Web Registry Service
Research Document

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Submitted To: Program Manager
GeoConnections
Victoria, BC, Canada

Submitted By: Jody Garnett
Refractions Research Inc.
Suite 400 – 1207 Douglas Street
Victoria, BC   V8W 2E7
E-mail: jgarnett@refractions.net
Phone: (250) 383-3022
Fax: (250) 383-2140

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1 INTRODUCTION

This document outlines the use of the Web Registry Service (WRS) with respect to the uDig project. The WRS Specification is provided by the Open GIS Consortium (OGC) and is available publicly in draft form.

A Web Registry Service is used by client applications to discover GIS information dynamically in a manner similar to a search engine. The complete specification allows for periodic synchronization of Web Registry Content. For this document we are primarily concerned with its use from the perspective of our client application.

The draft Web Registry Service specification mandates the following capabilities:

- Metadata query requirements including OGC Common, OGC Filter or SFSQL

- Registry Descriptors for Web Map Server and Web Feature Server content

These facilities will by used by the uDig client application to support data discovery.

The information contained in this document is based on the latest publicly available OGC Draft. This specification has not remained static and we are hoping further information will be made publicly available during the course of our project.

2 OVERVIEW OF uDIG

The User Friendly Desktop Internet GIS for OpenGIS Spatial Data Infrastructures project (*uDig*) will create an open source desktop GIS application, to make viewing, editing, and printing data from CGDI and local data sources simple for ordinary computer users.

Open source components are a critical part of the CGDI vision, because they allow organizations to deploy infrastructure widely, in a distributed fashion, without incurring multiple licensing fees. Open source components are also the most tractable for fast support of new OpenGIS interoperability standards.

There are already many different pieces of open source software that implement OpenGIS server standards: Mapserver implements WMS, GeoServer implements WMS and WFS-T, PostGIS implements SFSQL, DeeGree implements WMS and WFS, and so on. However, there is not a single piece of desktop software capable of binding information from all these servers together into a unified desktop view. *uDig* is the open source application which will bring CGDI data sources to the desktop, and integrate them with local data sources for standard business processes – data viewing, data editing, and data printing.
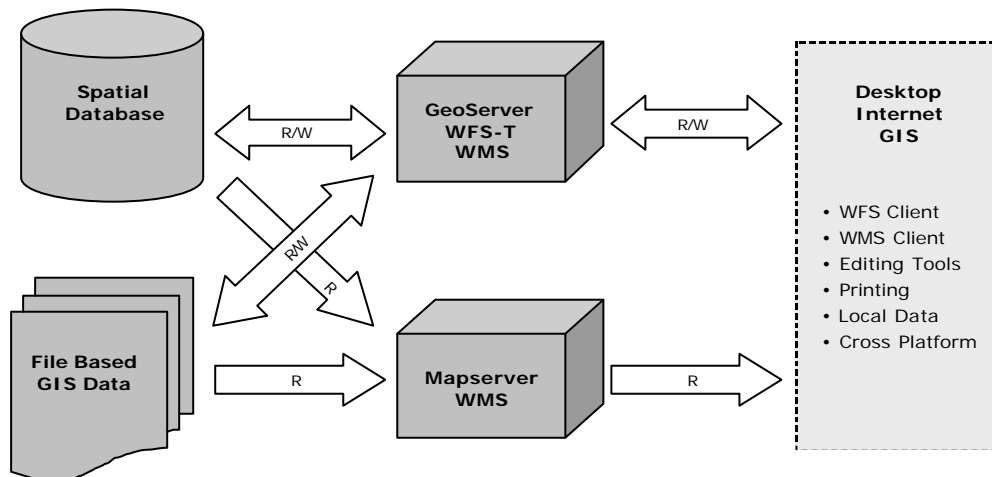
Figure 1: OpenGIS Spatial Infrastructures

3 WEB REGISTRY SERVICE OVERVIEW

The Web Registry Service (WRS) represents a synthesis of several OGC technologies into one logical package.

