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Open Geospatial Consortium

Open Geospatial Consortium Meteorology & Oceanography Domain Working Group Update

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ECWMF, Reading UK
2017-02-29/31

Introduction

1. Past:

   What is OGC?

2. Now:

   Origins of Met Ocean DWG

   WMO / Met Ocean DWG Interests & Progress

3. Future:

   Works & Possibilities

4. Questions & (maybe) Answers

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Past: What is OGC?

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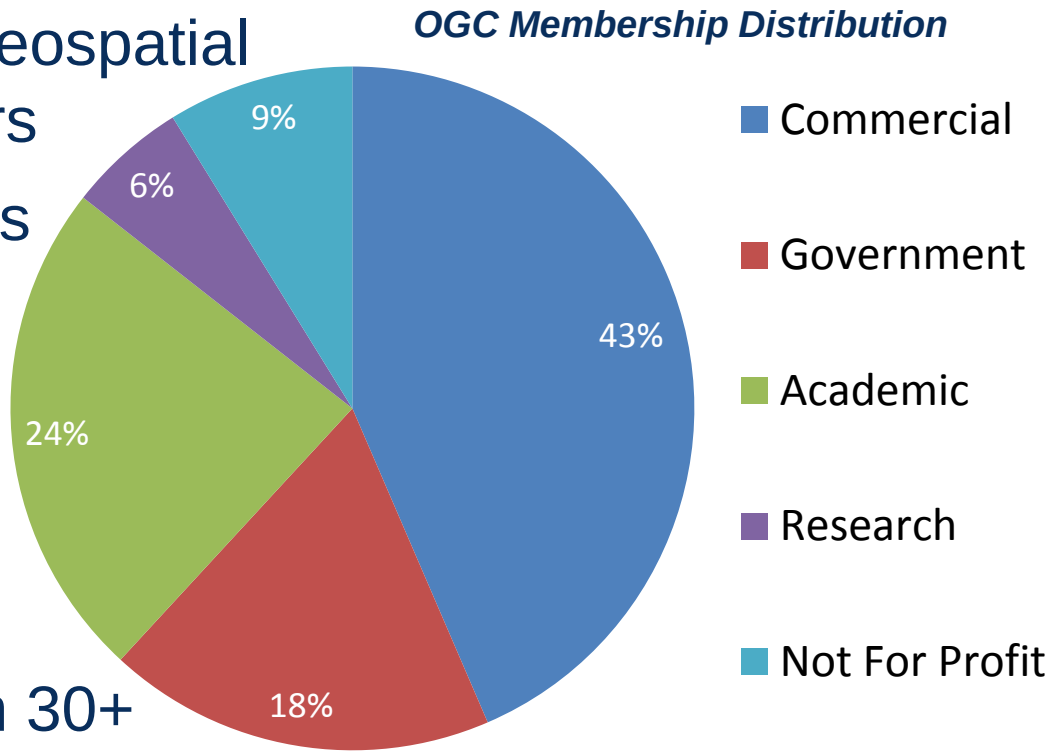
What is OGC? See http://www.opengeospatial.org

- International, non-profit, consortium
- Develops standards for geospatial data & services, >25 years
- Funded by >500 members
- 38 adopted standards
- Consensus process
- Docs freely available
- 100s of implementations
- Alliance partnerships with 30+ standards & professional organizations
- Broad user community worldwide
- Several standards fast tracked in ISO (and WMO!)



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What does OGC do?

- Interoperability standards:
  - Abstract/conceptual models
  - Implementation standards:protocols, formats, APIs
- Interoperability Experiments:
  - Testbeds
  - Plugfests (less formal)
- Compliance Testing & Certification
  - CITE
- Education and outreach

For all things geospatial and location

Other Standards Organisations

- WMO
- ICAO
- ISO
- ITU
- UNESCO/IOC
- IHO
- IMO
- …
- IETF (Internet Engineering Task Force)
- IANA (Internet Assigned Name Authority)
- IEEE (Institute of Electrical and Electronic Engineers)
- …
- W3C (World Wide Web Consortium)
- OASIS (Organization for the Advancement of Structured Information Standards)
- OMG (Object Management Group)
- …

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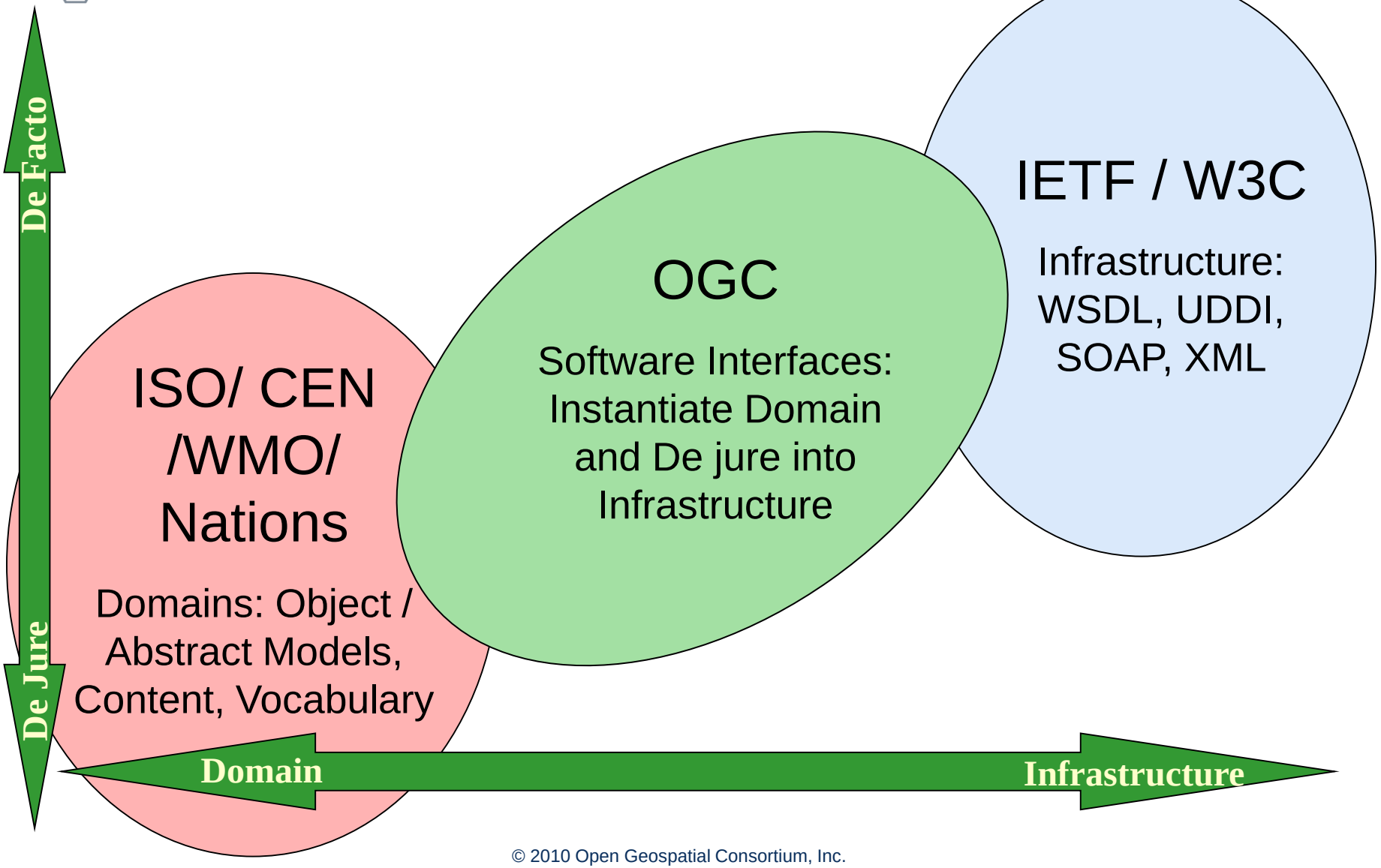
Where does OGC fit in the 'standards' world?



