Geospatial Standards & Interoperability:

A necessary foundation for better understanding of climate change and risk reduction

Nadine Alameh, Ph.D.
Open Geospatial Consortium (OGC)
Executive Director, OGC Interoperability Program
nalameh@opengeospatial.org

August 21, 2013

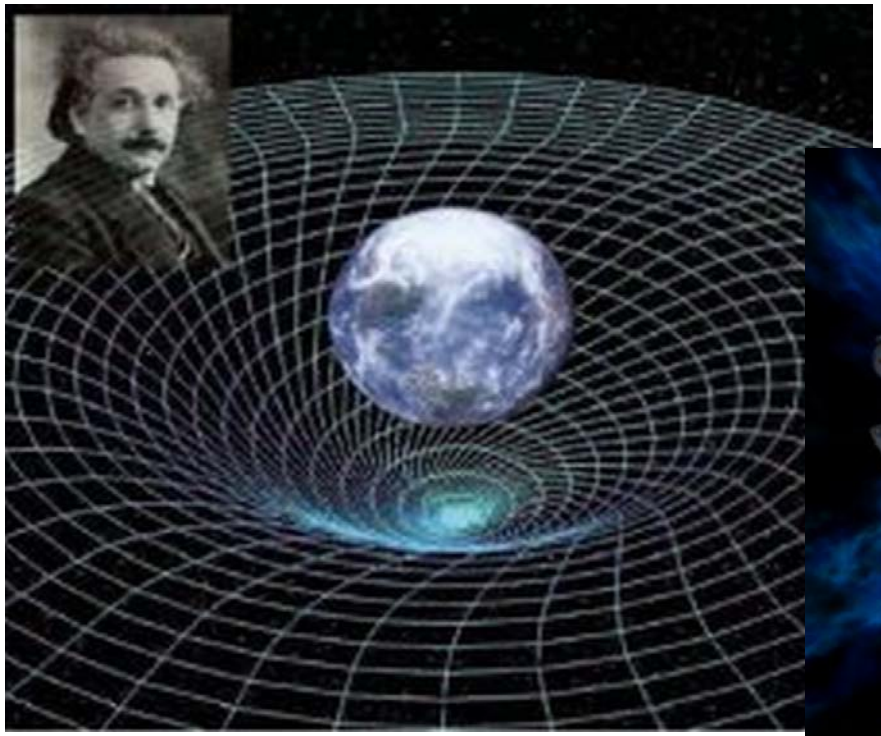
Outline

- Value of location information
- Value of interoperability in a heterogeneous world
- OGC for geospatial standards development and promotion
- Examples of how geospatial standards can help
- Concluding remarks

OGC®

Premise

We live and operate in a space-time continuum!



NASA

Premise

Everything we do, every event happens somewhere, sometime!

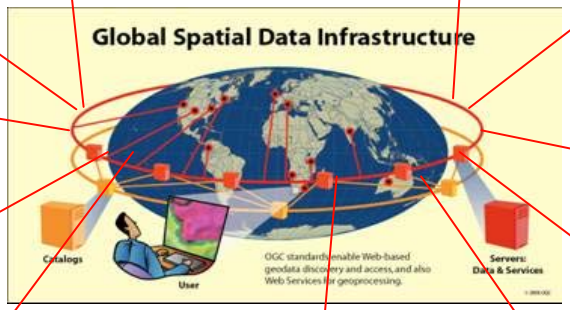
Tourism

Education & Research

Sustainable Development

Infrastructure - Transportation

Health



E -Government

Emergency Services

Aviation

Energy

Consumer Services, Real Time Information

Geosciences

OGC®

Premise

Every decision we make has a location (geographic) element

What is:
Fastest way to school?
Safest way through swamp?
Rainfall pattern?
Stream flow for rafting?
Best patrol allocation?
Floor plan for mall?

Where to live? eat?
get gas? buy shoes?
to build? to hike?
Is closest drinking water?
Is a hospital?
Is last place I fished

OGC®

Fact – We face challenges that require access to geospatial data and services on a scale never seen before: Extreme Weather / Climate Change

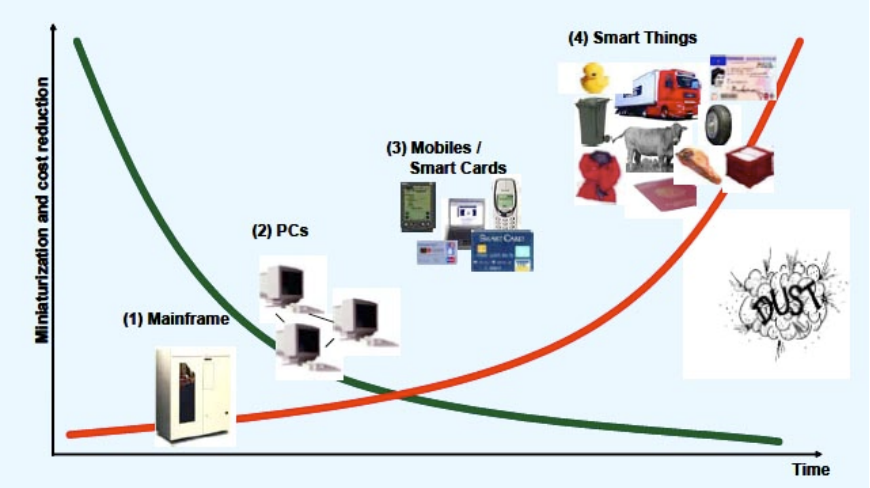
Oxfam East Africa at http://flickr.com/photos/46434833@N05/5933226731

Source: VirtualSteve at the English language Wikipedia

OGC®

Fact

Sources of data are multiplying – data is getting “bigger”



OGC®

Variety - Sensors

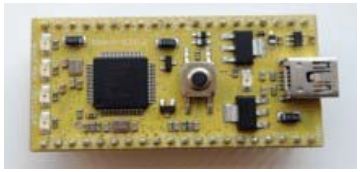
OGC®

Variety – Systems

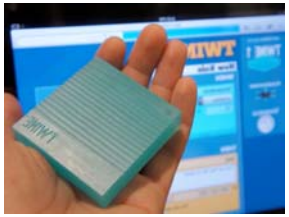
OGC®

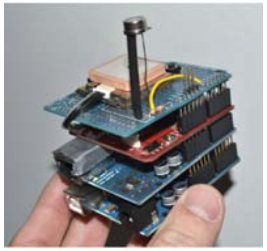
Internet of Things

- “In 2008, the number of devices connected to the Internet exceeded the number of people on Earth. By 2020, there will be 50 billion devices connected” - CISCO

