INSPIRE

Infrastructure for Spatial Information in Europe

Technical Guidance for implementing download services using the OGC Sensor Observation Service and ISO 19143 Filter Encoding

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[1] France will submit this document to a national stakeholder consultation (until end of January 2017), as foreseen as an option under the workflow of the MIWP 2014-2016.

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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.

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."*

The Implementing Rules are adopted as Commission Decisions or Regulations, and are legally binding.

In addition to the Implementing Rules, non-binding Technical Guidance documents describe detailed implementation aspects and relations with existing standards, technologies and practices in order to support the technical implementation process. 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. In other words, these Technical Guidance documents are supporting material to assist in the technical implementation of the INSPIRE Directive but no additional obligations can be derived from these documents over and above the obligations set out in the Directive and the Implementing Rules. The Technical Guidance documents are also not intended to interpret legal obligations. Figure 1 illustrates the relationship between the INSPIRE Regulations containing Implementing Rules and their corresponding Technical Guidance documents.

The scope of this document is to provide Technical Guidance for the implementation of the requirements related to download services included in [**INS NS**] using Sensor Observation Services (SOS), such that these services can be implemented consistently across Europe. Other Technical Guidance exists for describing implementations of the requirements for download services using other specifications, such as for Atom Syndication Format, Web Feature Services (WFS) and Web Coverage Services (WCS).

Implementing this Technical Guidance are designed to maximise the interoperability of INSPIRE services. Technical Guidance documents describe how Member States might implement the Implementing Rules described in a Commission Regulation. The technical provisions and the underlying concepts are often illustrated by use case diagrams and accompanied by examples. Technical Guidance

documents may also include non-binding technical recommendations that should be satisfied if a Member State chooses to conform to the Technical Guidance. However, these recommendations have no legally binding effect.

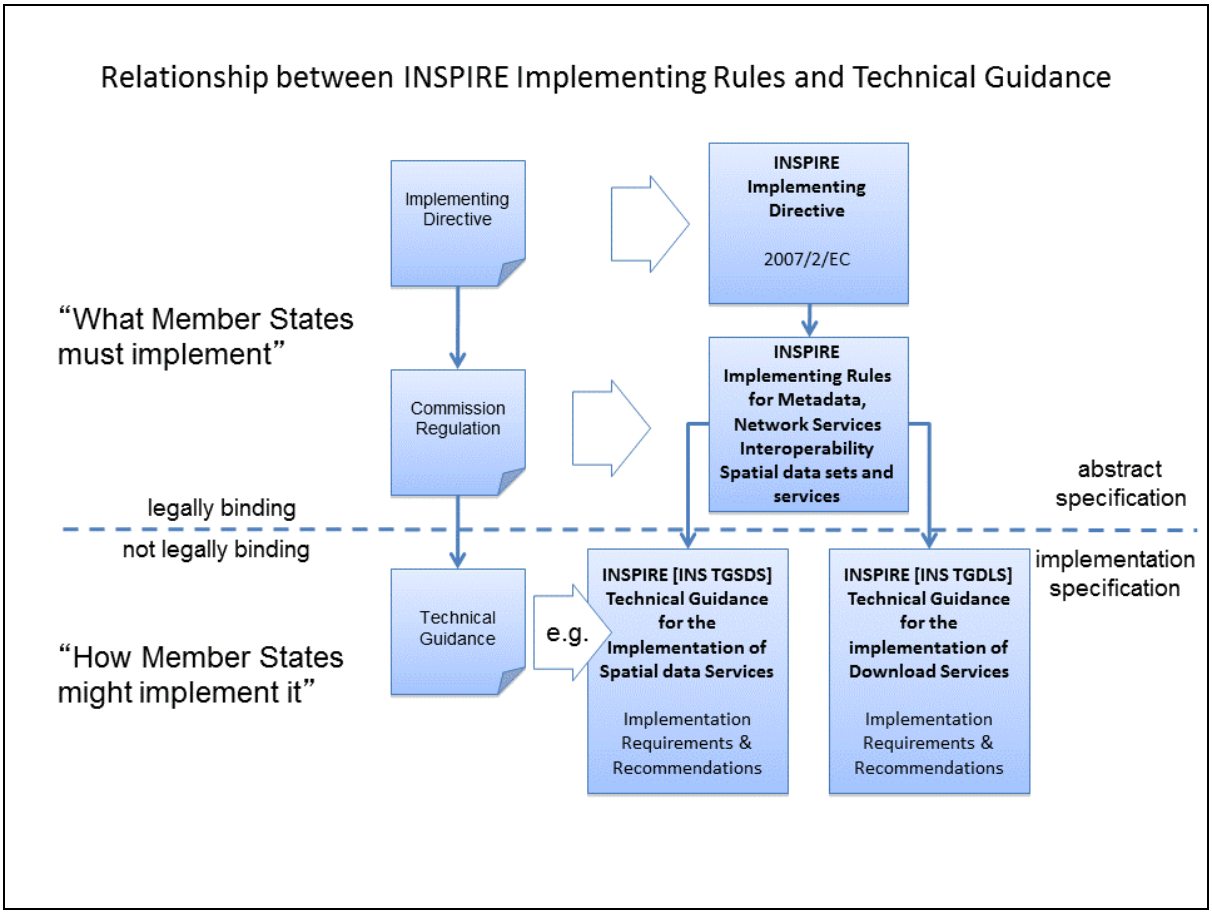

Figure 1: Relationship between the INSPIRE Implementing Rules and the associated Technical Guidance.

Disclaimer

This document has been developed collaboratively through the INSPIRE maintenance and implementation framework, involving experts of the European Commission services, the European Environment Agency, EU Member States, the Accession and EFTA Countries. The document should be regarded as presenting an informal consensus position on best practice agreed by all partners. However, the document does not necessarily represent the official, formal position of any of the partners. To the extent that the European Commission's services provided input to this technical document, such input does not necessarily reflect the views of the European Commission and its services. This document does not bind the Commission and its services, nor can the Commission and its services be held responsible for any use which may be made of the information contained herein.

The technical document is intended to facilitate the implementation of Directive 2007/2/EC and is not legally binding. Any authoritative reading of the law should only be derived from Directive 2007/2/EC itself and other applicable legal texts or principles such as the related Implementing Rules. Only the Court of Justice of the European Union is competent to authoritatively interpret Union legislation.

Revision History

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21 March 2016	1.0rc2	Sylvain Grellet	Feedback from update of D2.9 'Guidelines for the use of Observations & Measurements and Sensor Web Enablement-related standards in INSPIRE Annex II and III data specification development'
09 June 2016	1.0rc3	Sylvain Grellet	After Inspire maintenance group (MIWP-7a) feedbacks
10 October 2016	1.0rc4	Sylvain Grellet	After MIG-T feedbacks
18 November 2016	1.0rc4	Alexander Kotsev, Michael Lutz	Editorial changes to harmonise the document with other TG documents
13 December 2016	1.0	Michael Lutz	Final editorial changes for publication

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 25th April 2007. The INSPIRE Directive entered into force on the 15th 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 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 **Download Services** 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 document is to be used together with INSPIRE D2.9 document “Guidelines for the use of Observations & Measurements and Sensor Web Enablement-related standards in INSPIRE”.

2 References

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

2.1 Normative references

INSPIRE Directive, 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), **INSPIRE Directive**

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

INSPIRE Metadata Regulation, **INS MD,** 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. See also Corrigendum to INSPIRE Metadata Regulation.

INSPIRE spatial datasets and services Regulation, **INS ISDSS,** 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 datasets and services

IETF RFC 4287 The Atom Syndication Format, **ATOM**

OGC 07-122r2 OpenGIS Encoding Standard SensorML, Version 1.0.1, **OGC SensorML**

OGC 09-001 OpenGIS SWE Service Model Implementation Standard, **OGC SWE Service Model**

OGC 10-025 OpenGIS Implementation Standard, Observations and Measurements - XML Implementation, Version 2.0, **OGC O&M**

OGC 12-006 OGC Sensor Observation Service Interface Standard, Version 2.0, **OGC SOS**

ISO 19142:2010 Geographic information -- Web Feature Service, **ISO 19142**

ISO 19143:2010 Geographic information -- Filter encoding, **ISO 19143**

ISO 19156:2011 Geographic information -- Observations and Measurements, **ISO 19156**

2.2 Technical references

Technical Guidance for the implementation of INSPIRE Download Services, version 3.1, **INS TG Atom+WFS**

NOTE This TG document covers Technical Guidance for implementing download services using either the Atom syndication format or the ISO 19142 Web Feature Service and ISO 19143 Filter Encoding Specification

INSPIRE Technical Guidance for implementing download services using the OGC Web Coverage Service, **INS TG WCS**

INSPIRE Metadata Implementing Rules, **IR MDTG,** Guidelines based on EN ISO 19115 and EN ISO 19119 for 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

INSPIRE Specification on Coordinate Reference Systems – Guidelines, **INSPIRE CRS**

INSPIRE D2.9 Guidelines for the use of Observations & Measurements and Sensor Web Enablement-related standards in INSPIRE, **INS O&M**

INSPIRE Data Specification on Environmental Monitoring Facilities – Technical Guidelines V 3.0, **INS EF**

3 Terms and abbreviations

3.1 Terms

(1) **download services**
enabling copies of spatial datasets, or parts of such sets, to be downloaded and, where practicable, accessed directly [INSPIRE Directive]

(2) **INSPIRE registry**
the official registry containing definitions for terms and feature concepts in INSPIRE. http://inspire-registry.jrc.ec.europa.eu/

(3) **metadata**
information describing spatial datasets and spatial data services and making it possible to discover, inventory and use them [INSPIRE Directive]

(4) **network services**
network services should make it possible to discover, transform, view and download spatial data and to invoke spatial data and e-commerce services [INSPIRE Directive]

(5) **spatial data**
data with a direct or indirect reference to a specific location or geographic area [INSPIRE Directive].

