Open Geospatial Consortium

Testbed-11 DGIWG GMLJP2 testing results

Engineering Report

Warning

License Agreement

Permission is hereby granted by the Open Geospatial Consortium, ("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.

Contents

i.   Abstract

This OGC Engineering Report (ER) describes work done in OGC Testbed 11 to test GMLJP2 in terms of defining a DGIWG GMLJP2 version 1 profile.

The requirements for a DGIWG profile of GMLJP2 have been documented in the DGIWG GMLJP2 version 1 profile. The Imagery WG inside DGIWG has developed a filter to map the files produced using the previous GMLJP2 schema into the GMLJP2 version 2 schema and is about to submit a GMLJP2 2.0 profile to DGIWG.

The DGIWG implementation of the GMLJP2 profile is based on the OGC GMLJP2 v2 and other requirements are coming directly from the adoption inside the DGIWG of the new OGC GMLJP2 version 2.

This Testbed 11 activity is a response to the need of harmonization between DGIWG and OGC.

ii.   Keywords

The following are keywords to be used by search engines and document catalogues.

ogcdoc, ogc document, GMLJP2, Testbed-11, JPEG2000, GMLCOV, SensorML, Grid, Metadata, imagery

iii.   Preface

iv.   Business Value

The OGC GMLJP2 2.0 standard bridges an interoperability gap between data and services. This bridging is done by using GMLCOV [09-146r2] and includes GML (3.2 equivalent to ISO 19136) and JPEG2000. Further, GMLJP2 is easily implemented inside WFS-T and WCS-T thus making it easier consuming these data in OGC services. Moreover SensorML integration has been studied and demonstrated in other ERs in OGC Testbed-11. Therefore it will be possible to handle a large variety of imagery (georefereanceable) and subsequently to widen the usage of such standard. The inter-standards coordination managed during this activity demonstrate the feasibility of such format. No changes are foreseen for Sensor ML and GMLJP2 v2 but in the future the adption of CIS 1.1 could generate a new version of the GMLJP2 or more probably a common imagery data model WG.

As JPEG2000 is widely used in many other markets (medical, film industry, etc..), this could open the door to geo-enabling , or geo positioning geospatial imagery.

v.   Future Work

Improvements in this test and document are desirable to match the new requirements for the geo-refereanceable imagery once this will be defined in the refereanceable coverage extension specification. Moreover if new datasets should be made available this test and document should be improved.

NB: Possible future topics: Integration in Geopackage, Annotated Imagery, multiple codestreams, video encoding (Motion JPEG2000 based).

vi.   Submitters

All questions regarding this submission should be directed to the editor or the submitters:

Name	Organization
Lucio Colaiacomo	**EUSC**
Peter Baumann	**Jacobs University**
Emmanuel Devys	**IGN**

1. Scope

The scope of this report is to document testing the modified GDAL[1] library accommodating version 2.0 of the gmljp2 with the objective of defining DGIWG requirements. This activity was part of the Urban Climate Resilience Thread, Phase 11 of the OGC Web Service Testbed Initiative.

2. Conformance

Conformance with this proposed Profile shall be checked using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site2.

---

[1] http://www.gdal.org/

2 www.opengeospatial.org/cite

In order to conform to this profile, a software implementation shall choose to implement:

a) Any one of the conformance levels specified in Annex B (normative).

b) Any one of the Distributed Computing Platform profiles specified in Annexes TBD through TBD (normative).

All requirements-classes and conformance-classes described in this document are owned by the standard(s) identified.

3. References

The following normative documents contain provisions that, through reference in this text, constitute provisions of 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.

[1] *DGIWG Profile of JPEG2000 for Georeferenced Imagery 1.0.0*

[2] *DGIWG Profile of JPEG2000 for Georeferenced Imagery 2.0 (DRAFT)*

[3] OGC 08-054r4, OGC® GML in JPEG 2000 (GMLJP2) Encoding Standard Part 1: Core

[4] OGC 06-121r3 OGC Web Services Common Specification

4. Terms and Definitions

This document uses the terms defined in Sub-clause 5.3 of [OGC 06-121r8], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word "shall" (not "must") is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

For the purposes of this document, the following additional terms and definitions apply.

