International Geomatics Standards Development Activities

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Presentation Outline

1) Standards and Their Importance
2) ISO and Canada’s Standards
3) Imagery, Gridded and Coverage Data
4) Standards-based Technologies in Canada
5) On-going and Future Activities
What are Standards?

Standardization is the process of getting people to agree on an acceptable technical solution, not the development of the best, or cheapest approach.

Through an iterative process and building on previous standardization work, it is possible to develop new standards that guide (prescribe) new technology, but support existing systems and data.

The iterative process of standards development is important since it is clearly impossible for any group of experts to set the path for all time. It is necessary to build upon existing standards and refine them to develop new, broader standards.
Some objectives ...

- increase the understanding and usage of geographic information

- increase the availability, access, integration, and sharing of geographic information, enable interoperability of geospatially enabled computer systems access, integration, and sharing of geographic information

- promote the efficient, effective, and economic use of digital geographic information and associated hardware and software systems
Some goals ...

- contribute to a unified approach to addressing global ecological and humanitarian problems

- and ease the establishment of geospatial infrastructures at local, regional and global level.

... and cooperate with others in achieving this!
Importance of Standards

- achieve interoperability by establishing a common information infrastructure for use by all stakeholders.
- cooperate with international activities to ensure the Canadian solution is in tune with international community.
- demonstrate solutions for the global delivery of integrated geospatial information, applications and services.
Present Situation

- Quality Issues
- Lack of complete Metadata
- Proprietary Structures
- Evolving Systems (hardware and software changes)
- Data Loss
Quality Issues / Data Loss

Quality Issues and Data Loss
  - Data Recovery on Legacy information
    - unknown Vertical and Horizontal datums
    - unknown scale
    - unknown projections

Data Loss due to
  - Projection Conversions
  - Precision/Accuracy
  - units

Data loss due to lack of meta information
Proprietary Structures

- Application dependant
- Platform dependant
- Legacy Formats
- Legal Ownership
- Operating System Dependant
- Limited Flexibility
- Limited Interoperability
Evolving Systems

Hardware changes:
- Continually Changing Hardware and Operating systems
- Data Encoding Issues
  - Little Endian Big Endian
  - 12 bit byte - 8 bit byte
  - 60 bit word- 64 bit word
- Increased Costs

Software changes:
- Technology shifts
- Limited backward compatibility
- Frequent version changes
- Limited interoperability
- Constant re-engineering
How can we remedy this?

- Define the requirements of our industries and agencies.
- Follow and/or participate in the development of international standards.
- Participate in the implementation and use of international standards.
- Actively take a role in developing our Canadian / N. American ISO profiles as they become available in the next 6 - 12 months.
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What is ISO/TC 211?

ISO/TC 211 is the technical Committee that deals with Geographic Information & Geomatics Internationally

- Standardize in the field of digital geographic information.

- Establish a structured set of standards concerning objects or phenomena directly or indirectly associated with a location on Earth.

- Specify methods, tools and services for data acquisition, processing, analysis, access, visualization, transfer & management of digital data between different users, systems and locations.

- link to appropriate standards and develop sector-specific applications using geographic data.
ISO/TC 211 organization

- CAC leads the International Standards Activities.
- CGSB CoG mimics the ISO/TC211 structure.
- Canada has experts on all Working Groups.
Canadian National Committees

Canadian Advisory Committee to ISO (CAC ISO)

Canadian Advisory Committee to IEC (CAC IEC)

CGSB

CoG

These bodies publish standards in a wide variety of fields:

- information technology
- medical technology
- the environment
- quality management
Standards Council of Canada (SCC)

- A federal Crown corporation established by a 1970 Act of Parliament to promote efficient and effective standardization.

- Reports to Parliament through the Minister of Industry.

- Mandate: to coordinate standardization in Canada. This includes participation in international standardization.
Canadian General Standards Board (CGSB)

- The only accredited Federal Government standards-development body in Canada.

