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Gazetteer Service Profile of the Web Feature Service Implementation Specification

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Contents

i.	Preface	iii
ii.	Submitting organizations.....	iii
iii.	Submission contact points	iv
iv.	Contributors	iv
v.	Acknowledgements.....	v
	Revision history	vi
vi.	Changes to the OpenGIS® Abstract Specification	vi
	Foreword	vii
0	Introduction	vii
0.1	Use Cases (Informative).....	vii
0.2.	Architectural Constraints (Informative).....	ix
	Query constraints	xi
	Feature Relationships	xi
1	Scope.....	1
2	Conformance.....	2
3	Normative references	2
4	Terms and definitions	2
5	Conventions.....	3
5.1	Normative verbs	3
5.2	Abbreviated terms.....	3
6	DescribeFeatureType Operation	3
6.1	Request	3
6.2	Response.....	3
6.3	Exceptions	5
6.4	Examples	5
6.4.1	Request Example.....	5
6.4.2	Response Example.....	5
7	GetFeature Operation.....	6
7.1	Request	6
7.2	Response.....	7
7.3	Exceptions	8
7.4	Examples	8
7.4.1	Request Example.....	8
7.4.2	Response Example.....	9
8	GetCapabilities Operation.....	12
8.1	Request	12
8.2	Response.....	12
8.3	Exceptions	14
8.4	Examples	14
	Annex A (normative) XML Schema definitions	15
	A.2 GetFeature Response	16
	A.3 ISO19112 Feature Types.....	17
	Annex B (normative) Conformance Tests.....	21
	Bibliography	22

i. Preface

There is growing interest in the development of a common feature-based model for access to named features, often referred to as a gazetteer. Three major activities form the basis of this specification, an OGC Discussion paper on gazetteers, an ISO draft standard for geographic identifiers, and work in the digital library community towards a common schema and access method.

As a result of the OGC Geospatial Fusion Services Testbed Phase I and the Web Mapping Testbed Phase II, an Open GIS Gazetteer Interface was defined and published as an Open GIS Discussion Paper [OGC 2001]. The standardization process in the ISO TC 211 led to a separate mature draft standard defining "Spatial referencing by geographic identifiers" [ISO19112] which defines an abstract model to be implemented by a gazetteer service. In the Alexandria Digital Library Project [ADL] a gazetteer content model and an access protocol have been designed.

The outcomes of these activities have been taken into account and a consolidated Web Gazetteer Service implementation specification has been developed. The Web Gazetteer Service is a specialized Web Feature Service that provides additional capabilities specific to a gazetteer-like feature collection. Instances within a collection of gazetteer features may be – as the terms in a thesaurus – related to each other and constitute a hierarchical vocabulary of geographic places. The overall database structure is here implemented as a GML application schema which defines a general feature type to be served by a Web Gazetteer Service. The overall design process is aligned with the data management-oriented approaches taken by the Alexandria Digital Library gazetteer service effort. A complete harmonization and profile of the Alexandria Digital Library content model remains to be completed, however preliminary analysis suggests that the GML schemas presented here provide a robust GML implementation of an ISO feature model

In addition to the capabilities of a Web Feature Server, the Web Gazetteer Service as proposed here exposes the following interfaces to query, insert, and update location instances in a gazetteer database:

- Get or Query features based on thesaurus-specific properties (broader term (BT), narrower term (NT), related term (RT))
- Retrieve properties of the gazetteer database, such as the location type class definitions and the spatial reference system definitions

ii. Submitting organizations

The following organizations submitted this Implementation Specification to the Open GIS Consortium Inc. **as a Discussion Paper**:

- a) US Federal Geographic Data Committee
- b) Canada Center for Remote Sensing
- c) Social Change Online Pty Ltd
- d) University of Bonn
- e) lat/lon

iii. Submission contact points

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iv. Contributors

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v. Acknowledgements

In addition to the contributors noted above, the OpenGIS Consortium acknowledges the direct support of the following organizations in the development of this specification.

In-Q-Tel Inc

Australian Antarctic Division

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2002-08-17 2002-08-19	0.0.4 0.0.5	Jens Fitzke, Rob Atkinson	whole document	general editing, arrangement of bibliographical references
2002-08-19	0.0.6	Rob Atkinson	Whole document	Accepted changes. Added schema illustrations. Clarified Feature Types issues.
2002-08-26	0.0.7	Jens Fitzke	Scope; examples	Added the main UML diagram from ISO DIS 19112. Updates on the examples.
2002-08-28	0.0.8	Doug Nebert	Whole document	Re-cast introduction as Web Feature Server Profile Minor edits
2002-08-28	0.0.9	Rob Atkinson	Whole document	Reconciled comments
2002-09-01	0.0.10	Rob Atkinson	Section 7	Made geographic position and extent elements a repeatable choice – updated schema and diagram. Insert OGC document number
2002-09-15	0.0.11	Jens Fitzke	examples	updated schemas and examples (namespace wfs-g and minor corrections)
2002-09-20	0.9	Rob Atkinson	Versions, contact, status	Final Edit to release as version 0.9 for public discussion

vi. Changes to the OpenGIS® Abstract Specification

The OpenGIS® Abstract Specification does not require changes to accommodate this OpenGIS® standard. It is recommended however that the Abstract Specification be extended to explicitly incorporate the ISO 19112 standards to be consistent with current practice with regards to implementation of ISO TC211 standards.

Foreword

Attention is drawn to the possibility that some of the elements of this part of OGC 02-076r3 may be the subject of patent rights. Open GIS Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Normative Annexes

Annexes A and B are normative.

0 Introduction

This document describes the OGC Web Gazetteer Server (WFS-G) operations.

Per [ISO19112] a **Gazetteer** is a "directory of instances of a class or classes of features containing some information regarding position".

A **Gazetteer Service** is here defined as a network-accessible service that retrieves one or more features (after the ISO feature model), given a query (filter) request. This filter request must support selection by well-known feature attribute values, and especially by published or context-unique identifiers.. The queryable feature attributes are any properties that describe the features, including but not limited to feature type, feature name, authority, or identification code. Each instance of a Gazetteer Service has an associated vocabulary of identifiers. Thus, a Gazetteer Service may apply to a given region, such as a country, or some other specialized grouping of features. The returned features will include one or more geometries expressed in an OGC Spatial Reference System .

This interface extends the OpenGIS Web Feature Server specification (v1.0.0) by defining additional behaviour and formalizing the response schema elements in the interests of semantic interoperability.

A Gazetteer Service exposes both a potentially structured vocabulary and a feature collection, and thus may support, with the same data structure, all the capabilities of a hierarchical vocabulary and a Web Feature Server (WFS).

0.1 Use Cases (Informative)

Navigation Use Case

In this use case, a viewer client application wishes to give the user the ability to navigate through a spatially organised information service using place names. This can be done by either allowing structured searches or by browsing a hierarchy of gazetteer terms to narrow

down search requirements. The browse tree view of such a hierarchy is the general portrayal case, and gazetteer service searches return sub-trees of varying complexity.

Although this provides a framework for rich functionality, a simple Gazetteer Service can return an unstructured list that is either the child nodes of a query term, or possibly a complete list of nodes generated by walking the tree. In the most trivial case, the tree depth is one and there is no hierarchy.

The user can then select a geographic feature of interest for a variety of actions, for example:

- 1) Zoom a map or otherwise run a query relating to the feature;
- 2) Refine navigation choices with a new list of features within the feature specified; and
- 3) Focus a locator map on a new scale, to show position of bottom most (target) term.

The interface would either build such a tree through recursive calls to the Gazetteer Service, or be able to extract a fully formed tree from a single call.

“Geocoding” Use Case

This Use Case pertains to a Geocoder Service that invokes a Gazetteer Service to extract a particular set of geometries that pertain to a given set of identifiers, which are derived from arbitrary resources.

The use of a network-accessible Gazetteer Service by a Geocoder Service may have the following advantages:

- The target vocabulary might be huge
- The target vocabulary may be highly specialized
- The target vocabulary may be partitioned across multiple nodes (e.g. use Australian Gazetteer Service to get Australian place names)
- The geometry of the Gazetteer Service may be inconvenient for the Geocoder Service to manage internally (e.g. size, multiple equivalents, on-the-fly generalization and re-projection required)

Other uses may include:

- Acquisition of a vocabulary for re-use (i.e. a generic Geoparser Service is pointed at documents containing names of water features in Uzbekistan – it might load the relevant Gazetteer Service out-of-band and cache it for some period). In this case consideration should be given to a “Gazetteer Content Standard” such as the Alexandria Digital Library Gazetteer Content Standard.

- A set of terms may be sent as a batch and a single response retrieved for improved efficiency. (Note this may simply replace the need for a Geocoder Service to remember common terms – although its own encoding of the geocoded output should re-use features.)

