SLOVENSKI STANDARD

SIST-TP CEN/TR 15449:2006

01-november-2006

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Geographic information - Standards, specifications, technical reports and guidelines, required to implement Spatial Data Infrastructure

Geoinformation - Normen, Spezifikationen, technische Berichte und Leitfäden zur Einführung von Geodateninfrastrukturen

iTeh STANDARD PREVIEW

Information géographique - Normes, spécifications, rapports techniques et lignes directrices, nécessaires a la mise en oeuvre d'une infrastructure d'information spatiale

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TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 15449

August 2006

English Version

Geographic information - Standards, specifications, technical reports and guidelines, required to implement Spatial Data Infrastructure

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This Technical Report was approved by CEN on 24 June 2006. It has been drawn up by the Technical Committee CEN/TC 287.

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e136b7175db7/sist-tp-cen-tr-15449-2006

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Contents

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SIST-TP CEN/TR 15449:2006
https://standards.iteh.ai/catalog/standards/sist/f3eba44f-1de1-4c9f-92d0-
e136b7175db7/sist-tp-cen-tr-15449-2006

Foreword

This Technical Report (CEN/TR 15449:2006) has been prepared by Technical Committee CEN/TC 287 "Geographic information", the secretariat of which is held by NEN.

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Introduction

Spatial Data Infrastructures (SDIs)

The proposal of the European Commission for a Directive establishing a spatial data infrastructure for Europe (INSPIRE) (European Commission 2004) defines a SDI as the metadata, spatial data sets and spatial data services; network services and technologies; agreements on sharing, access and use; and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in an interoperable manner.

This Technical Report focuses on the technical aspects of a SDI, thereby limiting the term SDI to mean a platform- and implementation-neutral technological infrastructure for geospatial data and services, based upon standards and specifications. This report does not consider a 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.

Intended readership

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

Aim of the report

The aims of this report are three-fold:

— to identify the standards, specifications, technical reports and guidelines, required to implement a SDI in Europe;

— to give recommendations as to whether any of these items should become EN, and to propose a roadmap for future work items;

— to provide recommendations for measures to be taken in order to support implementation and maintenance of a SDI.

Structure of the report

Existing material about SDIs abounds. This report structures and refers to this existing material. The criteria used for determining if a given standard or specification is referred to in this report are:

- the publication is non- proprietary of nature, and

- the publication addresses an aspect of the SDI.

Based on the above considerations, and based on discussion within CEN/TC 287 Working Group SDI, the following reports have been taken into account:

— documents produced by ISO/TC 211 (ISO/TC 211, 2005);

— documents produced by the Open Geospatial Consortium (OGC), including the OpenGIS Reference Model (ORM) (OGC, 2003);

— INSPIRE Architecture and Standards Position Paper (Smits, 2002);

— Geospatial Interoperability Reference Model (GIRM) (Evans, 2003);

— internal report of CEN/TC 287/WG5 Spatial Data Infrastructure on the use of standards in SDI projects (August 2004);

— existing national guidelines based on the (EN) ISO 19100 series of standards.

Clauses 1 to 5 are introductory of nature, with the first four focusing on the scope, the considered standardization initiatives, the terms and definitions, and the symbols and abbreviated terms, respectively. Clause 5 explains what a SDI is.

The subsequent clauses cover the main concerns of a SDI in Europe. Clauses 6 and 7 give a data-centric and a service-centric view on SDI. The data- and service-centric views are brought together in the Reference Model for a SDI (Clause 8). Clause 9 addresses concerns related to multi-lingual and cultural adaptability, followed by a clause dedicated to geo-portals (Clause 10). Clause 11 provides considerations that are relevant for the implementation of SDI. Clause 12 identifies SDI aspects currently not covered by standards.

Management summary

In order for standards and specifications to be useful for implementing a SDI in Europe, it needs to be straightforward to identify which standards are relevant in a particular situation, and the interpretation of standards should be unambiguous. This Technical Report provides a framework for the identification of standards, and gives a number of recommendations with the aim to enhance interoperability between information systems that provide data and services in support of a SDI. The following paragraphs summarize the recommendations of this Technical Report.

Recommended standards and documents

Standards and documents that are recommended for use within SDIs in Europe appear <u>underlined</u> in the Reference Model (Clause 8). Standards that are not underlined are standards that are used or could be very useful in some communities, but are not considered as a main component in a European SDI.

This Technical Report encourages the geographic information software industry to support standards for the creation and management of geographic information and to implement appropriate interface specifications in their products. At the same token, it is recommended that relevant standards be used in public procurement, and that any findings related to the implementation of standards are fed back to the relevant standardization bodies.

Registries

For the realisation of SDI in Europe, it is recommended to establish one or more registration authorities.

