Questionnaire on the use of the elements of spatial and temporal schema

1. Purpose of this questionnaire

Your input to this questionnaire is valuable; it will help to determine and define the Implementing Rules that will complement the implementation of the INSPIRE Directive. This will ensure that your views are considered when the Directive becomes law and the Implementing Rules are applied to your information and data.

INSPIRE and the Implementing Rules of INSPIRE will only apply to data that you publish externally and not to internal datasets and internal data processes.

The purpose of this questionnaire is to provide the INSPIRE Data Specifications Drafting Team with the current status of practices in your SDIC/LMO, in order to know if the envisaged Implementing Rules are feasible or not.

Please note that even incomplete answers are useful, so please do complete the questionnaire as far as you can.

2. Background

It is planned to use the conceptual modelling framework of the ISO 19100 series of International Standards as the basis for modelling application schemas. I.e. spatial and temporal characteristics of spatial objects will be based on ISO 19107 (spatial schema), ISO 19108 (temporal schema) and ISO 19123 (schema for coverage geometry and functions).

It is well-known that ISO standards cover a very wide range of spatial and temporal aspects, however only a part of these components is commonly employed by data providers, data users and existing software. Finally the DT purpose is to identify and recommend on the simplest possible set of such spatial and temporal components; so the benefit of this questionnaire is to identify which components are used in your organisation in order to know if restrictions are feasible.

Answers to the following questions will help to evaluate the proposed approach and prepare for modelling the application schemas for the themes, mostly to detect and clarify the characteristics that should be considered in the modelling process. The recommended types of spatial and temporal objects will be validated against reference material (data and documentation available to the Drafting Team). Then they will be employed in the next design activity specifying the INSPIRE data specifications through several application schemas, each devoted to a specific thematic area from Annexes I, II and III, to reach an homogeneous and flexible model.

Finally the results of this survey will enable the Drafting Team to improve knowledge on the existing status of data and to respond best to information requested for analysis and design activities. Furthermore a report with the survey’s results will be published and made available for all SDIC/LMOs.

Please answer the questions not per theme but **summarize the use of spatial and temporal characteristics** in your organisation. Please try to include each possible element of the spatial and temporal schemas in your response, even when they are used only in a single dataset.

3. Vector data - Geometrical and topological characteristics

Please look at the clauses **3a**, **3b**, **3c**, **3d**: can you identify, among spatial data that you usually use or produce, spatial objects having their shape as depicted here? Consider that every *graphic example* describes an undivided object, so when you look at those related to aggregations or compositions you should keep this in mind, even if each single component may have its own significance, as you can read in the *Description*. Please focus first on the *Answer options,* then you may add meaningful examples about your actual data in the section on *Your own real examples*.

On 2D/2.5D/3D answer options the following rules should applied for clauses **3** and **4** in this questionnaire:

- 2D deals with a flat object positioned in the horizontal plane and described by (x,y) coordinates;
- 2.5D deals with a flat object positioned in the horizontal plane and described by (x,y,z) coordinates;
- 3D deals with an object positioned in any way in 3D space.

The geometry types shown below were extracted from ISO 19125-1 (Simple Feature spatial schema) and from ISO 19107 (spatial schema).

3a. Vector data – elementary objects

1.

Graphic example	Name	Description	Examples from the real-world
	Point	Basic geographic object made of a single isolated point	A traffic light, a borehole, a traffic signal

Answer options:

☐ **2D**
☐ **2.5D / 3D**
☐ **Not used**
☐ **Unknown**

Your own real examples:

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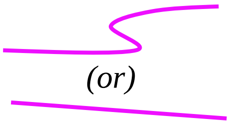
2.

Graphic example	Name	Description	Examples from the real-world
	**Curve**	Basic geographic object made of a single line or curve tract	A pipe, a road tract

Answer options:

- ☐ **2D**
- ☐ **2.5D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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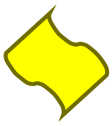
3.

Graphic example	Name	Description	Examples from the real-world
	**Surface**	Basic geographic object made of a single free shape surface; the surface may be a plane surface or not	A lake, a football field A water basin

Answer options:

- ☐ **2D**
- ☐ **2.5D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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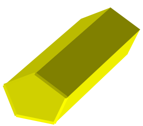
4.

