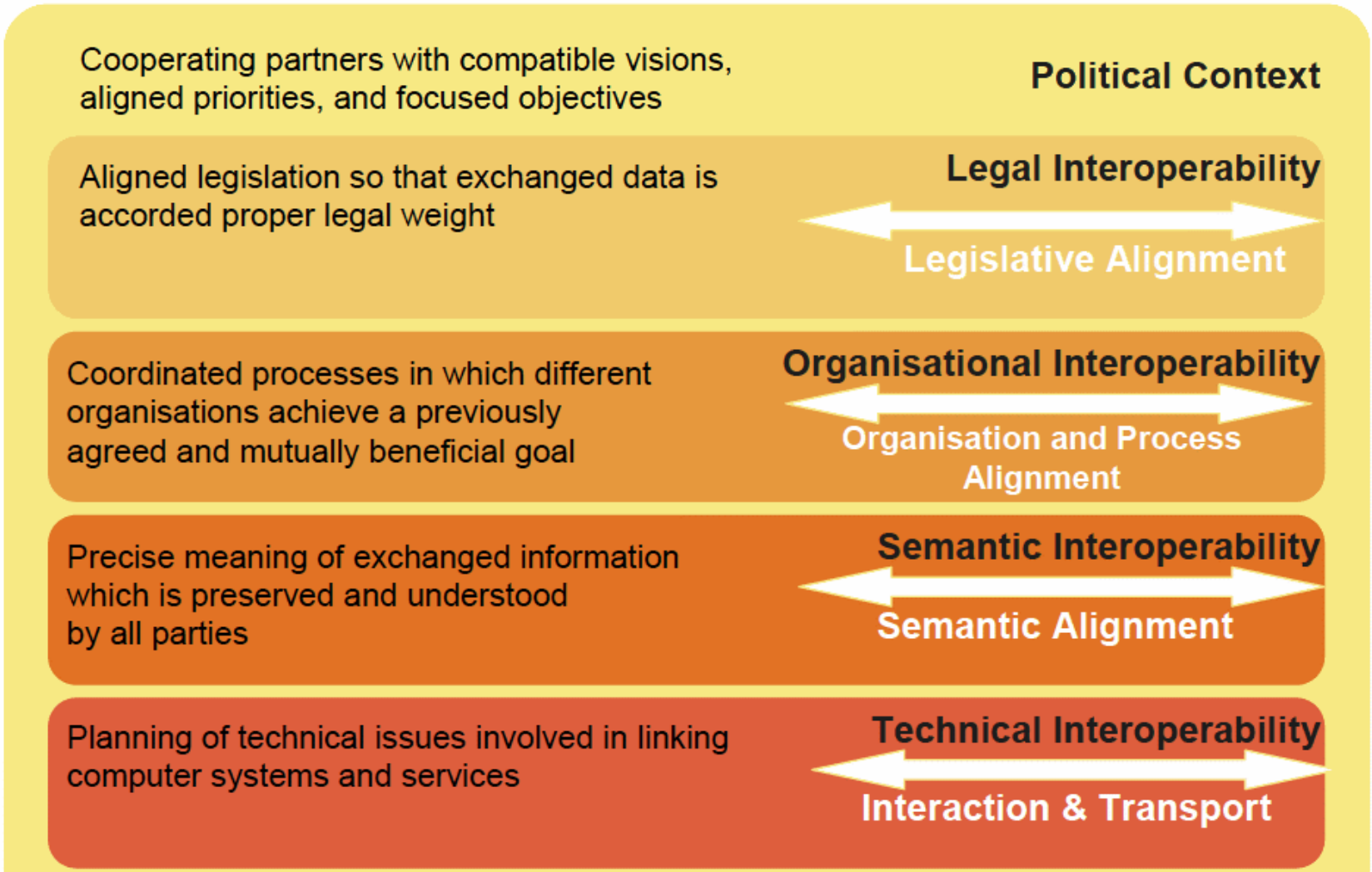


Availability of geo data is crucial for the administration, businesses and citizens alike.

But how to share data?

Key factor for accessibility is standardisation. It is the definition of common interfaces to enable interoperability.

Views on Interoperability Levels



Source: European Interoperability Framework, Annex II, p 26

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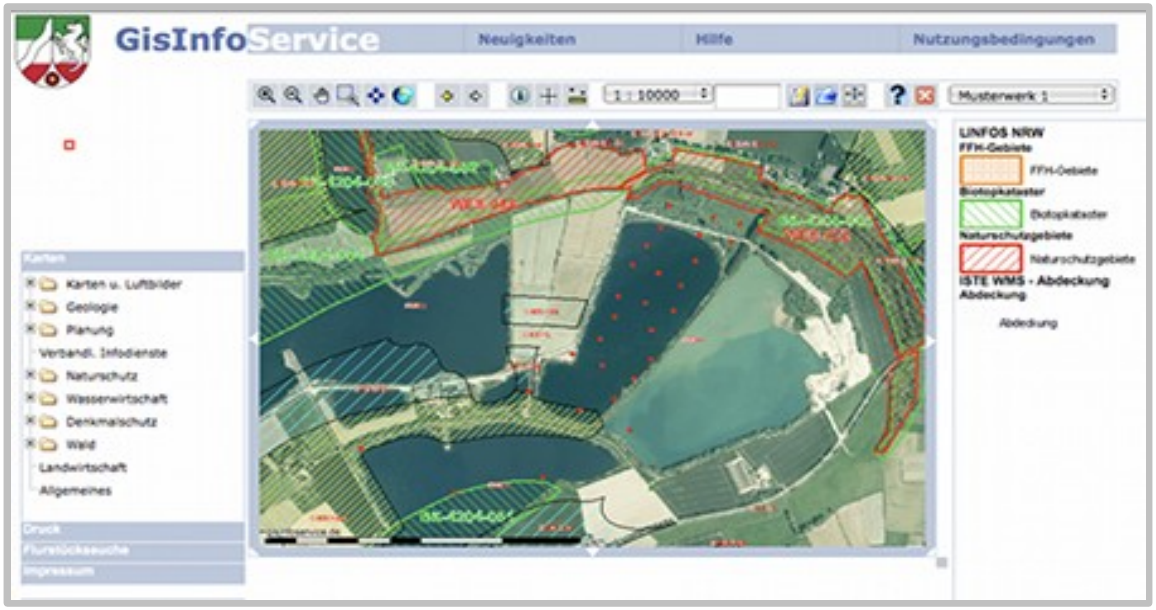
What is the OGC?