A SDI needs, like any other distributed information system, a reference frame. A reference frame is the aggregation of the data needed by different components of the information systems. In a SDI context, the reference frame concerns:

— the units of measures;

— the coordinate reference systems;

— the codelist definitions;

— the feature data dictionaries (see ISO 19126);

— the feature catalogues (see ISO 19110);

— the portrayal catalogues and related symbology registers.

It is recommended that registries are established for the above-listed information elements and geographical items, and for:

— cultural and linguistic adaptability of metadata elements;

— European common data models;

— national data which are of interest in a cross border community or in a multilingual community.

Appropriate standards for registries for information elements and geographical items would need to be identified or developed. Registries should be conformant to ISO 19135, *Geographic information — Procedures for registration of geographic information items*.

In order to enable the cultural and linguistic adaptability (CLA) of metadata and common data models, it is recommended to use unique names and codes for the information elements and the geographical items (e.g. feature type). A number of practical suggestions related to CLA are given in Clause 9.

Data

— The model-driven approach is promoted for ESDI.

— Unique identifiers for use in a European SDI should be composed of a namespace and a Universally Unique Identifier (UUID).

— ISO 19109 and referred standards are promoted as ESDI rules for specifying data structures and semantics.

— UML class diagrams used according to ISO/TS 19103 is promoted as an ESDI conceptual schema language.

— ISO 19136 (GML) is promoted as the ESDI encoding method when transferring geographic data.

— ISO 19139 is promoted as the ESDI encoding method when transferring information related to geographic data such as metadata, feature catalogues, data dictionaries, …

Services

This Technical Report recommends that all services be categorized according to the ISO 19119 taxonomy.

This Technical Report recommends applying the Web Service Architecture (WSA), including WSDL, SOAP, UDDI and XML when the following issues are considered to be important:

— components of information systems run on different platforms;

— the system consists of components from different vendors;

— the service is to be published and available on the internet;

— wrapping of existing services where these are exposed as web services;

— make existing services available for other applications on other platforms.

It is inappropriate to apply WSA when transferring large datasets.

Conceptual Schema Languages

This Technical Report encourages the use of UML.

If an information community applies a Conceptual Schema Language other than UML, it is the responsibility of that information community to map the ISO general feature model to the meta-model of the Conceptual Schema Language of choice, and to maintain the mapping rules, following the ISO/TS 19103 conformance statement:

> *Non-UML schemas shall be considered conformant if there is a well-defined mapping from a model in the source language into an equivalent model in UML and that this model in UML is conformant.*

In order to provide a GML application schema, an application schema should be made by applying a conceptual schema language, and the GML application schema should be derived from that conceptual model, applying the rules for mapping from UML as described in Annex E of ISO 19136.

Conformance testing

It is recommended to establish a conformance authority charged with the conformance testing of implementations of SDI elements in Europe.

Roadmap for new work

It is recommended that CEN/TC 287, in collaboration with ISO/TC 211 and OGC, start new work on the following items:

— catalogue server;

— XML encoding of portrayal;

— quality aspects of services;

— standards for registries for geographical items, depending on the progress on ISO 19126;

— Digital Rights Management;

— the use of web services for the transfer of large datasets.

It is further recommended that before a given standard or specification be made mandatory in a European or national legislation, the standard be implemented and tested.

Practical experience with the implementation of a given standard may reveal that a European profile thereof is needed.

For example, based on interoperability experiments, CEN/TC 287 has identified that European profiles of EN ISO 19115 (metadata) and ISO 19128 (Web Map Server interface) are needed in order to enhance interoperability in Europe and started new work on these topics.

1 Scope

This Technical Report identifies the standards, technical specifications, technical reports and guidelines, required to implement a Spatial Data Infrastructure (SDI) in Europe. It gives recommendations as to whether any of these items should become EN, and proposes a roadmap for future work items. It further provides recommendations for measures to be taken in order to support implementation and maintenance of a SDI. In so doing, the report addresses a range of topics, including:

— multi-lingual aspects,

— consistent identification of geographical items,

— conformance testing,

— geographic information metadata including catalogue service profile and guidelines, and

— WMS and WFS profiles and guidelines.

2 Considered standardisation initiatives

Being embedded in information and communication technology with a strong focus on geographic information, a SDI will rely on a variety of standards (Figure 1). This Technical Report considers primarily material produced by the following organisations and initiatives:

— International Organization for Standardization (ISO), including but not limited to ISO/TC 211 Geographic Information / Geomatics;

— European Committee for Standardization (CEN), including CEN/TC 287 Geographic Information;