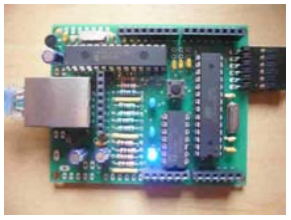


ARM® Cortex™-M0

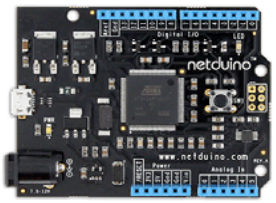




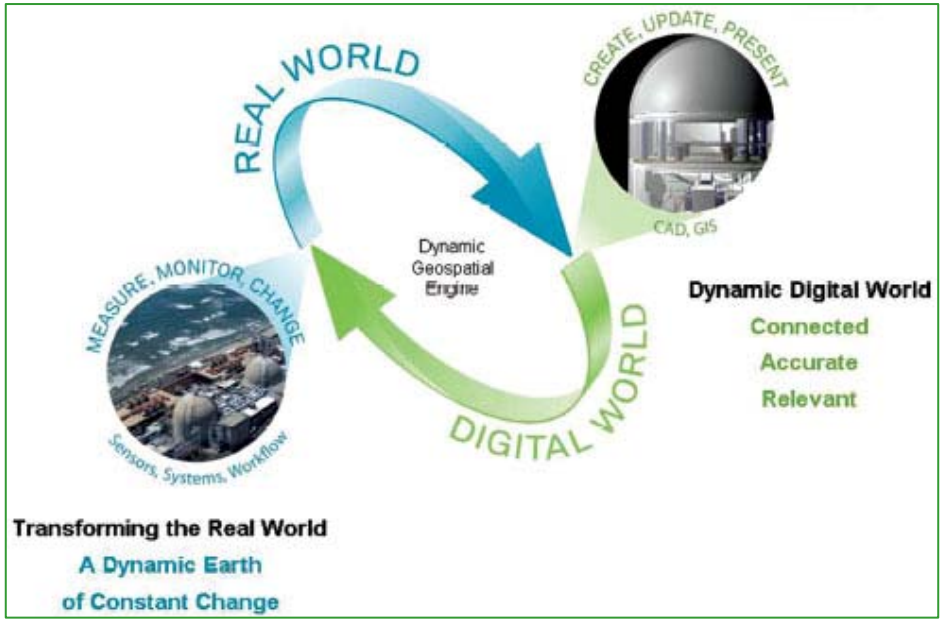
52North SenseBox



Nanode



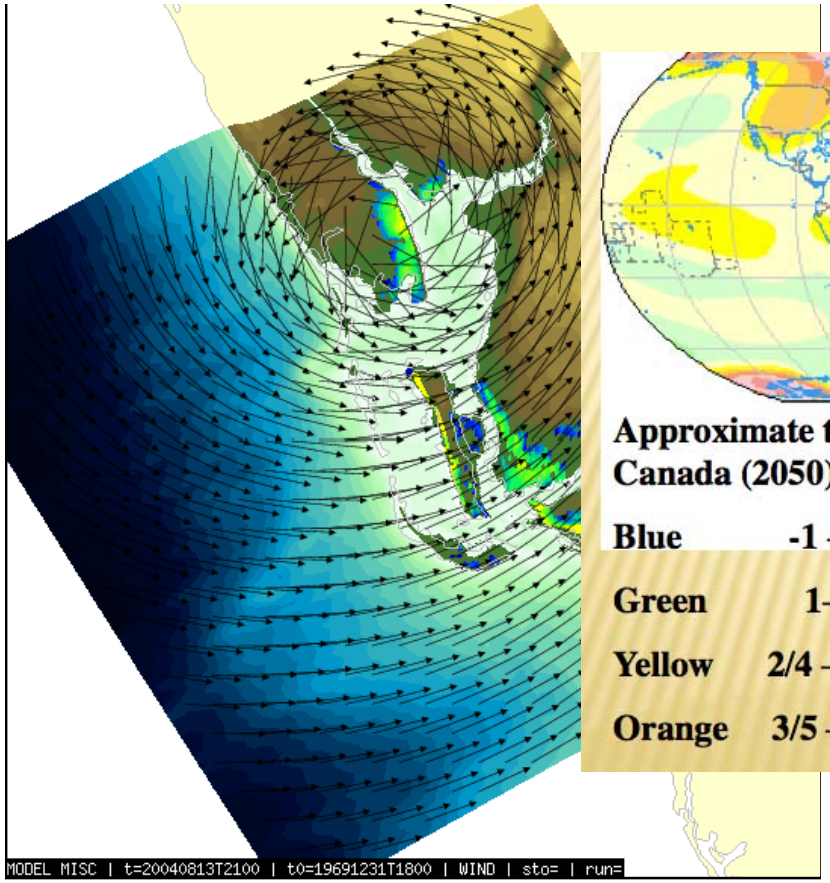
Netduino

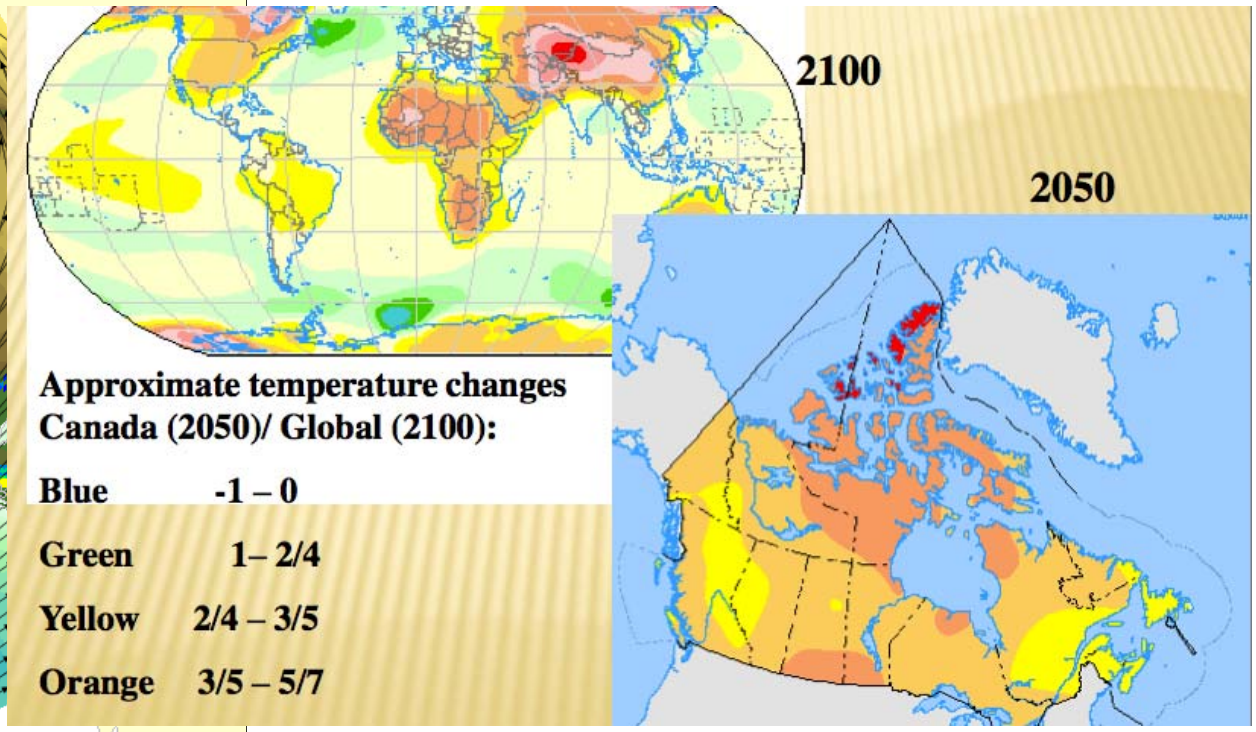


"Redefining the language of geospatial industry"
Ola Rollen, President and CEO, Hexagon AB.

