



# INSPIRE

Infrastructure for Spatial Information in Europe

## Technical Guidance for INSPIRE Spatial Data Services and services allowing spatial data services to be invoked

Drafting Team “Network Services”

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## Foreword

Directive 2007/2/EC of the European Parliament and of the Council [**Directive 2007/2/EC**], adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment. INSPIRE will make available relevant, harmonised and quality geographic information to support the formulation, implementation, monitoring and evaluation of policies and activities, which have a direct or indirect impact on the environment.

INSPIRE is based on the infrastructures for spatial information established and operated by the 27 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. This makes INSPIRE a unique example of a legislative “regional” approach.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the Directive requires that common Implementing Rules (IR) are adopted in the following areas.

- Metadata;
- The interoperability and harmonisation of spatial data and services for selected themes (as described in Annexes I, II, III of the Directive);
- Network Services;
- Measures on sharing spatial data and services;
- Co-ordination and monitoring measures.

The Implementing Rules are adopted as Commission Decisions or Regulations, and are binding in their entirety.

In particular with respect the Network Services, Implementing Rules are required for the following services (Article 11(1) of the Directive):

- a) *“discovery services search for spatial datasets and spatial data services on the basis of the content of corresponding metadata, and display the metadata content;*
- b) *view services as a minimum, display, navigate, zoom in/out, pan, or overlay spatial datasets and display legend information and any relevant content of metadata;*
- c) *download services enabling copies of complete spatial datasets, or of parts of such sets, to be downloaded;*
- d) *transformation services enabling spatial datasets to be transformed with a view to achieving interoperability;*
- e) *invoke spatial data services” enabling data services to be invoked.”*

In addition to the Implementing Rules, non-binding Technical Guidance documents describe detailed implementation aspects and relations with existing standards, technologies, and practices. They may need to be revised during the course of implementing the infrastructure to take into account the evolution of technology, new requirements, and cost benefit considerations. Figure 1 illustrates the relationship between the INSPIRE Regulations containing Implementing Rules and their corresponding Technical Guidance documents.

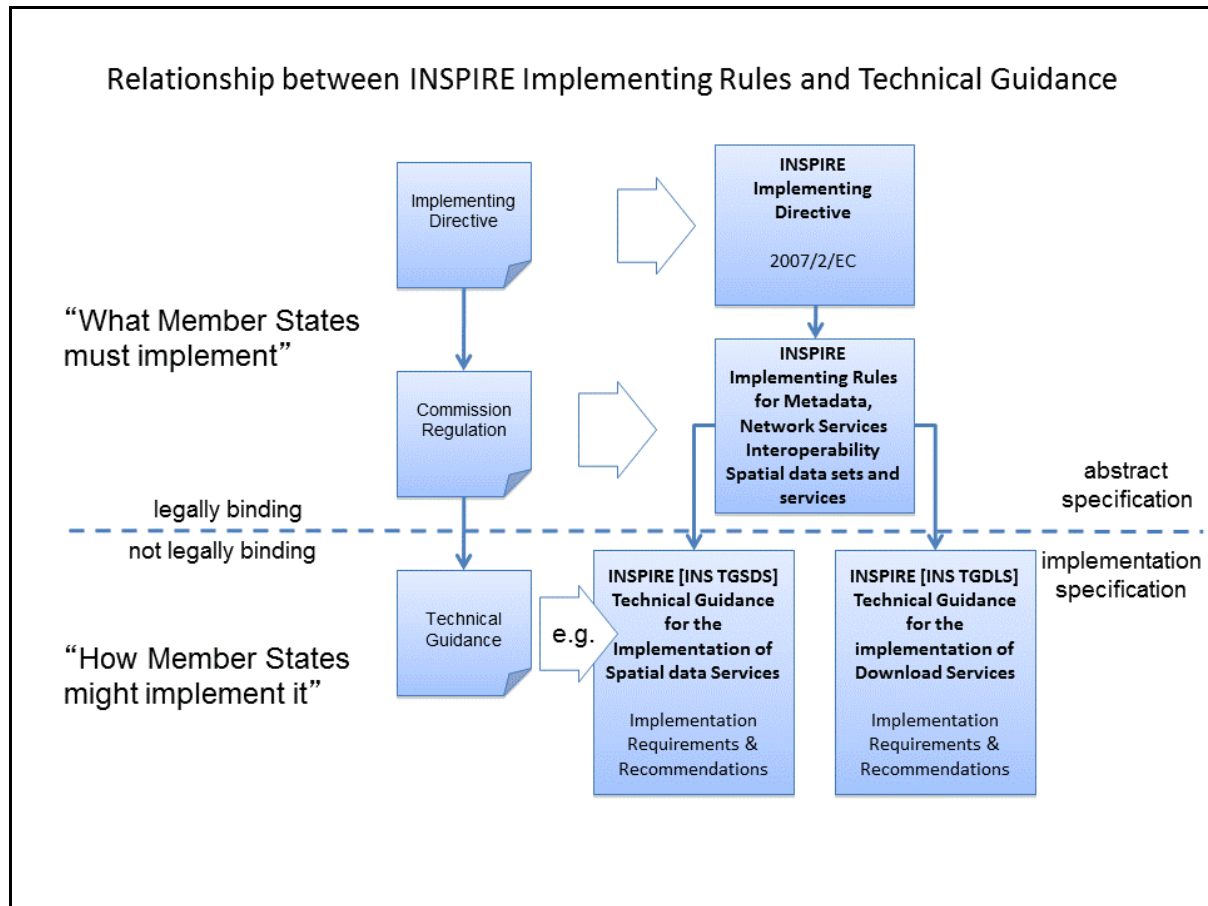


Figure 1 - relationship between the INSPIRE Implementing Rules and the associated Technical Guidance.

Technical Guidance documents define how Member States might implement the Implementing Rules described in a Commission Regulation. Technical Guidance documents may include non-binding technical requirements that must be satisfied if a Member State chooses to conform to the Technical Guidance. Implementing this technical guidance will maximise the interoperability of INSPIRE services.

This Technical Guidance relates to the INSPIRE Spatial Data Services and services allowing spatial data services to be invoked. The Technical Guidance contains detailed technical documentation highlighting the mandatory and the recommended elements related to the implementation of INSPIRE Spatial Data Services and services allowing spatial data services to be invoked. The technical provisions and the underlying concepts are often illustrated by use case diagrams and accompanied by examples.

**Many of the examples in this document refer to a real service; the description of the spatial data service used in the document is provided in Annex G.**

This document will be publicly available as a 'non-paper', as it does not represent an official position of the Commission, and as such cannot be invoked in the context of legal procedures.

### Legal Notice

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

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# 1 Introduction

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) was published in the official Journal on the 25<sup>th</sup> April 2007. The INSPIRE Directive entered into force on the 15<sup>th</sup> May 2007.

The purpose of the infrastructure is to enable the formulation, implementation, monitoring activities and evaluation of Community environmental policies at all levels – European, national and local – and to provide public information.

INSPIRE builds on the infrastructures for spatial information that have already been created by the Member States. The components of those infrastructures include: metadata, spatial data themes (as described in Annexes I, II, III of the Directive), network services and technologies; agreements on data sharing, access and use; coordination and monitoring mechanisms, processes and procedures.

The guiding principles of INSPIRE are:

- that the infrastructures for spatial information in the Member States should be designed to ensure that spatial data are stored, made available and maintained at the most appropriate level;
- that it is possible to combine spatial data from different sources across the Community in a consistent way and share them between several users and applications;
- that it is possible for spatial data collected at one level of public authority to be shared between all the different levels of public authorities;
- that spatial data are made available under conditions that do not restrict their extensive use; and
- that it is easy to discover available spatial data, to evaluate their fitness for purpose and to know the conditions applicable to their use.

The text of the INSPIRE Directive is available from the European Union Law website (EU-LEX) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0002:EN:NOT>. The Directive identifies what needs to be achieved, and Member States have two years from the date of adoption to bring into force national legislation, regulations, and administrative procedures that define how the agreed objectives will be met taking into account the specific situation of each Member State. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas. Implementing Rules are adopted as Commission Decisions, and are binding in their entirety.

According to Article 5(4) of the Directive, the INSPIRE Implementing Rules shall take account of relevant, existing international standards and user requirements.

The scope of this document is to detail the INSPIRE technical requirements for **Spatial Data Services and services allowing spatial data services to be invoked** from the Implementing Rules, such that these services can be implemented consistently across Europe.

These Implementing Rules are, as much as possible, in conformance with European and international standards, current practices in stakeholder communities and relevant European initiatives such as e-Government, and the EU interoperability framework.

This technical guidance relate only to new developed services relating to harmonised spatial data sets and will not apply to the already specified INSPIRE Network Service.

This document will be publicly available as a 'non-paper', as it does not represent an official position of the Commission, and as such cannot be invoked in the context of legal procedures.

## 1.1 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- [1] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), OJ L 108, 24.4.2007, p. 1
- [2] Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata (Text with EEA relevance) OJ L 326, 4.12.2008, p. 12
- [3] Commission Regulation (EU) No 1089/2010 of 23 November 2010 Implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services
- [4] Commission Regulation (EU) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services. OJ L 274, 20.10.2009, p. 9
- [5] Commission Decision 2009/442/EC of 5 June 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting, OJ L 148, 11.6.2009, p. 18
- [6] Commission Regulation (EC) No 268/2010 of 29 March 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the access to spatial data sets and services by the Member States to the Community institutions and bodies under harmonised conditions
- [7] INSPIRE Network Services performance Guidelines  
([http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/network/Network\\_Services\\_Performance\\_Guidelines\\_%20v1.0.pdf](http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/network/Network_Services_Performance_Guidelines_%20v1.0.pdf))
- [8] D3.10 Draft Implementing Rules for INSPIRE Transformation Services Drafting Team "Network Services"  
([http://inspire.jrc.ec.europa.eu/documents/Network\\_Services/INSPIRE\\_Draft\\_Implementing\\_Rules\\_Transformation\\_Services\\_%28version\\_3.0%29.pdf](http://inspire.jrc.ec.europa.eu/documents/Network_Services/INSPIRE_Draft_Implementing_Rules_Transformation_Services_%28version_3.0%29.pdf))
- [9] INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119  
([http://inspire.jrc.ec.europa.eu/documents/Metadata/INSPIRE\\_MD\\_IR\\_and\\_ISO\\_v1\\_2\\_20100616.pdf](http://inspire.jrc.ec.europa.eu/documents/Metadata/INSPIRE_MD_IR_and_ISO_v1_2_20100616.pdf))



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- [10] INSPIRE Spatial Data Service Draft Implementing Rule v.3
- [ISO 19115] ISO 19115:2003/Cor 1:2006, Geographic information – Metadata – Part 1: Fundamentals  
[http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=26020](http://www.iso.org/iso/catalogue_detail.htm?csnumber=26020)
- [ISO / DISM 19115-1] ISO/DIS 19115-1, Geographic information -- Metadata -- Part 1: Fundamentals  
[http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=53798](http://www.iso.org/iso/catalogue_detail.htm?csnumber=53798)
- [ISO 19119] ISO 19119:2005/Amd 1:2008, Geographic information – Services  
[http://www.iso.org/iso/home/store/catalogue\\_tc/catalogue\\_detail.htm?csnumber=44268](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=44268)
- [ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation  
[http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=32557](http://www.iso.org/iso/catalogue_detail.htm?csnumber=32557)
- [ISO 19108] ISO 19108:2002/Cor 1:2006, Geographic information - Temporal schema  
[http://www.iso.org/iso/home/store/catalogue\\_tc/catalogue\\_detail.htm?csnumber=44883](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=44883)
- [ISO 19111] ISO 19111:2007, Geographic information - Spatial referencing by coordinates  
[http://www.iso.org/iso/home/store/catalogue\\_tc/catalogue\\_detail.htm?csnumber=41126](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=41126)
- [ISO 19127] ISO/TS 19127:2005, Geographic information - Geodetic codes and parameters  
[http://www.iso.org/iso/home/store/catalogue\\_tc/catalogue\\_detail.htm?csnumber=41784](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=41784)
- [DST] Common document template provided for all INSPIRE Data Specifications  
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2>
- [OWS] OGC Web Services Common Standard  
[http://portal.opengeospatial.org/files/?artifact\\_id=38867](http://portal.opengeospatial.org/files/?artifact_id=38867)

## 2 Terms and abbreviations

### 2.1 Terms

- (1) **Access point:** The access point of a service contains a detailed description of the service, including a list of end point with the detailed description to allow an automatic execution.
- (2) **Computer application:** Any tool that functions and is operated by means of a computer aiming to accomplish user's tasks or specifically designed to meet end-user requirements. In other words, it is a subclass of computer software that employs the capabilities of a computer and interacts with the user in supporting or improving his activities.
- (3) **End point:** An end point of a service is the address used to directly call the operation provided by a service.
- (4) **Harmonised spatial data set:** Spatial data set conformant with [3].
- (5) **Interface:** named set of **operations** that characterize the behavior of an entity [ISO 19119].
- (6) **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].
- (7) **Operation:** an action supported by a spatial data service.
- (8) **Service:** distinct part of the functionality that is provided by an entity through **interfaces** [Adapted ISO/IEC TR 14252].
- (9) **Spatial data services:** means the operations which may be performed, by invoking a computer application, on the spatial data contained in spatial data sets or on the related metadata (as defined in article 3 (4) of [1])

### 2.2 Symbols and abbreviations

DT	Drafting Team
NS	Network Services
ISO	International Organization for Standardization <sup>1</sup>
OGC	Open Geospatial Consortium <sup>2</sup>

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<sup>1</sup> <http://www.iso.org/iso/home.htm>

<sup>2</sup> <http://www.opengeospatial.org/ogc>

QoS	Quality of Service
SDS	Spatial Data Services
SOAP	Simple Object Access Protocol <sup>3</sup>
URL	Uniform Resource Locator
WSDL	Web Services Description Language <sup>4</sup>
XSD	XML Schema Definition

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<sup>3</sup> <http://www.w3.org/TR/soap12>

<sup>4</sup> <http://www.w3.org/TR/wsd>

## 2.3 Verbal forms for the expression of provisions

In accordance with the ISO rules for drafting, the following verbal forms shall be interpreted in the given way:

- “shall” / “shall not” : a requirement, mandatory to comply with the technical guidance
- “should” / “should not” : a recommendation, but an alternative approach may be chosen for a specific case if there are reasons to do so
- “may” / “need not” : a permission

### Technical Guidance Conformance Classes notation

The Technical Guidance in this document is divided into Conformance Classes, so that it is possible to declare conformance to specific parts of the Technical Guidance. *To conform to a Conformance Class it is necessary to meet all of the Requirements (see next section) in that Conformance Class.*

Conformance Classes are identified in the document as follows:

**TG Conformance Class #:** [TITLE] conformance classes are shown using this style

### Technical Guidance Requirements and Recommendations notation

Requirements and the recommendations for INSPIRE Spatial Data Services and services allowing spatial data services to be invoked within this technical guidance are highlighted and numbered as shown below:

**Implementation Requirement #** requirements are shown using this style

**Implementation Recommendation #** recommendations are shown using this style.

It is important to note that, implementation requirements and implementation recommendations may refer to either service or client implementations. Requirements and recommendations belong to the conformance class in which they are found in this document.

**Note:** It is worth noting that requirements as specified in the INSPIRE Regulations and Implementing Rules are legally binding, and that requirements and recommendations as specified in INSPIRE Technical Guidance are **not** legally binding. Therefore, within this technical guidance we have used the terms ‘TG requirement’ and ‘TG recommendation’ to indicate what is technically required or recommended to conform to the Technical Guidance.

### XML Example notation

XML Examples are shown using Courier New on a grey background with yellow for emphasis as below:

```
<inspire:example>
  <inspire:highlight>
    Highlighted Text for emphasis
  </inspire:highlight>
</inspire:example>
```

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**Note:** XML Examples are informative and are provided for information only and are expressly not normative.

## 2.4 References

References within this document are denoted using “Section” or “Annex”. For example, Section 5.3.1 or Annex A.

References to other documents refer to the list of normative references in Section 3 and use the abbreviated title as indicated in **Bold** text. For example, [4] uses the abbreviated title for the document as shown below:

INSPIRE Network Services Regulation, **INS NS**, COMMISSION REGULATION (EU) No 1088/2010 of 23 November 2010 amending Regulation (EC) No 976/2009 as regards download services and transformation services

References within other documents are shown as above using the abbreviated title, together with the appropriate section within the document. For example, [**INS NS**, Section 2.2.3], refers to Section 2.2.3 within the document as listed above.