Note: The use of the word — spatial — in INSPIRE is unfortunate as in the everyday language its meaning goes beyond the meaning of — geographic — which is considered by the Drafting Team as the intended scope – and includes subjects such as observations, medical images, molecules, or other planets to name a few. However, since the term is used as a synonym for geographic in the Directive, this document uses the term —spatial data as a synonym for the term —geographic data used by the ISO 19100 series of International Standards and which is defined as —data with implicit or explicit reference to a location relative to the Earth.

(6) **spatial dataset**
identifiable collection of spatial data [INSPIRE Directive]

(7) **dataset**
short term sometimes used instead of ‘spatial dataset’, same meaning as ‘spatial dataset’.

3.2 Abbreviations

CRS	Coordinate Reference System
FE	Filter Encoding, referring to ISO 19143
GET	HTTP Get Method
GML	Geography Markup Language
HTTP	Hypertext Transfer Protocol
INSPIRE	Infrastructure for Spatial Information in Europe
IR	Implementing Rule
ISO	International Organisation for Standardisation
JRC	Joint Research Centre
NS	Network Services
O&M	Observations and Measurements, referring to ISO 19156
OGC	Open Geospatial Consortium
OWS	OGC Web Services Common Specification
POST	HTTP Post Method
SensorML	Sensor Model Language
SOS	Sensor Observation Service, referring to OGC 12-006
WFS	Web Feature Service, referring to ISO 19142

3.3 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 Download Services within this technical guidance are highlighted and numbered as shown below:

TG Requirement # requirements are shown using this style

TG 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>
```

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

3.4 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, [**INS NS**] 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 show 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.

4 INSPIRE Download Services based on SOS

This section provides an overview of the SOS-based implementation of technical service interfaces for INSPIRE Download Services. It is based on the abstract model established in the INSPIRE Network Services Regulation [**INS NS**].

The Network Services Regulation describes the following four download operations [**INS NS**, Annex IV, Part A] that *must* be implemented by Download Services:

- Get Download Service Metadata
- Get Spatial Dataset
- Describe Spatial Dataset
- Link Download Service

The Network Services Regulation also states that *where practicable*, the following two operations [**INS NS**, Annex IV, Part B] *shall* be implemented by Download Services:

- Get Spatial Object
- Describe Spatial Object Type

Furthermore, *if* the *Get Spatial Object* and *Describe Spatial Object Type* operations are implemented then particular search capabilities [**INS NS**, Annex IV, Part C] shall also be implemented. These capabilities include the ability to search by:

- URI of Spatial Dataset
- Key attributes of spatial objects, including URI and date/time of update
- Bounding Box
- Spatial data theme
- Combinations of the above

In practice therefore, this means there are *two* types of Download Services that may be implemented; those that satisfy the minimum functional requirements from the Regulation [**INS NS**, Annex IV, Part A] and those that satisfy the full functional requirements [**INS NS**, Annex IV, Parts A, B & C]. As stated in the Regulation, the later should be implemented *where practicable*.

In the download services Technical Guidance documents and the remainder of this overview section these two types of Download Service are referred to as follows:

- "Pre-defined dataset download service(s)"*;*

  A pre-defined dataset download service provides for the simple download of pre-defined datasets (or pre-defined parts of a dataset) with no ability to query datasets or select user-defined subsets of datasets. A pre-defined dataset or a pre-defined part of a dataset could be (for example) a file stored in a dataset repository, which can be downloaded as a complete unity with no possibility to change content, whether encoding, the CRS of the coordinates, etc.

- "Direct access download service(s)";

  A direct access download service extends the functionality of a pre-defined dataset download service to include the ability to query and download subsets of datasets. The direct access download service allows more control over the download than the simple download of a pre-defined dataset or pre-defined part of a dataset. It can therefore be considered to be more 'advanced' than pre-defined dataset download. In this case, the spatial information is typically stored in a repository (e.g. a database) and only accessible through a middleware data management system (although the precise implementation may vary). The term direct access is used to mean the capability of a client application or client service to interact directly with the contents of the repository, e.g. by retrieving parts of the repository based upon a query. The query can be based upon spatial or temporal criteria, or by specific properties of the instances of the spatial object types contained in the repository.

In addition to the above definitions, a pre-defined dataset or a pre-defined part of a dataset is characterised by two conditions:

- *It has a metadata record and can be discovered using an INSPIRE conformant discovery service.*
- *The metadata contains a link (URL – uniform resource locator) whereby the dataset or part of dataset can be immediately downloaded by a simple HTTP-protocol GET-request. The URL can optionally link to a resource where rights management services can be invoked prior to the simple download by use of HTTP-protocol.*

Furthermore, note that the phrase 'part(s) of a dataset' refers only to *logical* parts of a dataset. It does *not* refer to *physical* parts of a dataset, for example where a large dataset has been split into multiple files for storage or access reasons. Of course there may be a correspondence between the logical and physical parts of a dataset.

The precise definition of what constitutes a particular pre-defined dataset or pre-defined part of datasets is a matter for individual data providers and will vary according to the context. However an example of usage could be where the pre-defined dataset is a dataset conforming to one of the INSPIRE themes covering the whole Member State, while a pre-defined part of the dataset could be a subset of this, covering for instance an administrative subdivision of the Member State.

NOTE: For readability purposes, the short phrase "pre-defined dataset" is often used in this document. Whenever this phrase is encountered it should be interpreted as meaning the longer phrase "pre-defined dataset or a pre-defined part of a dataset". Where reference is made to physical parts of a dataset this is made explicit.

Figure 2 shows a typical sequence of operations used when downloading data from a pre-defined dataset download service.

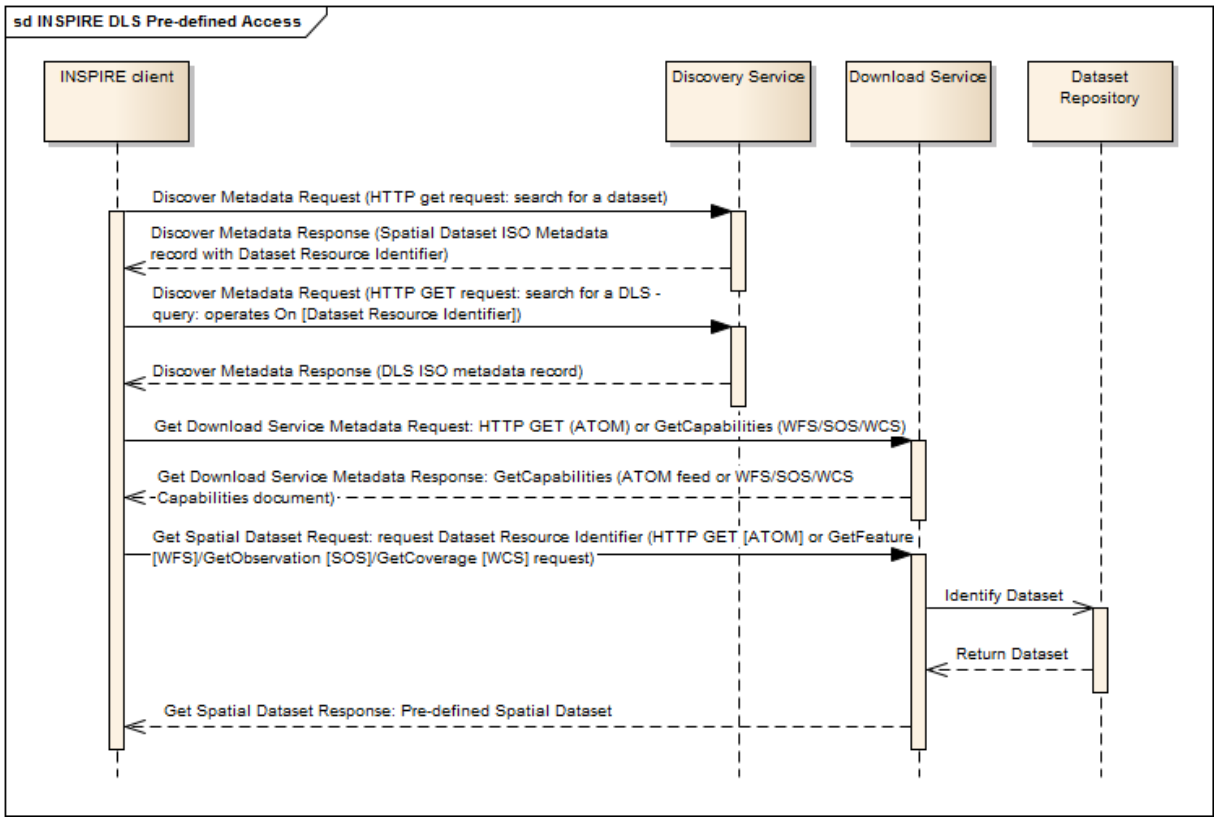

Figure 2: Simple sequence diagram showing download of datasets via a pre-defined download service

Figure 3 shows a typical sequence of operations used when downloading data from a direct access dataset download service.

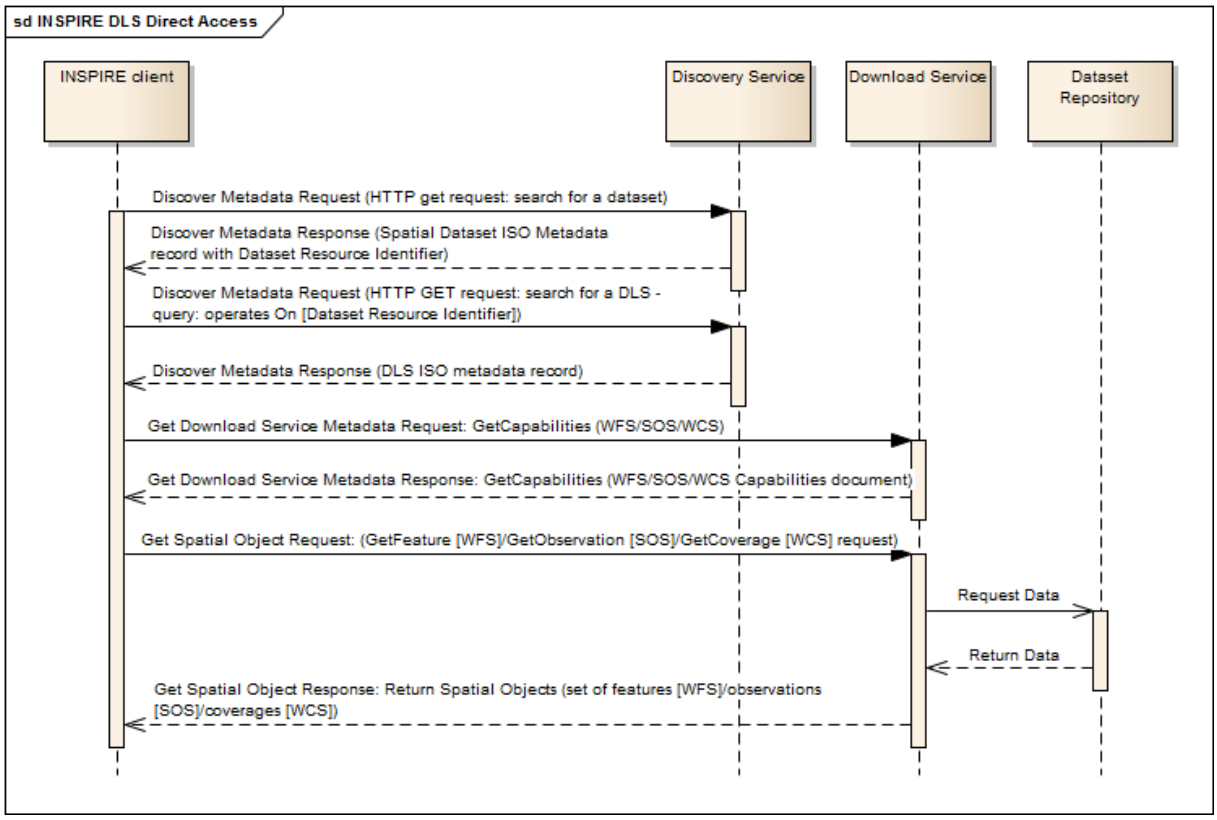

Figure 3: Simple sequence diagram showing a typical sequence of operations to download spatial data objects from a direct access dataset download service.

In both cases above, the end point for the *Get Download Service Metadata Request* (i.e. the GetCapabilities of the SOS) is taken from the Download Service ISO Metadata retrieved from the Discovery Service. More specifically the Resource Locator Metadata element shall include the link to the *Get Download Service Metadata Request.*

Anybody implementing Download Services should therefore choose to do one (or more, but at least one) of the following implementation options:

- Satisfy the minimum functional requirements of the Regulation [**INS NS**, Annex IV, Part A] by following the Technical Guidance in [**INS TG Atom+WFS**], [**INS TG SOS**] or [**INS TG WCS**].
- Satisfy the full functional requirements of the Regulation [**INS NS**, Annex IV, Parts A, B & C] by following, in addition, the Technical Guidance in [**INS TG Atom+WFS**], [**INS TG SOS**] or [**INS TG WCS**].

This document is explicitly dedicated to implementing the requirements of **[INS NS]** based on SOS.

Table 1 illustrates the relationship between the parts of the Regulation [**INS NS**, Annex IV] and the implementation choices presented in this document.

Technical Guidance document	Part A (mandatory)	Parts B & C (where practicable)
[**INS TG Atom+WFS**]	Chapter 5	Not possible with Atom
[**INS TG Atom+WFS**]	Chapter 6	Chapter 7
[**INS TG SOS**]	Chapter 5	Chapter 6
[**INS TG WCS**]	Chapter 5	Chapter 6

Table 1: Possible implementation choices for INSPIRE Download Services

In addition, the Network Services Regulation contains requirements for Quality of Service [**INS NS**, Annex I].

NOTE This specification does not currently include Technical Guidance on quality of service for SOS. The Technical Guidance on quality of service included in [**INS TG Atom+WFS**] and [**INS TG WCS**] can serve as an orientation for implementing QoS for SOS.

4.1 How this Technical Guidance maps to the Implementing Rules

The purpose of this Technical Guidance is to provide practical guidance for implementers. The tables are explicitly dedicated to SOS and show how the Guidance satisfies the legal requirements of the Network Services Regulation [**INS NS**]. The underlying legislation is rarely referred to in the rest of this document, so these tables should be referred back to if necessary.

4.1.1 Mapping the SOS-based Technical Guidance to the Implementing Rules

The following set of tables shows how the guidance for SOS implementations given in this specification satisfies the Network Services Regulation. Again, each operation is in a separate table.

Get Download Service Metadata		**M/O/C**
Description in INS NS (Annex IV, Part A) Provides all necessary information about the service, the available Spatial Datasets, and describes the service capabilities. • **Request parameters** o Natural language to be used for the content of the response • **Response parameters** o Download Service Metadata o Operations Metadata o Languages o Spatial Data Sets Metadata		M
Recommended SOS-based implementation		
Get Download Service Metadata Request	Metadata records for Download Services shall be available in a Discovery Service. The Resource Locator metadata element for the Download Service shall contain a link to the GetCapabilities of the SOS. The Get Download Service Metadata request is a GetCapabilities request to the SOS indicated in the metadata record.	
Get Download Service Metadata Response	The Get Download Service Metadata Response will be an extended SOS capabilities document, which includes the download service INSPIRE metadata, operations metadata, response and supported languages, spatial data sets metadata and their corresponding CRS.	
SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding	

Table 2: Get Download Service Metadata - SOS Implementation

Get Spatial Data Set	**M/O/C**

Description in INS NS (Annex IV, Part A)
The Get Spatial Data Set operation allows the retrieval of a Spatial Dataset.
• **Request parameters**
  ○ Language
  ○ Spatial Data Set Identifier
  ○ Coordinate Reference System
• **Response parameters**
  ○ Requested Spatial Data Set in the requested language and CRS
	M

Recommended SOS-based implementation	
Get Spatial Data Set Request	Pre-defined spatial datasets in different CRS and language combinations can be retrieved. Thereby, the concept of the SOS *observation offering* corresponds to the INSPIRE spatial dataset and can be uniquely identified and requested. This is described in Section 8. To get the spatial data set, a GetObservation request shall be made to an SOS with spatial filtering profile enabled. The offering parameter is used to identify the data set and CRS / language can be specified as request parameters. Then, observations are returned for a pre-canned period of time, as well as pre-defined observed properties, features and stations.
Get Spatial Data Set Response	The SOS shall return a set of observations and their locations, corresponding to the pre-defined dataset in the requested language and CRS.
SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding ISO 19143: Query

Table 3: Get Spatial Data Set - SOS Implementation

Describe Spatial Dataset	**M/O/C**

Description in INS NS (Annex IV, Part A)
This operation returns the description of all the types of Spatial Objects contained in the Spatial Dataset.
• **Request parameters**
  ○ Language
  ○ Spatial Data Set Identifier
• **Response parameters**
  ○ Description of the Spatial Objects in the requested Spatial Data Set and requested language.
	M

Recommended SOS-based implementation	
Describe Spatial Data Set Request	The spatial object types are described in the GetCapabilities response of the SOS. As all spatial data sets offered by the SOS server are described in the Capabilities document, the Spatial Data Set Identifier is not needed as request parameter. A GetCapabilities request is made to an SOS.

Describe Spatial Data Set Response	The SOS shall return a valid Capabilities document in the requested language, which describes the observation offerings available (see section 8 for the necessary SOS extension to support natural language selection). These descriptions shall be included as ObservationOffering descriptions in the Contents section of the SOS capabilities document.
SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding

Table 4: Describe Spatial Data Set - SOS Implementation

Link Download Service	**M/O/C**
Description in INS NS (Annex IV, Part A) Allows the declaration, by a Public Authority or a Third Party, of the availability of a Download Service for downloading Spatial Datasets or, where practicable, Spatial Objects, through the Member State's Download Service while maintaining the downloading capability at the Public Authority or the Third Party location.	M
Recommended SOS-based implementation	
To be implemented by uploading the Download Service INSPIRE metadata to the INSPIRE network as referred to in Article 11 using the PublishMetadata function of an INSPIRE compliant discovery service. The Resource Locator metadata element of the Download Service metadata record shall contain a link to the SOS GetCapabilities document.	
SOS/FE Conformance Classes	None

Table 5: Link Download Service - SOS Implementation

Get Spatial Object	**M/O/C**

Description in INS NS (Annex IV, Part B)
This operation allows the retrieval of Spatial Objects based upon a query.
• **Request parameters**
  ○ Language
  ○ Spatial Data Set Identifier
  ○ Coordinate Reference System
  ○ Query
• **Response parameters**
  ○ Spatial Objects Set
  ○ Spatial Objects Set Metadata
	O
	(Direct access download only)

Recommended SOS-based implementation	
Get Spatial Object Request	A GetObservation request with required query arguments is made to an SOS with spatial filtering profile enabled.
Get Spatial Object Response	The SOS returns a set of observations and their correspondent spatial locations that meet the requirements of the query expression.

SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding

Table 6: Get Spatial Object - SOS Implementation

Describe Spatial Object Type	**M/O/C**

Description in INS NS (Annex IV, Part B)
This operation returns the description of the specified Spatial Objects types [sic].
• **Request parameters**
  ○ Language
  ○ Spatial Object Type
• **Response parameters**
  ○ Description of the Spatial Object Type in conformity with regulation (EU) No.1089/2010
	O
	(Direct access download only)

Recommended SOS-based implementation	
Request	A GetCapabilities request is made to an SOS with spatial filtering profile enabled (see section 8 for the necessary SOS extension to support natural language selection).
Response	The SOS returns the GetCapabilities response with the observation types listed in the Contents section of the document.
SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding

Table 7: Describe Spatial Object Type - SOS Implementation