OGC®

Variety - Models



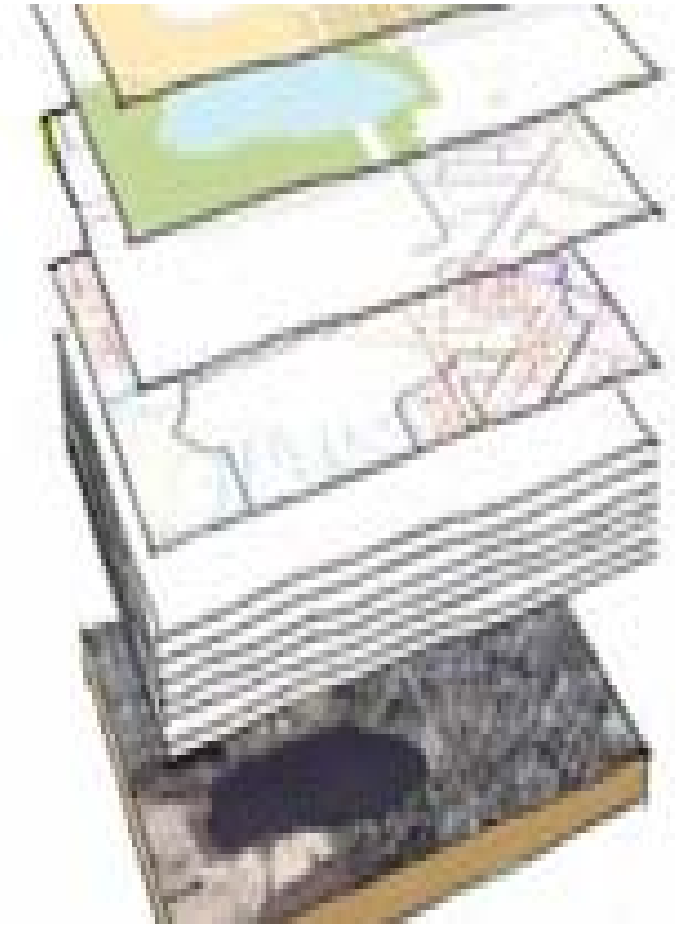


Short Term

Long Term

OGC®

Geospatial Integration



OGC®

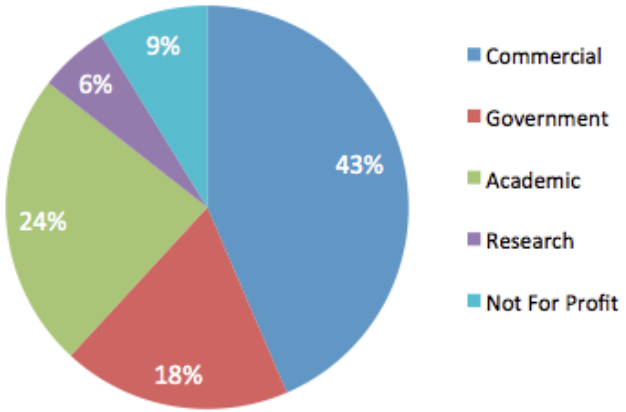
Outline

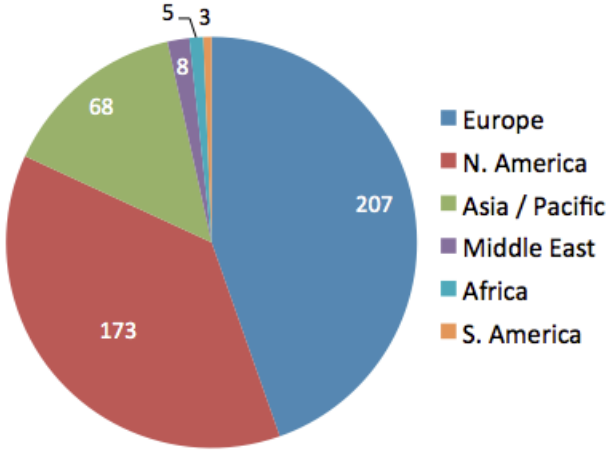
- Value of location information
- Value of interoperability in a heterogeneous world
- **OGC for geospatial standards development and promotion**
- Examples of how geospatial standards can help
- Concluding remarks

OGC®

What is OGC?

- A Voluntary Consensus Standards Organization, founded in 1994.
- 480+ members
- 38 adopted standards
- Hundreds of product implementations
- Broad user community implementation worldwide
- Alliance partnerships with 30+ standards & professional orgs





OGC®

Example Industry Members

And many, many more…

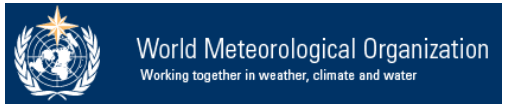
Example Government Organizations

- DOD Australia
- Geoscience Australia
- Eurocontrol
- European Environment Agency
- European Satellite Centre
- European Space Agency
- EU Joint Research Centre
- UK MOD
- UK MET
- METEO France
- BRGM (France)
- Ordnance Survey (UK)
- State Land Agencies (Germany)
- Ministry of Land Transport & Maritime Affairs (MLTM)
- GIS Center for Security (Abu Dhabi, UAE)
  Abu Dhabi Systems & Info. Center
- Dubai Municipality
- Arizona Geological Survey
- US DHS
- US EPA
- US FAA
- US NASA
- USGS / FGDC
- US NGA
- US NOAA
- Dept. of Land Conservation and Development (Oregon, USA)
- City of Vienna (Austria)
- Oakridge National Lab
- Natural Resources Canada
- Quebec Dept. of Natural Resources (Canada)
- Dept. Science & Technology (India)
- Landgate (Western Australia)
- Dept of Environment & Resource Mgt (Queensland, Australia)
- Wupperverband (NRW, Germany)

OGC®

OGC Alliance Partners

A Critical Resource for Advancing Standards



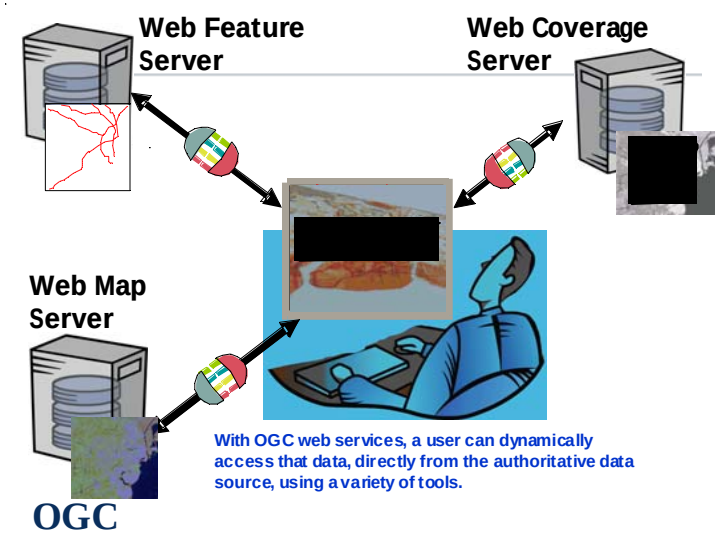
… and others

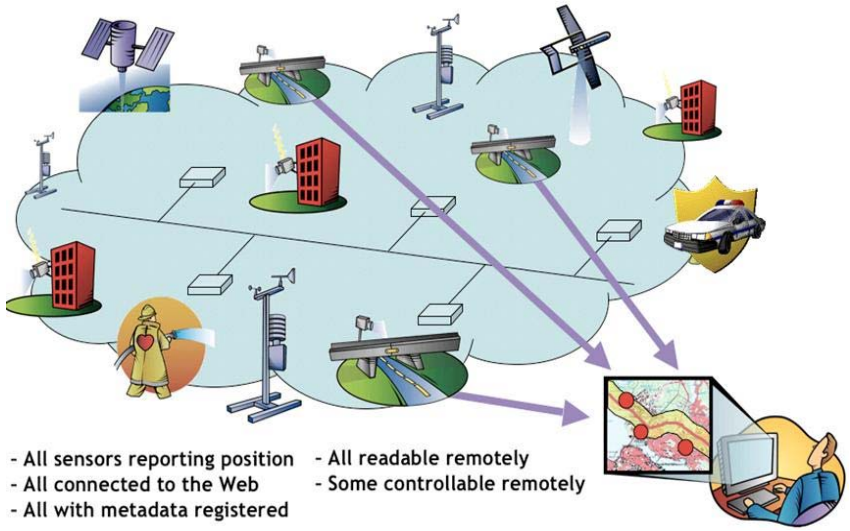
www.opengeospatial.org/ogc/alliancepartners

Major OGC Geospatial Standards

Some examples

- Web Map Service (WMS)
- Web Map Tiling Service (WMTS)
- Web Feature Service (WFS)
- Web Coverage Service (WCS)
- Web Processing Service (WPS)
- Catalogue Service for the Web (CSW)
- KML
- Web Map Context (WMC)
- Geography Markup Language (GML)
- Sensor Web Enablement (SWE)
- CityGML
- Open GeoSMS
- GeoSparql
- ……. *http://www.opengeospatial.org/standards*





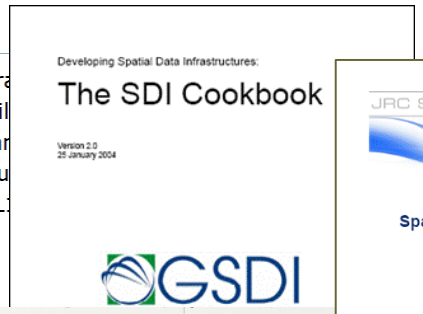
OGC®

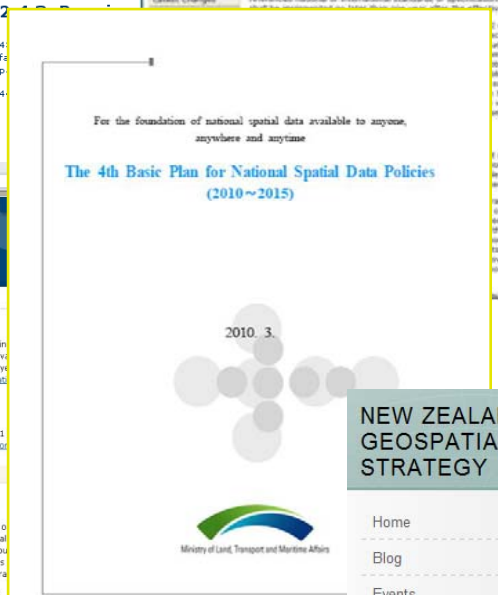
Policy and Guidance Worldwide

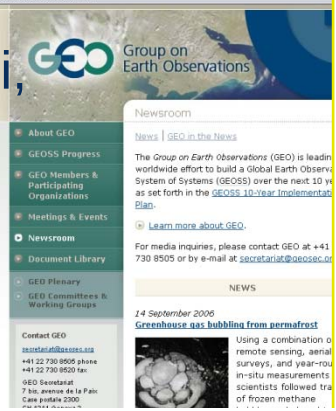
FGDC endorses over 60 external standards

