Open Geospatial Consortium

OGC® Testbed 10 Cross Community Interoperability (CCI) Profile Interoperability Engineering Report

Warning

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Preface

This Engineering Report was prepared as a deliverable for OGC Testbed 10, an initiative of the OGC Interoperability Program. The document presents the work completed with respect to the Cross Community Interoperability (CCI) thread within the testbed. The work has been commissioned in order to inform geospatial information frameworks of the Defence Geospatial Information Working Group (DGIWG), National System for Geospatial Intelligence (NSG) of the US National Geospatial Intelligence Agency (NGA) and the UK Ministry of Defence (MOD).

The Engineering Report presents an analysis and assessment of interoperability between DGIWG, NSG and UK MOD profiles of Web Map Service (WMS) and Web Feature Service (WFS) standards of the OGC. The engineering report also presents findings from the implementation of the reference profiles.

Suggested additions, changes, and comments on this report are welcome and encouraged. Such suggestions may be submitted by email message or by making suggested changes through OGC procedures.

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Contents

Page

Figures   Page

Tables   Page

1   Introduction

1.1   Scope

Members of the OGC have defined several profiles of OGC standards that are tailored to address requirements of specific communities of interest. The Testbed-10 Cross Community Interoperability (CCI) thread has explored the potential for implementing an architecture based on a selection of OGC web service profiles defined by the Defence Geospatial Information Working Group (DGIWG), US National System for Geospatial Intelligence (NSG) and the UK Ministry of Defence (MOD). DGIWG is the multi-national organisation with the goal of improving geospatial interoperability between defence organisations of member nations. NSG is the combination of technologies, policies, capabilities, doctrine, activities, people, data and communities needed to produce geospatial intelligence in an integrated, multi-intelligence, multi-domain environment. This Engineering Report aims to describe the work performed during OWS-10 to analyse and assess interoperability between DGIWG, NSG and UK MOD profiles of the Web Map Service (WMS) and Web Feature Service (WFS) standards. The report also presents findings from the implementation of these profiles. The report identifies issues that may be cause for interoperability concerns with standard OGC services or between the referenced profiles.

The following web service profiles are the subject of this report:

 DGIWG Web Feature Service 2.0 Profile [3]

 DGIWG Web Map Service 1.3 Profile (Draft) [4]

 US NSG Web Map Service 1.3 Profile [2]

 UK MOD Web Feature Service 1.1 Profile [5]

 UK MOD Web Map Service 1.3 Profile [6]

In order to achieve the aims of this engineering report, the following questions were addressed by the thread:

 What are the similarities between interfaces (including operations and their parameters) offered by services based on the DGIWG, US NSG and UK MOD profiles of WMS?

 What are the differences between interfaces (including operations and their parameters) offered by services based on the DGIWG, US NSG and UK MOD profiles of WMS?

□ What are the similarities between interfaces (including operations and their parameters) offered by services based on the DGIWG and UK MOD profiles of WFS?

□ What are the differences between interfaces (including operations and their parameters) offered by services based on the DGIWG, and UK MOD profiles of WFS?

□ How would the differences between the profiles of the aforementioned services prevent interoperability?

1.2   Document contributor contact points

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

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1.3   Revision history

Date	Release	Editor	Primary clauses modified	Description
2014/02/02	0.0.1	GH	All	Initial version

1.4   Future work

None planned.

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 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.

1. OGC 06-042, *Web Map Service (WMS) Implementation Specification, version 1.3.0, 2006*

2. NGA. *NSG Web Map Service Implementation Profile version 1.3.0, 2013*

3. DGIWG. *DGIWG Web Feature Service 2.0 Profile, 2013*

4. DGIWG. *DGIWG Web Map Service 1.3 Profile (Draft), 2013*

5. Ministry of Defence. *UK MOD Web Feature Service Profile, 2012*

6. Ministry of Defence. *UK MOD Web Map Service Profile, 2012*

7. DGIWG. *DGIWG Web Map Service (WMS) 1.3 Profile and Systems Requirements for Interoperability for Use within a Military Environment, 2008*

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] and in OGC® Abstract Specification shall apply. In addition, the following terms and definitions apply.

3.1
common operating picture
a single display of relevant information shared by more than one command. A common operational picture facilitates collaborative planning and assists all echelons to achieve situational awareness.

3.2
interoperability
capability to communicate, execute programs or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units

3.3
model
abstraction of some aspects of a universe of discourse

3.4
resource
a configured set of information which is uniquely identifiable to a user. This can be realised as in-line or external content or by one or more configured web services.