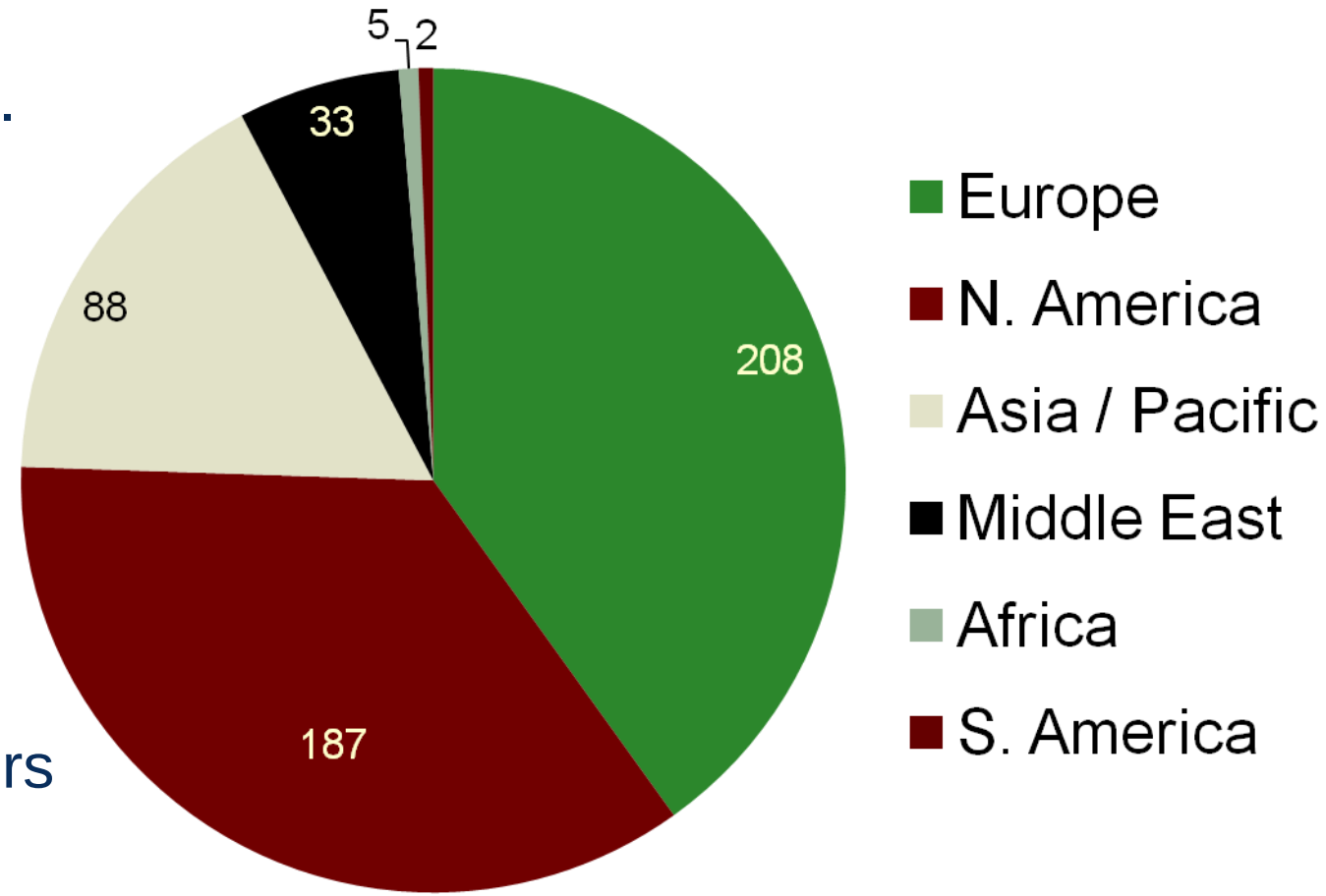
OGC: Membership Distribution

2008 - mostly N. American members

2010 - more European members

2012 – big increase of Eastern members

– becoming more global



"Only (geospatial) game in town!"

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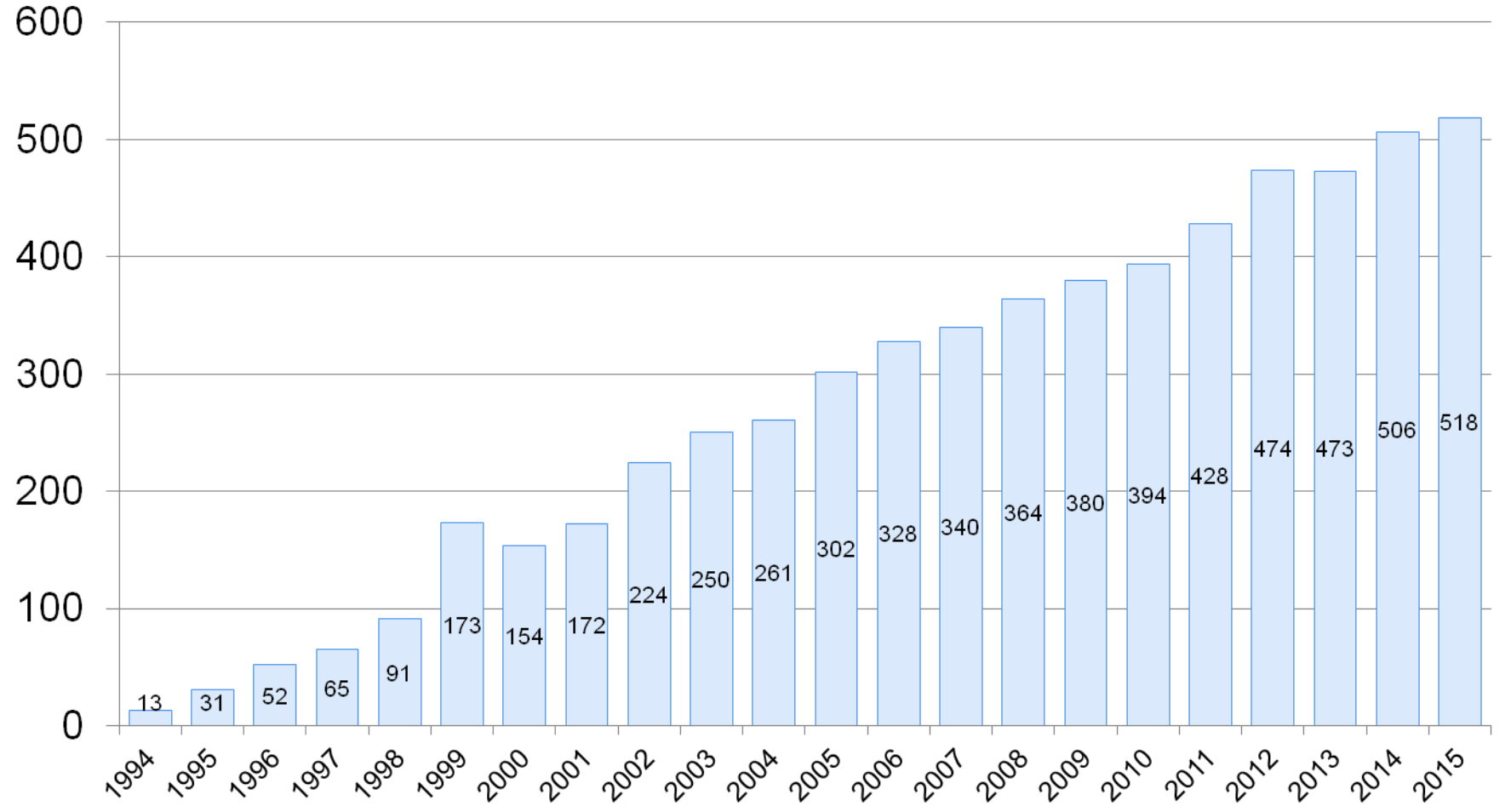
OGC Membership Growth



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OGC: Where is the money?

