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Symbology Management

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i. Preface

This Interoperability Program Report (IPR) document was developed as part of the OGC Web Service, Phase 3 initiative (OWS-3). This version of the IPR reflects the status of the specification as of the change history.

ii. Submitting organizations

The following organizations submitted this document to the Open Geospatial Consortium Inc.

- Galdos Systems, Inc

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iv. Revision history

Date	Release	Editor	Primary clauses modified	Description
25 Sep 2005	0.1.0	Milan Trninic	Initial draft	
21 Nov 2005	0.2.0	Milan Trninic	5.6, 5.7	Small updates
19 Jan 2006	0.2.1	Milan Trninic	5.1 Figure 1	Fixed the issue with the figure's semantics

v. Changes to the OpenGIS® Abstract Specification

The OpenGIS® Abstract Specification suggests the change in the domain of Styled Layer Descriptor 1.0 specification with respect to the structure of the definitions in the SLD schema. The change is described in the section 5.5 Symbology Encoding documents and Symbols. Note this change has been formulated before within the SLD RWG, as well as in this initiative, as described in the Feature Portrayal Service Interoperability Program Report.

vi. Future work

Improvements in this document are desirable to [text].

This clause is optional, to be included when there is a need for further work, and some needed parts of that further work are clear.

Foreword

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Introduction

This document describes Symbology Management System which is a system closely related to OpenGIS Style Management Services (SMS) (described in the document OGC 04-040). Having in mind their identical purpose, the system described in this document will also be referred to as SMS.

The SMS manages styles and symbols and defines their use in the process of producing maps from source GML data.

Symbology Management System

1 Scope

Symbology Management System (SMS) is based on distributed computational platform that employs a number of standard interfaces and encodings to allow for flexible, scalable and interoperable management of symbology (styles and symbols) in the process of producing maps from source GML data.

2 Normative references

The following normative documents contain provisions which, 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.

OGC 05-008c1, OWS Common Implementation Specification, May 2005

OGC 05-008c1, Styled Layer Descriptor Implementation Specification, Aug 2002

3 Terms and definitions

For the purposes of this specification, the definitions specified in Clause 4 of the OWS Common Implementation Specification [OGC 05-008] shall apply. In addition, the following terms and definitions apply.

4.1 application schema
Conceptual schema for data required by one or more applications [ISO/DIS 19109]

4.2 classification scheme
A taxonomy used to classify phenomena… used to characterize catalogue content [ebRIM 9.1]

4.3 client
Software component that can invoke an operation from a server

4.4 feature
Abstraction of real world phenomena; objects or phenomena on the Earth that are normally represented as graphical entities on a map (e.g., a house, political boundary, lake).
NOTE: A feature may occur as a type or an instance. Feature type or feature instance should be used when only one is meant. [ISO/DIS 19109]

4.5 feature attribute
feature property
A characteristic of a feature.
NOTE 1: A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance is used when only one is meant.
NOTE 2: A feature attribute type has a name, a data type and a domain associated to it. A feature attribute instance has an attribute value taken from the domain of the feature attribute type. [ISO/DIS 19109]

4.6 feature type
Class of real world phenomena with common properties; identifies the semantic, structure (properties and property types) and behavior of Feature instances and can be defined with an Application Schema.
EXAMPLE: The phenomenon ‘Eiffel Tower’ may be classified with other similar phenomena into a feature type ‘tower’. [ISO/DIS 19110]

4.7 interface
Named set of operations that characterize the behavior of an entity

4.8 operation
Specification of a transformation or query that an object may be called to execute

4.9 service
Distinct part of the functionality that is provided by an entity through interfaces

4.10 service instance
server
Actual implementation of a service

4.11 style
Styles provide the mapping from feature types and feature properties and constraints to (parameterized) symbols used in drawing maps; the properties and rules describing how features are drawn during a graphical rendering process.

