



# Open Standards and the EO Community: processes, applications and value

**Earth Observations for the Social Benefits of the Balkans  
Post-GEO Workshop  
Istanbul, Turkey - 18.-19. Nov 2011**

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**Open Geospatial Consortium**  
**Director European Services**

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**<http://www.opengeospatial.org>**

**With support from  
Nadine Alameh and George Percivall (OGC)**

# Agenda

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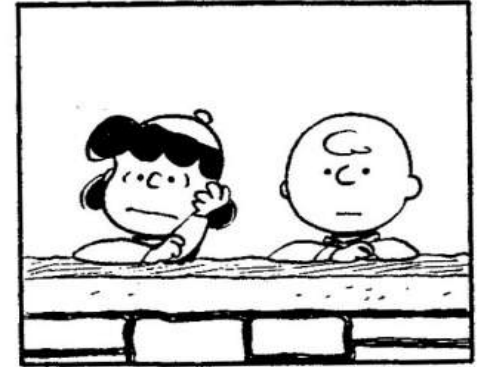


- **A few words about the OGC**
- **Interoperability and open standards**
- **The OGC addressing interoperability**
- **OGC Standards in use around the world**
- **Value, Benefits and Participation**

# View on standards...



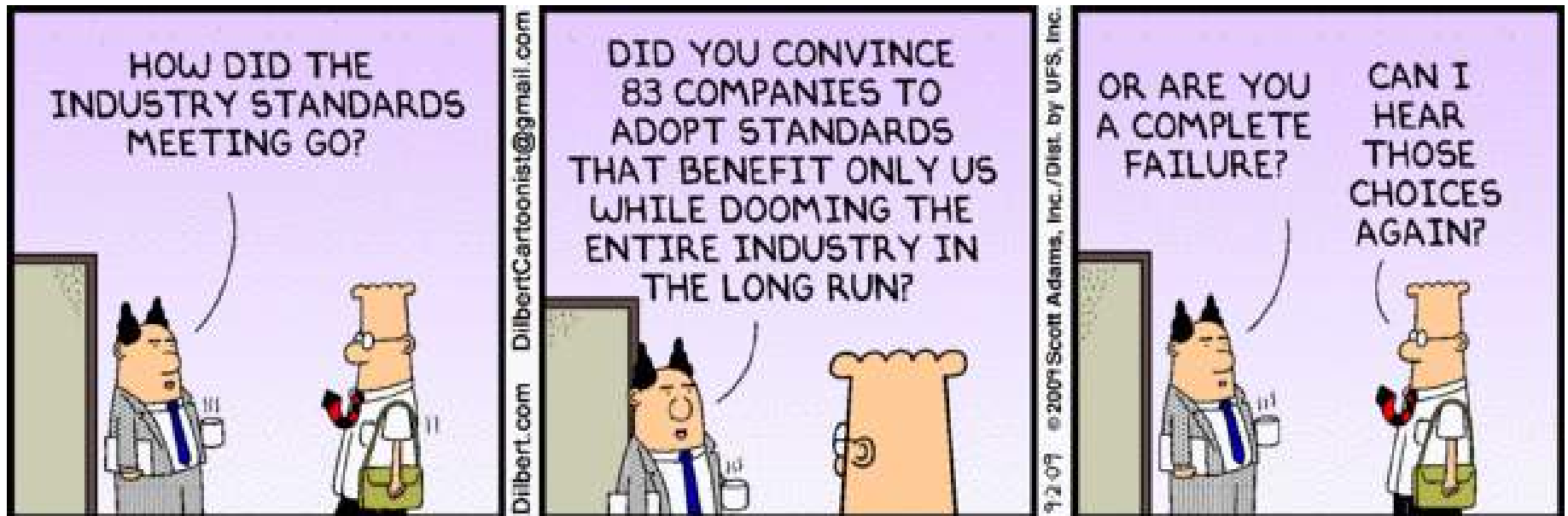
Standards development is boring...



Source:

<http://www.littlestuffedbull.com/images/comics/whereislucy/lucy-boring.jpg>

Or how others see them...



Source: <http://www.dilbert.com/strips/comic/2009-09-02/>

# Reality check



“... 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>.”

2004 NIST report titled "Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry,"

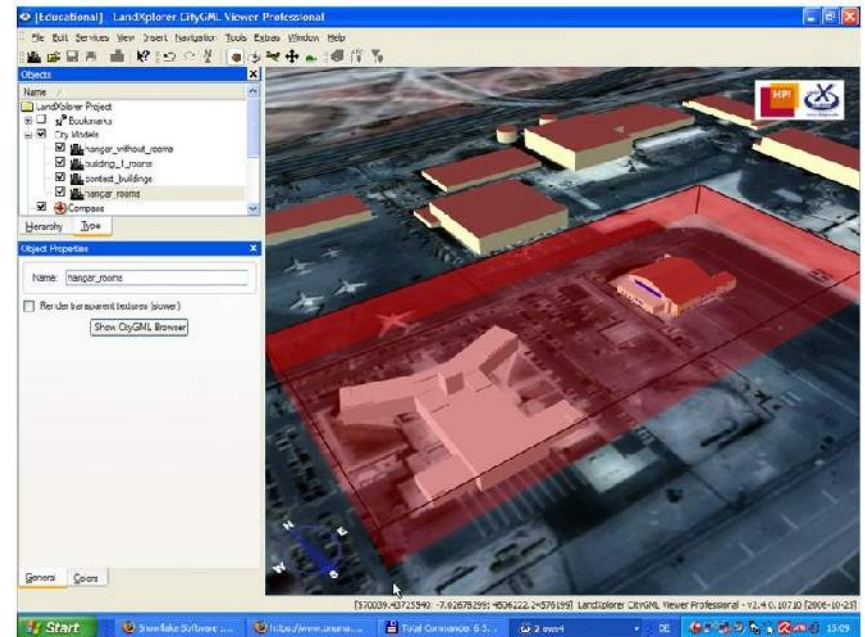
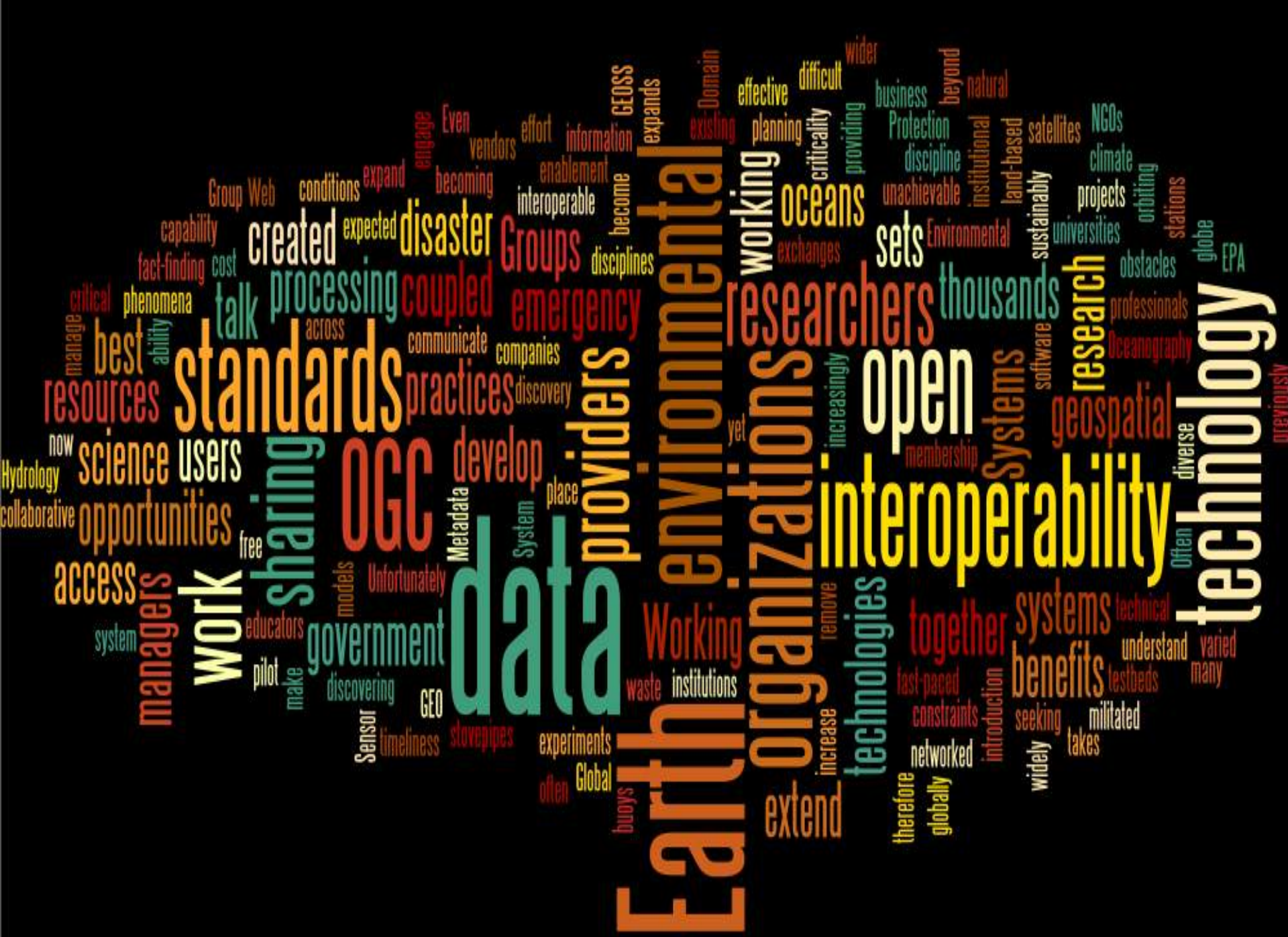


Image from OGC Web Services 4 Test Bed

<http://www.opengeospatial.org/projects/initiatives/ows-4>







Goddard  
Space  
Flight  
Center

JPL

UNIVERSITY OF  
MARYLAND

## Large Incidents - August 22, 2003



Terra (MODIS)



Aqua (MODIS)



MODIS Active Fire Map



Sensor Planning  
Services (SPS)



EO-1  
(ALI & Hyperion)



# Making Space-based Sensors Discoverable on the Internet Using A Service Oriented Architecture and Open Geospatial Consortium Standards

January 16, 2007

Dan Mandl NASA/GSFC

Co-authors:

Rob Sohlberg/Univ. of Md.