Graphic example	Name	Description	Examples from the real-world
	**Solid**	Basic geographic object made of a single free shape solid, positioned in any way in 3D space	A building in a 3D view

Answer options:

- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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3b. Vector data – geometric aggregations

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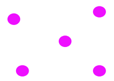
Graphic example	Name	Description	Examples from the real-world
	**MultiPoint**	Geographic object made of many (more than one) isolated points. The individual components are allowed to be elementary objects of type Point	An orchard made of individual trees; a water source with many outcrops

Answer options:

- ☐ **2D**
- ☐ **2.5D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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6.

Graphic example	Name	Description	Examples from the real-world
	**MultiCurve**	Geographic object made of many (more than one) separated lines or curves: no contiguity allowed. The individual components are allowed to be elementary objects of type Curve	A contour line made of more than one not –joined-up tracts; a fault made of many tracts

Answer options:

- ☐ **2D**
- ☐ **2.5D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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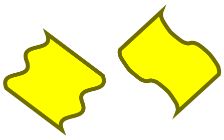
7.

Graphic example	Name	Description	Examples from the real-world
	**MultiSurface**	Geographic object made of many (more than one) separated surfaces: no contiguity allowed. The individual components are allowed to be elementary objects of type Surface	In Italy "administrative isles" exist for several municipalities, that is two or few more not-joined-up land areas belong all to one administrative unit A covering made of separated layers (like a pitched roof)

Answer options:

☐ **2D**
☐ **2.5D**
☐ **3D**
☐ **Not used**
☐ **Unknown**

Your own real examples:

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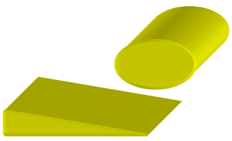
8.

Graphic example	Name	Description	Examples from the real-world
	**MultiSolid**	Geographic object made of many (more than one) separated solid objects: no contiguity allowed. The individual components are allowed to be elementary objects of type Solid	

Answer options:

☐ **3D**
☐ **Not used**
☐ **Unknown**

Your own real examples:

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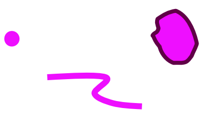
9.

Graphic example	Name	Description	Examples from the real-world
	**Mixed Aggregation**	Geographic object made of many (more than one) separated 2D and 3D basic objects: Points, Curves, Polygons, Surfaces, Solids with no contiguity allowed. The individual components are allowed to be elementary objects of type Point or Curve or Polygon or Surface or Solid	A farm composed of the buildings (Polygons), irrigation pipes (Curves), the individual trees (Points)

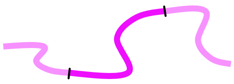
Answer options:

Your own real examples:

- [ ] **2D**
- [ ] **2.5D**
- [ ] **3D**
- [ ] **Not used**
- [ ] **Unknown**

3c. Vector data – geometric compositions

10.

Graphic example	Name	Description	Examples from the real-world
	**Composite Curve**	Geographic object made of many (more than one) individual lines or curves where contiguity is required. The individual components are allowed to be elementary objects of type Curve	A river or any other water course made of individual tracts

Answer options:

- [ ] **2D**
- [ ] **2.5D**
- [ ] **3D**
- [ ] **Not used**
- [ ] **Unknown**

Your own real examples:

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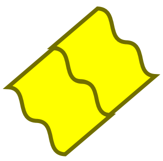
11.

Graphic example	Name	Description	Examples from the real-world
	**Composite Surface**	Geographic object made of many (more than one) individual surfaces where contiguity is required. The individual components are allowed to be elementary objects of type Surface	A cadastral parcel made of sub-parcels A covering made of connected layers (like a pitched roof)

Answer options:

- [ ] **2D**
- [ ] **2.5D**
- [ ] **3D**
- [ ] **Not used**
- [ ] **Unknown**

Your own real examples:

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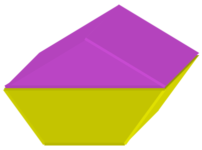
12.

