



Geospatial Interoperability Standards and Protocols for Supporting International Exchange of IPY Data

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Contents

- Introduce to ISO TC 211 and OGC standards
- Propose the levels of interoperability in IPY community.
- Discuss standards to be adopted by IPY for corresponding level of interoperability
- Profile or develop IPY-specific standards



Introduction

- The International Polar Year (IPY) 2007-2008 is a large international and interdisciplinary effort to understand the behavior of Earth's polar regions and their role in the broader Earth System, including the oceans, atmosphere, biosphere, cryosphere, and land surface.
- Scientists from organizations around the world will work collaboratively on various IPY themes.
- These scientists are not only the data producers but also the data users.
- Sharing the data collected by scientists around the world is essential for the success of the IPY program.



IPY data policy and Challenge

- In order to ensure the successful of IPY, the International Joint Committee on IPY has endorsed a policy of free and unrestricted data exchange.
- The IPY *Framework* states that “The overarching objective of IPY 2007-2008 data management is to ensure the security, accessibility and free exchange of relevant data that both support current research and leave a lasting legacy.”
- It is a tremendous challenge to reach the IPY data management objective with data generated and consumed by scientists around the world.
- In order to facilitate the exchange and sharing of IPY data, interoperability standards and protocols have to be established.



Geospatial data and Interoperability

- Geospatial data are those describing event and/or phenomena located on Earth.
- Most of IPY data are geospatial data.
- In the past several years, the international geospatial data community has worked together to develop a set of geospatial interoperability standards and protocols with representative ones from
 - International Organization for Standardization (ISO)
 - the Open Geospatial Consortium (OGC).
- Those standards and protocols are potentially useful for IPY to reach its data management objectives.
- The question is where to apply the standards, which standards to use, and how to use the standards in order to obtain the best benefits of standardization and to reach IPY data management objective effectively.



ISO TC 211

- ISO Technical Committee 211 (TC 211) is responsible for setting international standards on digital geographic information.
- The work of ISO TC 211 aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth.
- These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations.
- The work shall link to appropriate standards for information technology and data where possible, and provide a framework for the development of sector-specific applications using geographic data.



TC 211 Organization

- Chairman and secretariat
 - **Chairman: Olaf Østensen**
Statens kartverk
Norwegian Mapping Authority
 - **Secretariat: Bjørnhild Sæterøy**
Norsk Teknologisenter
Norwegian Technology Centre (NTS)
- 29 Participating country members (P-members)
- 27 Observing country members (O-members)
- 11 Internal and 21 external liaisons
- 6 Working groups
- 3 Advisory groups
- 1 Terminology maintenance group
- ISO/TC 211 – OGC co-ordination group (TOCG)
- ISO/TC 204 – TC 211 task force



ISO Standards on Digital Geographic Information

- [ISO 6709:1983](#) Standard representation of latitude, longitude and altitude for geographic point locations
- [ISO 19101:2002](#) Geographic information -- Reference model
- [ISO/TS 19103:2005](#) Geographic information -- Conceptual schema language
- [ISO 19105:2000](#) Geographic information -- Conformance and testing
- [ISO 19106:2004](#) Geographic information -- Profiles
- [ISO 19107:2003](#) Geographic information -- Spatial schema
- [ISO 19108:2002](#) Geographic information -- Temporal schema
- [ISO 19108:2002/Cor 1:2006](#) [ISO 19109:2005](#) Geographic information -- Rules for application schema
- [ISO 19110:2005](#) Geographic information -- Methodology for feature cataloguing
- [ISO 19111:2003](#) Geographic information -- Spatial referencing by coordinates
- [ISO 19112:2003](#) Geographic information -- Spatial referencing by geographic identifiers
- [ISO 19113:2002](#) Geographic information -- Quality principles
- [ISO 19114:2003](#) Geographic information -- Quality evaluation procedures
- [ISO 19114:2003/Cor 1:2005](#)