Service Invocation Use Case

A client or agent application performing service chaining may wish to exploit a Gazetteer Service to broaden particular search queries at run-time. For example, if the application is looking for information relevant to a particular suburb, it may wish to invoke a Gazetteer Service to find the city that contains the suburb in order to invoke a service organized by city names.

Consider the case of a tool to help locate relevant information – given a term, it might search for all synonyms of the term, thus making the term broader until a suitable result set is found. In this way, today's rather primitive Web search collections could possibly be exploited to harvest related content.

Geographic Selection Use Case

A simple use of such an interface is to access a feature collection that acts as a non-hierarchical collection of named features. A request by a client or agent may be to return all named features of a given feature type or types that fall within a specific bounding geometry. This essentially general WFS request would return features that may not have the associations present in other use cases, and are therefore all “root” nodes. This interface would be easiest to realize against spatial data sets that have no explicit relationships among features, allowing the client to use and build filters to select different sets of features.

There may be no a-priori knowledge of a desired Gazetteer Service. This knowledge may be derived at run time according to other metadata from the source feature or document. Accordingly, the client should not need to store all possible instances of Gazetteer Services, but rather needs to be able to discover them at run time, as needed.

0.2. Architectural Constraints (Informative)

The following requirements were identified from the Use Cases for Gazetteer Services.

Feature Types

For a service to be trusted as a Gazetteer it must provide Feature Types derived by extension from the well-known Feature Type “SI_LocationInstance” [former: GazetteerEntryType].

The base schema defines the naming, semantics and allowable geometric properties that a SI_LocationInstance must have. Derived schemas allow additional properties to be stored and returned without compromising the ability of clients to understand the elements in the base schema.

The base `SI_LocationInstance` also defines the syntax of an optional mechanism for describing relationships between gazetteer entries. These are typically parent-child relationships as per the ISO DIS 19112 data model.

Web Feature Server compatibility

By defining the interfaces for a Gazetteer Service to be syntactically and semantically similar to the interfaces for WFS, it is possible to then use a WFS instance, and its associated databases of features, as the underlying implementation for a general purpose Gazetteer Service. This specification defines a profile of the WFS by constraining the feature types in order to achieve in an interoperable sense the functionality described in the Use Cases above. It further defines the semantics and behaviour of an optional additional query operator, following the WFS extensibility design, to support retrieval an limited query capabilities over hierarchical relationships between Gazetteer terms.

Consistently with the Open GIS Web Services architecture, and directly derived from the proposed WFS specification, the response to a `<GetCapabilities>` request for a Gazetteer Service contains the list of supported well-known Feature Types defined for the service, as shown in [Appendix A](#).

Client applications may use the `<DescribeFeatureType>` interface to discover the specific set of properties for these Feature Types, and consequently allow additional query constraints and display of specific properties. This implies that it will be possible to construct a valid query without explicit knowledge of additional properties specific to the implementation.

Gazetteer Services require the `<GetFeature>` interface to return a set of feature instances whose types are must be listed in the `<GetCapabilities>` response and must conform to the schema returned by `<DescribeFeatureType>`.

With these interfaces, Web Service clients are able to:

- Determine if a WFS implementation is acting as a Gazetteer Service.
- Possibly query both Geocoder and Gazetteer Services in an interoperable way.
- Create extended types suitable for specific applications that can be portable.

Three interfaces apply to this version of Gazetteer Service:

- `GetCapabilities`
- `DescribeFeatureType`
- `GetFeature`

In the future, Gazetteer Services may have transactional interfaces added to enable updates by ad-hoc authorities, in which case they could optionally implement transaction interfaces like those now specified for WFS [WFS1.0.0].

Query constraints

A Gazetteer Service must be able to support spatial and thematic search constraints, per the OGC Filter Encoding Spec [[Filter1.0.0](#)].

Feature Relationships

A Gazetteer entry will exploit the GML relationship properties to implement the ISO DIS 19112 “location instance” hierarchy model (ISO 2001) such that:

- Each “location instance” may have zero or more “parent location instances” for which the “location instance” is a sub-division.
- An ISO “parent location instance” is referred in this specification as a “Broader Term” with a property identifier “BT”.
- Each “location instance” may have zero or more “child location instances” which sub-divide the “location instance”.
- An ISO “child location instance” is referred in this specification as a “Narrower Term” with a property identifier “NT”.
- Each “location instance” may have zero or more “alternative geographic identifiers” which may be used as synonyms for the “location instance”.
- ISO “alternative geographic identifiers” are referred in this specification as a “Related Term” with a property identifier “RT”.

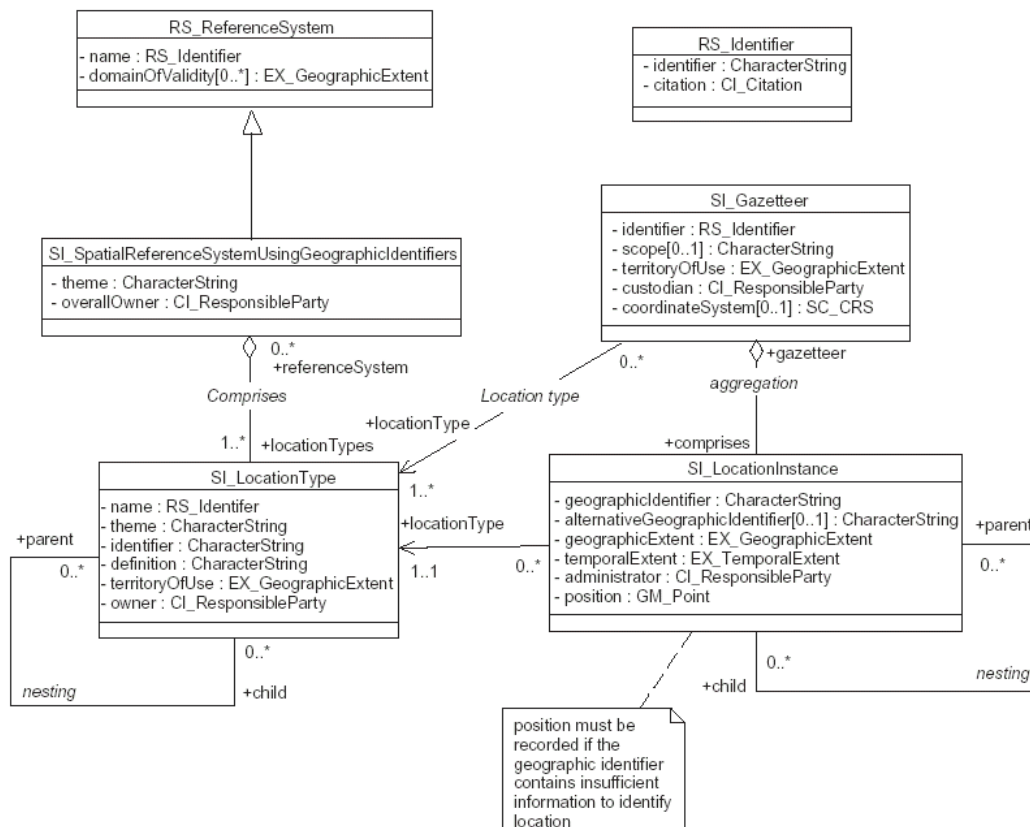
Terms addressable via a URI

The Gazetteer Service should allow feature relationships to be traversed easily. If links to remote features or relations (“featureAssociations” as defined by GML [GML2.1]) are returned in the result, they must be compliant with GML2.1.

Web Gazetteer Service Draft Implementation Specification

1 Scope

This OpenGIS® Profile specifies the OGC Web Feature Service operations for Gazetteers. Gazetteer services are considered as a specialisation or application profile of the Web Feature Server (WFS-G). Services conformant to this specification shall provide Feature Types derived by extension from the family of well-known Feature Types `SI_LocationInstance` (`SI_LocationInstance`, `SI_LocationInstance_Brief`). In Addition, they may support queries based on the (parent/child) relationships of feature instances, as defined in ISO DIS 19112. The following UML class diagram illustrates the concept of the base Feature Type `SI_LocationInstance` [ISO19112]:



The GetFeature operation of the Web Gazetteer Server returns a Feature Collection containing Features of Type `SI_LocationInstance` or a Type derived from it. The

Feature Types known to an instance of a WFS-G are returned by the DescribeFeatureType operation. Information on the gazetteer database itself (`SI_Gazetteer`) is given in the document delivered by the Get Capabilities operation.