Stu Frye/MitreTek

Pat Cappelaere/Vightel

Steve Ungar/GSFC

Troy Ames/GSFC

Steve Chien/JPL



# Making EO-based Sensors discoverable

[esto.nasa.gov/sensorwebmeeting/Papers/Mandl.pdf](http://esto.nasa.gov/sensorwebmeeting/Papers/Mandl.pdf)

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## User can access:

- **Data from sensors**  
(space-based, unmanned aerial vehicles and insitu)
- **Services**  
to perform various levels of data processing
- **Models**  
which describe how to create desired science products from available sensor data

# Endorsement – NASA Sensor Web Vision



“... We have increased the flexibility of the systems while decreasing the turn-around and delivery times for new target-of-opportunity acquisitions important to the disaster management community through use of Sensor Web Enabled (SWE) services we developed in concert with OGC-sponsored pilots and testbeds. We are implementing more new product generation capabilities and improving the ease of integration of these new products in our processing stream using the SOA-web services approach and OGC standards.”

**Dan Mandl**  
**EO-1 Mission Manager**  
**NASA Goddard Space Flight Center**



# NASA Sensor Web Vision

Click to edit Master text styles

Second level

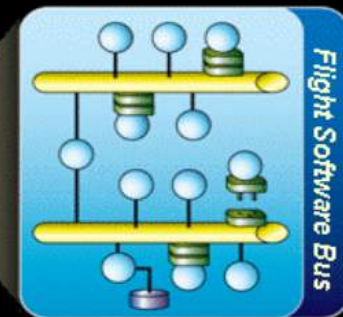
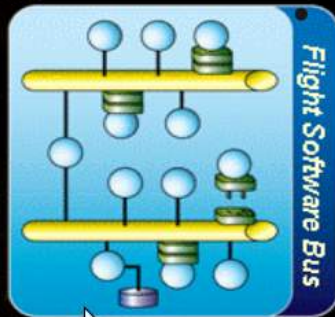
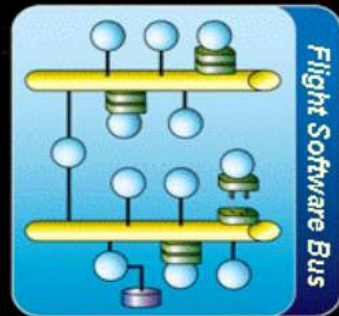
Third level

Fourth level

Fifth level

Manage complexity via simplicity  
using Internet methodology

1. Access via URI
2. Easy discovery
3. Easy upscale
4. Resource Oriented Architecture
5. Goal-oriented or theme based tasking
6. User/Event Driven



Plug-and-Play  
Flight Software

Software-driven  
Antenna Sensitivity  
Patterns - Software  
Tunes Reception to  
Targeted Satellite

Plug-and-Play  
Ground Software



Users



I N T E R N E T



# A few words about the OGC

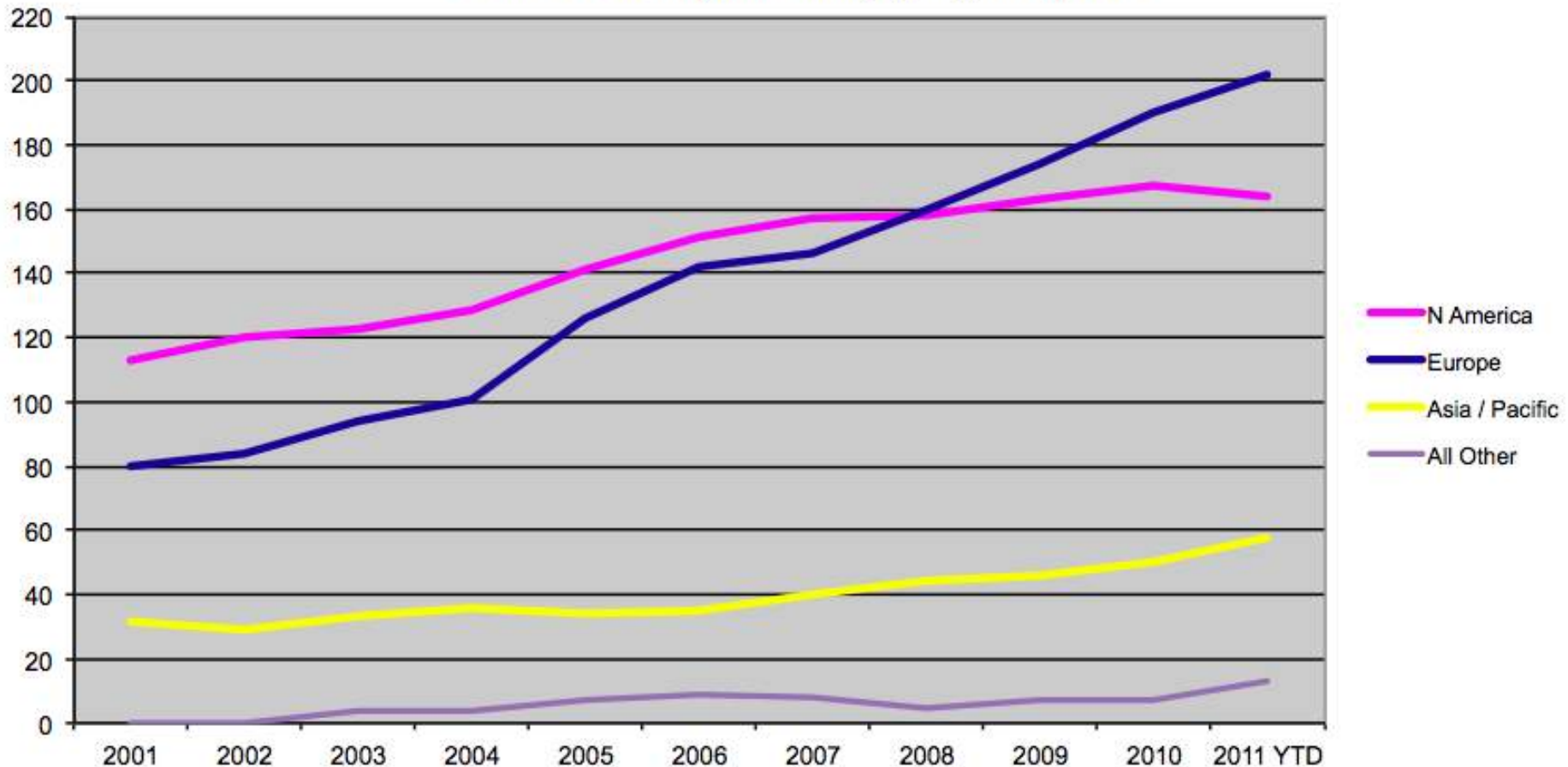
# OGC at a Glance



- Founded in 1994, not for profit, consensus based and voluntary
- 435+ member organisations (industry, government, academia) (Nov 2011) <http://www.opengeospatial.org/ogc/members>
- 30+ adopted OGC Standards (some are ISO Standards) <http://www.opengeospatial.org/standards>
- Several hundred software products, implementing OpenGIS Standards <http://www.opengeospatial.org/resource/products>
- Cooperation with other standards organisations, foundations and projects <http://www.opengeospatial.org/ogc/alliancepartners>

# OGC at a Glance

Member Census (Unit Count) by Region by Year



**Europe: 205, North America: 163, Asia/Pacific: 59,  
Middle East: 7, Africa: 4, South America: 2**



# OGC Members (examples –

<http://www.opengeospatial.org/ogc/members>)

