

Open Geospatial Consortium

Date: November 7, 2011

Reference number of this document: OGC 11-085r1

Category: Public Engineering Report

Editor: Panagiotis (Peter) A. Vretanos

OGC[®] OWS-8 Bulk Geodata Transfer Using GML Engineering Report

Copyright © 2011 Open Geospatial Consortium.

To obtain additional rights of use, visit <http://www.opengeospatial.org/legal/>.

Warning

This document is not an OGC Standard. This document is an OGC Public Engineering Report created as a deliverable in an OGC Interoperability Initiative and is not an official position of the OGC membership. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an OGC Standard. Further, any OGC Engineering Report should not be referenced as required or mandatory technology in procurements.

Document type:	OGC [®] Engineering Report
Document subtype:	NA
Document stage:	Approved for public release
Document language:	English

Preface

This document describes methods and apparatus for the bulk transfer of geo-data between systems that may or may not be connected by a network. Two approaches for satisfying this requirement are described in this document and it is anticipated that this document shall eventually be submitted to OGC to become an adopted technical standard.

This document is a deliverable for the OGC Web Services 8 (OWS-8) testbed activity. OWS testbeds are part of OGC's Interoperability Program, a global, hands-on and collaborative prototyping program designed to rapidly develop, test and deliver proven candidate standards or revisions to existing standards into OGC's Standards Program, where they are formalized for public release. In OGC's Interoperability Initiatives, international teams of technology providers work together to solve specific geoprocessing interoperability problems posed by the Initiative's sponsoring organizations. OGC Interoperability Initiatives include test beds, pilot projects, interoperability experiments and interoperability support services - all designed to encourage rapid development, testing, validation and adoption of OGC standards.

The OWS-8 sponsors are organizations seeking open standards for their interoperability requirements. After analyzing their requirements, the OGC Interoperability Team recommend to the sponsors that the content of the OWS-8 initiative be organized around the following threads:

- * Observation Fusion
- * Geosynchronization (Gsync)
- * Cross-Community Interoperability (CCI)
- * Aviation

More information about the OWS-8 testbed can be found at:

<http://www.opengeospatial.org/standards/requests/74>

OGC Document [11-139] “OWS-8 Summary Report” provides a summary of the OWS-8 testbed and is available for download:

https://portal.opengeospatial.org/files/?artifact_id=46176

.

Contents

Page

Contents

1	Introduction.....	1
1.1	Scope	1
1.2	Document contributor contact points	1
1.3	Revision history.....	1
1.4	Future work	2
1.4.1	Geodata Bulk Transfer format	2
1.5	Forward	2
2	References.....	2
3	Terms and definitions	3
4	Conventions	7
4.1	Abbreviated terms	7
4.2	UML notation	8
5	Geodata Bulk Transfer format	8
5.1	Introduction	8
5.2	GBT File Format	9
5.3	The manifest file.....	10
5.4	The global metadata file	12
5.5	The components of a feature set.....	12
5.5.1	Introduction.....	12
5.5.2	XML schema.....	12
5.5.3	GML feature collection.....	12
5.5.4	ISO 19115 metadata.....	12
5.5.5	Styled Layer Descriptor	13
5.6	Components of a named topology set	13
5.6.1	Introduction.....	13
5.6.2	Topology schema	13
5.6.3	Topology data	13
5.6.4	Topology metadata.....	14
5.7	Exporting	14
5.8	Importing	15

License Agreement

Permission is hereby granted by the Open Geospatial Consortium, Inc. ("Licensor"), free of charge and subject to the terms set forth below, to any person obtaining a copy of this Intellectual Property and any associated documentation, to deal in the Intellectual Property without restriction (except as set forth below), including without limitation the rights to implement, use, copy, modify, merge, publish, distribute, and/or sublicense copies of the Intellectual Property, and to permit persons to whom the Intellectual Property is furnished to do so, provided that all copyright notices on the intellectual property are retained intact and that each person to whom the Intellectual Property is furnished agrees to the terms of this Agreement.