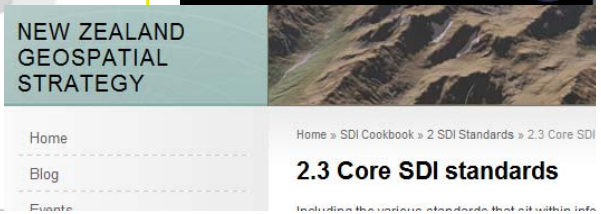
The FGDC Steering Committee has officially endorsed over 60 non-Federa
standards that play an important role in enabling geospatial interoperabil
include standards from Open Geospatial Consortium; ISO Technical Comr
information/Geomatics; the American National Standards Institute (throu
Committee for Information Technology Standards Technical Committee L

- National level policy and legislation
- European INSPIRE Directive
- Global Earth Observation System of Systems (GEOSS)
- European Space Agency
- Defense and Intelligence
- Sub-national level - Delhi,









Location: Essential to Address Social, Environmental and Economic Issues

Red Tide

Pandemic Disease Events

Extreme Weather & Climate Change

Oxfam East Africa at http://flickr.com/photos/46434833@N05/5933226731

OGC®

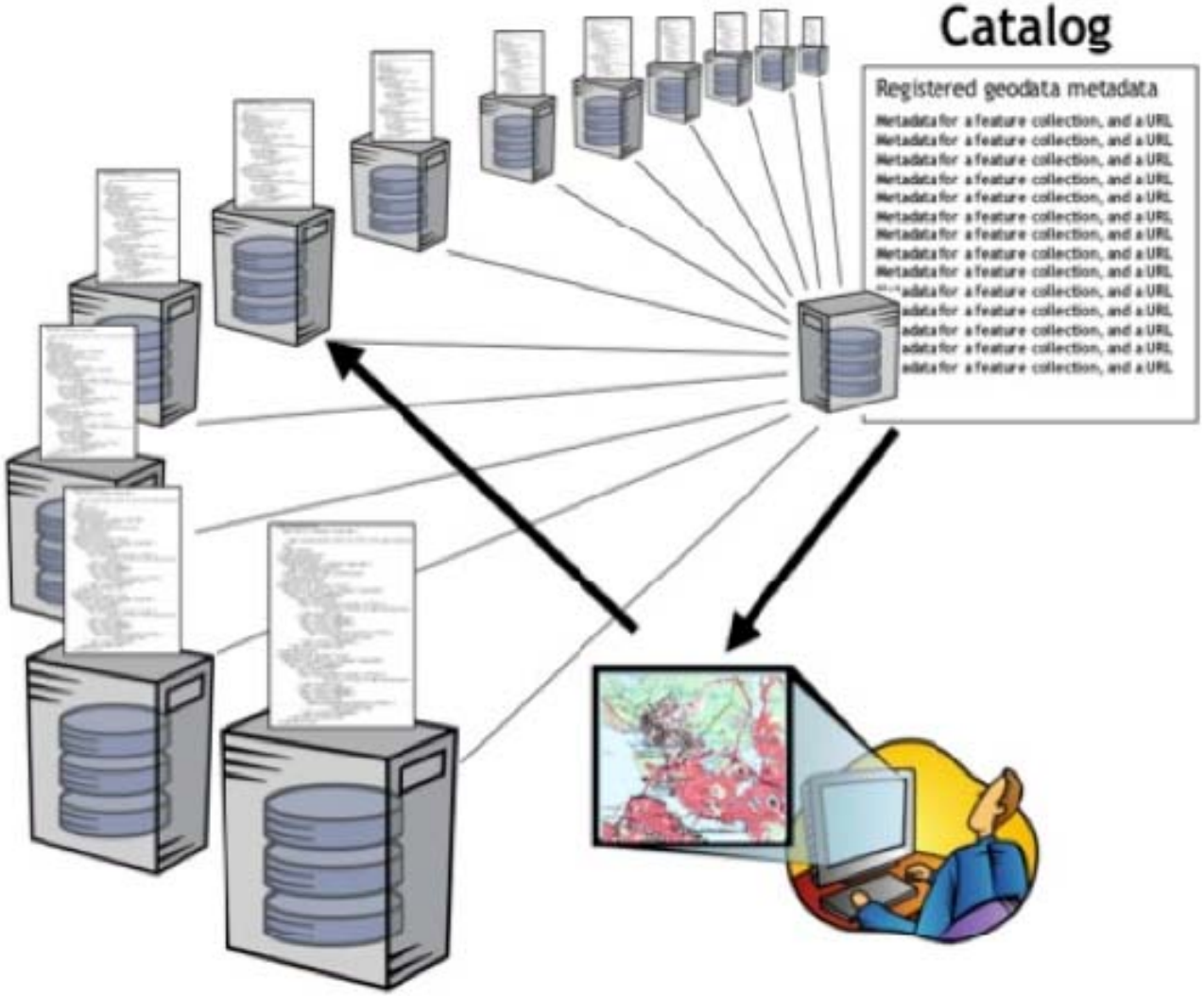
Outline

- Value of location information
- Value of interoperability in a heterogeneous world
- OGC for geospatial standards development and promotion
- **Examples of how geospatial standards can help**
- Concluding remarks

OGC®

Billions of sensors

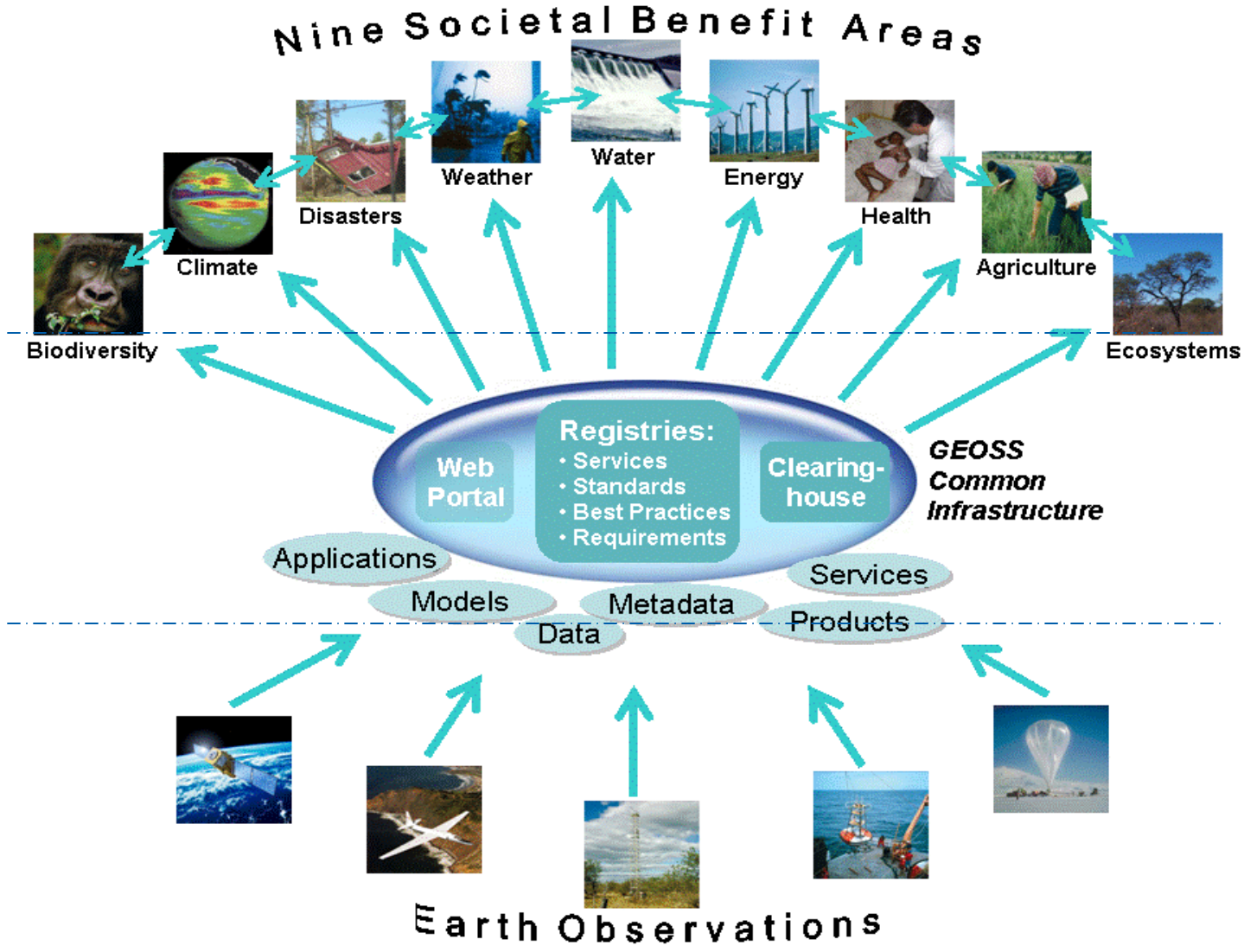
Catalogue Services for the Web (CSW)