4.12 symbol
Symbols are bundles of predefined graphical parameters and predefined fixed graphic icons ("images" or strokes); the instructions for how vector graphics are to be represented (e.g., geometry/graphic, fill, color, stroke, font, orientation, size, opacity, etc.); the instructions for how raster graphics are to be represented (e.g.,

opacity, R/G/B channel selection, color map, shaded relief, contrast enhancements, etc.).

4.13 portrayal

Presentation of information to humans [ISO 19117].

4.14 map

Portrayal of geographic information as a digital image file suitable for display on a computer screen.

4 Conventions

4.1 Abbreviated terms

Most of the abbreviated terms listed in Subclause 5.1 of the OWS Common Implementation Specification [OGC 05-008] apply to this document, plus the following abbreviated terms.

FPS Feature Portrayal Service

SMS Style Management Service

SE Symbology Encoding

SLD Styled Layer Descriptor

WMS Web Map Service

WFS Web Feature Service

WCS Web Coverage Service

GML Geography Markup Language

OGC Open Geospatial Consortium

OWS OGC Web Service

DCP Distributed Computing Platform

EPSG European Petroleum Survey Group

GIS Geographic Information System

XML Extensible Markup Language

SVG Scalable Vector Graphics

URL Uniform Resource Locator Web

HTTP Hypertext Transfer Protocol

IETF Internet Engineering Task Force

MIME Multipurpose Internet Mail Extensions

4.2 UML notation

Most diagrams that appear in this specification are presented using the Unified Modeling Language (UML) diagrams, as described in Subclause 5.2 of the OGC Web Services Common Implementation Specification [OGC 04-016r2].

4.3 Document terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [OGC 04-016r2].

5 Symbology Management

5.1 System context and the structure

The structure of the Symbology Management System is shown in the following figure:

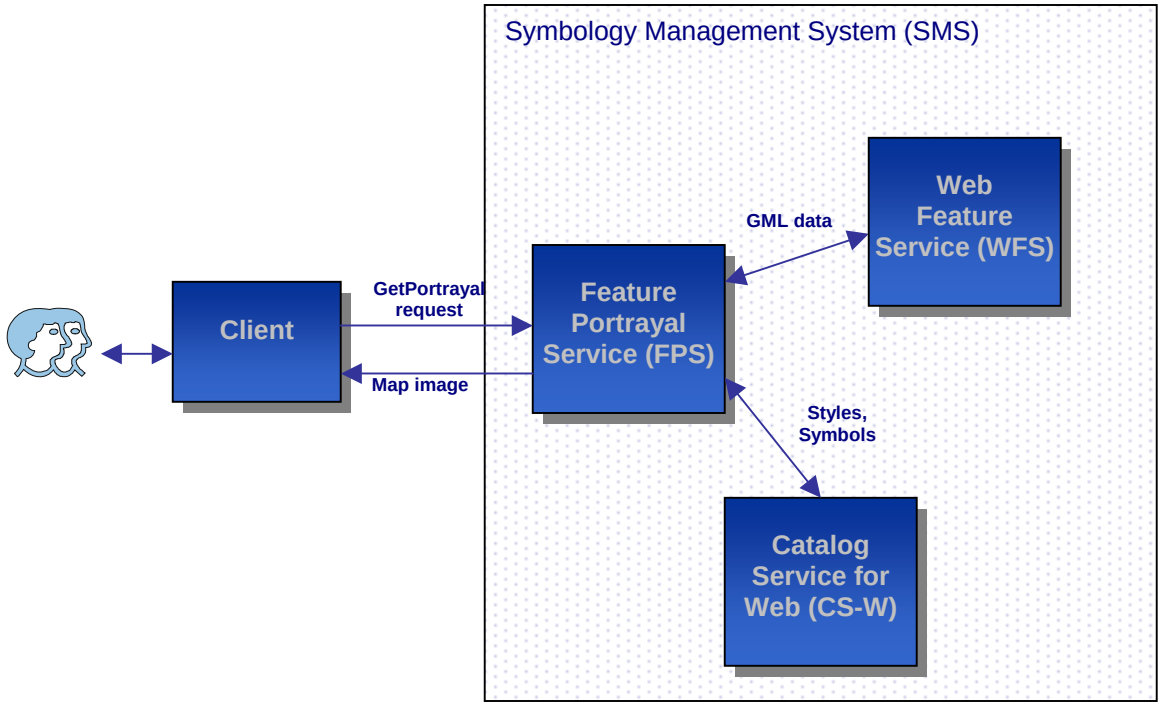

Figure 1 -- Symbology Management System

SMS consists of the following components:

***Feature Portrayal Service (FPS)* –** a service for producing map images from GML feature data.

***Web Feature Service (WFS)* –** a service for storing and retrieving GML feature data..

***Catalog Service for Web (CS-W)* –** a cataloguing web service used in this context primarily for cataloguing symbol and style entities.

Additionally, SMS manages and processes the following elements:

Style* –** a generic term for a description of styling attributes applied to a particular feature data in the portrayal process. This system (specifically, the FPS component) uses ***Symbology Encoding (SE) to encode the styles.

Symbol – a generic graphical entity referenced in the styles and used by FPS in the styling process.

Feature – objects/phenomena on the Earth that are normally represented as graphical entities on a map (e.g., a house, political boundary, lake). The term GML Feature in addition implies that the feature and its properties are encoded using GML.

5.2 Use-cases

The following use case diagram describes the different types of interaction between components in the system.