ISO Standards on Digital Geographic Information

- [ISO 19115:2003](#) Geographic information -- Metadata
- [ISO 19115:2003/Cor 1:2006](#)
- [ISO 19116:2004](#) Geographic information -- Positioning services
- [ISO 19117:2005](#) Geographic information -- Portrayal
- [ISO 19118:2005](#) Geographic information -- Encoding
- [ISO 19119:2005](#) Geographic information -- Services
- [ISO/TR 19120:2001](#) Geographic information -- Functional standards
- [ISO/TR 19121:2000](#) Geographic information -- Imagery and gridded data
- [ISO/TR 19122:2004](#) Geographic information / Geomatics -- Qualification and certification of personnel
- [ISO 19123:2005](#) Geographic information -- Schema for coverage geometry and functions
- [ISO 19125-1:2004](#) Geographic information -- Simple feature access -- Part 1: Common architecture [ISO 19125-2:2004](#) Geographic information -- Simple feature access -- Part 2: SQL option
- [ISO/TS 19127:2005](#) Geographic information -- Geodetic codes and parameters
- [ISO 19128:2005](#) Geographic information -- Web map server interface
- [ISO 19133:2005](#) Geographic information -- Location-based services -- Tracking and navigation
- [ISO 19135:2005](#) Geographic information -- Procedures for item registration



ISO Standards in Development

- WI 19101-2 Geographic information - Reference model - Part 2: Imagery
- WI 19115-2 Geographic information - Metadata - Part 2: Extensions for imagery and gridded data
- WI 19126 Geographic information - Geographic information - Profile - FACC Data Dictionary
- WI 19129 Geographic information - Imagery, gridded and coverage data framework
- WI 19130 Geographic information - Sensor and data models for imagery and gridded data
- WI 19131 Geographic information - Data product specifications
- WI 19132 Geographic information - Location Based Services - Reference model



ISO Standards in Development

- WI 19134 Geographic information - Location Based Services - Multimodal routing and navigation
- WI 19136 Geographic information - Geography Markup Language (GML)
- WI 19137 Geographic information - Generally used profiles of the spatial schema and of similar important other schemas
- WI 19138 Geographic information - Data quality measures
- WI 19139 Geographic information - Metadata - Implementation specifications
- WI 19142 Geographic information - Web Feature Service
- WI 19143 Geographic information - Filter encoding
- WI 19144-1 Geographic information - Classification Systems – Part 1: Classification system structure
- WI 19144-2 Geographic information - Classification Systems – Part 2: Land Cover Classification System LCCS



Open Geospatial Consortium (OGC)

- A membership consortium whose mission is to promote the development and use of advanced open systems standards and techniques in the area of geoprocessing and related information technologies.
 - Bring together the key players and provides a formal structure for achieving consensus on the common interfaces.
 - Creates transparent access to heterogeneous geodata and geoprocessing resources in a networked environment.
 - Provide a comprehensive suite of open interface specifications that enable developers to write interoperating components.
- Currently OGC consists of 309 members from industry, academia, and government worldwide.



OGC Organization

- OGC is organized as a not-for-profit organization.
- Board of directors: responsible for the direction of OGC
- OGC president and HQ: responsible for the daily operation of OGC
- Planning Committee (PC):
 - Consists of members who pay due at principal member or above level
 - Approval of OGC standards, new programs and initiative
- Technical Committee (TC):
 - Consists of members who pay due at TC or above levels
 - Work on technical issues related to interoperability
 - TC forms Special Interest Group (SIG) to handle specific technical issues.



OGC Standard Activities

- OGC manages consensus processes that result in interoperability among diverse geoprocessing systems, data, and services.
- In OGC, geoprocessing users, GIS/image processing/database software and computer vendors, and other technology providers work together on the technical details of open, interoperable interfaces.
- OGC develops geospatial industry standards by two ways
 - Specification Program (SP): Regular standard development procedures, very similar to the procedures used for developing standards in other standardization organizations.
 - Interoperability Program (IP): Testbed activities, in which a proposed interface standard is tested through a rapid, coordinated test in an open environment. The interface standard is refined many times through SP process before it becomes an OGC specification.