	Annual cost	Voting	Conf Places	Other Benefits
Strategic (5)	"Significant resources"	Strategic Advisory Committee	20 free	6 memberships for contracts 40 hours training
Principal (15)	$55K	Planning Committee	4 free	3 memberships for contracts 24 hours training
Technical (76)	$11K	Technical Committee	2 free	
Associate (130)	$4.4K	SWG & DWG	1 free	
Associate <$2m pa (43)	$2.2K	SWG & DWG	1 free	
NonGov, NonProfit (62)	$1.1K	SWG & DWG	1 free	
University (104)	$0.5K	SWG & DWG	1 free	
Provincial Gov (20)	$0.5K	SWG & DWG	1 free	
Individuals (34)	$0.5K	SWG & DWG	1 free	
Local Government (34)	$0.2K	SWG & DWG	1 free	

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OGC Structures

- Board of Directors (25) , Staff (16) , Members (506)
- Strategic Member Advisory Committee (5 Strategic Members)
- Planning Committee – quarterly (Principal Members)
- **OGC Architecture Board** (15 individuals, 3 year term, 5 elections/year)
- **Technical Committee – quarterly, open conference**
- Standing Subcommittees:
  - Documentation , Naming Authority,
  - Compliance Interoperability & Testing Evaluation
- **SWG Standards Working Groups** – 'vertical' (36)
  - Short life, for duration of creation/change of standard
- **DWG Domain Working Groups** – 'horizontal' (28)
  - Met Ocean, Aviation, Health, Defence, etc
- Regional and National Forums
- Programmes:
  - Specification, Interoperability, Outreach Education & Adoption

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OGC: Specification - How is it done?

- Voluntary consensus processes:
  - Specify
  - Implement
  - Interoperability Experiments (about annual)
  - Change standards/implementations - Repeat
- Technical & Planning Committees
  - Face to face every 3 months
  - Telcos all the time
- Standard Working Groups
  - Project orientated, ‘vertical’
  - Create or change one standard
- Domain Working Groups
  - Programme orientated ‘horizontal’
  - Communities of interest
  - Raise requirements for SWGs

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Key OGC Standards

Web Services – work over HTTP:

- WMS, Web Map Service: “Get me a map”
- WFS, Web Feature Service: “Get me something on a map”
  - Point or line
- WCS, Web Coverage Service: “Get me data covering an area on a map”
  - Area
  - Could be polygon, imagery, grid or point-cloud

Lots of associated standards & profiles: WMTS, SLD/SE, etc

Also Best Practices, Discussion Papers, Engineering Reports, etc

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Other OGC Standards

- SWE Sensor Web Enablement:
  - SPS Sensor Planning Service
  - SOS Sensor Observation Service
  - WaterML2.0 (now WMO standard) and TimeseriesML
- IoT Internet of Things
- 3D ML, CityGML, IndoorML
- Mobile
  - GeoSMS, GeoPackage, etc
- Underpinning standards:
  - ISO19xxx conceptual models
  - XML: O&M, GML
  - OWS Common

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What is OGC Summary

- "Only (geospatial) game in town", active, growing, thriving
  - But IETF, OASIS, W3C, ISO, WMO, etc., all overlap
  - Active collaborations with ISO, W3C, OASIS, etc.
- Many standards well established
  - WMS, WFS, WCS, CSW, O&M, SWE, etc
- Healthy mix of
  - Private/public
  - Practical/Academic
  - Legacy / mainstream / cutting edge technologies
- Becoming properly global
- Has opened up processes to community groups:
  - Twikis, Mailing lists, Domain WGs
  - But could support open source better

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Now: OGC Met Ocean DWG

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Origins of OGC Met Ocean DWG

- Regular ECWMF 11th Operations Workshop 2007:
  - recommended workshop/conference on GIS
- Eventually, 5 workshops held:
  - 2008 ECMWF, Reading
  - 2009 Meteo-France, Toulouse
  - 2010 Met Office, Exeter
  - 2011 ECMWF, Reading, with 13th Met Ops Workshop
  - 2014 DWD, Offenbach
- Met Ocean Domain WG formed 2009
- OGC-WMO MoU 2009 (Met, Ocean, Hydrology)
- Also awareness raising at EGOWS
- About 12 NHMSs have formally joined OGC

Met Ocean DWG Agreed Work Topics

- Web Map Services interoperability for NHMSs
  - WMS Best Practice for Time and Elevation
  - WMS Best Practice for Ensembles
  - SVG WMO Weather and ICAO Aviation symbols on GitHub
- Conceptual abstract model based on O&M for met/aviation
  - MetCE/WXXM
- WCS 2.0
  - GRIB Encoding (NetCDF already done)
  - Profile NWP patterns(4D cheese, slices, trajectories, corridors, etc)
  - Data tiling
- Temporal
  - TimeseriesML
  - WKT for Temporal CRSs
- Vertical CRS – no real progress

3. Met Ocean DWG work

Wiki (open)

http://external.opengeospatial.org/twiki_public/MetOceanDWG/WebHome

Mailing list (open)

meteo.dwg@lists.opengeospatial.org

Teleconferences most / many Wednesdays, 15:00 - 16:00 UTC

GitHub

https://github.com/OGCMetOceanDWG/WorldWeatherSymbols

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Met Ocean DWG Summary

- Members: M-F, UKMO, DWD, ECWMF, EUMETSAT, met.no, FMI, CMC, NOAA, KNMI, meteoromania (CMA,JMA,KMA,??)
- WMS 1.3 Best Practices recommendations being adopted
- Consistency between WMO, ICAO and OGC conceptual models achieved, published
- Work ongoing on WCS & data payloads (NetCDF, GRIB, data tiles/cubes, ‘slice & dice’, ‘curtains & corridors’)
- Temporal DWG producing Best Practice on TIME (CRS, Calendars, statistics, …), WKT for calendars, TimeseriesML
- Non-WMO observations are increasingly important, so OGC observation standards are becoming very important
- Lots of work, increasing importance, – join in!

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Future: Works and Possibilities

- What should we do? Given that:

Future (arm waving warning!)

Big Data getting too big to move. Therefore:

- Move apps to Big Data
- Generalised Big Data coarse or fine grain subsetting
- Move search query towards Big Data
- Big Data containers stay specialised/binary/compressed
  E.g. NetCDF, GRIB, BAM, FITS, …
- Big Data should expose allowed/disallowed queries

  Allowed/disallowed queries includes structural subsetting

  Needs controlled vocabularies/taxonomies/ontologies
- Big Data needs APIs.
- Big Data is usually cross-domain

This is all needs metadata, but not in ISO19115 'container'

Future work for OGC, Met Ocean DWG, others

- Query on parameter, observable, etc (WMO vocabularies)
- Query on different domains/namespaces/ontologies (W3C)
- Query on geospatial extent (OGC vocabularies)
- Query on temporal extent (OGC/ISO/W3C vocabularies)
- Query on different precision/resolution/LoD (Domain owner? OGC, W3C?)
- Query on structural pattern like slice, dice, etc (Domain owner? W3C? RDA??)
- Scalable queries – (W3C RESTful APIs)
- Repeatable queries, including across archives (ICSU RDA)

OGC Met Ocean DWG

- Questions and Answers?

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Want should the Met Ocean be doing next?

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Further Background Info slides

What is OGC's Vision?

Vision:

A world in which everyone benefits from the use of geospatial information and supporting technologies.

Mission:

Global forum for collaboration of developers and users of spatial data products and services and to advance the development of international standards for geospatial interoperability

Strategic Goals:

Goal 1 - Provide free and openly available standards to the market that are of tangible value to Members and have measurable benefits for users.

Goal 2 - Lead worldwide in the creation and establishment of standards that enable global infrastructures for delivery and integration of geospatial content and services into business and civic processes.

