Technical solutions and standards

How ISO can support a forum for global geographic information management

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The Conference,
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Requests that, by 1 November 2010, the Secretary-General and the United Nations Secretariat initiate discussions and prepare a report, for a future session of the Economic and Social Council, on global coordination of geographic information management, including consideration of the possible creation of a United Nations global forum for the exchange of information between countries and other interested parties, and in particular for sharing best practices in legal and policy instruments, institutional management models, technical solutions and standards, interoperability of systems and data, and sharing mechanisms that guarantee easy and timely accessibility of geographic information and services.

Resolution VII: Global geographic information management,
Eighteenth United Nations Regional Cartographic Conference for Asia and the Pacific

ISO/TC 211 was established in 1994 and has currently published nearly 40 standards and other deliverables within the field of geographic information and geomatics. Another set of around 20 is under development or revision. The work of the committee has provided a very solid state-of-the-art fundament for establishing, documenting, integrating, archiving, disseminating and interpreting geographic information. Unambiguous data description, including the semantic aspects, is of course essential for making assertions and reasoning about our environment. The ISO 19100-family of standards includes standards for describing data content and services to access the content. Metadata, i.e. data about data, has been a main focus to allow discovery of which data that actually exist, information allowing user communities to assess their fitness for use, and information on where to retrieve and possible conditions for the use of the data. Information about our earth can be reasonably static, like the basic topography, or very dynamic, like weather conditions. The ISO 19100-family allows all such spatial and temporal aspects to be described together with precise content including quality information that is essential for making decisions based on the collected information.

SDI and GGIM building blocks

There are many ways to describe the necessary component for a SDI or for GGIM. More or less they will point to the following aspects:

Governance and organizational aspects	the fundamental environment for the whole activity
Metadata for data and services	describing information assets for discovery and evaluation
Data and data harmonization	information itself and activities to achieve interoperability

Access to metadata and data	the technical means of accessing information and meta-information
Data policy and data sharing	the necessary means to allow information to be accessed and used with regards to licensing, pricing, and rights management

Standards are an important component in all these aspects. They are necessary to provide the different layers of interoperability that underpins the objectives of the SDI or GGIM, organizational, semantic and technical interoperability.

Governance and organizational aspects

The most challenging part of building spatial data infrastructures – SDI – or any global geographic information management, is the organizational aspects and the governance of the structures. The development of standards and other common specifications, and procedures to approve these, is a fundamental part of the governance. The International Organization for Standardization – ISO – is a long time cooperative organization to the UN in various fields. ISO/TC 211 – as one of many – ISO technical committees is no exception. UN, through UN ECE, was one of the four organizations to apply for a liaison already from the start of ISO/TC 211 in 1994. Since then, the cooperation has grown and many UN organizations, groups, and specialized agencies are now liaison to the committee. UN FAO being one of the most active, e.g. by submitting its work on land cover classification to become International Standards.

Thus, ISO in general, and ISO/TC 211specifically, wants to enhance the cooperation with UN in order to fulfill the aims of a GGIM. International standards as developed by ISO have great authority and reputation based on their consensus-driven process in a broad and representational environment. Both this approach and the global coverage of ISO, fits very well with UN and its objectives. Extended MoUs or cooperative agreements can be developed if deemed necessary in order to formalize further collaboration.

ISO can also provide a link to or between different standards committees and other organizations through its liaison mechanism. An advanced example of this is the planned Joint Steering Group between several UN affiliated organizations and several ISO committees to develop standard for climate variables to measure climate change.

Metadata for data and services

A vast amount of geographic information and geospatial services are available at the global scale. Very often the existence of these are only known to the producer or a small community. To ensure a broader knowledge and spread of these geospatial assets, one builds metadata catalogues and provides services to access the catalogues.