Types of OGC Specifications

- Abstract Specifications
 - High level guide providing the framework or reference model. It contains conceptual models sufficient enough to allow for the creation of Implementation specifications.
- Implementation specifications
 - Unambiguous technology platform specifications for implementation of industry-standard, software application programming interfaces.

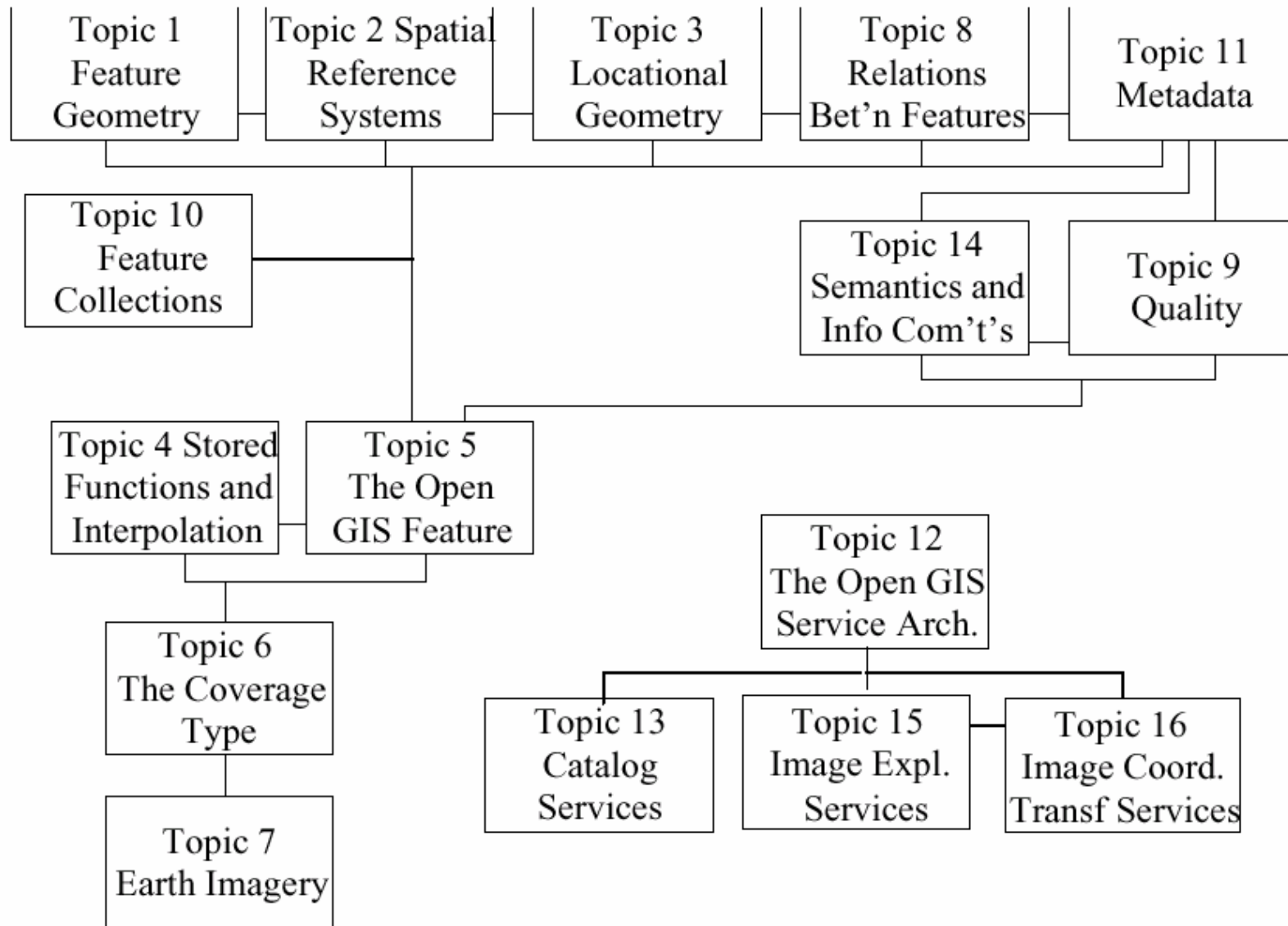


The relationship between ISO and OGC standards

- ISO TC 211 is technical committee in ISO responsible for setting international standards for geographic information/geometric.
- ISO TC 211 signed a MOU with OGC
 - OGC become a class A liaison of ISO TC 211
 - ISO 19100 series of standards will replace OGC abstract specification when applicable.
 - OGC concentrates on developing implementation specifications.
 - OGC will submit its specifications to ISO TC 211 to go through ISO standard process to become ISO standards.



Topics of OGC Abstract Specification





Completed OGC Implementation specifications

- Catalogue Service
- Coordinate Transformation
- Filter Encoding
- Geographic Objects
- Geography Markup Language
- GML in JPEG 2000
- Grid Coverage Service
- Location Services (OpenLS)
- Simple Feature Access 1
- Simple Feature Access 2
- Simple Features CORBA
- Simple Features OLE/COM
- Styled Layer Descriptor
- Web Coverage Service
- Web Feature Service
- Web Map Context
- Web Mapping Service
- Web Service Common



Levels of Interoperability in IPY

- Assume that:
 - IPY data will be distributed around the world provided by multiple diverse data providers.
 - Web technology will be used as the technology for data sharing and interoperability
 - Software system to software system interoperability is the major form of interoperability
- Data Discovery
 - Find where the needed data are archived.
- Data Search
 - Find a specific data set
- Data access
 - Obtain needed data from anywhere
- Service sharing
 - Able to chain services from different service providers
- Quality assured interoperability
 - Assure the data obtained or service received meet the users' requirement.



Proposed ISO & OGC standards for IPY

