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Geografske informacije - Infrastrukture za prostorske podatke - 1. del: Referenčni model

Geographic information - Spatial data infrastructures - Part 1: Reference model

Geoinformation - Geodateninfrastrukturen - Teil 1: Referenzmodell

Information géographique - Infrastructures de données spatiales - Partie 1: Modèle de référence

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English Version

Geographic information - Spatial data infrastructures - Part 1: Reference model

Information géographique - Infrastructures de données spatiales - Partie 1: Modèle de référence

Geoinformation - Geodateninfrastrukturen - Teil 1: Referenzmodell

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Contents

Page

Foreword

This document (CEN/TR 15449-1:2012) has been prepared by Technical Committee CEN/TC 287 “Geographic information”, the secretariat of which is held by BSI.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TR 15449:2011.

The present standard comprises the following parts:

— CEN/TR 15449-1, *Geographic information — Spatial data infrastructures — Part 1: Reference model* (the present part);

— CEN/TR 15449-2, *Geographic information — Spatial data infrastructures — Part 2: Best practices*;

— CEN/TR 15449-3, *Geographic information — Spatial data infrastructures — Part 3: Data centric view*;

— CEN/TR 15449-4, *Geographic information — Spatial Data Infrastructure (SDI) — Part 4: Service centric view*.

Introduction

Spatial data infrastructure (SDI) is a general term for the computerised environment for handling data that relates to a position on or near the surface of the earth. It may be defined in a range of ways, in different circumstances, from the local up to the global level.

This Technical Report focuses on the technical aspects of SDIs, thereby limiting the term SDI to mean an implementation neutral-technological infrastructure for geospatial data and services, based upon standards and specifications. It does not consider an SDI as a carefully designed and dedicated information system; rather, it is viewed as a collaborative framework of disparate information systems that contain resources that stakeholders desire to share. The common denominator of SDI resources, which can be data or services, is their spatial nature. It is understood that the framework is in constant evolution, and that therefore the requirements for standards and specifications supporting SDI implementations evolve continuously.

SDIs are becoming more and more linked and integrated with systems developed in the context of e-Government. Important drivers for this evolution are the Digital Agenda for Europe, and related policies (cf. Annex A). This Technical Report takes these developments into account. By sharing emerging requirements at an early stage with the standardization bodies, users of SDIs can help influence the revision of existing or the conception of new standards.

The users of an SDI are considered to be those individuals or organisations that, in the context of their business processes, need to share and access geo-resources in a meaningful and sustainable way. Based on platform- and vendor-neutral standards and specifications, an SDI aims at assisting organisations and individuals in publishing, finding, delivering, and eventually, using geographic information and services over the internet across borders of information communities in a more cost-effective manner.

Existing material about SDIs abounds. The criteria used for determining if a given standard or specification is referred to in this report are that the publication addresses an aspect of an SDI; and the publication is non-proprietary in nature.

Based on these considerations, the following reports have been taken into account:

- legal texts and guidelines produced in the context of INSPIRE;
- documents produced by ISO/TC 211 (and co-published by CEN);
- documents produced by the Open Geospatial Consortium (OGC), including the OpenGIS Reference Model (ORM) (OGC, 2003);
- the European Interoperability Framework and related documents;
- deliverables from the European Union-funded projects (e.g. GIGAS, SANY).

Considering the complexity of the subject and the need to capture and formalise different conceptual and modelling views, CEN/TR 15449 is comprised of multiple parts:

- Part 1: Reference model: this provides a general context model for the other Parts, applying general IT architecture standards.
- Part 2: Best Practices: this provides best practices guidance for implementing SDI, through the evaluation of the projects in the frame of the European Union funding programmes.

- Part 3: Data centric view: this addresses concerns related to the data, which includes application schemas and metadata.

- Part 4: Service centric view (in preparation): this includes the taxonomy of services, concepts of interoperability, service architecture, service catalogue, and the underlying IT standards.