3.5
profile
set of one or more base standards or subsets of base standards and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards, that are necessary for accomplishing a particular function

4   Conventions

4.1   Abbreviated terms

CCI   Cross Community Interoperability

DGIWG   Defence Geospatial Information Working Group

ER   Engineering Report

GML   Geography Markup Language

MOD   UK Ministry of Defence

NSG   National System for Geospatial Intelligence

OGC   Open Geospatial Consortium

OWS   OGC Web Service

OWS-10   OGC Web Services Initiative, Phase 10 (Renamed to Testbed-10)

SDI   Spatial Data Infrastructure

URL   Uniform Resource Locator

WFS   Web Feature Service

WMS   Web Map Service

5   Methodology

To address the questions presented in the previous section, the CCI thread adopted the following methodology:

1. Review requirements of the different profiles

2. Configure the web services to conform to the relevant profiles

3. Identify similarities and differences between the profiles

4. Collect feedback from subject matter experts and thread participants

5. Evaluate and document findings

5.1   Architecture

The architecture adopted by the Profile Interoperability aspect of the CCI thread is illustrated in Figure 1. The architecture shows components from Pyxis Innovation, Inc. Envitia Ltd. and Interactive Instruments GmbH (ii).
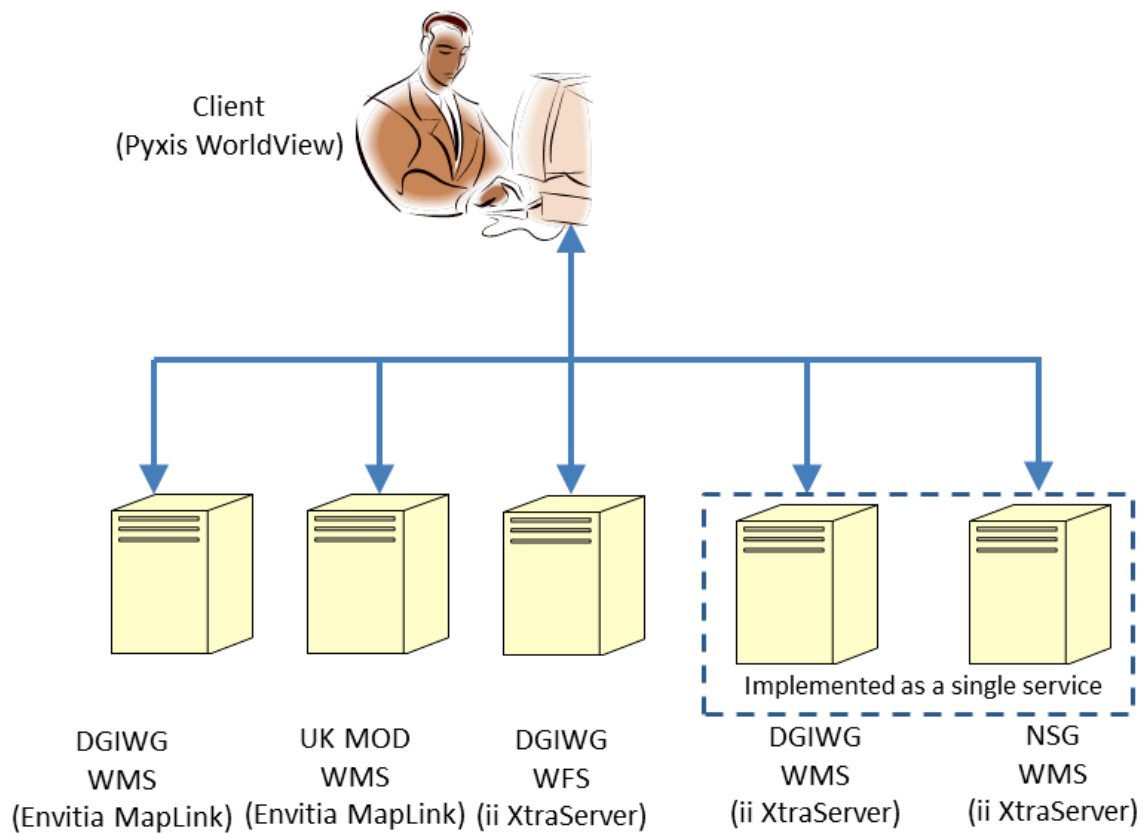
Figure 1. Testbed-10 CCI Profile Interoperability Architecture

As illustrated the architecture included both WFS and WMS services based on a variety of profiles. The architecture also included different implementations of the same profile,

specifically WMS, which facilitated testing of the profile. It should be noted that although the UK MOD WFS profile is discussed in this engineering report, it is however intentionally omitted from the architecture as none of the components used in the testbed currently implement the profile. It is envisioned that profiles not implemented in the current testbed shall be explored in future testbeds, subject to sponsor requirements and available resources.

6   Comparison of WMS Profiles

The following tables present the requirements of the WMS profiles against each operation offered by the service. Each row presents the requirements against the relevant operation and parameter in order to highlight the similarities and differences between the profiles. The phrase "Supported as specified in the OGC WMS 1.3 Standard" has been used to indicate that the profile does not make changes to the requirement specified in the base standard.