Graphic example	Name	Description	Examples from the real-world
	**Composite Solid**	Geographic object made of many (more than one) individual solid objects where contiguity is required. The individual components are allowed to be elementary objects of type Solid	

Answer options:

- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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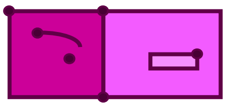
13.

Graphic example	Name	Description	Examples from the real-world
	**Mixed Composition**	Geographic object made of many (more than one) individual 2D and 3D basic objects: Points, Curves, Polygons, Surfaces, Solids where contiguity is required. The individual components are allowed to be elementary objects of type Point or Curve or Polygon or Surface or Solid	Water catchings on a river bank (an example of Points on a Polygon boundary) A building made of separate wall plugs, roof or covering, foundations, technical plants,… potentially coming from different data sources

Answer options:

- ☐ **2D**
- ☐ **2.5D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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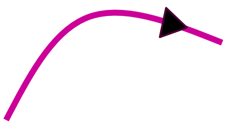
3d. Vector data – specific topology aspects

14.

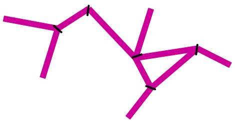
Graphic example	Name	Description	Examples from the real-world
	**Orientable Curve**	Geographic object made of a single line or curve tract with a defined orientation direction	An individual tract of a river or any other water course

Answer options:

☐ Yes
☐ Not used
☐ Unknown

Your own real examples:

15.

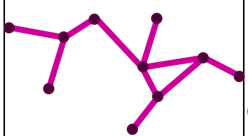
Graphic example	Name	Description	Examples from the real-world
	**Graph**	Geographic object made of many (more than one) individual Curves or Composite Curves where contiguity is required and multiple connection is allowed. The individual components are requested to be elementary objects of type Curve or Composite Curve	A water network

Answer options:

☐ Yes
☐ Not used
☐ Unknown

Your own real examples:

16.

Graphic example	Name	Description	Examples from the real-world
	**Edge-Node Graph**	Geographic object made of many (more than one) individual Curves or Composite Curves where contiguity is required, multiple connection is allowed and points function as nodes. The individual components are requested to be elementary objects of type Points, Curve or Composite Curve	A transport network with its crossroads

Answer options:

☐ Yes
☐ Not used
☐ Unknown

Your own real examples:

Free comment:

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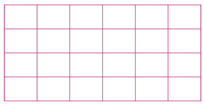
4. Coverages

A coverage associates positions within a bounded space (its domain, described by geometries) to attribute values (its range). In other words, it is both a feature and a function; in fact it is a function from a spatial, temporal or spatiotemporal domain to an attribute range and it associates a position within its domain to a record of values of defined data types.
Coverage is also a subtype of feature, that has a geographic distribution of values for each attribute type and each direct position within the geometric representation of the feature has a single value for each attribute type. A coverage may be discrete or continuous (based on interpolation between grid points).

A discrete coverage has a domain that consists of a finite collection of geometric objects and the direct positions contained in those geometric objects. A discrete coverage maps each geometric object to a single record of feature attribute values.
A continuous coverage acts as a mathematical function, returning a distinct record of feature attribute values for any direct position within its domain. The function may be analytical, or it may be based on interpolation.
Examples of coverages include a raster image, a polygon overlay or a digital elevation matrix.

So can you identify, among spatial data that you usually use or produce, the relevant coverage types as depicted below?

17.

Graphic example	Name	Description	Examples from the real-world
(domain shown)  *example* 	**Rectified Grid Coverage**	A rectified grid has grid lines that are regularly spaced. It is defined by an origin in an external coordinate reference system, and a set of offset vectors that specify the direction and distance between the grid lines within that external coordinate reference system.	Satellite imagery, raster maps, digital terrain models

Answer options:

- ☐ **2D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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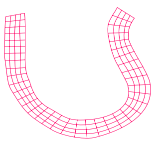
18.

