Discussion paper on INSPIRE IR's for Network Services mapping with WFS 3.0

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Introduction

Web Feature Service 3 (WFS3) is the new revision of the OGC's Web Feature Service standard for querying geospatial information on the web. It is a complete rewrite of previous versions, focusing on a simple RESTful core specified as reusable OpenAPI components with responses in JSON and HTML. The first release of the standard is available at OGC Web Feature Service 3.0 - Part 1: Core, First Draft Release

More information about WFS3 can be found from here:
https://webgate.ec.europa.eu/fpfis/wikis/display/InspireMIG/SDW-3:+WFS+3.0

The purpose of this discussion paper is to analyze how WFS3 could fit on the implementation of INSPIRE's network services, and maybe to be added as new Annex for "Technical Guidance for the implementation of INSPIRE Download Services".

The following chapters provide preliminary ideas on how the current WFS3 draft could implement the implementation rules.

This paper will be discussed during MIG-T meeting in Paris on October 25.

Get Download Service Metadata operation

IRs for Network Services	Possible implementation using WFS 3.0
The Download Service shall at least provide a **Get Download Service Metadata operation** that provides all necessary information about the service, the available Spatial Data Sets, and describes the service capabilities … … and supports the following request and response parameters:	
2.1. Get Download Service Metadata request **2.1.1. *Get Download Service Metadata request parameter*** The Get Download Service Metadata request parameter shall indicate the natural language to be used for the content of the Get Download Service Metadata response.	The request is mapped to a request to the landing page of the service (/), which contains links to the /api /conformance /collections
2.2. Get Download Service Metadata response The Get Download Service Metadata response shall contain the following sets of parameters:	
2.2.1. *Download Service Metadata parameter* The Download Service Metadata parameters shall at least contain the INSPIRE metadata elements of the Download Service.	Landing page response document consist of links. Add one link to the INSPIRE metadata
2.2.2. *Operations Metadata parameter* The Operations metadata parameter provides metadata about the operations implemented by the Download Service. It shall at least provide a description of each operation, including as a minimum a description of the data exchanged and the network address.	The operations metadata are provided by the OpenAPI description available in the /api path.
2.2.3. *Languages parameter* Two language parameters shall be provided: — the response Language parameter indicating the natural language used in the Get Download Service Metadata response parameters, — the Supported languages parameter containing the list of the natural languages supported by the Download Service.	Requires an extension to WFS3 Core. The extension would add query parameter lang={code} to /api and /collections metadata requests. Landing page response would include additional links to /api?lang={code} and /collections?lang={code} with all natural languages supported by the Download Service. The list of supported natural languages would obtained by parsing the links which isn't that pretty. Another solution would be to modify the Landing page response to include a list of the supported natural languages. This solution has the problem that the landing page would contain extra elements compare to the Core version of the document and would be sent to the client before the client has access to /conformance. Yet another solution would be to add the ?lang={code} parameter to the Landing page request as well. The client would first access the API as per usual. Then when it finds out that the /conformance includes the "Languages" extension it would request the Landing page with the ?lang={code} parameter and only then would there be language specific links and the extra "languages" array in the response. This solution has the benefit that clients unaware of the "Languages" extension wouldn't notice anything out of the ordinary.
2.2.4. *Spatial Data Sets Metadata parameters* The INSPIRE metadata elements of the available Spatial Data Sets shall be provided. In addition, for each Spatial Data Set, the list of those Coordinate Reference Systems referred to in Regulation (EU) No 1089/2010 which are available shall also be provided.	/collections and /collections/{collectionId} INSPIRE Metadata can be provided as a link in the "links" array in the response Feature Collection metadata response document. Support to additional Coordinate Reference Systems is added by the upcoming "CRS" extension. See: https://github.com/opengeospatial/WFS_FES/blob/master/extensions/crs/clause_06_crs.adoc https://github.com/opengeospatial/WFS_FES/issues/151

