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<b>Title:</b> ⓘ *	<input type="text" value="WFS support for non-CRS srsName and multiple dimension geometries"/>
<b>Source:</b> ⓘ *	*Ben Caradoc-Davies <Ben.Caradoc-Davies@csiro.au>
<b>Work item code:</b> ⓘ	
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<b>Reason for change:</b> ⓘ *	See attachment.
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<b>Summary of change:</b> ⓘ *	See attachment.
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<b>Consequences if not approved:</b> ⓘ	
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<b>Clauses affected:</b> ⓘ	* See attachment.
<b>Additional Documents affected:</b> ⓘ	
<b>Supporting Documentation:</b> ⓘ	
<b>Comments:</b> ⓘ	
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<b>Assigned To:</b> ⓘ	WFS/FES SWG ▾
<b>Disposition:</b> ⓘ	Referred ▾

## WFS support for non-CRS srsName and multiple dimension geometries

Spec: Web Feature Service 2.0 Interface Standard (also ISO 19142)  
SpecID: 442  
Specversion: 2.0  
DocNum: 09-025r1  
Title: WFS support for non-CRS srsName and multiple dimension geometries  
Source: Ben Caradoc-Davies <[Ben.Caradoc-Davies@csiro.au](mailto:Ben.Caradoc-Davies@csiro.au)>

### Reason

GML anticipates the use of non-CRS srsName and permits geometries with different srsName in a single instance document, but WFS precludes such patterns, limiting the expressivity of GML. In particular, see the note on non-CRS srsName in section 10.1.3.2 on page 56 of OGC 07-036 (GML 3.2.1).

A specific use-case in which WFS restrictions on encoded geometries is problematic is that of borehole intervals, in which it is desirable that specimens taken from the earth (cores) are georeferenced by their start and end along a curved path (down-hole depth), preserving the relationship between these specimens. GeoSciML is a GML application schema. The GeoSciML community indicate that they would like to represent borehole intervals in GML using a 1D geometry with srsName (an HTTP URI) that references another geometry, the borehole path, rather than a static CRS definition; this appears a natural fit with the information model and encoding available in GML. In effect, every borehole provides its own 1D CRS: the down-hole depth. Another example of such a 1D CRS is a GML 3.3 LinearSRS:

- <http://www.opengeospatial.org/blog/1654>
- [https://www.seegrid.csiro.au/wiki/CGIModel/BoreHolesAndObservation#Linear\\_Referencing\\_40Borehole\\_41](https://www.seegrid.csiro.au/wiki/CGIModel/BoreHolesAndObservation#Linear_Referencing_40Borehole_41)

Section 7.9.2.4.4 on page 35 and Table 11 on page 48 of OGC 09-025r1 (WFS 2.0.0) require that all geometries in a WFS response be encoded in a single CRS (either wfs:DefaultCRS or a member of wfs:OtherCRS selected with wfs:Query@srsName). This causes the following problems:

- srsName that references some shape such as a borehole curve cannot be reprojected to reference some other shape. The requirement to encode a response with a particular srsName can only be satisfied if the target srsName is the same as the storage srsName. This is a particular problem for WFS responses that contain multiple boreholes, where each feature contains a geometry with a different srsName; in this case there is no single srsName that can be used for encoding a WFS response.
- WFS responses that contain geometries of different dimensionalities cannot be encoded using a single srsName. For example, a borehole might contain a collar location that is a 2D geometry and also a 3D shape which is the path of the hole itself. The requirement that all WFS responses are encoded in a single CRS precludes the representation of this feature in a WFS response.

In a nutshell: WFS responses are more expressive if some geometries are encoded with srsName other than the target srsName of a request.

### Summary

Ease the restrictions in section 7.9.2.4.4 on page 35 and Table 11 on page 48 of OGC 09-025r1 (WFS 2.0.0) by permitting a service to encode geometries with srsName other than that requested or advertised in the capabilities document; it is anticipated that this would occur when reprojection makes no sense or geometries are of dimension incompatible with with the target srsName of a request. This modified behaviour would allow srsName to be delivered as data content, enhancing the expressivity of WFS responses.

Spatial filter queries are a more difficult problem: should a service be obliged to honour filter queries on properties that it cannot reproject? The expansion of 1D geometries into higher dimensions to support filtering is analogous to resolveDepth.

## Changes to OGC 09-025r1 (WFS 2.0.0)

### Section 7.9.2.4.4 (srsName parameter) on page 35

The optional `srsName` attribute may be used to assert a specific WFS-supported CRS transformation to be applied to the **compatible (see 7.9.2.4.4.1)** geometries of the features returned in a response document.