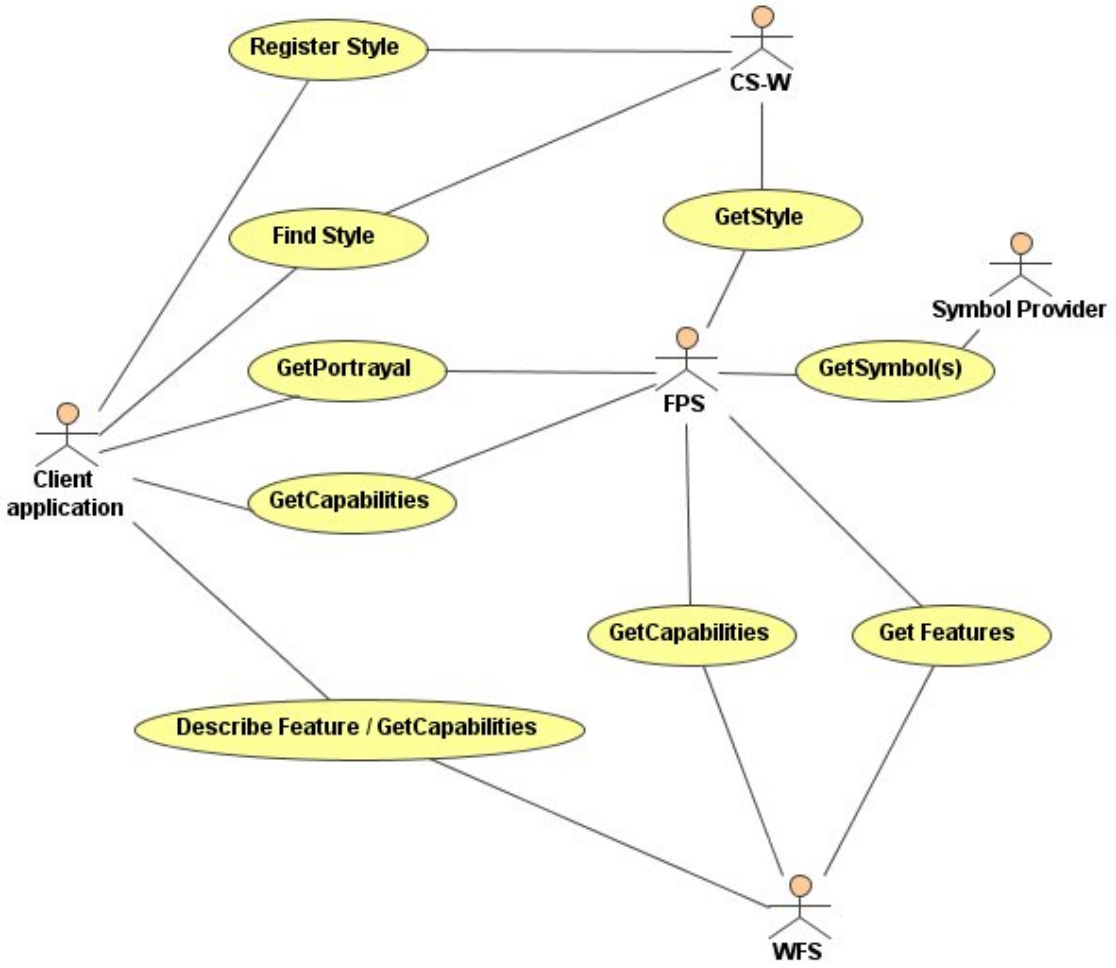

Figure 2 -- Use cases within Symbology Management System

Describe Feature / Get Capabilities

A user uses a client application to query a WFS of his choice for the capabilities and the data schema. These two information elements are used by the client for subsequent preparation of queries to CS-W and FPS.

Register Style

User uses a client application to create a Symbology Encoding (SE) style for a particular feature type. The SE Editor client can be a visual style editor client (which has not been developed in the current system implementation), or a simple text or XML editor.

The feature information required by the style, comes from capabilities and data schema obtained from a WFS(s) services.

User uses a client application to send the SE document(s) to the CS-W that classifies them in its repository and makes them available for querying and retrieval.

Find Style

A user uses a client application to find a style (SE) in a CS-W instance. Types of queries that can be submitted to the CS-W include queries by feature type, CS-W classification, assigned symbology standard (such as EMS or Geosym), and others.

GetCapabilities

User uses the client application to retrieve the capabilities information from the FPS in order to decide whether and how to use the service in the map creation process. The user can this way select a number of appropriate FPS services.

The client application can, in the process of performing the GetPortrayal (or some other) action, send the GetCapabilities request to the FPS service in order to obtain necessary information for the task.

GetPortrayal

User uses the client application to construct a GetPortrayal request and to send it to the FPS service. The request includes information about the data source, styling reference and map properties (bounding box, size, etc). The service responds with the styled image of the data.

The client can issue multiple requests, potentially to multiple FPS services, thus retrieving multiple map images which it composes into a single map.

GetStyle

FPS service interacts with the CS-W service to retrieve the style referenced in the GetPortrayal request issued by the client. The style can be retrieved using the style id. Currently the “CS-W client capabilities” of the FPS service are limited to requests by ID, more precisely, to HTTP method=GET form of requests. It is assumed that the client

performs the discovery and selection activities and supplies the FPS service with the direct reference (ID) of the style.

Get Features

FPS service interacts with the WFS service to retrieve the data referenced in the GetPortrayal request issued by the client.

Get Symbols

Symbol Provider is, in this context, an abstract term denoting any kind of agent against which a simple query can be made to retrieve a symbol. This can include File System, HTTP Web Server, other kinds of web services, etc.

The symbol is referenced in the SE document using URI scheme and the Symbol Provider must be able to accept such references and return appropriate result.

5.3 Sequence diagrams

5.3.1 Register Style

The sequence diagram in the Figure 3 shows the RegisterStyle action activity.