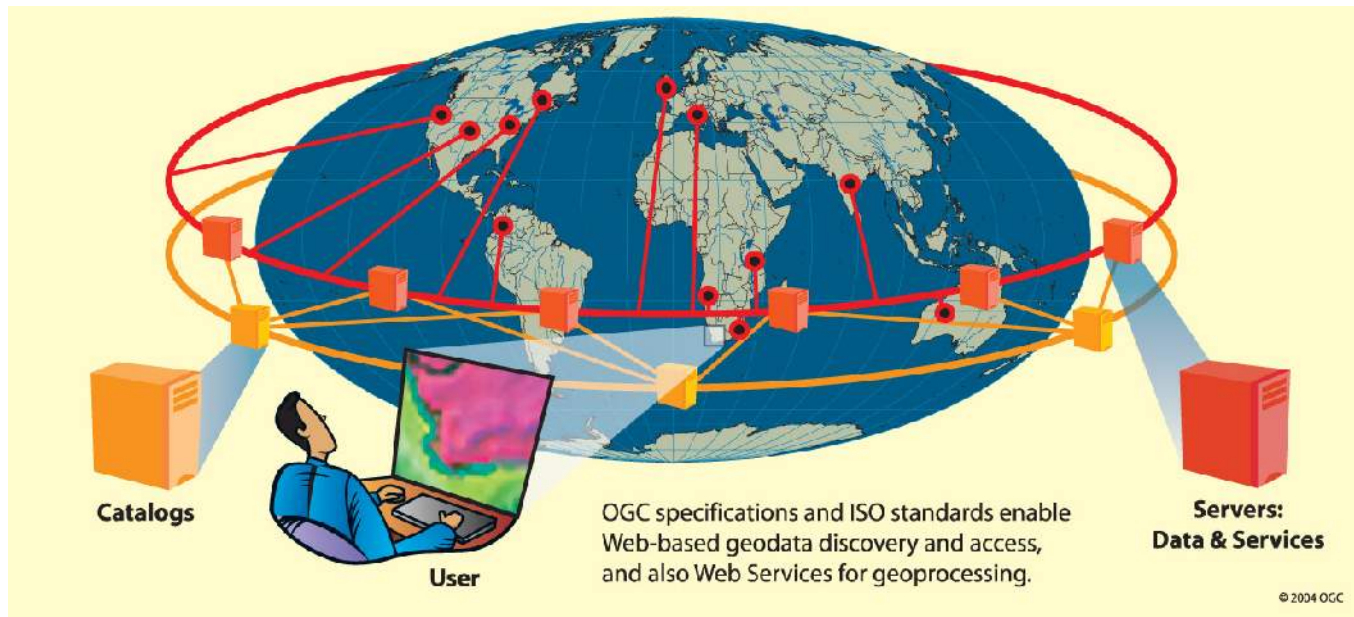


Australia (18)	Canada (20)	France (27)	Japan (10)
Austria (7)	China (2)	Germany (50)	Kenya (2)
Bahrain (1)	Chinese Taipei (4)	Greece (2)	Korea, Republic of (10)
Belgium (13)	Czech Republic (2)	India (11)	Latvia (1)
Brazil (1)	Denmark (4)	Ireland (2)	Malaysia (1)
Bulgaria (1)	Finland (4)	Italy (13)	Mexico (1)
		Netherlands (9)	Saudi Arabia (2)
		New Zealand (3)	Turkey (1)
		Norway (3)	United Arab Emirates (3)
		Poland (1)	United Kingdom (27)
		Portugal (1)	United States (142)
		Romania (1)	Venezuela (1)
			Switzerland (11)

# The OGC Mission



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

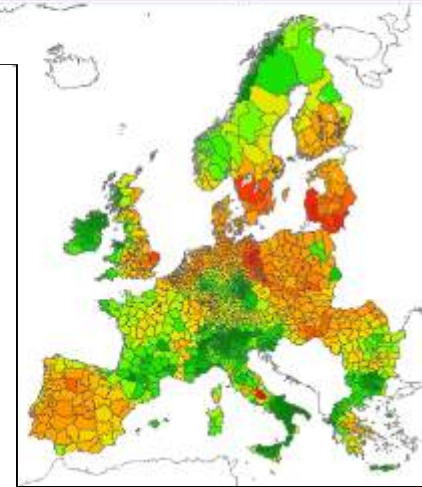
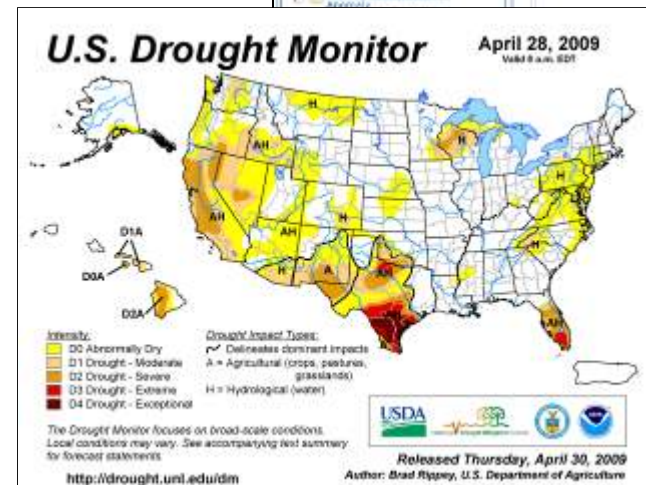


# Improving Knowledge Sharing and Transfer



**We are addressing critical issues, that need cooperation:**

- 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



# Standards Development is not easy!

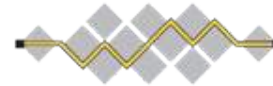


- Requires understanding of differences
- Requires cooperation on a global basis
- Requires consensus by many organizations
- Requires give and take
- Requires certified, repeatable process



# ... and does not exist in isolation

## Alliance Partners: Critical Resource for Advancing Standards



... and others

<http://www.opengeospatial.org/ogc/alliancepartners>



# Interoperability and Open Standards

# Interoperability – What OGC members say

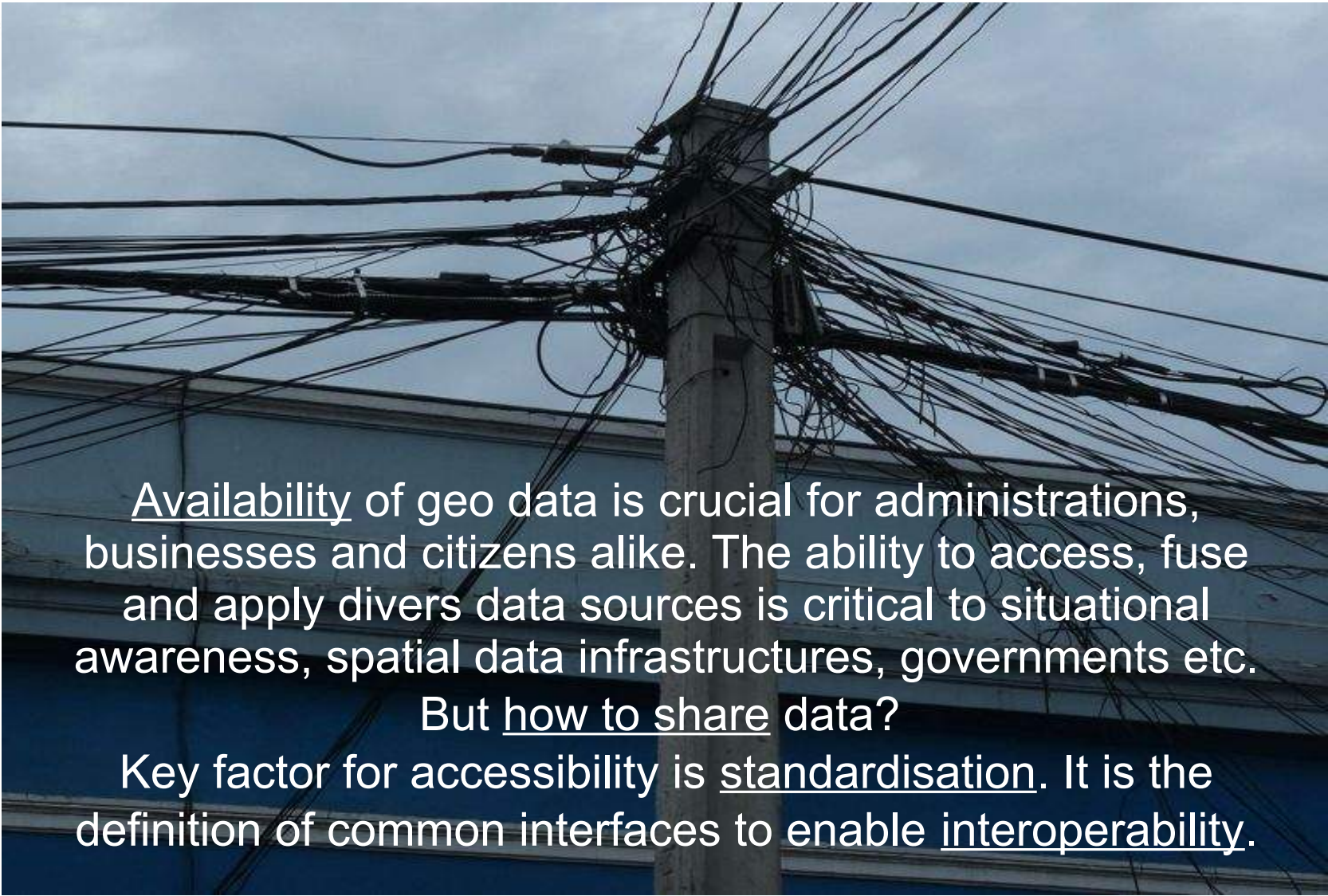
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## **OGC members identify interoperability problems:**

- „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.“

# Interoperability and Standards



Availability of geo data is crucial for administrations, businesses and citizens alike. The ability to access, fuse and apply divers data sources is critical to situational awareness, spatial data infrastructures, governments etc.

But how to share data?