6.1   GetCapabilities Operation

Table 1. WMS GetCapabilities operation comparison

Parameter or Metadata element	Sub-element or property	NSG Profile Comment	DGIWG Profile Comment[1]	UKMOD Profile Comment

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[1] Clarifications in this column were collected from the DGIWG meeting of February 2014

Service	Abstract	Includes a security classification identified at the top of the security field.	DGIWG profile requires a conforming WMS server to include the following information in the abstract element of the service metadata: "This service implements the DGIWG WMS profile 1.3 version 1.0." Additional Clarification: "Use of security classification is allowable, but not mandatory in the DGIWG profile" Additional Clarification: "DGIWG determines, identification of source CRS and transformation within the GetCapabilities Abstract to be an inappropriate location for this information."	Requires inclusion of text identifying the source CRS and transformation used.
Service	Access Constraints	Populate the wms:AccessConstraints element as you would the classification markings of a classified document. This defines the highest classification level of the content accessible through the WMS service. This may also include Fees.	Supported as specified in the OGC WMS 1.3 Standard, though likely to require support for multinational classification systems. Additional clarification: "For the use of the DGIWG profile in an NATO environment, the common NATO classification scheme has to be applied."	Supported as specified in the OGC WMS 1.3 Standard.
Service	LayerLimit	Supported as specified in the OGC WMS 1.3 Standard.	If a DGIWG WMS server implements the LayerLimit parameter, it shall not be less than 20.	General

Service	MaxWidth and MaxHeight	The MaxWidth and MaxHeight shall be greater or equal to 800 pixels.	The MaxWidth and MaxHeight shall be greater or equal to 800 pixels.	If omitted then MaxWidth and MaxHeight imply no limit on the parameters. If included MaxHeight and MaxWidth shall not be less than 800.
Layer	Abstract	The Abstract element is not inherited by child Layers.	Supported as specified in the OGC WMS 1.3 Standard. The DGIWG profile however is not clear on this and thus it is recommended that the profile be updated clarify the inheritance requirements.	Supported as specified in the OGC WMS 1.3 Standard.
Style	General	If only a single style is available, that style is known as the "default" style and need not be advertised by the server. Style declarations are inherited by child Layers. A child shall not redefine a Style with the same Name as one inherited from a parent. A child may define a new Style with a new Name that is not available for the parent Layer.	DGIWG profile states that "A DGIWG WMS server shall always provide at least one style element even if only a default style is advertised."	This profile mandates that a Named Layer must have at least one Style element.
Style	Format	Supported as specified in the OGC WMS 1.3 Standard.	DGIWG profile allows PNG, GIF or JPEG as a minimum.	Supported as specified in the OGC WMS 1.3 Standard.

EX_Geogra phicBoundi ngBox	General	Every named Layer shall have exactly one EX_GeographicBoundingBox element that is either stated explicitly or inherited from a parent Layer.	DGIWG profile is not clear on whether it requires the CRS of the EX_GeographicBoundingBox to be stated explicitly or inherited from a parent layer. Additional clarification: "The DGIWG WMS profile states no further requirement as already defined in the base standard. Recommendation to update DGIWG profile to clarify this aspect."	UKMOD profile mandates that every Layer whether Named or Category must have an explicit CRS for the layer.

| BoundingBox | CRS | The NSG provides the following profiling instruction "To be consistent with the DGIWG WMS 1.3 Profile, CRS elements shall be stated explicitly and not inherited from a parent layer. The service shall support the following Coordinate Reference Systems, and use the following associated keywords 1) to designate them in its responses, and 2) to process the clients' requests [WGS84 geographic longitude, then atitude, expressed in decimal degrees:CRS:84], [WGS84 geographic latitude, then longitude, expressed in decimal degrees:EPSG:4326] and [World Mercator projection:EPSG:3395]. The NSG also provides the following profiling instruction "Among the following Coordinate Reference Systems, the service shall support all those which validity zone overlaps data published by the service. For each of these Coordinate Reference Systems, the following associated keywords shall be used 1) to designate them in its responses, and 2) to process the clients' requests" [UTM projections over WGS84 (north zones): EPSG:32601 to EPSG:32660], [UTM projections over WGS84 (south zones): EPSG:32701 to EPSG:32760], [UPS projection over WGS84 (north zone): | At a minimum, DGIWG profile requires support of EPSG:4326, EPSG:3395 and CRS:84 | In a Named Layer it is appropriate Worldwide CRS are used in accordance with the previous DGIWG WMS profile [7] and UTM/UPS projections which the layer data covers. In addition to this it is recommended that for local operations (such as UK Operations which is illustrated by the EPSG:27700 in the example) such projections or datums should be added if the Named Layer data covers these CRS. When adding CRS other than those based on WGS 1984 to a Named Layer correct use of Geodetic Datum Transformations must be applied as per OGC document 09-187 and recorded in the <Abstract> as described above. |
| 12 | | | | |

BoundingBox	"minx miny maxx maxy"	If the Layer CRS is "CRS:1" (Map CS; see B.2), then the BoundingBox units are pixels, the origin is at the upper left, the first (x) axis increases to the right, and the second (y) axis increases toward the bottom.	Supported as specified in the OGC WMS 1.3 Standard.	Supported as specified in the OGC WMS 1.3 Standard.
MetadataURL	General	"The wms:MetadataURL element shall point to an NMIS instance document for that layer. That document includes the ISM elements for that layer. The result is a capabilities document with both an overall security marking and "portion markings" at the layer level. It follows the conventions for document marking so it will be intuitive to the user community. See AccessConstraints above."	The DGIWG WMS profile states no further requirement as already defined in the base standard. Recommendation to update DGIWG profile to clarify this aspect. It is foreseeable that DGIWG WMS will reference metadata documents based on the DGIWG metadata specification.	It is foreseeable that UKMOD WMS will reference metadata documents based on the UK MOD Geospatial Metadata Profile (MGMP).