Goal 3 - Facilitate the adoption of open, spatially enabled reference architectures in enterprise environments worldwide.

Goal 4 - Advance standards to support formation of new and innovative markets and applications for geospatial technologies.

Goal 5 - Accelerate market assimilation of interoperability research through collaborative consortium processes.

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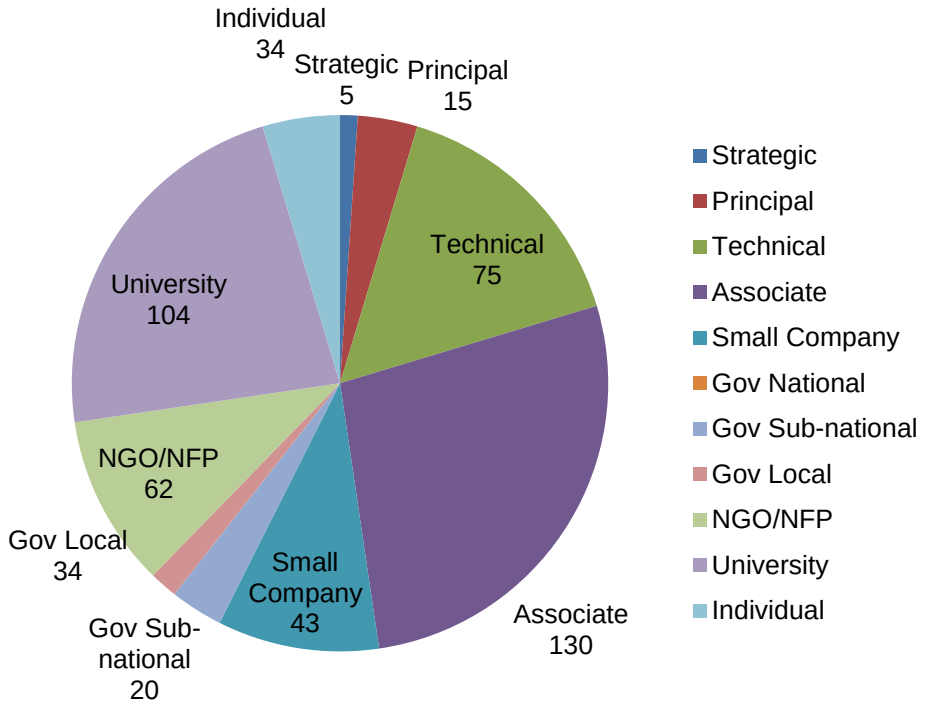
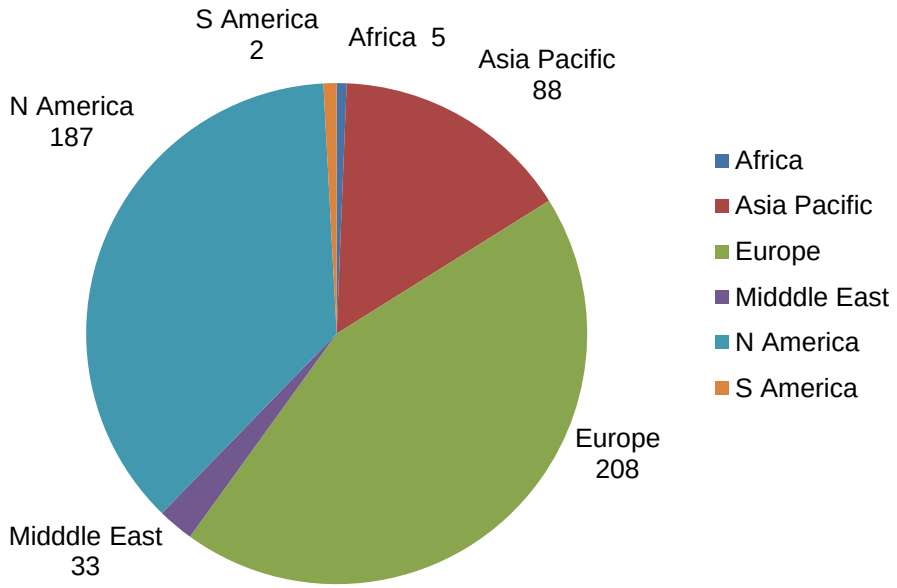
OGC Membership breakdown





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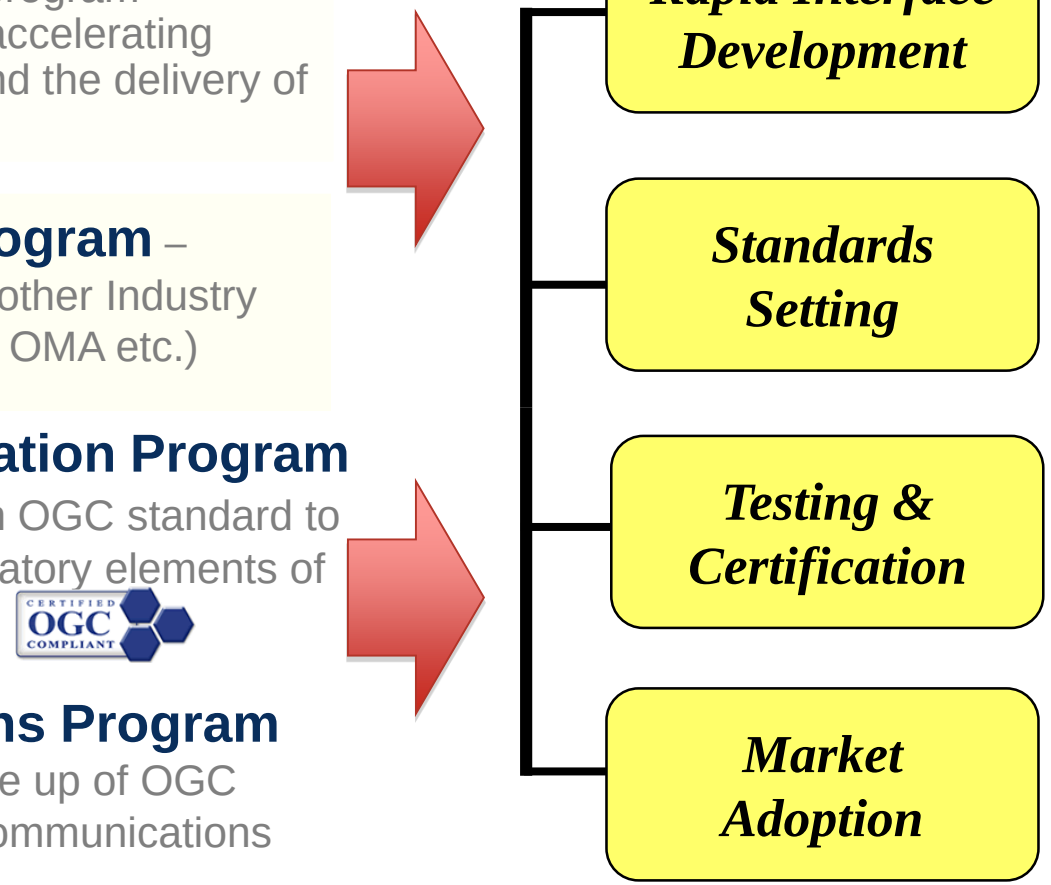
OGC: Approach to Advancing Interoperability

- **Interoperability Program** – a global, innovative, hands-on rapid prototyping and testing program designed to unite users and industry in accelerating interface development and validation, and the delivery of interoperability to the market
- **Specification Development Program** – consensus standards process similar to other Industry consortia (World Wide Web Consortium, OMA etc.)
- **Compliance Testing & Certification Program** – allows organizations that implement an OGC standard to test their implementations with the mandatory elements of that standard
- **Marketing and Communications Program** – education and training, encourage take up of OGC specifications, business development, communications programs



