**INSPIRE**

**Infrastructure for Spatial Information in Europe**

Action 2016.1 Fitness for purpose – addressing the challenges of interoperability for Annex III datasets

Outcome of discussions and suggested way forward

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| **Type** | Document for discussion | |
| **Creator** | DG ENV, JRC, EEA with input from the Reflection Group | |
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| **Addressee** | MIG (for discussion and possible endorsement of suggested follow up) | |
| **Identifier** | **[DOC3]** | |
| Description | Action 2016.1 was agreed by the MIG in June 2016 and the mandate was revised in December 2016. The work since then was implemented as set out in the revised mandate. The sub-group (or "Reflection Group") focused primarily on the issues relating to interoperability in particular with regard to the obligations linked to Annex III datasets. The meeting of the sub-group in February was a more open brainstorming whereas the meeting in May reviewed a discussion document which summarised the outcome of the brainstorming and suggested some possible actions. The meeting summaries of the "Reflection Group" are available on the MIG collaboration platform: <https://ies-svn.jrc.ec.europa.eu/projects/2016-1/wiki/Wiki>  The document summarises the work carried out in the meantime and makes suggestions for possible actions which could be included in the MIWP for action in 2018. In parallel, a discussion of a possible revision of the Implementing Rules is taking place under the remit of the INSPIRE Committee.  Should actions be supported, a concrete mandate will be prepared until the next meeting of the MIG so that these actions can be discussed during the annual revision process of the MIWP and started in 2018, provided they are agreed. Since the follow up is now either falling under the Committee or resulting in new actions, the work of the Reflection Group is done and the Action 2016.1 can be concluded and closed successfully. | |
| **Requested actions:** | The members of the MIG are invited to:   * Take note of the document and discuss it at the meeting; * Provide feedback on the various elements, in particular the suggested actions; * Discuss and agree which actions will be elaborated further into a mandate to be presented to the next MIG for approval and inclusion in the MIWP. * Endorse the successful completion of action 2016.1. | |
| **Proposed actions in the document:** | |  |

***Action 1: Master Guidelines:*** *(mandate to be prepared by new drafting group)*

Prepare simple “master guidelines – INSPIRE for beginners” focusing on the added value of applying the INSPIRE framework. These guidelines should be developed by policy, legal and communication experts and representatives from user communities (different from the "typical" INSPIRE implementation communities). It should avoid complex documents, have a visual documentation (diagram, flowchart, infographic …) and provide the right level of accessibility to a larger group of possible users. The precise nature, scope and focus of such guidelines should be developed further so that a mandate can be discussed and agreed at the next MIG. The mandate should include a testing and calibration phase with the target user group.

To start the process and develop the mandate, a drafting group of volunteers should be established.

***Action 2: Alternative simplified schemas*** *(mandate to be prepared by MIG-T)*

This proposed action aims at improving the usability of INSPIRE data through additional simplified data schemas. It is complementary to the proposed action 3 (better client tool support).

1. Draft alternative encoding rule

* Collect examples for simplified schemas (and the underlying use cases) and common practices for applying "voidability" from MS representatives and experts through the TC platform and MIWP-14 sub-group
* Create a repository of possible simplification rules to be applied
* Draft an alternative encoding rule that meets the requirements of the IRs (to be included in D2.7)
* If necessary propose how the mapping from the conceptual to the implementation model should be explicitly represented in UML

2. Develop draft schemas for selected themes

* Draft additional simplified schemas for selected application schemas based on proposed encoding rule
* Review and testing, in collaboration with thematic communities (through the Thematic Clusters platform and MIWP-14 sub-group)

3. Update encoding rules based on feedback from step 2

4. Develop a proposal for linking simplified and complete xml schemas in download services

5. Propose agreed simplified schemas as alternative encodings to be included in the relevant data specifications

The action would produce the following outcomes:

* Repository of possible simplification rules
* Proposals for an update of D2.7 Encoding Guidelines
* Proposals for additional simplified schemas for selected application schemas

It would be mainly carried out by JRC, with possible support from a contractor. Support from MS and thematic experts would be crucial (through the Thematic Clusters platform, MIG-T, 2016.1 sub-group, …) to provide examples, participate in testing and to provide feedback. If necessary, the work could be supported by dedicated workshops and/or a dedicated temporary sub-group.

***Action 3: Better client software/tool support for complex GML*** *(mandate to be prepared by MIG-T)*

This proposed action aims at improving the usability of INSPIRE data through better client SW tool support. It is complementary to the proposed action 2 (additional simplified data schemas).

1. Analyse which GML/XML schema aspects are actually being used in INSPIRE schemas, e.g. which themes use only Simple Feature, level 0 or which geometry types are used

2. Analyse support for the required aspects are supported in existing clients, including the popular GDAL/OGR open source library (that is underlying most OS and proprietary client solutions)

3. Discuss with the open source community and commercial vendors, how to improve client software/tool support for GML

The action would produce as its main outcome:

* a table of GML/XML schema aspects actually being used in INSPIRE schemas

It would be mainly carried out by JRC, with possible support from a contractor. Close cooperation with software providers from open source and commercial vendors will be crucial. If necessary, the work could be supported by dedicated workshops and/or a dedicated temporary sub-group.

# **Next steps / planning**

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| --- | --- |
| June 2017: | discussion of document/agree follow up |
| Sept-Nov 2017: | preparation of action mandates for MIWP (e.g. by asking MIG-T) |
| December 2017: | Agree new actions as part of MIWP |
| Jan-May 2018 | Implement (part of) actions |
| June 2018: | Review progress – agree outcome of actions, if possible |
| December 2018: | Review progress – agree outcome of actions, if possible |
| June 2019: | Review progress – agree outcome of actions (latest deadline) |

*Note: This 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 or the European Environment Agency. This document is, in parts, 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.*

Action 2016.1 Fitness for purpose – addressing the challenges of interoperability for Annex III datasets

Final report of the action and suggested way forward

(draft, 24/0405/2017)

# Introduction / context

The INSPIRE implementation report and REFIT evaluation have demonstrated that applying the rules set out in the context of INSPIRE has great benefits for improving data availability and (re-) use in the field of environment. However, these benefits cannot be realised for free, some investments and efforts are inevitably needed. In most parts of the INSPIRE implementation, this balance has already been found and good progress has been made in most Member States. However, the future obligations on data harmonisation/interoperability have raised some concerns (see box).