If you modify the Intellectual Property, all copies of the modified Intellectual Property must include, in addition to the above copyright notice, a notice that the Intellectual Property includes modifications that have not been approved or adopted by LICENSOR.

THIS LICENSE IS A COPYRIGHT LICENSE ONLY, AND DOES NOT CONVEY ANY RIGHTS UNDER ANY PATENTS THAT MAY BE IN FORCE ANYWHERE IN THE WORLD.

THE INTELLECTUAL PROPERTY IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE INTELLECTUAL PROPERTY WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE INTELLECTUAL PROPERTY WILL BE UNINTERRUPTED OR ERROR FREE. ANY USE OF THE INTELLECTUAL PROPERTY SHALL BE MADE ENTIRELY AT THE USER'S OWN RISK. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR ANY CONTRIBUTOR OF INTELLECTUAL PROPERTY RIGHTS TO THE INTELLECTUAL PROPERTY BE LIABLE FOR ANY CLAIM, OR ANY DIRECT, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM ANY ALLEGED INFRINGEMENT OR ANY LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR UNDER ANY OTHER LEGAL THEORY, ARISING OUT OF OR IN CONNECTION WITH THE IMPLEMENTATION, USE, COMMERCIALIZATION OR PERFORMANCE OF THIS INTELLECTUAL PROPERTY.

This license is effective until terminated. You may terminate it at any time by destroying the Intellectual Property together with all copies in any form. The license will also terminate if you fail to comply with any term or condition of this Agreement. Except as provided in the following sentence, no such termination of this license shall require the termination of any third party end-user sublicense to the Intellectual Property which is in force as of the date of notice of such termination. In addition, should the Intellectual Property, or the operation of the Intellectual Property, infringe, or in LICENSOR's sole opinion be likely to infringe, any patent, copyright, trademark or other right of a third party, you agree that LICENSOR, in its sole discretion, may terminate this license without any compensation or liability to you, your licensees or any other party. You agree upon termination of any kind to destroy or cause to be destroyed the Intellectual Property together with all copies in any form, whether held by you or by any third party.

Except as contained in this notice, the name of LICENSOR or of any other holder of a copyright in all or part of the Intellectual Property shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Intellectual Property without prior written authorization of LICENSOR or such copyright holder. LICENSOR is and shall at all times be the sole entity that may authorize you or any third party to use certification marks, trademarks or other special designations to indicate compliance with any LICENSOR standards or specifications.

This Agreement is governed by the laws of the Commonwealth of Massachusetts. The application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods is hereby expressly excluded. In the event any provision of this Agreement shall be deemed unenforceable, void or invalid, such provision shall be modified so as to make it valid and enforceable, and as so modified the entire Agreement shall remain in full force and effect. No decision, action or inaction by LICENSOR shall be construed to be a waiver of any rights or remedies available to it.

None of the Intellectual Property or underlying information or technology may be downloaded or otherwise exported or reexported in violation of U.S. export laws and regulations. In addition, you are responsible for complying with any local laws in your jurisdiction which may impact your right to import, export or use the Intellectual Property, and you represent that you have complied with any regulations or registration procedures required by applicable law to make this license enforceable.

OGC® OWS-8 Bulk Geodata Transfer

1 Introduction

1.1 Scope

This document describes the work done during the OWS-8 test bed investigating methods and apparatus for distributing individual geospatial data sets and/or collections of data sets in a consistent manner between machines that may or may not be connected via a network. The investigation focuses on the initialization of a target WFS, from a source WFS, for the purpose of GeoSynchronization. Data, schema, metadata and/or topology are exported from a source WFS, transferred to a target WFS (either electronically or physically via some media) and then imported into the target WFS. From that point on, the two WFS's are maintained in synchrony using a Geosynchronization Service (see OGC 10-069r2).

Two approaches for the bulk transfer of geo-data were investigated.