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

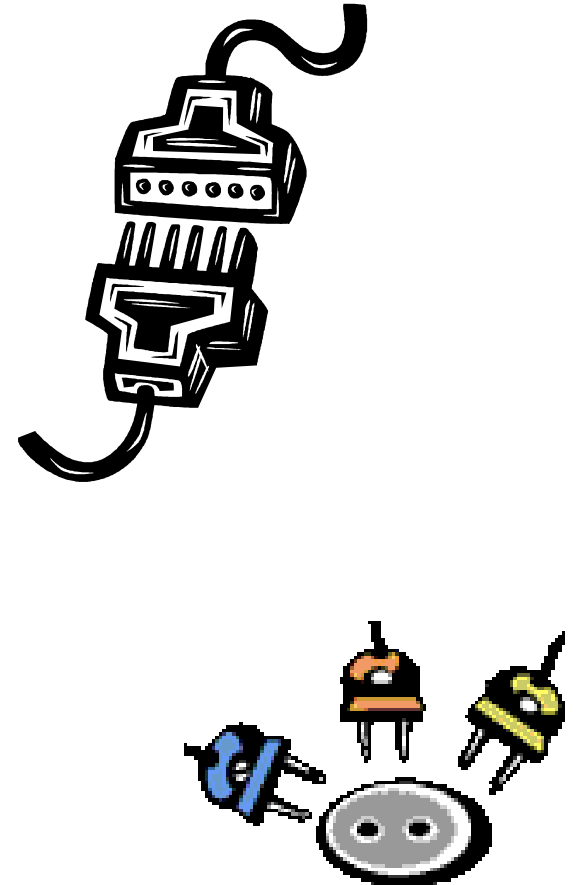



# What is Interoperability?



**"The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units"**

*Source: OGC Abstract Specification Topic 12: Services. Derived from ISO 2382-1.*



A person in a camouflage suit is rappelling down a large, green, geodesic dome structure. The dome is made of many triangular panels and has a central blue circular opening. The person is positioned in the lower left, and the text is on the right side of the image.

**Standards are  
like parachutes  
they work best  
when they're  
open.**

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

„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**

# 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](http://wiki.osgeo.org/wiki/Open_Source_and_Open_Standards)
- OGC standards are ***Open Standards***
  - Freely and publicly available
  - No license fees
  - Vendor neutral

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

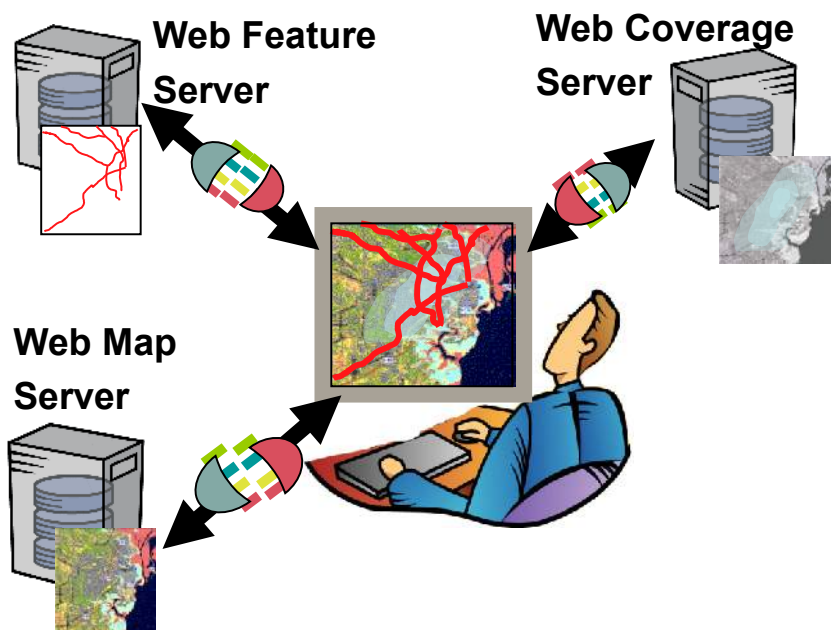
**Jim Willis, Director of e-Government at  
theRhode Island Secretary of State  
Office**



# What are OGC Web Services (OWS)?



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:



**Web Map Service (WMS)**

**Web Feature Service (WFS)**

**Web Coverage Service (WCS)**

**CityGML**

**Geography Markup Language (GML)**

**Web Map Context (WMC)**

**OGC KML**

**Sensor Web Enablement (SWE)**

**Others...**

**Relevant to geospatial information applications:**

**EO Information, Critical Infrastructure, Environment, Weather, Climate, Water, Homeland Security, Defense & Intelligence and others**

# Increasing use of EO through interoperability standards

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- OGC standards provide interoperability for Earth Observations
  - Remote sensors
  - In-situ sensors
  - Processing
- OGC standards used by the EO community are (examples):
  - OGC Web Map Service (OGC WMS)
  - OGC Web Coverage Service (OGC WCS)
  - Coverage Encodings
  - Sensor Web Enablement (SWE)
  - Web Processing Service (WPS)

**Further reading at:**

**<http://www.ogcnetwork.net/GeosciencesTutorial>**

# Increasing use of EO through interoperability standards



- OGC Web Map Service (WMS)

<http://www.opengeospatial.org/standards/wms> :