### 3 Technical Guidance

#### 3.1 Mappings between IR requirements and Implementation requirements

Table 1 - Requirements mapping

IR Requirement	Implementation Requirement (TG)
1	No technical requirement needed
2	1
3	2,4
4	3
5	5
6	6
7	7
8	No technical requirement needed
9	No technical requirement needed
10	8
11	No technical requirement needed
12	15
13	9
14	9
15	10
16	11,12,13
17	11
18	12
19	13

20	14
21	No technical requirement needed
22	No technical requirement needed
23	No technical requirement needed
24	No technical requirement needed
25	16
26	17
27	No technical requirement needed
28	18
29	19
30	20

### 3.2 Metadata elements table

The table below shows the 4 spatial data services conformance classes and their relative metadata elements. For each metadata element not already included in [2] or with some differences with the same element described in [2], the table contains a reference (x.y.z) to the paragraph where the details are.

C: conditional (refer to [2] for the conditions) – M: Mandatory

Table 2 - Metadata elements mapping

Metadata element	Class 1 Discoverable	Class 2 Invocable	Class 3 Interoperable	Class 4 Harmonized
Resource title (B1.1)	M	=	=	=
Resource abstract (B1.2)	M	=	=	=
Resource Type (B1.3)	M	=	=	=
Resource Locator (B1.4)	C	M (3.7.1)	M (3.7.1)	M (3.7.1)
Coupled Resource (B1.6)	C	=	=	=
Spatial data service type (B2.2)	M	=	=	=

Keyword value (B3.1)	M	=	=	=
Geographic Bounding Box (B4.1)	C	=	=	=
Temporal extent (B5.1)	C	=	=	=
Date of publication (B5.2)	C	=	=	=
Date of last revision (B5.3)	C	=	=	=
Date of creation (B5.4)	C	=	=	=
Spatial Resolution (B6.2)	C	=	=	=
Specification (B7.1)	M	M (3.7.3)	M (3.7.3)	M (3.7.3)
Degree (B7.2)	M	=	=	=
Conditions applying to access and use (B8.1)	M	=	=	=
Limitations on public access (B8.2)	M	=	=	=
Responsible party (B9.1)	M	=	3.8.3	3.8.3
Responsible partyrole (B9.2)	M	=	3.8.3	3.8.3
Metadata point of contact (B10.1)	M	=	=	=
Metadata Date (B10.2)	M	=	=	=
Metadata Language (B10.3)	M	=	=	=
Coordinate Reference System			M (3.8.1)	M (3.8.1)
Spatial Data Service Class		M (3.5)	M (3.5)	M (3.5)
Quality of Service - Performance			M (3.8.2)	M (3.8.2)
Quality of Service - Availability			M (3.8.2)	M (3.8.2)
Quality of Service - Capacity			M (3.8.2)	M (3.8.2)
Contains Operations				C (3.9.2)

The metadata elements already detailed in [9] are not repeated in this TG. In the following paragraphs you can find the details of the **new** or **extended** element, including the specific encoding example. For details on the other elements, please refer to [9].



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### 3.3 Contains Operations multiplicity note

In [ISO 19119] the element containsOperation is set to mandatory. However in the INSPIRE Spatial Data Services context this element is not required (refer to [9]); it becomes conditional only at Harmonization level (as indicated in the previous table – more information can be found in chapter 3.9).

For all the other classes of conformance (discoverable, invocable and interoperable spatial data services) this element is optional.

If there is no data to fill it, it is to be filled with the gco:nilReason element; you can find an encoding example below (taken from [9, Section A.12.3.2]):

```
<srv:containsOperations gco:nilReason="missing"/>
```

The encoding example related to the Harmonization level, with the containsOperation element filled is provided in the Harmonization section.

### 3.4 Metadata extension note

Using the current [ISO 19115] and [ISO 19119] it is not possible to express all the metadata required by [4]. In particular, there is no metadata element for the Quality Of Service.

In order to describe these elements in a machine readable way, the standard [ISO 19115]/[ISO 19119] has to be extended.

After some communication with ISO, it has been clarified that the UML and the XML schema of the new element is to be provided. There is no the need to document the extension in the metadata document itself.

The description of these extended elements and an encoding example is provided in the annexes at the end of this document.

In order to use the extended element all the service metadata shall use the updated XML schema included in Annex F.

### 3.5 INSPIRE Spatial Data Services

In this context the broad class of INSPIRE spatial data services is broken down to distinguish the following categories:

1. Discoverable spatial data services. This is the largest set fulfilling the definitions and requirements in [1]. Once a spatial data service is described by INSPIRE metadata (as requested in article 5 (1) of [1] and detailed in [2]) it becomes discoverable through the INSPIRE Network Service of type discovery (as requested in article 11 (1) of [1] and technically specified in [4]).
2. Invocable spatial data service. The invocability is an intrinsic property of the spatial data services that following the definition in article 3 (4) of [1] provides invocable operations. Here, as detailed in 3.2, the invocability is understood in a more restricted sense including the availability of an access point on the Internet. This sub-set is defined to explicitly list the minimum set of properties a spatial data service must possess for interoperability.

3. Interoperable spatial data services. These are the ones compliant with Interoperability arrangements. The corresponding requirements go further than invocability by mandating additional information to be provided to facilitate interoperability and not only stand-alone invocability.
4. Harmonised spatial data services. These are the ones compliant with harmonisation requirements. This even smaller set of spatial data services, whenever practicable goes even further towards interoperability by requiring the upgrade of existing spatial data services.

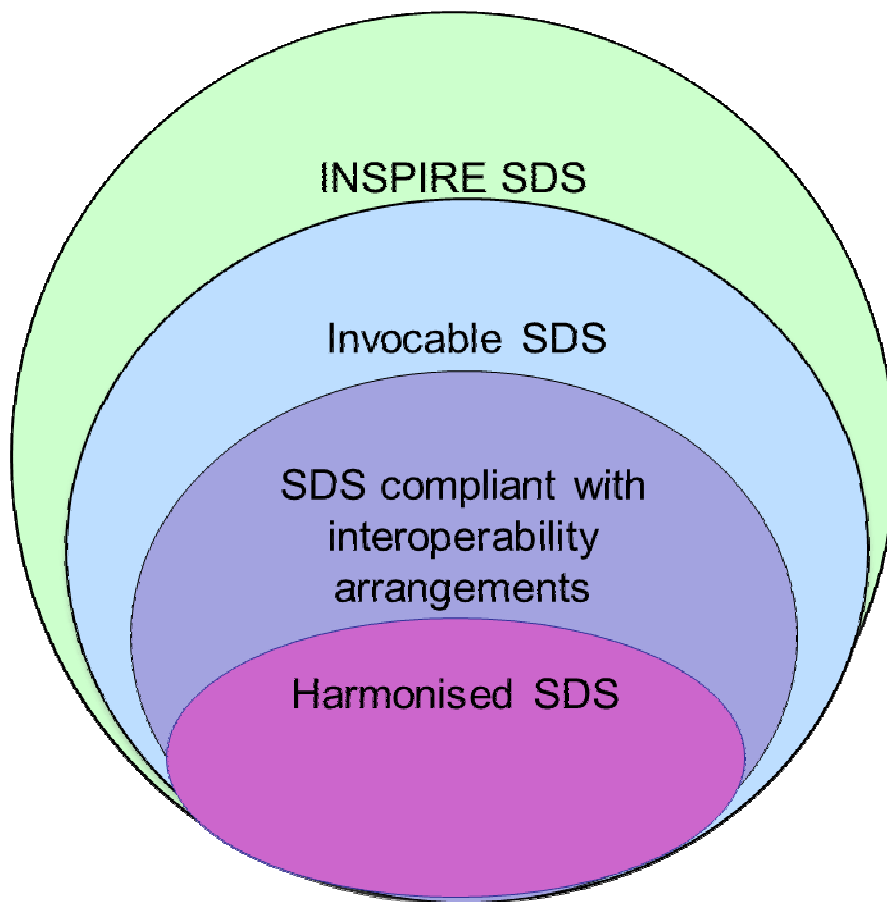


Figure 2 - INSPIRE Spatial Data Services categories

**Implementation Requirement 1**

A New metadata shall indicate if the spatial data service is Invocable, Interoperable or Harmonised. In order to describe the Spatial Data Service Class in a machine readable way, the standard [ISO 19115]/[ISO 19119] has to be extended.

The detailed description of this extended element example is provided in annex A. Below you can find a simple encoding example for this element:

```
<srv:spatialDataServiceClass>invocable</srv:spatialDataServiceClass>
```

### 3.6 Discoverable Spatial Data Services (in the INSPIRE context)

#### **TG Conformance Class 1:** Implementation of Discoverable Spatial Data Services

*This conformance class is inclusive of:*

*Implementation Recommendation 1*

Making spatial data services discoverable does not bring any other obligation than creation of metadata. In particular there are no Quality of Service requirements that have to be met and there is no obligatory quality of service information in the metadata record.

**Implementation Recommendation 1** There shall be no other requirements applicable to ALL spatial data services than the creation of discovery metadata.

[9] explains how to provide the metadata elements required by the [2] using ISO specifications ([ISO 19115] and [ISO 19119]). Those metadata are implemented using [ISO 19139].

### 3.7 Invocable Spatial Data Services

#### **TG Conformance Class 2:** Implementation of Invocable Spatial Data Services

*This conformance class is inclusive of:*

*TG Conformance Class 1*

*TG Requirement 2 to TG Requirement 7*

A spatial data service is invocable if sufficient machine readable metadata exists, is accessible, and is sufficient to allow for its automatic execution (invocation) by another service or an application.

The Metadata elements that need to be provided for invocable services are described below.

#### 3.7.1 Resource Locator

A definition of “access point” and “end point” used in this paragraph is provided at chapter 2.1.

**Implementation Requirement 2** The Resource Locator metadata element, defined in section 1.4 of the part B of the Annex of [2], shall contain at least one access point of the service and it shall be unambiguously identified as such.

The following table shows the detailed information about the resource locator element.

Table 3 - Resource locator detail

Metadata element name	Resource Locator
Definition	Location (address) for on-line access using a Uniform Resource Locator address or similar addressing scheme.
ISO 19115 number and name	397 linkage
ISO/TS 19139 path	distributionInfo/*/transferOptions/*/onLine/*/linkage
INSPIRE obligation / condition	In table 2 of [2] the resource locator is indicated as to be provided "if linkage to the service is available" but for an invocable spatial service at least one resource locator is required aimed at technically invoking the service
INSPIRE multiplicity	1..*
Data type (and ISO 19115 no.)	URL
Domain	URL (IETF RFC1738 and IETF RFC 2056)
Implementing instructions	
Example	http://www.dinoservices.nl/geo3dmodelwebservices-1/Geo3DModelService
Example XML encoding	<pre> &lt;gmd:MD_Metadata ... ...   &lt;gmd:distributionInfo&gt;     &lt;gmd:MD_Distribution&gt;       ...         &lt;gmd:transferOptions&gt;           &lt;gmd:MD_DigitalTransferOptions&gt;             &lt;gmd:onLine&gt;               &lt;gmd:CI_OnlineResource&gt;                 &lt;gmd:linkage&gt;                   &lt;gmd:URL&gt;http://www.dinoservices.nl/geo3dmodel webservices-1/Geo3DModelService&lt;/gmd:URL&gt;                 &lt;/gmd:linkage&gt;               &lt;/gmd:CI_OnlineResource&gt;             &lt;/gmd:onLine&gt;           &lt;/gmd:MD_DigitalTransferOptions&gt;         &lt;/gmd:transferOptions&gt;       &lt;/gmd:MD_Distribution&gt;     &lt;/gmd:distributionInfo&gt;   ... &lt;/gmd:MD_Metadata&gt; </pre>

Comments	
----------	--

**Implementation Requirement 3**

There shall be only one service INSPIRE metadata per spatial data service, providing in particular information about all possible access points to the service.

As requested in the Implementation Requirement 2, the access point of the service “shall be unambiguously identified as such”.

**Implementation Requirement 4**

The type of the resource linked by the Resource Locator shall be documented in a new metadata element from [ISO 19115]: the CI\_OnlineFunctionCode.

The following table shows the detailed information about the function code element.

Table 4 – Function code detail

Metadata element name	Function Code
Definition	Code for function performed by the online resource
ISO 19115 number and name	402 function
ISO/TS 19139 path	distributionInfo/*/transferOptions/*/onLine/*/function
INSPIRE obligation / condition	Mandatory if the resource locator is provided for Conformance class 1. Mandatory for Conformance class 2, 3 and 4.
INSPIRE multiplicity	0..1
Data type (and ISO 19115 no.)	CI_OnLineFunctionCode (B.5.3)
Domain	<<Codelist>>
Implementing instructions	
Example	accessPoint

<p>Example XML encoding</p>	<pre> &lt;gmd:MD_Metadata ... ...   &lt;gmd:distributionInfo&gt;     &lt;gmd:MD_Distribution&gt;       ...       &lt;gmd:transferOptions&gt;         &lt;gmd:MD_DigitalTransferOptions&gt;           &lt;gmd:onLine&gt;             &lt;gmd:CI_OnlineResource&gt;               &lt;gmd:linkage&gt; &lt;gmd:URL&gt;http://www.dinoservices.nl:80/geo3dmodel webservices-1/Geo3DModelService?wsdl&lt;/gmd:URL&gt;               &lt;/gmd:linkage&gt;               &lt;gmd:function&gt;                 &lt;gmd:CI_OnLineFunctionCode codeList="http://inspire/extended/codelist" codeListValue="accessPoint- selfDescribing"&gt;accessPoint- selfDescribing&lt;/gmd:CI_OnLineFunctionCode&gt;               &lt;/gmd:function&gt;             &lt;/gmd:CI_OnlineResource&gt;           &lt;/gmd:onLine&gt;         &lt;/gmd:MD_DigitalTransferOptions&gt;       &lt;/gmd:transferOptions&gt;     &lt;/gmd:MD_Distribution&gt;   &lt;/gmd:distributionInfo&gt; ... &lt;/gmd:MD_Metadata&gt; </pre>
<p>Comments</p>	

The values contained in the standard [ISO 19115, Section B.5.3] codelist cannot be used to unambiguously identify the access point provided in the resource locator. That's why the codelist from [ISO 19115, Section B.5.3] shall be extended or replaced by another code list.

Hence, there are 2 possibilities to document this value:

- extend the [ISO 19115, Section B.5.3] codelist;
- provide a new codelist.

The following sections describe these two possibilities.

### 3.7.1.1 Extension to the [ISO 19115, Section B.5.3] codelist

The CI\_OnlineFunctionCode code list needs to be extended in order to better describe the possible resource locator type in a machine readable way. This extension is described in Annex B.

The following table shows the original codes (highlighted in orange) from [ISO 19115, section B.5.3] and the extended codes.

Table 5 - CI\_OnlineFunctionCode original code and extensions [ISO 19115, section B 5.3]

Key	Description
download	Online instructions for transferring data from one

	storage device or system to another
information	Online information about the resource
offlineAccess	Online instructions for requesting the resource from the provider
order	Online order process for obtaining the resource
search	Online search interface for seeking out information about the resource
accessPoint	Used to describe an access point of the service
accessPoint-selfDescribing	Used to describe an access point of the service that describe itself in a machine readable format (e.g. WSDL)
provideServiceMetadata	Used to specify an address to a document that describe the service metadata (such as GetCapabilities)

### 3.7.1.2 Creation of a new codelist

The creation of the new codelist for the CI\_OnlineFunctionCode element is detailed in Annex B.

### 3.7.2 Spatial data service classification

#### **Implementation Requirement 5**

Spatial data services classified as belonging to the category “100 Geographic human interaction services”, as defined in B.4 of [2], shall not be considered as invocable. All the other categories are to be considered as invocable.

Below you can find an example of this element (from [9, Section 2.4.1]):

Metadata element name	Keyword
Definition	Commonly used word(s) or formalized word(s) or phrase(s) used to describe the subject.
ISO 19115 number and name	402 function
ISO/TS 19139 path	identificationInfo[1]*/descriptiveKeyword*/keyword
INSPIRE obligation / condition	Mandatory
INSPIRE multiplicity	1..*

Data type (and ISO 19115 no.)	CharacterString
Domain	Free text
Implementing instructions	Each instance of [ISO 19115] keyword may originate from a controlled vocabulary described through the thesaurus_Name property of the instance of descriptiveKeyword to which the keyword pertains.
Example	203 Coverage access service (infoCoverageAccessService)
Example XML encoding	<pre>&lt;gmd:descriptiveKeywords&gt;   &lt;gmd:MD_Keywords&gt;     &lt;gmd:keyword&gt;       &lt;gco:CharacterString&gt;203 Coverage       (infoCoverageAccessService) &lt;/gco:CharacterString&gt;     &lt;/gmd:keyword&gt;   &lt;/gmd:MD_Keywords&gt; &lt;/gmd:descriptiveKeywords&gt;</pre>
Comments	

### 3.7.3 Specification

**Implementation Requirement 6** The specification metadata element shall be as defined in [2].

**Implementation Requirement 7** The specification metadata element shall as well refer to or contain technical specifications providing all the necessary technical elements (human or machine readable) to allow for an automated invocation of the spatial data service.