Metadata is a fundamental component of any SDI, and will also be so for a GGIM. ISO/TC 211 has several standards in this category, mainly

ISO 19115:2003 – Metadata (under revision)
ISO 19115-2:2008 – Metadata – Part 2: Extensions for imagery and gridded data
ISO 19119:2005 – Services
ISO 19119:2005/Amd 1:2008 Extensions of the service metadata model
ISO/TS 19139:2007 – Metadata – Implementation specification

These standards form also the basis for the approach taken in INSPIRE. INSPIRE (Infrastructure for Spatial Information in the European Community), based on a European directive approved in May 2007, is probably the most ambitious SDI programme today spanning tenfolds of countries.

Data and data harmonization

The largest range of ISO/TC 211 developed standards relate to geographic content, the information itself. More than half of the currently published standard deal with data specification and components of data specifications in some sense.

Data harmonization across national and regional boundaries is important for comparison and homogeneous decision making, i.e. that we produce information that adheres to the same specifications. The ISO-standards have proven to be a mature basis for this task after years of practical use at national, regional and – in some cases – global level. Again it is easy to point to INSPIRE as one of the success stories. INSPIRE defines 34 spatially related themes that shall be described and established at pan-European level. These themes include land cover, soil, land use, environmental monitoring facilities, atmospheric conditions, oceanographic geographical features, bio-geographical regions, habitats and biotopes, species distribution and energy resources, to mention a few. The general guidelines and methodology to develop these specifications, list 20 of the ISO 19100-series standards as normative references, meaning that they are important and indeed, mandatory to use in order to have open, interoperable, precise, data specifications.

Access to metadata and data

Once information content within a domain has been defined, and production running, different user communities must be able to discover and access the information for their various uses. The technical basis for sharing data is today a set of web-based network access services. Firstly, services to discover what is available, evaluate its fitness for the purpose, and the access the information content itself.

ISO/TC 211 has again a range of suitable standards in this respect. The network services have typically been developed in joint projects with industry and organizations organizing the industry. Open Geospatial Consortium, OGC, is by far the most important partner for ISO in this respect.

Through services for metadata discovery, view services (web map service, WMS), and data access and download service (web feature service, WFS), the most important access methods are well developed and readily in place.

Data policy and data sharing

Neither data content nor access service matters unless data policies and data sharing agreements are in place. One of the major obstacles today for the exploitation of geographic information is complex and unclear conditions for the reuse outside its original intent. In order to have a successful SDI or GGIM, major efforts must be paid to this area. Simplified and harmonized rules for data sharing and licensing is necessary for any progress in this area.

Most of the work here is of legal and political nature, and mostly out of scope for technical standards. Nevertheless, standards can support successful implementation of data policy and data sharing regimes. ISO/TC 211 has two standards in this domain:

ISO 19149 – Rights expression language for geographic information – GeoREL
ISO 19153 – Geospatial Digital Rights Management Reference Model (GeoDRM RM)

Both these are developed in collaboration with OGC.

Some specific developments

As described above, there is a growing need to describe global frameworks for information domains. In ISO/TC 211 there are several projects of this kind, e.g. land cover classification, land administration, addresses, generic observations and measurements, and ubiquitous geographic information.

There are mature use cases for reference data, ref. initiatives like Global map, which rather easily could be lifted to an International Standard. Geographical names is also clearly a candidate for application of basic data specification standards.

Programmes like INSPIRE has shown that the basic fundament for data harmonization within a very broad class of domains is achievable.