Related specifications:

- **OGC Open Web Service (OWS)** – OGC web service model.
- **OGC Catalog Specification** – abstract specification for data discovery.
- **OGC MetaData Specification** – abstract specification for metadata.
- **Web Map Server**
- **Web Feature Server**

These technologies are discussed in the following sections.

The WRS Specification is presented as a Draft Implementation Specification of the Catalog Specification as an Open Web Service.
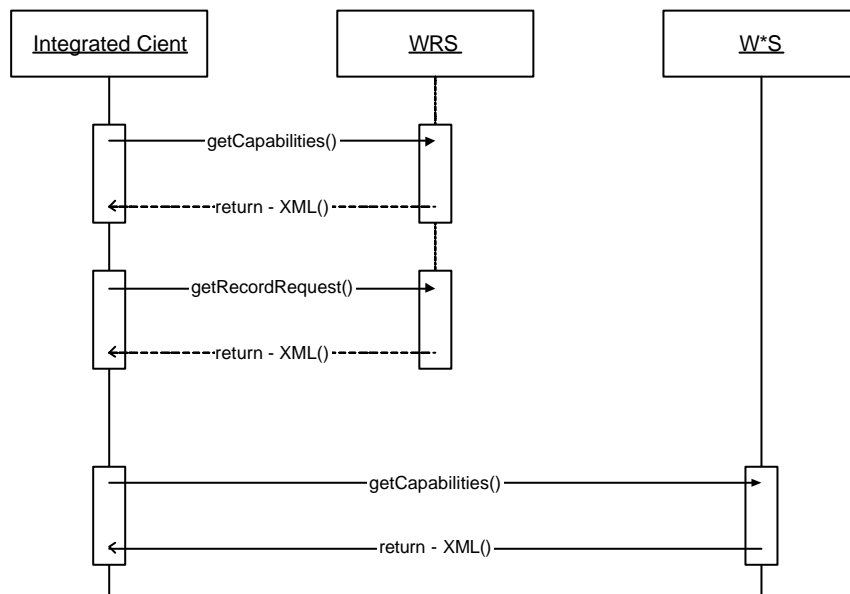
3.1.1 Data Discovery

The Web Registry Service processing model for data discovery is:

1. Client performs WRS search:
   - By specifying query elements to limit available information
   - Using a user interface to browse through organizations, subjects, time and location.

   Search is performed at brief or summary detail level.
2. Client retrieves metadata information
   - Local: Search is limited to harvested Metadata contained on the Web Registry Service
   - Cascade: Search is extended to backing WFS, WMS and WRS

   WRS implementations are required to support an XML result format.
3. Client is presented with the results of the query.
   - Client sets up an entry for associated WFS or WMS

Client uses distribution information to directly access WFS getFeatures or WMS getMap interfaces.

Figure 2: Web Registry Service Data Discovery

The uDig application will be using WRS to set up new WFS or WMS entries in the local (uDig) catalog.

3.2 Open Web Services (OWS)

The OGC Open Web Services represent an Internet-based component model for services similar to RPC, COBRA or Java RMI.

The OWS Application Model defines:

- Use of HTTP (GET/POST) protocol for messaging

- Stateless Services

- Single Request and Response Documents per interface

- Single Service Module document provided by "GET CAPABILITIES"

These guidelines allow the packaging of GIS services as scriptable components for web-based systems.

Open Web Services	CORBA	Java RMI
Service / OWS	Interface / IDL	Remote Object / Remote
Interface	Method	Remote Method Invocation
Web Registry Service	Broker	Registry
HTTP	Internet Inter Orb Protocol (IIOP)	Internet Inter Orb Protocol (IIOP), Remote Method Invocation (RMI)
GET KVP POST XML (preferred)	Common Data Representation	Serialized Java Objects

The missing piece in the OWS puzzle is that of directory services - similar to a CORBA Broker or Java RMI Registry. It is this void that the Web Registry Service fills.