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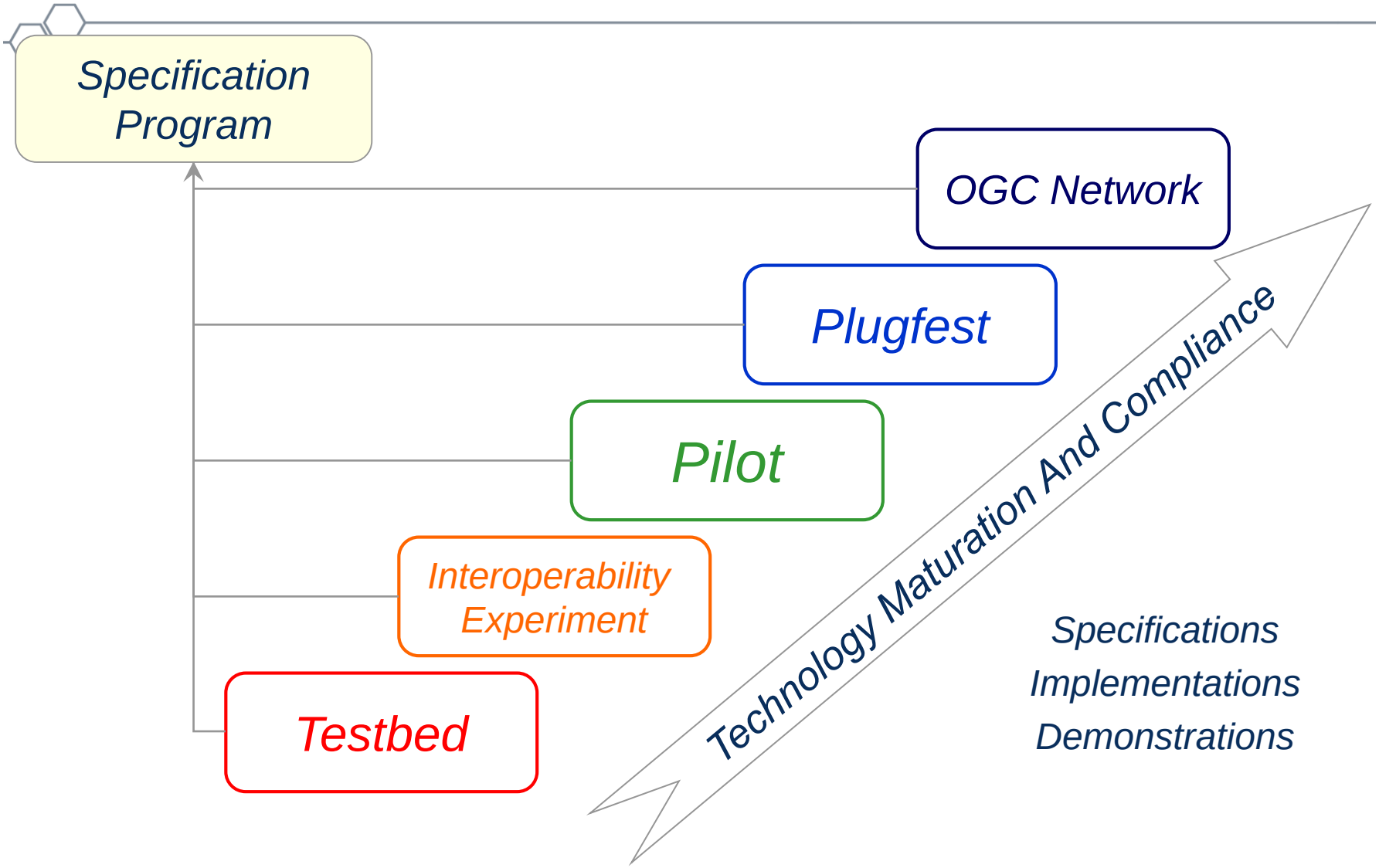
OGC Interoperability Program



Types of Interoperability Program Initiatives

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The Evolution of the OGC Strategic Focus…

Technical and Socioeconomic Impact

Broad scale application of geoprocessing technology and expanded understanding of global inter-community relationships

Second generation web-based interoperable services and decision support systems

Improved integration of geoprocessing with mainstream information technology capabilities

Information and multi-platform interoperability capacity, composite services

Improved inter-community and multi-enterprise data and processing resource sharing and platform-independent interoperability

First generation of web-based interoperable services

Improved multi-source information operations for technical interoperability in web-based environments, enabled enterprise applications and location services, broad base of operational implementations

Open GIS Abstract Models

Enhanced understanding of geoprocessing interoperability and digital representation of Earth and Earth phenomena

Open GIS Consortium established and Technical Committee organized

Current Strategic Focus is:

Steady improvement in the Technical Baseline and inter-community resource sharing capacity

OGC Technical Baseline

Capacity to exchange geospatial information and services across multiple computing environments, integrated with mainstream information technology

1994 1996 1998 2002 2004 2006 2008

Classes of OGC Standards

- Interface Standards
  - Application Profiles (extensions) to an interface standard
- Encoding Standards
  - Profiles
  - Application Schemas
- Tightly or Loosely Coupled
  - Server-Client or
  - Web Service

Key OGC Foundation Standards

Abstract Reference Model:

- Commonality with ISO 19xxx geospatial standards
- Well established and still relevant

GML Geospatial Mark-up Language:

- XML to describe geospatial things
- ISO standard
- Too complicated for general use?

OWS Common: OGC Common to Web Services

- Shared entities
- Needs updating

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Abstract Specifications:

reference models for the development of OGC Implementation Specifications

1. Feature Geometry
2. Spatial Referencing by Coordinates
3. Locational Geometry Structures
4. Stored Functions and Interpolation
5. Features
6. Coverage Type
7. Earth Imagery
8. Relationships between Features
9. Feature Collections
10. Metadata
11. OpenGIS Service Architecture
12. Catalog Services
13. Semantics and Information Communities
14. Image Exploitation Services
15. Image Coordinate Transformation Services
16. Location-based Mobile Services
17. Geospatial Digital Rights Management Reference Model (GeoDRM RM)
18. Topic Domain Models 1 - Telecommunications

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OGC Technical Issues

2D standards well accepted

- Stuff everything into 2D + ‘layers’

3D not quite integrated

- Mainly in city building descriptions

4D causing ‘churn’

- ‘slice & dice’
- WCS 2.0 approved but not yet widespread support
- WMS2.0 failed to gain support
- OWS Common, Abstract Ref Model probably need revision

5D ??

- Ensembles/Probability Distribution Function
- Another Layer?

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OGC 'Strategies'

- 'Old Guard' "2D world" vs 'New Guard' "4D+ world"
- Restructuring standards into Core + Extensions (Mod Spec)
- Moving from KVP Client/Server API to RESTful http based
- Keep using Interoperability Experiments and Test Beds
- Scenario and Use Case driven
- Establishing naming, registries & validation chains with URIs
- Expanding from US based to European to global
  - Expanding out of traditional GIS communities
- Opened up Twikis, Mailing lists, Domain WGs
  - In response to Met Ocean DWG lead
- Documents migrating to GitHub/HTML5 rather than MS Word

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Welcome to the MetOceanDWG web

The Meteorology and Oceanography Domain Working Group (Met Ocean DWG) is a community orientated working group of the Open Geospatial Consortium (OGC). The group does not directly revise OGC standards, but rather enables collaboration and communication between groups with meteorological and oceanographic interests. The Met Ocean DWG maintains a list of topics of interest to the meteorological and oceanographic communities for discussion, defining feedback to the OGC Standards Working Groups (SWG), and performing interoperability experiments. The DWG covers Oceanography as well, because of the long history of collaboration and shared institutions between meteorology and oceanography. Climatology is, of course, a subset of Meteorology.

The Met Ocean DWG is intended to be a public forum for communication, and both the email list and this Twiki are open to interested parties.