Annex – International standards within geographic information/geomatics

Published work:

ISO 6709:2008 – Standard representation of geographic point location by coordinates
ISO 19101:2002 – Reference model (under revision)
ISO 19101-2:2008 – Reference model – Part 2: Imagery
ISO/TS 19103:2005 – Conceptual schema language (under revision)
ISO/TS 19104:2008 – Terminology
ISO 19105:2000 – Conformance and testing
ISO 19106:2004 – Profiles
ISO 19107:2003 – Spatial schema
ISO 19108:2002 – Temporal schema
ISO 19109:2005 – Rules for application schema
ISO 19110:2005 – Feature cataloguing methodology
ISO 19111:2007 – Spatial referencing by coordinates
ISO 19111-2:2009 – Spatial referencing by coordinates – Part 2: Extension for parametric values
ISO 19112:2003 – Spatial referencing by geographic identifiers
ISO 19113:2003 – Quality principles (under revision)
ISO 19114:2003 – Quality evaluation procedures (under revision)
ISO 19115:2003 – Metadata (under revision)
ISO 19115-2:2008 – Metadata – Part 2: Extensions for imagery and gridded data
ISO 19116:2004 – Positioning services
ISO 19117:2005 – Portrayal (under revision)
ISO 19118:2005 – Encoding (under revision)
ISO 19119:2005 – Services

ISO/TR 19120:2001 – Functional standards
ISO/TR 19121:2000 – Imagery and gridded data
ISO/TR 19122:2004 – Qualification and certification of personnel
ISO 19123:2005 – Schema for coverage geometry and functions
ISO 19125-1:2004 – Simple feature access – Part 1: Common architecture (under revision)
ISO 19125-2:2004 – Simple feature access – Part 2: SQL Option (under revision)
ISO 19126:2009 – Feature concept dictionaries and registers
ISO/TS 19127:2005 – Geodetic codes and parameters
ISO 19128:2005 – Web Map Server Interface
ISO/TS 19129:2009 – Imagery, gridded and coverage data framework
ISO 19131:2007 – Data product specification
ISO 19132:2007 – Location-based services – Reference model
ISO 19133:2005 – Location-based services – Tracking and navigation
ISO 19134:2007 – Location-based services – Multimodal routing and navigation
ISO 19135:2005 – Procedures for item registration
ISO 19136:2007 – Geography Markup Language (GML)
ISO 19137:2007 – Core profile of the spatial schema
ISO/TS 19138:2006 – Data quality measures (under revision)
ISO/TS 19139:2007 – Metadata – Implementation specification
ISO 19141:2008 – Schema for moving features
ISO 19144-1:2009 – Classification systems – Part 1: Classification system structure

Still under process – at different stages:

ISO 19103 – Conceptual Schema language (revision)
ISO 19110 Amd. 1 – Methodology for feature cataloguing – Amendment 1
ISO 19115 – Metadata (revision)
ISO 19117 – Portrayal (revision)
ISO 19118 – Encoding (revision)
ISO 19125-1:2004 – Simple feature access – Part 1: Common architecture (revision)
ISO 19125-2:2004 – Simple feature access – Part 2: SQL Option (revision)
ISO 19130 – Imagery sensor models for geopositioning
ISO 19131 Amd. 1 – Data product specification
ISO 19142 – Web Feature Service
ISO 19143 – Filter encoding
ISO 19144-2 – Classification Systems – Part 2: Land Cover Classification System LCCS
ISO 19145 – Registry of representations of geographic point location
ISO 19146 – Cross-domain vocabularies
ISO 19147 – Location-Based Services - Transfer Nodes
ISO 19148 – Linear Referencing
ISO 19149 – Rights expression language for geographic information – GeoREL
ISO 19150 – Ontology
ISO 19151 – Dynamic Position Identification Scheme for Ubiquitous Space (u-Position)
ISO 19152 – Land Administration Domain Model (LADM)
ISO 19153 – Geospatial Digital Rights Management Reference Model (GeoDRM RM)
ISO 19154 – Standardization Requirements for Ubiquitous Public Access
ISO 19155 – Place Identifier (PI) Architecture
ISO 19156 – Observations and measurements
ISO 19157 – Data quality (revision of ISO 19113:2003, ISO 19114:2003 and ISO/TC 19138:2006)
ISO 19158 – Quality assurance of data supply
ISO 19160 – Addressing (Stage 0)

Annex II

ISO/TC 211 national member bodies

Participating members (active members)