2 Conformance

Conformance with this specification shall be checked using all the relevant tests specified in Annex B (normative). The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in ISO 19105: Geographic information — Conformance and Testing.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this **part of OGC 02-076r3**. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this **part of OGC 02-076r3** are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

[WFS1.0.0] Vretanos, Panagiotis A., ed., "Web Feature Server Implementation Specification", Version 1.0.0, Open GIS project document OGC 01-065r1

[Filter1.0.0] Vretanos, Panagiotis (ed.), "OpenGIS Implementation Specification #01-067r1: Filter Encoding Implementation Specification", May 2001

[ISO 19112] ISO TC211, "*Spatial referencing by geographic identifiers.*" (Text for DIS, ISO document ISO/TC 211 N 1172.

[GML2.1] Cox, S., Cuthbert, A., Lake, R., and Martell, R. (eds.), "OpenGIS Implementation Specification #02-009: OpenGIS® Geography Markup Language (GML) Implementation Specification, version 2.1.1", April 2002

[OGC 2001] Atkinson, R, "Draft Gazetteer Service Specification", OGC Document 01-036

4 Terms and definitions

See normative references. This specification introduces no new terms.

5 Conventions

5.1 Normative verbs

[...]

5.2 Abbreviated terms

API	Application Program Interface
ISO	International Organization for Standardization
OGC	Open GIS Consortium
XML	eXtended Markup Language
XSD	XML Schema Document
GML	Geography Markup Language
WFS	Web Feature Service

6 DescribeFeatureType Operation

The function of the **DescribeFeatureType** operation is to provide a client the means to request a schema definition of any feature type that a particular WFS-G can service. The description that is generated will define how a WFS-G expects a client application to express the state of a feature to be created or the new state of a feature to be updated. The result of a **DescribeFeatureType** request is an XML schema document, describing one or more feature types serviced by the WFS-G.

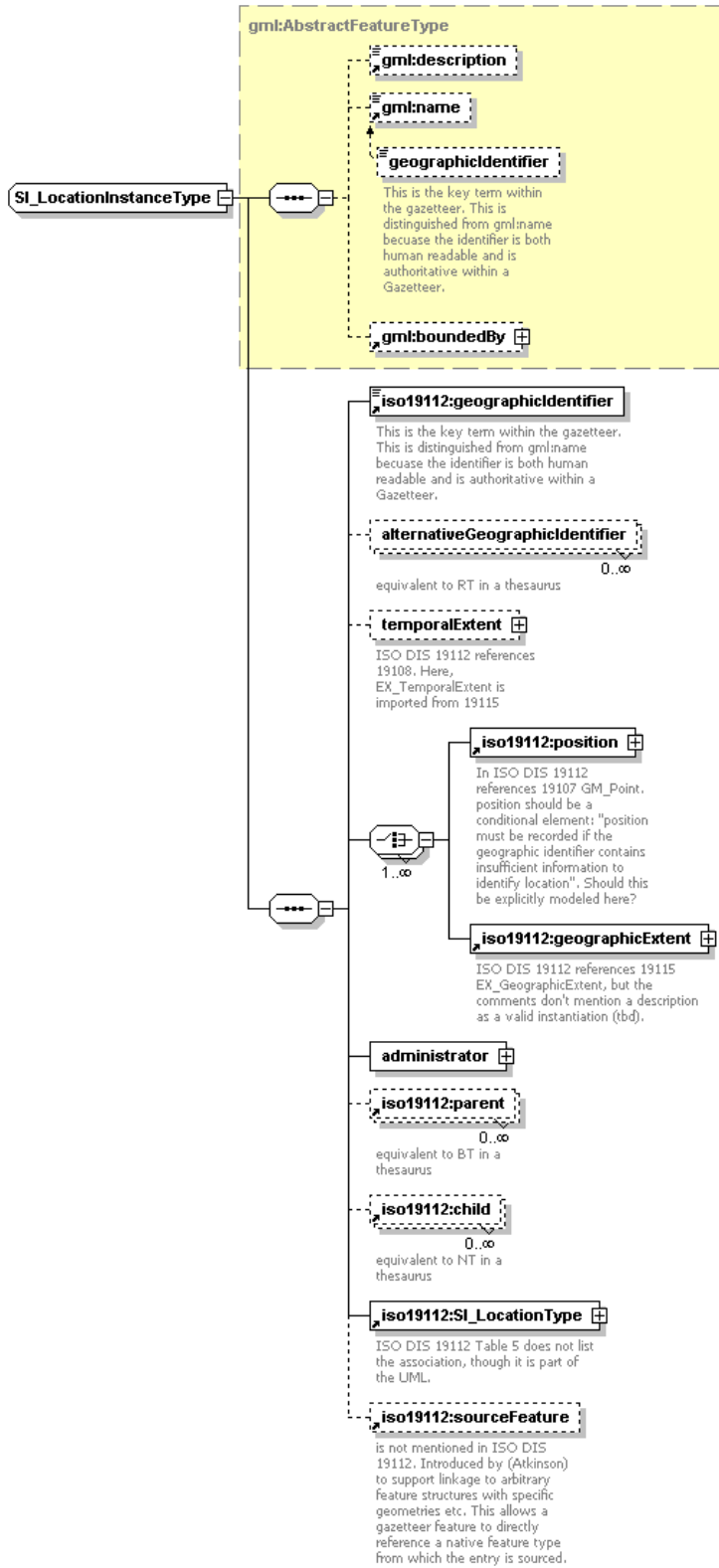
6.1 Request

This operation retrieves the well-known schema that characterises a Gazetteer Service. This operation is not strictly necessary for specialised gazetteer clients since they can exploit the well-known schema, however is required to meet the needs of general WFS clients and to conform to the WFS specification.

Refer to [WFS1.0.0]

6.2 Response

The response should map to one of the supported Feature Types. The following diagrams illustrate the well-known schemas of `SI_LocationInstance` and `SI_LocationInstance_Brief`:



Generated with XMLSpy Schema Editor www.xmlspy.com

Figure 1: View of SI_LocationInstanceType

6.3 Exceptions

6.4 Examples

6.4.1 Request Example

6.4.2 Response Example

The following schema fragment adds implementation specific Feature Types to the general gazetteer Feature Types SI_LocationInstance and SI_LocationInstance_Brief, as described in ANNEX A.2.

```

    <!-- implementation specific feature type mappings -->
    <element name="BKG_VG250" type="wgs:BKG_VG250_FeatureType"
    substitutionGroup="iso19112:SI_LocationInstance">
      <annotation>
        <documentation>An example of a private schema that extends the
    base</documentation>
      </annotation>
    </element>
    <element name="BKG_VG250_Brief" type="wgs:BKG_VG250_Brief_FeatureType"
    substitutionGroup="iso19112:SI_LocationInstance_Brief">
      <annotation>
        <documentation>An example of a private schema that extends the
    base</documentation>
      </annotation>
    </element>
    <element name="NIMA_GNS" type="wgs:NIMA_GNS_FeatureType"
    substitutionGroup="iso19112:SI_LocationInstance">
      <annotation>
        <documentation>An example of a private schema that extends the
    base</documentation>
      </annotation>
    </element>
    <element name="NIMA_GNS_Brief" type="wgs:NIMA_GNS_Brief_FeatureType"
    substitutionGroup="iso19112:SI_LocationInstance_Brief">
      <annotation>
        <documentation>An example of a private schema that extends the
    base</documentation>
      </annotation>
    </element>
    <complexType name="BKG_VG250_FeatureType">
      <complexContent>
        <extension base="iso19112:SI_LocationInstanceType"/>
      </complexContent>
    </complexType>
    <complexType name="BKG_VG250_Brief_FeatureType">
      <complexContent>
        <extension base="iso19112:SI_LocationInstance_BriefType"/>
      </complexContent>
    </complexType>
    <complexType name="NIMA_GNS_FeatureType">
      <complexContent>
        <extension base="iso19112:SI_LocationInstanceType"/>
      </complexContent>
    </complexType>
    <complexType name="NIMA_GNS_Brief_FeatureType">
      <complexContent>
        <extension base="iso19112:SI_LocationInstance_BriefType"/>
      </complexContent>
    </complexType>
  
```

7 GetFeature Operation

The basics of this operation are defined in the Web Feature Service Specification [WFS1.0.0].

The **GetFeature** operation allows retrieval of features from a Web Gazetteer Server. A **GetFeature** request is processed by a WFS-G and an XML document, containing the result set, is returned to the client.