— Open Geospatial Consortium (OGC);
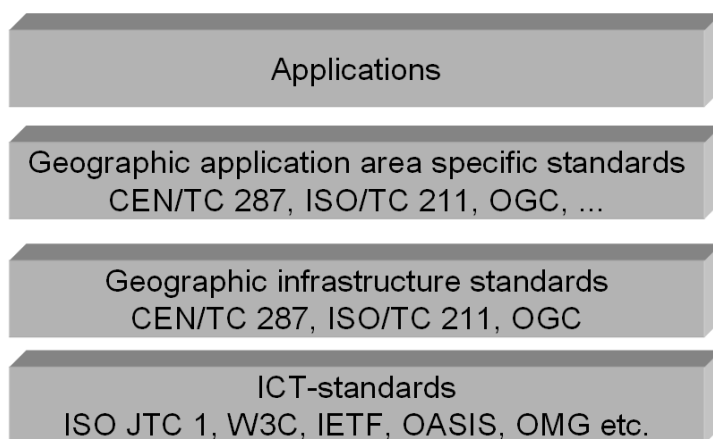
— World Wide Web Consortium (W3C).

Figure 1 – The stack of standards in support of SDIs

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

[EN ISO 19101:2005]

EXAMPLE   UML meta model, EXPRESS meta model.

NOTE   One conceptual formalism can be expressed in several conceptual schema languages.

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

[EN ISO 19101:2005]

3.3
conceptual schema
formal description of a conceptual model

[EN ISO 19101:2005]

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

[EN ISO 19101:2005]

EXAMPLE   UML, EXPRESS, IDEF1X.

NOTE   A conceptual schema language may be lexical or graphical. Several conceptual schema languages can be based on the same conceptual formalism.

3.5
conformance
fulfilment of specified requirements

[EN ISO 19113:2005]

3.6
component
physical, replaceable part of a system that packages implementation and provides the realization of a set of interfaces

[ISO/TS 19103:2005]

3.7
identifier
linguistically independent sequence of characters capable of uniquely and permanently identifying that with which it is associated

[ISO/IEC 11179-3:2003]

3.8
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

[ISO/IEC 2382-1:1993]

3.9
reference frame
aggregation of the data needed by different components of an information system

3.10
resource
asset or means that fulfils a requirement

[EN ISO 19115:2005]

3.11
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

NOTE   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.

3.12
Use Case
specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system

[OMG UML Specification]

4   Abbreviated terms

API   Application Programming Interface

CLA   cultural and linguistic adaptability

CORBA   Common Object Request Broker Architecture

DCE   Distributed Computing Environment

DRM   Digital Rights Management

ebXML   Electronic Business using eXtensible Markup Language

EOSE   Extended Open System Environment

EN   European Standard (CEN deliverable)

ESDI   European Spatial Data Infrastructure

INSPIRE   Infrastructure for Spatial Information in Europe

GI   Geographic information

GIRM	Geospatial Interoperability Reference Model
GML	Geography Markup Language
ISO	International Organization for Standardization
IT	Information Technology
NSDI	National Spatial Data Infrastructure
OASIS	Organization for the Advancement of Structured Information Standards
OCL	Object Constraint Language
ODP	Open Distributed Processing
OGC	Open Geospatial Consortium
OLE/COM	Object linking and embedding/ Component Object Model
OMG	Object Management Group
ORM	OpenGIS Reference Model
RM-ODP	Reference Model of Open Distributed Processing
SDI	Spatial Data Infrastructure
SLD	Styled Layer Descriptor
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
UDDI	Universal Description, Discovery and Integration
UML	Unified Modelling Language
UUID	Universally Unique Identifier
WCS	Web Coverage Service interface specification
WFS	Web Feature Service interface specification
WMS	Web Map Service interface specification
WRS	Web Registry Server
WSA	Web Service Architecture
WSDL	Web Service Description Language
W3C	World Wide Web Consortium
XMI	eXtensible Markup Interface
XML	eXtensible Markup Language

5 Spatial Data Infrastructure as an implementation-neutral framework

5.1 Management summary

A SDI relies on standards and specifications in the field of geographic information and information technology. This report systematically identifies standards that are of particular relevance to SDI development and implementation. A conditio sine qua non 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.

5.2 Standards and interoperability

The users of a 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, a 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 than would be possible without the SDI in place.

A SDI relies on standards and specifications in the field of geographic information and information technology, many of which are already available. There is, however, a need to systematically identify these standards and to determine whether or not these standards are sufficiently precise and unambiguous so that their implementation guarantees interoperability and fulfils requirements of a SDI in Europe.

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 to facilitate 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), and is a basis for the successful implementation of a SDI in Europe. A SDI in Europe will allow one to:

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

b) understand and employ the discovered information and tools, no matter what platform supports them; whether local or remote;

c) integrate and combine easier and more cost-effective data originating from heterogeneous sources;

d) support policies in Europe;

e) control the evolution of a SDI.

It is anticipated that the current lack of interoperability in the field of geographic information will 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.

Recommendation:

This Technical Report encourages the software industry to support standards for the creation and management of geographic information and to implement appropriate interface specifications in their products. It also recommends public authorities to reference relevant GI standards in public procurement processes that are to support SDI implementations.