3.3 *Catalog Specification*

The OGC Catalog Specification is an abstract specification describing catalog services for GIS information. The Catalog Specification defines collections of GIS information and the ability to perform metadata queries against them.
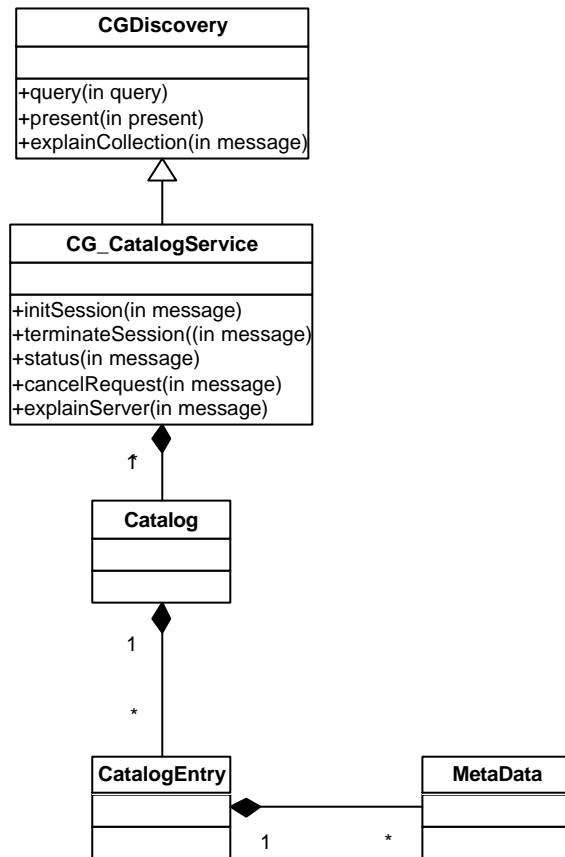
Figure 3: Catalog Services

The OGC Catalog Specification defines several interfaces:

Interface	Web Registry Service	Catalog Specification
CatalogService	GetDescriptor	CG_CatalogService
Discovery	GetDescriptor	CG_Discovery
Access	WMS, WFS	CG_Access
CatalogManager	RegisterService	CG_CatalogManager

The ability to describe the GIS information available through web services is provided by the realization of the OGC Catalog Specification as an OWS.

3.3.1 Catalog Metadata

The OGC Metadata Specification defines a common model for GIS metadata. The OGC Catalog Specification can be viewed as an entry point for metadata queries about collections of GIS information.

Terminology:

- Data Set - GIS information such as a feature collection, or map layer

- Metadata - data about data

- Metadata Entry - set of Metadata about a data set

- Catalog - collection of Metadata entries

- Catalog Service - handles Metadata queries

- Catalog Entry - a single Metadata entry from a Catalog Service

The OGC Metadata Specification is complete; it extends down to the Feature and Attribute level.

The Query Language assumed by the Catalog Specification is capable of:

- Logical queries

- Text matching

- "Simple" feature WKT representation and spatial operations

The Web Registry Service refines this definition to include queries based on OGC Common, OGC Filter, or SFSQL.

4 WEB REGISTRY SERVICE INTERFACES

The WRS Draft Specification defines the following interfaces:

- GetCapabilities, OWS service model document
- GetDescriptor, catalog query as a filter on GIS metadata
- RegisterService, to schedule OWS synchronization

These interfaces are implemented according to the Open Web Service model and are described in the following sections.

4.1 GetCapabilities

The GetCapabilities interface allows the Web Registry Service to fulfill one of the basic requirements of an Open Web Service: the specification of additional interfaces. The GetCapabilities document is used to define the available query language and attribute information.