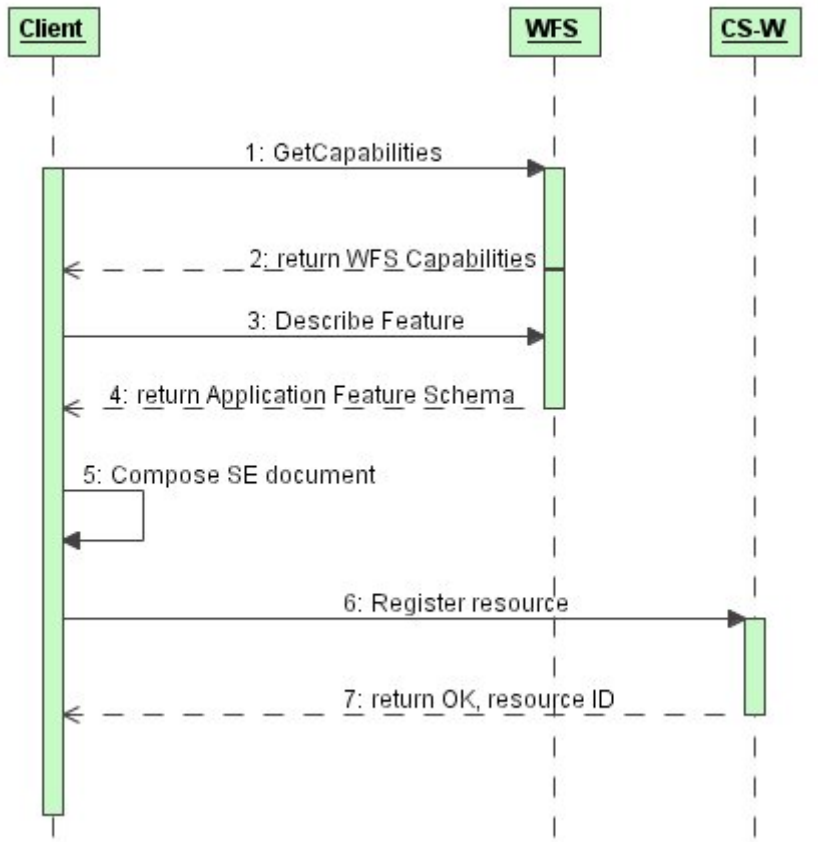

Figure 3 – Register Style sequence diagram

1. The client queries a WFS for capabilities.
2. return GetCapabilities. The WFS returns the capabilities. The client can repeat step 1 multiple times against different WFSs.
3. The client queries a WFS for data schema.
4. WFS returns the schema. The client can repeat step 3 multiple times against different WFSs.
5. Compose SE document. User uses the client to assemble an SE document.
6. Register resource. Client submits the document to CS-W for registration.
7. Response OK (ID). CS-W responds with affirmative response that includes the ID of the newly registered resource.

5.3.2 GetPortrayal

The sequence diagram in the Figure 4 shows the GetPortrayal action activity.