4.1 Rectified Grid

As per ISO 19123, "Grid for which there is an affine transformation between the grid coordinates and the coordinates of an external coordinate reference system". A rectified grid is defined by an origin in an external coordinate reference system, and a set of offset vectors that specify the direction and distance between grid lines within that external CRS.

4.2   Referenceable Grid

As per ISO 19123, "a referenceable grid is associated with a transformation that can be used to convert grid coordinate values to values of coordinates referenced to an external coordinate reference system"

5. Conventions

This sections provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of XML schema, or special notes regarding how to read the document.

5.1 Abbreviations

AP   Application Profile

CRS   Coordinate Reference System

DWG   Domain Working Group

GML   Geographical Markup Language

ISO   International Organization for Standardization

O&M   Observations and Measurements

SensorML   Sensor Markup Language

SWE   Sensor Web Enablement

SWG   Standards Working Group

WCS   Web Coverage Service

5.2 Identifiers

The normative provisions in this document are denoted by the URI

```
http://www.opengis.net/spec/{standard}/{m.n}
```

All requirements and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

6. DGIWG GMLJP2 testing results overview

6.1 Description

Items included in this testbed are:

- DGIWG GMLJP2, e.g orthoimage data and ESM GMLJP2 DTM(object of this Engineering Report

- OGC / DGIWG Georeferenceable extension for GMLJP2 and Sensor Model – Satellite and sensor imagery(future releases of this ER)

- DGIWG WCS Geo Profile for data access JPEG2000 /GMLJP2 extension (future releases of this ER).

6.2 Use cases

They cover testing of codec (georeferenced):

- high resolution optical imagery 8/16/24/32 bit encoding

- high resolution SAR images

- DEM

- Large files (> 2GB to be compressed)

- The same with georefereanceable imagery (not applicable for DEM)

- The above with annotations at the moment only for gereferenceable imagery

The library possibly has been modified to work both with hard disk usage and GPU, at the moment only working on RAM (Satcen requirement)

The following table is resuming use case testing requirements (for GMLJP2 V1 and V2)

UC #	Use case	Initiating actor	Receiving actor	Description	Test Result
1	**Raster types**				
1.1	Gray tone	Raster image processor	File system	Raster image with a single band is compressed.	OK
1.2	RGB	Raster image processor	File system	Colour raster image with three bands denoting Red, Green and Blue respectively, is compressed.	OK
1.3	Multispectral	Raster image processor	File system	A multispectral image is compressed.	OK
1.4	Discrete raster	Raster image processor	File system	An image with large solid colour areas is compressed (synthetic image).	PENDING
1.5	Palletized image	Raster image processor	File system	An image which uses a palette for the colours, i.e. indexed colours, is compressed.	NO-OK
1.6	Elevation grid	Raster image processor	File system	An elevation grid is compressed.	PENDING
1.7	Raster map	Raster image processor	File system	A thematic map where the pixel values denotes different objects in the map.	OK
2	**GML**				
2.1	Geo-rectified	Photogramme tric expert	User	A geo-rectified image has its geo-rectification parameters encoded in GML.	PENDING
2.2	Ortho-rectified	Photogramme tric expert	User	An ortho-rectified image has its ortho-rectification parameters encoded in GML.	OK

9

3	**Metadata**				
3.1	Embed metadata	Geodata handler	User	The image's metadata is embedded in the image file.	OK
3.2	Extract metadata	User	User	The image's metadata is read from the image file.	APPLICATION TOOL GDAL
4	**Annotations**				
4.1	Annotate an image	Image interpreter	User	An image interpreter annotates an image. The image and its annotations are read by a user.	APPLICATION TOOL, It is possible to generate a GMLJPEG2000V2 with it. But the process of making the annotation is an application tool. (ViewIt)
4.2	Annotate a set of related images	Image interpreter	User	Image interpreters annotate a set of related images. The images and their annotations are assembled into a package. The user read the images and the annotations from the package.	PENDING
4.3	Annotate a stereo pair	Image interpreter	User	Image interpreter annotates images in a stereo pair.	
4.4	Annotate a set of images in a triangulation block	Image interpreter	User	Image interpreter annotates images in a triangulation block.	PENDING
4.5	Archive a set of images with annotations	User	DB or file archive	User archives a set of images and their annotations.	PENDING
4.6	Reproject an image with annotations in geo-	User	File system	An image with annotations should be reprojected to a different reference system. The annotation location should be	PENDING just for DGIWG profile 1.0