The GetCapabilities interface is available via HTTP Post and HTTP GET:

```
GET http://localhost:8080/wrs?REQUEST=GetCapabilities
```

The GetCapabilities is an XML document to be validated against an OGC provided schema. The available public draft of the WRS Specification does not provide this information.

4.2 RegisterService

The RegisterService interface permits the synchronization of the Web Registry Service with listed Open Web Services. A synchronization schedule can be negotiated. Updates may occur in batch, or the service can be populated passively.

The RegisterService interface is not of interest to the uDig application.

4.3 GetDescriptor

The GetDescriptor interface allows the WRS to handle client queries. Both the client request and the service response are to be supplied in a predefined format indicated by GetCapabilities.

Overview of GetDescriptor HTTP POST request:

Element	Description
GetDescriptors	Root
querySpec	Describes query language (such as OGC Filter), query scope and type of catalog.
queryExpression	Defined according to query type; will be an OGC Filter Element when using the OGC Filter Specification
presentationSpec	Defines the format of the returned document
elementSchema	Describes the element information returned as conforming to the brief, summary or full schema.

The GetDescriptor interface is also available with a reduced set of functionality via HTTP GET:

Component	Description
QueryLanguage	OGC Common, OGC Filter, SFSQL
QueryExpression	String expression in specified QueryLanguage
AttributeSetName	URL of attributes used in Query

Sample HTTP GET request:

```
http://ogc.compusult.nf.ca/cgi-bin/catqueryiso/
catquery?RS=XML&QUERY=SRS%3D%27EPSG%3A4326%27%0D%0AAND+title+like+
%27%25COASTLINES%25%27%0D%0AAND+%28Format%3D%27gif%27+OR+format%3D
%27jpeg%27%29%0D%0AAND+ServiceType%3D%27Web+Mapping+Layer%27+%0D%0AA
ND+Intersects%28LatLongBoundingBox%2C%0D%0A%09%09Envelope%28-160%2C+-
50%2C+50%2C+10%29%29%0D%0A%09%09%09&SCHEMA=ISO19119&ESN=b
```

The GetDescriptor document generated is based on the OGC Metadata standards. The Draft WFS Specification defines three schemas for describing brief, summary and full element sets.

5 WEB REGISTRY SERVICE DESCRIPTOR MODEL

The Web Registry Service descriptor model is used to describe metadata harvested from the following sources:

- Web Feature Server
- Transaction Web Feature Server
- Web Map Server
- Web Coverage Service (WCS)
- OGC Web Mapping Testbed phase 2 (WMT2)
- OGC Geospatial Fusion Services (GFS) Testbed

The use of Web Coverage Service and the two Testbed Services are out of scope for the uDig project and will not be discussed.
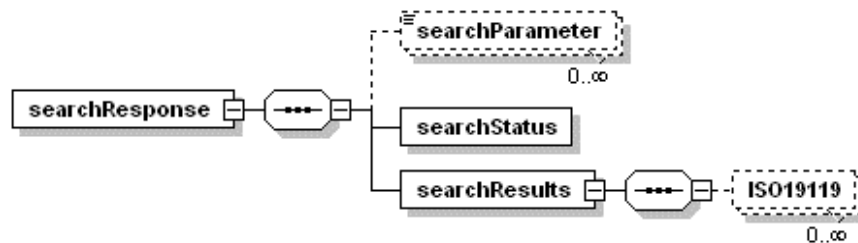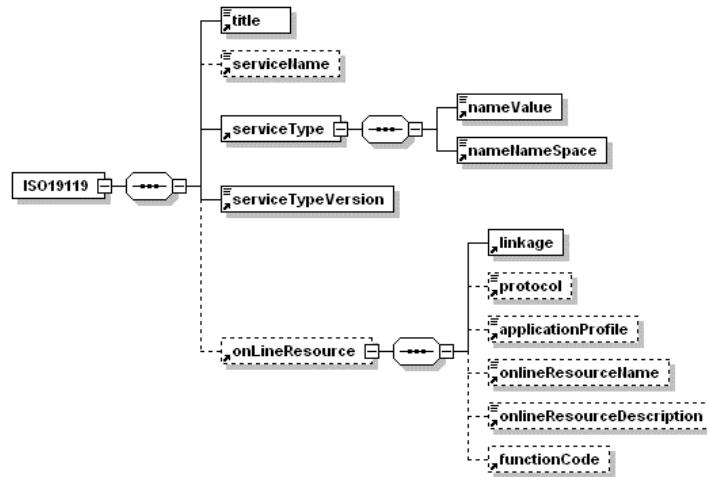