The first approach, called Geodata Bulk Transfer (GBT), defines a container format that is ZIP compressed and contains feature data, feature schema and topology encoded using GML and metadata encoded using ISO19115.

The second approach, called Geodatabase API, uses ESRI's file Geodatabase format which is accessed using the newly published Geodatabase API. This approach is described in a separate OGC Engineering Report.

1.2 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

Name	Organization	Email
Keith Pomakis	CubeWerx Inc.	pomakis[at]cubewerx.com
Panagiotis (Peter) A. Vretanos	CubeWerx Inc.	pvretano[at]cubewerx.com

1.3 Revision history

Date	Release	Editor	Primary clauses modified	Description
2011-07-18	0.0.1	PAV	All	Initial creation.

1.4 Future work

1.4.1 Geodata Bulk Transfer format

For the GBT format, the work in the OWS-8 test bed primarily focused on transferring feature schema and data from a source WFS to a target WFS to initialize the WFS for GeoSynchronization. Other aspects of bulk geo-data transfer – transferring topology and metadata – were not exercised during the test bed because the available topology was not available in a form easily encoded in GML and metadata, while desirable, was not primarily necessary in achieving the goal of initializing a target WFS for GeoSynchronization.

The disconnect in transferring topology was related to the fact that GML topology is based on encoding nodes, edges and faces while the available topology was rules-based which GML does not currently support. Future work might involve proposing an extension to GML for encoding rule-based topology.

1.5 Forward

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

2 References

The following documents are referenced in this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

ISO/TS 19103:2005, Geographic information — Conceptual schema language

ISO 19136:2007, Geographic information — Geography Markup Language (GML)

ISO 19143:2010, Geographic information — Filter Encoding

OGC 06-121r3, OGC Web Services Common Specification, OGC® Implementation Standard (9 February 2009)

OGC 07-092r3, Definition identifier URNs in OGC namespace, OGC® Best Practices (15 January 2009)

OGC 09-025r1, Web Feature Service 2.0 Interface Standard (02 November 2010)

W3C Extensible Markup Language (XML) 1.0 (Fifth Edition) (26 November 2008)

W3C XML Namespaces, Namespaces in XML, W3C Recommendation (14 January 1999)

W3C XML Schema Part 1, *XML Schema Part 1: Structures*, W3C Recommendation (2 May 2001)

W3C XML Schema Part 2, *XML Schema Part 2: Datatypes*, W3C Recommendation (2 May 2001)

In addition to this document, this report includes several XML Schema Document files as specified in Annex A.

3 Terms and definitions

For the purposes of this report, the definitions specified in Clause 4 of the OWS Common Implementation Specification [OGC 06-121r3] shall apply. In addition, the following terms and definitions apply.

3.1

attribute <XML>

name-value pair contained in an element (4.6)

[ISO 19136:2007, definition 4.1.3]

NOTE In this document an attribute is an XML attribute unless otherwise specified.

3.2

client

software component that can invoke an operation (4.17) from a server (4.28)

[ISO 19128:2005, definition 4.1]

3.3

coordinate

one of a sequence of n numbers designating the position of a point in n-dimensional space

[ISO 19111:2007, definition 4.5]

3.4

coordinate reference system

coordinate system (4.5) that is related to an object by a datum

[ISO 19111:2007, definition 4.8]

3.5

coordinate system

set of mathematical rules for specifying how coordinates (4.3) are to be assigned to points
[ISO 19111:2007, definition 4.10]

3.6

element <XML>

basic information item of an XML document containing child elements, attributes (4.1) and character data
[ISO 19136:2007, definition 4.1.23]

3.7

feature

abstraction of real world phenomena
[ISO 19101:2002, definition 4.11]

NOTE A feature can occur as a type or an instance. The term "feature type" or "feature instance" should be used when only one is meant.