Get Spatial Data Set operation

IRs for Network Services	Possible implementation using WFS 3.0
The Download Service shall at least provide a **Get Spatial Data Set operation** that allows the retrieval of a Spatial Data Set …	
… and supports the following request and response parameters:	
3.1. Get Spatial Data Set request The Get Spatial Data Set request contains the following parameters:	/collections/{collectionId}/items?crs={crs-uri}&limit={highEnoughNumber}&lang={code} To request the whole dataset must require the servers to set the maximum limit to high enough number. See: https://github.com/opengeospatial/WFS_FES/issues/152
3.1.1. *Language parameter* The Language parameter shall indicate the natural language requested for the Spatial Data Set.	The "&lang=" parameter requires the additional "Languages" extension.
3.1.2. *Spatial Data Set Identifier parameter* The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the Spatial Data Set.	This can be mapped to the {collectionId} parameter in the request path.
3.1.3. *Coordinate Reference System parameter* The Coordinate Reference System parameter shall contain one of the Coordinate Reference Systems included in the list of available Coordinate Reference Systems referred to in point 2.2.4.	The "&crs=" parameter is added by the "CRS" extension. See: https://github.com/opengeospatial/WFS_FES/blob/master/extensions/crs/clause_06_crs.adoc#parameter-crs
3.2. Get Spatial Data Set response **3.2.1. *Get Spatial Data Set response parameter*** The Get Spatial Data Set response parameter shall be the requested Spatial Data Set in the requested language and in the requested Coordinate Reference System.	The request returns the requested feature collection. The *Core* conformance class does not mandate a specific encoding or format for representing features or feature collections. Four requirements classes depend on the *Core* and specify representations for these resources in commonly used encodings for spatial data on the web: • HTML, • GeoJSON, • Geography Markup Language (GML), Simple Features Profile, Level 0, and • Geography Markup Language (GML), Simple Features Profile, Level 2. The number of features returned depends on the server and the parameter limit: • The client can request a limit it is interested in. • The server likely has a default value for the limit, and a maximum limit. • If the server has any more results available than it returns (the number it returns is less than or equal to the requested/default/maximum limit) then the server will include a link to the next set of results.

Describe Spatial Data Set operation

IRs for Network Services	Possible implementation using WFS 3.0
The Download Service shall at least provide a **Describe Spatial Data Set operation** that returns the description of all the types of Spatial Objects contained in the Spatial Data Set …	
… and supports the following request and response parameters:	

4.1 Describe Spatial Data Set request The Describe Spatial Data Set request shall contain the following parameters:	/collections/{collectionId}?lang={code} To request the whole dataset must require the servers to set the maximum limit to high enough number. See: https://github.com/opengeospatial/WFS_FES/issues/152
4.1.1. *Language parameter* The Language parameter shall indicate the natural language requested for the description of the Spatial Objects type.	The "&lang=" parameter requires the additional "Languages" extension.
4.1.2. *Spatial Data Set Identifier parameter* The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the Spatial Data Set.	This can be mapped to the {collectionId} parameter in the request path.

4.2. Describe Spatial Data Set response
4.2.1. *Describe Spatial Data Set response parameter*
The Describe Spatial Data Set response parameter shall be the description of the Spatial Objects in the requested Spatial Data Set and in the requested language.
	Schema for the metadata about a feature collection
	
	`type: object`
	`required:`
	`  - name`
	`  - links`
	`properties:`
	`  name:`
	`    description: identifier of the collection used, for example, in URIs`
	`    type: string`
	`  title:`
	`    description: human readable title of the collection`
	`    type: string`
	`  description:`
	`    description: a description of the features in the collection`
	`    type: string`
	`  links:`
	`    type: array`
	`    items:`
	`      $ref: https://raw.githubusercontent.com/opengeospatial/WFS_FES/master/core/openapi/schemas/link.yaml`
	`  extent:`
	`    $ref: https://raw.githubusercontent.com/opengeospatial/WFS_FES/master/core/openapi/schemas/extent.yaml`
	`  crs:`
	`    description: the list of coordinate reference systems supported by the service; the first item is the default coordinate reference system`
	`    type: array`
	`    items:`
	`      type: string`
	`    default:`
	`      - http://www.opengis.net/def/crs/OGC/1.3/CRS84`
	
	Note The `crs` property is not used by this conformance class, but reserved for future use.

Link Download Service operation

IRs for Network Services	Possible implementation using WFS 3.0
The Download Service shall at least provide a **Link Download Service operation** that allows the declaration, by a Public Authority or a Third Party, of the availability of a Download Service for downloading Spatial Data Sets or, where practicable, Spatial Objects, through the Member State's Download Service while maintaining the downloading capability at the Public Authority or the Third Party location …	
… and supports the following request and response parameters:	
5.1. Link Download Service request **5.1.1. Link Download Service request parameter** The Link Download Service request parameter shall provide all information about the Public Authority's or Third Party's Download Service compliant with this Regulation, enabling	Same as WFS2

the Member State Download Service to provide access to Spatial Data Sets and, where practicable, to Spatial Objects from the Public Authority's or Third Party's Download Service.	