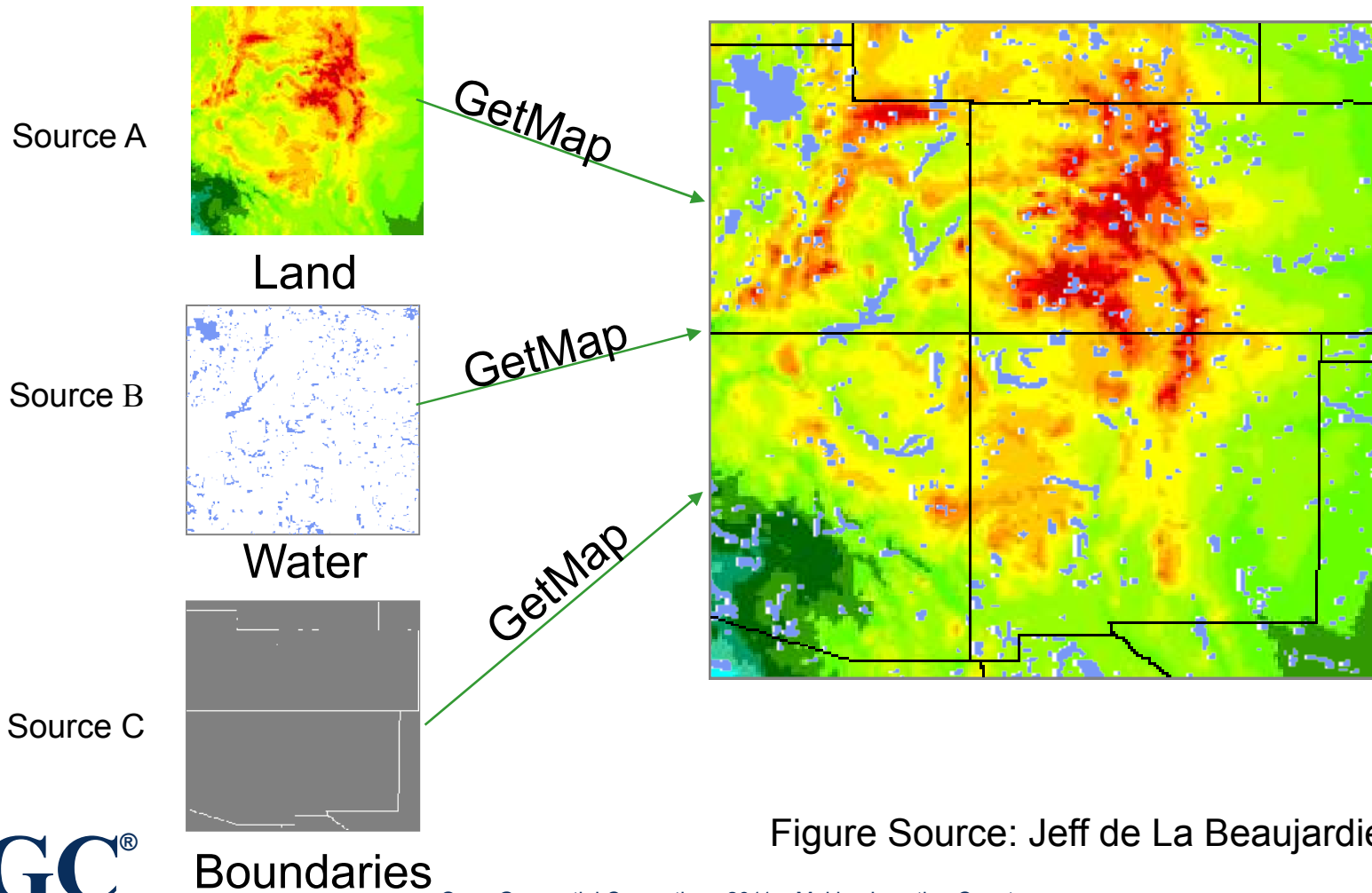


Figure Source: Jeff de La Beaujardiere, NASA

# OGC Coverages

further reading: <http://www.ogcnetwork.net/GeosciencesTutorial>



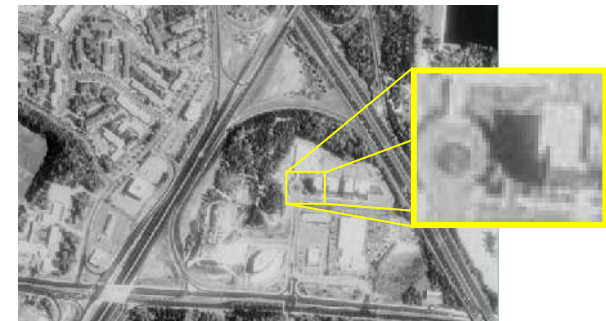
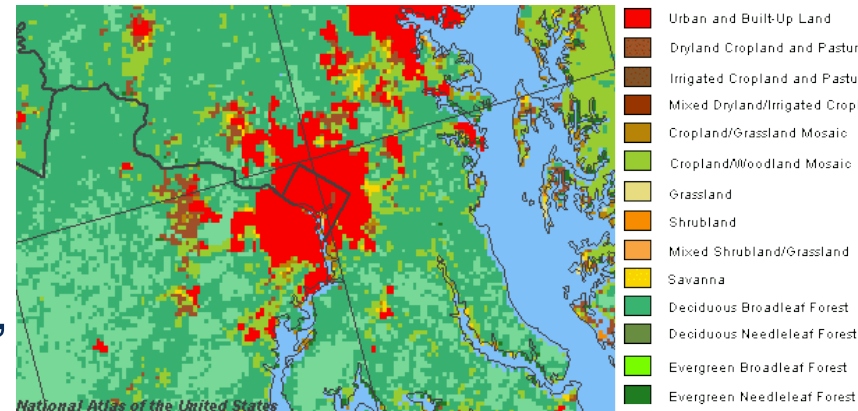
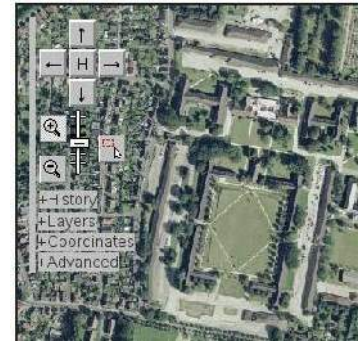
- **Coverage** = "space-time varying phenomenon"

- ISO 19123 (= OGC Abstract Topic 6)
- Today typically **raster**, but more defined (curved grids, meshes, ...)

- **Web Coverage Service (WCS)**

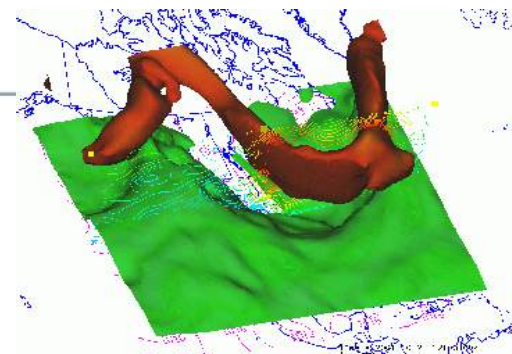
= coverage access service

- Get **original data** (or subset thereof), suitable for further processing
- [www.ogcnetwork.net/wcs](http://www.ogcnetwork.net/wcs)
- Coverage-related working groups within OGC: WCS.Standards WG, Coverages Domain WG





# OGC and NetCDF

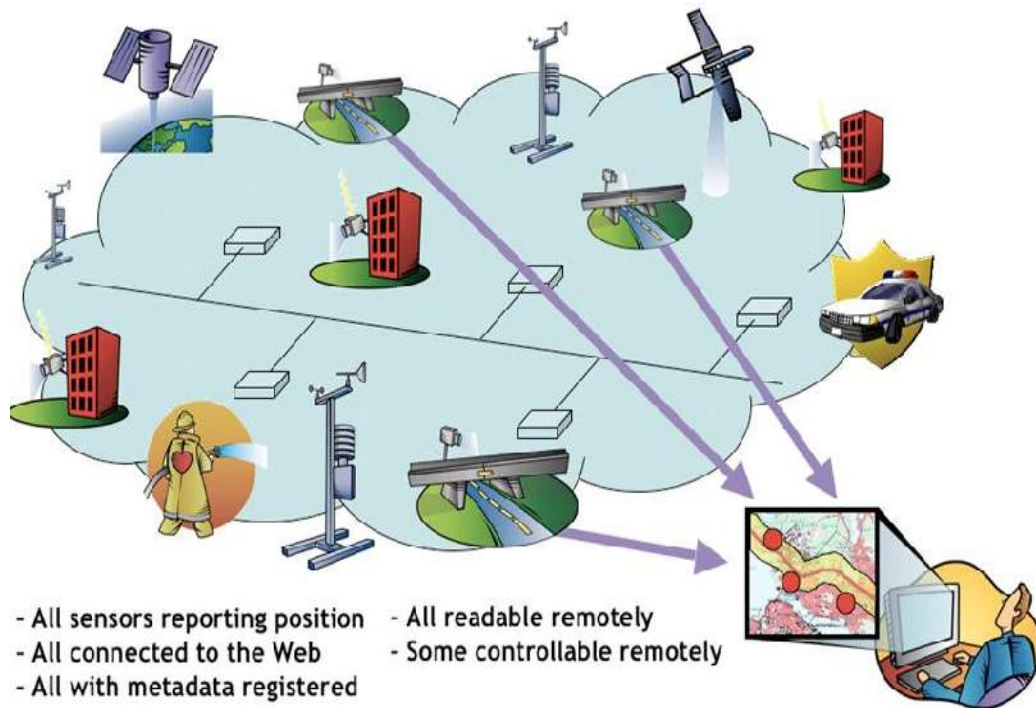


- **GALEON Interoperability Experiment: Geo-interface to Atmosphere, Land, Earth, Ocean, netCDF** <http://www.ogcnetwork.net/galeon>
- CF-netCDF
  - Encoding of geospatial data – digital geospatial information representing space/time-varying phenomena.
  - Development led by Unidata (University Corporation for Atmospheric Research with NSF sponsorship)
- OGC Standards Working Group currently active
  - Coordination with other groups (NASA and NOAA in particular)
  - <http://www.opengeospatial.org/projects/groups/cf-netcdf1.0swg>

# OGC Sensor Web Enablement (SWE)



Enables discovery and tasking of sensor assets, and application of sensor observations for enhanced situational awareness, much like HTML, and HTTP enabled WWW.



SWE is a suite of OGC standards:

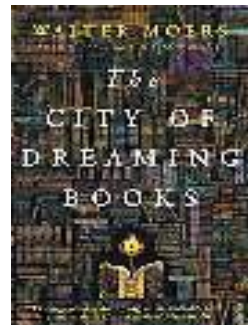
- SWE is an open, consensus-based set of standards
- 3 standard XML encodings (SensorML, O&M, TML)
- 4 standard web service interfaces (SOS, Sensor Alert Service SAS, SPS, WNS)
- SWE is a Service Oriented Architecture (SOA) approach

# Understanding OGC standards – the ORM\*

OGC Reference Model [www.opengeospatial.org/standards/orm](http://www.opengeospatial.org/standards/orm)



- What is the purpose of the ORM?
  - Overview of OGC Standards Baseline
  - Insight into the current state of the work of the OGC
  - Basis for coordination and understanding of the OGC documents
  - Resource for defining architectures for specific applications
- In Spanish
  - [http://external.opengeospatial.org/twiki\\_public/ILAFpublic/QueEsOpenGeospatial](http://external.opengeospatial.org/twiki_public/ILAFpublic/QueEsOpenGeospatial)