- **Charter :** Please see the current Met Ocean DWG Charter. *(The original charter is at Meteo DWG Charter)* .
- **Twiki :** Anyone can edit this wiki, but, of course, responsibly. Instructions can be found on the TWiki Text Formatting Rules page.
- **Email list :** Subscribe to the public email list at : https://lists.opengeospatial.org/mailman/listinfo/meteo.dwg

Events

- **Met Ocean Teleconfs and Meetings Announcements** UPDATED, UPDATED
- **Last meeting Austin, Texas, USA : OGC TC/PC Meeting : 19 March- 23 March 2012 : MetOceanDWGAustin**
- **Next meeting Exeter, UK : OGC TC/PC Meeting : 18 June-21 June2012 :** MetOceanDWGExeter
- **Other connected events**
- **Met Ocean DWG Meetings archives**

Current Activities

* *WMS Best Practices:*

- **Minutes of all telecons on WMS Best Practices**
- **Met Ocean WMS Best Practices Hot Topics** _Cleaned up in March 2012 to focus on issues that really impact the Best Practices
- **Archives of older works on Met Ocean WMS Best Practices Hot Topics**

* *SLD/SE Requirements:*

- Styling (using SLD/SE) in other words: **Weather Symbols**

* *Conceptual Modelling:*

_UNDER REORGANISATION TO ENHANCE CLARITY

- Overview
- Use Cases for conceptual modelling
- Roadmap [TO BE DEFINED]

OGC Public Documents

All at the OGC Portal

- Implementation Standards (50)
- Profiles of Standards (5)
- Abstract Specification and Reference Model (~20 topics)
- Formal Schemas (26)
- Best Practices (25)
- Public Discussion Papers & Engineering Reports (~200)
- Policy directives and documents (8)
- White Papers (36)
- Requests for Comment, Requests for Quotation
- Change Requests
- Deprecated and Retired Documents

>38 OGC Public Standards

Catalogue Service (CSW) / Cat: ebRIM App Profile: Earth Observation Products
CityGML
Coordinate Transformation
Filter Encoding
Geography Mark-up Language (GML, ISO19136:2007) / GML in JPEG 2000 / KML
Geospatial eXtensible Access Control Mark-up Language (GeoXACML)
Location Services (OpenLS)
Observations and Measurements (O&M, proposed ISO19156)
Sensor Model Language (SML)
Sensor Observation Service (SOS)
Sensor Planning Service (SPS)
Simple Features / CORBA / OLE/COM / SQL (SF, ISO19106:2004, ISO19107:2003)
Styled Layer Descriptor / Symbology Encoding (SLD/SE) / Geographic Objects
Transducer Mark-up Language (TML)
Web Coverage Service / Web Coverage Processing Service / Grid Coverage Service
Web Feature Service (WFS)
Web Map Service (WMS, ISO19128:2005) / Web Map Context
Web Map Tile Service (WMTS)
Web Processing Service (WPS)
Web Service Common (OWS Common)

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OGC Standards Working Groups (2015)

3D Portrayal SWG (3DP SWG)
Catalogue Services 3.0 SWG (Cat 3.0 SWG)
CDB SWG (CDB SWG)
CityGML SWG (CityGML SWG)
CRS Well Known Text SWG (CRS WKT SWG)
Discrete Global Grid Systems SWG (DGGS SWG)
ebRIM AP of CSW SWG (ebRIM AP of CSW)
ebXML RegRep SWG (ebXMLRegRepSWG)
EO Product Metadata and OpenSearch SWG (EO PMOS SWG)
GeoAPI 3.0 SWG (GeoAPI 3.0 SWG)
GeoPackage SWG (GeoPackage SWG)
GeoSciML SWG (GeoSciML SWG)
Geospatial User Feedback SWG (GUFswg)
GeoSynchronization 1.0 SWG (Geosync SWG)
GeoTIFF SWG (GeoTIFF SWG)
GeoXACML SWG (GeoXACML SWG) GML 3.3 SWG (GML 3.3 SWG)
GMLJP2 SWG (GMLJP2-SWG)
I15 (Cataloging of ISO19115 Metadata) Extension Package of ebRIM Profile of CS-W 1.0 SWG (I15 SWG)
IndoorGML SWG (IndoorGML SWG)
KML 2.3 SWG (KML SWG)
Land and Infrastructure SWG (LandInfraSWG)
Moving Features SWG (MovFeat SWG)
NetCDF SWG (NetCDFSWG)
O&M 2.0 SWG (OM 2.0 SWG)
OLS 1.3 SWG (OLS 1.3 SWG)
OWS Common 1.2 SWG (OWSCommon1.2SWG)
OWS Context SWG (OWScontextSWG)
PipelineML SWG (PipeML SWG)
Points of Interest SWG (PoI SWG)
PubSub SWG (PubSub SWG)
RESTful Services Policy SWG (RESTful SWG)
Sensor Model Language (SensorML) 2.0 SWG (SensorML2.0SWG)
SensorThings SWG (SensorThings)
Simple Features SWG (SF SWG)
Styled Layer Descriptor and Symbology Encoding 1.2 SWG (SLDSE 1.2 SWG)
WaterML 2.0 SWG (WaterML2.0SWG)
Web Coverage Service (WCS) SWG (WCS.SWG)
Web Mapping Service 1.4 SWG (WMS 1.4 SWG)
Web Processing Service 2.0 SWG (WPS 2.0 SWG)
WFS Gazetteer Profile 1.0 SWG (WFSgaz1.0 SWG)
WFS/FES SWG (WFS/FES SWG)