The specification metadata element needs to provide sufficient information to actually invoke the service and enable its usage.

This might include:

- A description of the service interface;
- One or more conformity references for the spatial data being produced by the service should be given;
- A WSDL description;
- A schema description or a reference to a schema description for the data being or to be provided.

The following code is an example of technical specification (conformity references):

```
<gmd:specification>
```



```

<gmd:CI_Citation>
  <gmd:title>
    <gco:CharacterString>Webservice for making virtual boreholes in the
    Digital Subsurface Models of the Netherlands</gco:CharacterString>
  </gmd:title>
  <gmd:date>
    <gmd:CI_Date>
      <gmd:date>
        <gco>Date>2011-11-03</gco>Date>
      </gmd:date>
      <gmd:dateType>
        <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodetlists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
        </gmd:dateType>
      </gmd:CI_Date>
    </gmd:date>
  </gmd:CI_Citation>
</gmd:specification>

```

In order to make machine-readable the documentation of the service interface (e.g. WSDL) the element `gmx:Anchor` is to be used instead of `gco:CharacterString`. The backward compatibility is still valid because the human readable text is kept.

The following code is an example of technical specification using `gmx:Anchor` (WSDL):

```

<gmd:specification>
  <gmd:CI_Citation>
    <gmd:title>
      <gmx:Anchor
xlink:href="http://www.dinoservices.nl:80/geo3dmodelwebservices-
1/Geo3DModelService?wsdl">wsdl</gmx:Anchor>
      </gmd:title>
    <gmd:date>
      <gmd:CI_Date>
        <gmd:date>
          <gco>Date>2011-11-03</gco>Date>
        </gmd:date>
        <gmd:dateType>
          <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodetlists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
          </gmd:dateType>
        </gmd:CI_Date>
      </gmd:date>
    </gmd:CI_Citation>
  </gmd:specification>

```

### 3.8 Interoperability arrangements for spatial data services

*This conformance class is inclusive of:*

*TG Conformance class 1, TG Conformance class 2*

*Implementation Requirement 8 to Implementation Requirement 15*

*Implementation Recommendation 2*

As defined in [ISO 19119], 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.

### 3.8.1 Coordinate Reference Systems

INSPIRE spatial data sets produced or modified by a spatial data service shall be made available using one of the three-dimensional, two-dimensional or compound coordinate reference systems specified below (listed in Annex II.1 of the Commission Regulation (EC) No 1089/2010):

#### 1. Three-dimensional Coordinate Reference Systems

- Three-dimensional Cartesian coordinates
- Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height), using the parameters of the GRS80 ellipsoid

#### 2. Two-dimensional Coordinate Reference Systems

- Two-dimensional geodetic coordinates, using the parameters of the GRS80 ellipsoid
- Plane coordinates using the Lambert Azimuthal Equal Area projection and the parameters of the GRS80 ellipsoid (ETRS89-LAEA)
- Plane coordinates using the Lambert Conformal Conic projection and the parameters of the GRS80 ellipsoid (ETRS89-LCC)
- Plane coordinates using the Transverse Mercator projection and the parameters of the GRS80 ellipsoid (ETRS89-TMzn)

#### 3. Compound Coordinate Reference Systems

- For the horizontal component of the compound coordinate reference system, one of the two-dimensional coordinate reference systems specified above shall be used.
- For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope. Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS. The geodetic codes and parameters for these vertical reference systems shall be documented and an identifier shall be created, according to [ISO 19111] and [ISO 19127].

- For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere, or other linear or parametric reference systems shall be used. Where other parametric reference systems are used, these shall be described in an accessible reference using [ISO 19111-2:2012].
- For the vertical component in marine areas where there is an appreciable tidal range (tidal waters), the Lowest Astronomical Tide (LAT) shall be used as the reference surface.
- For the vertical component in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 meters, the Mean Sea Level (MSL) or a well-defined reference level close to the MSL shall be used as the reference surface.

Other coordinate reference systems than those listed above may only be used if specified for a specific spatial data theme and for regions outside of continental Europe. The geodetic codes and parameters for these coordinate reference systems shall be documented, and an identifier shall be created, according to [ISO 19111] and [ISO 19127].

**Implementation Requirement 8**

A spatial data service compliant with interoperability arrangement shall include [ISO 19115] metadata about the coordinate reference system(s) the spatial data service is able to support.

**Implementation Requirement 9**

A new metadata element shall be provided to contain the list of Coordinate Reference Systems identifiers supported by the spatial data service.

**Implementation Requirement 10**

The coordinate Reference Systems identifiers shall be provided either by: (i) Following [3] and the INSPIRE Specification on Coordinate Reference Systems – Guidelines” for the INSPIRE coordinate Reference System or (ii) According to EN ISO 19111 and ISO 19127 for other Coordinate Reference Systems (similarly to 1.3.4 “Other Coordinate Systems” in annex II of [2])

The following table shows the detail about the ReferenceSystemInfo’s element:

Table 6 - Coordinate Reference System taken from [DST]

Metadata element name	Coordinate Reference System
Definition	Description of the coordinate reference system used in the dataset.
ISO 19115 number and name	13. MD_ReferenceSystem

ISO/TS 19139 path	MD_ReferenceSystem
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type(and ISO 19115 no.)	186. MD_ReferenceSystem
Domain	To identify the reference system, the referenceSystemIdentifier (RS_Identifier) shall be provided.  NOTE More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.
Implementing instructions	
Example	referenceSystemIdentifier:  code: http://www.opengis.net/def/crs/EPSG/0/28992 http://www.opengis.net/def/crs/EPSG/0/23031 http://www.opengis.net/def/crs/EPSG/0/32631 http://www.opengis.net/def/crs/EPSG/0/4230 http://www.opengis.net/def/crs/EPSG/0/4326  codeSpace: EPSG
Example XML encoding	<pre> &lt;gmd:MD_ReferenceSystem xlink:role="in-out" &gt;   &lt;gmd:MD_ReferenceSystem&gt;     &lt;gmd:referenceSystemIdentifier&gt;       &lt;gmd:RS_Identifier&gt;         &lt;gmd:code&gt;           &lt;gco:CharacterString&gt;<a href="http://www.opengis.net/def/crs/EPSG/0/28992">http://www.opengis.net/def/crs/EPSG/0/28992</a>&lt;/gco:CharacterString&gt;         &lt;/gmd:code&gt;         &lt;gmd:codeSpace&gt;           &lt;gco:CharacterString&gt;EPSG&lt;/gco:CharacterString&gt;         &lt;/gmd:codeSpace&gt;       &lt;/gmd:RS_Identifier&gt;     &lt;/gmd:referenceSystemIdentifier&gt;   &lt;/gmd:MD_ReferenceSystem&gt; &lt;/gmd:MD_ReferenceSystem&gt; </pre>
Comments	

Coordinate reference system parameters and identifiers shall be managed in one or several common registers for coordinate reference systems. Only identifiers contained in a common register shall be used for referring to the coordinate reference systems listed in this section.

**Implementation Recommendation 2** It is recommended to use the http URIs provided by the Open Geospatial Consortium as coordinate reference system identifiers (see identifiers for the default CRSs in Table 7). These are based on and redirect to the definition in the EPSG Geodetic Parameter Registry (<http://www.epsg-registry.org/>).

Table 7 - Recommended http URIs for the default coordinate reference systems

Coordinate reference system	Short name	http URI identifier
3D Cartesian in ETRS89	ETRS89-XYZ	<a href="http://www.opengis.net/def/crs/EPSSG/0/4936">http://www.opengis.net/def/crs/EPSSG/0/4936</a>
3D geodetic in ETRS89 on GRS80	ETRS89-GRS80h	<a href="http://www.opengis.net/def/crs/EPSSG/0/4937">http://www.opengis.net/def/crs/EPSSG/0/4937</a>
2D geodetic in ETRS89 on GRS80	ETRS89-GRS80	<a href="http://www.opengis.net/def/crs/EPSSG/0/4258">http://www.opengis.net/def/crs/EPSSG/0/4258</a>
2D LAEA projection in ETRS89 on GRS80	ETRS89-LAEA	<a href="http://www.opengis.net/def/crs/EPSSG/0/3035">http://www.opengis.net/def/crs/EPSSG/0/3035</a>
2D LCC projection in ETRS89 on GRS80	ETRS89-LCC	<a href="http://www.opengis.net/def/crs/EPSSG/0/3034">http://www.opengis.net/def/crs/EPSSG/0/3034</a>
2D TM projection in ETRS89 on GRS80, zone 26N (30°W to 24°W)	ETRS89-TM26N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3038">http://www.opengis.net/def/crs/EPSSG/0/3038</a>
2D TM projection in ETRS89 on GRS80, zone 27N (24°W to 18°W)	ETRS89-TM27N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3039">http://www.opengis.net/def/crs/EPSSG/0/3039</a>
2D TM projection in ETRS89 on GRS80, zone 28N (18°W to 12°W)	ETRS89-TM28N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3040">http://www.opengis.net/def/crs/EPSSG/0/3040</a>
2D TM projection in ETRS89 on GRS80, zone 29N (12°W to 6°W)	ETRS89-TM29N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3041">http://www.opengis.net/def/crs/EPSSG/0/3041</a>
2D TM projection in ETRS89 on GRS80, zone 30N (6°W to 0°)	ETRS89-TM30N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3042">http://www.opengis.net/def/crs/EPSSG/0/3042</a>
2D TM projection in ETRS89 on GRS80, zone 31N (0° to 6°E)	ETRS89-TM31N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3043">http://www.opengis.net/def/crs/EPSSG/0/3043</a>
2D TM projection in ETRS89 on GRS80, zone 32N (6°E to 12°E)	ETRS89-TM32N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3044">http://www.opengis.net/def/crs/EPSSG/0/3044</a>
2D TM projection in ETRS89 on GRS80, zone 33N (12°E to 18°E)	ETRS89-TM33N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3045">http://www.opengis.net/def/crs/EPSSG/0/3045</a>
2D TM projection in ETRS89 on GRS80, zone 34N (18°E to 24°E)	ETRS89-TM34N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3046">http://www.opengis.net/def/crs/EPSSG/0/3046</a>
2D TM projection in ETRS89 on GRS80, zone 35N (24°E to 30°E)	ETRS89-TM35N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3047">http://www.opengis.net/def/crs/EPSSG/0/3047</a>
2D TM projection in ETRS89 on GRS80, zone 36N (30°E to 36°E)	ETRS89-TM36N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3048">http://www.opengis.net/def/crs/EPSSG/0/3048</a>
2D TM projection in ETRS89 on GRS80, zone 37N (36°E to 42°E)	ETRS89-TM37N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3049">http://www.opengis.net/def/crs/EPSSG/0/3049</a>
2D TM projection in ETRS89 on GRS80, zone 38N (42°E to 48°E)	ETRS89-TM38N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3050">http://www.opengis.net/def/crs/EPSSG/0/3050</a>
2D TM projection in ETRS89 on GRS80, zone 39N (48°E to 54°E)	ETRS89-TM39N	<a href="http://www.opengis.net/def/crs/EPSSG/0/3051">http://www.opengis.net/def/crs/EPSSG/0/3051</a>

Height in EVRS	EVRS	<a href="http://www.opengis.net/def/crs/EPSSG/0/5730">http://www.opengis.net/def/crs/EPSSG/0/5730</a>
3D compound: 2D geodetic in ETRS89 on GRS80, and EVRS height	ETRS89-GRS80-EVRS	<a href="http://www.opengis.net/def/crs/EPSSG/0/7409">http://www.opengis.net/def/crs/EPSSG/0/7409</a>

### 3.8.2 Quality of Service

The metadata mandated by the following requirements need an extension of the standard [ISO 19119] metadata. This extension description and the encoding example are provided in Annex C.

**Implementation Requirement 11** A new metadata shall be provided to document the availability of the Spatial Data Service

The availability describes the percentage of time the service is available for immediate consumption.

```

<srv:qualityOfService>
...
  <srv:SV_QualityOfService>
    <srv:type>
      <srv:SV_QualityOfServiceType>availability</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>percentage of time</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>99.0</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString> Availability on yearly basis, expressed as
percentage of time</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
...
</srv:qualityOfService>

```

**Implementation Requirement 12** A new metadata shall be provided to document the performance of the Spatial Data Service

The performance of a service represents how fast a service request can be completed. In general performance might be expressed by ([7]):

1. Throughput, i.e. the number of service requests served in a given time interval.
2. Response time, i.e. the time required to complete a service request
3. Latency, i.e. the round-trip delay (RTD) between sending a request and receiving the response
4. Execution time, i.e. the time taken by a service to process its sequence of activities
5. Transaction time, i.e. the time that passes while the web service is completing one transaction.

```

<srv:qualityOfService>
...
  <srv:SV_QualityOfService>
    <srv:type>
      <srv:SV_QualityOfServiceType>performance</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>seconds</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>1.457</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Average response time in
seconds</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
...
</srv:qualityOfService>

```

**Implementation Requirement 13** A new metadata shall be provided to document the capacity of the Spatial Data Service

In this context it could be understood as the maximum number of simultaneous requests with the performance criteria defined above.

The capacity shall be expressed as a numerical value.

```

<srv:qualityOfService>
...
  <srv:SV_QualityOfService>
    <srv:type>
      <srv:SV_QualityOfServiceType>capacity</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>number of requests per
second</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>20</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Maximum number of simultaneous requests per
second meeting the performance criteria</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
...
</srv:qualityOfService>

```

### 3.8.3 Point of contact for the care and maintenance

Even if the documentation of the “ORGANISATIONS RESPONSIBLE FOR THE ESTABLISHMENT, MANAGEMENT, MAINTENANCE AND DISTRIBUTION OF SPATIAL DATA SETS AND SERVICES” is mandated in [2], the successful invocation of a spatial data service requires specifically this information to be available for the party responsible for the care and maintenance of the service.

#### Implementation Requirement 14

A point of contact for the care and maintenance of the spatial data service shall be provided using the responsible party and responsible party role metadata element as described in [INS MD TG]. The role of the contact point shall be set to “custodian”.

Below you can find an encoding example related to Implementation Requirement 14:

```

<gmd:MD_Metadata ... >
...
<gmd:identificationInfo>
<gmd:MD_DataIdentification>
...
<gmd:pointOfContact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>TNO Geological Survey of the
Netherlands</gco:CharacterString>
    </gmd:organisationName>
    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:address>
          <gmd:CI_Address>
            <gmd:electronicMailAddress>
              <gco:CharacterString>info@dinoloket.nl</gco:CharacterString>
            </gmd:electronicMailAddress>
          </gmd:CI_Address>
        </gmd:address>
      </gmd:CI_Contact>
    </gmd:contactInfo>
    <gmd:role>
      <gmd:CI_RoleCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/gmxCodetlists.xml#CI_RoleCode"
codeListValue="custodian">custodian</gmd:CI_RoleCode>
    </gmd:role>
  </gmd:CI_ResponsibleParty>
</gmd:pointOfContact>
...
</gmd:MD_DataIdentification>
...
</gmd:identificationInfo>
...
</gmd:MD_Metadata>

```



### 3.8.4 Restrictions related to the access and use

It is recognized that the access to the spatial data service may be restricted or may require proper license.

**Implementation Requirement 15** Restrictions related to the access and use of the spatial data service for both user information purpose and the support of the machine-to-machine semantic interoperability shall be documented using the [ISO 19115] MD\_Constraints element.

When applicable, the adequate information would be provided in the response to a get spatial data service operation request and should be according to [2]

The “useLimitation” and “otherConstraints” have both CharacterString as data type. Therefore it is possible to use a common gco:CharacterString and specify the constraint as free text, or to use the gmx:Anchor element and specify a text with an url pointing at the resource that describes the constraints (for example a web page or a pdf).

#### Free text example:

```
<gmd:resourceConstraints>
  <gmd:MD_Constraints>
    <gmd:useLimitation>
      <gco:CharacterString>Creative Commons - Attribution 3.0 Unported
    </gco:CharacterString>
    </gmd:useLimitation>
  </gmd:MD_Constraints>
</gmd:resourceConstraints>
```

#### Anchor and free text example:

```
<gmd:resourceConstraints>
  <gmd:MD_Constraints>
    <gmd:useLimitation>
      <gmx:Anchor
xlink:href="http://creativecommons.org/licenses/by/3.0/deed.nl">Creative
Commons - Attribution 3.0 Unported</gmx:Anchor>
    </gmd:useLimitation>
  </gmd:MD_Constraints>
</gmd:resourceConstraints>
```

## 3.9 Harmonized spatial data services

**TG Conformance Class 4:** Implementation of Spatial Data Services compliant with Harmonisation Requirements where practicable

*This conformance class is inclusive of:*

*TG Conformance class 1, TG Conformance class 2, TG Conformance class 3*

### Implementation Requirement 16 to Implementation Requirement 20

In article 7 (1) of [1] states that Implementing rules laying down technical arrangements for the interoperability (also called interoperability arrangements in this Document) and, **where practicable**, harmonisation of spatial data services, designed to amend non-essential elements of the Directive by supplementing it, shall be adopted. While section 3.3 addressed the interoperability arrangements, this section addresses the harmonisation of the spatial data services for the Member States to comply with, “**where practicable**”.