# **The OGC addressing Interoperability – an organizational perspective**



# How does OGC work?

<http://www.opengeospatial.org/projects>

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



“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***





# **OGC standards in use around the world**

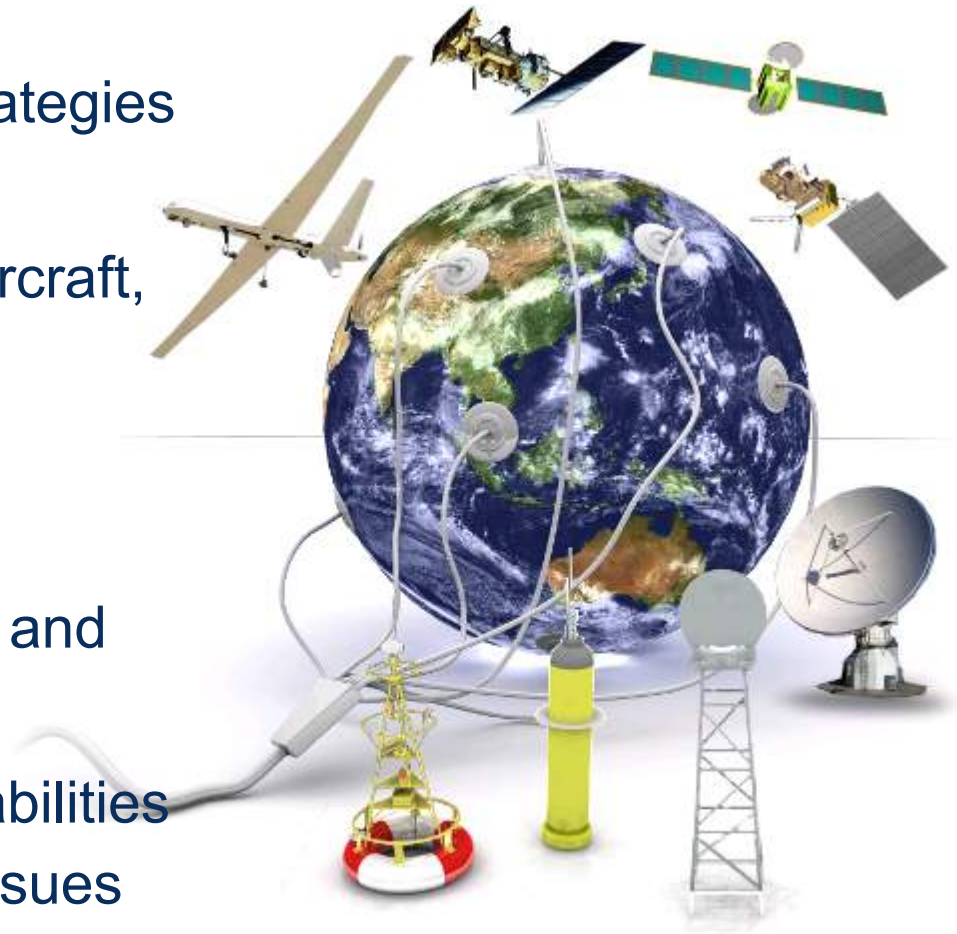
# GEOSS

## Global Earth Observation System of Systems



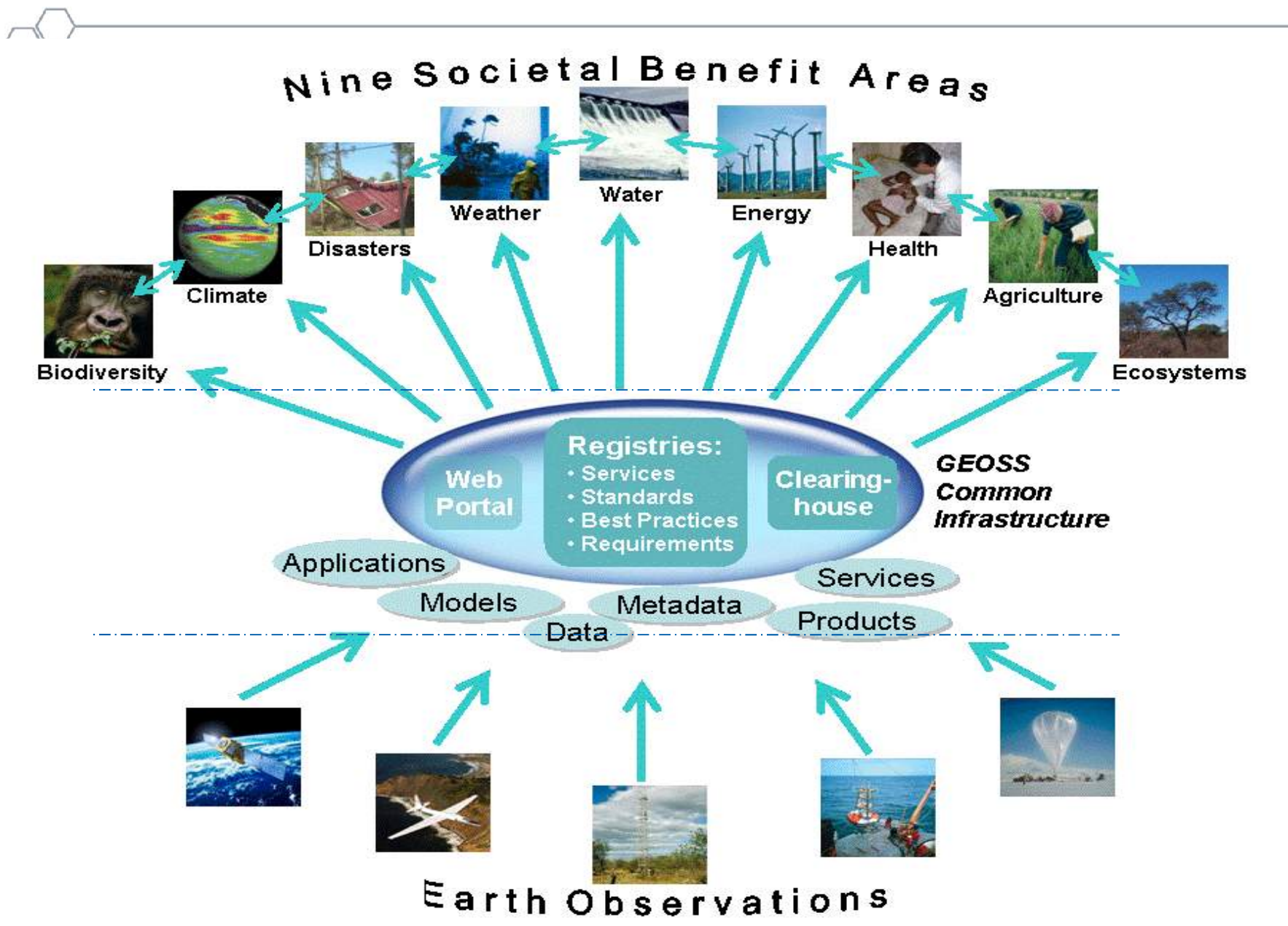
A distributed system of systems

- Improves coordination of strategies and observation systems
- Links all platforms: in situ, aircraft, and satellite networks
- Identifies gaps in our global capacity
- Facilitates exchange of data and information
- Improves decision-makers' abilities to address pressing policy issues





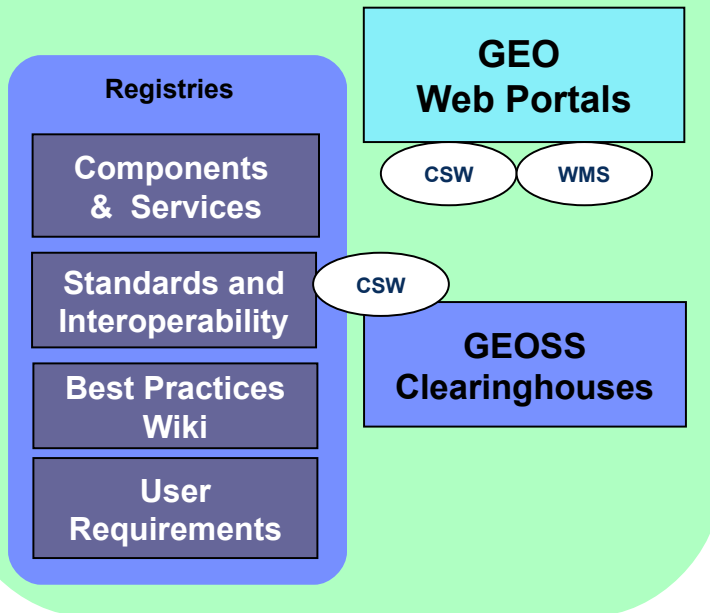
# GEOSS connects Observations to Decisions



# GEOSS Engineering Viewpoint

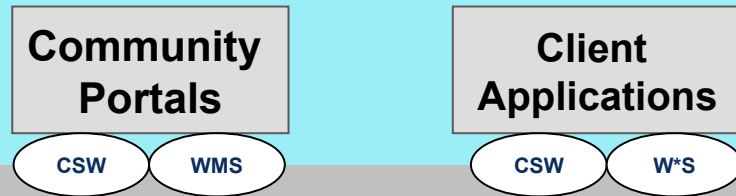
## GEOSS Common Infrastructure

Main GEO  
Web Site

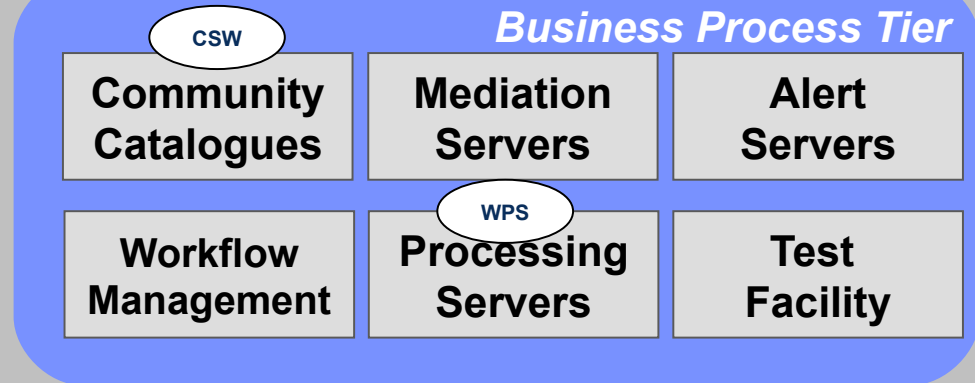


## Registered Community Resources

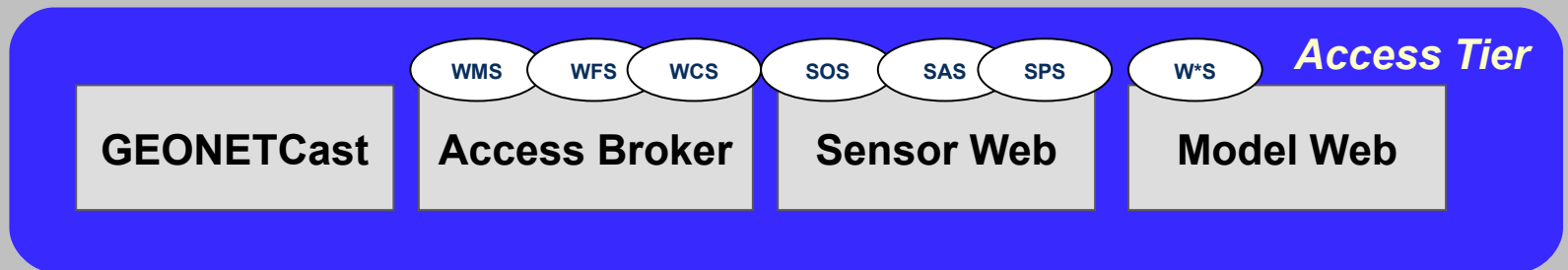
### Client Tier



### Business Process Tier



### Access Tier



# Architecture Implementation Pilot

<http://www.opengeospatial.org/projects/initiatives/geoss/ogc>

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- AIP is a series of pilot projects to prepare for evolution of the GEOSS architecture
- AIP-4 will improve access to the GEOSS datasets that support critical EO priorities (from study by GEO User Interface Committee).
- AIP phases in order to promote the availability of new data services, clients, and applications.