Further parts may be created in the future.

1 Scope

This part of the Technical Report provides a reference model for a Spatial Data Infrastructure (SDI). It covers framework standards and identifies the relevant standards, technical specifications, technical reports and guidelines.

This part of the Technical Report provides a context model for the other parts of this Technical Report applying general architecture standards.

The intended readership of this Technical Report are those people who are responsible for creating frameworks for SDIs, experts contributing to INSPIRE, experts in information and communication technologies and e-government that need to familiarise themselves with geographic information and SDI concepts, and standards developers and writers.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
conceptual formalism
set of modelling concepts used to describe a conceptual model

EXAMPLE UML meta model, EXPRESS meta model.

Note 1 to entry: One conceptual formalism can be expressed in several conceptual schema languages.

[SOURCE: EN ISO 19101:2005]

3.2
conceptual model
model that defines concepts of a universe of discourse

[SOURCE: EN ISO 19101:2005]

3.3
conceptual schema
formal description of a conceptual model

[SOURCE: EN ISO 19101:2005]

3.4
conceptual schema language
formal language based on a conceptual formalism for the purpose of representing conceptual schemas

EXAMPLE UML, EXPRESS, IDEF1X.

Note 1 to entry: A conceptual schema language may be lexical or graphical. Several conceptual schema languages can be based on the same conceptual formalism.

[SOURCE: EN ISO 19101:2005]

3.5
conformance
fulfilment of specified requirements

[SOURCE: EN ISO 19113:2005]

3.6
identifier
linguistically independent sequence of characters capable of uniquely and permanently identifying that with which it is associated

[SOURCE: ISO/IEC 11179-3:2003]

3.7
interoperability
capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units

[SOURCE: ISO/IEC 2382-1:1993]

3.8
reference frame
aggregation of the data needed by different components of an information system

3.9
resource
asset or means that fulfils a requirement

[SOURCE: EN ISO 19115:2005]

3.10
Spatial Data Infrastructure
SDI
metadata, spatial data sets and spatial data services; network services and technologies; agreements on sharing, access and use; coordination and monitoring mechanisms, processes and procedures, established, operated or made available in an interoperable manner

[SOURCE: INSPIRE]

Note 1 to entry: In the context of this report the term SDI is restricted to a platform- and implementation-neutral technological infrastructure for geospatial data and services, based upon standards and specifications.

3.11
use case
specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

[SOURCE: ISO/IEC 19501:2005]

4 Abbreviated terms

API	application programming interface
CORBA	Common Object Request Broker Architecture
EIF	European Interoperability Framework

EN	European Standard (CEN deliverable)
INSPIRE	Infrastructure for Spatial Information in Europe
GI	geographic information
GML	Geography Markup Language
ISO	International Organization for Standardization
ICT	information and communications technology
ODP	Open Distributed Processing
OGC	Open Geospatial Consortium
OLE/COM	Object linking and embedding/ Component Object Model
OMG	Object Management Group
OSE	Open Systems Environment
RM-ODP	Reference Model of Open Distributed Processing
SDI	Spatial Data Infrastructure
SLD	Styled Layer Descriptor
SOA	Service Oriented Architecture
UML	Unified Modelling Language
WAI	Web Accessibility Initiative
WCS	Web Coverage Service interface specification
WFS	Web Feature Service interface specification
WMS	Web Map Service interface specification
W3C	World Wide Web Consortium
XML	eXtensible Markup Language
XSL	eXtensible Stylesheet Language

5 SDI interoperability

5.1 Interoperability Standards

A Spatial Data Infrastructure (SDI) relies on standards and specifications in the field of geographic information and information technology. This chapter systematically identifies standards that are of particular relevance to SDI development and implementation. A necessary condition for the successful establishment of a SDI is that the software industry supports relevant standards in commercial products. At the same time, public authorities are to request the support of standards in public procurement processes.