Hence, in order to maximise the benefits and reduce the inevitable costs of setting up and maintaining a spatial data infrastructure, the obligations set out in the Directive and the Implementing rules and the recommendations provided by the Technical Guidelines need to be applied in a pragmatic way whilst respecting the legal obligations. Following the REFIT evaluation, there is an increasing emphasis to review INSPIRE implementation efforts and to conducted it so that it is “fit for purpose” where this has not yet been sufficiently the case.

*The 2016 Commission evaluation concluded that "there are indications that some implementation efforts which are not due until 2020 may be costly and difficult to achieve, in particular in relation to data harmonisation."* This was also reflected in the INSPIRE report, e.g.: “*Member States also questioned the effectiveness of future data harmonisation (step 5) due to the significant effort and cost involved in transforming existing datasets to meet the new requirements (deadlines in 2017 and 2020). Many acknowledged that greater interoperability is needed to achieve efficiency gains. They also expressed concern regarding the complexity and the feasibility of adapting all spatial data to common data models by 2017 (Annex I) or 2020 (Annex II and III). They called for a flexible, pragmatic and user-driven application of the existing data specifications.” And “[…] focusing on end-user needs and applications in a cross-border and EU context can assist implementation and help prioritise resources and investments.”*

*As a consequence, the Commission announced that it will "review, and possibly revise, the INSPIRE rules, in particular on spatial data harmonisation, to take into account the implementing risks and complexities with a view to reducing them (simplifying requirements);" and "assist the Member States in applying and implementing the INSPIRE Directive (simplification of use), e.g. by the use of common tools, and promote priority setting together with the Member States."*

It is ultimately all about balancing the added value/benefits and the efforts/costs which means that the appreciation of what is fit-for-purpose can also change over time. The main purpose is using and re-using the spatial data to create value for the users. The MIWP 2017-2020 also recognises this user-driven perspective. Decisions made in the implementation should be made on the basis of what added value it creates, in particular for the data user communities. Having said this, it is not possible to know all the user needs and demands in advance or without considerable effort engaging with a large number of different users or thousands of user groups or communities. Moreover, the INSPIRE rules are not “arbitrary” depending on users choice and sometimes different users choices may be conflicting or complicating data management unnecessarily. Hence, there is a need to develop and steer the implementation choices on the basis of common criteria and recommendations.

These findings were translated into the action 2016.1 in the INSPIRE MIWP 2017-2020 which aimed at systematically analysing and reviewing INSPIRE requirements in the legal (implementing rules) and technical (guidelines, etc) framework and investigating the implementation practices and concrete difficulties in the Member States. The results of this review would then be used to identify and propose possible measures for streamlining and simplification of INSPIRE implementation.

In the first phase of this review from September to November 2016, a broad screening of the all relevant issues took place. This resulted in a discussion document which led to the following conclusions at the Maintainance and Implementation Expert Group (MIG) meeting of December 2016: "*There was a consensus amongst MIG members to focus the review and possible revision of the Implementing Rules (IR) to the part of Annex III in the one IR on data specifications."* Consequently, a new mandate for continuation of the works for a second phase was agreed which stated: "*The continuation of this activity (January to May 2017) will focus on a need to review and (possibly) revise the Implementing Rules on data specifications, limited to the part related to Annex III. […] It will look at the identification of possible structural issues in order to reduce burdens which emerge from recent implementation experience and identify specific elements for technical and scientific adaptation. Proposals for further measures will be made to the Committee following a more in-depth analysis of the issues identified above. To do so, additional evidence needs to be collected as to the nature of the identified problems and the possible amendments that would solve these problems.*".

The work was carried out mainly by the reflection group and this document is summarizing the findings of this work and is making proposals for the way forward. It therefore represents the final report for action 2016.1 which has successfully delivered according to its mandate.

# Flexibilities and the maturity level concept

As part of the discussions on the fitness-for-purpose, the questions arose whether there is a common understanding regarding the existing obligations and whether Member States were using the existing flexibilities in the Directive and the Implementing Rules to address (as far as possible) there implementation concerns and challenges. The result of these discussions is documented in the Annex to this document. One idea was to develop a "maturity level" concept which would be particularly helpful and interesting to demonstrate gradual progress in particular when it comes to interoperability. The ideas for this concept are also documented in the Annex. Further work will be carried out by the INSPIRE Coordination Team with the view of possibly using it more systematically when analysing the fitness-for-purpose of particular datasets, e.g. when agreeing interoperability rules in the domain of environmental reporting. So the concept can be applied in the context of action 2016.5. If necessary, further discussions can take place in this context.

# Relationship between Implementing Rules and Technical Guidelines

## Development of "Master guidelines – INSPIRE for beginners"

The requirements of the INSPIRE Directive and its related Implementing Rules for data interoperability, in particular for Annex III datasets, are sometimes described (or perceived) as cumbersome and costly. One of the reasons is that these judgements are made on the basis of the recommendations set out in the set of Technical Guidelines (20 TG documents for Annex III data specifications) that have been developed.

The TG documents map the abstract legal requirements to one or several technical solutions and standards and give detailed implementation instructions for the chosen base standard or technology. In some cases, several alternative options are provided, based on different base standards[[1]](#footnote-2). In addition, the TGs also include recommendations, which are to help implementers to take decisions where the underlying base standard is flexible and allows different options. In terms of the flexibilities mentioned above, the data specification TGs clearly explain the concept of voidability and how to use it, but do not make explicit reference to the concept of “harmonisation where practicable”.

The relationship between the INSPIRE legal acts (the INSPIRE Directive and Implementing Rules) and the INSPIRE Technical Guidelines is described in all guidelines (correctly) as follows: "*The INSPIRE Directive and Implementing Rules include legally binding requirements that describe, usually on an abstract level, what Member States must implement. In contrast, the Technical Guidelines define how Member States might implement the requirements included in the INSPIRE Implementing Rules. As such, they may include non-binding technical requirements that must be satisfied if a Member State data provider chooses to conform to the Technical Guidelines. Implementing these Technical Guidelines will maximize the interoperability of INSPIRE spatial data sets.*"

This means that the TG documents only provide *one* way to implement the legal requirements, and that there may also be other ways to comply with the INSPIRE Directive from a legal point of view. At the same time, the role of the TGs is crucial for ensuring interoperability at technical level. If every implementer chooses a different standard, technology or custom-made approach to implement the legal requirements, it will be impossible to create generic client or value-added application that can be used across Europe. Instead, custom adapters or mediators would need to be built for every chosen implementation approach or technology.