Figure 4: GetDescriptor Response

The subset of ISO19119 Metadata information returned by the GetDescriptor interface is determined by the elementSchema specified in the request.
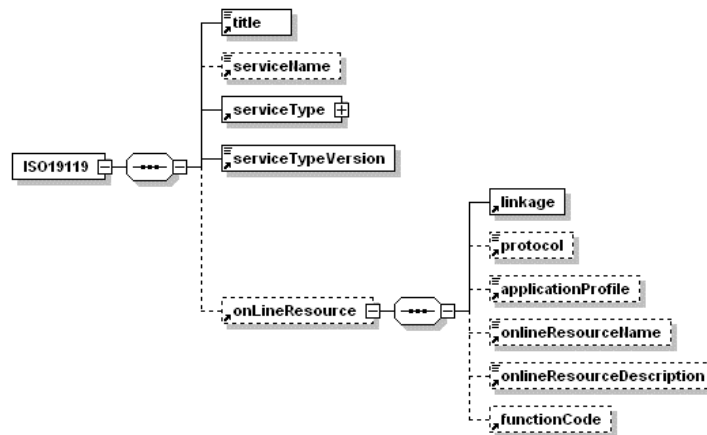
5.1.1 Brief Schema

The Descriptor model returned by GetDescriptor using the brief schema is a restricted subset of the full ISO19119 specification.

**Figure 5: ISO19119 Brief Schema Subset**

5.1.2 Summary Schema

The Descriptor model returned by GetDescriptor using the summary schema is a restricted subset of the full ISO19119 specification.

Figure 6: ISO19119Summary Schema Subset

5.1.3 Full Schema

The Descriptor model returned by GetDescriptor using the full schema is a restricted subset of the full ISO19119 specification.
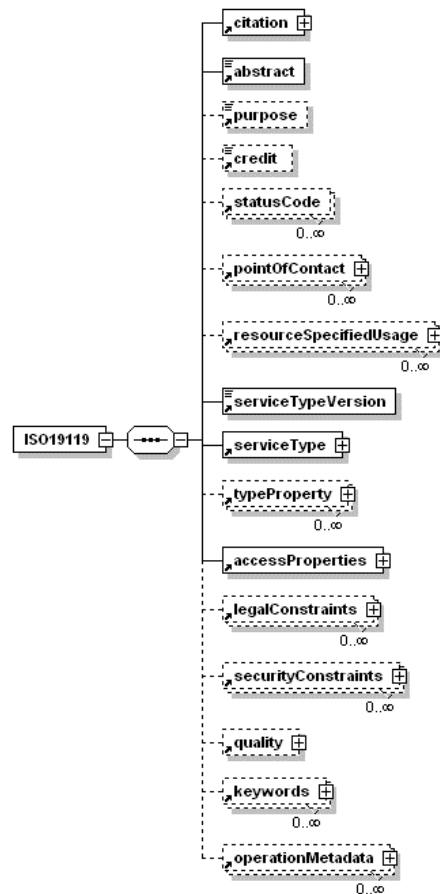
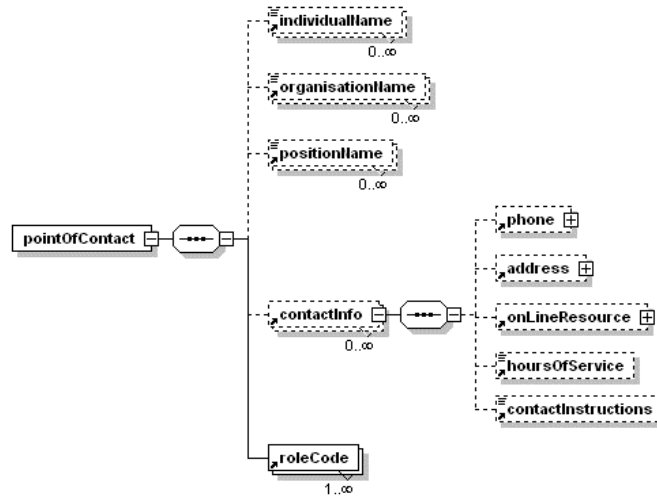**Figure 7: ISO19119 Full Schema Subset**