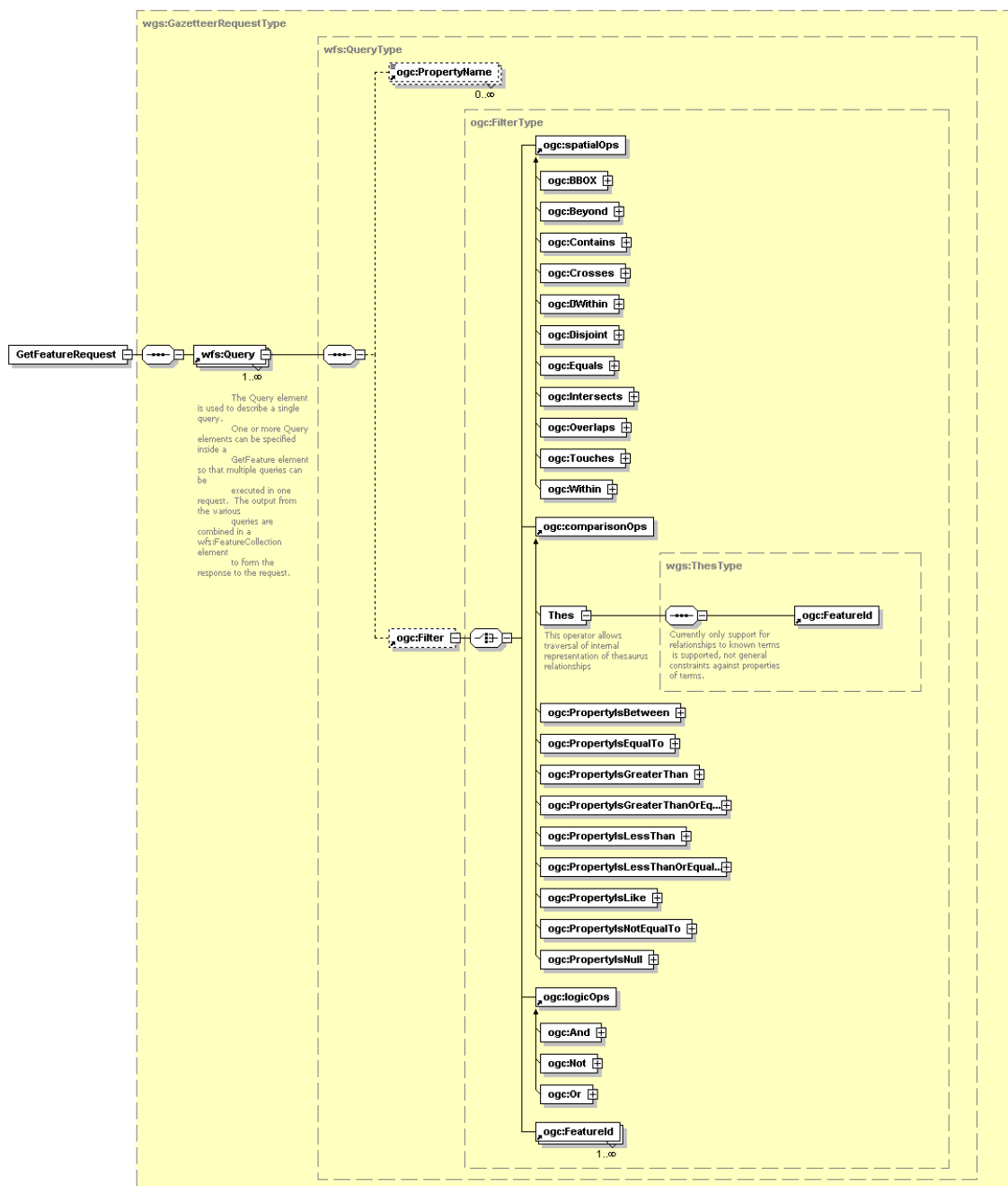
7.1 Request

This section documents only changes to the base WFS request type.

The default value for the **outputFormat** attribute is GML2 indicating that GML 2.1 shall be used.

To support the thesaurus aspect of a gazetteer the **GetFeature** operation is optionally extended by mechanisms to recursively (possibly limited to n hierarchy levels) retrieve child, parent, or related features of a given feature [or the top-most parent feature of a given feature]. To achieve this the **wfs:Filter** element is extended by the **wgs:Thes** element which is in the substitution group of **wfs:_AbstractOperator**.

The following view illustrates how this operator relates to the base WFS schema using the XML schema substitutionGroup extensibility mechanism.

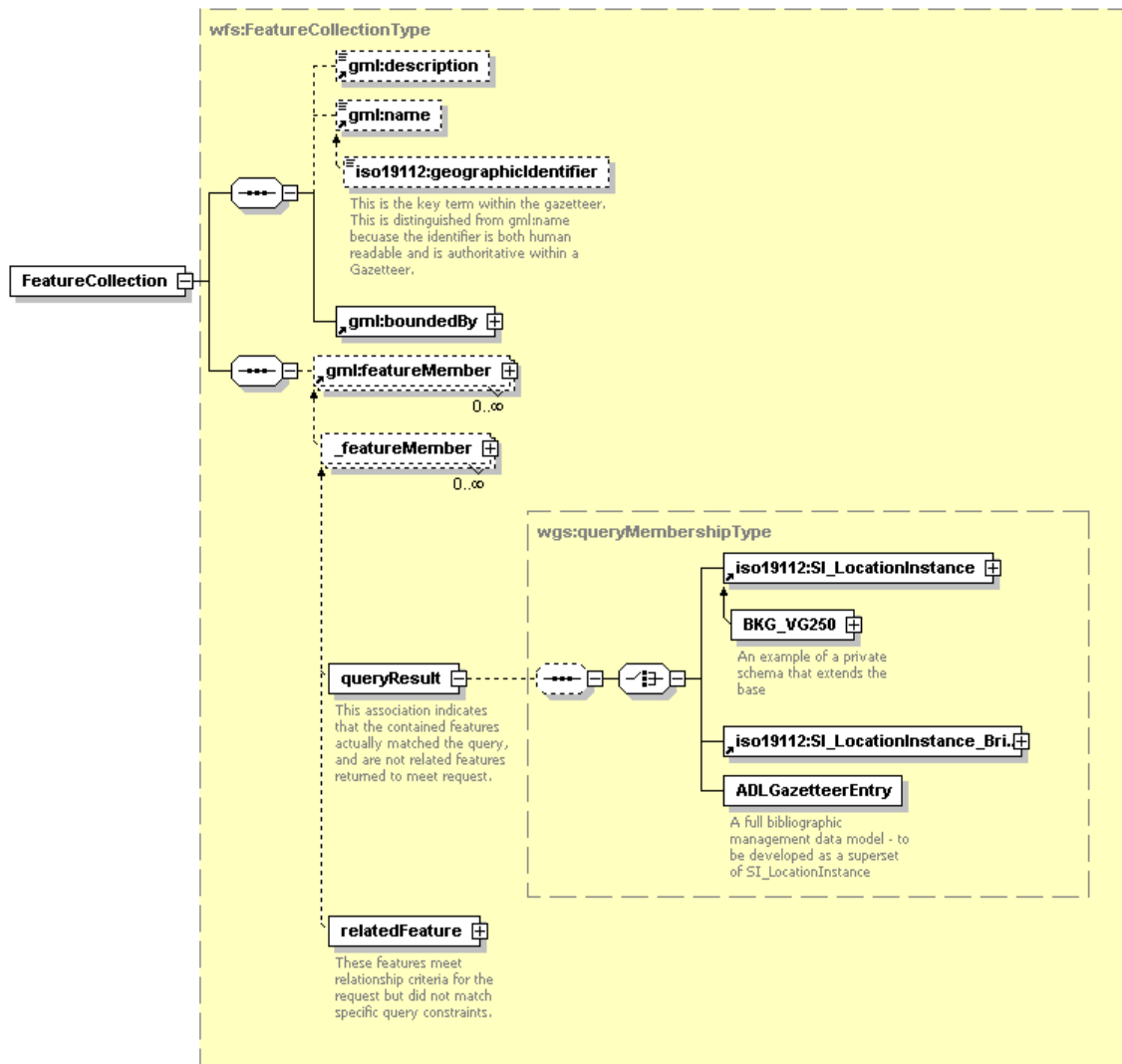


Generated with XMLSpy Schema Editor www.xmlspy.com

7.2 Response

The WFS-G returns a GML FeatureCollection which shall validate against the schema returned by the DescribeFeatureType operation. The schema returned shall define a well known Feature Type derived from iso19112:SI_LocationInstance.

The response schema is illustrated here:



Generated with XMLSpy Schema Editor www.xmlspy.com

7.3 Exceptions

Exceptions should be generated in response to ill-formed queries or system failure. Most other conditions will result in an empty result set being generated.