#### 3.9.1 Encoding

**Implementation Requirement 16** A spatial data service returning spatial objects, as part of the output, shall encode those spatial objects according to [2].

This means that the rules defined in EN ISO 19118:2011 shall be followed.

**Implementation Requirement 17** The encoding shall follow the specifications for the different themes in Annex I, II and III of the INSPIRE Directive given in the corresponding annexes of [2].

#### 3.9.2 Invocation

**Implementation Requirement 18** A Harmonised spatial data service shall have well documented interfaces and list the end points to enable automatic machine-to-machine communication.

Two ways are proposed to fulfil the Implementation Requirement 18:

- Provide the [ISO 19119] containsOperation with all the information needed; The containsOperation can describe the service’s operation and its parameters in a generic way. In fact the SV\_OperationMetadata has a standard set of elements which, in some cases, cannot fully describe all the characteristics of a specific spatial data service. For example, using the SV\_Parameter, it is difficult to provide complex parameter type through the SV\_Parameter element.
- Provide a WSDL: a complete WSDL example is provided in Annex D.

### 3.9.2.1 containsOperation element

The tables below, taken from [ISO 19119, Section C.2], show the detailed information about the containsOperation element.

Table 8 - SV\_OperationMetadata detail

Attribute name / Role name	Definition	Obligation / Condition	Maximum occurrence	Attribute class or target class of role
operationName	A unique identifier for this interface.	M	1	CharacterString
DCP	Distributed Computing Platforms on which the operation has been implemented.	M	N	DCPlist
operationDescription	Free text description of the intent of the operation and the results of the operation.	O	1	CharacterString
invocationName	The name used to invoke this interface within the context of the DCP. The name is identical for all DCPs.	O	1	CharacterString
parameters	The parameters that are required for this interface.	O	1	sequence(SV_Parameter) (ref. to table 6)
connectPoint	Handle for accessing the service interface.	M	N	CL_OnlineResource
dependsOn	List of operations that must be completed immediately before current operation is invoked, structured as a list for capturing alternate predecessor paths and sets for capturing parallel predecessor paths.	O	1	set{sequence{operationName}   set{operationName}}

The SV\_Parameter is used to provide service parameters.

Table 9 - SV\_Parameter detail

Attribute name / Role name	Definition	Obligation / Condition	Maximum occurrence	Attribute class or target class of role
Name	The name, as used by the service for this parameter.	M	1	MemberName
Direction	Indication if the parameter is an input to the service, an output or both.	O	1	ParameterDirection
Description	A narrative explanation of the role of the parameter	O	1	CharacterString
Optionality	Indication if the parameter is required	M	1	CharacterString
Repeatability	Indication if more than one value of the parameter may be provided.	M	1	Boolean
ValueType	Operation parameters value type	O	N	Association

The code below is an example of contains one operation element.

```
<srv:containsOperations>
  <srv:SV_OperationMetadata>
    <srv:operationName>
      <gco:CharacterString>sampleColumn</gco:CharacterString>
    </srv:operationName>
    <srv:DCP>
      <srv:DCPList codeList="http://someurl#DCPList "
codeListValue="HTTPGet"/>
    </srv:DCP>
    <srv:parameters>
      <srv:SV_Parameter>
        <srv:name>
          <gco:aName>
            <gco:CharacterString>model</gco:CharacterString>
          </gco:aName>
          <gco:attributeType>
            <gco:TypeName>
              <gco:aName>
                <gco:CharacterString>CharacterString</gco:CharacterString>
              </gco:aName>
            </gco:TypeName>
          </gco:attributeType>
        </srv:name>
      </srv:SV_Parameter>
    </srv:parameters>
  </srv:SV_OperationMetadata>
</srv:containsOperations>
```

```

</srv:name>
<srv:direction>
  <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
</srv:direction>
<srv:optionality>
  <gco:CharacterString>required</gco:CharacterString>
</srv:optionality>
<srv:repeatability>
  <gco:Boolean>>false</gco:Boolean>
</srv:repeatability>
<srv:valueType>string</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>xCoordinate</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>required</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>double</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>yCoordinate</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>required</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>double</srv:valueType>

```

```

</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>resolution</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>required</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>int</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>coordinateSystem</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>optional</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>AvailableCoordinateSystemType</srv:valueType>
</srv:SV_Parameter>
</srv:parameters>
<srv:connectPoint>
  <gmd:CI_OnlineResource>
    <gmd:linkage>
      <gmd:URL>http://www.dinoservices.nl:80/geo3dmodelwebservices-
1/Geo3DModelService</gmd:URL>
    </gmd:linkage>
  </gmd:CI_OnlineResource>
</srv:connectPoint>
</srv:SV_OperationMetadata>

```

</srv:containsOperations>

### 3.9.3 Get Spatial Data Service Metadata

<b>Implementation Requirement 19</b>	A harmonised spatial data service shall include a Get Spatial Data Service Metadata operation similar to the Get xx Service Metadata Operations described in [4].
--------------------------------------	---

#### 3.9.3.1 Get Spatial Data Service Metadata Description

Get Spatial Data Service Metadata	
<p>It Provides the mandatory information about the service and describes the service capabilities. It is inspired by the generic elements of the similar operations as included in [4] for the network services.</p> <ul style="list-style-type: none"> <li>• <b>Request parameters</b> <ul style="list-style-type: none"> <li>○ Natural language to be used for the content of the response</li> </ul> </li> <li>• <b>Response parameters</b> <ul style="list-style-type: none"> <li>○ Spatial Data Service Metadata</li> <li>○ Operations Metadata</li> <li>○ Language</li> </ul> </li> </ul>	
Recommended implementation	
<b>Get Spatial Data Service Metadata Request</b>	<p>Metadata records for Spatial Data Service shall be available in a Discovery Service.</p> <p><i>Note: The Resource locator metadata element for the Spatial Data Service shall contain a link to the Get Spatial Data Service Metadata operation and it shall be unambiguously identified</i></p>
<b>Get Spatial Data Service Metadata Response</b>	<p>The Get Spatial Data Service Metadata response will be a custom capabilities document. There is two possibilities to implement this response:</p> <ul style="list-style-type: none"> <li>• Scenario 1: Repeat all metadata and operations</li> <li>• Scenario 2: Provide a link to ISO metadata and to a document describing the operations provided by the service (e.g. WSDL)</li> </ul>

--	--

Leading to the following Implementation Requirement

<b>Implementation Requirement 20</b>	The Resource locator metadata element for the Spatial Data Service shall contain a link to the Get Spatial Data Service Metadata operation and it shall be unambiguously identified.
--------------------------------------	--

Its recommended implementation is similar to the one proposed for implementation requirement 4 (see 3.7.1)

And the response shall be provided using one of the 2 following options.

### 3.9.3.2 Scenario 1 – Get Capabilities response

If you choose to follow this scenario, all the metadata provided in the ISO metadata shall be repeated in the Get Capabilities metadata (including INSPIRE Extended Capabilities metadata elements). This scenario is based on the experience of the discovery, view and download (WFS option) technical guidance.

In order to provide all the new metadata needed by the INSPIRE Spatial Data Service, the current XSD describing the INSPIRE Extended Capabilities ([http://inspire.ec.europa.eu/schemas/inspire\\_vs\\_ows11/1.0/inspire\\_vs\\_ows\\_11.xsd](http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0/inspire_vs_ows_11.xsd)) has to be extended.

Below you can find an example for the XSD's extension.

```
<xs:complexType name="QualityOfService">
  <xs:sequence>
    <xs:element name="type" type="QualityOfServiceType"/>
    <xs:element name="unit" type="xs:string"/>
    <xs:element name="value" type="xs:string"/>
    <xs:element name="measurementContext" type="xs:string"/>
  </xs:sequence>
</xs:complexType>
<xs:simpleType name="QualityOfServiceType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="availability"/>
    <xs:enumeration value="performance"/>
    <xs:enumeration value="capacity"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="SpatialDataServiceClass">
  <xs:restriction base="xs:string"/>
</xs:simpleType>
```



In addition to the service information metadata, an operation for each service's operation has to be provided in the operation metadata section of the Get Capabilities response.

An encoding example of this scenario is provided in Annex E.

### 3.9.3.3 Scenario 2 – Get Capabilities response

If you choose this scenario, in order to avoid duplication of metadata already provided in the ISO metadata, the GetCapabilities operation has only to provide the reference to the ISO metadata and to a document that describes all the operation provided by the service itself. This scenario follows more the atom implementation of the download service (use of describedby for each “block”) while still providing explicitly a get service metadata operation.

The reference to the spatial data service metadata is provided through the “MetadataUrl” element in the INSPIRE Extended Capabilities.

The operation section contains the GetCapabilities operation itself and an operation called “DescribeServiceOperations”. This operation is a link to a document (for example a WSDL) that provides all the information needed to invoke the service.

An encoding example of this scenario is provided in Annex E.

## 3.10 Services allowing spatial data services to be invoked

### **Implementation Requirement 21**

For each invocable spatial data services, the metadata allowing the spatial data services to be invoked shall be provided in the Discovery metadata response of the INSPIRE Discovery Service.

It implies to be compliant with the extended XSD schema provided in Annex G. A metadata encoding example is provided in Annex H.

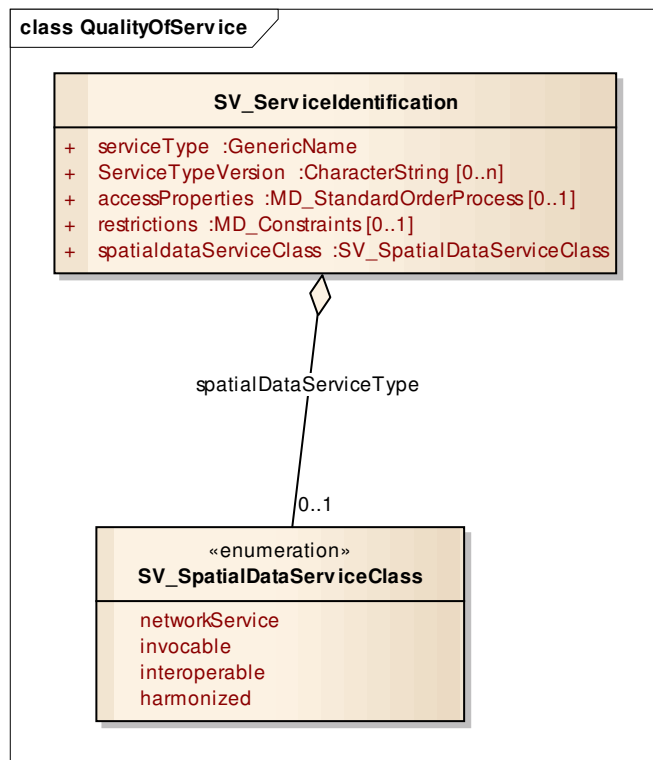
## Annex A – Spatial Data Service Class

This annex describes the extension to [ISO 19119] in order to provide the metadata element needed to document the “spatial data service class”.

The extended element is the SV\_ServiceIdentification [ISO 19119, Section C.2].

### A.1 - Extension UML schema

The original UML schema has been extended as described in the figure below. The new element is an enumeration list with a restricted list of possible codes.



### A.2 XML encoding example

```

...
<srv:SV_ServiceIdentification>
...
  <gmd:identificationInfo>
...
    <srv:spatialDataServiceClass>invocable</srv:spatialDataServiceClass>
  </srv:SV_ServiceIdentification>
</gmd:identificationInfo>
...
  
```

## Annex B – CI\_OnlineFunctionCode Extension

This annex describes the extension to CI\_OnlineFunctionCode codelist from [ISO 19115, Section B.5.3] and the new codelist in order to document the access point type (as described at paragraph 3.7.1).

The XML file provided below shall be used as URL in the CI\_OnlineFunctionCode element to point the new/extended code list descriptor.

```
<gmd:CI_OnLineFunctionCode codeList="http://inspire/new/codelist.xml"
codeListValue="accessPoint">
```

### B.1 – Extension to [ISO 19115, Section B.5.3] codelist descriptor

The following code is the XML encoding representing the extension to the standard [ISO 19115] codelists.

#### B.1.1 – XML Encoding

```
<?xml version="1.0" encoding="UTF-8"?>
<CT_CodelistCatalogue xsi:schemaLocation="http://www.isotc211.org/2005/gmx
http://www.isotc211.org/2005/gmx/gmx.xsd http://www.isotc211.org/2005/gco
http://www.isotc211.org/2005/gco/gco.xsd http://www.opengis.net/gml
http://www.isotc211.org/2005/gml/gml.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns="http://www.isotc211.org/2005/gmx">
  <!--====Catalogue description====-->
  <name>
    <gco:CharacterString>gmxExtendedCodelists</gco:CharacterString>
  </name>
  <scope>
    <gco:CharacterString>Codelists Extended for the INSPIRE Spatial Data
Services</gco:CharacterString>
  </scope>
  <fieldOfApplication>
    <gco:CharacterString>GMX (and imported)
namespace</gco:CharacterString>
  </fieldOfApplication>
  <versionNumber>
    <gco:CharacterString>0.0</gco:CharacterString>
  </versionNumber>
  <versionDate>
    <gco:Date>2013-02-14</gco:Date>
  </versionDate>
  <codelistItem>
    <CodeListDictionary gml:id="CI_OnLineFunctionCode">
      <gml:description>function performed by the
resource</gml:description>
```

```

    <gml:identifier
codeSpace="ISOTC211/19115">CI_OnLineFunctionCode</gml:identifier>
    <codeEntry>
      <CodeDefinition gml:id="CI_OnLineFunctionCode_download">
        <gml:description>online instructions for transferring data from
one storage device or system to another</gml:description>
        <gml:identifier
codeSpace="ISOTC211/19115">download</gml:identifier>
        </CodeDefinition>
      </codeEntry>
      <codeEntry>
        <CodeDefinition gml:id="CI_OnLineFunctionCode_information">
          <gml:description>online information about the
resource</gml:description>
          <gml:identifier
codeSpace="ISOTC211/19115">information</gml:identifier>
          </CodeDefinition>
        </codeEntry>
        <codeEntry>
          <CodeDefinition gml:id="CI_OnLineFunctionCode_offlineAccess">
            <gml:description>online instructions for requesting the
resource from the provider</gml:description>
            <gml:identifier
codeSpace="ISOTC211/19115">offlineAccess</gml:identifier>
            </CodeDefinition>
          </codeEntry>
          <codeEntry>
            <CodeDefinition gml:id="CI_OnLineFunctionCode_order">
              <gml:description>online order process for obtaning the
resource</gml:description>
              <gml:identifier
codeSpace="ISOTC211/19115">order</gml:identifier>
              </CodeDefinition>
            </codeEntry>
            <codeEntry>
              <CodeDefinition gml:id="CI_OnLineFunctionCode_search">
                <gml:description>online search interface for seeking out
information about the resource</gml:description>
                <gml:identifier
codeSpace="ISOTC211/19115">search</gml:identifier>
                </CodeDefinition>
              </codeEntry>
              <codeEntry>
                <CodeDefinition gml:id="CI_OnLineFunctionCode">
                  <gml:description>used to describe an access point of the
service</gml:description>
                  <gml:identifier
codeSpace="INSPIRE_SDS">accessPoint</gml:identifier>
                  </CodeDefinition>
                </codeEntry>
                <codeEntry>
                  <CodeDefinition gml:id="CI_OnLineFunctionCode">
                    <gml:description>Used to describe an access point of the
service that describe itself in a machine readable format (e.g.
WSDL)</gml:description>
                    <gml:identifier codeSpace="INSPIRE_SDS">accessPoint-
selfDescribing</gml:identifier>
                    </CodeDefinition>
                  </codeEntry>

```

```

    <codeEntry>
      <CodeDefinition gml:id="CI_OnLineFunctionCode">
        <gml:description> Used to specify an address to a document that
describe the service metadata (such as GetCapabilities)</gml:description>
        <gml:identifier
codeSpace="INSPIRE_SDS">provideServiceMetadata</gml:identifier>
      </CodeDefinition>
    </codeEntry>

  </CodeListDictionary>
</codelistItem>
</CT_CodelistCatalogue>

```

## B.2 – New codelist descriptor

The following code is the XML encoding representing the new codelist.