3.8

feature identifier

identifier that uniquely designates a feature (4.7) instance

3.9

filter expression

predicate expression encoded using XML
[ISO 19143, definition 4.11]

3.10

interface

named set of operations (4.17) that characterize the behaviour of an entity
[ISO 19119:2005, definition 4.2]

3.11

join predicate

filter expression (4.9) that includes one or more clauses that constrain properties from two different entity types
[ISO 19143, definition 4.16]

NOTE In this International Standard, the entity types will be feature (4.7) types.

3.12

join tuple

set of two or more object instances that satisfy a filter that includes join predicates (4.11)
NOTE In this International Standard, the object instances will be feature (4.7) instances.

3.13

local resource

resource that is under the direct control of a system

NOTE In this International Standard, the system is a web feature service and the resource is held in a data store that is directly controlled by that service.

3.14**locator attribute**

attribute (4.1) whose values is a reference to a local resource (4.13) or remote resource (4.20)

NOTE In XML, this attribute is commonly called an href and contains a URI reference to the remote resource (see W3C XLink).

3.15**Multipurpose Internet Mail Extensions (MIME) type**

media type and subtype of data in the body of a message that designates the native representation (canonical form) of such data

[IETF RFC 2045:1996]

3.16**namespace <XML>**

collection of names, identified by a URI reference which are used in XML documents as element (4.6) names and attribute (4.1) names

[W3C XML Namespaces:1999]

3.17**operation**

specification of a transformation or query that an object may be called to execute

[ISO 19119:2005, definition 4.3]

3.18**property**

facet or attribute of an object, referenced by a name

[ISO 19143:2010, definition 4.21]

3.19**resource**

asset or means that fulfils a requirement

[ISO 19143, definition 4.23]

NOTE In this International Standard, the resource is a feature (4.7), or any identifiable component of a feature (e.g. a property of a feature)

3.20**remote resource**

resource that is not under direct control of a system

NOTE In this International Standard, the system is a web feature service. The resource is not held in any data store that is directly controlled by that service and thus cannot be directly retrieved by the service.

3.21

request

invocation of an operation (4.17) by a client (4.2)
[ISO 19128:2005, definition 4.10]

3.22

relocate

<reference> update a reference to a resource that has been moved or copied to a new location

EXAMPLE A server (4.28) is generating a response (4.24) to a GetFeature request (4.21), it has to copy a referenced feature (4.7) into the response document and the server has to "relocate" the original link contained in the referencing feature to the copy placed in the response document.

3.23

resolve

retrieval of a referenced resource and its insertion into a server-generated response document

NOTE The insertion may be accomplished by either replacing the reference in-line with a copy of the resource or by relocating the reference to point to a copy of the resource that has been placed in the response document.

3.24

response

result of an operation (4.17) returned from a server (4.28) to a client (4.2)
[ISO 19128:2005, definition 4.11]

3.25

response model

schema (4.26) defining the properties of each feature (4.7) type that can appear in the response (4.24) to a query operation (4.17)

NOTE This is the schema of feature types that a client (4.2) can obtain using the DescribeFeatureType operation (see Clause 9).

3.26

schema

formal description of a model
[ISO 19101:2002, definition 4.25]

NOTE In general, a schema is an abstract representation of an object's characteristics and relations to other objects. An XML schema represents the relationship between the attributes (4.1) and elements (4.6) of an XML object (for example, a document or a portion of a document).

3.27

schema <XML Schema>

collection of schema (4.26) components within the same target namespace (4.16)
[ISO 19136:2007, definition 4.1.54]

EXAMPLE Schema components of W3C XML Schema are types, elements (4.16), attributes (4.1), groups, etc.

3.28**server**

particular instance of a service (4.29)
[ISO 19128:2005, definition 4.12]

3.29**service**

distinct part of the functionality that is provided by an entity through interfaces (4.10)
[ISO 19119:2005, definition 4.1]

3.30**service metadata**

metadata describing the operations (4.17) and geographic information available at a server (4.28)
[ISO 19128:2005, definition 4.14]

3.31**traversal**

<XML> using or following an XLink link for any purpose
[W3C XLink:2001]

3.32**tuple**

ordered list of values
[ISO 19136:2007, definition 4.1.63]
NOTE In this International Standard, the order list will generally be a finite sequence for features (4.7), each of a specific feature type.