Get Spatial Object operation

IRs for Network Services	Possible implementation using WFS 3.0
Where the Download Service gives direct access to spatial data sets, it shall provide, in addition to the operations listed above, a **Get Spatial Object operation** that allows the retrieval of Spatial Objects based upon a query …	/collections/{collectionId}/items
… and supports the following request and response parameters:	
7.1.1. ***Language parameter*** The Language parameter shall indicate the natural language requested for the Spatial Objects.	Add the "Languages" extension.
7.1.2. ***Spatial Data Set Identifier parameter*** The Spatial Data Set Identifier parameter shall contain the Unique Resource Identifier of the required Spatial Data Set. Where the parameter is not provided, it shall be assumed that all available Spatial Data Sets have been selected.	This can be mapped to the {collectionId} parameter in the request path. The latter part of the requirement is not possible with WFS3 currently. The Spatial data Set parameter must be provided. There is an on-going discussion about adding a way to query features from multiple feature collections (spatial data sets) implemented like: /items?collectionId={collectionId1}(,,…,{collectionIdN}) See: https://github.com/opengeospatial/WFS_FES/issues/170 But the discussion seems to have ignored access to single features for /items?collection={collectionId}.
7.1.3. ***Coordinate Reference System parameter*** The Coordinate Reference System parameter shall contain one of the Coordinate Reference Systems included in the list of Coordinate Reference Systems set out in Regulation (EU) No 1089/2010.	CRS extension adds query parameter &crs=
7.1.4. ***Query parameter*** The query parameter shall support the following search criteria: — Unique Resource Identifier of Spatial Data Set, — all relevant key attributes and the relationship between Spatial Objects as set out in Regulation (EU) No 1089/2010; in particular the Unique Identifier of Spatial Object and the temporal dimension characteristics, including the date of update, — bounding box, expressed in any of the Coordinate Reference Systems listed in Regulation (EU) No 1089/2010, — Spatial Data Theme. To allow for discovering spatial objects through a combination of search criteria, logical and comparison operators shall be supported.	/collections/{collectionId}/items/{featureId} provides access to single uniquely identifiable feature. /collections/{collectionId}/items?bbox=x1,y1,x2,y2&bbox-crs=URI provides bounding box functionality (bbox-crs requires CRS extension) /collections/{collectionId}/items?time=start/end provides support for temporal queries. This points to date of update (beginLifespanVersion) automatically, in the same way as the bbox= points to the "main" geometry of the feature. Other relevant search criteria can be added by the service provider within the WFS3 Core. For example for a Building the "function" of the building might deemed relevant and thus made filterable for example like this: /collections/Building/items?function=123 HOWEVER! WFS3 Core does not support full searching capabilities. bbox, time and other relevant search criteria can be combined, but only by an implicit AND, e.g. &bbox=x1,y1,x2,y2&time=start/end means (bbox) AND (time). Support for full search criteria functionality is under discussion. See OGC Testbed-14 Engineering Report recommendations: https://rawgit.com/opengeospatial/D040-Complex_Feature_Handling_Engineering_Report/master/18-021.html#rec-1a

7.2 Get Spatial Object response The Get Spatial Object response shall contain the following parameters:	
7.2.1. *Spatial Objects Set parameter* The Spatial Objects Set parameter shall be the set of Spatial Objects which complies with Regulation (EU) No 1089/2010 and fulfils the search criteria in the query, in the requested language and in the Coordinate Reference System.	The actual Feature collections Response. The *Core* conformance class does not mandate a specific encoding or format for representing features or feature collections. Four requirements classes depend on the *Core* and specify representations for these resources in commonly used encodings for spatial data on the web: • HTML, • GeoJSON, • Geography Markup Language (GML), Simple Features Profile, Level 0, and • Geography Markup Language (GML), Simple Features Profile, Level 2. The number of features returned depends on the server and the parameter limit: • The client can request a limit it is interested in. • The server likely has a default value for the limit, and a maximum limit. • If the server has any more results available than it returns (the number it returns is less than or equal to the requested/default/maximum limit) then the server will include a link to the next set of results.
7.2.2. *Spatial Objects Set Metadata parameter* The Spatial Objects Set Metadata parameter shall contain at least the INSPIRE metadata elements of the set of Spatial Objects.	Feature collections Response contains links, can add metadata link easily.

Describe Spatial Object Type operation

IRs for Network Services	Possible implementation using WFS 3.0	Example
Where the Download Service gives direct access to spatial data sets, it shall provide, in addition to the operations listed above, a **Describe Spatial Object Type operation** that returns the description of the specified Spatial Objects types …	See WFS3 Core draft-1 Recommendation 7: Feature Collection Metadata response to request /collections/{collectionId} SHOULD contain a link with rel=”describedBy” if an external schema or description for the dataset exists.	
… and supports the following request and response parameters:		
8.1. Describe Spatial Object Type request The Describe Spatial Object Type request shall contain the following parameters:		
8.1.1. *Language parameter* The Language parameter shall indicate the natural language requested for the description of the Spatial Object type.	Language support requires the “Languages” extension	
8.1.2. *Spatial Object Type parameter* The Spatial Object Type parameter shall contain the language-neutral name of the Spatial Object Type as specified in Regulation (EU) No 1089/2010. Where the parameter is not provided, it shall be assumed that all types of Spatial Objects have been selected.		
8.2. Describe Spatial Object Type response **8.2.1. *Describe Spatial Object Type response parameter*** The Describe Spatial Object type response parameter shall be the description of the spatial object type, in conformity with Regulation (EU) No 1089/2010.		