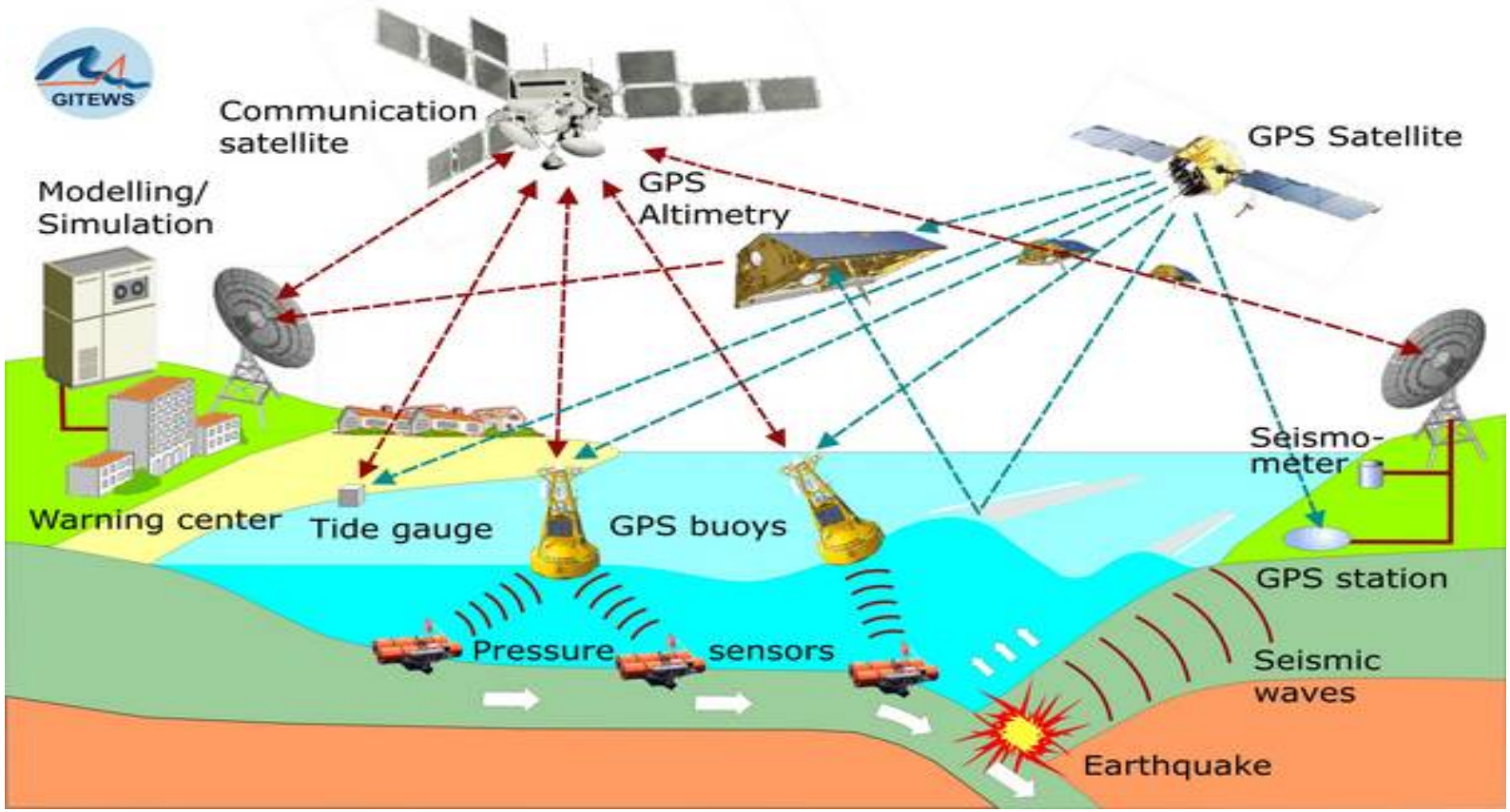
OGC®

GROUP ON EARTH OBSERVATIONS

GEOSS connects Observations to Decisions



Disaster Management
German Indonesian Tsunami Early Warning System



Source: www.gitews.org

OGC®

Disaster Management
German Indonesian Tsunami Early Warning System

www.gitews.de/fileadmin/documents/content/press/fact8000_01.pdf

FACTSHEET
System Integration

GITEWS

German Indonesian Tsunami Early Warning System

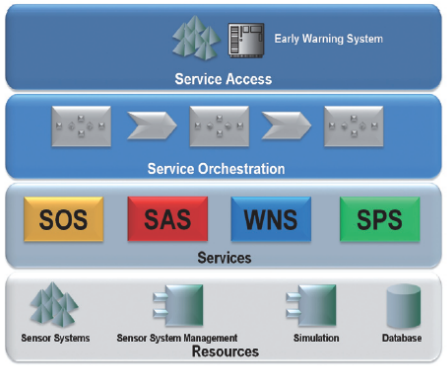
Establishment of a

System Integration

The German Indonesian Tsunami Early Warning System GITEWS is a complex system consisting of several sensor types like seismometers, sea level sensors, and GPS land stations, each sensor with its own system behavior and proprietary data structure. To operate a warning chain, beginning from sensor measurements scaling up to warning products, all system components have to interact in a correct way, syntactically and semantically.

Warning systems will evolve over time: New sensor types might be added, old sensors will be replaced and sensor integration as well as decision software will be improved. To keep GITEWS operating under these circumstances its software architecture must be tailored for evolution.

Given these requirements a flexible GITEWS infrastructure is a prereq-



Designing service interfaces great emphasis was laid on conformity to the OpenGIS specification *Sensor Web Enablement (SWE) by Open Geospatial Consortium (OGC[1]).*

The benefits of using a flexible SOA architecture together with Sensor Web Enablement (SWE) as the interface standard leads to an open integration platform: Integrating, accessing, and controlling different types of sensors in a standardized and uniform way.