Search Criteria for the Get Spatial Object Operation	**M/O/C**
Description in INS NS (Annex IV, Part C) For the purposes of the Get Spatial Object Operation of the Download Service, the following search criteria shall be implemented: — Unique Resource Identifier* of Spatial Dataset , — all relevant key attributes and the relationship between Spatial Objects as set out in Regulation (EU) No 1089/2010; in particular the Unique Identifier of Spatial Object and the temporal dimension characteristics, including the date of update, — bounding box, expressed in any of the Coordinate Reference Systems listed in Regulation (EU) No 1089/2010, — Spatial Data Theme. To allow for discovering spatial objects through a combination of search criteria, logical and comparison operators shall be supported. * The phrase 'Unique Identifier of Spatial Object' should be interpreted in this Technical Guidance as being the 'External unique object identifier' as set out in section 2.1 of Annex I of (EU) No 1089/2010 [INS ISDSS].	O (Direct access download only)
Recommended SOS-based implementation	

Request	The request parameters can be mapped to the SOS specification as follows: — the spatial dataset can be queried through the offering parameter, — for the relevant key attributes, the filters for observed property, feature of interest and procedure as well as temporal filters can be used. — the bounding box can be covered through a spatial filter, — spatial data theme In addition, for accessing individual observations, the GetObservationById operation can be used.
Response	The SOS returns a set of observations and their correspondent spatial locations that meet the requirements of the query expression.
SOS/FE Conformance Classes	[OGC SOS]: SOS Core, Spatial Filtering Profile, XML Encoding, Core KVP Binding ISO 19143: Minimum Spatial Filter, Minimum Temporal Filter

Table 8: Search Capabilities - SOS Implementation

4.1.2 Mapping of Spatial Data Set Identifier parameter

The Spatial Data Set Identifier parameter is defined in the Network Service regulation [**INS NS**] as *"The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the Data Set"*

The following table demonstrates how the Spatial Data Set Identifier is mapped between the Atom, WFS and SOS based Technical Guidance and the corresponding ISO metadata of the spatial data set. The Spatial Data Set Identifier parameter maps to either the RS_Identifier or the MD_Identifier depending on what type of Spatial Data Set Identifier is used in the corresponding ISO metadata.

	INSPIRE Download Service	**RS_Identifier**	**MD_Identifier**
WFS	inspire_dls:SpatialDataSetIdentifier/inspire_common:Code	gmd:RS_Identifier/code	gmd:MD_Identifier/code
	inspire_dls:SpatialDataSetIdentifier/inspire_common:Namespace	gmd:RS_Identifier/codespace	
ATOM	spatial_dataset_identifier_code	gmd:RS_Identifier/code	gmd:MD_Identifier/code
	spatial_dataset_identifier_namespace	gmd:RS_Identifier/codespace	
SOS	inspire_dls:SpatialDataSetIdentifier/inspire_common:Code	gmd:RS_Identifier/code	gmd:MD_Identifier/code
	inspire_dls:SpatialDataSetIdentifier/inspire_common:Namespace	gmd:RS_Identifier/codespace	

Table 9: Mapping the Spatial Data Set Identifier parameter

4.2 Conformance Classes for Download Services Technical Guidance

In order to declare a level of conformance with this Technical Guidance it is necessary to meet the requirements of any conformance class to which conformance is declared.

The following conformance classes are defined in the download service Technical Guidance documents.

Conformance Class	Description	M/O/C	TG document and chapter
1: Pre-defined Atom	Implementation of pre-defined download service using Atom	C M if not conformant with conformance class 2, 4 or 6	[**INS TG Atom+WFS**, chapter 5]
2: Pre-defined WFS	Implementation of pre-defined download service using WFS	C M if not conformant with conformance class 1, 4 or 6	[**INS TG Atom+WFS**, chapter 6]
3: Direct WFS	Implementation of direct access download service using WFS	O	[**INS TG Atom+WFS**, chapter 7]
4: Pre-defined SOS	Implementation of pre-defined download service using SOS	C M if not conformant with conformance class 1, 2 or 6	[chapter 5 (of this specification)]
5: Direct SOS	Implementation of pre-defined download service using SOS	O	[chapter 6 (of this specification)]
6: Pre-defined WCS	Implementation of pre-defined download service using SOS	C M if not conformant with conformance class 1, 2 or 4	[**INS TG WCS**, chapter 5]
7: Direct WCS	Implementation of pre-defined download service using SOS	O	[**INS TG WCS**, chapter 6]
8: Quality of Service	Quality of Service criteria and requirements	M	[**INS TG Atom+WFS**, chapter 8; **INS TG WCS**, chapter 7]

Table 10: Conformance Classes for Download Service Technical Guidance

Conformance may be declared in the Download Service ISO 19139 metadata record. Since the metadata record requires conformance to a specification rather than a part of a specification, it is suggested that the form *technicalGuidance#levelN* is used, where *technicalGuidance* refers to this document and *N* refers to the conformance class (e.g. *technicalGuidance#level2*).

Also the conformance with several conformance classes can be specified. For example, for a “hybrid” implementation based on Atom for Part A and WFS for Parts B and C, which meets the quality of service requirements could declare conformance with *technicalGuidance#level1, technicalGuidance#level3 and technicalGuidance#level4.*

If a WFS or SOS service does not conform to Part A of [**INS NS,** Annex IV], it cannot on its own be considered compliant with the requirements of the Regulation. Only the combination of an Atom, WFS, or SOS service conformant with part A with a WFS or SOS conformant to Parts B and C can be considered compliant.

4.3 Language Requirements

The Network Services Regulation requires that multilingual aspects for network services are supported [**INS NS**]. As there is no standard way to deal with multilingualism within the current ISO or OGC specifications, the following basic principles shall be used for INSPIRE Network Services (including Download Services):

> *A network service [Download Service] metadata response shall contain a list of the natural languages supported by the service. This list shall contain one or more languages that are supported*.

A client may specify a specific language in a request. If the requested language is contained in the list of supported languages, the natural language fields of the service response shall be in the requested language. If the requested language is not supported by the service, then this parameter shall be ignored.

For each relevant Conformance Class in this document these statements are defined as requirements and additional implementation guidance is given.

4.4 Implementation Roadmap for Download Services

Note: This section is entirely informative and is here simply to assist with practical implementations. It has no legal basis and is not any way intended to supplement, modify or replace any legally binding statements made elsewhere.

The milestones (including dates) for implementation of all INSPIRE Services are outlined in the INSPIRE Implementation Roadmap which can be found at:

http://inspire.ec.europa.eu/index.cfm/pageid/44

In order to provide clear Technical Guidance for implementation it is useful to expand upon the meaning and practical implications of the roadmap milestones that relate to Download Services.

Note that the INSPIRE Implementation Roadmap does not make any distinction between pre-defined dataset download services and direct access download services as described in this document. The timescales and milestones for both are the same, the only discriminator being that direct access download services should be implemented where practicable.

In the initial stages of the INSPIRE Implementation Roadmap, datasets made available via Download Services are not required to be compliant with the thematic Data Specifications and may be provided via Download Services in existing formats 'as-is'. So for convenience we shall refer to these here as "*non-interoperable*" Download Services.

In later stages of the INSPIRE Implementation Roadmap datasets made available via Download Services *are* expected to be compliant with the thematic Data Specifications, i.e. the *data* delivered via these services must conform to the requirements of the thematic Data Specifications. So, again for convenience only, we shall refer to these here as "*interoperable*" Download Services.

Since the timescales for Annex I, II and III themes differ there is some overlap between the implementation timescales of non-interoperable and interoperable Download Services.

Sections 4.4.1 to 4.4.3 provide additional guidance to help with the interpretation of those milestones, which are relevant to the provision of Download Services.

4.4.1 Roadmap for "non-interoperable" Download Services

The milestones in Table 11 (below) can be interpreted to mean that datasets should be made available for download via Download Services but the datasets *do not* have to be formatted according to the INSPIRE Data Specifications*.

**This interpretation was clarified during the workshop on legal issues held on the 17th of June 2010 in Brussels with Q&A available at:*
http://inspire.ec.europa.eu/documents/INSPIRE_/INSPIRE_legal_issues.PDF *(page 18, final question and question part (c) page 28)*

For the latest dates of these milestones please refer to the INSPIRE Implementation Roadmap.

	Milestone	***Article****	***Technical Guidance***
MS1	**Member States shall provide the Download Services with initial operating capability**	16	For *Annex I and II* datasets, Download Services shall be provided, although these services need not fully comply with the Network Services implementing rules at this point. The *data* delivered by these services do not need to comply with the thematic Data Specifications.
MS2	**Download services operational**	16	For *Annex I and II* datasets, fully compliant (with IR NS) Download Services shall be provided. The *data*

			delivered by these services do not need to comply with the thematic Data Specifications.
MS3	**Metadata available for spatial datasets and services corresponding to Annex III**	6(b)	For Annex III datasets, fully compliant (with IR NS) Download Services shall be provided. The *data* delivered by these services do not need to comply with the thematic Data Specifications.

Table 11: Milestones for "non-interoperable" Download Services

*From the INSPIRE Directive

4.4.2 Roadmap for “interoperable” Download Services

The milestones in Table 12 (below) can be interpreted to mean that datasets should be made available for download via Download Services in a way that is *compliant* with the requirements of the Data Specifications as well as the Network Services requirements.

	Milestone	***Article****	***Technical Guidance***
MS4	**Implementation of Commission Regulation (EU) No 102/2011 of 4 February 2011 amending Regulation (EU) No 1089/2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial datasets and services for newly collected and extensively restructured Annex I spatial datasets available**	7§3, 9(a)	Newly collected or extensively restructured Annex I datasets shall be made available via Download Services in a way that is compliant with both Data Specifications and Network Services requirements.
MS5	***Newly collected and extensively restructured Annex II and III spatial datasets available***	7§3, 9(b)	Newly collected or extensively restructured Annex II and III datasets shall be made available via Download Services in a way that is compliant with both Data Specifications and Network Services requirements.
MS6	**Implementation of 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 datasets and services for other Annex I spatial datasets still in use at the date of adoption**	7§3, 9(a)	All Annex I datasets still in use shall be made available via Download Services in a way that is compliant with both Data Specifications and Network Services requirements.
MS7	**Other Annex II and III spatial datasets available in accordance with IRs for Annex II and III**	7§3, 9(b)	All Annex II and III datasets still in use shall be made available via Download Services in a way that is compliant with both Data Specifications and Network Services requirements.

Table 12: Milestones for "interoperable" Download Services

*From the INSPIRE Directive

4.4.3 Illustrative Roadmap for all Download Services

The roadmap described above in sections 4.4.1 and 4.4.2 is further illustrated in Figure 4:

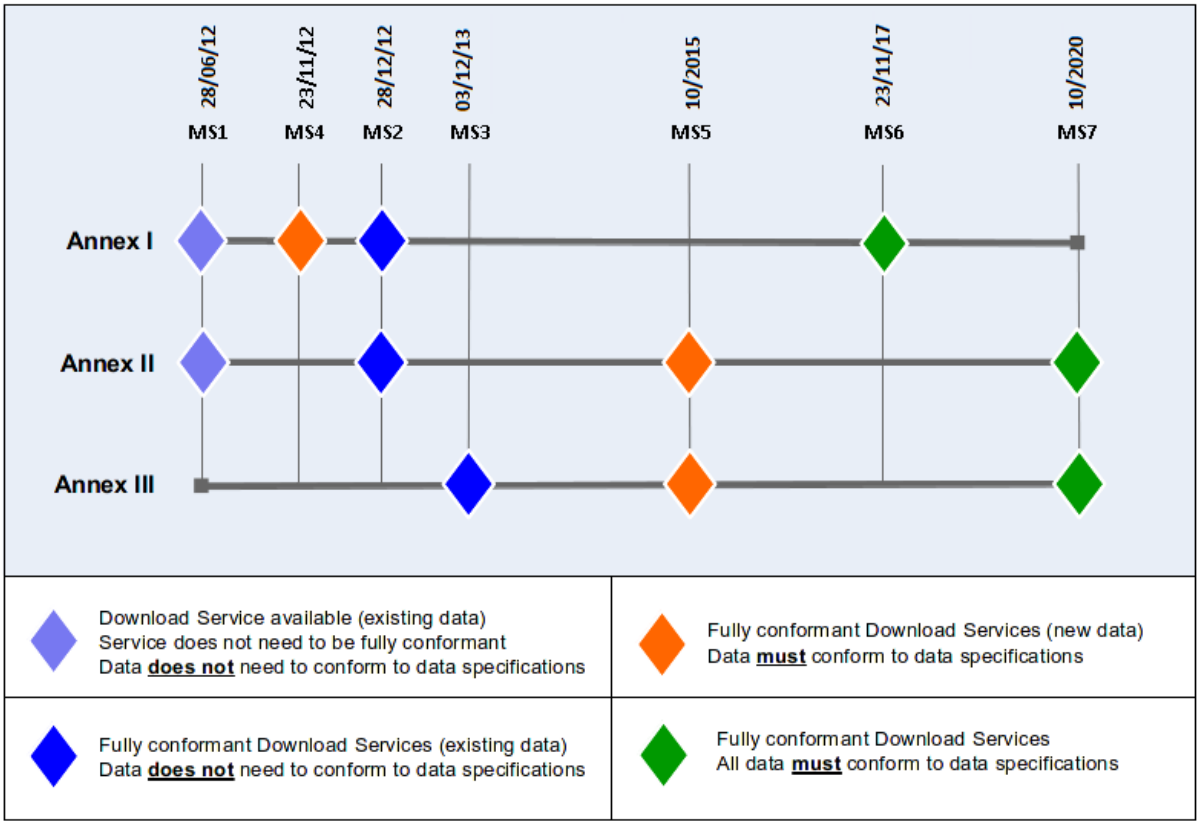

Figure 4: Illustration of Implementation Roadmap*

**Dates in this figure are accurate at the time of publication. For definitive dates refer to the roadmap published on the INSPIRE website: (http://inspire.ec.europa.eu/index.cfm/pageid/44)*

5 Sensor Observation Service and Filter Encoding implementation of Pre-defined Dataset Download Service

TG Conformance Class 4: Pre-defined SOS: Implement Pre-defined Dataset Download Service ("Part A") using Sensor Observation Service and ISO 19143 Filter Encoding.

This conformance class is inclusive of:

TG Requirement 4.1 to TG Requirement 4.6

TG Recommendation 4.1 to TG Recommendation 5.2

Direct Access download services (that fully satisfy Part A of the IR) may be implemented using the Sensor Observation Service **[OGC SOS].** To avoid repetition conformance class definitions of the Sensor Observation Service standard are referenced from this section. Where additional functionality is required, as it is the case with multi-lingual requirements, this is described below.

5.1 Conformance to 'SOS Core' Conformance Class

In order to implement a pre-defined dataset download service using a Sensor Observation Service, it is necessary to conform to the 'SOS Core' conformance class as described in the interface standard [**OGC SOS**].

TG Requirement 4.1	Implementations of an SOS pre-defined dataset download service SHALL conform to the [**OGC SOS**] Conformance Class 'SOS Core'

5.2 Conformance to 'Spatial Filtering Profile' Conformance Class

TG Requirement 4.2	Implementations of an SOS pre-defined dataset download service SHALL conform to the [**OGC SOS**] Conformance Class 'Spatial Filtering Profile' to ensure that each observation served through the download service provides a sampling geometry.

With the Spatial Filtering Profile enabled the SOS sampling geometry of the observation is encoded as a parameter of the observation. The spatial filtering profile ensures that the requirement of (Article 3(2) of the **[INSPIRE Directive]**), for reference to a specific location or geographical area is fulfilled.

Example 1: O&M observation with contained location according to the Spatial Filtering Profile