FeatureList URL	General	A server may use a FeatureListURL element to point to a list of the features represented in a Layer. FeatureListURL is not inherited by child layers.	DGIWG requires that If the GetCapabilities document identifies support for FeatureListURL then the list of features that are in the particular layer shall be resolvable through the provided URL. Additional clarification: "DGIWG might want to define either a structure for the FeatureListURL or at least provide an example"	Supported as specified in the OGC WMS 1.3 Standard.
DataURL	General	A server may use DataURL to offer a link to the underlying data represented by a particular layer.	DGIWG requires that If the GetCapabilities document identifies support for DataURL then the underlying data of the particular layer shall be resolvable through the provided URL.	Supported as specified in the OGC WMS 1.3 Standard.
Layer	General	A Layer may have zero or more of the following XML attributes: queryable, cascaded, opaque, noSubsets, fixedWidth, fixedHeight. All of these attributes are optional and default to 0. Each of these attributes can be inherited or replaced by subsidiary layers	DGIWG profile requires that a DGIWG WMS server shall provide the XML Attributes: queryable, cascaded, Opaque, noSubsets, fixedWidth and fixedHeight.	Queryable attribute must be provided however, a Layer may have zero or more of the following XML attributes: cascaded, opaque, noSubsets, fixedWidth, fixedHeight.
Layer	queryable	DGIWG Web Map Service (WMS) 1.3 Profile: All layers publishing vector data and coverage data shall be queryable.	DGIWG Web Map Service (WMS) 1.3 Profile: All layers publishing vector data and coverage data shall be queryable.	Requires all services offering vector layers to be queryable.

Layer	noSubsets	Allows both subsettable and non-subsettable layers. When set to a true value, noSubsets indicates that the server is not able to make a map of a geographic area other than the layer's bounding box.	The DGIWG Web Map Service (WMS) 1.3 Profile: All layers published by the service shall be subsettable and resizable - enables the client to benefit from service-oriented data dissemination.	All layers published by the service shall be subsettable, resizable and not defined as opaque.
Format	General	Every server shall support the default text/xml format defined in Annex A. Support for other formats is optional. If the request specifies a format not supported by the server, the server shall respond with the default text/xml format.	DGIWG Requirement 3 states that "A DGIWG WMS server shall support text/xml and text/html as output formats for the GetCapabilities and the GetFeatureInfo Operations"	The default format for the response to a GetCapabilities must be "text/xml". Other formats may be present, but must include as a minimum "text/xml".

| Layer | MinScaleDenominator and MaxScaleDenominator | The WMS service must be configured to serve requests that range from at least 4x to at least 0.25x the native scale(s) or resolution(s) of the underlying datasets, and match commonly used scales such as [1/5000 1/10k 1/25k 1/50k 1/100k 1/250k 1/500k 1/1M 1/2M 1/4M 1/5M 1/10M]. A compliant service would serve [VMap0 layers or 1M raster maps from 4M to 250k], [VMap1 layers or 250k raster maps from 1M to 50k], [VMap2 layers or 50k raster maps from 250k to 10k], [5m imagery or elevation data from 1m pixel-resolution to 20m pixel-resolution] | A DGIWG WMS server shall provide scale denominators for all layers it provides. A DGIWG WMS service should be configured to serve requests that range from at least 4x to at least 0.25x the native scale(s) or resolution(s) of the underlying datasets". | For layers that are providing data which is presented at an appropriate range a MinScaleDenominator and/or a MaxScaleDenominator should be provided for such a layer. If both are present, the MinScaleDenominator value shall be lower than the MaxScaleDenominator value. |

6.2   GetMap Operation

Table 2. WMS GetMap operation comparison

Parameter or Metadata element	Sub-element or property	NSG Profile Comment	DGIWG Profile Comment	UKMOD Profile Comment

EXCEPTIONS	exception_format	In an HTTP environment, the MIME type of the returned XML shall be "text/xml". Individual error messages appear as ServiceException elements within the ServiceExceptionReport element. The messages can be formatted either as chunks of plain text or, if included in a character data (CDATA) section, as XML-like text containing angle brackets ("" and ""). In addition to XML, INIMAGE and BLANK exception reporting are supported.	A DGIWG WMS server shall support the EXCEPTIONS parameter support of text/xml and text/html is mandatory. A DGIWG WMS server shall support the INIMAGE EXCEPTIONS. A DGIWG WMS server shall support the BLANK EXCEPTIONS.	XML and INIMAGE exception reporting are supported. Note, the profile does not mention BLANK exception reporting.
Format	General	The GetMap Format shall include the following MIME types: image/png, image/gif and image/jpeg	The GetMap Format shall include the following MIME types: image/png, image/gif and image/jpeg	The GetMap shall include the following MIME types: image/png, image/gif and image/jpeg
Transparency	General	Supported as specified in the OGC WMS 1.3 Standard.	A DGIWG WMS Service shall support transparency	Supported as specified in the OGC WMS 1.3 Standard.