The Open Geospatial Consortium (OGC) is a non-profit, international, voluntary, consensus based standards organization that is leading the development of standards for geospatial and location based services.



GisInfoService
German Information platform for the mining industry
http://www.gisinfoservice.de/

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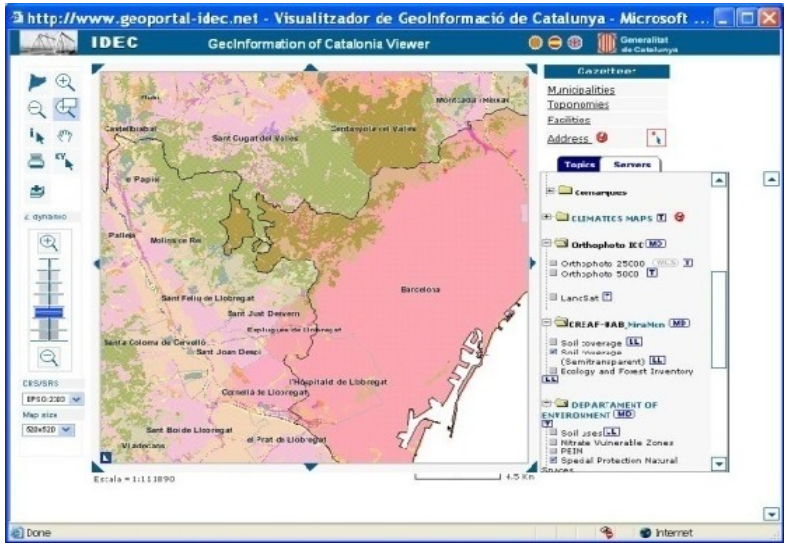
What does the OGC?

The OGC facilitates a consensus process in which government, private industry, NGOs and academia collaborate to create open and extensible software application programming interfaces and standards for geospatial and other mainstream information technologies.



Geoportal of the Catalonia SDI
http://www.geoportal-idec.net/

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Improving Knowledge Sharing and Transfer...

… by addressing critical issues, that need cooperation.
… across domain, cross boundaries and multi-disciplinary.

- Growth in urban centers and coastal areas
- Climate Change, Environmental Monitoring
- Water Resource availability and quality
- Emergency planning, preparedness & response
- Aviation Safety

...and many more

Source: GTA Geoinformatik GmbH, www.gta-geo.de

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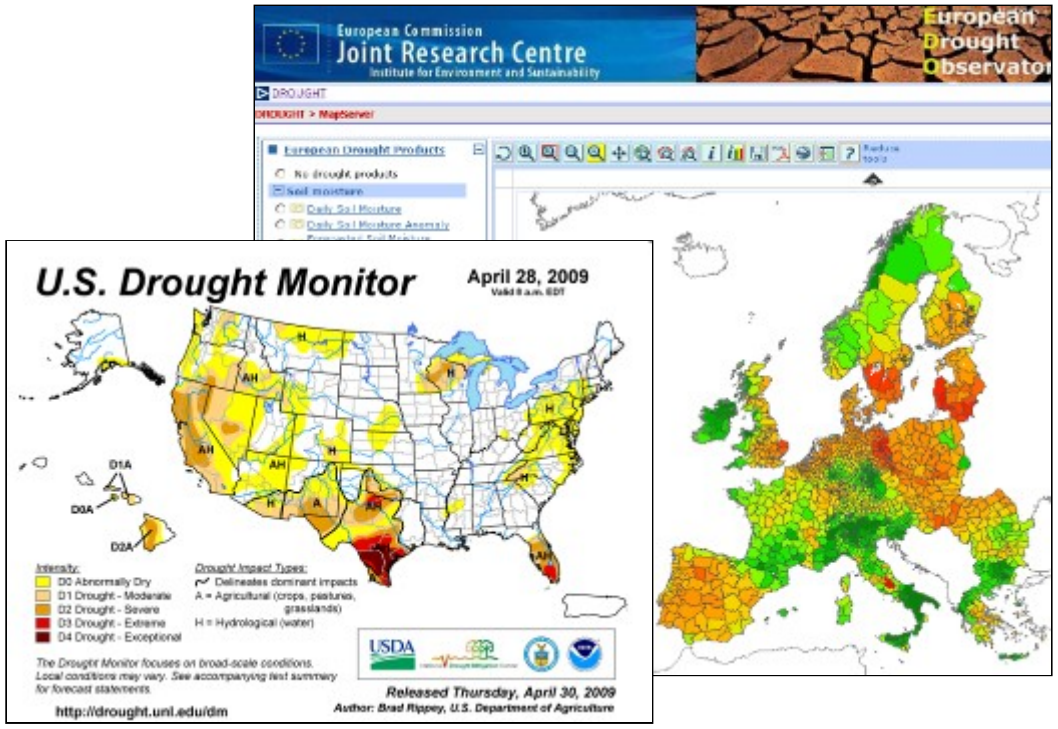