	coordinates			reprojected as well as the image coverage.	
5	**Data access**				
5.1	Query WMS or WCS and getting a GMLJP2 file as a response	WMS- or WCS-client	WMS- or WCS-server	An OWS client sends a GetMap request to a WMS-server or a GetCoverage request to a WCS-server, and gets a GMLJP2 file as a response.	WCS/WFS transactional done WMS pending
5.2	Query metadata from a JPIP-server	JPIP-client	JPIP-server	A JPIP-client request metadata from a JPIP-server, and gets a JPIP data-bin containing only metadata.	OK

11

6.3 Performances report

6.3.1 Hardware/Software configuration:
Intel Xeon CPU E5-1620 @ 3.6 Ghz

16GB RAM

Windows 7 64 bit

GDAL library with openjpeg

6.3.2 Average compression time
Panchromatic image 716MB 135 sec compression factor 25

Panchromatic image 716MB 110 sec lossless

RGB 24 bit image 346MB 105 sec compression factor 25

RGB 24 bit image 346MB 75 sec lossless

6.4 Data
Areas on which imagery, ortho, DSM or DTM are available (why not consider previously available UV14, or future UV16 zone)

CSK (Cosmo-SkyMed) SAR satellite images provided by IT

1 SPOT6 and 1 Pleiades scene provided by Airbus D&S.

6.5 Technical requirements

The imagery used for this Testbed activity is orthoimagery 3 bands 8 bits each (small to large files (>2GB)) , 1 SAR imagery (Cosmo skymed), generic DEM. For hardware and software see 6.3.1

6.6 Implementation
The library was implemented using a definition file in which there is the description of the metadata to be managed (see example below Annex A. The metadata section is optional, and can consist of 0 or more metadata specification elements. Each element specifies the file path and type of the metadata (GeoEye, Pleiades, WorldView.) The type

is necessary since the driver must convert the metadata into <gmljp2:eopMetadata> on the fly.

Annex A: Conformance Class Abstract Test Suite (Normative)

This annex provides an abstract test suite for GMLJP2 data conforming to the DGIWG profile. Some of these tests require that the tester uses software that gives a good overview of the content in a JPEG2000 file. Annex I in DGIWG profile refer to software that can be used for the abstract test suite.

The test classes refer to the conformance classes that are described in Annex B of reference [1]

A.1. Tests

A.1.1. Georeferenced with GML according to GMLJP2

a) Test purpose: Verify that the GMLJP2 file is georeferenced with GML according to the GMLJP2 standard.

b) Test method: Inspect that the GML georeference exists at its proper location. The required GML structure is labeled *"gml.root-instance"*.

c) Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding

d) Test type: Basic

A.1.2. GML code passes XML schema validation

a) Test purpose: Verify that the GML code referencing the JPEG2000 data is valid according to the XML schema that the DGIWG profile provides. This validation is capable of catching a number of errors.

b) Test method: Extract the GML georeference and validate the code with the xml schema provided by this profile, *DGIWGgmlJP2Profile.xsd*, which is described by Annex F.2.1.

c) Reference: DGIWG GMLJP2 Profile, Annex F and A.5

d) Test type: Basic.

A.1.3. GML code has RectifiedGridCoverage

a) Test purpose: Verify that the GML code has a feature that is a *RectifiedGridCoverage*. The *RectifiedGridCoverage* is the only coverage that is allowed to be used as a georeference in *GMLJP2*.

b) Test method: Inspect the GML reference. There should be a *RectifiedGridCoverage* at following XPath:
/gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml:feat ureMember/gml:RectifiedGridCoverage

c) Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding. An additional description is in this profile (DGIWG GMLJP2: D.2.1).

d) Test type: Basic.