## **The goals of AIP-4 are to:**

- Increase on-line access to “Critical EO Priorities Data Sources”
- Ensure that datasets are discoverable through the GCI
- AIP-4 involves less new development than previous phases → better focus on access to priority EO data sources.

Afriterrra  
Astrium SpotImage  
CIESIN  
Compusult  
CREAF  
enviroGRIDS  
EO2HEAVEN  
EOX and Rasdaman  
EuroGEOSS - GENESIS  
EuroGEOSS - UncertWEB  
GENESI  
GeoViQua, QA4EO, ESIP  
GIS.FCU  
Graphitech

INCOSE  
INPE  
Jacobs University  
KNMI  
Mines ParisTech  
NASRDA  
NOAA DMIT  
NOAA & GMU  
PML  
PYXIS  
SIF  
TEAM Network  
Vighetel  
Wash Univ St.Louis





Accessibility  
to Critical  
Earth  
Observation  
Priority Data  
Sets

Thesaurus for  
Earth  
Observation  
Parameters

General and  
specialized  
software  
tools for  
using data

Tutorials to  
support data  
providers to  
get data  
online

AIP-4



## Activity #1

Tutorials  
and server  
toolkits to  
get earth  
observation  
data online

### WMS

Web  
Mapping  
Service

### WFS

Web  
Feature  
Service

### WCS

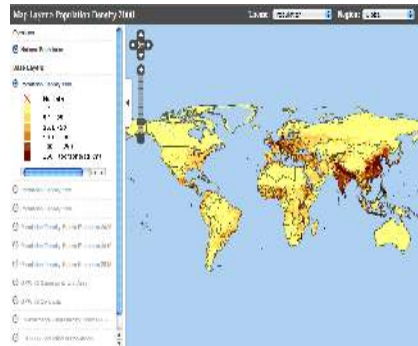
Web  
Coverage  
Service

### WPS

Web  
Processing  
Service

### SOS

Sensor  
Observa-  
tion  
Service



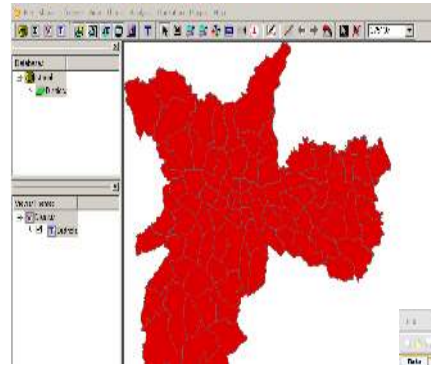
CIESIN Map Client



SOS Generator



CompuSult GEO Portal



INPE Terraview



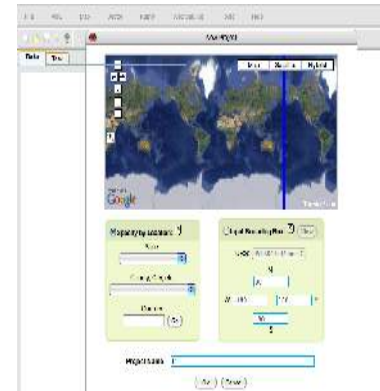
enviroGRIDS Client



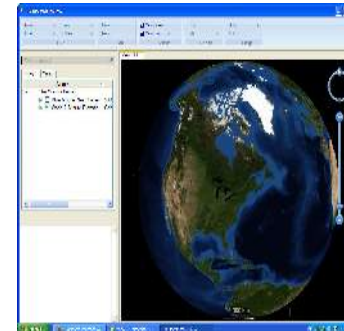
Graphitec BRISEIDE Client



GENESIS WebGIS



NOAA GMU GeOnAs



PYXIS Worldview

## Activity #2

Enabler  
components  
to explore  
earth  
observation  
data

# Disaster Prediction and Warning

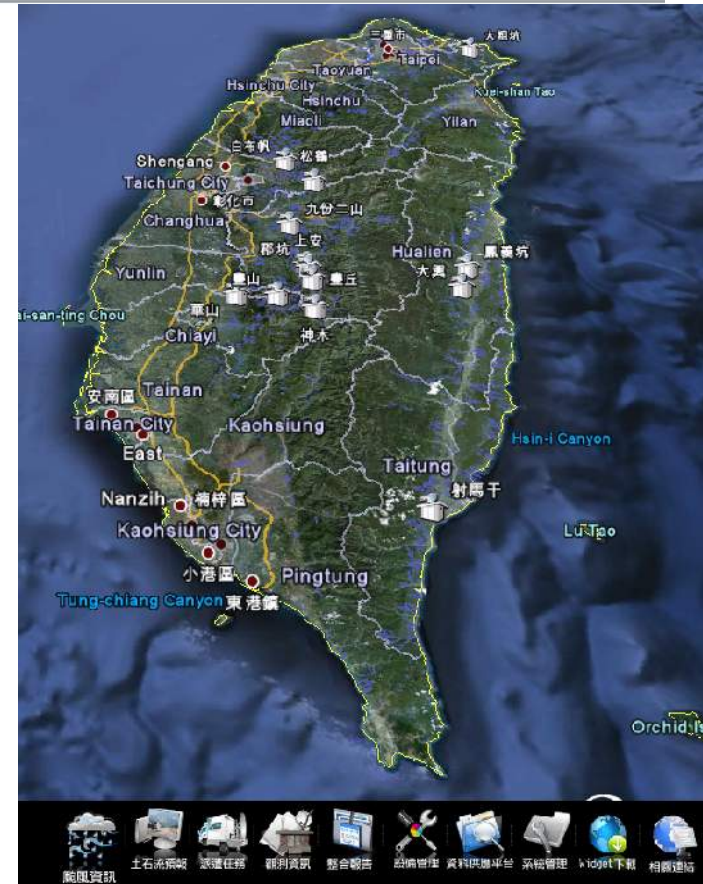


Typhoons and earthquakes trigger frequent landslides and flooding

OGC services used with an array of spatial data and sensors provide situational awareness for forecasting, detecting, alerting and response to debris flow situations.

Rapidly deployed network of debris flow sensors, and distributed services perform sensor data analysis and processing

**OGC**<sup>®</sup>



逢甲大學  
Feng Chia University





# Monitoring Stations

01. 白布帆站 (Baibufan Station)
02. 九份二山站 (Jiufen-Ershan Station)
03. 神木站 (Shenmu)
04. 上安站 Station(Shang-an Station)
05. 郡坑站 (Jyunkeng Station)
06. 豐丘站 (Fongciou Station)
07. 大粗坑站 (Dacukeng Station)
08. 鳳義坑站 (Fongyikeng Station)
09. 射馬干站 (Shemangan Station)
10. 華山站 (Huashan Station)
11. 大興站 (Dasing Station)
12. 豐山站 (Fongshan Station)
13. 松鶴站 (Songhe Station)
14. 坪頂站 (PingDing)
15. 蘇樂站 Station (Suru Station)
16. 玉峰站 (Yufong Station)
17. 下田埔站 (Shiatainpu Station)
18. 羌黃坑站 (Cianghuangkeng Station)
19. 集來站 (Jilai Station)
20. 來義站 (Laiyi Station)
21. 大鳥站 (Daniao Station)