http://www.ogcnetwork.net/pub/ogcnetwork/GEOSS/AIP3/index.html

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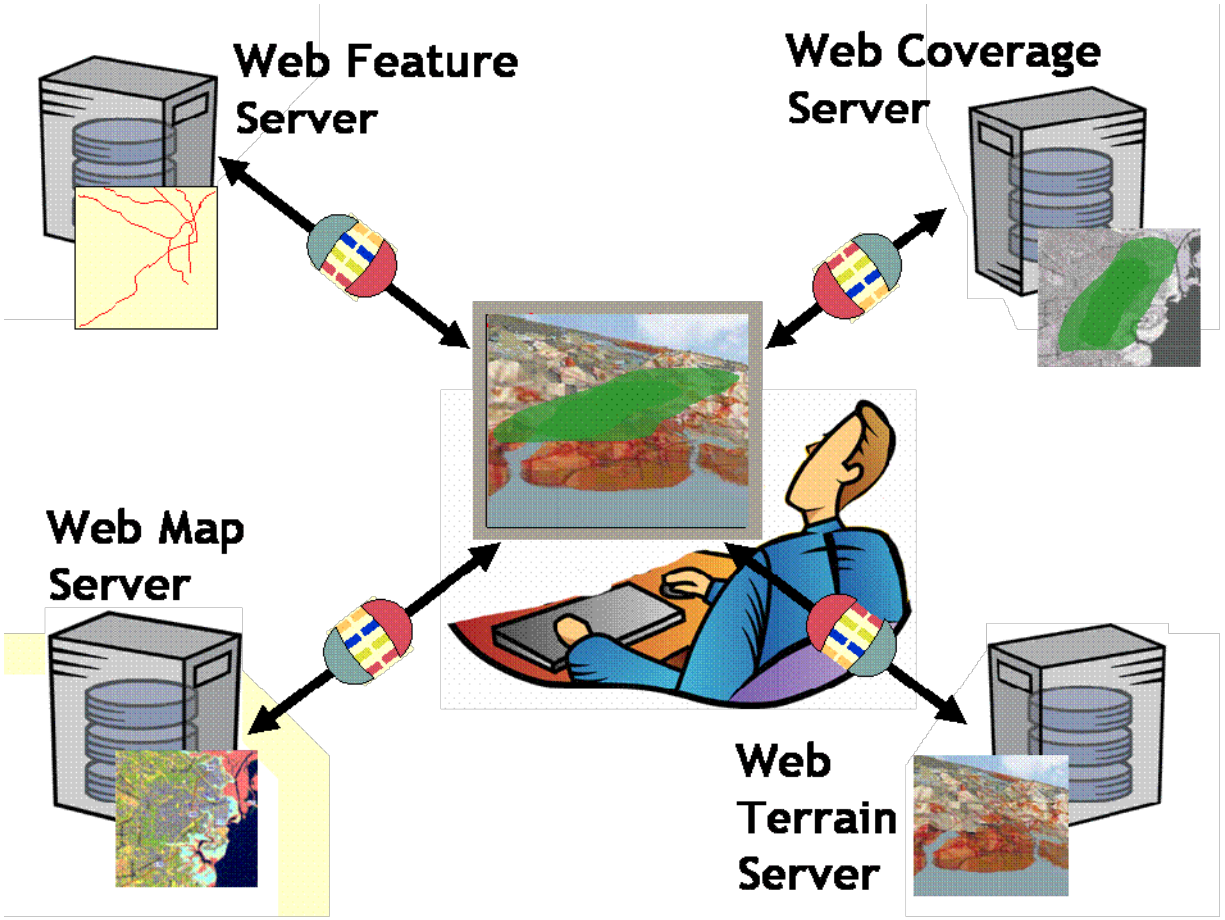
The Geospatial Web



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.

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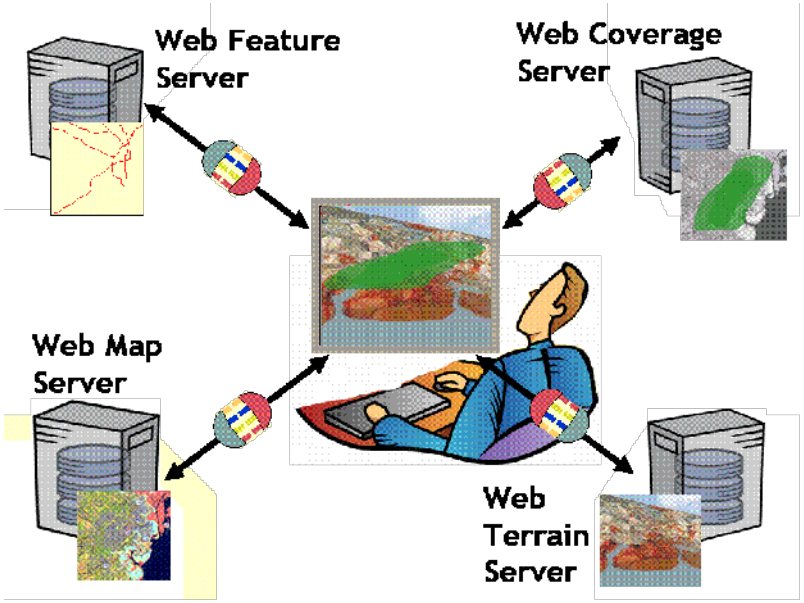
Major OGC Standards

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)**

OGC standards are Open Standards: Freely and publicly available, no license fees, vendor neutral.