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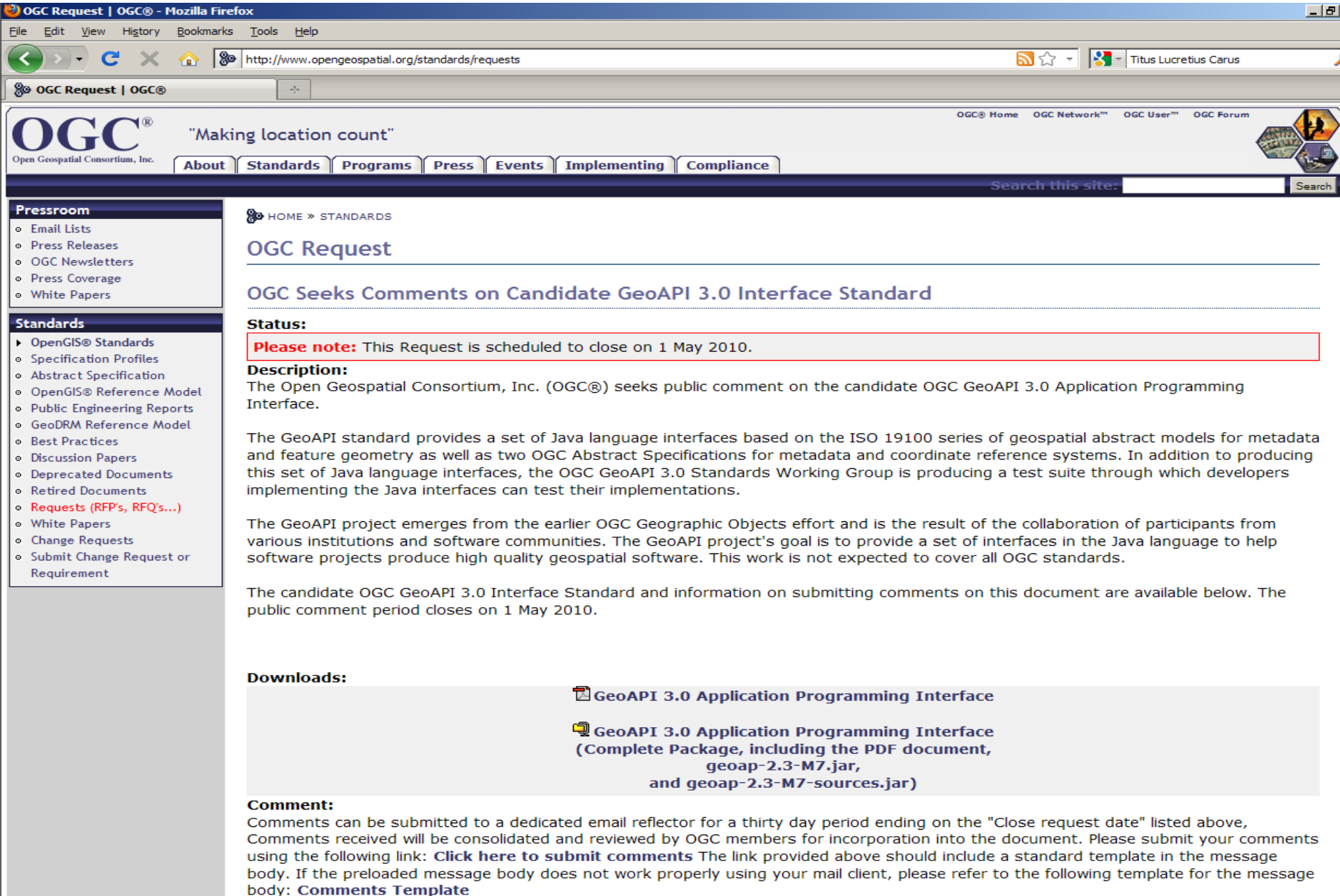
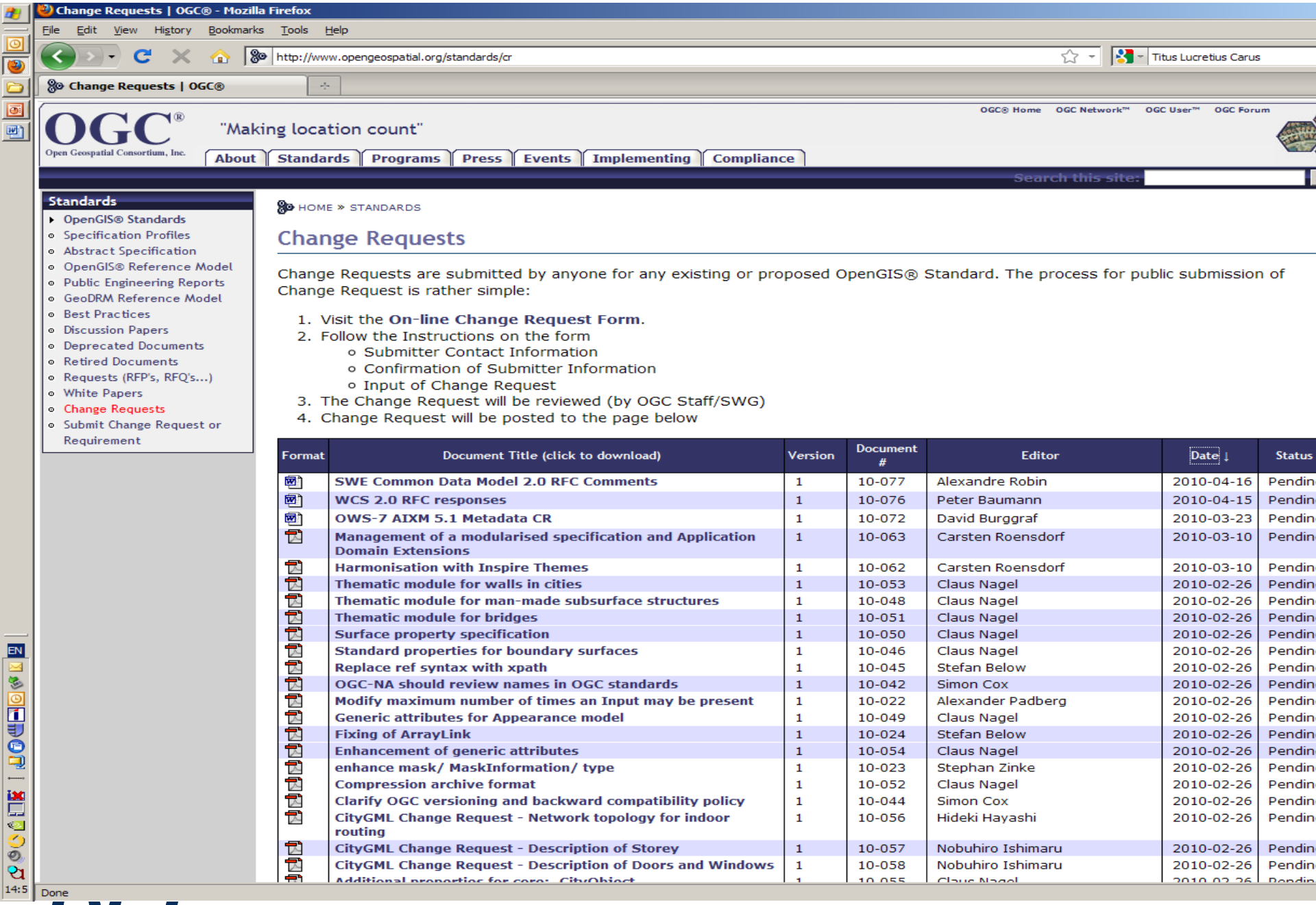
OGC Portal http://www.opengeospatial.org/ogc





OGC Domain Working Groups (2015)

3DIM DWG (3DIM DWG)

Agriculture DWG (Agriculture DWG)

Architecture DWG (Arch DWG)

Aviation DWG (Aviation DWG)

Big Data DWG (BigData DWG)

Catalog DWG (Cat DWG)

Coordinate Reference System DWG (CRS DWG)

Coverages DWG (Coverages DWG)

Data Preservation DWG (PreservDWG)

Data Quality DWG (DQ DWG)

Defense and Intelligence DWG (D and I DWG)

Earth Systems Science DWG (ESS WG)

Emergency & Disaster Management DWG (EDM DWG)

Energy and Utilities DWG (EnergyUtilities)

Geography Markup Language (GML) DWG (GML DWG)

Geosemantics DWG (Semantics)

Health DWG (Health DWG)

Hydrology DWG (Hydrology DWG)

Land and Infrastructure DWG (LandInfraDWG)

Law Enforcement And Public Safety DWG (LEAPS DWG)

Metadata DWG (Metadata DWG)

Meteorology & Oceanography DWG (Met Ocean DWG)

Mobile Location Services DWG (MLSDWG)

Point Cloud DWG (Point Cloud DWG)

Security DWG (SecurityDWG)

Sensor Web Enablement DWG (SensorWeb DWG)

Temporal DWG (Temporal DWG)

University DWG (Univ DWG)

Urban Planning DWG (Urban Planning)

Web Feature Service DWG (WFS DWG)

Workflow DWG (Workflow DWG)

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OGC Summary

- Is updating standards:
  - To Modular Specifications (to enable conformance testing)
  - From client/server to RESTful
  - To a ‘Core & Extensions’ model
  - In middle of ‘2D+Layers’ versus ‘4D+slice & dice’ churn
- Interoperability Experiments & Test beds are heavyweight
  - To protect members’ IPR
  - Not an issue for Met Ocean community
  - Realistic Met & Ocean data needed, both volume and timeliness
- Takes on Met Ocean requirements in key standards
  - Even when Met Ocean people not actively involved
  - We have a good reputation More volunteers and experts needed

Met Ocean Domain Working Group

- Regular ECWMF 11th Operations Workshop 2007:
  - recommended workshop/conference on GIS
- Workshop on the Use of GIS/OGC Standards in Meteorology:
  - ECMWF, 2008-11-24/26
  - Review use of OGC (Open Geospatial Consortium) standards in geo-sciences in Europe & worldwide
  - Promote collaboration between meteorological services in order to define a set of common standards that will enhance interoperability
  - Recommended OGC involvement and establish Met DWG
    - Météo-France joined OGC 2007, UKMO 2008
  - Established major theme: **Web Map Services interoperability for National Met Services**
  - Organise another Workshop!