Of interest to the uDig application are:

- pointOfContact

- citation

- operationMetadata

- typeProperty

The details of these elements will be explored in the following sections.

5.1.4 Full Schema pointOfContact

Point of Contact information can be used to locate GIS information published by an organization or individual.

Figure 8: Full Schema pointOfContact

5.1.5 Full Schema citation

Citation is used to locate GIS information through association with related works.
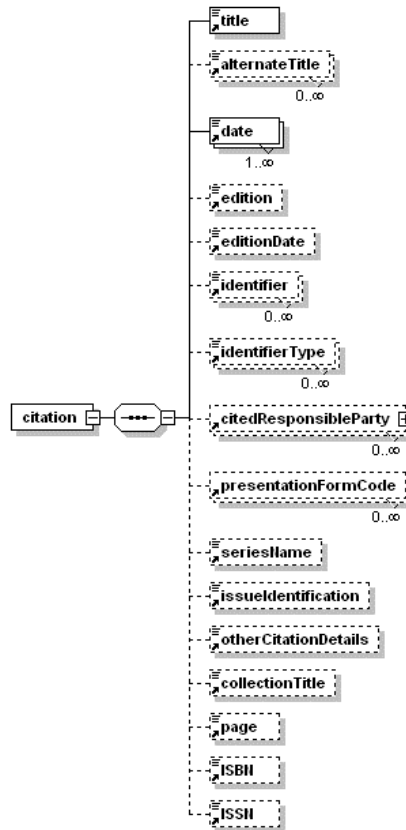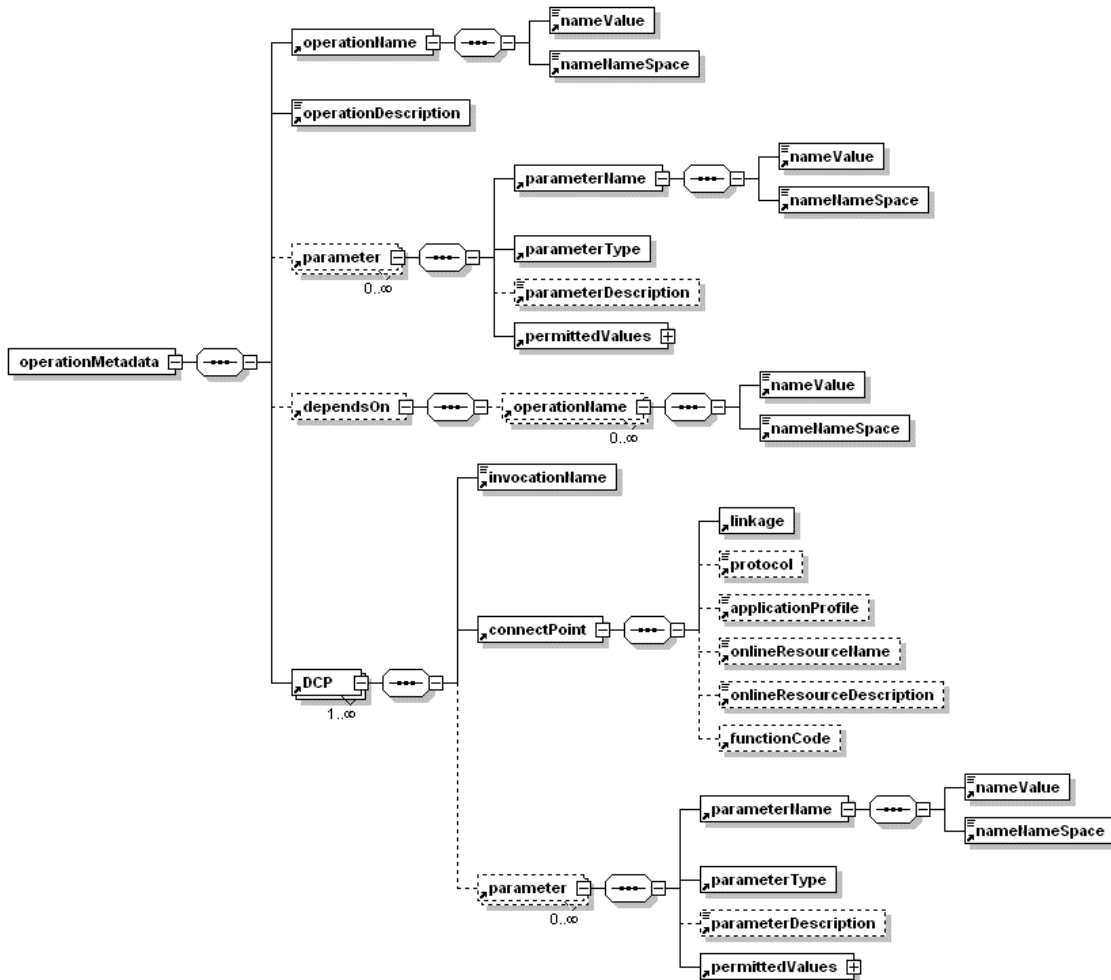