6.3 GetFeatureInfo Operation

Table 3. WMS GetFeatureInfo operation comparison

Parameter or Metadata element	Sub-element or property	NSG Profile Comment	DGIWG Profile Comment	UKMOD Profile Comment

17

Transparency	General	Supported as specified in the OGC WMS 1.3 Standard.	A DGIWG WMS Service shall support transparency	Supported as specified in the OGC WMS 1.3 Standard.
EXCEPTIONS	exception_format	In an HTTP environment, the MIME type of the returned XML shall be "text/xml". Individual error messages appear as ServiceException elements within the ServiceExceptionReport element. The messages can be formatted either as chunks of plain text or, if included in a character data (CDATA) section, as XML-like text containing angle brackets ("" and "")	DGIWG requirement 29 states that "A DGIWG WMS server shall support the EXCEPTIONS parameter support of text/xml and text/html is mandatory".	Supported as specified in the OGC WMS 1.3 Standard.
Format	General	Supported as specified in the OGC WMS 1.3 Standard.	A DGIWG WMS server shall support text/xml and text/html as output formats for the GetCapabilities and the GetFeatureInfo Operations	The service shall support at least one of the following MIME types for the INFO-FORMAT Parameter text/xml, text/html and text/plain

7   Comparison of WFS Profiles

The following tables present the requirements of the WFS profiles against each operation offered by the service. Each row presents the requirements against the relevant operation and parameter in order to highlight the similarities and differences between the profiles. The phrases

"Supported as specified in the OGC WFS 1.1 Standard" or "Supported as specified in the OGC WFS 2.0. Standard" has been used to indicate that the profile does not make changes to the requirement specified in the base standard.

7.1   Basic WFS – GetCapabilities Operation

Table 4. Basic WFS – GetCapabilities operation comparison

Parameter or Capability	DGIWG	UKMOD
Name	Supported as specified in the OGC WFS 2.0 Standard.	Supported as specified in the OGC WFS 1.1 Standard.
Title	One human readable title is mandatory. Providing an (additional) English title is recommended for coalition interoperability.	Supported as specified in the OGC WFS 1.1 Standard.
Abstract	A WFS server that claims to be conformant with the DGIWG Basic WFS profile shall provide Abstract elements with following value: This server implements the DGIWG BASIC WFS profile v0.9.1 (draft) of WFS 2.0. A WFS server that claims to be conformant with the DGIWG Basic WFS profile shall provide ows:Profile elements with following value: urn:dgiwg:service:DGIWG 122_DGIWG-Web Feature Service 2.0 Profile	Supported as specified in the OGC WFS 1.1 Standard.
Abstract	One abstract element is recommended (national language). Providing an (additional) English abstract is recommended for coalition interoperability.	Supported as specified in the OGC WFS 1.1 Standard.
Keywords	At least one keyword is required for each feature type to facilitate data discovery in catalogues. Keywords can be duplicated in multiple languages.	Supported as specified in the OGC WFS 1.1 Standard.

DefaultCRS	A service implementing the DGIWG WFS profiles shall provide their data in EPSG:4326. Optionally data may be provided in additional CRSs, depending on national requirements.	Supported as specified in the OGC WFS 1.1 Standard.
OtherCRS	A service implementing the DGIWG WFS profiles shall provide their data in EPSG:4326. Optionally data may be provided in additional CRSs, depending on national requirements.	Supported as specified in the OGC WFS 1.1 Standard.
NoCRS	The wfs:NoCRS element shall be used for feature types that have no spatial properties.	Supported as specified in the OGC WFS 1.1 Standard.
OutputFormats	If this optional element is not specified, then all the result formats listed for the GetFeature operation are assumed to be supported.	Supported as specified in the OGC WFS 1.1 Standard.
WGS84BoundingBox	This knowledge aids client applications by letting them know where they should query in order to have a high probability of finding feature data.	Supported as specified in the OGC WFS 1.1 Standard.
MetadataURL	When MetadataURL is used, the xlink:href element shall be used to reference any metadata. In an SDI like architecture, a link to the metadata resource available on a CSW server should be provided.	Supported as specified in the OGC WFS 1.1 Standard.
ExtendedDescription	A WFS may add elements to the description of a feature type, without having to redefine the capabilities schema, using the wfs:ExtendedDescription element.	Not supported

Abstract	A WFS server that claims to be conformant with the DGIWG Transactional (Locking) WFS profile shall provide Abstract elements with the following value: This server implements the DGIWG Transactional (Locking) WFS profile v0.9.1 (draft) of WFS 2.0. A WFS server that claims to be conformant with the DGIWG Transactional (Locking) WFS profile shall provide ows:Profile elements with the following value: urn:dgiwg:service:DGIWG 122_DGIWG-Web Feature Service 2.0 Profile	Supported as specified in the OGC WFS 1.1 Standard.

7.2   Basic WFS – DescribeFeatureType Operation

Table 5. Basic WFS – DescribeFeatureType operation comparison

Parameter or Capability	DGIWG	UKMOD
TYPENAME	A comma separated list of feature types to describe. If no value is specified, the complete application schema offered by the server shall be described.	Supported as specified in the OGC WFS 1.1 Standard.
OUTPUTFORMAT	Shall support the value "application/gml+xml; version=3.2" indicating that a GML (see ISO19136:2007) application schema shall be generated. A server may support other values to which this International Standard does not assign any meaning.	Supported as specified in the OGC WFS 1.1 Standard.