3.33**Uniform Resource Identifier**

unique identifier for a resource, structured in conformance with IETF RFC 2396
[ISO 19136:2007, definition 4.1.65]
NOTE The general syntax is <scheme>::<scheme-specified-part>. The hierarchical syntax with a namespace (4.16) is <scheme>://<authority><path>?<query>

4 Conventions**4.1 Abbreviated terms**

API	Application Program Interface
CRS	Coordinate Reference System
DCP	Distributed Computing Platform
EPSG	European Petroleum Survey Group

FES	Filter Encoding Specification
GBT	Geodata Bulk Transfer format
GML	Geography Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Secure Hypertext Transfer Protocol
IETF	Internet Engineering Task Force
MIME	Multipurpose Internet Mail Extensions
OGC	Open Geospatial Consortium
OWS	OGC Web Service
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
WFS	Web Feature Service
XML	Extensible Markup Language

4.2 UML notation

T.B.D.

5 Geodata Bulk Transfer format

5.1 Introduction

Results from previous GSS activities indicate that introducing a WFS service into a GSS framework can be a very complicated and time-consuming task. This is further complicated when the initialization process involves loading a large volume of Geodata on a WFS service over an unreliable Web network with poor or very low bandwidth. In such a situation, a “sneaker network” may be the only alternative to supporting the initialization process.

In order to support this scenario, CubeWerx has developed a Geodata Bulk Transfer (GBT) file format. The intent is that a data set can be exported from the source WFS into a GBT file. This GBT file can then be transferred to the site of the destination WFS by whatever means available, and then imported into the destination WFS.

This mechanism requires the existence of a GBT export utility at or near the site of the source WFS and a GBT import utility at or near the site of the destination WFS. While

implementations of such utilities have been developed by CubeWerx over the course of the project and are being made available to demonstrate the GBT mechanism, it is not the purpose of this proposal to promote or define any particular implementation. In the context of the GBT transfer mechanism, the source WFS, the destination WFS, the GBT export utility and the GBT import utility are all multi-vendor black boxes. Therefore, this proposal focuses only on the GBT file format itself.

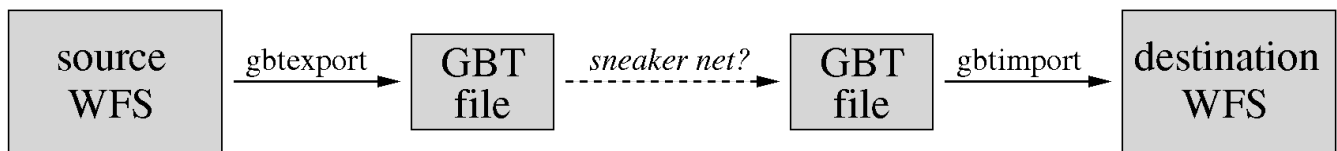


Figure 1 – GBT export/import chain

5.2 GBT File Format

A GBT file is a standard ZIP archive file that contains the following set of files (with no directory structure):

```
ows-manifest.xml

gbt_metadata.xml

featureSet1.gml
featureSet1.xsd
featureSet1_meta.xml

featureSet2.gml
featureSet2.xsd
featureSet2_meta.xml

[...]

namedTopology1.gml
namedTopology1.xsd
namedTopology_meta.xml

namedTopology2.gml
namedTopology2.xsd
namedTopology2_meta.xml

[...]
```

The ZIP archive format was chosen for a number of reasons:

1. There is extensive support for this type of archive format, and it has a rich history of being co-opted for specific-purpose archives. For example, it is the archive format used by the OpenDocument, Java Archive (JAR) and EPUB standards.
2. ZIP archives contain 32-bit CRC checksum information to support data integrity.
3. Compression (on a file-by-file basis) is natively supported by the ZIP archive format.
4. Files within a ZIP archive can be randomly accessed without having to UNZIP the entire archive. This allows for efficient extraction of a subset of the feature sets contained within a GBT file.
5. Even when a GBT import utility is not available, it is possible to make effective use of a GBT file by manually UNZIPPING it and performing the necessary import steps by hand.