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

* “Minds, like parachutes, function better when open (...).”
L.E. Modesitt, Jr., American Author (1943 --)

Source picture: http://www.all-hd-wallpapers.com/wallpapers/sports/425236.jpg

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
- 480+ member organisations (industry, government, academia) (May 2013) http://www.opengeospatial.org/ogc/members
- 23 staff members
- 35+ 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

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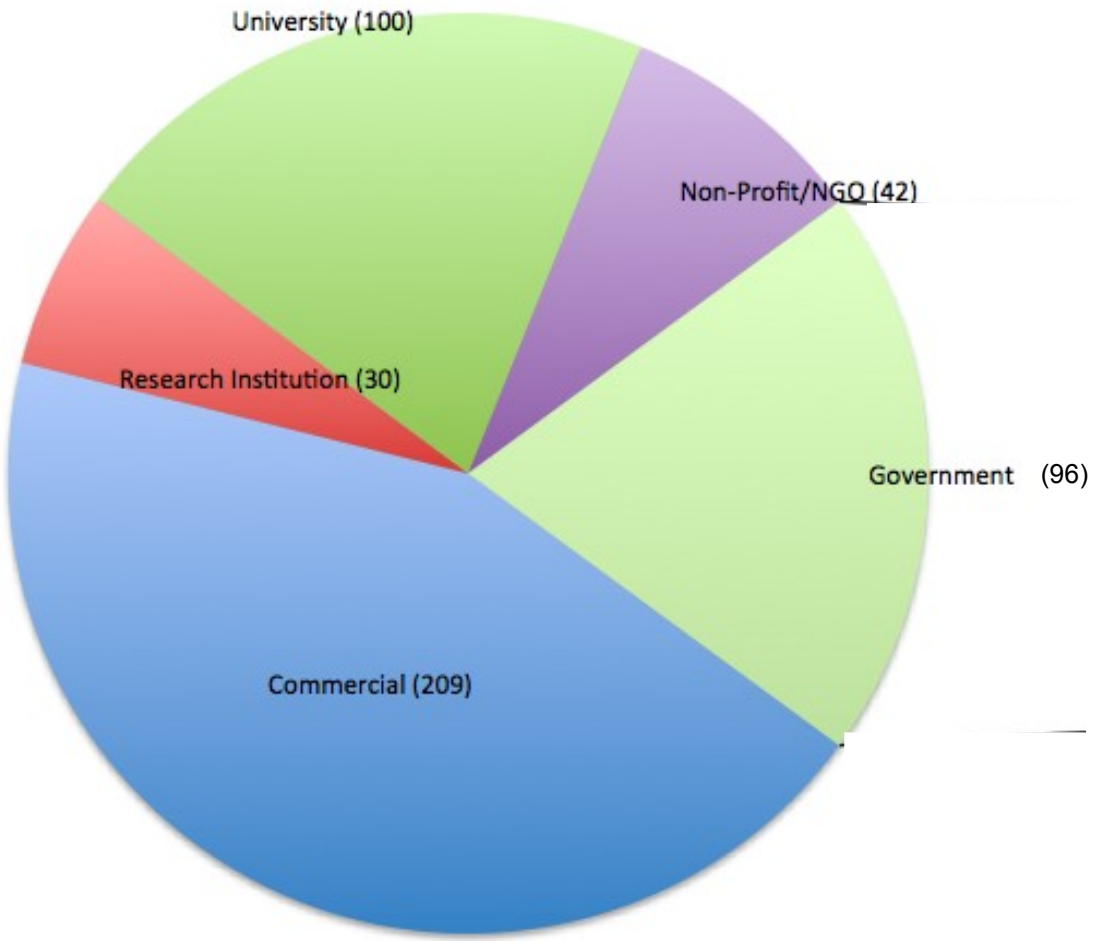
OGC membership (May 2013)



Africa (4)

Asia Pacific (77)

Europe (213)

Middle East (10)

North America (177)

South America (3)

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OGC Members (examples)

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

Industry

- Oracle
- Google
- EADS Astrium
- RapidEye
- Intergraph
- ESRI
- GE Smallworld
- Bentley Systems

Research & University

- Salzburg University (Austria)
- Feng Chia University
- LE2I - UNIVERSITY OF BOURGOGNE
- University of Pretoria
- EDINA

Government

- Geoscience Australia
- National Institute of Advanced Industrial Science & Technology (AIST)
- BRGM (France)
- Polish Geological Institute – National Research Institute
- Geological Survey of Finland
- GeoConnections (Canada)
- UK Natural Environment Research Council (NERC)
- Ministry of Infrastructure and the Environment (Netherlands)
- Eurocontrol
- EMSA (European Maritime Safety Agency)
- Ministère des Ressources naturelles et de la Faune (Gouvernement du Québec) (MRNF)
- Surveying Authorities of the States of the Federal Republic of Germany
- Rotterdam Municipality
- Dubai Municipality

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Why to get engaged in OGC Programs?

- Improve choice and competition in the marketplace
- Reduce technology risks
- Opportunity to cooperatively develop and influence open standards
- Early insight into user requirements for interoperability
- Bring new standards-based products and services into the marketplace earlier
- Broaden market reach via products that implement OGC standards
- And many more...

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OGC Programs

How does OGC work?

http://www.opengeospatial.org/projects

- **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).

Standards Setting

- Making use of **innovative processes** – for testing, verifying and documenting user requirements (→ Interoperability Program http://www.opengeospatial.org/ogc/programs/ip).