Many of the standards and specifications are already available. There is, however, a need to systematically identify these standards and to determine whether or not they are sufficiently precise and unambiguous so that their implementation provides interoperability and fulfils requirements of an SDI in Europe.

Standards should make interoperability as easy, simple and reliable as possible. The ISO 19100-series of standards both individually and collectively are quite complex. The risk of different interpretations of the same standard in different implementations exists and has to be minimised as much as possible. The aim must be to establish implementations of the standards which are as unambiguous and precise as possible. Avoiding variations of interpretation can be achieved through the use of suitable, standard based tools for data modelling, interface description, data transfer and quality control.

Recent EU initiatives have brought 'Interoperability' to centre-stage of the European Union's ICT governance framework. A range of stakeholders (governments, industry, consumers, and other social partners) have recognised the need for interoperability and recognise the benefits interoperability could bring. Interoperability has supplemented earlier discussions focused exclusively on open group standards, different software licensing models, or technical specifications under public procurement laws. Interoperability embraces the wider policy perspective to enhance ICT-embedded industries and the information society at large, including the geographic information communities.

Interoperability is the capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units. Standardization of geographic information can best be served by a set of standards that integrates a detailed description of geographic information concepts with the concepts of information technology. A goal of the GI standardization efforts is the facilitation of interoperability of geographic information systems, including interoperability in distributed computing environments. Interoperability provides the freedom to mix and match information system components without compromising overall success (OGC, 2003). It is the basis for the successful implementation of a SDI in Europe, and will allow:

a) finding information and processing tools, when they are needed, independent of physical location;

b) understanding and use of the discovered information and tools, no matter what platform supports them; whether local or remote;

c) easier and more cost-effective integration and combination of data originating from heterogeneous sources;

d) support of policies in Europe;

e) control of the evolution of an SDI.

Lack of interoperability should be resolved by the support and implementation of international standards by software providers. This will greatly increase the efficiency of the use of geographic information in the future.

5.2 Challenges

5.2.1 Costs

Costs of implementation and operation are an important consideration. Whilst it is possible to establish individual interfaces for or between any systems or databases, the advantage of using standards should be to provide an easier and cheaper implementation. Interoperability gets more difficult for more complex systems, databases and interfaces. Therefore it is important to keep it as simple as possible at least at the level of system and user interfaces.

5.2.2 Quality

Quality issues are also an important consideration. Completeness and consistency of content, e.g. structure, and format of transfer data should be automatically checkable against reference and target data model. Once more tools based on standards are the solution of choice.

5.2.3 Impact and checkpoints

The full impact of standards on interoperability is reached when everything in the whole process from the description of data models to the description of exchange format and quality control can be described and derived unambiguously with a set of standard based tools following the model driven approach. This process should be possible without any complex manual working steps to support straightforward and conformant maintenance of the different system components.

There are several general considerations for achieving interoperability:

- Use the Modelling Driven Approach (MDA) based on standards;
- Be precise;
- Keep things simple;
- Use standard based tools;
- Automate the processes;
- Check the quality.

5.3 The European Interoperability Framework (EIF)

The generic architecture model for geographic information and services aligns with the general requirements for European e-Government Services, as stated in the European Interoperability Framework (EIF)[1)] strategy. This framework identifies the organisational, semantic and technical interoperability aspects.

Interoperable Delivery of European eGovernment Services to public administrations, businesses and citizens (IDABC) uses the opportunities offered by information and communication technologies to encourage and support the delivery of cross-border public sector services to citizens and enterprises in Europe, to improve efficiency and collaboration between European public administrations and to contribute to making Europe an attractive place to live, work and invest.

The European Interoperability Framework comprises five interoperability levels:

- Political Context;
- Organisational Interoperability;
- Legal interoperability;
- Semantic Interoperability;
- Technical Interoperability.

These are illustrated in Figure 1.

1) See http://ec.europa.eu/idabc/.