Whilst this may be clear and self-evident for those experts involved in the Maintenance and Implementation Groups, for a wider community of experts which is in one way or another tasked with implementation tasks (e.g. at regional or local level in Member States or in specialized thematic expert communities which want to use INSPIRE as a tool), the sheer amount and technical language of the Technical Guidelines can be overwhelming[[2]](#footnote-3). At the same time, the level of detail and concrete implementation examples are appreciated by many implementers. It would be difficult, time consuming and also not meaningful to review, let alone re-draft the existing stock of TGs into a language that is more easy to understand and that would take account of all the possibilities to apply the INSPIRE rules in a more flexible manner.

One suggestion that came up in the discussions was that simpler, shorter and more general “master guidelines” or “INSPIRE for beginners guidelines” could be developed. The aim would be to describe the minimum obligations in a more easy to understand manner, point out the flexibilities, make reference to more detail TGs and other documents. Most importantly, this “master guide” would argue mainly on the basis of the benefits and added value for users to apply the INSPIRE framework and not the legal and technical obligations or recommendations. This idea should be based on existing work on making the content of the Implementing Rules and Technical Guidelines more easily accessible (see section 3.2). It should therefore be discussed how to continue this work to complement the proposed “master guidelines".

***Possible Action:***

Prepare simple “master guidelines – INSPIRE for beginners” focusing on the added value of applying the INSPIRE framework. These guidelines should be developed by policy, legal and communication experts and representatives from user communities (different from the "typical" INSPIRE implementation communities). It should avoid complex documents, have a visual documentation (diagram, flowchart, infographic …) and provide the right level of accessibility to a larger group of possible users. The precise nature, scope and focus of such guidelines should be developed further so that a mandate can be discussed and agreed at the next MIG. The mandate should include a testing and calibration phase with the target user group.

To start the process and develop the mandate, a drafting group of volunteers should be established.

## Content and presentation of TGs

Shortly after the publication of the IR on data interoperability together with the set of TG documents beginning of 2014, JRC started to work on how to better present the content of the especially INSPIRE Data specification TGs. The activity was also presented and discussed in the MIG-T (e.g. Minutes from the 1st MIG-T virtual meeting and got very high priority by MIG-T members. A dedicated action MIWP-1 was also proposed but not ultimately included in the MIWP 2014-2016.

The JRC activity to support MS with implementation by making the better access the content of the TGs including other related artefacts (data models, schemas, best practices etc.) as well as other were carried out in 2 interlinked lanes.

1. Internal JRC work on "Interactive Data specification toolbox"[[3]](#footnote-4)
2. Development of the "INSPIRE in Practice" platform (under the ARE3NA ISA action)[[4]](#footnote-5)

The Interactive Data Specification Toolbox consists of two major applications:

1. The application **“Read/Compare TG”** – that facilitates the reading of INSPIRE Data Specification – Technical Guidelines documents by enabling to study only selected parts of the INSPIRE technical documentation. Furthermore the selected parts can be compared with the same parts of other data themes.
2. The application **“**[Find your scope**”**](http://inspire-regadmin.jrc.ec.europa.eu/dataspecification/FindYourScope.action) supports data providers with identification of the INSPIRE spatial data themes and spatial object types that are relevant to the dataset(s) they administer. This application, which consists of 3 tools, is recommended as a starting step for INSPIRE newcomers to help them with understanding of the INSPIRE data scope, as well as data mapping and transformation. It is foreseen to be also useful especially in situations when datasets fall under two or more INSPIRE data themes / application schemas content.

The "INSPIRE in Practice" platform is a key piece of the new INSPIRE Knowledge Base website, helping stakeholders to share approaches to implementing and using INSPIRE.

It is a collaborative platform targeted at INSPIRE implementers, solution providers and end-user application developers. One key element of the platform is a task vocabulary that consists of a hierarchical set of tasks describing the duties an implementer might need to carry out to produce any INSPIRE resources.

The list of tasks relies on the legal requirements (both from the Directive and Regulations) and INSPIRE’S technical guidance documents. The task vocabulary is used in the platform to describe steps in implementation examples and to understand what software tools are available to support certain implementation tasks.

In the frame of the proposed action MIWP-1, some tests were also carried out to change the structure of the TG documents utilizing the fact that all the TG documents have followed strictly not only the same template, but also contain the general text (the same for all) and the domain-specific text. Consequently the INSPIRE data specification –TG documents are very long. So the test was carried out using the TG for Soil – 319 pages. The result showed that it is possible to create a document of ca. 25-30 pages, which would contain all the relevant, but only theme-specific information necessary to meet the IR on data interoperability for Soil. The generic common text, best practices, suggested extensions, recommended code lists / values, feature catalogue etc. could be stored and linked to this document only. In the framework of the ARE3NA ISA action, related work is planned to propose a wiki-based system for making the TGs and related artefacts (UML models, code lists, schemas) more easily maintainable and more readily consumable for implementers.

It is important to say that the new version of the INSPIRE website / knowledge base has also helped users in accessing and using the INSPIRE implementation related documentation. The on-going integration of various users platforms under the INSPIRE knowledge base will also improve the situation.

# Simplification of Implementation & Use

## Encoding: simplified / aligned encodings beyond IRs

There is an apparent gap between the (complex) INSPIRE xml schemas and what current client tools (web and desktop) can consume. The INSPIRE xml schemas are complex, because they are generated automatically from the conceptual UML model (according to the UML-to-GML encoding rules described in the GML standard and D2.7 Encoding TG) and therefore reflect all the complex structures present in the conceptual model. In contrast, most existing clients, including the popular GDAL/OGR open source library (that is underlying most OS and proprietary client solutions) consumes and writes flat data structures, where e.g. each attribute can only have at most one value and attributes can have only simple types (e.g. integer, string, boolean) and not complex ones . This means that, while INSPIRE data encoded according to the current schemas can be downloaded and viewed, simple use (visualisation, simple joins, visual overlays, spatial search, …) is difficult in standard GIS clients.

This gap could be addressed by either (1) creating alternative simplified schemas for basic data exchange and direct visualisation in standard GI tools, or by (2) encouraging better support by vendors (or a combination of both).

Proposals exist for simplification, also often referred to as “flattening”, of the existing xml schemas (e.g. in the ELF project or the example presented by DK in the 2nd 2016.1 meeting) and are already implemented in tools (e.g. ShapeChange). However, there is currently no agreed way on how to create simplified schemas that would still meet the requirements of the INSPIRE implementing rules. To be compliant with the requirements of the IRs on data interoperability, the procedure for generating simplified schemas would need to be described and published in an (additional) encoding rule (see section below). Such an encoding rule would need to include cross-cutting aspects (e.g. how to flatten recurring complex structures such as geographical names) as well as theme-specific aspects.