Debris Flow Monitoring Station×17

Landslide Monitoring Station×1

Sediment Concentration Monitoring Station×3

Mobile Debris Flow Monitoring Station ×3

Portable Unit×14

# Anatomy of a Monitoring Station

## A typical layout of a fixed monitoring station





# Compound Events



甲仙鄉小林村災  
害

✓ *Compound hazards occurred  
at Xiao-lin Village, Jia-xien,  
Kaoshiung:*

- Flooding
- Shallow landslide
- Debris flow
- Deep landslide
- Dam failure

*Pre-typhoon*

*2008/11*



*Post-Morakot*

*2009/8*



# Compound Events



✓ *Compound hazards of  
at Xiao-lin Village, Ji  
Kaoshiung:*

- Flooding
- Shallow landslide
- Debris flow
- Deep landslide
- Dam failure





# AIP-5 Planning

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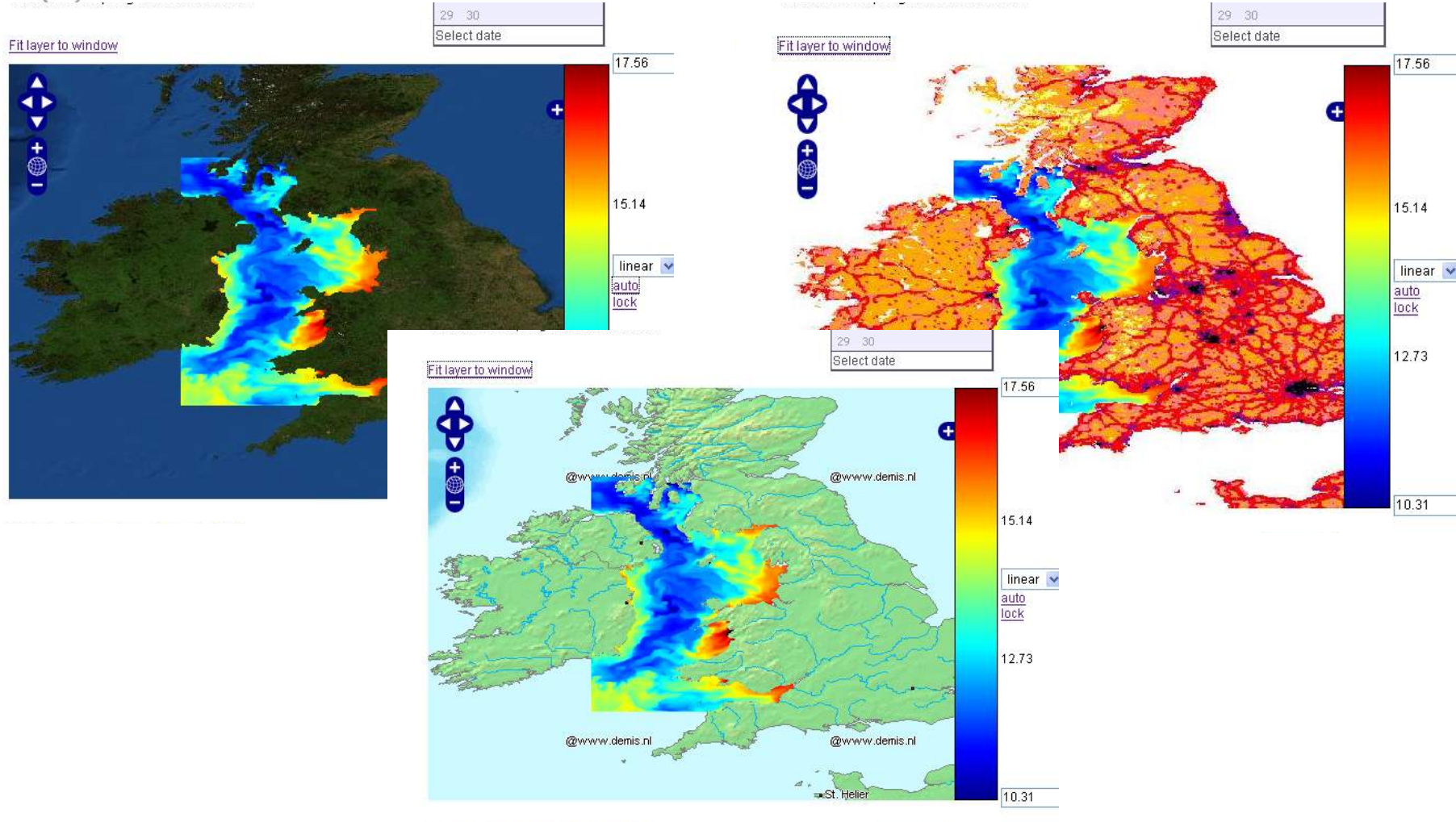
- Scenario based development based on requests
  - Energy
  - Health
  - Water
  - Disaster
- Draft Schedule:
  - Develop CFP: December to February 2012
  - Kickoff Workshop: April or May 2012
  - Development: 4 months
  - Complete for GEO Plenary in 2012



- HMA provides harmonised and standardised access to ESA mission data and to other mission ground segments
- HMA supports GMES (Global Monitoring for Environment and Security) operational scenarios needed to provide the GMES Services with the required data.
- OGC is the forum to discuss HMA proposed standards
  - OGC GML Application Schema for EO Products
  - OGC Cataloguing of ISO Metadata using ebRIM profile of CSW
  - OGC Ordering Services for Earth Observation Products
  - OGC Sensor Planning Service Application Profile for EO Sensors
  - OGC WMS EO Extension

# WMS interoperability in the portal

## Met Office UK & University of Reading



Thanks to Jon Blower (Uni Reading)



# Value, Benefits and Participation



# Disaster Prediction and Warning

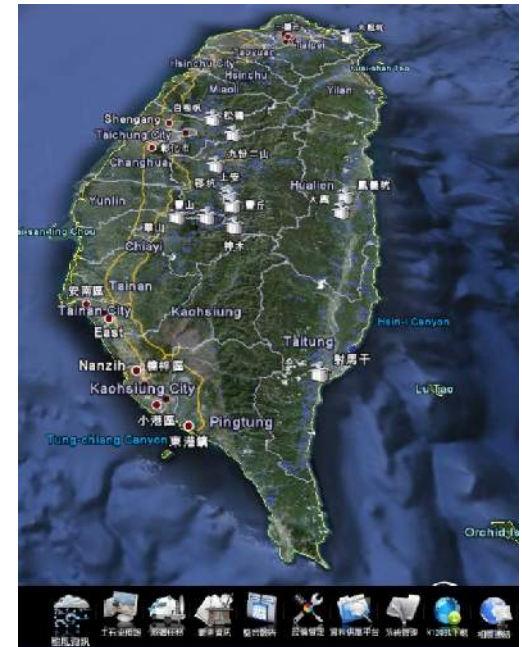
## Feng Chia University



“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



# OGC Business Value Committee

from data, to re-use and added value – translating interoperability



- **OGC Business Value Committee**

<http://www.opengeospatial.org/projects/groups/businessvalue>

<https://lists.opengeospatial.org/mailman/listinfo/business.value>

- Understand and articulate the advantages of developing and using OGC standards
- Enable the wider community of stakeholders to leverage business value as a tool to foster investment and implementation
- Survey on „Business Value of OGC Standards“
  - <http://www.opengeospatial.org/pressroom/pressreleases/1496>
- Help policy and decision makers to address the following:
  - Is the activity for public benefit? (Measure and record value)
  - What is the business driver? (Internal efficiency, customer satisfaction)

# Avenues for Public Input from the EO community

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- **Public Domain Working Groups (DWG)**

Offer a forum for discussion and documentation of interoperability requirements for a given information or user community, informal presentations and discussions about the market use of adopted OGC Standards (<http://www.opengeospatial.org/projects/groups/wg>)

- Hydrology DWG  
<http://www.opengeospatial.org/projects/groups/hydrologydwg>
- Emergency and Disaster Management  
<http://www.opengeospatial.org/projects/groups/edmdwg>
- Meteorology and Oceans DWG  
<http://www.opengeospatial.org/projects/groups/meteodwg>

# Avenues for Public Input



- **Requests for Information**
- **Requests for Comment**
- **Call For Participation**
- **OGC Network**

<http://www.ogcnetwork.net/>

- **Architecture Implementation Pilot**

<http://www.ogcnetwork.net/Aipilot>

- **Change Requests and New Requirements**

<http://www.opengeospatial.org/standards/requests>

[http://portal.opengeospatial.org/public\\_ogc/change\\_request.php](http://portal.opengeospatial.org/public_ogc/change_request.php)

- **Fast track process**

<http://www.opengeospatial.org/pressroom/newsletters/201006/#C3>

**OGC**®

**Current Requests and Initiatives**

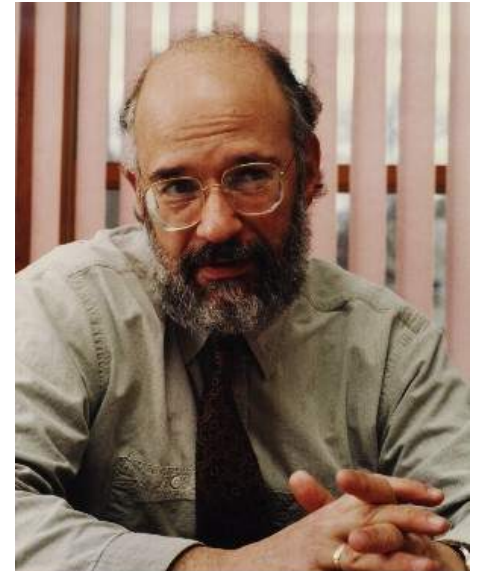
- » OGC seeks comment on PUCK standard for sensors and transducers
- » Request for Comments on Earth Observation Metadata profile of the OGC Observations and Measurements Standard
- » OGC Requests Web Map Tile Service (WMTS) Reference Implementations
- » OGC announces Indoor Navigation Discussion Paper
- » More...

# OGC addressing interoperability



“What we are doing is facilitating a common picture of reality for different organizations which have different views of the reality, the disaster, the catastrophe, that they all have to deal with collectively.”

*David Schell*  
*CEO and Chairman*  
*OGC*





# Some closing thoughts

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- *Experience* what GEO/GEOSS means.
- Add value to (scientific) data through (AIP) scenarios / applications.
- AIP helps cross-checking GEOSS needs and priorities with industry, government and other (S&T) communities, outputs can contribute proposals and guidelines to assist (national) R&D agencies in addressing GEO needs.
- AIP provides a forum, visibility, state-of-the-art technology input and a ground-rooted approach to the GCI.

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

# Questions? Get involved!

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