Rapid Interface Development

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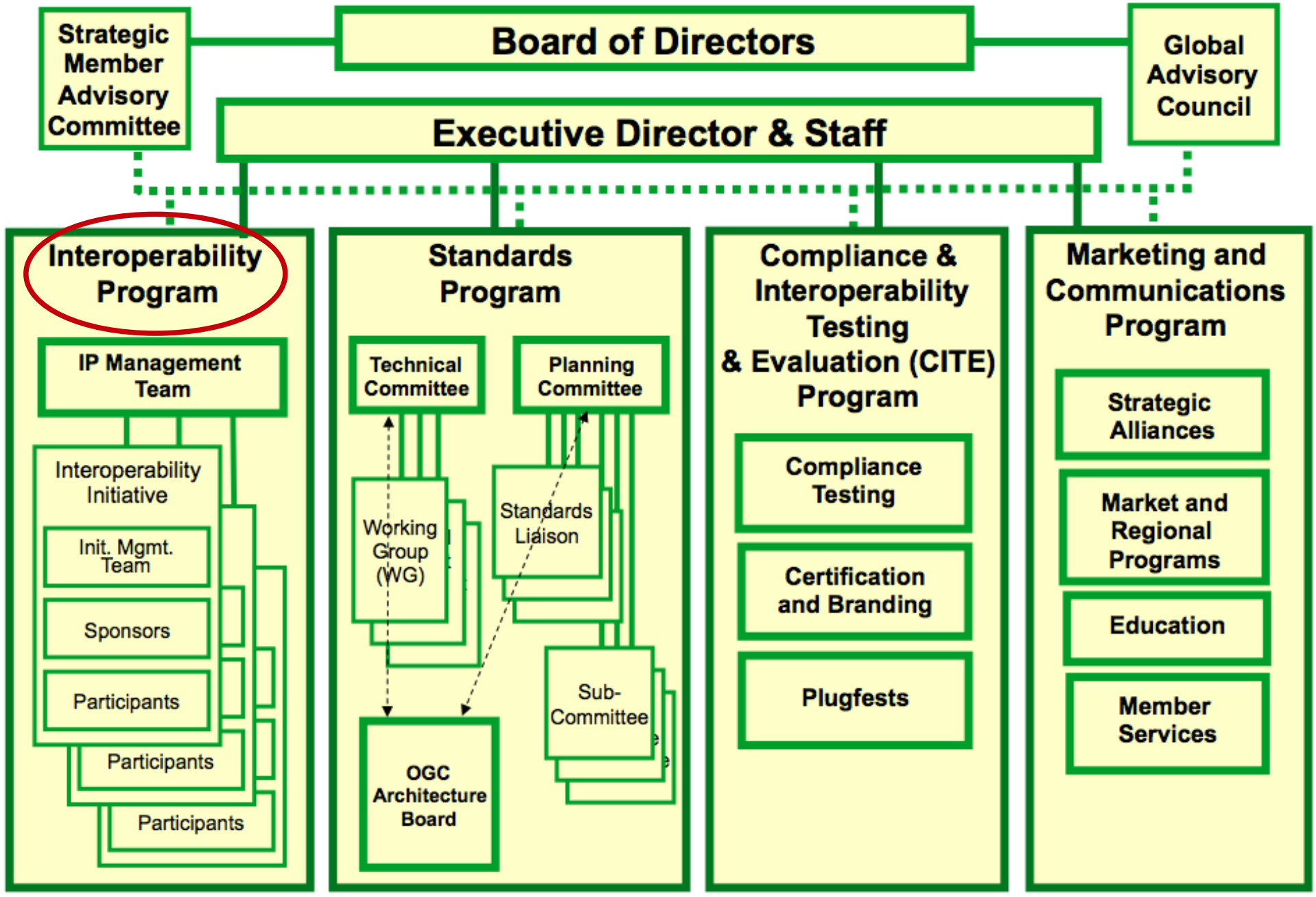
Strategic Member Advisory Committee
Board of Directors
Global Advisory Council
Executive Director & Staff
Interoperability Program
IP Management Team
Interoperability Initiative
Init. Mgmt. Team
Sponsors
Participants
Participants
Participants
Standards Program
Technical Committee
Planning Committee
Working Group (WG)
Standards Liaison
Sub-Committee
OGC Architecture Board
Compliance & Interoperability Testing & Evaluation (CITE) Program
Compliance Testing
Certification and Branding
Plugfests
Marketing and Communications Program
Strategic Alliances
Market and Regional Programs
Education
Member Services

OGC Interoperability Program

http://www.youtube.com/user/ogcvideo/videos
→ OGC Interoperability Program Introduction

Standards Development is not easy!
nteroperability involving geographic data and services
easier said than done...

Standards Development is not easy!

→ Requires understanding of differences

→ Requires cooperation on a global basis

→ Requires consensus by many organizations

→ Requires give and take

→ Requires certified, repeatable process

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What we need is...

- *… a setting that aligns technology users and providers to work collaboratively*
- … an agile development environment to evolve, test, and validate standards under marketplace conditions
- *… an effective way to share the costs of developing well-crafted standards that provide concrete foundations for future enterprise architectures*
- *… a repeatable process for building & exercising private-public partnerships to drive global trends in technology and interoperability*

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What is the 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 50 initiatives successfully conducted using proven policies and procedure

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Types of IP Initiatives

→ **Testbeds**

→ **Interoperability Experiments**

→ **Pilot Projects**

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Types of IP Initiatives - Testbeds

- **Testbeds** provide an environment for fast-paced, multi-vendor collaborative efforts to define, design, develop, and test candidate interface and encoding specifications.
  These draft specifications then move into the OGC Standards Program where they are reviewed, revised and potentially approved as new international standards.

Reduced Risk – Lower Cost – More Innovation – Agile Process

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OWS-9 testbed Activity Threads

http://www.ogcnetwork.net/ows-9 and http://www.youtube.com/user/ogcvideo

NGA & LMCO

Security and Services Interoperability (SSI)

- Security Management
- UML-GML Schema Tools
- Web Services Façade
- Architecture Profiles
- Bulk Data Transfer

FAA & Eurocontrol

Aviation

- AIXM and WXXM
- Discover, Retrieve, Portray
- Geometry Processing
- Transmission to Aircraft
- Conceptual Mapping Tool

NGA

Compliance (CITE)

- WMS 1.3 Server
- WMS 1.3 Client
- WFS 2.0
- GML 3.2.1
- OWS Context 1.0
- SWE
- WCS–EO 1.0
- TEAM Engine

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

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

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Sponsors - Requirements and Funding

2,7 Mio US$ funding

- US National Geospatial Intelligence Agency (NGA)
- US Geological Survey (USGS)
- US Army Geospatial Center (AGC)
- US Federal Aviation Administration (FAA)
- EUROCONTROL
- US National Aeronautics & Space Administration (NASA)
- UK Defence Science & Technology Laboratory (DSTL)
- Lockheed Martin Corporation
- GeoConnections/Natural Resources Canada
- GeoViqua/CREAF/European Commission (EC)

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OWS-9 Participating Organizations: International Expertise

Onto OWS-10 testbed

http://www.opengeospatial.org/projects/initiatives/ows-10

Date	Milestone
January 2013	**Call for sponsors/1st Sponsor Meeting**
January-April 2013	**Concept development**
June 2013	RFQ (responses due in July)
September 2013	Kickoff meeting
March 2014	Demonstrations and final deliverables

Geospatial in the cloud

Augmented Reality

Data Quality and Provenance

Location Privacy

Internet of Things

Mobile Security

Conflation

Mobile Apps

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Types of IP Initiatives

- **Testbeds**
- **Interoperability Experiments** are brief, low overhead, formally structured and approved initiatives led and executed by OGC members to achieve specific technical objectives that further the OGC Technical Baseline.