At the same time, some vendors and projects have also already started to improve the support for GML. However, different projects/vendors implement different (arbitrary subsets) of GML/XML, since an analysis of the subset of XML schema (and GML) that is required in INSPIRE and for specific INSPIRE themes is currently missing.

To deal with the issues described above, the following possible action on "improving the usability of INSPIRE data" was presented at the MIG-T meeting #38 in Ghent. The proposal was welcomed and the MIG-T agreed to propose it as a possible follow-up action of action 2016.1.

***Possible set of actions:***

***Alternative simplified schemas***

This proposed action aims at improving the usability of INSPIRE data through additional simplified data schemas. It is complementary to the proposed action 3 (better client tool support).

1. Draft alternative encoding rule

* Collect examples for simplified schemas (and the underlying use cases) and common practices for applying "voidability" from MS representatives and experts through the TC platform and MIWP-14 sub-group
* Create a repository of possible simplification rules to be applied
* Draft an alternative encoding rule that meets the requirements of the IRs (to be included in D2.7)
* If necessary propose how the mapping from the conceptual to the implementation model should be explicitly represented in UML

2. Develop draft schemas for selected themes

* Draft additional simplified schemas for selected application schemas based on proposed encoding rule
* Review and testing, in collaboration with thematic communities (through the Thematic Clusters platform and MIWP-14 sub-group)

3. Update encoding rules based on feedback from step 2

4. Develop a proposal for linking simplified and complete xml schemas in download services

5. Propose agreed simplified schemas as alternative encodings to be included in the relevant data specificationsThe action would produce the following outcomes:

* Repository of possible simplification rules
* Proposals for an update of D2.7 Encoding Guidelines
* Proposals for additional simplified schemas for selected application schemas

It would be mainly carried out by JRC, with possible support from a contractor. Support from MS and thematic experts would be crucial (through the Thematic Clusters platform, MIG-T, 2016.1 sub-group, …) to provide examples, participate in testing and to provide feedback. If necessary, the work could be supported by dedicated workshops and/or a dedicated temporary sub-group.

***Better client software/tool support for complex GML***

This proposed action aims at improving the usability of INSPIRE data through better client software/tool support. It is complementary to the proposed action 2 (additional simplified data schemas).

1. Analyse which GML/XML schema aspects are actually being used in INSPIRE schemas, e.g. which themes use only SF, level 0 or which geometry types are used

2. Analyse support for the required aspects are supported in existing clients, including the popular GDAL/OGR open source library (that is underlying most OS and proprietary client solutions)

3. Discuss with the open source community and commercial vendors, how to improve client support for GML

The action would produce as its main outcome:

* a table of GML/XML schema aspects actually being used in INSPIRE schemas

It would be mainly carried out by JRC, with possible support from a contractor. Close cooperation with software providers from open source and commercial vendors will be crucial. If necessary, the work could be supported by dedicated workshops and/or a dedicated temporary sub-group.

## Whatever the further work in this area, particular attention should be given to "backward compatibility". In other words, new guidelines or recommendations should not contradict existing guidelines or invalidate implementation efforts that have already been made.

## Other issues

A number of other, very specific, issues have been highlighted during the 2nd meeting of the reflection group, that present obstacles for the implementation of the IRs on data interoperability, including:

* Code lists: closed code lists, 15 code lists definitions are missing and marine code list needed
* EU wide datasets and statistics
* Data themes without geometry
* Unclear scope of the theme population distribution – demography
* Coordination (conflicts) with other data pan-European communities

For specific issues such as these, discussion fora and procedures already exist, including the following:

* Implementation questions, best practices and necessary coordination with other initiatives can be discussed with implementers across Europe on Thematic Clusters platform.
* Where errors or bugs in tools, TGs or the IRs are identified in these discussions and the community has agreed on the way forward in their discussion, the facilitators of the Thematic Clusters can formulate concrete change proposals and discuss them in the dedicated MIG sub-group 2016.4 on theme-specific implementation issues. If the sub-group agrees on the proposed change proposals, these are then forwarded to the MIG for endorsement and action (i.e. to fix bugs or correct errors in the TGs or related data models, code lists or schemas). Where proposed changes would affect the IRs, these have to be handled following the legal procedure. This procedure has already been successfully applied and the resulting TG corrigenda were published at the end of 2016.
* For issues related to the INSPIRE registers (including for code lists), changes should be proposed through the nominated submitting organisations, after discussion and agreement at national level or in the relevant Thematic Cluster. Where such changes affect the TGs or IRs, they will be discussed and agreed with the MIG sub-group 2016.4 and the MIG as described above.

## Extensions to data models

Geonovum, in collaboration with the MIG, and supported by DG ENV, EEA and JRC, launched a study to collect and document best practices for extending INSPIRE models. This study elaborated an extension methodology that describes the process, people and tools needed to make an INSPIRE extension project successful, and provides common extension approaches in the form of a pattern catalogue.

The results of the study, running from January to October 2016, are presented on a dedicated page that will be maintained by the contractors wetransform[[5]](#footnote-6). The site has three core elements: The initial survey and inventory of existing INSPIRE Model Extensions, the extension pattern catalogue and an end-to-end tutorial project:

1. Introduction
2. Results of the Survey
3. Model Extensions Inventory
4. The INSPIRE Model-Driven Approach
5. The Extension Methodology
6. The Pattern Catalogue
7. An End-to-End Tutorial Project
8. Conclusions and Outlook

The content as well as the organisation of the website could represent a new way of presenting a technical support to implementation of INSPIRE. It also allows a direct feedback from the users (modellers, domain experts, SW providers).

Further extensions can be added to the inventory through GitHub.

A number of possible follow-up actions have been identified, e.g. related to outreach (including promotion in the MIG-T, the thematic clusters platform and through a video to be produced by JRC), maintenance of the site, re-using the repository in different contexts (including in a possible future INSPIRE implementation sandbox), usage of the approach and inventory for future activities around INSPIRE-based e-Reporting.

## Use of INSPIRE data – role of INSPIRE geoportal

In the two recent MIG-T face-to-face meetings, the question was discussed how to improve the usability of the INSPIRE geoportal, in order to improve the possibility for searching and filtering for data sets meeting specific criteria, such as "open data", "priority data set", specific environmental domains (air, water, …), geographic coverage (national, regional, local) – linked also to the MIWP action 2016.2 on Monitoring and Reporting 2019 and 2016.5 List of priority data sets.