- Services:
  - Development of standards, specifications, manuals, guides;
  - CGSB Qualification and Certification Listings of pre-qualified products and services;
  - Quality Systems Division.

- Committee on Geomatics (CGSB CoG), responsible for National standards in geomatics.
ISO/TC 211 suite

- ISO 19101 - Reference model
- ISO 19102 - Overview
- ISO 19103 - Conceptual schema language
- ISO 19104 - Terminology
- ISO 19105 - Conformance and testing
- ISO 19106 - Profiles
- ISO 19107 - Spatial schema
- ISO 19108 - Temporal schema
- ISO 19109 - Rules for application schema
- ISO 19110 - Feature cataloguing methodology
- ISO 19111 - Spatial referencing by coordinates
- ISO 19112 - Spatial referencing by geographic identifiers
- ISO 19113 - Quality principles
- ISO 19114 - Quality evaluation procedures
- ISO 19115 - Metadata
- ISO 19116 - Positioning services
ISO/TR 19120 - Functional standards + new revisions
ISO/TR 19121 Imagery and gridded data
ISO/TR 19122 - Qualifications and certification of personnel
ISO 19123 - Schema for coverage geometry and functions
ISO 19124 - Imagery and gridded data components
ISO 19125 - Simple feature access - SQL option
ISO 19126 - Profile - FACC Data Dictionary
ISO 19127 - Geodetic codes and parameters
ISO 19128 - Web Map Server Interface
ISO 19129 - Imagery, gridded and coverage framework
ISO 19130 - Sensor and data model for imagery and gridded data

30 Standards in the TC211 Suite
Published standards and reports

International Standards and Technical Reports
- ISO 19105:2000 - Conformance and Testing
- ISO/TR 19121:2000 - Imagery and Gridded data

Draft International Standards
- ISO/DIS 19101 - Reference model
- ISO/DIS 19108 - Temporal schema
- ISO/DIS 19111 - Spatial referencing by coordinates
- ISO/DIS 19125 - Simple feature access
  Part 1: Common architecture & Part 2: SQL option
New work

New work accepted

- ISO 19129, Geographic Information - Imagery, gridded and coverage data framework.
- ISO 19130, Geographic information - Sensor and data models for imagery and gridded data.

In preparation

- Location based services
- Location based services, tracking and navigation
- Data product specifications
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New Projects approved by ISO/TC 211

- ISO 19129 - Imagery, Gridded and Coverage Data Framework, led by NRCan, Canada Centre for Remote Sensing along with NASA, NIMA, USGS, OCG, ISPRS, MACRES, etc. (First meeting in June 20th, 2001 in Berlin, Germany)

- ISO 19130 - Sensor and Data Models for Imagery and Gridded Data, led by NASA along with NRCan, OGC, NIMA, USGS, ISPRS, MACRES, etc. (First meeting on June 18 & 19th, 2001 in Berlin, Germany)

The two work in close collaboration as a team
Imagery, Gridded and Coverage Data Framework (Scope)

To standardize concepts for the description and representation of imagery, gridded and coverage data. This New Work Item develops Technical Specification to define the framework for imagery, gridded and coverage data and those elements that require standardization that are not identified in other ISO 19100 standards.
Imagery, Gridded and Coverage Data Framework (Model)

Abstract Level

Schema for Coverage Geometry & Functions per TC 211 19123 (including Grid, Trees, TINs, and Riemann Hyperspatial Structure)

Content Model Level

Imagery, Gridded and Coverage Data (Stage 1)

- Framework for IGCD (Reference Model 19101)
- Sensor and Data Models (19130)
- Grid Coverage implementation specification per OGC

Exchange Format or Storage Media Interface

BIIF

CEOS

HDF-EOS

SQL/MM

GeoTiff

DGIWG

Metadata per 19115

Quality elements (19113 & 19114)

Spatial Referencing by coordinates per 19111

Encoding per 19118
The Technical Specification defines

- Reference Model;