7.4 Examples

7.4.1 Request Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- File: example_request.xsd -->
<wfs-g:GetFeatureRequest
  xmlns:wfs-g="http://www.opengis.net/wfs-g"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:wfs="http://www.opengis.net/wfs"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.opengis.net/wfs-g ../gazetteer/0.9/WFS-
G_GetFeatureRequest.xsd" version="1.0.0" service="WFS">
```

```

<wfs:Query typeName="NIMA_GNS">
  <ogc:Filter>
    <ogc:And>
      <ogc:PropertyIsLike wildcard="*" singleChar="?" escape="\ ">
        <ogc:PropertyName>iso19112:geographicIdentifier</ogc:PropertyName>
        <ogc:Literal>Bonn*</ogc:Literal>
      </ogc:PropertyIsLike>
      <ogc:PropertyIsEqualTo>
        <ogc:PropertyName>iso19112:SI_LocationType/iso19112:identifier</ogc:PropertyName>
        <ogc:Literal>PPL</ogc:Literal>
      </ogc:PropertyIsEqualTo>
      <ogc:BBOX>
        <ogc:PropertyName>iso19112:geographicExtent</ogc:PropertyName>
        <gml:Box>
          <gml:coordinates>6.8,50 7.5,51</gml:coordinates>
        </gml:Box>
      </ogc:BBOX>
    </ogc:And>
  </ogc:Filter>
</wfs:Query>
<wfs:Query typeName="BKG_VG250">
  <ogc:Filter>
    <ogc:And>
      <ogc:PropertyIsLike wildcard="*" singleChar="?" escape="\ ">
        <ogc:PropertyName>iso19112:geographicIdentifier</ogc:PropertyName>
        <ogc:Literal>Bonn*</ogc:Literal>
      </ogc:PropertyIsLike>
      <ogc:PropertyIsEqualTo>
        <ogc:PropertyName>iso19112:SI_LocationType/iso19112:identifier</ogc:PropertyName>
        <ogc:Literal>GEM</ogc:Literal>
      </ogc:PropertyIsEqualTo>
      <ogc:BBOX>
        <ogc:PropertyName>iso19112:geographicExtent</ogc:PropertyName>
        <gml:Box>
          <gml:coordinates>6.8,50 7.5,51</gml:coordinates>
        </gml:Box>
      </ogc:BBOX>
    </ogc:And>
  </ogc:Filter>
</wfs:Query>
</wfs-g:GetFeatureRequest>

```

This example shows a thesaurus query to find the parent of an identified term (in this case "Bonn")

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- File: example_request_thes.xsd -->
<wfs-g:GetFeatureRequest xmlns:wfs-g="http://www.opengis.net/wfs-g"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:gml="http://www.opengis.net/gml"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs-g ../gazetteer/0.9/WFS-
G_GetFeatureRequest.xsd" version="1.0.0" service="WFS">
  <!-- This example shows a thesaurus query to find the parent
of an identified term (in this case "Bonn") -->
  <wfs:Query typeName="NIMA_GNS">
    <ogc:Filter>
      <wfs-g:Thes relationType="BT" hierachyLevels="1">
        <ogc:FeatureId fid="NIMA_GNS.-2447933"/>
      </wfs-g:Thes>
    </ogc:Filter>
  </wfs:Query>
</wfs-g:GetFeatureRequest>

```

7.4.2 Response Example

Example 1 illustrates the shortest form of a WFS-G response. It includes only mandatory elements of the Feature Type SI_LocationInstance_Brief. Sample Data from NIMA GNS and BKG VG250 (German Federal Agency for Cartography and Geodesy).

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- File: example_response_brief_mandatory.xml -->
<wfs-g:FeatureCollection xmlns:gml="http://www.opengis.net/gml"
xmlns:iso19112="http://www.opengis.net/iso19112" fid="ID000000" xmlns:wfs-
g="http://www.opengis.net/wfs-g" xmlns:wfs="http://www.opengis.net/wfs"
xmlns="http://www.opengis.net/wfs-g" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs-g ..\..\gazetteer\0.9\WFS-
G_GetFeatureResponse.xsd">
  <gml:boundedBy>
    <gml:Box srsName="EPSG:4326">
      <gml:coordinates cs="," decimal="." ts=" ">7,50.5 7.3,51</gml:coordinates>
    </gml:Box>
  </gml:boundedBy>
  <wfs-g:queryResult>
    <wfs-g:BKG_VG250_Brief>
      <iso19112:geographicIdentifier>Bonn</iso19112:geographicIdentifier>
      <iso19112:position>
        <gml:Point>
          <!-- to be changed to gml:pos in GML3.0 -->
          <gml:coordinates cs="," decimal="." ts=" "
">7.10993405,50.7056914</gml:coordinates>
        </gml:Point>
      </iso19112:position>
    </wfs-g:BKG_VG250_Brief>
  </wfs-g:queryResult>
  <wfs-g:queryResult>
    <wfs-g:NIMA_GNS_Brief>
      <iso19112:geographicIdentifier>Bonn</iso19112:geographicIdentifier>
      <iso19112:position>
        <gml:Point>
          <gml:coordinates cs="," decimal="." ts=" "
">7.1,50.7333333</gml:coordinates>
        </gml:Point>
      </iso19112:position>
    </wfs-g:NIMA_GNS_Brief>
  </wfs-g:queryResult>
</wfs-g:FeatureCollection>

```

Example 2 illustrates a more comprehensive response. It contains all mandatory elements of the SI_LocationInstance Feature Type plus some instances of wfs-g:relatedFeature comprising the element set of SI_LocationInstance_brief:

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- File: example_response_mandatory_plus.xml -->
<wfs-g:FeatureCollection xmlns:gml="http://www.opengis.net/gml"
xmlns:iso19112="http://www.opengis.net/iso19112"
xmlns:iso19115="http://www.isotc211.org/iso19115/" fid="ID000000" xmlns:wfs-
g="http://www.opengis.net/wfs-g" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns="http://www.opengis.net/wfs-g"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs-g
..\..\gazetteer\0.9\WFS-G_GetFeatureResponse.xsd">
  <gml:description>sample WFS-G response</gml:description>
  <gml:name>WFS-G response</gml:name>
  <gml:boundedBy>
    <gml:Box srsName="EPSG:4326">
      <gml:coordinates cs="," decimal="." ts=" ">7,50.5 7.3,51</gml:coordinates>
    </gml:Box>
  </gml:boundedBy>
  <wfs-g:queryResult>
    <wfs-g:BKG_VG250 fid="BKG_VG250.0531400000">
      <iso19112:geographicIdentifier>Bonn</iso19112:geographicIdentifier>
      <iso19112:geographicExtent>
        <iso19115:EX_BoundingPolygon>
          <iso19115:polygon>
            <iso19115:polygon>
              <gml:outerBoundaryIs>
                <gml:LinearRing>
                  <gml:coordinates cs="," decimal="." ts=" "
">7.06093344,50.6327601 7.1943768,50.6424065 7.19526636,50.642616 7.21074312,50.6497487
7.20946764,50.736821 7.20407844,50.7447356 7.19984772,50.7480007 7.1351298,50.771321
7.13182104,50.7724081 7.12523412 50.7743991 7.06712112,50.7712943 7.04855088,50.76436
7.03844532,50.7592832 7.037316,50.7582037 7.02247392,50.7066729 7.02238068,50.7063067
7.02377892 50.6613098 7.02414,50.6593798 7.02602676,50.6542991 7.05698244,50.632905
7.06093344,50.6327601</gml:coordinates>