In the MIG-T meeting #38 in Ghent, it was agreed to test the proposal on using keywords from agreed controlled vocabularies in the data set metadata to identify the data sets from the list of priority data sets (and possibly other characteristics) with a number of volunteers from the MIG-T and EIONET INSPIRE group. Based on the outcomes of this ad-hoc action, further follow-up actions for inclusion in the MIWP 2018 could be defined (if necessary).

**Annex**

# Existing flexibility in applying the Directive and Implementing Rules

When discussing implementation challenges and complexities in relation to interoperability requirements, it became clear that there is a different or insufficient understanding amongst the INSPIRE community in relation to the obligations and flexibilities which are provided by the INSPIRE legal framework. Using these flexibilities in an appropriate manner would allow overcoming some of the existing or perceived implementation challenges without undermining the objectives and the ambition level of the INSPIRE Directive.

This section introduces some of these elements and aims at establishing a common understanding as a basis for further discussions and further implementation work.

## Application of interrelation between Article 7 and 8

When looking at the legal requirements in relation to interoperability in more detail, it becomes clear that there is a high degree of flexibility for Member States to implement the legal requirements for data interoperability (or data specifications) laid down in the Implementing Rules.

The overarching obligation on Member States is set out in Article 7.3:

Article 7.3: "*Member States shall ensure that all newly collected and extensively restructured spatial data sets and the corresponding spatial data services are available in conformity with the implementing rules referred to in paragraph 1 within two years of their adoption, and that other spatial data sets and services still in use are available in conformity with the implementing rules within seven years of their adoption. Spatial data sets shall be made available in conformity with the implementing rules either through the adaptation of existing spatial data sets or through the transformation services referred to point (d) of Article 11(1).*"

It spells out what Member States have to do and by when. At the same time, it becomes clear that this obligation can only be fully understood and applied in conjunction with other Articles, in particular articles 7.1, 7.4, 8 and 11 and with the respective Implementing Rules (i.e. COMMISSION REGULATION (EU) No 1089/2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services as amended by Commission Regulations (EU) No 102/2011, No 1253/2013 and No 1312/2014).

The provision in Articles 7.1 gives further details on the scope of the Implementing Rules.

Article 7.1: "*Implementing rules laying down technical arrangements for the interoperability and, where practicable, harmonisation of spatial data sets and services, […], shall be adopted […]*"

Already at this stage, the question of practicability of this approach is introduced (see more details below).

When looking at Article 7.4, this scope is defined further for all spatial datasets falling within the scope of this Directive (i.e. related to themes listed in Annex I, II and III).

Article 7.4: "*Implementing rules referred to in paragraph 1 shall cover the definition and classification of spatial objects relevant to spatial data sets related to the themes listed in Annex I, II or III and the way in which those spatial data are geo-referenced*."

Reading further to Article 8, however, it becomes clear that the level of ambition and harmonization between datasets covered by Annex I and II themes is different to the ones in Annex III.

Article 8:

*"1. In the case of spatial data sets corresponding to one or more of the themes listed in Annex I or II, the implementing rules provided for in Article 7(1) shall meet the conditions laid down in paragraphs 2, 3 and 4 of this Article.*

*2. The implementing rules shall address the following aspects of spatial data:*

*(a) a common framework for the unique identification of spatial objects, to which identifiers under national systems can be mapped in order to ensure interoperability between them;*

*(b) the relationship between spatial objects;*

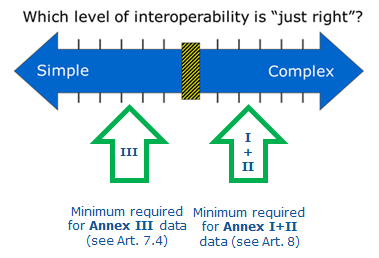
*(c) the key attributes and the corresponding multilingual thesauri commonly required for policies which may have an impact on the environment;*

*(d) information on the temporal dimension of the data;*

*(e) updates of the data.*

*3. The implementing rules shall be designed to ensure consistency between items of information which refer to the same location or between items of information which refer to the same object represented at different scales.*

*4. The implementing rules shall be designed to ensure that information derived from different spatial data sets is comparable as regards the aspects referred to in Article 7(4) and in paragraph 2 of this Article."*



This clear distinction could become useful when discussing the meaning of practicability (see below). This reading also suggests that different levels of interoperability or harmonisation (or maturity) are embedded into the INSPIRE Directive already. The following figure aims at illustrating this is a simple away.

## The meaning of "where practicable"

As mentioned above, practicability plays an important role in this context. In line with Article 7.1, the Article 1 of the IR on data specifications (COMMISSION REGULATION (EU) No 1089/2010 as amended) frames the entire application of these data specifications.

Article 1 of COMMISSION REGULATION (EU) No 1089/2010:

"*This Regulation sets out the requirements for technical arrangements for the interoperability and, where practicable, harmonisation of spatial data sets and spatial data services corresponding to the themes listed in Annexes I, II and III to Directive 2007/2/EC.*"

This addition of "where practicable" is an indication that there is some form of flexibility and that a "practicability test" can be applied by Member States before investing in harmonization. There are several aspects that need to be discussed in this context.

The Directive and the Regulation distinguish for spatial data sets and spatial data services between "*technical arrangements for the interoperability"* and *"harmonization".* It seems clear that the legislator intended technical arrangements for the interoperability to be mandatory (without flexibility) but harmonization only applicable "where practicable".

So the first question is: what constitutes a "*technical arrangements for the interoperability"* how this can be distinguished from *"harmonisation".* The Directive and the Implementing Regulation do not answer this question.

Interoperability is defined in the Directive whereas harmonization is not.

Article 3.7 of the INSPIRE Directive says:

*"‘interoperability’ means the possibility for spatial data sets to be combined, and for services to interact, without repetitive manual intervention, in such a way that the result is coherent and the added value of the data sets and services is enhanced*"

On this basis, the distinction was discussed in the Data Specifications Drafting Team, when drafting the Generic Conceptual Model[[6]](#footnote-7), which provides the conceptual foundation for the work on the IRs on data interoperability. The understanding of the Drafting Team is captured in the document. The same distinction is followed in the JRC Reference Report[[7]](#footnote-8). Basically the difference is: a data provider can make a dataset interoperable by providing the dataset in conformance with the data specifications. The data itself is not harmonised, but it is mapped as good as possible to the INSPIRE data specification. Data harmonisation would require changing the data and may involve

* making it consistent with other datasets (across scales/resolutions - generalization; at the boundary of the dataset extent - edge matching; roads in datasets of a road administration and a mapping agency)
* using European code lists as the basis (often with extensions) instead of a national or organisational code list with a best-effort-mapping
* using INSPIRE data specifications as a basis for national data specifications and capture/maintain the data on that basis instead of mapping it on a best-effort basis
* using an ETRS89 CRS (geodetic or projected) in the native geometries, at least where ETRS89 applies
* changing what data is captured and maintained in which dataset by which organisation in the Member State (to remove duplication of work, to establish base registers for certain topics, etc.)
* etc.