### B.2.1 – XML Encoding

```

<?xml version="1.0" encoding="UTF-8"?>
<CT_CodelistCatalogue xsi:schemaLocation="http://www.isotc211.org/2005/gmx
http://www.isotc211.org/2005/gmx/gmx.xsd http://www.isotc211.org/2005/gco
http://www.isotc211.org/2005/gco/gco.xsd http://www.opengis.net/gml
http://www.isotc211.org/2005/gml/gml.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns="http://www.isotc211.org/2005/gmx">
  <!--=====Catalogue description=====-->
  <name>
    <gco:CharacterString>gmxINSPIRECodestlists</gco:CharacterString>
  </name>
  <scope>
    <gco:CharacterString>New Codestlists for the INSPIRE Spatial Data
Services</gco:CharacterString>
  </scope>
  <fieldOfApplication>
    <gco:CharacterString>GMX (and imported)
namespace</gco:CharacterString>
  </fieldOfApplication>
  <versionNumber>
    <gco:CharacterString>0.0</gco:CharacterString>
  </versionNumber>
  <versionDate>
    <gco:Date>2013-02-14</gco:Date>
  </versionDate>
  <codelistItem>
    <codeEntry>
      <CodeDefinition gml:id="CI_OnLineFunctionCode">
        <gml:description>used to describe an access point of the
service</gml:description>
        <gml:identifier
codeSpace="INSPIRE_SDS">accessPoint</gml:identifier>

```

```
        </CodeDefinition>
    </codeEntry>
    <codeEntry>
        <CodeDefinition gml:id="CI_OnLineFunctionCode">
            <gml:description>Used to describe an access point of the
service that describe itself in a machine readable format (e.g.
WSDL)</gml:description>
            <gml:identifier codeSpace="INSPIRE_SDS">accessPoint-
selfDescribing</gml:identifier>
        </CodeDefinition>
    </codeEntry>
    <codeEntry>
        <CodeDefinition gml:id="CI_OnLineFunctionCode">
            <gml:description> Used to specify an address to a document that
describe the service metadata (such as GetCapabilities)</gml:description>
            <gml:identifier
codeSpace="INSPIRE_SDS">provideServiceMetadata</gml:identifier>
        </CodeDefinition>
    </codeEntry>
</CodeListDictionary>
</codelistItem>
</CT_CodelistCatalogue>
```

## Annex C – Quality of Service extension

This annex describes the extension to the [ISO 19119] in order to provide the metadata element needed to document the Quality of Service information.

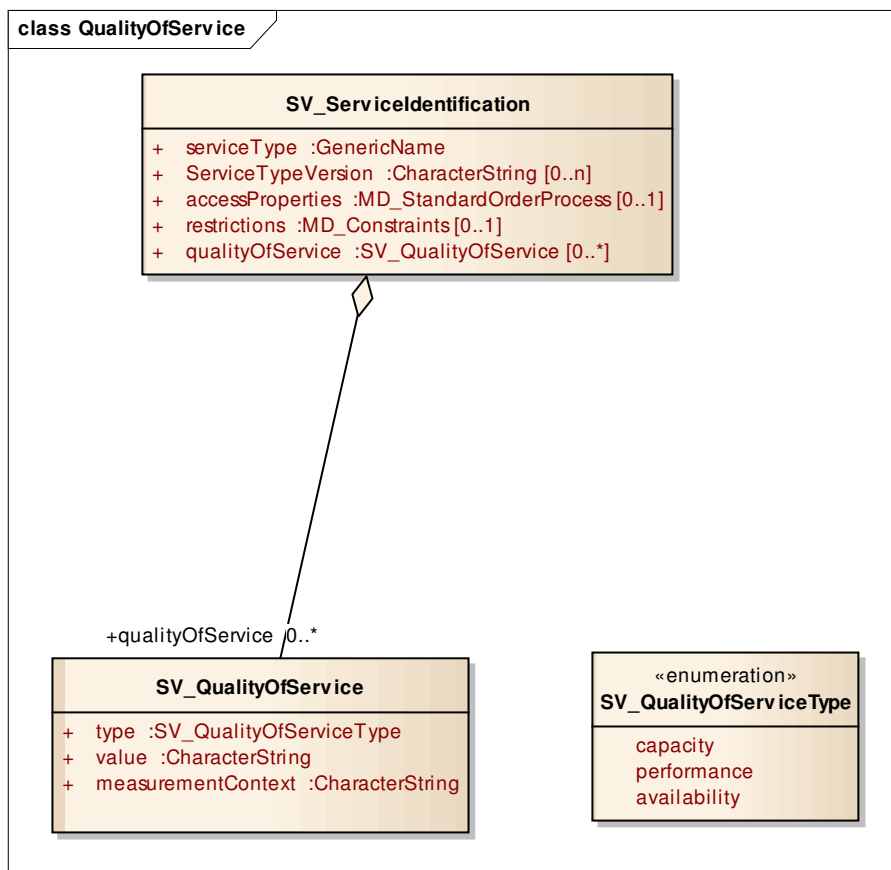
The element extended is the SV\_ServiceIdentification; you can find the original element in [ISO 19119, Section 7.4.2, Section C.2].

There are 3 kinds of QoS information to be provided in the metadata: availability, performance and capacity. For this reason a enumeration representing these 3 QoS types was introduced.

All the information about the new element is described in the paragraph below.

### B.1 - Extension UML schema

The original UML schema has been extended as described in the figure below.



## B.2 - Data dictionary and enumerations

Data dictionary for SV\_QualityOfService

Attribute name / Role name	Definition	Obligation / Condition <sup>a</sup>	Maximum occurrence <sup>b</sup>	Attribute class or target class of role
type	The quality of service type name from the enumeration list.	M	1	SV_QualityOfServiceType
value	The value of the data	M	1	CharacterString
measurementContext		O	1	CharacterString
<sup>a</sup> M = mandatory, O = optional <sup>b</sup> N = repeating occurrences				

SV\_QualityOfServiceType <<Enumeration>>

Name	Description
availability	The ratio of the total time a service is capable of being used during a given interval to the length of the interval.
performance	The performance of a service represents how fast a service request can be completed
capacity	The Capacity is the maximum number of simultaneous requests.

## B.3 – Example values table

Performance	
type	performance
value	90% of the time performance has to meet the following requirements (excluding peak load): initial answer download metadata / describe < 10s; initial answer get less < 30s; download speed > 500kBps; download image 470b kB < 5s; view service 20 concurrent users
measurementContext	For a 470 Kilobytes image (e.g. 800 × 600 pixels with a colour depth of 8 bits), the response time for sending the



	initial response
<b>Availability</b>	
type	availability
value	Two regimes: Basic, for which registration is needed: working days 7:00 – 18:00 99% availability (currently measured: ~ 99.5%) - Open: best effort for the open access service (currently measured: ~ 99.5%)
<b>Capacity</b>	
type	capacity
value	Minimum of 20 concurrent users, maximum unknown

#### B.4 - Encoding Example

Encoding example for the documentation of the performance, availability and capacity QoS properties:

```

...
<gmd:identificationInfo>
<srv:SV_ServiceIdentification>
...
<srv:qualityOfService>
  <srv:SV_QualityOfService>
    <srv:type>
<srv:SV_QualityOfServiceType>performance</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>seconds</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>1.457</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Average response time in
seconds</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
  <srv:SV_QualityOfService>
    <srv:type>
<srv:SV_QualityOfServiceType>availability</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>percentage of time</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>99.0</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Availability on yearly basis, expressed as
percentage of time</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>

```

```
<srv:SV_QualityOfService>
  <srv:type>
    <srv:SV_QualityOfServiceType>capacity</srv:SV_QualityOfServiceType>
  </srv:type>
  <srv:unit>
    <gco:CharacterString>number of requests per
second</gco:CharacterString>
  </srv:unit>
  <srv:value>
    <gco:CharacterString>20</gco:CharacterString>
  </srv:value>
  <srv:measurementContext>
    <gco:CharacterString>Maximum number of simultaneous requests per
second meeting the performance criteria</gco:CharacterString>
  </srv:measurementContext>
</srv:SV_QualityOfService>
</srv:qualityOfService>
...
</srv:SV_ServiceIdentification>
</gmd:identificationInfo>
...
```

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## Annex D - WSDL Example

The following code shows a WSDL example that can be provided in order to fulfil Implementation Requirement 19.

Original URL: <http://www.dinoservices.nl/geo3dmodelwebservices-1/Geo3DModelService?wsdl>

The code highlighted in yellow is an addition to the original example in order to include the getCapabilities operation in the WSDL document.

```
<?xml version="1.0" encoding="UTF-8"?><!-- Published by JAX-WS RI at
http://jax-ws.dev.java.net. RI's version is JAX-WS RI 2.1.3-b02-. --
><ws:definitions xmlns:ws="http://schemas.xmlsoap.org/wsdl/"
xmlns:types="http://ws.geo3dmodel.dino.nitg.tno.nl/types"
xmlns:gml="http://www.opengis.net/gml"
xmlns:tns="http://ws.geo3dmodel.dino.nitg.tno.nl/"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xmime="http://www.w3.org/2005/05/xmlmime"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:wsa="http://www.w3.org/2006/05/addressing/wsdl"
targetNamespace="http://ws.geo3dmodel.dino.nitg.tno.nl/"
name="Geo3DModelService">

  <ws:documentation>
    This WSDL describes a webservice for making "virtual" boreholes in the
    Digital Subsurface Models of DINO.
    The following operations are provided:
    1. sampleColumn creates a synthetic borehole for the specified
    location using the specified model.
    See the documentation in the schema for the types (available at the
    schemaLocation below) for additional details.
    2. listModels lists all models available for sampling.
  </ws:documentation>
  <ws:types>
    <xs:schema>
      <xs:import namespace="http://ws.geo3dmodel.dino.nitg.tno.nl/types"
schemaLocation="http://www.dinoservices.nl:80/geo3dmodelwebservices-
1/Geo3DModelService?xsd=1"></xs:import>
    </xs:schema>
  </ws:types>
  <ws:message name="sampleColumn">
    <ws:part name="parameters" element="types:sampleColumn"></ws:part>
  </ws:message>
  <ws:message name="sampleColumnResponse">
    <ws:part name="parameters"
element="types:sampleColumnResponse"></ws:part>
  </ws:message>
  <ws:message name="drawColumn">
    <ws:part name="parameters" element="types:drawColumn"></ws:part>
  </ws:message>
  <ws:message name="drawColumnResponse">
    <ws:part name="parameters"
element="types:drawColumnResponse"></ws:part>
  </ws:message>
  <ws:message name="listModels">
    <ws:part name="parameters" element="types:listModels"></ws:part>
  </ws:message>
```

```

<ws:message name="listDocuments">
  <ws:part name="parameters" element="types:listDocuments"></ws:part>
</ws:message>
<ws:message name="listRasters">
  <ws:part name="parameters" element="types:listRasters"></ws:part>
</ws:message>
<ws:message name="listModelsResponse">
  <ws:part name="parameters"
element="types:listModelsResponse"></ws:part>
</ws:message>
<ws:message name="listDocumentsResponse">
  <ws:part name="parameters"
element="types:listDocumentsResponse"></ws:part>
</ws:message>
<ws:message name="listRastersResponse">
  <ws:part name="parameters"
element="types:listRastersResponse"></ws:part>
</ws:message>
<ws:message name="describeModel">
  <ws:part name="parameters" element="types:describeModel"></ws:part>
</ws:message>
<ws:message name="describeModelResponse">
  <ws:part name="parameters"
element="types:describeModelResponse"></ws:part>
</ws:message>
<ws:message name="sampleDepth">
  <ws:part name="parameters" element="types:sampleDepth"></ws:part>
</ws:message>
<ws:message name="sampleDepthResponse">
  <ws:part name="parameters"
element="types:sampleDepthResponse"></ws:part>
</ws:message>
<ws:message name="drawDepthSection">
  <ws:part name="parameters" element="types:drawDepthSection"></ws:part>
</ws:message>
<ws:message name="drawDepthSectionResponse">
  <ws:part name="parameters"
element="types:drawDepthSectionResponse"></ws:part>
</ws:message>
<ws:message name="drawVerticalSection">
  <ws:part name="parameters"
element="types:drawVerticalSection"></ws:part>
</ws:message>
<ws:message name="drawVerticalSectionResponse">
  <ws:part name="parameters"
element="types:drawVerticalSectionResponse"></ws:part>
</ws:message>
<ws:message name="userInputErrorResponse">
  <ws:part name="parameters"
element="types:userInputErrorResponse"></ws:part>
</ws:message>
<wsdl:message name="GetCapabilitiesRequestMessage">
  <wsdl:part name="body" element="sos:GetCapabilities"/>
</wsdl:message>
<wsdl:message name="GetCapabilitiesResponseMessage">
  <wsdl:part name="body" element="sos:Capabilities"/>
</wsdl:message>
<ws:portType name="Geo3DModelPortType">

```

```
<ws:operation name="sampleColumn">
  <ws:input message="tns:sampleColumn"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/sampleColumnRequest"></ws:input>
  <ws:output message="tns:sampleColumnResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/sampleColumnResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
</ws:operation>
  <ws:operation name="drawColumn">
  <ws:input message="tns:drawColumn"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawColumnRequest"></ws:input>
  <ws:output message="tns:drawColumnResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawColumnResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
</ws:operation>
  <ws:operation name="listModels">
  <ws:input message="tns:listModels"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listModelsRequest"></ws:input>
  <ws:output message="tns:listModelsResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listModelsResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
</ws:operation>
  <ws:operation name="listDocuments">
  <ws:input message="tns:listDocuments"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listDocumentsRequest"></ws:input>
  <ws:output message="tns:listDocumentsResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listDocumentsResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
</ws:operation>
  <ws:operation name="listRasters">
  <ws:input message="tns:listRasters"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listRastersRequest"></ws:input>
  <ws:output message="tns:listRastersResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/listRastersResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
</ws:operation>
  <ws:operation name="describeModel">
  <ws:input message="tns:describeModel"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/describeModelRequest"></ws:input>
  <ws:output message="tns:describeModelResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/describeModelResponse"></ws:output>
  <ws:fault name="fault"
message="tns:userInputErrorResponse"></ws:fault>
```

```

</ws:operation>
  <ws:operation name="sampleDepth">
    <ws:input message="tns:sampleDepth"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/sampleDepthRequest"></ws
:input>
    <ws:output message="tns:sampleDepthResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/sampleDepthResponse"></w
s:output>
    <ws:fault name="fault "
message="tns:userInputErrorResponse"></ws:fault>
  </ws:operation>
  <ws:operation name="drawDepthSection">
    <ws:input message="tns:drawDepthSection"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawDepthSectionRequest"
></ws:input>
    <ws:output message="tns:drawDepthSectionResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawDepthSectionResponse
"></ws:output>
    <ws:fault name="fault "
message="tns:userInputErrorResponse"></ws:fault>
  </ws:operation>
  <ws:operation name="drawVerticalSection">
    <ws:input message="tns:drawVerticalSection"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawVerticalSectionReque
st"></ws:input>
    <ws:output message="tns:drawVerticalSectionResponse"
wsaw:Action="http://ws.geo3dmodel.dino.nitg.tno.nl/drawVerticalSectionRespo
nse"></ws:output>
    <ws:fault name="fault "
message="tns:userInputErrorResponse"></ws:fault>
  </ws:operation>

```

```

<wsdl:operation name="GetCapabilities">
  <wsdl:input
wsam:Action="http://www.opengis.net/sos/2.0/GetCapabilities"
message="sosw:GetCapabilitiesRequestMessage"/>
  <wsdl:output
wsam:Action="http://www.opengis.net/sos/2.0/GetCapabilitiesResponse"
message="sosw:GetCapabilitiesResponseMessage"/>
  <wsdl:fault name="MissingParameterValueException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>
  <wsdl:fault name="InvalidParameterValueException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>
  <wsdl:fault name="VersionNegotiationFailedException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>
  <wsdl:fault name="InvalidUpdateSequenceException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>
  <wsdl:fault name="OptionNotSupportedException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>
  <wsdl:fault name="NoApplicableCodeException"
wsam:Action="http://www.opengis.net/ows/1.1/Exception"
message="sosw:ExceptionMessage"/>