A.1.4. The RectifiedGrid contains all required content

a) Test purpose: Verify that the RectifiedGrid contains all mandatory attributes and elements.

b) Test method: Inspect the GML reference. Inspect the *RectifiedGrid* at following XPath:
/gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml:feat ureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/gml:Rectif iedGrid

Following elements and attributes should exist:

Name	Type
limits	XML element
origin	XML element
offsetVector	XML element. Two elements are required.
axisName	XML element. Two elements are required.
srsName	XML attribute

c)   Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery
       (GMLJP2) Encoding and this profile (DGIWG GMLJP2: D.2.2.1.2).

d)   Test type: Basic.

A.1.5.   The number of grid cells is the same as the number of pixels

a)   Test purpose: Verify that the GML grid have the same number of grid cells as
       the raster data it is supposed to describe. The raster is interpreted as a grid.
       That means the *RectifiedGrid* is a description of the geometric properties of the
       raster.

b)   Test method: Check the actual dimensions of the image. In the GML
       georeference, check the following XPath:

       /gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml:

       featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain

       /gml:RectifiedGrid/gml:limits/gml:GridEnvelope

       where the number of grid cells is given as min- and max-coordinates in a
       coordinate system *(width, height)* with its origin at the upper left corner. This
       system spans from (*0*) to (*raster dimension size – 1*). Verify that this is the
       case.

c)   Reference: OGC 03-105r1 – OpenGIS Geography Markup Language (GML)
       Implementation Specification, v3.1.1 and OGC 05-047r3 - GML in JPEG 2000
       for Geographic Imagery (GMLJP2) Encoding and *DGIWG GMLJP2 D.2.2.1.3*.

d)   Test type: Basic.

16

A.1.6.   Coordinate lists in GML, have sufficient number of coordinates

a)   Test purpose: Verify that the GML code has sufficient number of coordinates at certain places in the GML georeference. GML uses the *XML Schema Language* type *list* for allowing more than one coordinate in one element. The *XML Schema Language* doesn't allow a schema to put any restrictions on the number of coordinates when using the *list* type. This means an *XML schema validation* will not catch that error. Therefore the number of coordinates has to be verified manually in the GML code. Typically, there should be at least two coordinates in one element, but the *gml:Point* and the *gml:offsetVector* could have three coordinates in the case of 3D data.

b)   Test method: Check that there are at least two coordinates in the GML code at following XPaths:

   a.   */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain /gml:RectifiedGrid/gml:limits/gml:GridEnvelope/gml:low*

   b.   */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:limits/gml:GridEnvelope/gml:high*

   c.   */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:origin/gml:Point/gml:pos*

   d.   */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:offsetVector*

c)   Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding

d)   Test type: Basic.

A.1.7.   The RectifiedGrid refers to a reference system

a)   Test purpose: Verify that the reference system is given by the attribute *srsName* in the *RectifiedGrid* element.

b)   Test method: Inspect that the attribute *srsName* is used at appropriate place in the GML, i.e. the *RectifiedGrid*. There are a few places where this attribute can be used. This profile require that this attribute is used at this location:

/gml:FeatureCollection/gml:featureMember/gml:FeatureCollection /gml:featureMember/gml:RectifiedGridCoverage/gml: rectifiedGridDomain/gml:RectifiedGrid@srsName

c)   Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding and *DGIWG GMLJP2 – D.2.3*

d)   Test type: Basic

A.1.8.   Left-hand order coordinate system is used for WGS84 LL coordinates

a)   Test purpose: This profile prescribes that the axis order for WGS84 LL should follow standard practice, i.e., use *left-hand order* axis (latitude, longitude). This test is not applicable for UTM/WGS84, which uses *right-hand order* axis.

b) Test method: It is not advisable to test this by inspecting the image in GIS software, because that might instead highlight the axis handling in the software. One important part of the problem is that both types of axis orders are common in the software. This profile tries to achieve unification in the handling of axis orders, which is in line with the recommendation of GML 3.2.1. Therefore inspect the coordinates directly in the GML code at following XPaths:

   a. */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:origin/gml:Point/gml:pos*
      While using WGS84-LL, the axis order shall be left-handed.

   b. */gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:offsetVector*
      While using WGS84-LL, the axis order shall be left-handed.

c) Reference: DGIWG GMLJP2 Profile – D.2.2.1.3 and 6.3 for an illustration

d) Test type: Basic

A.1.9. Image coordinate system gives the coordinates in the correct order

a) Test purpose: The image coordinates does not follow the same rule as the ground coordinates. The image coordinates shall always be given in following order (width, height).