Accordingly, it could be argued that all the technical arrangements in Regulation 1089/2010 (and its amendments) are related to "interoperability". At the same time, Article 1 of the Implementing Regulations clearly states that both, interoperability and harmonization specifications are included.

It is ultimately up to Member States, within limits[[8]](#footnote-9), how to distinguish between interoperability needs and harmonization and whether and in how far they take steps towards harmonisation of their dataset with INSPIRE. Moreover, as data harmonisation typically could mean (re)collecting data (which is excluded by Article 4(4) of the Directive) it is left to Member States, where they find data harmonisation "practicable".

The only explicit requirement for data harmonisation is probably in Article 10(2) in the Directive, but no specific technical arrangement for harmonisation has been included in the regulation (as the statement in the Directive is already quite clear).

The next question is how to apply the concept of "practicability". Despite the findings of the TG on Generic Data Models, there is no definition in the INSPIRE rules and, as a matter of principle, it is therefore the responsibility of the Member State to define and apply this correctly when transposing and implementing the Directive.

At EU level, the Commission, or at national level affected parties, may, as always, question the approach chosen by the Member State but would have to provide evidence to demonstrate that the obligations under the Directives are not met. In other words, the "burden of proof" is with the Commission although it can ask a Member State to provide information and explain in more detail the approach before making any judgment.

Rather than exchanging such information on a bilateral basis, it is desirable that the Member State makes its approach transparent, i.e. allows other administrations, businesses or other interested parties to understand and scrutinize the approach.

Give the importance of this element for the achievement of interoperability and harmonization, it may be useful to understand better how this concept of "practicability" could be applied.

We may want to consider a reflection on technical level on whether there are certain good practices or common criteria which would help in the further implementation process.

A practical application of using these flexibilities is already happening, e.g. when we define the consequences of applying the “linked approach” by environmental reporting obligation. These experiences should feed into any further follow up actions.

## The "voidability" concept in the implementing rules

The INSPIRE data specifications (i.e. IRs on data interoperability) introduce also other flexibilities.

First of all, there is no requirement in the IRs on data interoperability for a Member State or public authority to provide *all* spatial object types included in a theme, but only to use those spatial object types for which the public authority has data within the scope of the Directive Art. 4. This reflects the provision of the Directive in Art. 4(4) that INSPIRE "does not require collection of new spatial data".

Article 4, point 1 of COMMISSION REGULATION (EU) No 1089/2010:

*"For the exchange and classification of spatial objects from data sets meeting the conditions laid down in Article 4 of Directive 2007/2/EC, Member States shall use the spatial object types and associated data types, enumerations and code lists that are defined in Annexes II, III and IV for the themes the data sets relate to."*

Furthermore, for each provided spatial object, the Regulation on data interoperability includes an aspect of flexibility through the concept of "voidable" which can be applied to attributes or association roles of spatial object types.

Article 2, point 20 of COMMISSION REGULATION (EU) No 1089/2010:

*"‘voidable’ means that, for an attribute or association role a value of ‘void’ may be made available if no corresponding value is contained in the spatial data sets maintained by the Member States or no corresponding value can be derived from existing values at reasonable costs. If an attribute or association role is not voidable, the table cell specifying its voidability is left blank*".

It includes, however, an additional condition which must be met. It basically says if a particular requirement in the IRs (to provide an attribute or association role of a spatial object type) is marked as "voidable, it only has to be implemented if the two conditions apply (in a cumulative manner):

1. the corresponding value must exist (which is analogous to the obligation in Article 4.4 of the INSPIRE Directive that no new data have to be collected as part of this Directive) AND
2. the derivation of such a corresponding value can be undertaken with "*reasonable costs*".

The first condition appears clear, simple and easy to establish. Either a corresponding value exists or it does not.

The second condition is more challenging to determine. However, the same principles apply as in the above-mentioned case of "where practicable", i.e. it is in the discretion of the Member State to determine what "*reasonable costs*" are. At the same time, transparency of the national approaches and technical discussions on how this is applied are useful to avoid fragmentation and counterproductive effects in relation to the objective of "interoperability".

The application of "voidable" in the implementation allows for significant flexibility and efficiency gains.

These two major elements of flexibility ("where practicable" and "voidable") offer a clear framework for Member States to introduce interoperability in a gradual manner. One could imagine that the assessment of what is practicable and reasonable in terms of costs will change over time. Hence, a first push towards interoperability could be complemented by later efforts (after the deadlines apply) to enhance interoperability in particular in cases where this offers additional benefits from a user perspective. At the same time, these concepts introduce a risk that if applied in an arbitrary way, interoperability will be difficult to achieve, in particular in a cross-border and pan-European context. Therefore, further discussion in the context of the "maturity level" concept (see below) may be useful.

Finally, the above-mentioned flexibilities also allow for finding pragmatic solutions with user domains or use cases where similar obligations are laid down in EU law. In particular for the work on eReporting and the alignment on data models in the eReporting flows of spatial datasets (see list of priority datasets) is not fully complete despite the efforts made at the time of developing the IRs. This flexibility can now be used to take account of the fact that for some of the existing reporting flows it may still not be "practicable" or not possible at "reasonable costs" to align the existing reporting data specifications to the full INSPIRE IRs, at least in the short term. Such a determination will have to be made on a case-by-case basis and in close collaboration between experts in the reporting field and experts working on INSPIRE implementation.

## Obligations on different levels of governance (national, regional, local)

During the discussion, some questions arose how to deal with INSPIRE implementation at local level. Some Member States reported that this is one of the most challenging and costly aspects whereas others did not seem to have a problem. It is clear from the scope and the definitions (Article 3.9) that the rules of the Directive apply to all levels of government within a Member State, national, regional and local. However, it is also clear that there are different ways to go about this, i.e. in a more centralized or decentralized approach. Most importantly, there is a clear derogation in Article 4.6 under which circumstances local authorities can benefit from other authorities taking over their duties.

Article 4, paragraph 6 of the Directive says:

*"‘By way of derogation from paragraph 1, this Directive shall cover spatial data sets held by or on behalf of a public authority operating at the lowest level of government within a Member State only if the Member State has laws or regulations requiring their collection or dissemination.*".