- Data Discovery
 - ISO 19115 for the directory metadata
- Data Search
 - ISO 19115 and ISO 19115-2 for metadata contents
 - OGC CSW for catalog interoperable interfaces
- Data access
 - Interfaces
 - WFS for feature data (e.g., vector, point measurements)
 - WCS for coverage data (e.g., satellite images)
 - WMS for browse, visualization, and map generation
 - Format for encoding the data communicated among the systems
 - GML for feature data
 - Select two or three formats from WCS preferred formats (e.g., GeoTiff, HDF-EOS, netCDF)
 - Projections (e.g., Lat/Lon, UTM)



Proposed ISO & OGC Standards for IPY

- Service sharing
 - ISO 19119
 - OGC web service chaining specifications, geoprocessing specifications in development
 - Approved or under-development OGC specifications for some fundamental services
 - OGC Coordinate Transformation Service (CTS)
 - Reprojection service, reformatting services, feature cutting service, etc.
- Quality assured interoperability
 - ISO 191113, ISO 19114, ISO 19138 for quality reporting.
 - ISO 19131 for data product specification
 - Data content standards, ISO 19130, need to develop additional IPY specific product content standards
 - Geospatial one-stop content standards for the framework layers can be used as references.



Standards in the Highest Priority for IPY to Adopt

- Standards in the highest priority: ISO 19115, OGC CSW, WCS, WMS, and WFS.
- ISO 19115 for metadata interoperability
- OGC CSW, WCS, WFS, and WMS for data search and access.
 - Assume user using CSW to search the data catalog, and use either WCS, WFS, or WMS for data retrieval.



IPY Community Profiles or Standards

- In order for the IPY community to use those proposed standards or any existing standards, it is possible that
 - modifications to the suggested standards are needed
 - Create IPY profiles of the standards by following the approach defined in ISO 19106
 - Creation of new community standards
 - Through consensus-building process
 - Submission to OGC or ISO to approve as OGC or ISO standards so that more communities can use such standards.
- All standards should be set by following the consensus-building process.