Figure 9: Full Schema citation

5.1.6 Full Schema operationalMetadata

Operational metadata is used to define services; this is of special importance to the uDig application as it defines our connections to WFS and WMS services.
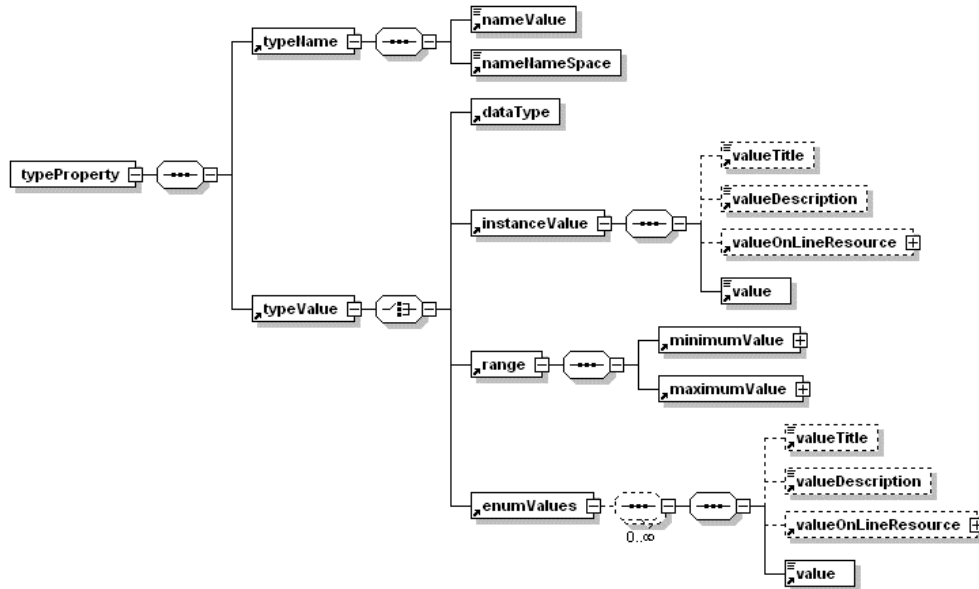

Figure 10: Full Schema operationalMetadata

Of interest to the uDig application is:

- dependsOn – used to track service chains, such as a WMS that is rendering the contents of a WFS.