Australia	Hungary	Russian Federation
Austria	Italy	Saudi Arabia
Belgium	Japan	Serbia
Canada	Rep. of Korea	South Africa
China	Malaysia	Spain
Czech Rep.	Morocco	Sweden
Denmark	Netherlands	Switzerland
Ecuador	New Zealand	Thailand
Finland	Norway	United Kingdom
France	Peru	United States of America
Germany	Portugal	

Observing members

Argentina	India	Philippines
Bahrain	Indonesia	Poland
Brunei Darussalam	Isl. Rep. of Iran	Romania
Colombia	Ireland	Slovakia
Croatia	Israel	Slovenia
Cuba	Jamaica	Tanzania
Estonia	Kenya	Turkey
Greece	Mauritius	Ukraine
Hong Kong	Oman	Uruguay
Iceland	Pakistan	Zimbabwe

Liaison members

UN
UN Economic Commission for Africa
UN Economic Commission for Europe, Statistical Division
UN FAO, Food & Agriculture Organization of the United Nations
UNGEGN, United Nations Group of Experts on Geographical Names
UNGIWG, United Nations Geographic Information Working Group

UN Specialized agencies
ICAO, International Civil Aviation Organization
UPU, Universal Postal Union
WMO, World Meteorological Organization

Other liaison members

CEOS, Committee on Earth Observation Satellites
DGIWG, Defence Geospatial Information Working Group
Energistics
EuroGeographics
EuroSDR, European Spatial Data Research
ESA, European Space Agency
FIG, International Federation of Surveyors
GSDI, Global Spatial Data Infrastructure
IAG, International Association of Geodesy
ICA, International Cartographic Association
IEEE Geoscience and Remote Sensing Society
IHB, International Hydrographic Bureau
ISCGM, International Steering Committee for Global Mapping
ISPRS, International Society for Photogrammetry and Remote Sensing
JRC, Joint Research Centre, European Commission
OGC, Open Geospatial Consortium, Inc.
OGP, International Association of Oil and Gas Producers
OASIS, Organization for the Advancement of Structured Information Standards
PAIGH, Panamerican Institute of Geography and History
PCGIAP, The Permanent Committee on GIS Infrastructure for Asia and the Pacific
PC IDEA, Permanent Committee on Spatial Data Infrastructure for the Americas
SCAR, Scientific Committee on Antarctic Research

Internal liaisons and other standard bodies liaisons

ISO/IEC JTC 1/SC 24 Computer graphics, image processing and environmental data representation
ISO/IEC JTC 1/SC 31 Automatic identification and data capture
ISO/IEC JTC 1/SC 32 Data Management and Interchange
ISO/IEC JTC 1/SC 36 , Information technology for learning, education and training
ISO/TC 20/SC 13 Space data and information transfer
ISO/TC 59/SC 13 Organization of information about construction works
ISO/TC 69 Applications of statistical methods
ISO/TC 154 Processes, data elements and documents in commerce, industry and administration
ISO/TC 171 Document management application
ISO/TC 184/SC4 Industrial Data
ISO/TC 204 Intelligent transport systems
ISO/TC 207 Environmental management
ISO/TC 241 Project Committee: Road Traffic Safety Management System
The ISO Steering Committee for Image Technology (SCIT)
The Study Group on Sensor Networks
CEN/TC 287 Geographic Information
CEN/TC 278 Road Transport and Traffic Telematics
CEN/ISSS Workshop on Metadata for Multimedia Information - Dublin Core

References

www.isotc211.org - Web site of ISO/TC 211
www.iso.org   - Central web site for the International Organization for Standardization – ISO Standards guide – ISO/TC 211 - http://www.isotc211.org/Outreach/ISO_TC%20_211_Standards_Guide.pdf
Measurements to know and understand our world – ISO Focus, February 2008, http://www.iso.org/iso/iso-focus-index/iso-focus_2008/iso-focus_2008-02.htm