```
</xml version="1.0" encoding="UTF-8"?>
<om:OM_Observation>
  …
  <om:parameter>
    <om:NamedValue>
      <om:name
      Xlink:href="http://www.opengis.net/def/param-name/OGC-
OM/2.0/samplingGeometry"/>
      <om:value>
          <gml:Point gml:id="SamplingPoint">
          <gml:pos
srsName="http://www.opengis.net/def/crs/EPSG/0/4258">18.52 42.54</gml:pos>
        </gml:Point>
```

```
        </om:value>
      </om:NamedValue>
   </om:parameter>
   …
</om:OM_Observation>
```

5.3 Conformance to 'XML Encoding' and 'Core KVP Binding' Conformance Classes

The SOS server shall use a key-value-pair (KVP) binding for all operations listed in the OperationsMetadata section of the SOS GetCapabilities response. The implementations of those operations shall encode their responses according to the XML encoding conformance class defined in [**OGC SOS**]. The following requirement formally defines this behavior.

TG Requirement 4.3	Implementations of a SOS pre-defined dataset download service SHALL conform to the [**OGC SOS**] Conformance Classes 'Core KVP Binding' and 'XML Encoding'.

5.4 Observation Offerings as INSPIRE Datasets

Article 3(3) of the [**INSPIRE Directive**] defines *spatial data set* as "an identifiable collection of spatial data". The SOS 2.0 standard [**OGC SOS**] defines that an *ObservationOffering* (or short: 'offering') groups a collection of observations produced by one procedure (in accordance with **[OGC SOS]** a procedure is a method, algorithm, instrument, sensor, or system of these which may be used in making an observation). Hence, the offering concept might be treated as equivalent to a spatial data set in accordance with **[INSPIRE Directive]**. The observation offering element contained in the SOS GetCapabilities response lists the basic metadata for the associated observations of the offering.

A SOS offering is defined for one procedure, a specific period of time and a spatial bounding box. The dataset can be retrieved through a GetObservation request specifying the offering identifier (Spatial Data Set Identifier).

TG Requirement 4.4	According to [**OGC SWE Service Model**], the ObservationOffering identifier SHALL be a URI.

TG Requirement 4.5	Each observation related spatial dataset SHALL be made available through separate SOS ObservationOfferings(s) and be retrievable through a GetObservation query.

For example the following request is issued to retrieve a ground water level dataset.

Example 2: Request of a dataset of a ground water level monitoring network (informative only)