```

```

        </gml:LinearRing>
      </gml:outerBoundaryIs>
    </iso19115:polygon>
  </iso19115:polygon>
</iso19115:EX_BoundingPolygon>
</iso19112:geographicExtent>
<iso19112:position>
  <gml:Point>
    <!-- to be changed to gml:pos in GML3.0 -->
    <gml:coordinates cs="," decimal="." ts="
">7.10993405,50.7056914</gml:coordinates>
  </gml:Point>
</iso19112:position>
<iso19112:administrator>
  <iso19115:CI_ResponsibleParty>
    <iso19115:role>
      <iso19115:CI_RoleCode_CodeList>owner</iso19115:CI_RoleCode_CodeList>
    </iso19115:role>
    <iso19115:organisationName>BKG</iso19115:organisationName>
  </iso19115:CI_ResponsibleParty>
</iso19112:administrator>
<iso19112:parent xlink:type="locator" xlink:href="#BKG_VG250.053000000"/>
<iso19112:SI_LocationType>
  <iso19112:name>Gemeinde</iso19112:name>
  <iso19112:theme>Verwaltungsgliederung der Bundesrepublik
Deutschland</iso19112:theme>
  <iso19112:identifizier>BKG:GEM</iso19112:identifizier>
  <iso19112:definition/>
  <iso19112:owner>
    <iso19115:role>
      <iso19115:CI_RoleCode_CodeList>owner</iso19115:CI_RoleCode_CodeList>
    </iso19115:role>
    <iso19115:organisationName>BKG</iso19115:organisationName>
  </iso19112:owner>
  <iso19112:territoryOfUse>
    <iso19115:EX_GeographicBoundingBox>
      <iso19115:westBoundLongitude>5</iso19115:westBoundLongitude>
      <iso19115:eastBoundLongitude>16</iso19115:eastBoundLongitude>
      <iso19115:southBoundLatitude>47</iso19115:southBoundLatitude>
      <iso19115:northBoundLatitude>56</iso19115:northBoundLatitude>
    </iso19115:EX_GeographicBoundingBox>
  </iso19112:territoryOfUse>
</iso19112:SI_LocationType>
  <iso19112:sourceFeature xlink:type="locator"
xlink:href="http://www.mywfs.org/wfs.cgi&SERVICE=WFS&VERSION=1.0.0&REQUEST=GetFeat
ure&FEATUREID=BKG_VG250_BASE.053140000"/>
  </wfs-g:BKG_VG250>
</wfs-g:queryResult>
<wfs-g:queryResult>
  <wfs-g:NIMA_GNS fid="NIMA_GNS.-2447933">
    <gml:description>sample location instance from NIMA GNS</gml:description>
    <iso19112:geographicIdentifier>Bonn</iso19112:geographicIdentifier>
    <iso19112:geographicExtent>
      <iso19115:EX_GeographicBoundingBox>
        <iso19115:westBoundLongitude>7</iso19115:westBoundLongitude>
        <iso19115:eastBoundLongitude>7.2</iso19115:eastBoundLongitude>
        <iso19115:southBoundLatitude>50.5</iso19115:southBoundLatitude>
        <iso19115:northBoundLatitude>51.2</iso19115:northBoundLatitude>
      </iso19115:EX_GeographicBoundingBox>
    </iso19112:geographicExtent>
    <iso19112:position>
      <gml:Point>
        <gml:coordinates cs="," decimal="." ts="
">7.1,50.7333333</gml:coordinates>
      </gml:Point>
    </iso19112:position>
    <iso19112:administrator>
      <iso19115:CI_ResponsibleParty>
        <iso19115:role>
          <iso19115:CI_RoleCode_CodeList>owner</iso19115:CI_RoleCode_CodeList>
        </iso19115:role>
        <iso19115:organisationName>NIMA</iso19115:organisationName>
      </iso19115:CI_ResponsibleParty>
    </iso19112:administrator>
    <iso19112:parent xlink:type="locator" xlink:href="#NIMA_GNS.CC1.GM"/>
    <iso19112:child xlink:type="locator" xlink:href="#NIMA_GNS.-2447936"/>
    <iso19112:SI_LocationType>
      <iso19112:name>Populated Place</iso19112:name>
      <iso19112:theme>Populated Place Features</iso19112:theme>
      <iso19112:identifizier>PPL</iso19112:identifizier>

```

```

</iso19112:definition/>
<iso19112:owner>
  <iso19115:role>
    <iso19115:CI_RoleCode_CodeList>owner</iso19115:CI_RoleCode_CodeList>
  </iso19115:role>
  <iso19115:organisationName>NIMA</iso19115:organisationName>
</iso19112:owner>
<iso19112:territoryOfUse>
  <iso19115:EX_GeographicBoundingBox>
    <iso19115:westBoundLongitude>-180</iso19115:westBoundLongitude>
    <iso19115:eastBoundLongitude>180</iso19115:eastBoundLongitude>
    <iso19115:southBoundLatitude>-90</iso19115:southBoundLatitude>
    <iso19115:northBoundLatitude>90</iso19115:northBoundLatitude>
  </iso19115:EX_GeographicBoundingBox>
</iso19112:territoryOfUse>
</iso19112:SI_LocationType>
<iso19112:sourceFeature xlink:type="locator"
xlink:href="http://www.mywfs.org/wfs.cgi&SERVICE=WFS&VERSION=1.0.0&REQUEST=GetFeature&FEATUREID=NIMA_GNS_BASE.-2447933"/>
</wfs-g:NIMA_GNS>
</wfs-g:queryResult>
<wfs-g:relatedFeature>
  <wfs-g:BKG_VG250_Brief fid="BKG_VG250.0530000000">
    <iso19112:geographicIdentifier>Köln
(Regierungsbezirk)</iso19112:geographicIdentifier>
    <iso19112:position>
      <gml:Point>
        <gml:coordinates cs="," decimal="." ts=" ">6.8,50.8</gml:coordinates>
      </gml:Point>
    </iso19112:position>
  </wfs-g:BKG_VG250_Brief>
</wfs-g:relatedFeature>
<wfs-g:relatedFeature>
  <wfs-g:NIMA_GNS_Brief fid="NIMA_GNS.-2447936">
    <iso19112:geographicIdentifier>Bonn-Beuel</iso19112:geographicIdentifier>
    <iso19112:position>
      <gml:Point>
        <gml:coordinates cs="," decimal="." ts=" ">7.13,50.73</gml:coordinates>
      </gml:Point>
    </iso19112:position>
  </wfs-g:NIMA_GNS_Brief>
</wfs-g:relatedFeature>
<wfs-g:relatedFeature>
  <wfs-g:NIMA_GNS_Brief fid="NIMA_GNS.CC1.GM">
    <iso19112:geographicIdentifier>Germany</iso19112:geographicIdentifier>
    <iso19112:position>
      <gml:Point>
        <gml:coordinates cs="," decimal="." ts=" ">-999,-999</gml:coordinates>
      </gml:Point>
    </iso19112:position>
  </wfs-g:NIMA_GNS_Brief>
</wfs-g:relatedFeature>
</wfs-g:FeatureCollection>

```

8 GetCapabilities Operation

8.1 Request

Refer to [WFS]

8.2 Response

[extensions to the WFS response type:]

The GetCapabilities Response of a Web Gazetteer Server shall include ISO 19112 compliant descriptions of the gazetteer database (SI_Gazetteer), the spatial reference systems

(SI_SpatialReferenceSystem) and the associated location types (SI_LocationType) as defined by the following XML Schema document fragment.

JF-2: We have to find a place for the Gazetteer element in WFS-G_Capabilities.xsd: Best solution would be an abstract element in wfs:Capability --> change proposal to WFS1.0.0?

JF-3: These descriptions may be given as an xlink reference to an external document describing SI_Gazetteer or be included in the capabilities response.

Question: Should the SI_Gazetteer instance document itself contain the descriptions of the SI_SpatialReferenceSystems and SI_LocationTypes or should it point to a document describing the SI_SpatialReferenceSystems which then points to a document describing the SI_LocationTypes?

RA-2 This is an interesting issue – where does one describe the content a service exposes. The OWS Common Architecture group has been looking at mechanisms to do this. 19131 Data Product Description is the logical candidate for this.

For now, the WFS allows a URL

```
<xsd:element name="MetadataURL" type="wfs:MetadataURLType"
minOccurs="0" maxOccurs="unbounded"/>
```

```
<xsd:complexType name="SI_GazetteerType">
  <xsd:sequence>
    <xsd:element name="identifier" type="iso19112:RS_IdentifierType"/>
    <xsd:element name="territoryOfUse">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="iso19115:_EX_GeographicExtent"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="custodian" type="iso19115:CI_ResponsiblePartyType"/>
    <xsd:element name="locationType" type="iso19112:SI_LocationTypeType"
maxOccurs="unbounded"/>
    <xsd:element name="scope" type="xsd:string" minOccurs="0"/>
    <xsd:element name="coordinateSystem" type="xsd:string" minOccurs="0">
      <xsd:annotation>
        <xsd:documentation>complex model in ISO DIS 19111. not
implemented</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="SI_LocationTypeType">
  <xsd:annotation>
    <xsd:documentation>This allows for either an inline description or a reference to
such a description. The reference is an xlink allowing both human readable labels and
definitive identifiers. A gazetteer response may optionally include a block for such
definitions.</xsd:documentation>
  </xsd:annotation>
  <xsd:choice>
    <xsd:element name="locationTypeRef" type="iso19112:TermRelationshipType"/>
    <xsd:sequence>
      <xsd:element name="name" type="iso19112:RS_IdentifierType"/>
      <xsd:element name="theme" type="xsd:string"/>
      <xsd:element name="identifier" type="xsd:string"/>
      <xsd:element name="definition" type="xsd:string"/>
      <xsd:element name="owner" type="iso19115:CI_ResponsiblePartyType"/>
      <xsd:element ref="iso19112:parent" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:choice>
</xsd:complexType>
```

```

        <xsd:element ref="iso19112:child" minOccurs="0" maxOccurs="unbounded" />
        <xsd:element name="territoryOfUse">
            <xsd:complexType>
                <xsd:sequence>
                    <xsd:element ref="iso19115:_EX_GeographicExtent" />
                </xsd:sequence>
            </xsd:complexType>
        </xsd:element>
    </xsd:sequence>
</xsd:choice>
</xsd:complexType>
<xsd:complexType name="SI_SpatialReferenceSystemType">
    <xsd:sequence>
        <xsd:element name="name" type="iso19112:RS_IdentifierType" />
        <xsd:element name="domainOfValidity"
type="iso19115:EX_GeographicBoundingBoxType" />
        <xsd:element name="theme" type="xsd:string" />
        <xsd:element name="overallOwner" type="iso19115:CI_ResponsiblePartyType" />
        <xsd:element ref="iso19112:SI_LocationType" maxOccurs="unbounded" />
    </xsd:sequence>
</xsd:complexType>

```

8.3 Exceptions

[tbd.]