Graphic example	Name	Description	Examples from the real-world
(domain shown) 	**Referenceable Grid Coverage**	A referenceable grid has grid lines that are irregularly spaced. It is associated with a transformation between grid coordinate values and values of coordinates in an external coordinate reference system. This transformation doesn't need to be in analytic form; it may be a table, relating the grid points to coordinates in the external coordinate reference system.	Numerical models following 'natural' boundaries, or with 'telescoped' resolution

Answer options:

- ☐ **2D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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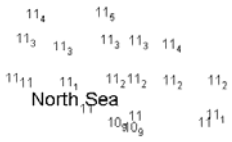
19.

Graphic example	Name	Description	Examples from the real-world
	**Point Coverage**	A discrete point coverage is characterized by a finite domain consisting of points. Generally, the domain is a set of irregularly distributed points. The principal use of discrete point coverages is to provide a basis for continuous coverage functions, where the evaluation of the continuous coverage function is accomplished by interpolation between the points of the discrete point coverage.	Sensor measurements, boreholes, trigonometric points, hydrographic soundings

Answer options:

- ☐ **2D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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20.

Graphic example	Name	Description	Examples from the real-world
	**Curve Coverage**	A discrete curve coverage is characterized by a finite spatial domain consisting of curves. Often the curves represent features such as roads, railroads or streams. They may be elements of a network.	Contour lines with elevation values, construction material on segments of a road system, streamflows associated to segments of a river

Answer options:

- ☐ **2D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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21.

Graphic example	Name	Description	Examples from the real-world
	Surface Coverage	A discrete surface coverage is a coverage whose domain consists of a collection of surfaces. Usually, the surfaces that constitute the domain are mutually exclusive and exhaustively partition the extent of the coverage. Surfaces or their boundaries may be of any shape.	Regional temperature map, maps of soil type and geology

Answer options:

- ☐ **2D**
- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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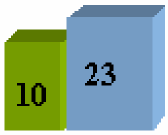
22.

Graphic example	Name	Description	Examples from the real-world
	**Solid Coverage**	A discrete solid coverage is a coverage whose domain consists of a collection of solids. Solids or their boundaries may be of any shape. Generally, the solids that constitute the domain of a coverage are mutually exclusive and exhaustively partition the extent of the coverage.	Urban buildings as a set of solids each with attributes such as building name, address, floor space and number of occupants

Answer options:

- ☐ **3D**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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23.

Graphic example	Name	Description
	**Thiessen polygons**	A Thiessen polygon encloses one of a set of points, and consists of the locations in the plane closer to that point than to any other point in the set (also called a Voronoi polygon). The continuous coverage is defined by interpolation between surrounding points. (Note that nearest-neighbour interpolation returns a constant value over each polygon, and acts like a discrete surface coverage.)

Answer options:

☐ **Yes**
☐ **Not used**
☐ **Unknown**

Your own real examples:

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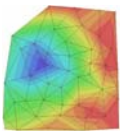
24.

Graphic example	Name	Description
	**TIN (Triangulated Irregular Network)**	A Triangulated Irregular Network (or Delaunay triangulation) partitions the plane into non-overlapping triangles with a set of defined points forming the vertices. The continuous coverage is defined by interpolation within each triangle between the points at its vertices.

Answer options:

☐ **Yes**
☐ **Not used**
☐ **Unknown**

Your own real examples:

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25.

Graphic example	Name	Description
	**Hexagonal Grid**	A hexagonal grid is a Rectified Grid of dimension two with offset vectors of equal length and directions separated by 60º. The continuous coverage is defined by interpolation between surrounding points. (Note that nearest-neighbour interpolation returns a constant value over each hexagon, and acts like a discrete surface coverage.)

Answer options:

- ☐ **Yes**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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26.

Graphic example	Name	Description
	**Segmented Curve**	A continuous curve coverage is characterized by a finite spatial domain consisting of curves and is based on interpolation along each curve.

Answer options:

- ☐ **Yes**
- ☐ **Not used**
- ☐ **Unknown**

Your own real examples:

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Free comment:

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Spatial-*temporal* coverage domains

27.

Do your coverages have a temporal component to the domain (e.g. time-series, that is data collected over a time interval, regarded as a coverage)?