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Examples from the Hydrology community

- **OGC Hydrology Domain Working Group**
  → joint OGC/WMO working group
  → http://www.opengeospatial.org/projects/groups/hydrologydwg
- Active OGC **ground water interoperability experiment (Phase 2)**
  → activity (began on 23 October 2012) will develop & test the candidate standard **OGC Groundwater Markup Language** (GWML) 2
  → harmonizing and advancing existing initiatives such as GWML1, the EU-INSPIRE effort, GeoSciML, and others
  → later: advance toward adoption as the OGC Groundwater Markup Language 2 (GWML 2) Standard.

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Example – CHISP US-Canadian Pilot Project (1)

In November 2012, members of the Open Geospatial Consortium (OGC) began a project called the OGC **Climate-Hydrology Information Sharing Pilot, Phase 1**, or CHISP-1, to test solutions to these shared modeling and assessment challenges.

- Climatology-Hydrology Information Sharing Pilot, Phase 1 (CHISP-1)
- Sponsors

GeoConnections

USGS science for a changing world

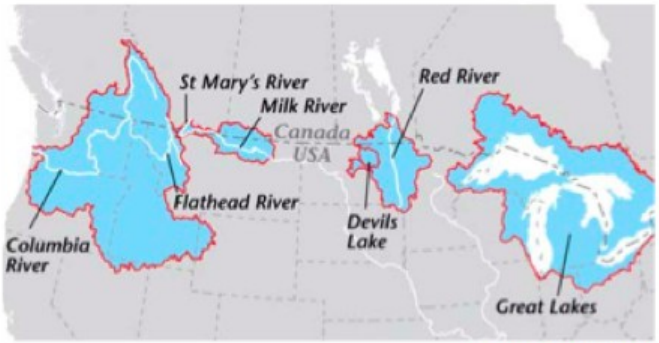
EPA United States Environmental Protection Agency

WATER WITHOUT BORDERS? INTRODUCTION

Flashpoints and Collaboration: How problems [illegible] solutions for Canada, the US, and the governance of shared waters

The Canada-US border offers a leading example of transboundary water governance.

These two countries have worked together for more than one hundred years – through changing economic and social climates – to co-manage shared resources. With more than 8,800 kilometres (5,468 miles) of shared borders (including 2,475 kilometres (1,537 miles) with Alaska), and huge bodies of water to co-manage (from the Great



Source: Original map.
Cartographer: Eric Leinberger, Department of Geography, UBC.

Content from Luis Bermudez (OGC)

Benefits

"The OGC process is really working: since OGC engaged with WMO and jointly created the Hydrology DWG, there has been active and effective work. (…) The global engagement in these developments is impressive. (…) The OGC Interoperability Program structure and policies provide an open, productive environment for all interested experts, and this has made more progress in the last two years than similar government initiatives have made in 20 years."

David Maidment, Director, Center for Research in Water Resources, University of Texas at Austin

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Types of IP Initiatives – Pilot Projects

- **Testbeds**
- **Interoperability Experiments**
- **Pilot Projects** apply and test OGC standards in real world applications using standards-based products that implement OGC standards. Pilot projects are an opportunity for users to understand how to best address their requirements using standards-based architectures.

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Example: GEOSS Architecture Implementation Pilot

The **OGC** is a participating organisation in the Group on Earth Observation (GEO) and **leads the GEOSS Architecture Implementation Pilot (AIP)** using the OGC Interoperability Program policy and procedures. AIP is part of Task IN-05 in the GEO Work Plan.

The GEOSS AIP develops and deploys new process and infrastructure components for the GEOSS Common Infrastructure (GCI) and the broader GEOSS architecture.

AIP is an agile and evolutionary development process.

The process was initiated in 2007.

→ **http://www.opengeospatial.org/projects/initiatives/geoss/ogc**

→ **http://www.ogcnetwork.net/AIpilot**

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GEO GROUP ON EARTH OBSERVATIONS

AIP-6 proposed Showcases – Water SBA

Source: David Maidment presenationa at Geospatial World Forum

Demo 1: „Improving & Using GEOSS by Building Better Water Information“

→ http://www.ogcnetwork.net/system/files/AIP6-Water_Demo_1_Summary_Univ_Texas_v1-7.pdf

Demo 2: „Federation of Regional Water Information Management“

→ using CUAHSI Hydrologic Information System (HIS), a standardsbased open-source solution, that allows regional agencies to communicate with each other and with the national center more quickly and effectively.

→ http://www.ogcnetwork.net/system/files/AIP6-Water_Demo_2_Summary_ARPA_v1-3.pdf

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GEO GROUP ON EARTH OBSERVATIONS

Deliverables of IP Initiatives

- **Technical Documents** (draft standards, best practices, change requests etc.)
- **Prototype Implementations** (services, clients, tools etc.)
- **Demonstrations** (see OGC youtube channel - http://www.youtube.com/user/ogcvideo)

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IP Program – Players & Return on Invest

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

Sponsors

→ Contribute financial resources in support of an initiative
→ Drive requirements, technical scope, agenda, demonstration form and content of an initiative

Participants

→ Contribute to the definition of interfaces, prototypical implementations and other engineering support
→ Contribute in-kind funding

Return on Invest

→ for every one US$ or € in sponsorship funding the testbeds have yielded between **2.5 and 4 times**
→ Participants contribute more in in-kind resources (labor, software, etc) than is provided in Sponsor funding.