Compression of the files within a GBT file is optional but recommended. GBT files shall have the extension “.gbt”, and the proposed internet MIME type for communicating the type of this file is “application/vnd.opengeospatial.gbt”. The final MIME type shall be developed in consultation with the OGC Naming Authority.

Within a GBT file, the ows-manifest.xml file must have that exact filename. The other filenames presented here, however, are recommendations only. Any filenames may be used, as long as they are properly referenced in the ows-manifest.xml file. The files can exist in any order.

ZIP files have the ability to contain a comment. It is recommended that this comment be filled in with a short description of the contents of the GBT file in order to make the purpose of the GBT file clear at a glance, and to provide an indication of the GBT nature of the file to users of general-purpose ZIP tools.

5.3 The manifest file

The manifest file, called “ows-manifest.xml”, is an XML document describing the contents of the GBT file. The structure of this manifest file is specified in section 13.3 of the OGC Web Services Common Standard version 2.0.0 (OGC 06-121r9). It contains an optional textual description (title, abstract and/or keywords) of the contents, and a <ReferenceGroup> element for each of the feature or topology sets.

Each <ReferenceGroup> element contains an identifier identifying the feature or topology set it represents, an optional textual description (title, abstract and/or keywords) of that feature or topology set, and a <Reference> element for each of the files associated with that feature or topology set. Each <Reference> element provides an href, role, MIME type format, and optional title for the file it references. Every referenced file must exist in the GBT file. Clauses 5.4 and 5.5 specify a set of standardized roles and their meanings.

For feature sets, the value of the <Identifier> element of a <ReferenceGroup>, which identifies the feature type that the <ReferenceGroup> represents, should be interpreted as a QName so that the namespace of the feature type is properly communicated.

The following is an example ows-manifest.xml file:

```
<?xml version="1.0" encoding="UTF-8"?>
<Manifest xmlns="http://www.opengis.net/ows/2.0"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.opengis.net/ows/2.0
    http://schemas.opengis.net/ows/2.0.0/owsAll.xsd">
  <Title xml:lang="en">example GBT</Title>
  <Abstract xml:lang="en">example Geodata Bulk Transfer
file</Abstract>
  <ReferenceGroup xmlns:vmap0="http://cubewerx.com/ns/vmap0">
    <Identifier>vmap0:coastl_1m</Identifier>
    <Title>Coastlines</Title>
    <Reference xlink:href="coastl_1m.gml"
      xlink:role="gmlFeatureCollection"
      xlink:title="GML feature collection">
      <Format>application/gml+xml; version="3.2"</Format>
    </Reference>
    <Reference xlink:href="coastl_1m.xsd"
xlink:role="xmlSchema"
      xlink:title="XML schema">
      <Format>text/xml</Format>
    </Reference>
  </ReferenceGroup>
  <ReferenceGroup xmlns:vmap0="http://cubewerx.com/ns/vmap0">
    <Identifier>vmap0:polbndl_1m</Identifier>
    <Title>Political Boundary Lines</Title>
    <Reference xlink:href="polbndl_1m.gml"
      xlink:role="gmlFeatureCollection"
      xlink:title="GML feature collection">
      <Format>application/gml+xml; version="3.2"</Format>
    </Reference>
    <Reference xlink:href="polbndl_1m.xsd"
      xlink:role="xmlSchema"
      xlink:title="XML schema">
      <Format>text/xml</Format>
    </Reference>
  </ReferenceGroup>
</Manifest>
```

GBT import utilities should use the manifest file as its source of information about what the GBT archive provides.