b) Test method: Inspect the coordinates directly in the GML code at following XPath:
   /gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rectifiedGridDomain/ gml:RectifiedGrid/gml:limits/gml:GridEnvelope/gml:high
   The axis order shall be given as width and height in that order. This can only be inspected in a test case there the image **is not square**.

c) Reference: DGIWG GMLJP2 Profile – D.2.2.1.3

d) Test type: Basic

A.1.10. *Metadata extent is coherent with the GML extent*

a)   Test purpose: Verify that the extent information in the metadata is coherent with the *RectifiedGridCoverage* that gives the extent of the GMLJP2 file.

b)   Test method: Inspect the GML reference and the metadata extent information. The extent should be the same area. The *RectifiedGridCoverage* is at following Xpath in the GML georeference:
/gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml:featureMember/gml:RectifiedGridCoverage

The metadata extent is at following Xpath:

/gmd:MD_Metadata/gmd:identificationInfo/gmd:MD_DataIdentification/ gmd:extent

if ISO/IEC 19139 is used.

c)   Reference: DGIWG GMLJP2 Profile – 6.6.1

d)   Test type: Basic.

A.1.11. *Security classification in metadata*

a)   Test purpose: Verify that the security classification is recorded in the metadata.

b)   Test method: Inspect the metadata to see if there is a security classification.

   a. The metadata is embedded at the following XPath:
   /gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:metadataProperty

   b. In the metadata, the security classification is found at following XPath:
   /gmd:MD_Metadata/gmd:identificationInfo/gmd:MD_DataIdentificatio n
   /gmd:resourceConstraints/gmd:MD_SecurityConstraints/gmd: classification

c)   Reference: ISO 19115

d)   Test type: Basic.

A.1.12. Security classification in Intellectual property rights box

a)   Test purpose: If the file is classified in a security class more restricted than *unclassified*, the classification shall be recorded in an *Intellectual property rights* box in order to secure that information in case the metadata is lost in some way.

b)   Test method: Inspect the *'jp2i'*-box (the *Intellectual property rights* box). The box shall contain an IPR element. The security classification shall be stored at following XPath:

   /jp:IPR/jp:IPR_EXPLOITATION/jp:IPR_USE_RESTRICTION

c)   Reference: DGIWG GMLJP2 Profile – C.1.5

d)   Test type: Basic.

A.1.13. References to embedded codestreams and XML instances are valid

a)   Test purpose: The GML code uses *GMLJP2 URI* addresses to refer to different embedded parts of the file. These parts can be either codestreams or XML blocks within the *gml.data* structure. Codestreams are addressed by their order in the file beginning with number zero. XML blocks are addressed by their accompanying *label* boxes.

b)	Test method: Inspect that existing *GMLJP2 URI:s* refers to existing parts of the file.

   a.	One *GMLJP2 URI* in particular, is essential:
   /gml:FeatureCollection/gml:featureMember/gml:FeatureCollection/gml: featureMember/gml:RectifiedGridCoverage/gml:rangeSet/gml:File /gml:fileName
   This element refers to the codestream that the GML code is georeferencing. This element shall always exist and refer to an existing codestream.

   b.	There can be other *GMLJP2 URI:s* for referring to XML instances, like SVG symbols. These will occur in the annotations. This part of the test is only required for *class A* and *class XA* files.

c)	Reference: OGC 05-047r3 - GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding

d)	Test type: Basic.

A.1.14. The Reader Requirement box signals the use of GML

a)	Test purpose: The use of GML shall be signaled by the *reader requirement* box.

b)	Test method: Inspect the file with some software that understands the *reader requirement* box. The flag with number 67 must be among the standard flags.

c)	Reference: ISO/IEC 15444-2 and DGIWG GMLJP2 Profile: C.1.3.

d)	Test type: Basic.

A.1.15. Precinct partition size

a)	Test purpose: The precinct partition size is restricted to be a power of two.

b) Test method: Inspect the codestreams markers COD and COC. The COC information overrides the COD information. COD and COC for a tile, overrides the COD and COC for the whole codestream.

c) Reference: ISO/IEC 15444-1 B.5, A.6.1, A.6.2 and DGIWG GMLJP2 Profile: 5.3.2.6.

d) Test type: Basic.