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

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Benefits

- For Participants
  - **Early insight** into user requirements for interoperability,
  - **Early skill building; Early visibility; Early market deployment**
  - **Influencing** the development of standards in the context of user business cases
  - **Broaden market reach** via products that implement OGC standards
- For Sponsors
  - ***Ability to Determine Market Interest*** -- Process validates the willingness of industry to address specific interoperability issues requiring new standards
  - Rapid prototyping yields ***workable interface specifications in 4-6 months*** vs years for traditional standards processes
  - ***Vendors test, validate and demonstrate interface integrity*** by implementing candidate specifications in their products (reduces the risk that a proposed standard will not perform as intended)
  - Accelerated process encourages ***rapid time to market*** for Standards-based solutions

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Benefits - Quotes

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

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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

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Interoperability Program - Summary

Proven Process

- Accelerate development, testing, acceptance and refinement of standards & best practices

Effective Process

- Align industry in advancing standards in state-of-practice IT systems

Repeatable Process

- Over 40 initiatives successfully conducted using proven policies and procedures

Competitive Process

- Regularly yielding a high-level of industry participation and cooperation

Cost effective Process

- For sharing expertise and cost while gaining early marketplace insight and advantage

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More examples
OGC Domain and Standards Working Groups

… OGC Domain Working Groups

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

Domain Working Groups

Domain Working Groups (DWG or WG) provide a forum for discussion of key interoperability requirements and issues, discussion and review of implementation specifications, and presentations on key technology areas relevant to solving geospatial interoperability issues.

Name	Lead **
3DIM DWG (3DIM DWG)	Scott Simmons, CACI International Inc.
Architecture DWG (Arch DWG)	Doug Nebert, US Geological Survey (USGS)
Aviation DWG (Aviation DWG)	Navin Vembar, FAA System Operations Airspace and AIM Office
Catalog DWG (Cat DWG)	Doug Nebert, US Geological Survey (USGS)
Coordinate Reference System DWG (CRS DWG)	Victor Minor, Blue Marble Geographics
Coverages DWG (Cover DWG)	Peter Baumann, FORWISS (Bavarian Research Centre for Knowledge Based Systems)
Data Preservation DWG (PreservDWG)	Steve Morris, North Carolina State University
Data Quality DWG (DQ DWG)	Matt Beare, 1Spatial Group Ltd.
Decision Support DWG (DS DWG)	Stan Tillman, Intergraph Corporation
Defense and Intelligence DWG (D and I DWG)	Lucio Colaiacomo, European Union Satellite Centre
Earth Systems Science DWG (ESS WG)	Phillip Dibner, Ecosystem Research
Emergency & Disaster Management DWG (EDM DWG)	Lewis Leinenweber, SE Solutions, Inc.
Geo Rights Management (GeoRM) DWG (GeoRM DWG)	Roland Wagner, BHT-Berlin (Beuth Hochschule für Technik Berlin)
GeoBI DWG (GeoBI DWG)	Raj R. Singh, Open Geospatial Consortium, Inc.
Geography Markup Language (GML) DWG (GML DWG)	Ron Lake, Galdos Systems Inc.
Geometry DWG (GeometryDWG)	John Herring, Oracle USA
Geosemantics DWG (Semantics)	Joshua Lieberman, Deloitte Financial Advisory Services, LLP
Hydrology DWG (Hydrology DWG)	David Lemon, CSIRO
Location Services DWG (LS DWG)	Marwa Mabrouk, Esri
Mass Market DWG (MassMarket DWG)	Ed Parsons, Google
Metadata DWG (Metadata DWG)	David Danko, Esri
Meteorology & Oceanography DWG (Met Ocean DWG)	Chris Little, UK Met Office

…provide a forum for discussion of key inter-operability requirements and issues (…)

… and Standards Working Groups

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

Standards Working Groups

Standards Working Groups (SWG) have specific charter of working on a candidate standard prior to approval as an OGC standard or on making revisions to an existing OGC standard.

Name	Lead **
ARML 2.0 SWG (ARML 2.0 SWG)	Martin Lechner, Wikitude GmbH
Catalogue Services 3.0 SWG (Cat 3.0 SWG)	Doug Nebert, US Geological Survey (USGS)
CF-NetCDF 1.0 SWG (CF-NetCDF1.0SWG)	Ben Domenico, University Corporation for Atmospheric Research (UCAR)
CityGML SWG (CityGML SWG)	Carsten Roensdorf, Ordnance Survey
ebRIM AP of CSW SWG (ebRIM AP of CSW)	Frédéric Houbie, Intergraph Corporation
ebXML RegRep SWG (ebXMLRegRepSWG)	Frédéric Houbie, Intergraph Corporation
GeoAPI 3.0 SWG (GeoAPI 3.0 SWG)	Martin Desruisseaux, GEOMATYS
Geographic Linkage Service 1.0 SWG (GLS 1.0 SWG)	Peter Schut, GeoConnections - Natural Resources Canada
GeoServices Rest SWG (GServRestSWG)	Satish Sankaran, Esri
GeoSPARQL SWG (GeoSPARQL SWG)	Carl Reed III, Open Geospatial Consortium, Inc.
GeoSynchronization 1.0 SWG (Geosync SWG)	Panagiotis (Peter) A. Vretanos, CubeWerx
GeoXACML SWG (GeoXACML SWG)	Jan Herrmann, Technische Universität München, Dept. of Informatics
GML 3.3 SWG (GML 3.3 SWG)	Clemens Portele, interactive instruments GmbH
GMLJP2 1.1 SWG (GMLJP2-1.1SWG)	Lucio Colaiacomo, European Union Satellite Centre
IndoorGML SWG (IndoorGML SWG)	Ki-Joune Li, Pusan National University
KML 2.3 SWG (KML SWG)	David Burggraf, Galdos Systems Inc.
O&M 2.0 SWG (OM 2.0 SWG)	Simon Cox, CSIRO
OLS 1.3 SWG (OLS 1.3 SWG)	Carl Stephen Smyth, MAGIC Services Sarl
Open GeoSMS SWG (Open GeoSMS SWG)	Kuo-Yu Chuang, Industrial Technology Research Institute
Ordering Services for Earth Observation Products SWG (order-eo1.0.swg)	Daniele Marchionni, European Space Agency (ESA)
OWS Common 1.2 SWG (OWSCommon1.2SWG)	James Greenwood, SeiCorp, Inc.
OWS Context SWG (OWScontextSWG)	David Wesloh, US National Geospatial-Intelligence Agency (NGA)