7.3   Basic WFS – GetFeature Operation

Table 6. Basic WFS – GetFeature operation comparison

Parameter or Capability	DGIWG	UKMOD
Filter	A WFS server that claims to be conformant with the DGIWG WFS Basic profile shall support ISO 19142 Standard joins. A WFS server that claims to be conformant with the DGIWG WFS Basic profile shall support ISO 19142 Spatial joins. A WFS server that claims to be conformant with the DGIWG WFS Basic profile shall support ISO 19142 Temporal joins.	Standard, Spatial and Temporal Joins not supported
Bindings	A WFS server that claims to be conformant with the DGIWG WFS Basic profile shall implement HTTP GET conformance class. A WFS server that claims to be conformant with the DGIWG WFS Basic profile shall implement HTTP POST conformance class.	This WFS implementation profile shall support the use of both HTTP GET and HTTP POST.
Paging	A WFS server that claims to be conformant with the DGIWG WFS profile shall implement Response paging conformance class.	Not supported
outputFormat	Shall include the value "application/gml+xml; version=3.2". May include any other string or MIME type that the server supports including previous versions of GML.	Both GML 3.1.1 and GML 2.1.2 will be supported by this profile for Basic WFS.

7.4   Basic WFS – GetPropertyValue Operation

Table 7. Basic WFS – GetPropertyValue operation comparison

Parameter or Capability	DGIWG	UKMOD
outputFormat	Shall include the value "application/gml+xml; version=3.2". May include any other string or MIME type that the server supports including previous versions of GML	Not supported

7.5   Basic WFS – ListStoredQueries Operation

Table 8. Basic WFS – ListStoredQueries operation comparison

Parameter or Capability	DGIWG	UKMOD
General	Shall be supported by a Basic WFS	Not supported

7.6   Basic WFS – DescribeStoredQueries Operation

Table 9. Basic WFS – DescribeStoredQueries operation comparison

Parameter or Capability	DGIWG	UKMOD
General	Shall be supported by a Basic WFS	Not supported

7.7 Transactional WFS – GetCapabilities Operation

Table 10. Transactional WFS – GetCapabilities operation comparison

Parameter or Capability	DGIWG	UKMOD
Abstract	A WFS server that claims to be conformant with the DGIWG Transactional (Locking) WFS profile shall provide Abstract elements with the following value: This server implements the DGIWG Transactional (Locking) WFS profile v0.9.1 (draft) of WFS 2.0. A WFS server that claims to be conformant with the DGIWG Transactional (Locking) WFS profile shall provide ows:Profile elements with the following value: urn:dgiwg:service:DGIWG 122_DGIWG-Web Feature Service 2.0 Profile	Supported as specified in the OGC WFS 1.1 Standard.

7.8 Transactional WFS – GetFeatureWithLock Operation

Table 11. Transactional WFS – GetFeatureWithLock operation comparison

Parameter or Capability	DGIWG	UKMOD
General	This operation is optional	This operation is optional

7.9 Transactional WFS – LockFeature Operation

Table 12. Transactional WFS – GetFeatureWithLock operation comparison

Parameter or Capability	DGIWG	UKMOD

General	A WFS server that claims to be conformant with the DGIWG Transactional (Locking) WFS profile shall implement at least the LockFeature operation.	This operation is optional

8   Discussion

The various profiles were successfully implemented in the testbed and a number of observations made. This section presents those observations. A screenshot showing an overlay of topographic and maritime data from some of the services discussed in this report is presented in Figure 2. The screenshot highlights a key benefit of profile interoperability and that is that it is possible to bring together data from disparate sources across a community.
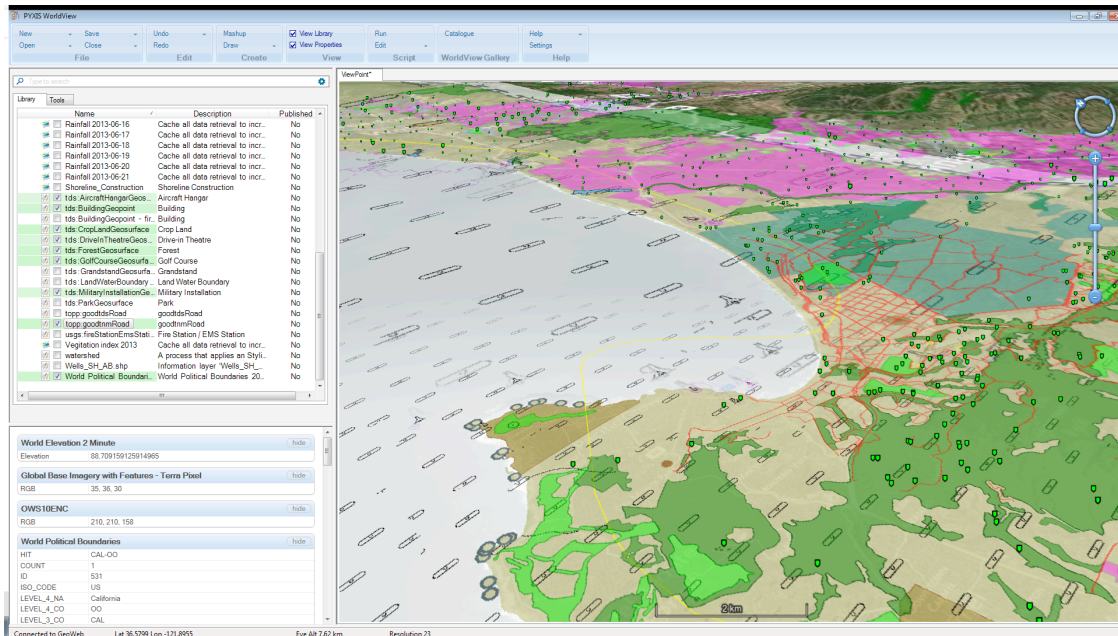