8.4 Examples

[see wfs-g_additions_to_wfs_capabilities.xml for a comprehensive example of gazetteer metadata to be included in a getCapabilities response]

Annex A (normative)

XML Schema definitions

A.1 GetFeature Request

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- File: WFS-G_GetFeatureRequest.xsd -->
<schema targetNamespace="http://www.opengis.net/wfs-g" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wfs-g="http://www.opengis.net/wfs-g" xmlns:wfs="http://www.opengis.net/wfs"
xmlns="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="2.02">
  <!-- import constructs from the WFS FilterRequest schemas -->
  <import namespace="http://www.opengis.net/wfs" schemaLocation="../../wfs/1.0.0/WFS-
basic.xsd"/>
  <import namespace="http://www.opengis.net/ogc"
schemaLocation="../../filter/1.0.0/filter.xsd"/>
  <!-- define global elements -->
  <element name="GetFeatureRequest" type="wfs-g:GazetteerRequestType"
substitutionGroup="wfs:GetFeature"/>
  <element name="Thes" type="wfs-g:ThesType" substitutionGroup="ogc:comparisonOps">
    <annotation>
      <documentation>This operator allows traversal of internal representation of
thesaurus relationships</documentation>
    </annotation>
  </element>
  <!-- type definitions -->
  <complexType name="GazetteerRequestType">
    <complexContent>
      <extension base="wfs:GetFeatureType"/>
    </complexContent>
  </complexType>
  <complexType name="ThesType">
    <annotation>
      <documentation>
        This operator defines a thesaurus term relationship query. This avoids a general
purpose join syntax requirement or specific reference to an internal implementation schema. It
also provides a high degree of convenience.
      </documentation>
    </annotation>
    <sequence>
      <annotation>
        <documentation>Currently only support for relationships to known terms is
supported, not general constraints against properties of terms.</documentation>
      </annotation>
      <element ref="ogc:FeatureId">
        <annotation>
          <documentation>
            This trivial operator allows the relationships for a known feature to be
recovered simply. This can be combined with other operators to restrict the result set to
features that match certain criteria, but does not support queries like "get Capital Cities of
States within a Bounding Box". It allows you to perform "get States" then "get Capital Cities
where State = X"
          </documentation>
        </annotation>
      </element>
    </sequence>
    <attribute name="relationType" type="wfs-g:relationTypesType" use="required"/>
    <attribute name="hierachyLevels" type="integer" use="required"/>
  </complexType>
  <simpleType name="relationTypesType">
    <restriction base="string">
      <enumeration value="BT"/>
      <enumeration value="NT"/>
      <enumeration value="RT"/>
    </restriction>
  </simpleType>
</schema>
```

A.2 GetFeature Response

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- File: WFS-G_GetFeatureResponse.xsd -->
<schema targetNamespace="http://www.opengis.net/wfs-g"
xmlns:iso19112="http://www.opengis.net/iso19112" xmlns:wfs-g="http://www.opengis.net/wfs-g"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gml="http://www.opengis.net/gml" xmlns="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified">
  <annotation>
    <appinfo>GetFeatureResponse.xsd v0.2 2001-02</appinfo>
    <documentation xml:lang="en">WFS interface schema. Copyright (c) 2001 OGC, All Rights
Reserved.</documentation>
  </annotation>
  <!-- =====
Includes and Imports
===== -->
  <import namespace="http://www.opengis.net/wfs" schemaLocation="../../wfs/1.0.0/WFS-
basic.xsd"/>
  <import namespace="http://www.opengis.net/iso19112" schemaLocation="iso19112.xsd"/>
  <!-- =====
Global elements and attributes
===== -->
  <!-- =====
Root element
===== -->
  <element name="FeatureCollection" type="wfs:FeatureCollectionType"
substitutionGroup="gml:_FeatureCollection"/>
  <element name="_featureMember" type="wfs-g:queryMembershipType" abstract="true"
substitutionGroup="gml:featureMember"/>
  <element name="queryResult" type="wfs-g:queryMembershipType" substitutionGroup="wfs-
g:_featureMember">
    <annotation>
      <documentation>This association indicates that the contained features actually
matched the query, and are not related features returned to meet request.</documentation>
    </annotation>
  </element>
  <element name="relatedFeature" type="wfs-g:queryMembershipType" substitutionGroup="wfs-
g:_featureMember">
    <annotation>
      <documentation>These features meet relationship criteria for the request but did
not match specific query constraints.</documentation>
    </annotation>
  </element>
  <!-- =====
Types
===== -->
  <!-- query collection -->
  <complexType name="FeatureCollectionType">
    <annotation>
      <documentation>This constrains a gazetteer service to return recognisable feature
types conforming to well-known semantics </documentation>
    </annotation>
    <complexContent>
      <extension base="gml:AbstractFeatureCollectionType">
        <sequence>
          <element name="queryPattern" type="string" minOccurs="0">
            <annotation>
              <documentation>Optional string representation of
query</documentation>
            </annotation>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <!-- featureMembership -->
  <complexType name="queryMembershipType">
    <complexContent>
      <restriction base="gml:FeatureAssociationType">
        <sequence minOccurs="0">
          <choice>
            <element ref="iso19112:SI_LocationInstance"/>
            <element ref="iso19112:SI_LocationInstance_Brief">
              <annotation>
                <documentation>A simplified element to support a "brief"
response set for navigation purposes.</documentation>
              </annotation>
            </element>
          </choice>
        </sequence>
      </restriction>
    </complexContent>
  </complexType>

```

```

        <element name="ADLGazetteerEntry" type="wfs-g:ADLGazetteerEntryType">
          <annotation>
            <documentation>A full bibliographic management data model -
to be developed as a superset of SI_LocationInstance</documentation>
          </annotation>
        </element>
      </choice>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </restriction>
</complexContent>
</complexType>
<complexType name="ADLGazetteerEntryType">
  <annotation>
    <documentation>Model for ADL Gazetteer Content model, re-using ISO19112 compliant
terms where relevant. The ADL Gazetteer provides not only a full record but also serialisation
of a range of management and bibliographic details. Recommended for data transfer rather than
interactive Web Services. TBD</documentation>
  </annotation>
</complexType>
<!-- implementation specific feature type mappings -->
<element name="BKG_VG250" type="wfs-g:BKG_VG250_FeatureType"
substitutionGroup="iso19112:SI_LocationInstance">
  <annotation>
    <documentation>An example of a private schema that extends the
base</documentation>
  </annotation>
</element>
<element name="BKG_VG250_Brief" type="wfs-g:BKG_VG250_Brief_FeatureType"
substitutionGroup="iso19112:SI_LocationInstance_Brief">
  <annotation>
    <documentation>An example of a private schema that extends the
base</documentation>
  </annotation>
</element>
<element name="NIMA_GNS" type="wfs-g:NIMA_GNS_FeatureType"
substitutionGroup="iso19112:SI_LocationInstance">
  <annotation>
    <documentation>An example of a private schema that extends the
base</documentation>
  </annotation>
</element>
<element name="NIMA_GNS_Brief" type="wfs-g:NIMA_GNS_Brief_FeatureType"
substitutionGroup="iso19112:SI_LocationInstance_Brief">
  <annotation>
    <documentation>An example of a private schema that extends the
base</documentation>
  </annotation>
</element>
<complexType name="BKG_VG250_FeatureType">
  <complexContent>
    <extension base="iso19112:SI_LocationInstanceType"/>
  </complexContent>
</complexType>
<complexType name="BKG_VG250_Brief_FeatureType">
  <complexContent>
    <extension base="iso19112:SI_LocationInstance_BriefType"/>
  </complexContent>
</complexType>
<complexType name="NIMA_GNS_FeatureType">
  <complexContent>
    <extension base="iso19112:SI_LocationInstanceType"/>
  </complexContent>
</complexType>
<complexType name="NIMA_GNS_Brief_FeatureType">
  <complexContent>
    <extension base="iso19112:SI_LocationInstance_BriefType"/>
  </complexContent>
</complexType>
</schema>