… work on candidate OGC standards prior to approval, make revisions to existing OGC standard.

Building Experience with Water Resources

Hydrology DWG

The Hydrology Domain Working Group is a Joint Working Group of the World Meteorological Organisation (WMO) and the OGC

The purpose of the Hydrology DWG is to provide a venue and mechanism for seeking technical and institutional solutions to the challenge of describing and exchanging data describing the state and location of water resources, both above and below the ground surface. The path to adoption will be through OGC papers and standards, advanced to ISO where appropriate, and also through the World Meteorological Organization's (WMO) and it's Commission for Hydrology (CHy) and Information Systems (WIS) activities.

While CHy has the recognized mandate to publish and promote standards in this area, OGC contributes to the process with its resources and experience in guiding collaborative development among disparate participants in a rapidly evolving technological environment. The OGC Hydrology DWG will provide a means of developing candidate standards for adoption by CHy as appropriate.

The Hydro DWG isopen to both member and non member participation and is intended to be a public forum for communication, and both the email list and the wiki are open to interested parties.

Co:Chairs: David Lemon (CSIRO), Ilya Zaslavsky (SDSC) and Ulrich Looser (GRDC)

→ **http://www.opengeospatial.org/projects/groups/hydrologydwg**

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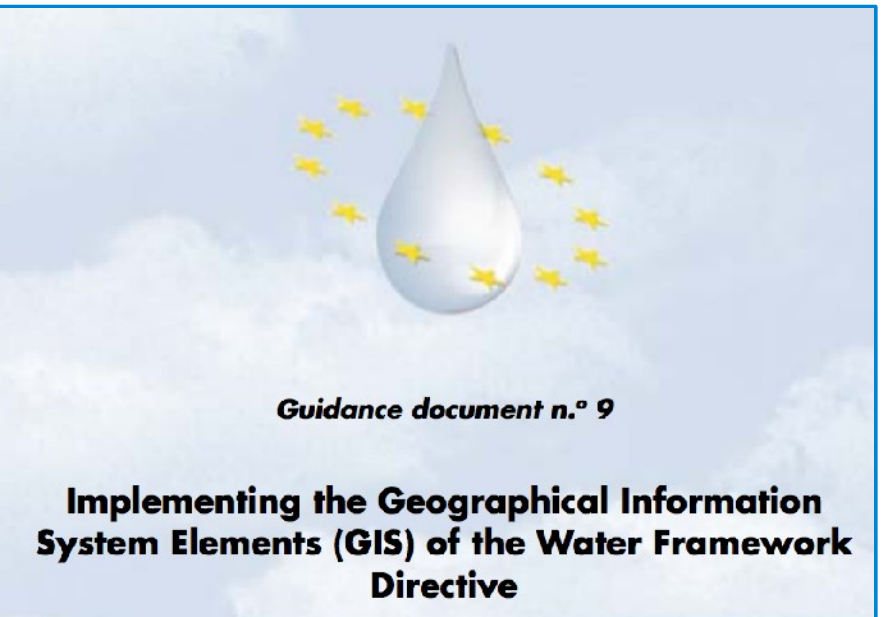
“Once you have understood how much open standards can underpin environmental policies, you keep trying to convince others. This is exactly what we at OIEau have been doing for years now in France and in other nations. I really enjoy taking part in this movement and will continue planting open standards seeds wherever I can.“

Sylvain Grellet (IOEau)
http://www.opengeospatial.org/blog/1667



… mentions various OGC standards.
http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents

More relevant Domain and Standards WG

- **Domain Working Groups** http://www.opengeospatial.org/projects/groups/wg
  - Earth Systems & Sciences
  - Meteorology & Oceanograpgy
  - Sensor Web Enablement
  - 3DIM / Land Development → what about BIM community?
    → Civil Engineering?

- **Standard Working Groups** http://www.opengeospatial.org/projects/groups/swg
  - GeoSciML (IUGS-CGI/OGC working group)
  - WaterML
  - CityGML (3D urban models)
  - What else? → Sensor Web Enablement
    → Augmented Reality ML (ARML)?

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Value & Benefits of Open Standards

- Various levels of benefits (results from a NASA study on the use of open GI standards)
  - Easy sharing, data availability and accessibility can put **value** to your data
  - Better decision making ability, institutional **effectiveness, efficient** use of taxpayer resources
  - Intragovernmental cooperation, **ease of intergration** of various data sources

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Some closing thoughts and discussion

→ progress made to address needs of Geoscience community

→ don't re-invent the wheel, share experience

→ contribution and cooperation

Some closing thoughts

- Substantial progress has been made in advancing open standards to address the needs of the Geoscience community

- There is much more work to do!
  Contribute and work together – participation in the international standardisation process is paramount for success.

- Don't re-invent the wheel and avoid duplication of work and efforts - If you need to share data, why not also share your experiences and build on existing one.

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Thank you for your attention
... and questions?

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