5.4 The global metadata file

role: iso19115Metadata
format: text/xml; version="3.1"
recommended title: ISO 19115 Metadata
recommended filename: gbt_metadata.xml
optionality: Optional

This optional file contains ISO 19115 metadata information about the GBT file as a whole. ISO 19115 metadata information associated with components of a GBT are discussed in clauses 5.5.4 and 5.6.4.

5.5 The components of a feature set

5.5.1 Introduction

Each feature set within a GBT file is represented by two or more files, each with a specific role, and each referenced by a <Reference> element within the <ReferenceGroup> for that feature set in the manifest file. A set of standardized roles and their meanings is specified below. However, files with non-standard roles are allowed to exist in a GBT file (to allow for vendor-specific functionality). GBT import utilities are required to ignore files with unrecognized roles.

5.5.2 XML schema

role: xmlSchema
format: text/xml
recommended title: XML Schema
recommended filename: *featureSetName.xsd*
optionality: Required

This required file contains the XML schema of the feature set. This XML schema document can optionally contain textual descriptions of the feature set and its properties by placing ows:DescriptionType elements within <xsd:annotation><xsd:appinfo> elements as described in the *(see Schema Creation Change Proposal for WFS)*.

5.5.3 GML feature collection

role: gmlFeatureCollection
format: application/gml+xml; version="3.1"
application/gml+xml; version="3.2"
recommended title: GML Feature Collection
recommended filename: *featureSetName.gml*
optionality: Required

This required file contains the features of the feature set, encoded as a GML feature collection. If this file contains a schema reference, it must be a relative reference to the corresponding XML schema in the GBT file.

5.5.4 ISO 19115 metadata

role: iso19115Metadata

format: text/xml; version="3.1"
recommended title: ISO 19115 Metadata
recommended filename: *featureSetName_meta.xml*
optionality: Optional

This optional file contains ISO 19115 metadata information about the feature set.

5.5.5 Styled Layer Descriptor

role: Sld
format: application/vnd.ogc.sld+xml; version="1.0"
application/vnd.ogc.sld+xml; version="1.1"
recommended title: Styled Layer Descriptor (SLD)
recommended filename: *featureSetName.sld*
optionality: Optional

This optional file contains a styled layer descriptor (SLD) for the feature set, effectively providing the definition of one or more layers that can be used to visualize the feature set.

5.6 Components of a named topology set

5.6.1 Introduction

Each named topology within a GBT file is represented by one or more files, each with a specific role, and each referenced by a <Reference> element within the <ReferenceGroup> for that named topology in the manifest file. A set of standardized roles and their meanings is specified below. However, files with non-standard roles are allowed to exist in a GBT file (to allow for vendor-specific functionality). GBT import utilities are required to ignore files with unrecognized roles.

5.6.2 Topology schema

role: xmlSchema
format: text/xml
recommended title: XML Schema
recommended filename: *topologyName.xsd*
optionality: optional

This optional file contains the GML application schema of the topology.

5.6.3 Topology data

role: namedTopology
format: application/gml+xml; version="3.1"
application/gml+xml; version="3.2"
recommended title: Named Topology

recommended filename: *topologyName.gml*

optionality: Required

This required file contains the topology, encoded using GML. If this file contains a schema reference, it must be a relative reference to the corresponding XML schema in the GBT file.

Editor's Note: The GBT file format canonically uses GML to represent topology. GML topology is based on ISO19107 which defines a topology based on nodes, edges and faces. However, other types of topology exist, such as rule-based topology. Although not described in this document, such topologies can be accommodated within the GBT file by using an encoding other than GML for the topology. In this case, the content type would need to be adjusted accordingly.

5.6.4 Topology metadata

role: *iso19115Metadata*

format: *text/xml; version="3.1"*

recommended title: ISO 19115 Metadata

recommended filename: *topologyName_meta.xml*

optionality: optional

This optional file contains ISO 19115 metadata information about the topology.