```
http://www.inspiresos.com/
service/sosRawPiezo?request=GetObservation&service=SOS&version=2.0.0&offeri
ng=http://www.inspiresos.com/data/Piezometre/06988C0281/F.2
```

TG Recommendation 4.1	Datasets including observations for a predefined period of time and for logically consistent geographical entities observed by the same procedure MAY be grouped to form INSPIRE datasets to be provided through a download service. These data sets correspond to the ObservationOfferings of a SOS server.

The way how the ObservationOfferings are structured depends on the specific domain and the preferences of the data provider. Typical ways to structure ObservationOfferings are:

- All observations for a certain environmental monitoring facility from **INS EF** (e.g. a station)
- All observations for a certain region
- All observations for a certain time period
- All observations for a certain thematic field (e.g. a set of meteorological observations)

It is important to note, that often these grouping criteria are combined (e.g. all meteorological observations for a country for a certain year).

The only requirement that needs to be followed is that one ObservationOffering may only contain one procedure. If data from multiple procedures shall be included in one single offering, the individual procedures shall be aggregated (e.g. into a higher level procedure) or abstracted (e.g. as a sensor type).

In some specific cases attention should be drawn to the need to choose a modeling approach that avoids very large amounts of offerings. If the number of offerings is too high, the length of capabilities files may increase to a size which is difficult to be handled by SOS clients. However, this has to be balanced with the underlying observation amount for a given offering identifier as direct download of all observations in a dataset by a GetObservation with the offering parameter may cause problems with performance criteria of service.

TG Recommendation 4.2	To reduce the number of offerings, data providers may A°/ define procedure as sensor types or use a hierarchical approach that groups individual procedures into higher level ones, or B°/ implement an hierarchical observation offering approach as recommended by **[INS O&M]** (/rec/inspire-SOS/HierarchicalOffering)

Note: In section 4.1.1, the Get Spatial Data Set operation is mapped to GetObservation + offering. Other core observation features will be retrieved by the appropriate service pattern; each of them is described in their respective part:

- featureOfInterest: this document chapter 5.6 “Retrieval of Related Geospatial Objects”
- OM_Process: this document chapter 5.7 “DescribeSensor Operation”
- ObservationSet: **[INS O&M]** “/rec/inspire-SOS/ObservationSetImplementation”

5.5 Extending SOS GetCapabilities to contain INSPIRE metadata

5.5.1 Service Metadata

In order to make the Download Service INSPIRE metadata elements available via a SOS it is necessary to extend the SOS GetCapabilities response and publish the INSPIRE metadata according to an extension schema within an *inspire_dls:ExtendedCapabilities* element. The additional section should be added through extension. The INSPIRE extension schema and example instance documents are available at: http://inspire.ec.europa.eu/schemas/inspire_dls/

The schema document is available at http://inspire.ec.europa.eu/schemas/inspire_dls/1.0/inspire_dls.xsd

There are two possible solutions which may be used and it is up to the implementer Member State to decide which is more appropriate.

- The first option is to use the extended SOS capabilities to publish a link to a Download Service metadata record (e.g. in a discovery service). This should be done using a <inspire_common2:MetadataURL> in the extended capabilities section.
- The second option is to publish all the metadata elements directly in the SOS capabilities in accordance with the following table.

[2] inspire_common namespace refers to http://inspire.ec.europa.eu/schemas/common/1.0/common.xsd

INSPIRE Metadata elements (Mandatory - Conditional)	**OGC SOS elements of <SOS_Capabilities>**
Resource Title (M)	ows:ServiceIdentification/ows:Title
Resource Abstract (M)	ows:ServiceIdentification/ows:Abstract
Resource Type (M)	inspire_common:ResourceType (ExtendedCapabilities)
Resource Locator (C)	inspire_common:ResourceLocator (ExtendedCapabilities)
Coupled Resource (C)	inspire_common:MetadataURL
Spatial Data Service Type (M)	inspire_common:SpatialDataServiceType (ExtendedCapabilities)
Keyword (M)	ows:ServiceIdentification/ows:Keywords/ows:Keyword inspire_common:Keyword
Geographic Bounding Box (M)	sos:ObservationOffering/sos:observedArea (Offering property)
Temporal Reference (M)	sos:ObservationOffering/sos:phenomenonTime (Offering property)
Spatial Resolution (C)	ows:ServiceIdentification/ows:Abstract
Conformity* (M) *refers to conformity of the service to the Implementing Rules	inspire_common:Conformity (ExtendedCapabilities)
Conditions for Access and Use (M)	ows:ServiceIdentification/ows:Fees
Limitations on Public Access (M)	ows:ServiceIdentification/ows:AccessConstraints
Responsible Organisation (M)	ows:ServiceProvider/ows:ProviderName and: ows:ServiceProvider/ows:ServiceContact/ows:ContactInfo
Metadata Point of Contact (M)	inspire_common:MetadataPointOfContact (ExtendedCapabilities)
Metadata Date (M)	inspire_common:MetadataDate (ExtendedCapabilities)
Metadata Language (M)	inspire_common:SupportedLanguages (ExtendedCapabilities)

Table 13: Mapping INSPIRE Metadata elements to OGC SOS specifications

TG Requirement 4.6	INSPIRE Metadata for the Download Service SHALL EITHER be linked to via an `<inspire_common:MetadataURL>` in an extended capabilities section, OR the extended capabilities section shall contain all the INSPIRE Metadata for the Download Service in accordance with the `inspire_dls:ExtendedCapabilities` schema.

The following example shows an extended Contents section of a SOS GetCapabilities.

Example 3: Extended capabilities

```
<!—example extended capabilities -->
<ows:ExtendedCapabilities>
…
<inspire_dls:ExtendedCapabilities>
        <inspire_common:ResourceLocator>

<inspire_common:URL>http://someHOST.example/sos?REQUEST=GetCapabilities&SER
VICE=SOS&LANGUAGE=eng</inspire_common:URL>
        </inspire_common:ResourceLocator>
        <inspire_common:ResourceType>service</inspire_common:ResourceType>
        <inspire_common:TemporalReference/>
        <inspire_common:Conformity>
            <inspire_common:Specification>
                <inspire_common:Title>Please enter a
                    title</inspire_common:Title>
                <inspire_common:DateOfPublication>0000-01-
01</inspire common:DateOfPublication>
            </inspire_common:Specification>
            <inspire_common:Degree>notEvaluated</inspire_common:Degree>
        </inspire_common:Conformity>
        <inspire_common:MetadataPointOfContact>
            <inspire_common:OrganisationName/>
<inspire_common:EmailAddress>someone@somewhere.org</inspire_common:EmailAdd
ress>
        </inspire_common:MetadataPointOfContact>
        <inspire_common:MetadataDate>0000-01-
01</inspire_common:MetadataDate>
<inspire_common:SpatialDataServiceType>download</inspire_common:SpatialData
ServiceType>
        <inspire_common:MandatoryKeyword>
<inspire_common:KeywordValue> infoFeatureAccessService
</inspire_common:KeywordValue>
        </inspire_common:MandatoryKeyword>
        <inspire_common:SupportedLanguages>
            <inspire_common:DefaultLanguage>
                <inspire_common:Language>bul</inspire_common:Language>
            </inspire_common:DefaultLanguage>
            <inspire_common:SupportedLanguage>
                <inspire_common:Language>eng</inspire_common:Language>
            </inspire_common:SupportedLanguage>
        </inspire_common:SupportedLanguages>
```