Figure 2. The OWS Client with topographic data from the DGIWG WFS overlaid on maritime data from the UK MOD WMS

8.1   WMS

The DGIWG WMS profile was implemented using two different products in the testbed, namely Envitia MapLink and Interactive Instruments GmbH XtraServer. The former was also configured to conform to the UK MOD WMS profile, whereas the latter was also configured to conform to the NSG WMS Profile. Configuration of the products to the referenced profiles was overall successful, and it was observed that both the UK MOD profile and the NSG WMS profile are generally consistent with the DGIWG WMS profile. There are, however, some issues worth noting.

Both the DGIWG and NSG WMS profiles require that "a server shall use one or more <MetadataURL> elements to offer detailed, standardized metadata about the data corresponding to a particular layer". It was observed during implementation of the profiles that if metadata for the layers was not available, it reduced conformance of the

implementation to the profile. As the unavailability of metadata is common, the requirement to always provide MetadataURL elements should therefore be considered across all of the referenced profiles and implementers encouraged to populate it.

With regard to <MetadataURL> it is also worth noting that the NSG WMS profile requires the metadata to be based on NSG Metadata Implementation Specification (NMIS), whereas (although not specified) the DGIWG Metadata Foundation would be more appropriate for use with implementations of the DGIWG WMS profile. Similarly, the UK MOD Geospatial Metadata Profile (MGMP) would be more appropriate for use with implementations of the UK MOD WMS profile.

The DGIWG profile lists a minimum set of CRS and alignment of the NSG profile to the DGIWG CRS requirement means that no significant issues are likely. The UK MOD profile recommends that "Named Layers support a Worldwide CRS" but does not mandate a specific CRS. To reduce the possibility of implementations selecting a Worldwide CRS that is not supported by the other referenced profiles, it is necessary for the UK MOD profile to require that at least one of the CRS required by the DGIWG profile be offered by services conforming to the UK MOD profile. One such appropriate CRS that could be used across all of the three referenced profiles would be the World Geodetic System 1984 (also referred to as WGS84 or EPSG:4326), which is arguably the most widely used Worldwide CRS – used in smartphones, surveying equipment, satellite navigation systems, search engines and other mass market applications.

The testbed observed that the previous version of the DGIWG WMS profile forbade hierarchical layers on the grounds that most clients and servers did not support them [7]. However, the draft version of the profile (which is the reference DGIWG profile for this testbed) states that "the <Layer> element can enclose child elements providing metadata about the Layer. The values of some of these elements can be inherited by subsidiary layers" [4]. Both Envitia MapLink and XtraServer were configured to allow all data carrying layers to appear as direct children of the root layer. Testbed participants noted that allowing hierarchical layers is a useful part of the WMS standard and current client applications are typically able to cope with the capability.

8.2   WFS

The WFS 2.0 standard allows for the following types of Conformance classes: Simple WFS, Basic WFS, Transactional WFS and Locking WFS. All of these WFS 2.0 conformance classes include operations that are not supported by WFS 1.1, which presents an obstacle to interoperability with WFS 1.1 implementations. One of the obstacles to interoperability is that a Basic WFS 2.0 allows for Joins in Query objects as part of Filter objects used by WFS 2.0. The Filter objects used by WFS 2.0 are specified in the Filter 2.0 standard. A Simple WFS however, only requires that the service offer at least "One stored query, that fetches a feature using its id, shall be available but the server may also offer additional stored queries".

According to the WFS 2.0 standard, a Simple WFS service can offer a StoredQuery that accepts parameters of any type. This implies that although a Basic WFS 2.0 requires

Filter 2.0 objects, a Simple WFS 2.0 can offer a StoredQuery that receives Filter 1.1 objects. To enable cross community interoperability, it may be necessary to change the WFS 2.0 standard to require a Simple WFS to offer an additional StoredQuery that accepts Filter 1.1 objects. This would make WFS 2.0 more "backward compatible" than it currently is. Alternatively, and possibly more efficiently, it may be left up to future WFS 2.0 profiles to require implementation of such StoredQueries.