Hence, Member States can apply a variety of implementation models taking account the most cost-effective solutions as long as the arrangements are laid down in laws or regulations at national level.

## INSPIRE rules and eReporting (the linked approach)

With the Commission priority to focus on making INSPIRE more useful for environmental reporting, there is often the question how the rules set out under INSPIRE to the agreements relate to those made under other environment legislation with respect to reporting. Often they include also specifications for data harmonization which may or may not (fully) be consistent with the INSPIRE IRs. At the same time, these sectorial data specifications often have similar legal effect. If they are not consistent, the question of which rule prevails may be asked in 2020 (e.g. what is "*lex generalis*" and what "*lex specialis*", as it is considered as a general rule that special rules prevail over general ones).

Most data providers only want to support one information model for data harmonization, one data format and one information stream to fulfill the European environmental legislation. If INSPIRE data specifications for interoperability and specifications for data harmonization made under other environment legislation with respect to reporting are not or partly consistent, solutions have to be found.

Data under other environment legislation with respect to reporting often is data falling within the scope of all 3 INSPIRE annexes with a direct or indirect reference to a specific location or geographical area and therefore part of the core of INSPIRE relevant for reuse. Full benefits from interoperability are only reached if all this spatial data is made available consistent with INSPIRE specifications and the information model supports both INSPIRE and reporting obligations.

Overall, the concept paper on “the future of eReporting and the link to INSPIRE” has answered some of the questions and is proposing a pragmatic way forward. This document has been consulted widely over the past months and a revised version is now available[[9]](#footnote-10). The document provides the reference point on how to develop this particular uses case for INSPIRE further. The approach advocated therein will now have to be stepwise implemented in concrete reporting cases. Once available, this will be shared through the web pages established in the context of action 2016.5[[10]](#footnote-11).

The paper introduces the linked approach, a way to maximize benefits of interoperability first and foremost for those spatial data (type 1 data) which provide a geospatial basis or reference dataset (e.g. river basin districts, water bodies, monitoring stations or location of installations) that thematic reporting data can be linked to. The list of priority data sets which has been established contains most of these “type 1 datasets” with relevance for environmental reporting. Enhanced interoperability in line with INSPIRE would therefore be pursued for these datasets which are also the ones which can be re-used in many different contexts or for different purposes. The thematic data (type 2) are often specific to the reporting obligations and therefore less relevant for reuse. Interoperability improvements could be considered only at a later stage once the type 1 data are sufficiently interoperable. In other words, for type 1 datasets, a higher level of interoperability (and therefore less flexibility) is advocated whereas for type 2 datasets, the available flexibilities are, at this stage, exploited more exhaustively.

If necessary, a further discussion on compliance and conformity should take place which aims as much as possible to a situation that there is clarity about what is required and what rules have to be followed for certain datasets relevant for environmental reporting. It should be possible to find practical and meaningful solutions (taking account the above-mentioned flexibilities) which strike the balance between thematic interests and historic developments in a particular reporting domain and the interest to improve interoperability. A situation where particular reporting approaches are considered incompatible with the INSPIRE legal framework in 2020 should be avoided at all costs, if necessary (and not achieved through gradual alignment of the reporting rules, through changes to the INSPIRE Implementing Rules for Annex III data (as discussed below).

## Data encoding (multiplicity and flattening)

A number of comments related to the perceived complexity of the INSPIRE rules for data interoperability are related to the GML[[11]](#footnote-12)-based default encodings that are recommended in the data specification TGs. As discussed in section 1.1, this is only *one* (if the preferred) option to meet the requirements for encoding laid down in the IRs for data interoperability.

Article 7 of COMMISSION REGULATION (EU) No 1089/2010:

*"Encoding*

*1. Every encoding rule used to encode spatial data shall conform to EN ISO 19118. In particular, it shall specify schema conversion rules for all spatial object types and all attributes and association roles and the output data structure used.*

*2. Every encoding rule used to encode spatial data shall be made available."*

Other encoding rules and corresponding exchange formats/schemas could be defined, by individual data providers, or (in order to guarantee interoperability) as agreed alternative encodings in the TG documents. This has been demonstrated by a presentation from Danish implementation approach[[12]](#footnote-13) which looked a ways in how to deal with questions of multiplicity and flattening. Whilst this is covered by encoding rules, the IRs are not setting out strict requirements in this area. Hence, the Danish approach is perfectly legitimate. However, it poses the risk that if every data provider makes different choices is this respect, the objective of interoperability will be more difficult to achieve. Hence, some further collaborative work may be useful (see section 4.2 for a concrete proposal to address the issues of complexity in the current default GML-based encoding).

# The maturity level concept

The maturity level concept offers a guiding framework to implement the overall approach set out by the INSPIRE evaluation. It was introduced by the MIWP 2017 but was not defined in detail. The idea behind the maturity levels is that the INSPIRE framework is flexible, simpler than sometimes perceived and can (should) be applied in a step-by-step manner. It thereby links the cost/efforts needed for INSPIRE implementation with the expected benefits that it can potentially create. It is not dependent on knowing the user needs but it can be adapted and tailor-made if the user demands are known. Moreover, it offers re-assurance on the question what is legally required (legal compliance) and what is technically advised, at a particular moment in time, but not mandatory (technical conformity). Finally, it brings in the element of proportionality and priority setting when implementing the Directive.

The approach set out below is a general starting point for discussion and should be refined. The first thing to decide is that the "maturity level" concept can and should be applied to the main INSPIRE obligations, i.e. metadata, services and interoperability. Moreover, it should be clear that such a classification or categorization is applied to specific datasets and will mainly be applied at EU level (by the EU Coordination Team) when defining the level of maturity of a given dataset (e.g. validators) or when trying to find solutions in specific areas where the INSPIRE obligations should be applied (e.g. in the area of reporting). It offers transparency on the situation and can provide an incentive to move from a lower maturity level to a higher one, thereby acknowledging progress in the right direction.

In order to keep the approach clear and simple, three maturity levels of INSPIRE implementation have been identified: basic, essential and advanced/premium, see table for details.

**The “basic” level**

When setting up any spatial data infrastructure, the starting points will be very different. Independent of this situation, there are minimum requirements or “simple” issues which need to be put in place in order to ensure, at least, “basic” functionality and benefit from introducing an organised and structured approach. The introduction of this simple level is better than not doing anything. Such a level is considered by experts as the foundation for any spatial data infrastructure. Minimum requirements may not necessarily be linked to the INSPIRE Directive, let alone fully comply with it, but they should be introduced with having the Directive as the main reference point. They should also be benefit and objective driven. In other words, how can we achieve with minimum effort a maximum return for investment on the way to a fully developed EU spatial data infrastructure as described by the INSPIRE rules.