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Met Ocean Domain Working Group - 2

2009-03 OGC Technical Conference, Athens:

- Meteorology DWG established
- Hydrology DWG also established

2009-06 OGC Technical Conference, Boston

- Meteorology DWG Co-chair elected

2009-09 OGC Technical Conference, Darmstadt:

- Meteorology DWG converted itself to :
- Meteorology & Oceanography DWG
- Stopped separate Climatology DWG
- Environmental System Science DWG already well established

2009-11 OGC and WMO signed MoU (Met, Ocean, Hydro)

- Short legal doc, flexible Annex, lightweight – let experts work

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Met Ocean Domain Working Group - 3

- 2nd Workshop on Use of GIS/OGC Standards in Meteorology
  - Toulouse, 23-25 November 2009
  - Established second major work theme: **Conceptual modelling**
  - Third workshop planned Exeter 2010, Observations theme
- 3rd Workshop on Use of GIS/OGC Standards in Meteorology
  - Exeter, 15-27 November 2010
  - Progressed previous work, re-established Interoperability Experiments, SLD/SE started
  - Nothing happened about Obs
  - 4th workshop planned: Washington/Boulder/Offenbach?

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Met Ocean Domain Working Group - 4

2011-11 ECMWF 13th Workshop on Operational Meteorology

- Emphasised WCS requirements
- Emphasise Discovery, Access & Retrieval rather than Visualisation

4th Workshop on Use of GIS/OGC Standards in Meteorology:

- 2013-03 Reading
- WMS 1.3 Best Practice needs editorial work only
- Support WMS2.0 work (-> 4D)
- WCS 2.0 Met Ocean extensions work started, including Data tiling
- Temporal work started
- WKT CRS work started
- Inspire recommendations
- Mismatch between OGC CSW3.0 and WMO WIS SRU1.3
- Link GitHub Weather symbols to real WMO registry

Met Ocean Domain Working Group - 5

5th Workshop on Use of GIS/OGC Standards in Meteorology:

Offenbach, 28/30 October 2014

WMS further work:

- Implementation testing, extend to Profile or Standard
- Extend for climatological time
- Support WMS2.0 (now in abeyance)

Conceptual Modelling:

- Aviation more or less finished
- Another domain starting (climatology?)
- Time Model needed (Temporal DWG started: leap seconds, Gregorian calendar start, heliocentric coordinates, climatological periods)
- SLD/SE GitHub symbols need styling and linking to real WMO registry

WCS 2.0 Extension:

- Appl. Profile, 4D+, not 2D+Layers, ensembles, time, ‘corridors’, tiles
- Encoding formats GRIB2 TBD
- Data tiling TBD may be separate standard

Met Ocean DWG work

- WMS Best Practice, retrofit WMS 1.3:
  - TIME
  - (Climatological Periods & Time)
  - Vertical Coordinates, ELEVATION
  - Coordinate Reference Systems CRS (being tackled in other groups)
  - Customer / User orientated, so no Met traditional terminology
- SLD/SE wiki and GitHub https://github.com/chris-little/WorldWeatherSymbols
- Conceptual Modelling
  - Based on O&M
  - Jeremy Tandy leading, driven by Aviation, but other domains in longer term
- WCS, new WCS 2.0

WMO / Met Ocean DWG Standard Interests - 1

- WMS –Proactive
  - Time & Elevation – consensus achieved. Published. Plugfest held. Referenced by defence standard profile (DGIWG)
  - Ensembles – active again
  - Map Projections – changes to existing repositories in progress, WKT
  - SLD/SE – Aviation SigWx and standard WMO Plots Use Cases - slow
  - Tiling – commonplace but need DATA tiling – progressing
- Conceptual Modelling - Proactive
  - IWXXM for Aviation
  - GML3.2.1, KML2.2
  - Emergency & Disaster Management COP architecture – big issues

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WMO / Met Ocean DWG Standard Interests - 2

- WCS/WFS – lots of 'churn' – Proactive
  - Met Ocean extensions - proactive
  - Payload formats (GRIB2) - inactive
  - Data Cubes/Tiling - active
- Temporal CRS – Proactive
  - Temporal WKT for Calendars - proactive
  - Best Practice - active
- Vertical CRS - Just starting to be active
- CSW – compatibility with ISO23950, OpenSearch - Reactive
- O&M, SWE increasing in importance - Passive

Met Ocean DWG: Some Interesting Domain WGs

Active dialogues

- Aviation
- Catalogues
- Co-ordinate Reference Systems
- Coverages
- Defence & Intelligence
- Emergency & Disaster Management
- Hydrology
- Metadata (Discovery, not Interpretation)

Not currently Active

- Data Preservation
- Decision Support
- Earth Systems Science
- Location Services
- Mass Market
- Sensor Web Enablement *
- Internet of Things*

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WMO / Met Ocean DWG currently NOT* Interested

- GeoXAMCL – security at detailed feature level
- CityGML – city and building modelling
- OpenLS - Location Services ??
- WPS - Web Processing Service ??
- 3D and Augmented Reality ?? But some activity
- Etc

* Or rather: no critical mass of interested volunteers

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Activities outside Met Ocean DWG

- WCS2.0 Extensions:
  - Collections of Coverages
  - 4-D Trajectory corridors
- WC (Data) Tile Service SWG
- Time:
  - Timeseries ML SWG (based on WaterML2.0 Time Series)
  - Temporal DWG working on Best Practice
  - Temporal WKT for Calendars SWG established:
    - 360, 365 day calendars, Gregorian no leap secs
- Vertical CRS just starting
- NetCDF SWG
- EDM Emergency & Disaster Management DWG
- Joint OGC / W3C Spatial Data on the Web WG

Challenges for OGC standards in Met Ocean

- Long history of interoperability at human/paper level
- Spatial & Temporal, 2D, 3D, 4+D, constantly changing
- Not MBytes, but GB, TB and PBytes of data daily.
- Regular & Irregular time intervals
- Timescales: hours,.., seasons,.., centuries, + & -
- Multiple Time attributes
- 'Regular' grids are not always regular
- Continual change of coordinate systems & re-projecting
- Eulerian versus Lagrangian viewpoints
- Vertical coordinates
- Cross-sections, height-time diagrams, T/φs, etc
- Ensembles: probabilistic distributions
- Significant 'Objects', features of interest

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Met Ocean DWG future work priorities*

- Work on Met Ocean aspects of WCS2.0 extension proposals
- Follow GeoTIFF WCS shortcut process with WMO GRIB format
- Develop WCS Data Tile standard

- Extend WMS1.3 BP to other standards (WMTS… Other than WCS 2.0)
- Extend the BP towards a Profile (+ Chair WMS SWG?) + conformance
- Expand WMS1.3 BP with climatological periods, calendars, etc
- Express Requirements/Change Request to WMS2.0 (now back to 1.4)
- Carry on with weather symbols in SVG, & styles, for SLD/SE on Github

- Interact more with the on Aviation DWG for Met
- Influence or use other OGC standards e.g. O&M, PubSub, WPS, etc
- Work on WMO Registries, Vertical & Temporal CRSs, SKOS/LD etc

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* Based on straw polls at TCs and Wiki nominations

Met Ocean DWG Achievements

- Open Wiki, open mailing list, community established
  - OGC more open Twikis, Mailing lists in response to Met Ocean
- WMS 1.3 Best Practice published, no Met terminology
  - Successful EGOWS plugfest 2014 Oslo
- Aviation/Meteorology Conceptual modelling published
  - Founded on O&M
- WCS 2.0 Extension progressing (slice, dice, curtain, …)
- Met Ocean DWG and Hydro DWG collaboration
  - Hydro WaterML is now WMO standard
- Météo-France participated in OGC IE Test bed
  - Lightweight Plugfests preferable to IE
- Contributing to 2D versus 4D debate in OGC
  - Move to 4D world has slowed in OGC
- Realise importance of O&M, Sensor Web, IoT
  - Clearer view of importance of other standards

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