- Terminology related to Imagery, Gridded and Coverage Data;

- Spatial Referencing by Coordinates (e.g. Time varying vertical and horizontal datum);

- Quality principles and/or ISO Quality evaluation procedures;

- Metadata (e.g. Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing Metadata); and

- Encoding (e.g. BIIF, GeoTIFF, HHCodes, HDF, and other encoding Scheme).
Sensor and Data Model for Imagery and Gridded Data (Scope)

- Aims to develop a generic and standardised sensor and data models for all existing and known sensors
- These models shall allow the use of the metadata for the above mentioned applications.
- Describes the physical and geometrical properties of each kind of photogrammetric, remote sensing, and other sensors
- Defines a conceptual data model that specifies the minimum content requirement and the relationship among the components of the content for the raw data that was measured by the sensor
ISO Standards & Their implementation

- The ISO/TC 211 suite of standards are abstract standards, dealing with topics such as schema, framework, components, etc.

- Their implementation is done by building specifications.

- Industry Consortiums such as 3i along with OGC are actively implementing the ISO standards.

- The standards based technologies are developed and being developed in both government laboratories and industry.
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Standards in Action
Demonstration Highlights

Canada has created a demonstration site to showcase the components of a standards-based distributed spatial architecture. The components are based on ISO/TC 211 19100 suite of standards. The standards in action demo comprises several implementations, some of them are:

- Distributed navigation, data access, viewing and download as an implementation of Simple feature Access (ISO 9125-1 & 19125-2), Metadata (ISO 19115), and Spatial referencing by coordinates (ISO 19111).
- Geospatial Standards based data products, related to ISO 19107 (Spatial Schema), ISO 19110 (feature cataloguing methodology), and ISO 19111 (spatial reference by coordinates).
- Multilingual support for meta-content as per ISO 19115 (Metadata).
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A proposed approach for image and gridded data

• The general structure of ISO coverage geometry defines a set of “pixels” (grid or other hyperspatial structure) in a multidimensional space

• ISO “Application schema” for gridded data which will allow attributes to be assigned for each pixel and metadata for the data set as a whole

• The sensor data model will provide both sensor specific metadata, and attributes at the pixel level.

• Data derived from SAR sensors for example will have unique metadata elements, and multidimensional and complex attributes per pixel.
A proposed approach for image and gridded data

- **Self Defining Structure (SDS)** is an implementation of the Riemann Hypercube Structure for image and gridded components (ISO TC 211 19124)
- It is a complex coverage function with different size data elements in a number of dimensions.
Benefits of SDS architecture

- **Ease of Handling, Storage, and Retrieval of Very Large Data Bases.**

- **Improve and maintain Data Quality (metadata imbedded in the structure).**

- **Facilitate existing Data Management Infrastructure (connects to existing GIS’s).**

- **Facilitate Interoperability between applications.**
SDS Functions

- **Data Fusion** - Large datasets fused into *multisource* files with encapsulated metadata; *Multidimensional* positioning

- **Tiling** - a mechanism of storing information without significant degradation of quality by aggregating point information into statistical tesselates, which are variable sized cells in Multi-D.

- **Data Visualization** - Dynamic Contours & Tidal Datums
On-going and Future Activities

- First round of ISO-TC211 abstract and component Standards are completed
- Organizations such as OGC, DGWIG (DIGEST v.3.0), IHO (S57 v.4), etc. are adopting these standards
- New ISO work is shifting to Web Mapping Implementation specs.
- Major New work on Imagery, Gridded and Coverage Data
- New emphasis on Quality and Testing
- Establishment of Registration mechanism to support common models, portrayal and encoding (ISOizing GML)
- New Work on Location-based Services
Conclusions

- Standards based technologies are very important and provide:
  - Interoperability
  - Common information infrastructure
  - Ease of data recovery

- For any application, the following are crucial:
  - Standards including a content model
  - Geospatial information
  - Metadata
Standards based technologies are Building Bridges

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