In exploring the DGIWG WFS 2.0 profile, an instance of the XtraServer product by Interactive Instruments GmbH was successfully configured according to the profile. All of the requirements specified in the profile were found to be understandable and sound. The requirements and most recommendations could be easily configured, changes in the software were not necessary. The only exceptions were support for response paging and joins. A number of issues concerning the clarity of the requirements were found in Requirement 21 of the profile, which specifies constraints to apply on specific operations. The issues, which are listed next, seem to suggest that the profile is a work-in-progress:

1. Constraint name "CountDefault" is mandatory (M), though the Description allows for leaving it out.

2. There is no obligation (e.g. mandatory or optional) value for "SortLevelLimit".

3. Constraint name "ResolveLocalScope" is mandatory (M), though the Description allows for leaving it out.

4. The DGIWG values constraint column specifies "To be discussed!" for the "QueryExpression" constraint

Since the DGIWG tests are based on the conformance classes defined in the WFS standard of the International Organisation for Standardisation (ISO 19142), an attempt has been made to run the configured service against the Compliance and Interoperability Testing Initiative (CITE) Test Suite provided by OGC. This was not successful due to errors in the CITE tests. The observed issues have been reported to the CITE administrators.

The role of StoredQuery functionality was also explored in relation to data conflation, using the NSG Topographic Data Store (TDS). The DGIWG WFS was configured to offer a set of TDS feature types through a Stored Query that could be invoked with only two parameters, namely the identifier of the StoredQuery and the area of interest. Such queries are particularly useful for disseminating complete or subsets of datasets made up of multiple feature types. This aspect of the work however, highlighted that the naming of StoredQuery functions seems to be an issue, for which profiles other than the core WFS 2.0 standard may be needed to help. The schema, as specified by the standard, requires that the name is a Uniform Resource Identifier (URI). Therefore, since DGIWG owns a top level URI Namespace, DGIWG would be in a position to define a URI schema for DGIWG related URI-based StoredQuery names. This suggests that the other

organisations e.g. US NGA and UK MOD would also need to provide similar URI schemes to support identification of StoredQuery functions.

9   Conclusions

This report has presented a comparative analysis of NSG, DGIWG and UK MOD profiles of WMS and WFS. The analysis considered operations offered by each service and the parameters accepted or capabilities offered. The report has also presented observations from the implementation of the profiles within the Testbed-10 testbed. The discussion has also been informed by feedback from the DGIWG community.

This report concludes that there is significant interoperability between the NSG, DGIWG and UK MOD profiles of WMS. The high degree of interoperability is due to the three profiles being based on the same versions of WMS and supporting common capabilities such as worldwide CRS, image formats and data encodings. Unsurprisingly there are some capabilities that are specific to each profile, for example, the mandatory support of specific CRS by the DGIWG profile. However, the observed common capabilities imply that the profiles are primarily interoperable.

The report also concludes that interoperability between the DGIWG and UK MOD profiles of WFS could be improved significantly if both profiles were based on the same version of WFS. Given that the DGIWG profile of WFS is based on the latest version of the WFS standard, a key recommendation of this report is that a UK MOD profile for version 2.0 of the WFS standard be developed. The complete set of recommendations is presented in the following section.

10   Recommendations

The following recommendations have been identified.

10.1   Offer an Optional StoredQuery in WFS 2.0 for Supporting Filter 1.1 Requests

Currently the Filter 2.0 standard prevents WFS 2.0 from being backwards compatible with WFS 1.1. To help address this issue, Simple WFS based on WFS 2.0 could optionally implement a StoredQuery for receiving a Filter 1.1 Query and processing it as a WFS 1.1 would.

10.2   Establish a StoredQuery Registry and URI scheme for profiles

To facilitate the reuse of StoredQuery implementations across communities, a mechanism for unique identification and registration should be established. The WFS schema, as specified by the standard, requires that the name of a StoredQuery is a URI. Since DGIWG owns a top level URN Namespace, DGIWG would be in a position to define a URI scheme for DGIWG related StoredQuery names.

29

10.3   Develop a UK MOD Profile for WFS 2.0

There is limited backwards compatibility between WFS 1.1 and 2.0, therefore some of the factors affecting interoperability between the DGIWG WFS profile (based on WFS 2.0) and the UK MOD WFS profile (based on WFS 1.1) may not be resolvable unless both profiles are grounded on the same version of WFS. Following the March 2014 Technical Committee meeting, Dstl confirmed that the UK MOD are currently considering the adoption of the DGIWG WFS 2.0 profile.

10.4   Offer an Optional WMS Capability for Styling GetFeatureInfo Responses

Although the WMS standard allows for GetFeatureInfo to return responses in different encodings, it however relies on a client application or a separate web service to transform the responses (e.g. for different HTML styling). WMS could offer an optional capability that allows GetFeatureInfo requests to ingest complete or subsets of XSLT scripts to apply to GetFeatureInfo responses. This could be implemented in a similar way to how WMS can ingest SLDs.

10.5   WMS GetFeatureInfo responses should be offered in at least XML format

The DGIWG WMS profile requires services to support text/xml and text/html as output formats for the GetFeatureInfo Operation. The UK MOD requires services to support at least one of the following MIME types for the INFO-FORMAT Parameter text/xml, text/html and text/plain. This means that an implementation of the UK MOD profile could return text/plain responses and remain conformant to the UK MOD profile but not interoperable with the DGIWG profile.

10.6   All WMS profiles should require provision of MetadataURL

Currently not all of the referenced profiles mandate the use of MetadataURL elements. The provision of additional metadata through this element could help inform client applications of the suitability of resources offered by the service.