The value of the `srsName` parameter may be the `wfs:DefaultCRS` or any of the `wfs:OtherCRS` values listed for the feature type in a server's capabilities document (see 8.3.3). If no `srsName` value is supplied, then the **compatible** feature geometries shall be encoded in the response document using the advertised `wfs:DefaultCRS` value.

[...]

Servers that advertise more than one `wfs:OtherCRS` value in their capabilities document (see 8.3.3) shall be able to transform between the CRS used to store **features geometries** and any **compatible** CRS requested using the `srsName` attribute.

#### New section: 7.9.2.4.4.1 Compatibility of coordinate reference systems

Coordinate reference systems that differ in dimensionality or that have no defined datum transformation between them may be incompatible for the purposes of geometry coordinate conversion. Where the request `srsName` references a CRS that is incompatible with the storage CRS of a geometry property, the service shall encode that geometry property using some other CRS identified with an `srsName` attribute on that property; there is no requirement that this `srsName` attribute be `wfs:DefaultCRS` or one of those listed in `wfs:OtherCRS`.

If a filter predicate compares two geometries with incompatible CRS, the server shall generate an `InvalidParameterException`.

EXAMPLE: A feature with both 2D and 3D geometry properties is requested with `srsName` set to a 2D CRS; the 2D property is encoded in the requested CRS, and the 3D property is encoded with some 3D CRS identified in the `srsName` of the geometry.

EXAMPLE: A 1D geometry property whose coordinate is the path length along a `LineString` (itself defined in 3D with some CRS) with `gml:id="geom.123"` in the same response is encoded with `srsName="#geom.123"`.

EXAMPLE: A 1D geometry property whose coordinate is defined in an external resource is encoded with `srsName` set to an HTTP URI for that external resource.

### Table 11 Elements to describe feature types on page 48

<code>DefaultCRS</code>	<p>The <code>wfs:DefaultCRS</code> element indicates which coordinate reference system shall be used by a WFS to express the state of <b>a spatial feature compatible spatial properties</b> if not otherwise explicitly identified within a query or transaction request. For example, if a <code>GetFeature</code> request specifies no CRS value for the <code>wfs:Query srsName</code> attribute, any <b>compatible</b> spatial properties of feature data satisfying the request shall be expressed using the <code>wfs:DefaultCRS</code> value. <b>The CRS shall be encoded using the URL format defined in "Definition Identifier URNs in the OGC namespace" (see OGC 07-092r2).</b> The <code>wfs:DefaultCRS</code> shall not necessarily be the internal storage CRS used for the feature data, and therefore should not be interpreted as such. If the <code>wfs:DefaultCRS</code> is different from <b>but compatible with</b> the internal storage CRS, then the WFS shall support a transformation between the <code>wfs:DefaultCRS</code> and the internal storage CRS. The effects of such a transformation shall be considered when determining and declaring the guaranteed data accuracy.</p>
<code>OtherCRS</code>	<p>The <code>wfs:OtherCRS</code> element shall be used to indicate other supported CRSs within transaction and query requests. A 'supported CRS' means that the WFS supports the transformation of <b>compatible</b> spatial properties between the <code>wfs:OtherCRS</code> and the internal storage CRS. The effects of such a transformation shall be considered when determining and declaring the guaranteed data accuracy.</p>

### A.2.18.1 inputFormat parameter (b) on page 114 has a spurious srsName in the text

b) Test Method: Create a transaction with an insert action having the `srsName` inputFormat set to "application/gml+xml; version=3.2" and the content of the action being an invalid feature. The server should detect the invalid feature encoding and raise an exception.

### A.2.18.2 srsName parameter on page 114

Should clause (b) be modified?

#### New conformance class: CRS local resolve

The server shall be able to transform geometries whose CRS is defined in terms of a resource local to the server into the CRS of the defining resource. The server shall honour filter predicates using geometry properties defined in terms of a local resource by transforming the geometry into the CRS of the resource so that is compatible with the CRS of the other geometry in the filter predicate.

EXAMPLE: A 1D geometry "geom.1d" is defined in terms of a single coordinate whose CRS is the path length along the 3D LineString geometry "geom.123", which itself has CRS EPSG:4979 (WGS 84 3D Geocentric). That is, "geom.1d" has `srsName="#geom.123"` if they are encoded in the same document. A server implementing this conformance class declares its ability to convert the 1D points of "geom.1d" into 3D points in EPSG:4979 to satisfy filter requests.

#### New conformance class: CRS remote resolve

As for CRS local resolve, but the server shall also resolve CRS resources remote to the server.

## Changes to OGC 09-026r1 (FES 2.0.0)

### 7.8.4 Coordinate reference system handling (a) on page 26

There is a minor typographical error:

a) the two geometry values have ~~difference~~ different `srsName` values;