5.1.7   Full Schema typeProperty

The typeProperty is used to describe both the name and type of Catalog contents.


Figure 11: Full Schema typeProperty

Of interest to the uDig application are:

- typeName – name of WMS Map Layer or WFS FeatureType
- dataType – corresponds with WFS FeatureType

5.2 Web Feature Server

The OGC Web Feature Server provides GIS Feature information as an OWS. Feature information is made available by a GetFeature interface; the resulting document is encoded in Geographic Markup Language (GML).
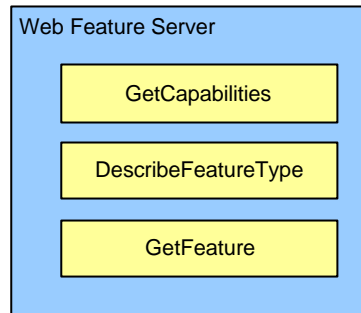
Figure 12: Web Feature Server

Web Registry Service harvests the following information from a Web Feature Server:
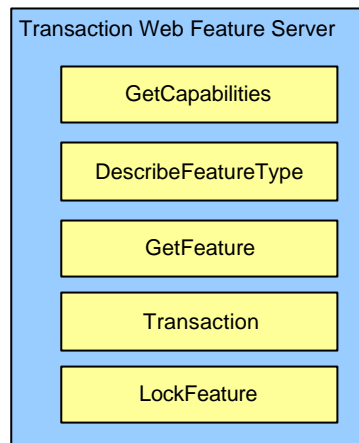
Web Registry Service	Web Feature Service
GetCapabilities	GetCapabilities
GetCapabilities	DescribeFeatureType
GetDescriptor	GetFeature
CatalogType	FeatureType
QueryExpression	Filter
AttributeSetName	FeatureType

There is some question with respect to the use of registry descriptors and WFS. The public draft specification information does not explicitly state if a WFS FeatureType, or the FeatureCollection resulting from a GetFeature request should be captured as a registry descriptor.

The above breakdown has been gathered from the "Comparison of WFS, WRS and OGC Catalog Services" discussion paper.

5.3 Transactional Web Feature Server

The OGC Web Feature Server may allow for the modification of Feature information. This capability is realized through the addition of a Transaction interface, and optional LockFeature interface.
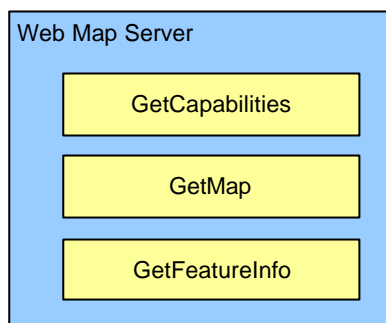

Figure 13: Transactional Web Feature Server

Web Registry Service provides additional service descriptions for Transactional Web Feature Servers.

5.4 Web Map Server

The OGC Web Map Server allows the generation of raster images from GIS Feature information. Feature information is rendered according to a common Style Layer Descriptor.

Figure 14: Web Map Server

Web Registry Service harvests the following information from a Web Map Server.

Web Registry Service	Web Map Server
GetCapabilities	GetCapabilities
GetDescriptor	GetCapabilities
Registry Descriptor	Mapping Layer

6 REFERENCES

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  http://www.gsdi.org/pubs/cookbook/index.html