Source: http://www.gitews.de/fileadmin/documents/content/press/fact8000_01.pdf

OGC®

Monitoring Stations

01.白布帆站 (Baibufan Station)
02.九份二山站 (Jiufen-Ershan Station)
03.神木站 (Shenmu Station)
04.上安站 (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 Station)
15.蘇樂站 (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×21
Landslide Monitoring Station×1
Sediment Concentration Monitoring Station×3
Mobile Debris Flow Monitoring Station ×3
Grid Debris Flow Monitoring Station ×14

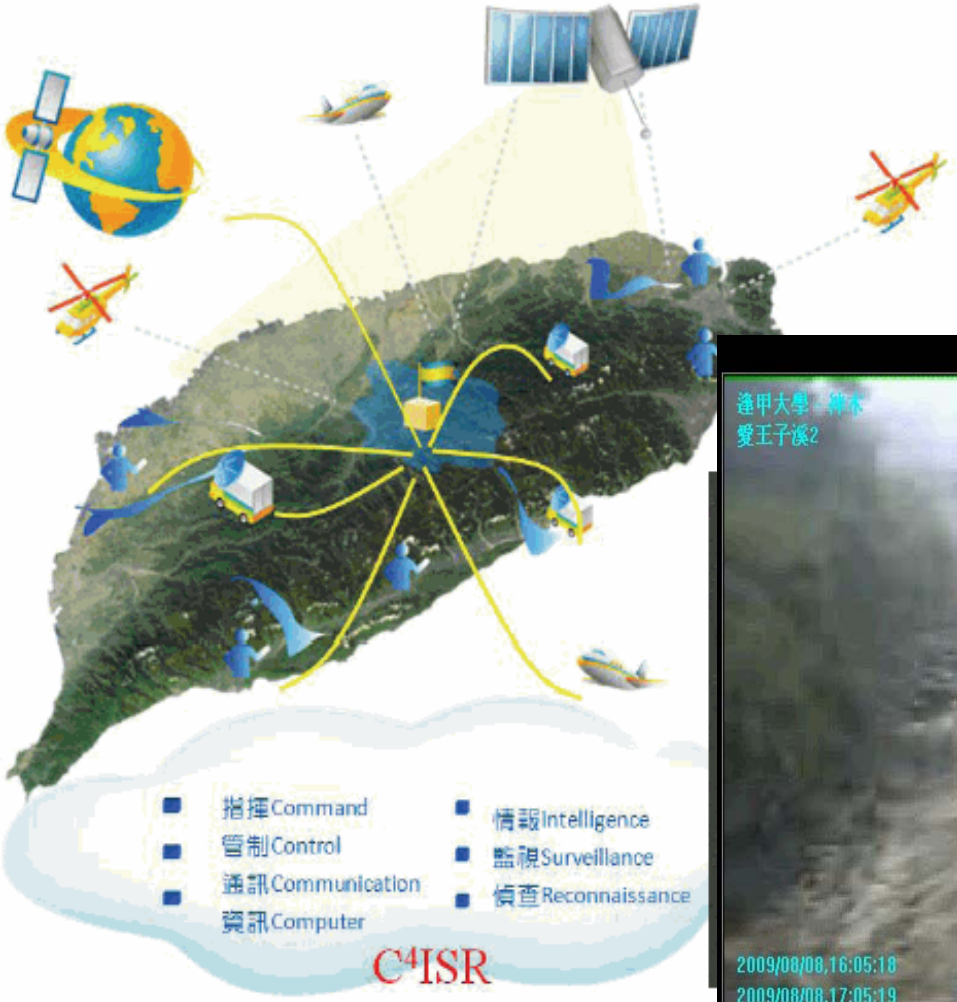
OGC®

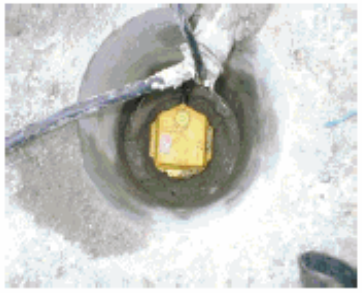
Source: Feng Chia University, GIS Research Center

Debris Flow Monitoring System

GIS.FCU

rain gauge





geophone

ITRI
Industrial Technology
Research Institute

FP7 Theme Environment (including climate change) EO2HEAVEN 02/2010-05/2013

http://www.eo2heaven.org/

jointly led by

EC contribution to GEO Societal Benefit Area „Health“

EO2HEAVEN will develop a better understanding of the complex relationships between environmental factors, population exposure, and health impacts

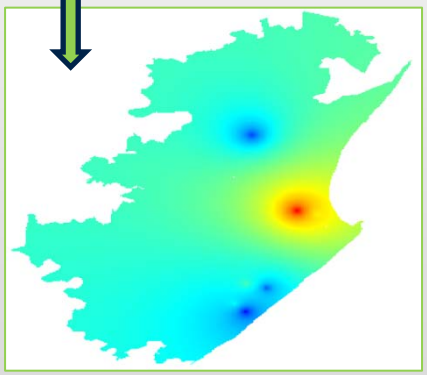
EO2HEAVEN: Impact of Environmental Factors on Health