```

```

        <wsdl:fault name="InvalidRequestException"
wsam:Action="http://www.opengis.net/swes/2.0/Exception"
message="sosw:ExceptionMessage"/>
        <wsdl:fault name="RequestExtensionNotSupportedException"
wsam:Action="http://www.opengis.net/swes/2.0/Exception"
message="sosw:ExceptionMessage"/>
    </wsdl:operation>

</ws:portType>
<ws:binding name="Geo3DModelServicePortBinding"
type="tns:Geo3DModelPortType">
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http"
style="document"></soap:binding>
    <ws:operation name="sampleColumn">
        <soap:operation soapAction="sampleColumn"></soap:operation>
        <ws:input>
            <soap:body use="literal"></soap:body>
        </ws:input>
        <ws:output>
            <soap:body use="literal"></soap:body>
        </ws:output>
        <ws:fault name="fault">
            <soap:fault name="fault"></soap:fault>
        </ws:fault>
    </ws:operation>
    <ws:operation name="drawColumn">
        <soap:operation soapAction="drawColumn"></soap:operation>
        <ws:input>
            <soap:body use="literal"></soap:body>
        </ws:input>
        <ws:output>
            <soap:body use="literal"></soap:body>
        </ws:output>
        <ws:fault name="fault">
            <soap:fault name="fault"></soap:fault>
        </ws:fault>
    </ws:operation>
    <ws:operation name="listModels">
        <soap:operation soapAction="listModels"></soap:operation>
        <ws:input>
            <soap:body use="literal"></soap:body>
        </ws:input>
        <ws:output>
            <soap:body use="literal"></soap:body>
        </ws:output>
        <ws:fault name="fault">
            <soap:fault name="fault"></soap:fault>
        </ws:fault>
    </ws:operation>
    <ws:operation name="listDocuments">
        <soap:operation soapAction="listDocuments"></soap:operation>
        <ws:input>
            <soap:body use="literal"></soap:body>
        </ws:input>
        <ws:output>
            <soap:body use="literal"></soap:body>
        </ws:output>
        <ws:fault name="fault">
            <soap:fault name="fault"></soap:fault>
        </ws:fault>
    </ws:operation>

```

```
</ws:fault>
</ws:operation>
<ws:operation name="listRasters">
  <soap:operation soapAction="listRasters"></soap:operation>
  <ws:input>
    <soap:body use="literal"></soap:body>
  </ws:input>
  <ws:output>
    <soap:body use="literal"></soap:body>
  </ws:output>
  <ws:fault name="fault">
    <soap:fault name="fault"></soap:fault>
  </ws:fault>
</ws:operation>
<ws:operation name="describeModel">
  <soap:operation soapAction="describeModel"></soap:operation>
  <ws:input>
    <soap:body use="literal"></soap:body>
  </ws:input>
  <ws:output>
    <soap:body use="literal"></soap:body>
  </ws:output>
  <ws:fault name="fault">
    <soap:fault name="fault"></soap:fault>
  </ws:fault>
</ws:operation>
<ws:operation name="sampleDepth">
  <soap:operation soapAction="sampleDepth"></soap:operation>
  <ws:input>
    <soap:body use="literal"></soap:body>
  </ws:input>
  <ws:output>
    <soap:body use="literal"></soap:body>
  </ws:output>
  <ws:fault name="fault">
    <soap:fault name="fault"></soap:fault>
  </ws:fault>
</ws:operation>
<ws:operation name="drawDepthSection">
  <soap:operation soapAction="drawDepthSection"></soap:operation>
  <ws:input>
    <soap:body use="literal"></soap:body>
  </ws:input>
  <ws:output>
    <soap:body use="literal"></soap:body>
  </ws:output>
  <ws:fault name="fault">
    <soap:fault name="fault"></soap:fault>
  </ws:fault>
</ws:operation>
<ws:operation name="drawVerticalSection">
  <soap:operation soapAction="drawVerticalSection"></soap:operation>
  <ws:input>
    <soap:body use="literal"></soap:body>
  </ws:input>
  <ws:output>
    <soap:body use="literal"></soap:body>
  </ws:output>
  <ws:fault name="fault">
```



```
<soap:fault name="fault"></soap:fault>
</ws:fault>
</ws:operation>

</ws:binding>
<ws:service name="Geo3DModelService">
  <ws:port name="Geo3DModelServicePort"
binding="tns:Geo3DModelServicePortBinding">
  <soap:address
location="http://www.dinoservices.nl:80/geo3dmodelwebservices-
1/Geo3DModelService"></soap:address>
  </ws:port>
</ws:service>
</ws:definitions>
```

## Annex E Get Spatial Data Service Metadata

This is an example of the Get Spatial Data Service Metadata operation as described at chapter 3.9.3.

### E.1 Get Spatial Data Service Metadata Request

This section contains a description about the get capabilities Request, including a table specifying the parameters needed by the request.

In this capabilities request there is no the need to provide the “service” information (this is a deviation from the standard OWS capabilities).

Table 10 - Get Spatial Data Service Metadata request

Request Parameter	Mandatory / optional	Description
Request=GetCapabilities	M	Operation name (text).  Fixed value: GetCapabilities.
AcceptVersions=version	O	Request version: 2.0.2

The Network Services Regulation requires that multilingual aspects for network services are supported [4]. As there is no standard way to deal with multilingualism within the [OWS] specifications, the HTTP/GET binding of the GetCapabilities-Operation is extended by an additional parameter that indicates the client’s preferred language.

Request Parameter	Parameter value	Description																										
LANGUAGE	<p>Codelist (See ISO/TS 19139) based on alpha-3 codes of ISO 639-2. Use only three-letter codes from in ISO 639-2/B (bibliographic codes), The list of codes for the 23 official EU languages and EFTA Countries is:</p> <table border="0"> <tr> <td>Bulgarian – <b>bul</b></td> <td>Italian – <b>ita</b></td> </tr> <tr> <td>Czech – <b>cze</b></td> <td>Latvian – <b>lav</b></td> </tr> <tr> <td>Danish – <b>dan</b></td> <td>Liechtenstein – <b>ger</b></td> </tr> <tr> <td>Dutch – <b>dut</b></td> <td>Lithuanian – <b>lit</b></td> </tr> <tr> <td>English – <b>eng</b></td> <td>Maltese – <b>mlt</b></td> </tr> <tr> <td>Polish – <b>pol</b></td> <td>Norwegian – <b>nor</b></td> </tr> <tr> <td>Estonian – <b>est</b></td> <td>Portuguese – <b>por</b></td> </tr> <tr> <td>Finnish – <b>fin</b></td> <td>Romanian – <b>rum</b></td> </tr> <tr> <td>French – <b>fre</b></td> <td>Romansh - <b>roh</b></td> </tr> <tr> <td>German – <b>ger</b></td> <td>Slovak – <b>slo</b></td> </tr> <tr> <td>Greek – <b>gre</b></td> <td>Slovenian – <b>slv</b></td> </tr> <tr> <td>Hungarian – <b>hun</b></td> <td>Spanish – <b>spa</b></td> </tr> <tr> <td>Irish – <b>gle</b></td> <td>Swedish – <b>swe</b></td> </tr> </table>	Bulgarian – <b>bul</b>	Italian – <b>ita</b>	Czech – <b>cze</b>	Latvian – <b>lav</b>	Danish – <b>dan</b>	Liechtenstein – <b>ger</b>	Dutch – <b>dut</b>	Lithuanian – <b>lit</b>	English – <b>eng</b>	Maltese – <b>mlt</b>	Polish – <b>pol</b>	Norwegian – <b>nor</b>	Estonian – <b>est</b>	Portuguese – <b>por</b>	Finnish – <b>fin</b>	Romanian – <b>rum</b>	French – <b>fre</b>	Romansh - <b>roh</b>	German – <b>ger</b>	Slovak – <b>slo</b>	Greek – <b>gre</b>	Slovenian – <b>slv</b>	Hungarian – <b>hun</b>	Spanish – <b>spa</b>	Irish – <b>gle</b>	Swedish – <b>swe</b>	<p>It is optional for a Client Request.</p> <p>It is mandatory to be supported for the service and shall be processed if the parameter is present in a client’s request with a supported language code. If the parameter is absent in a clients request or it requested an unsupported language the service shall response in the service default language.</p>
Bulgarian – <b>bul</b>	Italian – <b>ita</b>																											
Czech – <b>cze</b>	Latvian – <b>lav</b>																											
Danish – <b>dan</b>	Liechtenstein – <b>ger</b>																											
Dutch – <b>dut</b>	Lithuanian – <b>lit</b>																											
English – <b>eng</b>	Maltese – <b>mlt</b>																											
Polish – <b>pol</b>	Norwegian – <b>nor</b>																											
Estonian – <b>est</b>	Portuguese – <b>por</b>																											
Finnish – <b>fin</b>	Romanian – <b>rum</b>																											
French – <b>fre</b>	Romansh - <b>roh</b>																											
German – <b>ger</b>	Slovak – <b>slo</b>																											
Greek – <b>gre</b>	Slovenian – <b>slv</b>																											
Hungarian – <b>hun</b>	Spanish – <b>spa</b>																											
Irish – <b>gle</b>	Swedish – <b>swe</b>																											

	<p>Icelandic – <b>ice</b></p> <p>The list of all the codes is defined at <a href="http://www.loc.gov/standards/iso639-2/">http://www.loc.gov/standards/iso639-2/</a> Regional languages also are included in this list.</p>	
--	---	--

## GetCapabilities Request Examples

### GetCapabilities Request KPV Encoding Example

<http://www.example.com/srv?REQUEST=GetCapabilities&LANGUAGE=eng>

## E.2 Scenario 1 - Get Spatial Data Service Metadata Response

```
<?xml version="1.0" encoding="UTF-8"?>
<Capabilities xmlns="http://www.opengis.net/ows/1.1"
xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ins_com="http://inspire.ec.europa.eu/schemas/common/1.0"
xmlns:ins_vs="http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0"
xmlns:ins_qos="http://to-be-provided/schemas/qos/1.0"
xmlns:ins_sdsc="http://to-be-provided/schemas/sdsc/1.0" version="1.0.0"
xsi:schemaLocation="http://www.opengis.net/ows/1.1
http://schemas.opengis.net/ows/1.1.0/Examples/exampleCapabilities.xsd
http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0
http://localhost/capabilities/inspire_sds_ows_11.xsd">
  <ows:ServiceIdentification>
    <ows:Title>Geo 3D Model service</ows:Title>
    <ows:Abstract>This Spatial Data Service supports various operations on
the Digital Subsurface Models (Regis, DGM and GeoTop) provided by the
Geological Survey of the Netherlands. There is for example an operation to
create a "virtual borehole" through one of the subsurface models for any
given location in the Netherlands. The result can either be returned as Xml
data or as a graphical representation. There is also supported for creating
a VerticalSection a depthSection and many others. All operations and
returned values are in the EPSG:28992 (RDNew) coordinate reference
system.</ows:Abstract>
    <ows:Keywords>
      <ows:Keyword>Coverage access service
(infoCoverageAccessService)</ows:Keyword>
      <ows:Keyword>subsurface</ows:Keyword>
      <ows:Keyword>geology</ows:Keyword>
      <ows:Keyword>Netherlands</ows:Keyword>
      <ows:Keyword>3D model</ows:Keyword>
    </ows:Keywords>
    <ows:ServiceType>other</ows:ServiceType>
    <ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
    <ows:Fees>none</ows:Fees>
```

```

    <ows:AccessConstraints>TNO terms and conditions
apply</ows:AccessConstraints>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <ows:ProviderName>Geological Survey of the
Netherlands</ows:ProviderName>
    <ows:ServiceContact>
      <ows:IndividualName>Servicedesk Geological Survey of the
Netherlands</ows:IndividualName>
      <ows:ContactInfo>
        <ows:Address>
<ows:ElectronicMailAddress>info@dinoloket.nl</ows:ElectronicMailAddress>
          </ows:Address>
        </ows:ContactInfo>
      </ows:ServiceContact>
    </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://www.example.com/service.cgi?">
            <ows:Constraint name="GetEncoding">
              <ows:AllowedValues>
                <ows:Value>KVP</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>
          </ows:Get>
          <ows:Post xlink:href="http://www.example.com/service.cgi?">
            <ows:Constraint name="PostEncoding">
              <ows:AllowedValues>
                <ows:Value>SOAP</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>
          </ows:Post>
        </ows:HTTP>
      </ows:DCP>
    </ows:Operation>
    <ows:Operation name="sampleColumn">
      <ows:DCP>
        <ows:HTTP>
          <ows:Post
xlink:href="http://www.dinoservices.nl/geo3dmodelwebservice-
1/Geo3DModelService?wsdl">
            <ows:Constraint name="GetEncoding">
              <ows:AllowedValues>
                <ows:Value>SOAP</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>
          </ows:Post>
        </ows:HTTP>
      </ows:DCP>
    </ows:Operation>
    <ows:Operation name="drawColumn">
      <ows:DCP>
        <ows:HTTP>
          <ows:Post
xlink:href="http://www.dinoservices.nl/geo3dmodelwebservice-
1/Geo3DModelService?wsdl">
            <ows:Constraint name="GetEncoding">

```

```

        <ows:AllowedValues>
            <ows:Value>SOAP</ows:Value>
        </ows:AllowedValues>
    </ows:Constraint>
</ows:Post>
</ows:HTTP>
</ows:DCP>
</ows:Operation>
...

<!-- =====>
<!-- == The INSPIRE Extended Capabilities. ==-->
<!-- =====>
<ins_vs:ExtendedCapabilities>
    <ins_com:ResourceLocator>
        <ins_com:URL/>
    </ins_com:ResourceLocator>
    <ins_com:ResourceType>service</ins_com:ResourceType>
    <ins_com:TemporalReference/>
    <ins_com:Conformity>
        <ins_com:Specification>
            <ins_com:Title>Webservice for making virtual boreholes in the
Digital Subsurface Models of the Netherlands</ins_com:Title>
            <ins_com:DateOfPublication>2011-11-
03</ins_com:DateOfPublication>
        </ins_com:Specification>
        <ins_com:Degree>notEvaluated</ins_com:Degree>
    </ins_com:Conformity>
    <ins_com:MetadataPointOfContact>
        <ins_com:OrganisationName/>
        <ins_com:EmailAddress>info@dinoloket.nl</ins_com:EmailAddress>
    </ins_com:MetadataPointOfContact>
    <ins_com:MetadataDate>2010-12-08</ins_com:MetadataDate>
    <ins_com:SpatialDataServiceType>other</ins_com:SpatialDataServiceType>
    <ins_com:MandatoryKeyword>
<ins_com:KeywordValue>infoCoverageAccessService</ins_com:KeywordValue>
        <!--Arbitrary value to make file valid-->
    </ins_com:MandatoryKeyword>
    <ins_com:SupportedLanguages>
        <ins_com:DefaultLanguage>
            <ins_com:Language>dan</ins_com:Language>
        </ins_com:DefaultLanguage>
        <ins_com:SupportedLanguage>
            <ins_com:Language>eng</ins_com:Language>
        </ins_com:SupportedLanguage>
    </ins_com:SupportedLanguages>
    <ins_com:ResponseLanguage>
        <ins_com:Language>eng</ins_com:Language>
    </ins_com:ResponseLanguage>
    <!-- An extension to the INSPIRE ExtendedCapabilities schma is
needed in order to support the following Quality of Service elements -->
    <ins_qos:QualityOfService>
        <ins_qos:type>availability</ins_qos:type>
        <ins_qos:unit>percentage of time</ins_qos:unit>
        <ins_qos:value>99.0</ins_qos:value>
        <ins_qos:measurementContext> Availability on yearly basis,
expressed as percentage of time</ins_qos:measurementContext>
    </ins_qos:QualityOfService>
    <ins_qos:QualityOfService>

```

```

<ins_qos:type>performance</ins_qos:type>
<ins_qos:unit>seconds</ins_qos:unit>
<ins_qos:value>1.457</ins_qos:value>
<ins_qos:measurementContext>Average response time in
seconds</ins_qos:measurementContext>
</ins_qos:QualityOfService>
<ins_qos:QualityOfService>
  <ins_qos:type>capacity</ins_qos:type>
  <ins_qos:unit>number of requests per second</ins_qos:unit>
  <ins_qos:value>20</ins_qos:value>
  <ins_qos:measurementContext> Maximum number of simultaneous
requests per second meeting the performance
criteria</ins_qos:measurementContext>
</ins_qos:QualityOfService>
  <!-- An extension to the INSPIRE ExtendedCapabilities schema is
needed in order to support the following SDS Class elements -->

  <ins_sdsc:SpatialDataServiceClass>invocable</ins_sdsc:SpatialDataServiceC
lass>
  </ins_vs:ExtendedCapabilities>
</ows:OperationsMetadata>
</Capabilities>