☐ **Yes** ☐ **No** ☐ **Unknown**

28.

Please identify interpolation methods that you use to derive a feature attribute values at any direct position within a continuous coverage:

Are you using interpolation methods? yes / no / unknown / not applicable

☐ **Yes** ☐ **No** ☐ **Unknown**

If yes: which interpolation methods (e.g. bicubic, bilinear, Kriging, …) are you using?

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Free comment:

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5. Temporal characteristics

Although spatial information is the core of INSPIRE, temporal information plays an important role in many spatial datasets and applications as well. The analysis of reference material so far has shown that temporal information occurs and is used in diverse ways. The following questions are intended to help the Drafting Team to identify, beyond the available information from the reference material, how temporal information is used.

5a. Management of updates

The draft Directive states the requirement that the Implementing Rules shall specify "the way in which updates of the data are to be exchanged."

29.
Do you use (as a customer) or provide (as a data provider) change-only updates to existing data sets?

☐ **Yes** ☐ **No** ☐ **Unknown** ☐ **Not applicable**

If yes:
30.
How often are changes typically transferred within your organisation/community (multiple answers allowed):

☐ **Continually** ☐ **Daily** ☐ **Weekly** ☐ **Monthly**
☐ **Quarterly** ☐ **Annually** ☐ **As needed** ☐ **Irregularly**
☐ **Unknown**

31.
What are typical granularities of updates within your organisation/community (multiple answers allowed):

☐ **Changed spatial objects** ☐ **All data in a tile** ☐ **Unknown**
☐ **Other**

If other, please specify: ____

32.
What are typical mechanisms used to identify objects to be updated within your organisation/community (multiple answers allowed):

☐ **Persistent object identifier** ☐ **Persistent object identifier plus version identifier**
☐ **Filenames** ☐ **Unknown**
☐ **Other**

If other, please specify: ____

5b. Versioning of spatial objects

33.
Do you use versioning of your spatial objects in your datasets to maintain information about past states of a spatial object in a spatial dataset?

☐ **Yes** ☐ **No** ☐ **No, only full datasets are versioned**

☐ **Unknown** ☐ **Not applicable**

34.
How is versioning managed within your organisation/community (multiple answers allowed)?

☐ **Versions are tagged with start and end date/time or using a time period**
☐ **Versions are tagged with version numbers**
☐ **History of changed attribute values is maintained per attribute**
☐ **Temporal extent metadata attached to the spatial object**
☐ **New unique object identifier for every version**
☐ **Unknown**
☐ **Other**

If other, please specify: ____

35.
If time is used to distinguish between two versions of the same spatial object, which semantics is associated with the date/time (multiple answers allowed)?

☐ **Transaction time = time when the object version was inserted in the dataset**
☐ **Valid time = time when the object version became valid/occurred in the real-world**
☐ **Verification time = time when the object version was verified to be correct**
☐ **Unknown**
☐ **Other**

If other, please specify: ____

36.
Semantic meaning of time

1. If date and time information are used as values of attributes of spatial objects, please describe the different semantics that are associated with the temporal information (multiple answers allowed)?

☐ **Time of event in the real world**
☐ **Time or period of data collection / observation**
☐ **Time of insertion in the dataset**
☐ **Time of verification**
☐ **Time of publication**
☐ **Time or period for which a simulation was computed**
☐ **Unknown**
☐ **Not applicable**
☐ **Other**

If other, please specify: ____

5d. Calendars

37.
Which types of temporal reference systems are used (multiple answers allowed)?

☐ **Gregorian calendar**
☐ **360-day calendar of 30-day months for simulations**
☐ **Ordinal reference systems**

☐ **Relative time from an origin**
☐ **Unknown**
☐ **Not applicable**
☐ **Other**

If other, please specify: ______________________________

5e. Management of time series data

38.

If you manage time series data, please describe how you manage the temporal information (multiple answers allowed)?

☐ **Encoding temporal information in the dataset identifier / filename**
☐ **Temporal information is part of the dataset / file content**
☐ **Unknown**
☐ **Not applicable**
☐ **Other**

If other, please specify: ______________________________

Other comments

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