EARTH OBSERVATIONS

HEALTH DATA

WEB-ENABLED PROCESSING, MODELLING AND FUSION

RISK MAPS ALERTING TOOLS



Air Quality and/or Aeroallergens

Image: UKZN

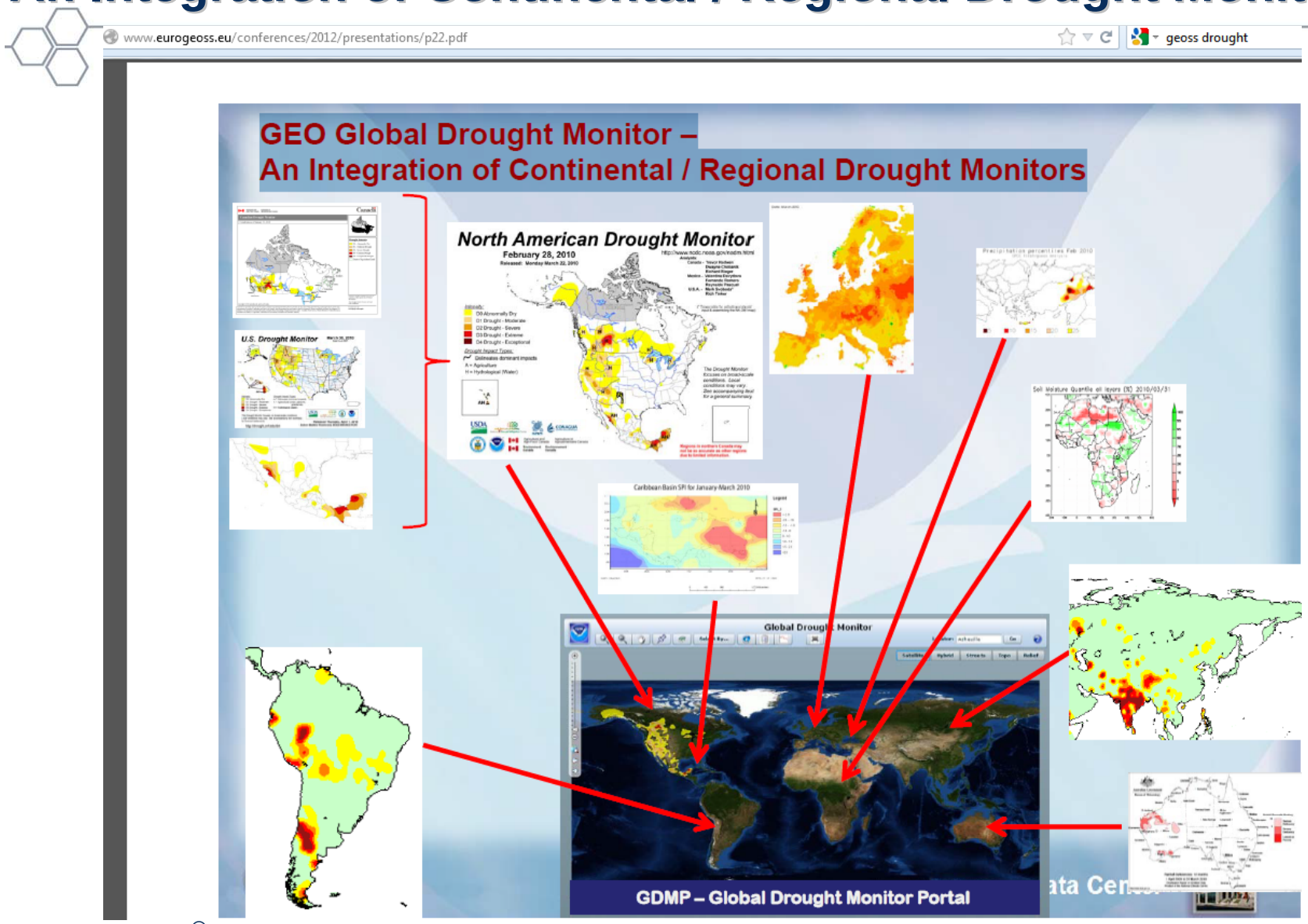
Durban, Saxony

Water borne disease cholera

Image: S. Woodborne, CSIR

Uganda

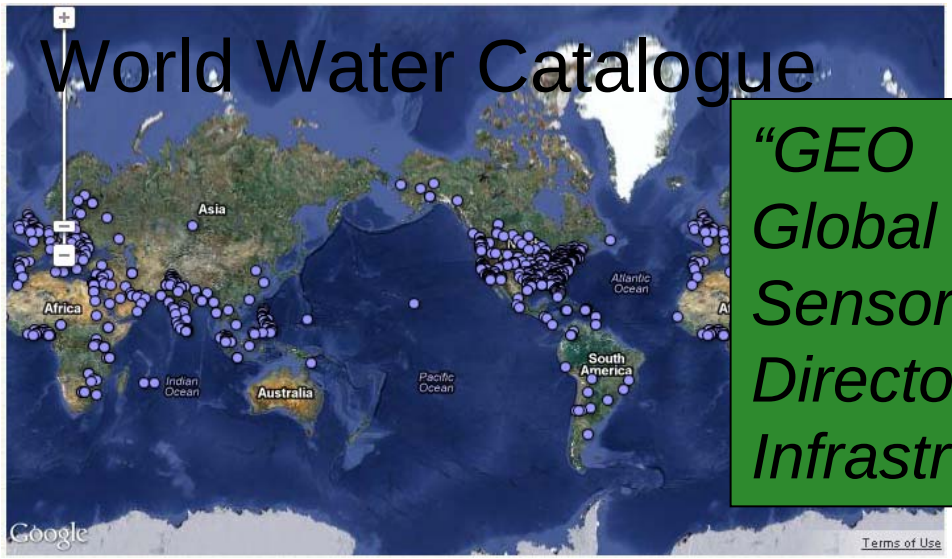
GEO (GEOSS) Global Drought Monitor – An Integration of Continental / Regional Drought Monitors



Vision: "World Water Catalogue"
Where are all in-situ sensors in the world (water cycle)? And related RS products?

Users: Find all stations.

Many Providers:



"GEO Global Sensor Directory Infrastructure"

"GEO sensor Standard"

Stations:
Variables:
Precipitation
Evaporation
Soil
Flow

Filter:
- per station type
- per variable
- Per time period

OGC HydroDWG:
SOS2.0
WaterML2
….

OGC®

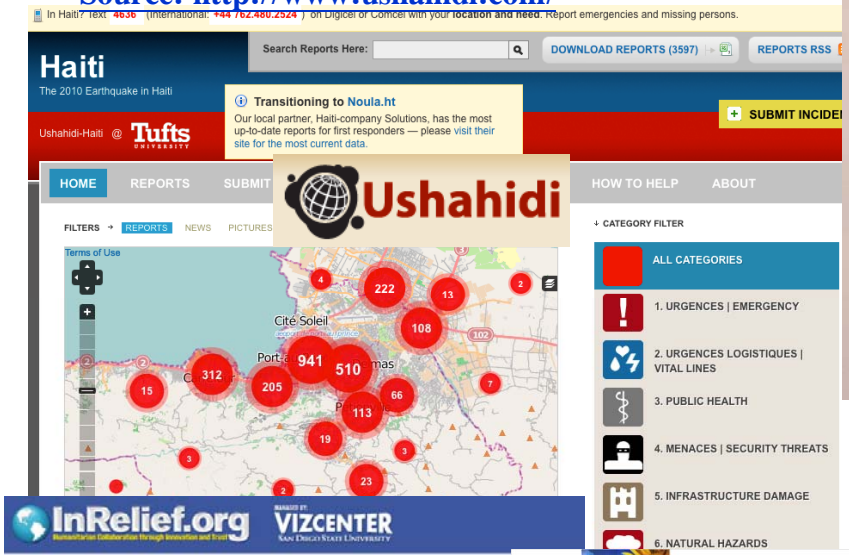
Outline

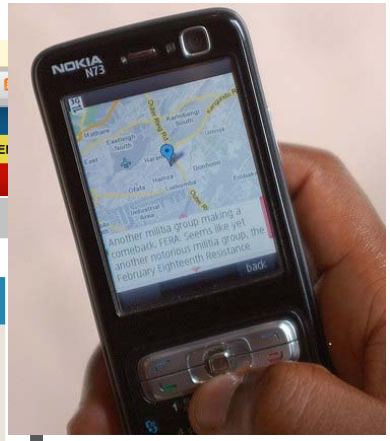
- Value of location information
- Value of interoperability in a heterogeneous world
- OGC for geospatial standards development and promotion
- **Examples of how geospatial standards can help**
- Concluding remarks

OGC®

Social Networking User Generated Information / Crowdsourcing

Source: http://www.ushahidi.com/





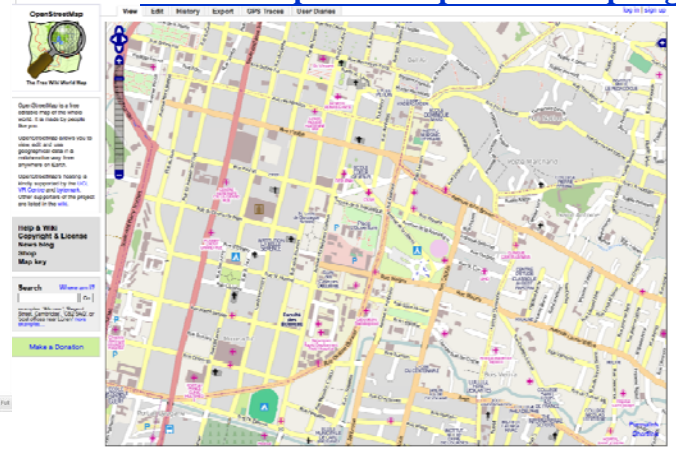
Source: Erik (HASH) Hersman. Flickr

- Ushahidi
- InRelief
- OpenStreetMap
- Sahana
- CrisisCommons

Source: www.inrelief.org

Source: http://www.sahanafoundation.org

Source: http://www.openstreetmap.org



OGC®

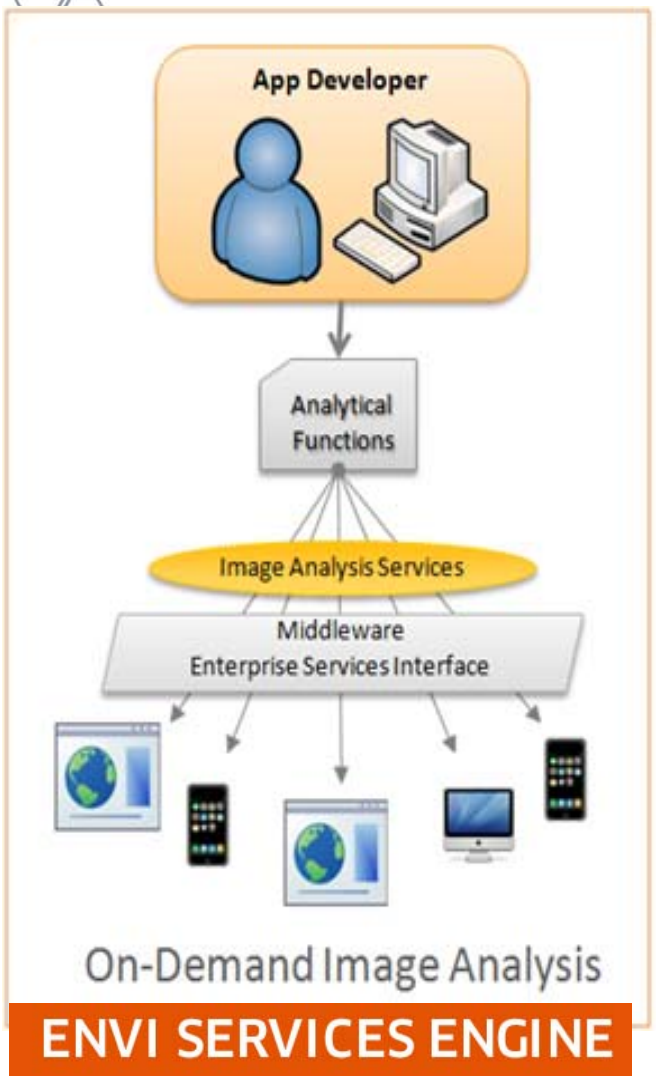
Twitter
90 Million tweets / day
8 terabytes / day

http://www.information-management.com/issues/21_5/big-data-is-scaling-bi-and-analytics-10021093-1.html

Geospatial Processing

- Geospatial data is a big part of the Big Data problem
  - georeferenced data - an exabyte per day globally.
- Big Data Initiatives:
  - NSF
  - Big Data Public Private Forum (European Commission)
- Shifting standards and interoperability emphasis
  - Geographic analytics
  - Geospatial models
  - Provenance
  - “Move beyond the interface”

Web Processing Services
As A Gateway to cloud processing



- As more and more GIS functionality is hurled into the cloud, it is only natural that this technology will move beyond simple search and discovery of data onto more advanced geo-processing capabilities.