```

### E.3 Scenario 2 - Get Spatial Data Service Metadata Response

```

<?xml version="1.0" encoding="UTF-8"?>
<Capabilities xmlns="http://www.opengis.net/ows/1.1"
xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ins_com="http://inspire.ec.europa.eu/schemas/common/1.0"
xmlns:ins_vs="http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0"
version="1.0.0" xsi:schemaLocation="http://www.opengis.net/ows/1.1
http://schemas.opengis.net/ows/1.1.0/Examples/exampleCapabilities.xsd
http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0
http://inspire.ec.europa.eu/schemas/inspire_vs_ows11/1.0/inspire_vs_ows_11.
xsd">
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://www.example.com/service.cgi?">
            <ows:Constraint name="GetEncoding">
              <ows:AllowedValues>
                <ows:Value>KVP</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>
          </ows:Get>
          <ows:Post xlink:href="http://www.example.com/service.cgi?">
            <ows:Constraint name="PostEncoding">
              <ows:AllowedValues>
                <ows:Value>SOAP</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>

```

```

        </ows:Post>
    </ows:HTTP>
</ows:DCP>
</ows:Operation>
<ows:Operation name="DescribeServiceOperation">
    <ows:DCP>
        <ows:HTTP>
            <ows:Get
xlink:href="http://www.dinoservices.nl/geo3dmodelwebservices-
1/Geo3DModelService?wsdl">
                <ows:Constraint name="PostEncoding">
                    <ows:AllowedValues>
                        <ows:Value>SOAP</ows:Value>
                    </ows:AllowedValues>
                </ows:Constraint>
            </ows:Get>
        </ows:HTTP>
    </ows:DCP>
</ows:Operation>
<!-- =====>
<!-- == The INSPIRE Extended Capabilities.          ==-->
<!-- =====>
<ins_vs:ExtendedCapabilities>
    <ins_com:MetadataUrl>
        <ins_com:URL>http://link-to/discovery-metadata</ins_com:URL>
    </ins_com:MetadataUrl>
    <ins_com:SupportedLanguages>
        <ins_com:DefaultLanguage>
            <ins_com:Language>dan</ins_com:Language>
        </ins_com:DefaultLanguage>
        <ins_com:SupportedLanguage>
            <ins_com:Language>eng</ins_com:Language>
        </ins_com:SupportedLanguage>
    </ins_com:SupportedLanguages>
    <ins_com:ResponseLanguage>
        <ins_com:Language>eng</ins_com:Language>
    </ins_com:ResponseLanguage>
</ins_vs:ExtendedCapabilities>
</ows:OperationsMetadata>
</Capabilities>

```

## Annex F – Extended XSD

This annex shows the modifications to the standard XSDs needed to support the extension described in this document.

serviceMetadata.xsd (included by srv.xsd) - this xsd has been extended in order to support the new elements for the “Quality of Service” and the “Spatial Data Service Class”.  
Original files can be found at: <http://schemas.opengis.net/iso/19139/20060504/srv/>

### F.1 serviceMetadata.xsd encoding

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:srv="http://www.isotc211.org/2005/srv"
xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gco="http://www.isotc211.org/2005/gco"
targetNamespace="http://www.isotc211.org/2005/srv"
elementFormDefault="qualified" version="0.1">
  <!-- ===== Annotation
===== -->
  <xs:annotation>
    <xs:documentation>This file was generated from ISO TC/211 UML class
diagrams == 10-13-2006 11:14:04 ===== </xs:documentation>
  </xs:annotation>
  <!-- ===== Imports
===== -->
  <xs:import namespace="http://www.isotc211.org/2005/gmd"
schemaLocation="http://schemas.opengis.net/iso/19139/20060504/gmd/identific
ation.xsd"/>
  <xs:import namespace="http://www.isotc211.org/2005/gco"
schemaLocation="http://schemas.opengis.net/iso/19139/20060504/gco/gco.xsd"/
>
  <xs:include schemaLocation="../srv/serviceModel.xsd"/>
  <!--
#####
-->
  <!--
#####
-->
  <!-- ===== Classes
===== -->
  <xs:complexType name="SV_Parameter_Type">
    <xs:complexContent>
      <xs:extension base="gco:AbstractObject_Type">
        <xs:sequence>
          <xs:element name="name" type="gco:MemberName_Type"/>
          <xs:element name="direction"
type="srv:SV_ParameterDirection_PropertyType" minOccurs="0"/>
          <xs:element name="description"
type="gco:CharacterString_PropertyType" minOccurs="0"/>
          <xs:element name="optionality"
type="gco:CharacterString_PropertyType"/>
          <xs:element name="repeatability"
type="gco:Boolean_PropertyType"/>
          <xs:element name="valueType" type="gco:TypeName_PropertyType"/>

```



```

        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!--
..... --
>
  <xs:element name="SV_Parameter" type="srv:SV_Parameter_Type"/>
  <!--
..... --
>
  <xs:complexType name="SV_Parameter_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_Parameter" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gco:ObjectReference"/>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>
  <!--
=====
-->
  <xs:complexType name="SV_OperationMetadata_Type">
    <xs:complexContent>
      <xs:extension base="gco:AbstractObject_Type">
        <xs:sequence>
          <xs:element name="operationName"
type="gco:CharacterString_PropertyType"/>
          <xs:element name="DCP" type="srv:DCPList_PropertyType"
maxOccurs="unbounded"/>
          <xs:element name="operationDescription"
type="gco:CharacterString_PropertyType" minOccurs="0"/>
          <xs:element name="invocationName"
type="gco:CharacterString_PropertyType" minOccurs="0"/>
          <xs:element name="parameters"
type="srv:SV_Parameter_PropertyType" minOccurs="0" maxOccurs="unbounded"/>
          <xs:element name="connectPoint"
type="gmd:CI_OnlineResource_PropertyType" maxOccurs="unbounded"/>
          <xs:element name="dependsOn"
type="srv:SV_OperationMetadata_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!--
..... --
>
  <xs:element name="SV_OperationMetadata"
type="srv:SV_OperationMetadata_Type"/>
  <!--
..... --
>
  <xs:complexType name="SV_OperationMetadata_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_OperationMetadata" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gco:ObjectReference"/>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>

```

```

<!--
=====
-->
  <xs:complexType name="SV_QualityOfService_Type">
    <xs:complexContent>
      <xs:extension base="gco:AbstractObject_Type">
        <xs:sequence>
          <xs:element name="type"
type="srv:SV_QualityOfServiceType_PropertyType"/>
          <xs:element name="unit"
type="gco:CharacterString_PropertyType"/>
          <xs:element name="value"
type="gco:CharacterString_PropertyType"/>
          <xs:element name="measurementContext"
type="gco:CharacterString_PropertyType"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!--
..... --
>
  <xs:element name="SV_QualityOfService"
type="srv:SV_QualityOfService_Type"/>
  <!--
..... --
>
  <xs:complexType name="SV_QualityOfService_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_QualityOfService" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gco:ObjectReference"/>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>
  <!--
=====
-->
  <xs:simpleType name="SV_QualityOfServiceType_Type">
    <xs:restriction base="xs:string">
      <xs:enumeration value="availability"/>
      <xs:enumeration value="performance"/>
      <xs:enumeration value="capacity"/>
    </xs:restriction>
  </xs:simpleType>
  <!--
..... --
>
  <xs:element name="SV_QualityOfServiceType"
type="srv:SV_QualityOfServiceType_Type"
substitutionGroup="gco:CharacterString"/>
  <!--
..... --
>
  <xs:complexType name="SV_QualityOfServiceType_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_QualityOfServiceType" minOccurs="0"/>
    </xs:sequence>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>

```

```

<!--
=====
-->

<xs:simpleType name="SV_SpatialDataServiceClass_Type">
  <xs:restriction base="xs:string">
    <xs:enumeration value="discoverable"/>
    <xs:enumeration value="invocable"/>
    <xs:enumeration value="interoperable"/>
    <xs:enumeration value="harmonized"/>
    <xs:enumeration value="network service"/>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="SV_ServiceIdentification_Type">
  <xs:complexContent>
    <xs:extension base="gmd:AbstractMD_Identification_Type">
      <xs:sequence>
        <xs:element name="serviceType"
type="gco:GenericName_PropertyType"/>
        <xs:element name="serviceTypeVersion"
type="gco:CharacterString_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="accessProperties"
type="gmd:MD_StandardOrderProcess_PropertyType" minOccurs="0"/>
        <xs:element name="restrictions"
type="gmd:MD_Constraints_PropertyType" minOccurs="0"/>
        <xs:element name="keywords" type="gmd:MD_Keywords_PropertyType"
minOccurs="0" maxOccurs="unbounded"/>
        <xs:element name="extent" type="gmd:EX_Extent_PropertyType"
minOccurs="0" maxOccurs="unbounded"/>
        <xs:element name="coupledResource"
type="srv:SV_CoupledResource_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="couplingType"
type="srv:SV_CouplingType_PropertyType"/>
        <xs:element name="containsOperations"
type="srv:SV_OperationMetadata_PropertyType" maxOccurs="unbounded"/>
        <xs:element name="operatesOn"
type="gmd:MD_DataIdentification_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="spatialResolution"
type="gmd:MD_Resolution_PropertyType" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element name="qualityOfService"
type="srv:SV_QualityOfService_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:element name="spatialDataServiceClass"
type="srv:SV_SpatialDataServiceClass_Type" minOccurs="0" maxOccurs="1"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!--
..... --
>
  <xs:element name="SV_ServiceIdentification"
type="srv:SV_ServiceIdentification_Type"
substitutionGroup="gmd:AbstractMD_Identification"/>

```

```

<!--
..... --
>
<xs:complexType name="SV_ServiceIdentification_PropertyType">
  <xs:sequence>
    <xs:element ref="srv:SV_ServiceIdentification" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gco:ObjectReference"/>
  <xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<!--
=====
-->
<xs:complexType name="SV_OperationChain_Type">
  <xs:complexContent>
    <xs:extension base="gco:AbstractObject_Type">
      <xs:sequence>
        <xs:element name="name"
type="gco:CharacterString_PropertyType"/>
        <xs:element name="description"
type="gco:CharacterString_PropertyType" minOccurs="0"/>
        <xs:element name="operation"
type="srv:SV_Operation_PropertyType" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<!--
..... --
>
<xs:element name="SV_OperationChain" type="srv:SV_OperationChain_Type"/>
<!--
..... --
>
<xs:complexType name="SV_OperationChain_PropertyType">
  <xs:sequence>
    <xs:element ref="srv:SV_OperationChain" minOccurs="0"/>
  </xs:sequence>
  <xs:attributeGroup ref="gco:ObjectReference"/>
  <xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<!--
=====
-->
<xs:complexType name="SV_OperationChainMetadata_Type">
  <xs:complexContent>
    <xs:extension base="gco:AbstractObject_Type">
      <xs:sequence>
        <xs:element name="name"
type="gco:CharacterString_PropertyType"/>
        <xs:element name="description"
type="gco:CharacterString_PropertyType" minOccurs="0"/>
        <xs:element name="operation"
type="srv:SV_OperationMetadata_PropertyType" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

```

```

<!--
..... --
>
  <xs:element name="SV_OperationChainMetadata"
type="srv:SV_OperationChainMetadata_Type"/>
  <!--
..... --
>
  <xs:complexType name="SV_OperationChainMetadata_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_OperationChainMetadata" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gco:ObjectReference"/>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>
  <!--
=====
-->
  <xs:complexType name="SV_CoupledResource_Type">
    <xs:complexContent>
      <xs:extension base="gco:AbstractObject_Type">
        <xs:sequence>
          <xs:element name="operationName"
type="gco:CharacterString_PropertyType"/>
          <xs:element name="identifier"
type="gco:CharacterString_PropertyType"/>
          <xs:element ref="gco:ScopedName" minOccurs="0" maxOccurs="1"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!--
..... --
>
  <xs:element name="SV_CoupledResource"
type="srv:SV_CoupledResource_Type"/>
  <!--
..... --
>
  <xs:complexType name="SV_CoupledResource_PropertyType">
    <xs:sequence>
      <xs:element ref="srv:SV_CoupledResource" minOccurs="0"/>
    </xs:sequence>
    <xs:attributeGroup ref="gco:ObjectReference"/>
    <xs:attribute ref="gco:nilReason"/>
  </xs:complexType>
  <!--
=====
-->
  <xs:simpleType name="SV_ParameterDirection_Type">
    <xs:restriction base="xs:string">
      <xs:enumeration value="in"/>
      <xs:enumeration value="out"/>
      <xs:enumeration value="in/out"/>
    </xs:restriction>
  </xs:simpleType>
  <!--
..... --
>

```

```
<xs:element name="SV_ParameterDirection"
type="srv:SV_ParameterDirection_Type"
substitutionGroup="gco:CharacterString"/>
<!--
..... --
>
<xs:complexType name="SV_ParameterDirection_PropertyType">
  <xs:sequence>
    <xs:element ref="srv:SV_ParameterDirection" minOccurs="0"/>
  </xs:sequence>
  <xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<!--
=====
-->
<!--
..... --
>
<xs:element name="DCPLList" type="gco:CodeListValue_Type"
substitutionGroup="gco:CharacterString"/>
<!--
..... --
>
<xs:complexType name="DCPLList_PropertyType">
  <xs:sequence>
    <xs:element ref="srv:DCPLList" minOccurs="0"/>
  </xs:sequence>
  <xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<!--
=====
-->
<!--
..... --
>
<xs:element name="SV_CouplingType" type="gco:CodeListValue_Type"
substitutionGroup="gco:CharacterString"/>
<!--
..... --
>
<xs:complexType name="SV_CouplingType_PropertyType">
  <xs:sequence>
    <xs:element ref="srv:SV_CouplingType" minOccurs="0"/>
  </xs:sequence>
  <xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<!--
=====
-->
</xs:schema>
```

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## Annex G – Metadata textual example

The following spatial service description is the source for the content of the majority of the examples provided in this document.

The orange elements are the elements not present in the original example.

### Geo 3D Model service

#### Resource title

Geo 3D Model service.

#### Resource abstract

This Spatial Data Service supports various operations on the Digital Subsurface Models (Regis, DGM and GeoTop) provided by the Geological Survey of the Netherlands. There is for example an operation to create a “virtual borehole” through one of the subsurface models for any given location in the Netherlands. The result can either be returned as Xml data or as a graphical representation. There is also supported for creating a VerticalSection a depthSection and many others. All operations and returned values are in the EPSG:28992 (RDNew) coordinate reference system.

#### Resource type

Spatial Data Service

#### Resource locator (URL)

Service access point: <http://www.dinoservices.nl/geo3dmodelwebservices-1/Geo3DModelService>

WSDL available at: <http://www.dinoservices.nl/geo3dmodelwebservices-1/Geo3DModelService?wsdl>

#### Resource Locator Function Code

accessPoint-selfDescribing

#### Coupled resource

N/A

#### Spatial data service type

Coverage access service (infoCoverageAccessService)

#### Keyword

subsurface, geology, Netherlands, 3D model.

#### Geographic Location

Netherlands.

#### Bounding box

EPSG:28992 (-10421, 300413, 280019, 626762)

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WGS84 (3.047, 50.670, 7.276, 53.612)

**Temporal reference**

N/A

**Spatial resolution**

The models have a resolution of 100x100 meters horizontally and have varying vertical resolutions.

**Conformity**

**Specification**

N/A

**Degree**

N/A

**Conditions applying to access and use**

Creative commons Free culture license conditions apply.

**Limitations on public access**

There are no limitations on public access.

**Responsible organization**

Geological Survey of the Netherlands

**Metadata Point of contact**

Servicedesk Geological Survey of the Netherlands

info@dinoloket.nl

**Metadata date**

2012-08-14

**Metadata language**

English

**Country Name**

Netherlands

**Spatial Data Service Class**

invocable

**Coordinate Reference System**

EPSG:28992



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**EPSG:23031**

**EPSG:32631**

**EPSG:4230**

**EPSG:4326**

### **Spatial data themes**

Geology

### **Specific Indicators**

The service provides 9 different operations. It does not access any related Spatial Data Services.

## **Deviation from INSPIRE regulation**

### **Resource description**

The Geological Survey of the Netherlands creates and maintains the following models of the subsurface of the Netherlands:

- DGM  
Digital Geological Model, covering Neogene and Quaternary units
- REGIS  
A 3D hydrogeological schematisation of the Dutch subsurface describing the geometry and hydraulic properties of ~160 hydrogeological units (horizontal and vertical conductivity of sandy and clayey units respectively).
- Geotop  
GeoTOP schematises the subsurface in voxels of 100 x 100 x 0.5 m (x, y, z) down to depths of 30 to 50 meters, covering the main zone of human activity. The model provides estimates of lithostratigraphy and lithology (including grain-size classes), as well as physical and chemical parameters such as hydraulic conductivity and chemical element concentrations. The layermodel of Geotop is available through the here described service.

This Spatial Data Service offers the following operations on these models:

- sampleColumn  
Virtually drills through a specified model on a specified location returning the occurring model-units in depth and their properties for the specific location.
- drawColumn  
Virtually drills through a specified model on a specified location returning a visualization of the occurring model-units.
- listModels  
Lists all available models (in a specified area)
- listDocuments  
Lists all available documentation on the specified model-unit

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- **listRasters**  
Lists references to all available data (depth, property, etc.) on which the specified model-unit is based. These data are rasters in WMS, preview or ZIP-download
- **describeModel**  
Describes a specified model including all contained model-units and available properties.
- **drawVerticalSection**  
Draws a vertical cross-section through a specified model along a specified line. These cross-section show model-units, lateral variation of a specified property or the result of a filter on depth, thickness and property value.

### Standards

SOAP webservice with GML 3.1 messages.

### Software

The SOAP service is an own Java based development of the Geological Survey of the Netherlands.

### Distribution

Not defined.

### Hardware/System Software

Linux based server park, JBoss application server with JAXWS Reference Implementation, Oracle database.

### Quality of service

99% uptime.

### Topology

Real time.

### Service end point

WSDL available at: <http://www.dinoservices.nl/geo3dmodelwebservices-1/Geo3DModelService?wsdl>

### Lessons learned

For building and maintaining SOAP and REST services there is a rich set of open source tools available that work well, are well supported and understood worldwide. SOAP and REST services are fully capable of handling geographic data and operations. Because of the wide adoption of these standards it is also easy to use these services in applications as spreadsheets and word processors. The extreme complexity of the openGIS Xsd's and the element naming used in GML 3.1 sometimes require a work around. This may well stand in the way of a wider adoption of GML. A refactoring of the Xsd's with this in mind can make GML less academic and more practical and usable.

### Future Plans

The Geological Survey of the Netherlands will provide many more services to unlock the vast quantities of data it has of the Dutch subsurface and their interpretations into 3D models. Additionally the Geological Survey of the Netherlands is preparing for a new law that will govern management and utilization of subsurface information. Under this law, a key register for the

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subsurface will be established: a single national database for the subsurface data and information, which will have to be both fed and consulted by all Dutch government bodies dealing with the subsurface. This key register will use webservice as means of acquiring and delivering data and information to its users.

### **Best Practice Availability**

This document may be made publicly available.

## Annex H – Complete XML Encoding example

The code below shows a complete example of Inspire SDS. The colours used are related to the metadata to be provided for each class of conformance presented in the TG.

The XML example provided below has been validated with the new XSD provided in Annex E using Altova XML Spy.

Discoverable  
 Invocable  
 Interoperable  
 Harmonized

Note: in this example the harmonization level has the containsOperation filled. As you can see at paragraph 3.9.2, it is not mandatory but conditional: the choice is between providing containsOperation element or a WSDL (example at Annex D) in order to describe the service operations.