***Table: Generic description of (five star) "maturity level" concept***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Level** | **Description** | **Legal INSPIRE compliance** |
| Basic | 1 (\*) | Minimum INSPIRE requirements which appear obvious to most experts in the field when any spatial data infrastructure is set up. | Not (fully) compliant with legal provisions. |
| Essential | 2 (\*\*) | Requirements are sufficient to comply with Directive and Implementing Rules taking account the flexibilities in the rules which would still aim at delivering on the objectives set out by the INSPIRE legal framework. | Compliant with legal provisions. |
| Advanced/Premium | 3 (\*\*\*) | The approach takes account to most advanced elements of the legal framework and satisfies the technical implementation options set out in the Technical Guidelines. It can also go beyond what has been set out in the INSPIRE Technical Guidelines in particular by applying innovative solutions and approaches or by extending the overall advanced level into a thematic domain which makes it more tailor made and effective. | Beyond legal compliance, technically desirable but not legally required. |

**The “essential” level**

The INSPIRE Directive goes beyond basic requirements because it aims at establishing a European Spatial Data Infrastructure based on comparable national infrastructures. When setting up any spatial data infrastructure, the starting points will be very different. Independent of these starting points, a common EU reference point as set out in the INSPIRE Directive and the Implementing Rules is assumed to strike the right balance between the ambition for an ambitious and multi-purpose spatial data infrastructure and a cost-effective and user-driven approach. This is reflected by the fact that some flexibilities have been introduced in the legal framework which allows the Member States to strike the right balance between “costs and benefits”. Where flexibilities exist, the minimum requirements should be defined for the “essential” level, not the additional requirements which do not necessarily have to be met (e.g. the establishment of download services providing direct access to spatial data sets, where practicable, would not be considered at the essential level).

Should it turn out that the balance that was found at the time is no longer valid, the revision of the Implementing Rules should be considered (based on concrete evidence).

In short, the application of this “essential” implementation maturity level will ensure that a European Spatial Data Infrastructure will be established based on minimum requirements that delivers on the ambition level set out in the INSPIRE Directive.

**The “advanced” or "premium" level**

Beyond the minimum requirements stipulated by the INSPIRE Directive and the Implementing Rules, there are two aspects which take the implementation to the next level. On one hand, the Directive or Implementing Rules may have parts which are flexible, conditional or optional, in other words, are not absolutely mandatory but desirable (sometimes linked to clear conditions). On the other hand, the (informal) Technical Guidelines present *one*, but not the only way, to implement the provisions from a technical and practitioners perspective (see section 1.1). Clearly there has been a desire to describe all these additional obligations, recommendations and approaches and many practitioners are grateful for this level of detail. Moreover, there are clear benefits going down this road of advanced implementation, in particular the higher degree of interoperability that can be achieved. However, it is not necessarily the case that these benefits will outweigh the costs of investment which would be necessary to apply this "advanced" or “premium” level. This ambitious approach should therefore be recognized and marked as best practices. The aspiration would be to gradually move to this level across Europe but clearly driven by user needs and concrete benefits that can be materialized. This would also allow spreading the investment over a longer time period beyond 2020 as long as the minimum requirements (“essential” level) are fulfilled. Moreover, the area of spatial data management is very dynamic and innovative and there are many new developments and solutions which positively contribute to the objectives set out in the INSPIRE Directive but which could not be considered at the time of drafting the IRs or the TGs because they were either not known or not applied in practice widely across administrations. Hence, this maturity level should capture such new and innovative solutions which contribute to the objectives but are not legally required or documented in the TGs. Furthermore, there are some specific cases where the INSPIRE obligations are not specific and far-reaching enough to cover for full interoperability in a given thematic area or to provide full benefits for a given application. In these cases, thematic extensions are increasingly being developed[[13]](#footnote-14), and additional recommendations and best practices are being proposed, e.g. for making spatial data more readily available on the mainstream web[[14]](#footnote-15). In order to ensure that such extensions, recommendations and best practices are still resulting in higher levels of interoperability, an additional level or label could be introduced to recognize those areas which have not only applied the INSPIRE premium level, but extended the data models or added recommendations to fully cover the needs and interoperability benefits in a given thematic area. All this can be captured with this "advanced" or "premium" level.

1. For example, there are TG documents for implementing the requirements for download services based on the Atom, Web Feature Service (WFS), Sensor Observation Service (SOS) and Web Coverage Service (WCS) standards. Similarly, in some data specifications, alternative encodings are proposed. [↑](#footnote-ref-2)
2. Examples: Presentation of the marine and the meteorological expert communities at the 2016 INSPIRE Conference plenary sessions. [↑](#footnote-ref-3)
3. <http://inspire-regadmin.jrc.ec.europa.eu/dataspecification/> [↑](#footnote-ref-4)
4. <http://inspire.ec.europa.eu/portfolio/inspire-practice> [↑](#footnote-ref-5)
5. <http://inspire-extensions.wetransform.to/> [↑](#footnote-ref-6)
6. <http://inspire.ec.europa.eu/documents/inspire-generic-conceptual-model> [↑](#footnote-ref-7)
7. <http://inspire.ec.europa.eu/documents/conceptual-model-developing-interoperability-specifications-spatial-data-infrastructures> [↑](#footnote-ref-8)
8. Such limits derive from the content, the scope, the purpose and the objective of the Directive and are usually defined by Courts. [↑](#footnote-ref-9)
9. https://ies-svn.jrc.ec.europa.eu/projects/2016-5 [↑](#footnote-ref-10)
10. https://ies-svn.jrc.ec.europa.eu/projects/2016-5 [↑](#footnote-ref-11)
11. Geography Markup Language, <http://www.opengeospatial.org/standards/gml> [↑](#footnote-ref-12)
12. [Link to presentation](https://ies-svn.jrc.ec.europa.eu/attachments/download/2115/fitness%20for%20purpose%202016.1%203rd%20meeting%20danish%20suggestion.pptx) [↑](#footnote-ref-13)
13. See the INSPIRE data model extensions repository at <http://inspire-extensions.wetransform.to/> [↑](#footnote-ref-14)
14. See e.g. the OGC/W3C Working Group Note on Spatial Data on the Web Best Practices, <https://www.w3.org/TR/sdw-bp/> [↑](#footnote-ref-15)