- Web Processing Service (WPS), and Web Coverage Processing Service (WCPS) have moved the industry forward by leaps and bounds, and given GIS developers common ground to stand on when gathering, analyzing, and disseminating information.

http://imageryspeaks.com/2012/08/09/image-analysis-in-the-cloud/

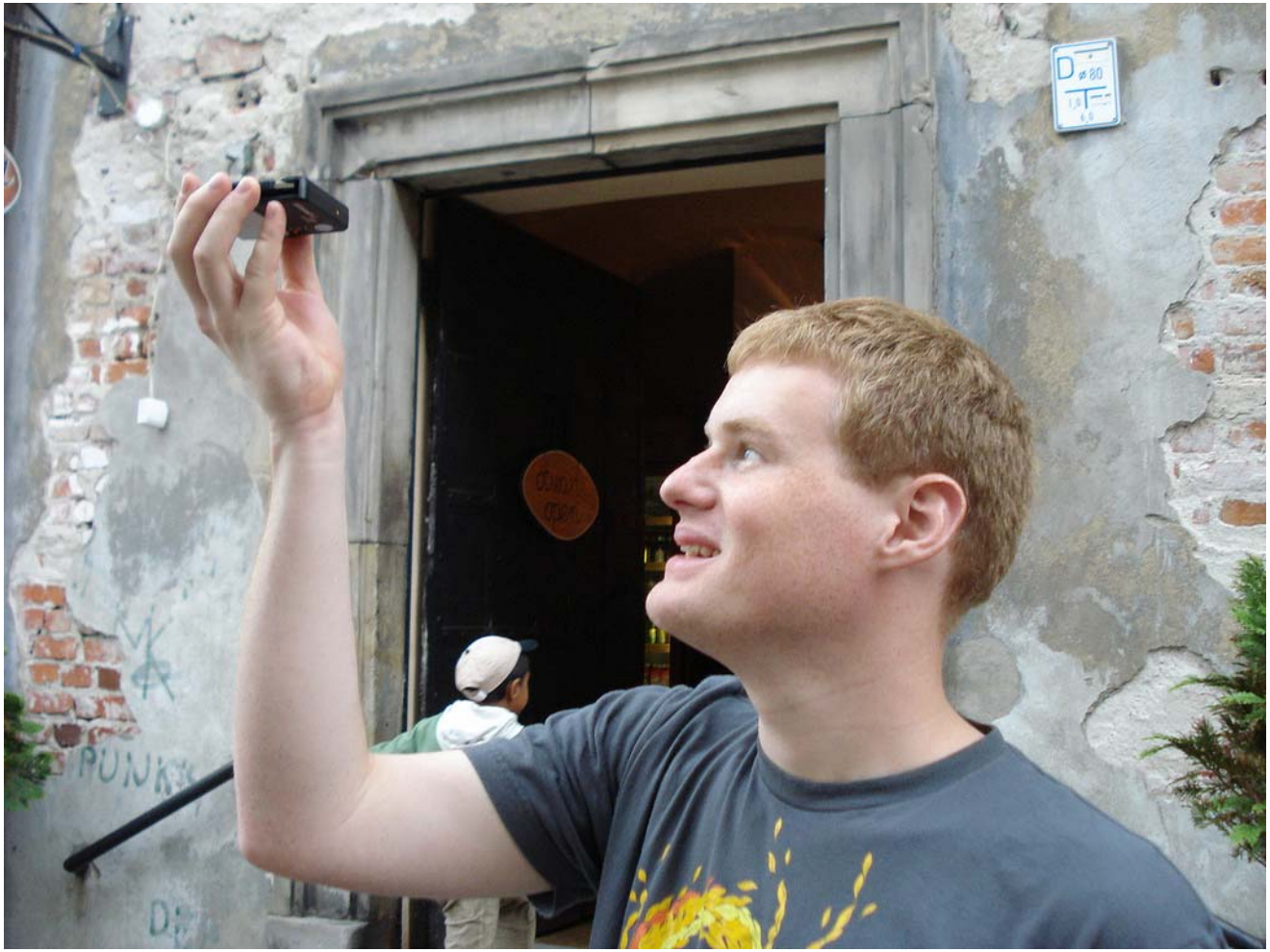
Exploring Standards for Cross-Community Interoperability

OGC®

One GB per mobile user per day by 2020

Applications are driving the network evolution

From: Yrjö Neuvo , Aalto University (Former CTO Nokia)
"Unfogging the Future" Opening speech at Microwave Week Amsterdam 2012



OGC®

Exploring Standards for the Mobile Environment

OGC®


OWS Co

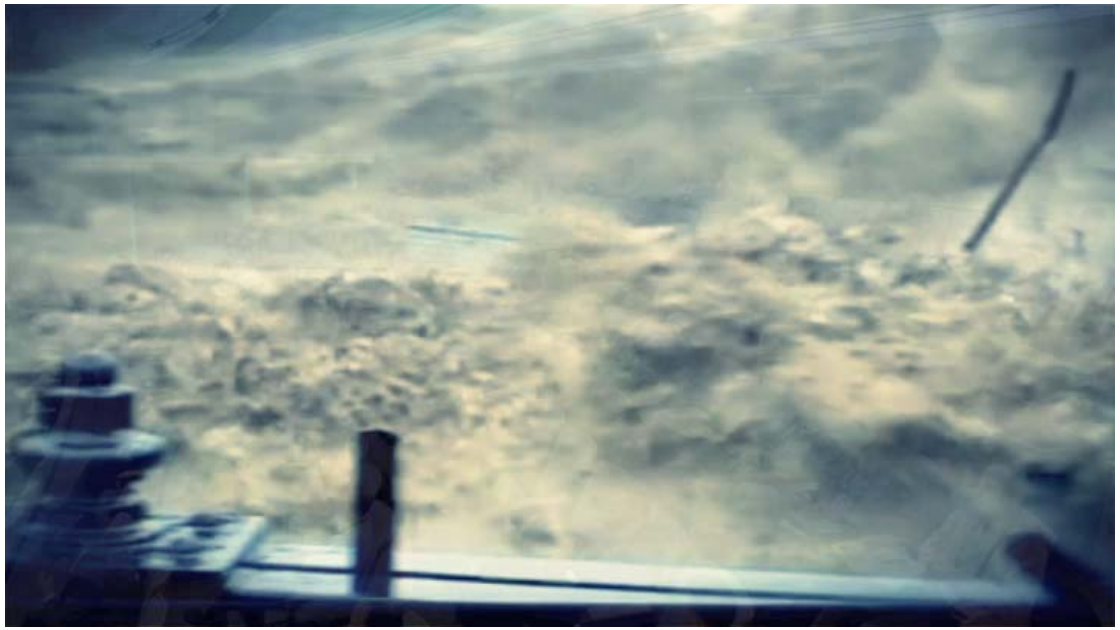
Outline

- Value of location information
- Value of interoperability in a heterogeneous world
- OGC for geospatial standards development and promotion
- Examples of how geospatial standards can help
- **Concluding remarks**

OGC®

Concluding Remarks

- **We need to work together**
  - Global problems require leveraging local resources
- **We need to strengthen collaborations**
  - Resulting in improved use of resources
- **Interoperability is not just about data and Information Systems**
  - It's really about the coordination of organizational behavior



OGC®

Questions?

- **More information**

  http://www.opengeospatial.org

- **Contact Information**

  Nadine Alameh, Ph.D.

  Executive Director, OGC Interoperability Program

  nalameh@opengeospatial.org

  http://www.linkedin.com/in/nadinealameh

OGC®