```
        <inspire_common:ResponseLanguage>
            <inspire common:Language>eng</inspire common:Language>
        </inspire_common:ResponseLanguage>
        <inspire_dls:SpatialDataSetIdentifier>
            <inspire_common:Code>mycode</inspire_common:Code>
<inspire_common:Namespace>http://myuri.org</inspire_common:Namespace>
        </inspire_dls:SpatialDataSetIdentifier>
        <inspire_dls:SpatialDataSetIdentifier>
            <inspire_common:Code>mycode2</inspire_common:Code>
<inspire_common:Namespace>http://myuri.org</inspire_common:Namespace>
        </inspire_dls:SpatialDataSetIdentifier>
    </inspire_dls:ExtendedCapabilities>
…
</ows:ExtendedCapabilities>
```

5.5.2 Dataset Metadata

Besides the service metadata, it is necessary to describe for each data set (i.e. SOS offering) in which combination(s) of natural languages, namespaces and CRSs it is being made available. For this purpose the ObservationOffering concept of the SOS standard offers an appropriate mechanism. Within the Contents section of each SOS Capabilities document, the metadata for each offering is provided within a corresponding ObservationOffering element. To describe in which languages, namespaces and CRSs a data set is available, the metadata fields shown in the table below need to be added as swes:extensions to each ObservationOffering. Furthermore, if the features associated to the observation of an ObservationOffering are provided through a WFS server, a reference to this WFS server needs to be added as Coupled Resource, as well.

Metadata Language (M)	`inspire_common:SupportedLanguages`
Metadata CRS (M)	`inspire_dls:SupportedSupportedCRS`
Metadata Namespace (M)	`inspire_dls:SpatialDataSetIdentifier/inspire_common:Namespace`
Coupled Resource (C)	`inspire_common:MetadataURL`

Table 14: INSPIRE Metadata elements for Observation Offerings

Note: *the cardinality of inspire_common:MetadataURL is 0..1. It is then not currently feasible to point to more than one coupled resource and then, for example, define a Coupled Resource for each observation type/offering or have several Coupled Resource for a given observation type/offering.*

TG Requirement 4.7	For each data set, the information about supported languages, namespaces and CRSs SHALL be provided in the corresponding ObservationOffering section in the SOS Capabilities document.

5.6 Retrieval of Related Geospatial Objects

Experiences with operational SOS deployments have shown that the GetFeatureOfInterest operation provides valuable functionality for clients, namely to retrieve feature instances, which are the target of the observations hosted by the SOS. Although the functionality of the GetFeatureOfInterest operation is not required by **[INS NS]**, and the featureOfInterest information can be provided along with the observation, this operation is of high relevance for the practical application of SOS servers.

TG Recommendation 4.3	Implementations of SOS servers to be used as INSPIRE Download Service SHOULD support the GetFeatureOfInterest operation as defined by the [**OGC SOS**] to provide access to the geometries to which the offered measurements are associated to.

TG Recommendation 4.9 and TG Recommendation 4.10 address the handling of multilingual support in the GetFeatureOfInterest operation.

TG Recommendation 4.4	SOS Servers SHOULD support GetFeatureOfInterest operation with a response that conforms to the approach recommended by **[INS O&M]** (/rec/inspire-SOS/FoI).

In addition, it is also possible to let the SOS only handle the pure observation data while the features to which the measurements are associated are handled by a separate WFS server (please note: if spatial filtering of the observations shall be supported, the SOS server still needs access to the locations of the observations). As this functionality requires, direct access functionality Atom is not considered for this purpose.

TG Recommendation 4.5	Implementations of SOS servers to be used as INSPIRE Download Service may refer to a WFS server for providing the features to which the offered measurements are associated to. In this case the feature elements returned in a SOS response SHOULD consist of xlink:href to URIs through which the features can be downloaded directly.

The following example shows an implementation of the xlink:href approach

Example 4: xlink:href approach example

```
…
<om:featureOfInterest xlink:href="http://ressource.brgm-
rec.fr/data/EntiteHydroGeol/113AA01"
xlink:title="Calcaire Ludien de l'Eocène sup. du Bassin Parisien"/>
…

When dereferenced the xlink:href will provide the gml flow describing the
hydrogeological unit according to Inspire Geology theme (Hydrogeology
application schema).
The link between the URI and the corresponding WFS GetFeatureById query is
done in the backend and, thus, transparent to the client system
```

Which of these options is used (or if even both are supported) by a server operator depends on the individual preferences. Thus, no recommendation is given which of these two alternatives should be chosen.

5.7 DescribeSensor Operation

Compliance with the SOS 2.0 Core conformance class is required by TG Requirement 4.1. The SOS 2.0 Core conformance class also mandates the implementation of the DescribeSensor operation. To fulfil this requirement, the DescribeSensor operation needs to be implemented by SOS servers.

The response type for sensor and measurement process descriptions recommended by the SOS 2.0 standard is SensorML Version 1.0.1. In addition, **[INS O&M]** defines a '*Process*' featureType as a further possible process description approach.

TG Recommendation 4.6	SOS Servers SHOULD support DescribeSensor operation with a response that conforms the approach recommended by **[INS O&M]** (/rec/inspire-om-core/procedure/noSensorInstance and /rec/inspire-om-core/procedure/process)

Further information on multilingual support of the DescribeSensor operation is provided within TG Recommendation 4.9.and TG Recommendation 4.10.

5.8 CRS Support

[INS NS] requires that the operations Get Spatial Data Set and Get Spatial Object are capable of returning data in the Coordinate Reference System (CRS) requested by the client. To fulfil these requirements, a CRS parameter needs to be added to the GetObservation operation (how the supported CRS can be obtained is defined in section 5.5):

TG Requirement 4.8	A client may specify a specific CRS in a GetObservation request. If the requested CRS is contained in the list of supported CRS, the coordinates returned in the service response SHALL be in the requested CRS. If the requested CRS is not supported by the service, then a corresponding exception SHALL be returned.

Example 5: GetObservation request including a CRS parameter

```
http://inspire.network.service.example/service?service=SOS&version=2.0.0&request=GetFeatureOfInterest&crs=EPSG::4258
```

If the CRS parameter is not present, the SOS server needs to return the data in a default way:

TG Recommendation 4.7	If the CRS parameter is absent in the request, ETRS89 SHOULD be used as a default CRS in areas within its geographical scope or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89 **[INSPIRE CRS]**.

Although the GetFeatureOfInterest operation is not mandatory, it is recommended. Thus, the CRS parameter is relevant is also for the GetFeatureOfInterest operation.

TG Recommendation 4.8	If a SOS server implements the optional GetFeatureOfInterest operation, the CRS handling SHOULD be implemented as it has been specified for the GetObservation operation (see TG Requirement 4.8).

5.9 Language Requirements for SOS Implementation of Pre-defined Download.

TG Requirement 4.9	A network service [Download Service] metadata response SHALL contain a list of the natural languages supported by the service. This list shall contain one or more languages that are supported.

TG Requirement 4.10	A client may specify a specific language in a request. If the requested language is contained in the list of supported languages, the natural language fields of the service response SHALL be in the requested language. If the requested language is not supported by the service, then this parameter SHALL be ignored.

To meet these requirements using the SOS 2.0 standard it is necessary to extend the SOS as follows:

5.9.1 GetCapabilities-Operation (language requirements)

GetCapabilities-Request:

The HTTP/GET binding of the GetCapabilities-Operation is extended by an additional parameter that indicates the client's preferred language.

TG Requirement 4.11	The name of the parameter to indicate the preferred language SHALL be "LANGUAGE". The parameter values are based on ISO 639-2/B alpha 3 codes as used in [**INS MDTG**].

Parameter Name	Parameter Value	Mandatory for a Client Request?	Mandatory support by the Service?
LANGUAGE	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 24 official EU languages and the languages of the EFTA Countries is: Bulgarian – **bul** Italian – **ita** Czech – **cze** Latvian – **lav** Danish – **dan** Liechtenstein– **ger** Dutch – **dut** Lithuanian – **lit** English – **eng** Maltese – **mlt** Polish – **pol** Norwegian – **nor** Estonian – **est** Portuguese – **por** Finnish – **fin** Romanian – **rum** French – **fre** Romansh - **roh** German – **ger** Slovak – **slo** Greek – **gre** Slovenian – **slv** Hungarian – **hun** Spanish – **spa** Irish – **gle** Swedish – **swe** Croatian - **hrv** Icelandic – **ice** The complete list of codes is defined at http://www.loc.gov/standards/iso639-2/ Regional languages are also included in this list.	No, it is optional.	Yes, it is mandatory to be supported 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 client's request or it requested an unsupported language the service shall respond in the service default language.

Table 15: Language parameter

Schema:

[OCG-GetCapabilities-Request]&LANGUAGE=<ISO 639-2/B alpha 3 code>

Example:

http://inspire.network.service.example/service?REQUEST=GetCapabilities&SERVICE=[...]&VERSION=[...]&LANGUAGE=eng

GetCapabilities-Response:

If a client request specifies a supported language several fields of the GetCapabilties-Response are affected:

TG Requirement 4.12	If a client request specifies an unsupported language, or the parameter is absent in the request, the following fields SHALL be provided in the service default language: '*Description* ', '*Title*', '*Abstract*', '*Offering names*'

This behaviour ensures backwards compatibility so that any existing clients may interact with the service using the default OGC standard.

Extended Capabilities

To advertise the supported languages the service shall respond to GetCapabilites requests with Extended Capabilities as follows:

Example 6: Extended Capabilities structure

```
...
  <ows:OperationsMetadata>
  ...
    <ows:ExtendedCapabilities>
      ...
      <inspire_dls:ExtendedCapabilities>
        <inspire_common:MetadataUrl>
          <inspire_common:URL>http://www.csw.de</inspire_common:URL>
        </inspire_common:MetadataUrl>
        <inspire_common:SupportedLanguages>
          <inspire_common:DefaultLanguage>
            <inspire_common:Language>eng</inspire_common:Language>
          </inspire_common:DefaultLanguage>
        </inspire_common:SupportedLanguages>
        <inspire_common:ResponseLanguage>
          <inspire_common:Language>eng</inspire_common:Language>
        </inspire_common:ResponseLanguage>
      </inspire_dls:ExtendedCapabilities>
      ...
    </ows:ExtendedCapabilities>
  ...
  </ows:OperationsMetadata>
...
```

TG Requirement 4.13	The Extended Capabilities shall indicate the response language used for the GetCapabilities-Response: Depending on the requested language the value of the `<inspire_common:ResponseLanguage>` corresponds to the current used language. If a supported language was requested, `<inspire_common:ResponseLanguage>` SHALL correspond to that requested language. If an unsupported language was requested or if no specific language was requested `<inspire_common:ResponseLanguage>` SHALL correspond to the service default language `<inspire_common:DefaultLanguage>`

TG Requirement 4.14	The Extended Capabilities SHALL contain the **list of supported languages** indicated in `<inspire_common:SupportedLanguages>`. This **list of supported languages** shall consist of 1. exactly one element `<inspire_common:DefaultLanguage>` indicating the service default language, and 2. zero or more elements `<inspire_common:SupportedLanguage>` to indicate all additional supported languages. Regardless of the response language, the **list of supported languages** is invariant for each GetCapabilities-Response.

TG Requirement 4.15	The Extended Capabilities SHALL use the XML Schema as defined in the INSPIRE online schema repository ((http://inspire.ec.europa.eu/schemas/inspire_dls/1.0/inspire_dls.xsd)

Examples:

A service supports French and English and the service default language is French:

Example 7: Response to [OGC-GetCapabilities-Request]&LANGUAGE=eng