A.1.16. Brand field

a) Test purpose: GMLJP2 files uses extensions from JPEG2000 Part 2, must use a file suffix which reflect the file type that is used.

b) Test method: Inspect the brand field in the file type box. The brand field must use the value 'jpx\040'.

c) Reference: ISO/IEC 15444-2 M.2.1, M.8 and DGIWG GMLJP2 Profile: 7.3 and C.1.2.

d) Test type: Basic.

A.1.17. Compatibility list

a) Test purpose: The compatibility list contains a list about which standards and profiles the file conforms to.

b) Test method: Inspect the compatibility list in the file type box. If none of the Part 2 options for opacity is used, the compatibility list shall contain 'jp2\040'. All files shall contain 'jpx\040'.

c) Reference: ISO/IEC 15444-2 M.8 and DGIWG GMLJP2 Profile: 7.2 and C.1.2.

d)   Test type: Basic.

A.1.18. File suffix

a)   Test purpose: A GMLJP2 file must use a file suffix which reflects the file type that is used.

b)   Test method: Inspect the compatibility list in the file type box and the filename. If the compatibility list contains 'jp2\040', the file suffixes ".jp2" and ".jpf" are allowed. Otherwise only ".jpf" is allowed.

c)   Reference: ISO/IEC 15444-2 M.2.1 and DGIWG GMLJP2 Profile: 7.5 and C.1.2.

d)   Test type: Basic.

A.2. Class A tests

Class A is described in B.3.2.

A.1.0.   Allowed style elements

a
)   Test purpose: *Class A* files contains annotations which can be styled. It has to be relevant styling elements for each of the annotations. A *Label* annotation can be styled with a *LabelStyle* element, but not with a *GeometryStyle* element.

b
)

Test method: Inspect the GML code that contains the annotations. Inspect the *defaultStyle* elements in annotations. Relative to the *defaultStyle* element, there can be two types of style elements, *geometryStyle* and *labelStyle*:

a. **gml:defaultStyle/gml:Style/gml:featureStyle/gml:FeatureStyle /gml:geometryStyle**

b. **gml:defaultStyle/gml:Style/gml:featureStyle/gml:FeatureStyle/gml:labelStyle**

The *labelStyle* element is used only when *defaultStyle* is a child element of the annotation content type *Label*. All other annotation types shall use *geometryStyle*. If they have labels, the labels are in their annotation content as a *Label* element, which can have a *LabelStyle* element.

c
)

Reference: DGIWG GMLJP2 Profile – D.3.4.1

d
)

Test type: Class A

A.1.2. References to embedded symbols are valid

a) Test purpose: *Class A* files can contain annotations which uses symbols in SVG format embedded in the JPEG2000 file in *xml* boxes.

b) Test method: Inspect all elements of type *gml:symbol*. The attribute *xlink:href* shall use a valid *GMLJP2 URI* for referring to the SVG symbol, which should be embedded in the *gml.data* structure in the file.

c) Reference: DGIWG GMLJP2 Profile – D.1.3.2 and D.3.4.1.3

d) Test type: Class A

A.3. Class XA tests

Class XA is described in B.3.3.

A.1.0.   References to embedded images and video streams are valid

a)   Test purpose: *Class XA* files contains *DGIWGJP2 URI* references to embedded images and video. These parts can be either *'uuid'*-boxes or *'moov'*-boxes. They shall in both cases be in an *Annotation* structure.

b)   Test method: Inspect that the *DGIWGJP2 URI* addresses refers to actual boxes in the *Annotation* structure.

c)   Reference: DGIWG GMLJP2 Profile – C.2 and D.1.4

d)   Test type: Class XA

Annex B Revision history

Date	Release	Editor	Primary clauses modified	Description
02/26/2015	**0.1**	**L.Colaiacomo, P.Baumann**		**Initial draft and outline**
06/05/2015	**0.2**	**E. Devys**		**Revised**
11/06/2015		**L.Colaiacomo**		**Finalisation**
25/06/2015		E. Devys		Revision of Abstract and Business Value
28/08/15		Carl Reed	Many	Get ready for publication, move to correct template.