```
<?xml version="1.0" encoding="UTF-8"?>
<gmd:MD_Metadata xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmx="http://www.isotc211.org/2005/gmx"
xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gml="http://www.opengis.net/gml"
xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss"
xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:srv="http://www.isotc211.org/2005/srv"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.isotc211.org/2005/srv
http://localhost/srv/srv.xsd http://www.isotc211.org/2005/gmx
http://schemas.opengis.net/iso/19139/20060504/gmx/gmx.xsd">
  <gmd:language>
    <gmd:LanguageCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodelists.xml#LanguageCode"
codeListValue="eng">eng</gmd:LanguageCode>
  </gmd:language>
  <gmd:hierarchyLevel>
    <gmd:MD_ScopeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/gmxCodelists.xml#MD_ScopeCode"
codeListValue="service">service</gmd:MD_ScopeCode>
  </gmd:hierarchyLevel>
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:organisationName>
        <gco:CharacterString>TNO Geological Survey of the
Netherlands</gco:CharacterString>
      </gmd:organisationName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:address>
            <gmd:CI_Address>
              <gmd:electronicMailAddress>
                <gco:CharacterString>
info@dinoloket.nl</gco:CharacterString>
```

```

        </gmd:electronicMailAddress>
        </gmd:CI_Address>
        </gmd:address>
        </gmd:CI_Contact>
        </gmd:contactInfo>
        <gmd:role>
        <gmd:CI_RoleCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
        </gmd:role>
        </gmd:CI_ResponsibleParty>
</gmd:contact>
<gmd:dateStamp>
        <gco:Date>2012-12-05</gco:Date>
</gmd:dateStamp>
<gmd:referenceSystemInfo>
        <gmd:MD_ReferenceSystem>
        <gmd:referenceSystemIdentifier>
        <gmd:RS_Identifier>
        <gmd:code>
        <gco:CharacterString>http://www.opengis.net/def/crs/EPSG/0/28992</gco:Cha
racterString>
        </gmd:code>
        <gmd:codeSpace>
        <gco:CharacterString>EPSG</gco:CharacterString>
        </gmd:codeSpace>
        </gmd:RS_Identifier>
        </gmd:referenceSystemIdentifier>
        </gmd:MD_ReferenceSystem>
</gmd:referenceSystemInfo>
<gmd:identificationInfo>
        <srv:SV_ServiceIdentification>
        <gmd:citation>
        <gmd:CI_Citation>
        <gmd:title>
        <gco:CharacterString>Geo 3D Model
service</gco:CharacterString>
        </gmd:title>
        <gmd:date>
        <gmd:CI_Date>
        <gmd:date>
        <gco:Date>2012-08-14</gco:Date>
        </gmd:date>
        <gmd:dateType>
        <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
        </gmd:dateType>
        </gmd:CI_Date>
        </gmd:date>
        </gmd:CI_Citation>
        </gmd:citation>
        <gmd:abstract>
        <gco:CharacterString>This Spatial Data Service supports various
operations on the Digital Subsurface Models (Regis, DGM and GeoTop)
provided by the Geological Survey of the Netherlands. There is for example
an operation to create a "virtual borehole" through one of the subsurface

```

models for any given location in the Netherlands. The result can either be returned as Xml data or as a graphical representation. There is also supported for creating a VerticalSection a depthSection and many others. All operations and returned values are in the EPSG:28992 (RDNew) coordinate reference system. The models have a resolution of 100x100 meters horizontally and have varying vertical resolutions. </gco:CharacterString>

```

</gmd:abstract>
<gmd:pointOfContact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>Geological Survey of the
Netherlands</gco:CharacterString>
    </gmd:organisationName>
    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:address>
          <gmd:CI_Address>
            <gmd:electronicMailAddress>
              <gco:CharacterString>info@dinoloket.nl</gco:CharacterString>
            </gmd:electronicMailAddress>
          </gmd:CI_Address>
        </gmd:address>
      </gmd:CI_Contact>
    </gmd:contactInfo>
    <gmd:role>
      <gmd:CI_RoleCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/gmxCodetlists.xml#CI_RoleCode"
codeListValue="custodian">custodian</gmd:CI_RoleCode>
    </gmd:role>
  </gmd:CI_ResponsibleParty>
</gmd:pointOfContact>
<gmd:descriptiveKeywords>
  <gmd:MD_Keywords>
    <gmd:keyword>
      <gco:CharacterString>203 Coverage access service
(infoCoverageAccessService)</gco:CharacterString>
    </gmd:keyword>
    <gmd:keyword>
      <gco:CharacterString>subsurface</gco:CharacterString>
    </gmd:keyword>
    <gmd:keyword>
      <gco:CharacterString>geology</gco:CharacterString>
    </gmd:keyword>
    <gmd:keyword>
      <gco:CharacterString>Netherlands</gco:CharacterString>
    </gmd:keyword>
    <gmd:keyword>
      <gco:CharacterString>3D model</gco:CharacterString>
    </gmd:keyword>
  </gmd:MD_Keywords>
</gmd:descriptiveKeywords>
<gmd:resourceConstraints>
  <gmd:MD_Constraints>
    <gmd:useLimitation>
      <gco:CharacterString>Creative Commons Free
Culture.</gco:CharacterString>
    </gmd:useLimitation>
  </gmd:MD_Constraints>

```

```

</gmd:resourceConstraints>
<gmd:resourceConstraints>
  <gmd:MD_Constraints>
    <gmd:useLimitation>
      <gmx:Anchor
xlink:href="http://creativecommons.org/licenses/by/3.0/deed.nl">Creative
Commons - Attribution 3.0 Unported</gmx:Anchor>
      </gmd:useLimitation>
    </gmd:MD_Constraints>
  </gmd:resourceConstraints>
<gmd:resourceConstraints>
  <gmd:MD_LegalConstraints>
    <gmd:accessConstraints>
      <gmd:MD_RestrictionCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/gmxCodetlists.xml#MD_RestrictionCode"
codeListValue="otherRestrictions">otherRestrictions</gmd:MD_RestrictionCode
>
      </gmd:accessConstraints>
      <gmd:otherConstraints>
        <gco:CharacterString>no limitations</gco:CharacterString>
      </gmd:otherConstraints>
    </gmd:MD_LegalConstraints>
  </gmd:resourceConstraints>
<srv:serviceType>
  <gco:LocalName>other</gco:LocalName>
</srv:serviceType>
<srv:extent>
  <gmd:EX_Extent>
    <gmd:geographicElement>
      <gmd:EX_GeographicBoundingBox>
        <gmd:westBoundLongitude>
          <gco:Decimal>3.047</gco:Decimal>
        </gmd:westBoundLongitude>
        <gmd:eastBoundLongitude>
          <gco:Decimal>50.670</gco:Decimal>
        </gmd:eastBoundLongitude>
        <gmd:southBoundLatitude>
          <gco:Decimal>7.276</gco:Decimal>
        </gmd:southBoundLatitude>
        <gmd:northBoundLatitude>
          <gco:Decimal>53.612</gco:Decimal>
        </gmd:northBoundLatitude>
      </gmd:EX_GeographicBoundingBox>
    </gmd:geographicElement>
  </gmd:EX_Extent>
</srv:extent>
<srv:couplingType gco:nilReason="missing"/>
<srv:containsOperations>
  <srv:SV_OperationMetadata>
    <srv:operationName>
      <gco:CharacterString>sampleColumn</gco:CharacterString>
    </srv:operationName>
    <srv:DCP>
      <srv:DCPList codeList="http://someurl#DCPList"
codeListValue="HTTPGet"/>
    </srv:DCP>
    <srv:parameters>
      <srv:SV_Parameter>

```

```
<srv:name>
  <gco:aName>
    <gco:CharacterString>model</gco:CharacterString>
  </gco:aName>
  <gco:attributeType>
    <gco:TypeName>
      <gco:aName>
        <gco:CharacterString>CharacterString</gco:CharacterString>
      </gco:aName>
    </gco:TypeName>
  </gco:attributeType>
</srv:name>
<srv:direction>
  <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
</srv:direction>
<srv:optionality>
  <gco:CharacterString>required</gco:CharacterString>
</srv:optionality>
<srv:repeatability>
  <gco:Boolean>>false</gco:Boolean>
</srv:repeatability>
<srv:valueType>string</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>xCoordinate</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>required</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>double</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>yCoordinate</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
```



```

</srv:name>
<srv:direction>
  <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
</srv:direction>
<srv:optionality>
  <gco:CharacterString>required</gco:CharacterString>
</srv:optionality>
<srv:repeatability>
  <gco:Boolean>>false</gco:Boolean>
</srv:repeatability>
<srv:valueType>double</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
<gco:CharacterString>resolution</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>required</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>int</srv:valueType>
</srv:SV_Parameter>
<srv:SV_Parameter>
  <srv:name>
    <gco:aName>
      <gco:CharacterString>coordinateSystem</gco:CharacterString>
    </gco:aName>
    <gco:attributeType>
      <gco:TypeName>
        <gco:aName>
          <gco:CharacterString>CharacterString</gco:CharacterString>
        </gco:aName>
      </gco:TypeName>
    </gco:attributeType>
  </srv:name>
  <srv:direction>
    <srv:SV_ParameterDirection>in</srv:SV_ParameterDirection>
  </srv:direction>
  <srv:optionality>
    <gco:CharacterString>optional</gco:CharacterString>
  </srv:optionality>
  <srv:repeatability>
    <gco:Boolean>>false</gco:Boolean>
  </srv:repeatability>
  <srv:valueType>AvailableCoordinateSystemType</srv:valueType>

```

```

    </srv:SV_Parameter>
  </srv:parameters>
  <srv:connectPoint>
    <gmd:CI_OnlineResource>
      <gmd:linkage>
        <gmd:URL>http://www.dinoservices.nl:80/geo3dmodelwebservices-
1/Geo3DModelService</gmd:URL>
        </gmd:linkage>
      </gmd:CI_OnlineResource>
    </srv:connectPoint>
  </srv:SV_OperationMetadata>
</srv:containsOperations>
  <srv:operatesOn xlink:href="http://www.dinoservices.nl/excat-
inspire/csw?Service=CSW&Request=GetRecordById&Version=2.0.2&id=F646DFB9-
5BF6-EAB9-042B-
CAB6FF2DC275&outputSchema=http://www.isotc211.org/2005/gmd&elementSetName=f
ull"/>
<srv:qualityOfService>
  <srv:SV_QualityOfService>
    <srv:type>
<srv:SV_QualityOfServiceType>performance</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit><gco:CharacterString>seconds</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>1.457</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Average response time in
seconds</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
  <srv:SV_QualityOfService>
    <srv:type>
<srv:SV_QualityOfServiceType>availability</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>percentage of time</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>99.0</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>
      <gco:CharacterString>Availability on yearly basis, expressed as
percentage of time</gco:CharacterString>
    </srv:measurementContext>
  </srv:SV_QualityOfService>
  <srv:SV_QualityOfService>
    <srv:type>
<srv:SV_QualityOfServiceType>capacity</srv:SV_QualityOfServiceType>
    </srv:type>
    <srv:unit>
      <gco:CharacterString>number of requests per
second</gco:CharacterString>
    </srv:unit>
    <srv:value>
      <gco:CharacterString>20</gco:CharacterString>
    </srv:value>
    <srv:measurementContext>

```

```

    <gco:CharacterString>Maximum number of simultaneous requests per
second meeting the performance criteria</gco:CharacterString>
  </srv:measurementContext>
</srv:SV_QualityOfService>
</srv:qualityOfService>
  <srv:spatialDataServiceClass>invocable</srv:spatialDataServiceClass>
</srv:SV_ServiceIdentification>
</gmd:identificationInfo>
<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://www.dinoservices.nl/geo3dmodelwebservices-
1/Geo3DModelService</gmd:URL>
            </gmd:linkage>
            <gmd:function>
              <gmd:CI_OnLineFunctionCode
codeList="http://inspire/new/codelist" codeListValue="accessPoint-
selfDescribing">accessPoint- selfDescribing</gmd:CI_OnLineFunctionCode>
            </gmd:function>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
      </gmd:onLine>
      <gmd:CI_OnlineResource>
        <gmd:linkage>
          <gmd:URL>http://link-to/get-service-metadata</gmd:URL>
        </gmd:linkage>
        <gmd:function>
          <gmd:CI_OnLineFunctionCode
codeList="http://inspire/new/codelist"
codeListValue="provideServiceMetadata">provideServiceMetadata</gmd:CI_OnLin
eFunctionCode>
        </gmd:function>
      </gmd:CI_OnlineResource>
    </gmd:onLine>
  </gmd:MD_DigitalTransferOptions>
</gmd:transferOptions>
</gmd:MD_Distribution>
</gmd:distributionInfo>
<gmd:dataQualityInfo>
  <gmd:DQ_DataQuality>
    <gmd:scope>
      <gmd:DQ_Scope>
        <gmd:level>
          <gmd:MD_ScopeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodetlists.xml#MD_ScopeCode"
codeListValue="service">service</gmd:MD_ScopeCode>
        </gmd:level>
      </gmd:DQ_Scope>
    </gmd:scope>
    <gmd:report>
      <gmd:DQ_DomainConsistency
xsi:type="gmd:DQ_DomainConsistency_Type">
        <gmd:result>

```

```

    <gmd:DQ_ConformanceResult
xsi:type="gmd:DQ_ConformanceResult_Type">
      <gmd:specification>
        <gmd:CI_Citation>
          <gmd:title>
            <gco:CharacterString>invocable</gco:CharacterString>
          </gmd:title>
          <gmd:date>
            <gmd:CI_Date>
              <gmd:date>
                <gco>Date>2010-12-08</gco>Date>
              </gmd:date>
              <gmd:dateType>
                <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
9_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
                </gmd:dateType>
              </gmd:CI_Date>
            </gmd:date>
          </gmd:CI_Citation>
        </gmd:specification>
        <gmd:explanation>
          <gco:CharacterString>See the referenced
specification</gco:CharacterString>
        </gmd:explanation>
        <gmd:pass>
          <gco:Boolean>true</gco:Boolean>
        </gmd:pass>
      </gmd:DQ_ConformanceResult>
    </gmd:result>
  </gmd:DQ_DomainConsistency>
</gmd:report>
</gmd:DQ_DataQuality>
</gmd:dataQualityInfo>
</gmd:MD_Metadata>

```