```
<inspire_dls:ExtendedCapabilities>
  <inspire_common:SupportedLanguages>
    <inspire_common:DefaultLanguage>
      <inspire_common:Language>fre</inspire_common:Language>
    </inspire_common:DefaultLanguage>
    <inspire_common:SupportedLanguage>
      <inspire_common:Language>eng</inspire_common:Language>
    </inspire_common:SupportedLanguage>
  </inspire_common:SupportedLanguages>
  <inspire_common:ResponseLanguage>
      <inspire_common:Language>eng</inspire_common:Language>
  </inspire common:ResponseLanguage
…
</inspire_dls:ExtendedCapabilities>
```

Example 8: Response to [OGC-GetCapabilities-Request] or [OGC-GetCapabilities-Request]&LANGUAGE=fre

```
<inspire_dls:ExtendedCapabilities>
…
  <inspire_common:SupportedLanguages>
    <inspire_common:DefaultLanguage>
      <inspire_common:Language>fre</inspire_common:Language>
    </inspire_common:DefaultLanguage>
    <inspire_common:SupportedLanguage>
      <inspire_common:Language>eng</inspire_common:Language>
```

```
      </inspire_common:SupportedLanguage>
   </inspire common:SupportedLanguages>
   <inspire_common:ResponseLanguage>
      <inspire_common:Language>fre</inspire_common:Language>
   </inspire_common:ResponseLanguage>
…
</inspire_dls:ExtendedCapabilities>
```

A service supports only German:

Example 9: Response to any GetCapabilities-Request (only German supported)

```
<inspire_dls:ExtendedCapabilities>
…
   <inspire_common:SupportedLanguages>
      <inspire_common:DefaultLanguage>
         <inspire_common:Language>ger</inspire_common:Language>
      </inspire_common:DefaultLanguage>
   </inspire_common:SupportedLanguages>
   <inspire_common:ResponseLanguage>
      <inspire_common:Language>ger</inspire_common:Language>
   </inspire_common:ResponseLanguage>
…
</inspire_dls:ExtendedCapabilities>
```

5.9.2 Common concept for other operations (optional)

Although further multilingual support is not required for INSPIRE Network Services, it may be desired by a service provider to implement further multilingual support such as:

- multilingual error messages
- multilingual support for additional Operations including HTTP/POST- and HTTP/GET-Binding

For that reason a further implementation concept for multilingual aspects is recommended as follows: For all SOS operations covered by this Technical Guidance the LANGUAGE KVP parameter is included as well. TG Requirement 4.9 gives an overview, how the LANGUAGE parameter should be taken into account in the different types of SOS response.

TG Recommendation 4.9	For the following SOS operations it is recommended to support the LANGUAGE KVP parameter: GetObservation, GetObservationById, GetFeatureOfInterest and DescribeSensor. If the LANGUAGE parameter is not provided in a request, the service SHOULD respond in its default language. Depending on the fields available in a response to these operation requests, the following fields are relevant for multilingual support: '*Descriptions'*, '*Titles'*, '*Abstracts'*, '*Observed Property names'*, '*Procedure names'*, '*Feature of Interest names'*, '*Textual quality descriptions'* All of the listed fields may apply to all four mentioned SOS operations.

5.9.3 Language support in OWS

With the on-going development of OWS Common it is expected that future versions of OGC Standards will include language support. For specific technical reasons, the concepts used for OWS common are not suitable to extend the current standards. However, with the availability of future versions of the OGC base standards the recommended approach to support multilingualism may need to be revisited.

IETF RFC 4646 is supported by OGC standards relying upon OWS 1.1.0.

TG Recommendation 4.10	The support of IETF RFC 4646 is recommended wherever the support of ISO/639 B alpha3 for languages infringes the conformity with the standard used for implementing the [**INS NS**].

ISO639/B alpha 3	IETF RFC 5646 short	IETF RFC 5646 long
bul	bg	bg-BG
cze	cs	cs-CZ
dan	da	da-DK
dut	nl	nl-NL
eng	en	en-GB
est	et	et-EE
fin	fi	fi-FI
fre	fr	fr-CH, fr-FR
ger	de	de-AT, de-CH, de-DE, de-LI
gre	el	el-GR
hrv	hr	hr-HR
hun	hu	hu-HU
gle	ga	ga-IE
ice	is	Is-IS
ita	it	it-CH, it-IT
lav	lv	lv-LV
lit	lt	lt-LT
mlt	mt	mt-MT
nor	no	no-NO
pol	pl	pl-PL
por	pt	pt-PT
roh	rm	rm-CH
rum	ro	ro-RO
slo	sk	sk-SK
slv	sl	sl-SI
spa	es	es-ES
swe	sv	sv-SE

Table 16: Mapping between ISO 639/B alpha 3 and the two forms of IETF RFC 4646 supported by OWS 1.1.0

6 Sensor Observation Service and Filter Encoding implementation of Direct Access Download Service

TG Conformance Class 5: Direct SOS: Implement Direct Access Download Service ("Parts A, B & C") using Sensor Observation Service

This conformance class is inclusive of:

TG Requirement 5.1 to TG Requirement 5.2

TG Recommendation 5.1 to TG Recommendation 5.2

Direct Access download services (that fully satisfy Parts A, B and C of the IR) should be implemented where practicable. This may be done using the Sensor Observation Service interface standard [**OGC SOS**] and ISO 19143 Filter Encoding [**ISO 19143**].

6.1 Necessary elements from SOS-based Pre-defined dataset download service

Direct Access Download Services provide additional functionality on top of the pre-defined Download Services. It is therefore a requirement that the guidance for pre-defined dataset access Download Services has been followed. Because both Pre-defined dataset and Direct Access Download services are based on **[OGC SOS]** there is an overlap of requirements for both types of solutions ensuring the ability to exist independent of each other.

TG Requirement 5.1	Implementations SHALL conform to the **[OGC SOS]** Conformance Class 'SOS Core' and meet TG Requirement 4.2, TG Requirement 4.3, and TG Requirement 4.6 to TG Requirement 4.15.

6.2 Support of Query Parameters

[OGC SOS] interface includes functionality which is equivalent to the filter types required for providing the Direct Access Download Service functionality. If a SOS server covers the Pre-defined SOS Conformance Class, it already fulfils the following required filters:

- Minimum Spatial Filter (bounding box) is covered by the GetObservation operation in conjunction with the spatial filtering profile
- Filtering for the relevant key attributes
  - Observed property
  - Feature of interest
  - Procedure
- Temporal filters are covered by default through the SOS interface (Minimum Temporal Filter including "during a time period" and "equals to a time instant").

In [**INS NS**], the spatial data theme is required as a query parameter. However, when a user connects to a SOS, this user already queries it from one specific spatial object type, which is defined in one spatial data theme. It can be then considered that this filter is already 'used' in the SOS discovery mechanism applied by the client.

Thus, in case of the SOS this query parameter is not useful.

No additional requirements are necessary.

6.3 Querying Individual Observations

For querying individual observation by its identifier, the GetObservationById operation of the SOS can be used. This operation takes the identifier of an observation as parameter and returns the appropriate observation.

Note: according to **[OGC SOS]** *(B.2 Identifying an Observation Offering)*: **"***Whenever an observation is requested by its identifier (e.g., via GetObservationById operation), the SOS implementation has to search in the gml:identifier field of all available observations to respond to that request*". The term 'identifier' is used in that sense and not in the sense of INSPIRE Identifier type.

TG Requirement 5.2	A Direct Access Download Service SHALL implement the GetObservationByID operation.

TG Recommendation 4.9 and TG Recommendation 4.10 address the handling of multilingual support in the GetObservationById operation.

6.4 SOS metadata for "hybrid implementations"

In case of a "hybrid implementation" based on Atom and SOS for Parts B and C, in addition to the Atom service, it is possible to also document the SOS service through metadata in a discovery service. In this case, the link between the Atom and SOS implementations can be established through the 'coupled resource' metadata element, which points to the same data set.

TG Recommendation 5.1	In addition, a textual reference to the Atom service implementing part A SHOULD be included in the 'abstract' metadata element of the SOS.

Also in those cases in which the features to which the measurement data of a SOS server is associated to other data which are provided through a WFS server, this link should be described through a 'coupled resource' metadata element.

TG Recommendation 5.2	In addition, a textual reference to the WFS service providing the features of interest SHOULD be included in the 'abstract' metadata element of the SOS.

For referencing a SOS server from Atom or from a WFS server, please refer to the Technical Guidance documents for Atom and WFS.