```

A.3 ISO19112 Feature Types

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- File: iso19112.xsd -->
<xsd:schema targetNamespace="http://www.opengis.net/iso19112"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:iso19115="http://www.isotc211.org/iso19115/"
xmlns:iso19112="http://www.opengis.net/iso19112" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="2.02">
  <!-- import constructs from the GML Feature and ISO TC 211 Metadata schemas -->
  <xsd:import namespace="http://www.opengis.net/gml"
schemaLocation="../../../gml/2.1/feature.xsd"/>
  <xsd:import namespace="http://www.isotc211.org/iso19115/"
schemaLocation="../../../19115nima/iso19115.xsd"/>
  <!-- =====
global element declarations
===== -->
  <xsd:element name="SI_Gazetteer" type="iso19112:SI_GazetteerType"/>
  <xsd:element name="SI_LocationInstance" type="iso19112:SI_LocationInstanceType"
substitutionGroup="gml:_Feature"/>
  <xsd:element name="SI_LocationInstance_Brief"
type="iso19112:SI_LocationInstance_BriefType" substitutionGroup="gml:_Feature"/>
  <xsd:element name="SI_LocationType" type="iso19112:SI_LocationTypeType"/>
  <xsd:element name="SI_SpatialReferenceSystem"
type="iso19112:SI_SpatialReferenceSystemType">
    <xsd:annotation>
      <xsd:documentation>ISO DIS 19112 Table 5 does not list the association, though it
is part of the UML.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="geographicIdentifier" type="xsd:string" substitutionGroup="gml:name">
    <xsd:annotation>
      <xsd:documentation>This is the key term within the gazetteer. This is
distinguished from gml:name because the identifier is both human readable and is authoritative
within a Gazetteer.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="position">
    <xsd:annotation>
      <xsd:documentation>In ISO DIS 19112 references 19107 GM_Point. position should
be a conditional element: "position must be recorded if the geographic identifier contains
insufficient information to identify location". Should this be explicitly modeled
here?</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="gml:Point"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name="geographicExtent">
    <xsd:annotation>
      <xsd:documentation>ISO DIS 19112 references 19115 EX_GeographicExtent, but the
comments don't mention a description as a valid instantiation (tbd).</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="iso19115:_EX_GeographicExtent"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <xsd:element name="parent" type="iso19112:TermRelationshipType">
    <xsd:annotation>
      <xsd:documentation>equivalent to BT in a thesaurus</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="child" type="iso19112:TermRelationshipType">
    <xsd:annotation>
      <xsd:documentation>equivalent to NT in a thesaurus</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="sourceFeature" type="iso19112:TermRelationshipType">
    <xsd:annotation>
      <xsd:documentation>is not mentioned in ISO DIS 19112. Introduced by (Atkinson) to
support linkage to arbitrary feature structures with specific geometries etc. This allows a
gazetteer feature to directly reference a native feature type from which the entry is
sourced.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <!-- =====
type definitions
=====

```

```

===== -->
<xsd:complexType name="SI_GazetteerType">
  <xsd:sequence>
    <xsd:element name="identifier" type="iso19112:RS_IdentifierType"/>
    <xsd:element name="territoryOfUse">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="iso19115:_EX_GeographicExtent"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="custodian" type="iso19115:CI_ResponsiblePartyType"/>
    <xsd:element name="locationType" type="iso19112:SI_LocationTypeType"
maxOccurs="unbounded"/>
    <xsd:element name="scope" type="xsd:string" minOccurs="0"/>
    <xsd:element name="coordinateSystem" type="xsd:string" minOccurs="0">
      <xsd:annotation>
        <xsd:documentation>complex model in ISO DIS 19111. not
implemented</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="SI_LocationInstanceType">
  <xsd:complexContent>
    <xsd:extension base="gml:AbstractFeatureType">
      <xsd:sequence>
        <xsd:element ref="iso19112:geographicIdentifier"/>
        <xsd:element name="alternativeGeographicIdentifier"
type="iso19112:TermRelationshipType" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:annotation>
          <xsd:documentation>equivalent to RT in a
thesaurus</xsd:documentation>
        </xsd:annotation>
        </xsd:element>
        <xsd:element name="temporalExtent" type="iso19115:EX_TemporalExtentType"
minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>ISO DIS 19112 references 19108. Here,
EX_TemporalExtent is imported from 19115</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:choice maxOccurs="unbounded">
          <xsd:element ref="iso19112:position"/>
          <xsd:element ref="iso19112:geographicExtent">
            <xsd:annotation>
              <xsd:documentation>TDB - should we support optional multiple
bounding boxes or a single one? Restricted to one to meet UML and minimise semantic
variability bewteen implementations.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:choice>
        <xsd:element name="administrator">
          <xsd:complexType>
            <xsd:sequence>
              <xsd:element ref="iso19115:CI_ResponsibleParty"/>
            </xsd:sequence>
          </xsd:complexType>
        </xsd:element>
        <xsd:element ref="iso19112:parent" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="iso19112:child" minOccurs="0" maxOccurs="unbounded"/>
        <xsd:element ref="iso19112:SI_LocationType"/>
        <xsd:element ref="iso19112:sourceFeature" minOccurs="0"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SI_LocationInstance_BriefType">
  <xsd:annotation>
    <xsd:documentation>This is used to provide the equivalent of a brief result set,
allowing basic lookup and navigation functions to be performed without full provenance or
geometry overheads.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="gml:AbstractFeatureType">
      <xsd:sequence>
        <xsd:element ref="iso19112:geographicIdentifier"/>
        <xsd:choice maxOccurs="unbounded">
          <xsd:element ref="iso19112:position"/>
          <xsd:element ref="iso19112:geographicExtent">

```

```

        <xsd:annotation>
          <xsd:documentation>TDB - should we support optional multiple
bounding boxes or a single one? Restricted to one to meet UML and minimise semantic
variability bewteen implementations.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:choice>
    <xsd:element ref="iso19112:SI_LocationType" minOccurs="0"/>
    <xsd:element ref="iso19112:sourceFeature" minOccurs="0"/>
    <xsd:element ref="iso19112:parent" minOccurs="0"/>
    <xsd:element ref="iso19112:child" minOccurs="0"/>
  </xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="SI_LocationTypeType">
  <xsd:annotation>
    <xsd:documentation>This allows for either an inline description or a reference to
such a description. The reference is an xlink allowing both human readable labels and
definitive identifiers. A gazetteer response may optionally include a block for such
definitions.</xsd:documentation>
  </xsd:annotation>
  <xsd:choice>
    <xsd:element name="locationTypeRef" type="iso19112:TermRelationshipType"/>
  </xsd:sequence>
    <xsd:element name="name" type="iso19112:RS_IdentifierType"/>
    <xsd:element name="theme" type="xsd:string"/>
    <xsd:element name="identifier" type="xsd:string"/>
    <xsd:element name="definition" type="xsd:string"/>
    <xsd:element name="owner" type="iso19115:CI_ResponsiblePartyType"/>
    <xsd:element ref="iso19112:parent" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="iso19112:child" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element name="territoryOfUse">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="iso19115:_EX_GeographicExtent"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
  </xsd:sequence>
</xsd:choice>
</xsd:complexType>
<xsd:complexType name="SI_SpatialReferenceSystemType">
  <xsd:sequence>
    <xsd:element name="name" type="iso19112:RS_IdentifierType"/>
    <xsd:element name="domainOfValidity"
type="iso19115:EX_GeographicBoundingBoxType"/>
    <xsd:element name="theme" type="xsd:string"/>
    <xsd:element name="overallOwner" type="iso19115:CI_ResponsiblePartyType"/>
    <xsd:element ref="iso19112:SI_LocationType" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="TermRelationshipType">
  <xsd:attributeGroup ref="xlink:locatorLink"/>
</xsd:complexType>
<xsd:simpleType name="RS_IdentifierType">
  <xsd:annotation>
    <xsd:documentation>ISO DIS 19112 references RS_Identifier (but not from ISO DIS
19115). The allowable values are free text.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string"/>
</xsd:simpleType>
</xsd:schema>

```

A.4 GetCapabilitiesResponse

[TDB we need an extension to the WFS here, if a WFS-G should provide "gazetteer metadata" as described in ISO DIS 19112: attributes of the Gazetteer, the SI_LocationTypes, and the SI_SpatialReferenceSystem]

Annex B (normative)

Conformance Tests

The following indicative tests supplement those that apply to conformance to the WFS specification in general.

Test 1: Compliance with Gazetteer profile: SI_LocationInstance

A WFS-G service shall support queries and return results against one or more FeatureTypes defined as or derived by extension from the SI_LocationInstanceType

Test 2: Compliance with wgs:Thes filter operation

If a WFS-G advertises support for the wgs:Thes operation, then a query containing an expression using this

Bibliography

[ADL] Alexandria Digital Library: Gazetteer Content Standard

[GML 3] GML version 3.0 draft