5.7 Exporting

Although the specific intent of the GBT mechanism, with respect to OWS-8, is to transfer of feature sets from one WFS to another, it has been designed to be generic enough to allow the transfer of feature sets from any feature-set-oriented service or repository to another. As such, no specific sequence of operations is mandated for exporting into a GBT file. However, here is the recommended sequence of operations for exporting from a WFS into a GBT file:

1. Fetch the capabilities document of the WFS to perform WFS version negotiation, to determine the base URL and supported formats, etc., of the required operations, and to either verify that the requested feature sets are present or to collect the list of all available feature sets.
2. Then, for each feature set to be exported:
 - a. Prepare a <ReferenceGroup> element in the manifest for the feature set.
 - b. Fetch the schema of that feature set by making a DescribeFeatureType request to the WFS. The response can be packaged verbatim into the GBT file and added to the manifest as a <Reference> with a role of "xmlSchema".
 - c. Fetch the features of the feature set by making a GetFeature request to the WFS. The GetFeature request may fetch all available features or a subset of features using a Filter expression. The response must be translated from a <wfs:FeatureCollection> document to a GML document of the desired GML version. The resulting GML document can then be packaged into the GBT file and added to the manifest as a <Reference> with a role of "gmlFeatureCollection".

The WFS 1.0.0 and WFS 1.1.0 specifications state that in the absence of a MAXFEATURES parameter, the response to a GetFeature request should return all matching features. However, despite this, most WFS servers implement a hard upper limit on how many features are returned in a GetFeature response. This may affect the ability for a GBT export utility to successfully export an entire feature set from a WFS. This engineering report does not offer a solution for this issue. The WFS 2.0.0 GetFeature operation, however, has STARTINDEX and COUNT parameters. A GBT export utility that is exporting features from a WFS version 2.0.0 can therefore successfully request all features of a feature set by making successive GetFeature requests with appropriate values for STARTINDEX and COUNT.

Since the test bed focused on the bulk transfer and initialization of feature schema and data from a source WFS to a target WFS, not tests were performed transferring ISO 19115 metadata or styled layer descriptors and so the “iso19115Metadata” and “sld” <Reference> roles were typically not present in a GBT files exported from a WFS.

NOTE:

There is no standard way of retrieving ISO 19115 or styled layer descriptors from a WFS, an export utility would need to obtain this information in some other manner. The most obvious approach is to have the export utility act as a CSW client and fetch associated ISO 19115 metadata and/or styled layer descriptors for a catalogue. Alternatively, for ISO 19115 metadata, the export utility could see if a MetadataURL element is included in the feature type metadata and include that content in the GBT.

5.8 Importing

As with exporting, no specific sequence of operations is mandated for importing from a GBT file. However, here is the recommended sequence of operations for importing from a GBT file into a WFS:

1. Read the GBT file.
2. Fetch the capabilities document of the WFS to perform WFS version negotiation, to determine the base URL and supported formats, etc., of the required operations, and to verify that the feature sets to be imported are not already present.

Then, for each feature set to be imported:

3. Insert the schema of the feature set into the WFS by invoking the CreateSchema operation as described in the *(see Schema Creation Change Proposal for WFS)*.

It may be necessary to convert from one version of GML to another, depending on the capabilities of the WFS.

Alternatively, in lieu of support for this operation, the WFS administrator could manually insert the schema and the GBT importer could skip this step.

4. Insert the features into the WFS by executing a Transaction operation containing one or more Insert actions.

Since there is no standard way of pushing ISO 19115 metadata or styled layer descriptors to a WFS, any “iso19115Metadata” and “sld” <Reference> roles are typically ignored in a GBT file that is being imported into a WFS.

Annex A

Abstract Test Suite

Annex B

XML Schema Documents

Annex C

UML model

Bibliography

- [1] Guidelines for Successful OGC Interface Standards, OGC document 00-014r1