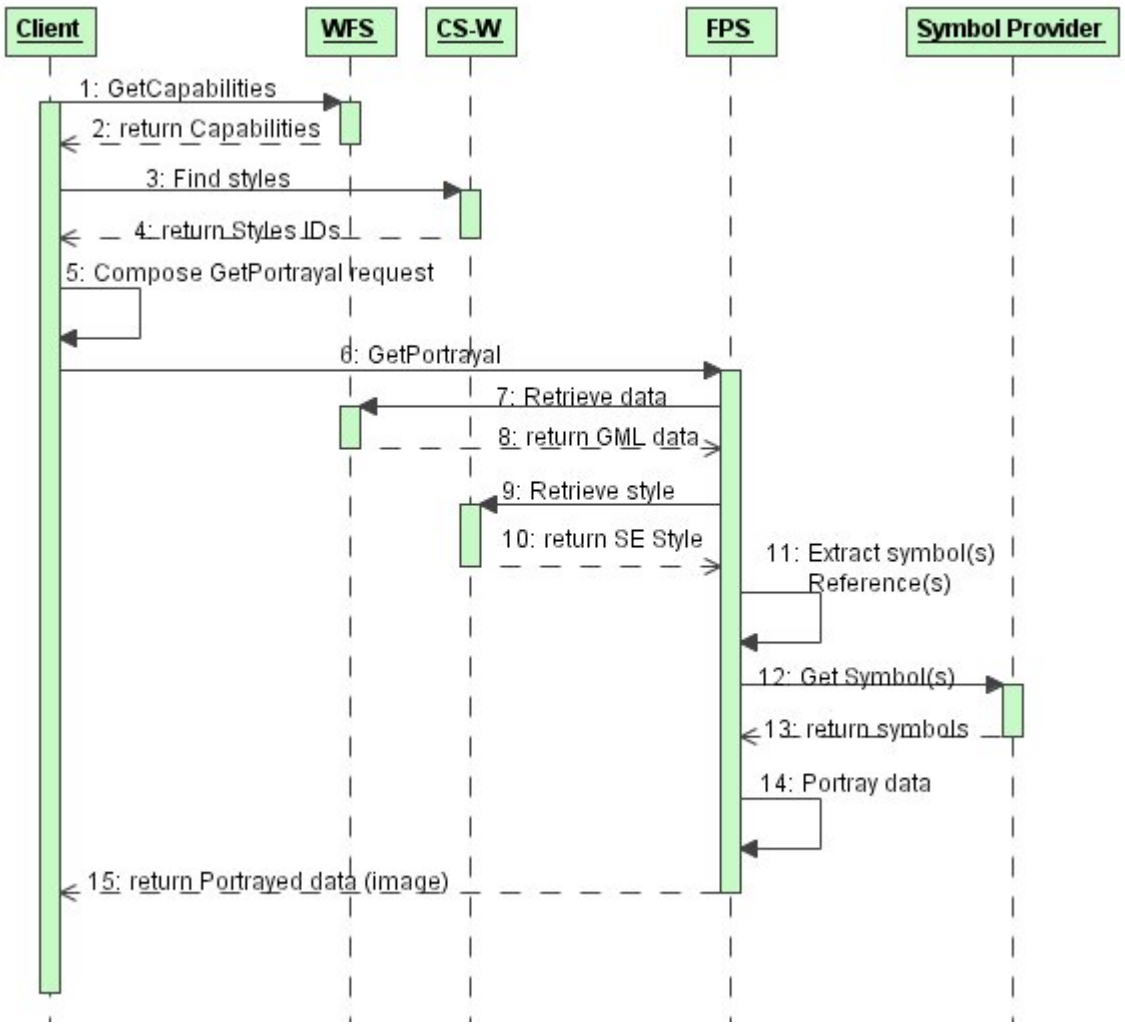

Figure 4 – GetPortrayal sequence diagram

1. The client queries a WFS for capabilities.
2. return GetCapabilities. The WFS returns the capabilities.
3. The client queries a WFS for data schema.
4. WFS returns the schema.
5. Compose GetPortrayal request. User uses the client to assemble an SE document.
6. GetPortrayal. Client submits the request to FPS service.
7. Retrieve data. FPS extracts the data source (WFS) reference from the request and submits the GetFeature request to it.

8. WFS returns the data (GML features)

9. Retrieve style. FPS extracts the style reference from the request and submits the appropriate request to the CS-W.

10. CS-W responds with the SE document

11. FPS extracts the symbol references from the SE style.

12. FPS makes the request to retrieve the referenced symbol

13. FPS receives the symbol

14. FPS portrays the features using the retrieved style and symbol

15. FPS returns the image to the client.

5.4 Feature Portrayal Service

The Symbology Management System has a significant difference compared to other similar OGC systems designed in the past in that it uses a new type of service component, namely, Feature Portrayal Service (FPS).

FPS is a service for portraying data into images and is similar to OGC Web Map Service. Both services take geospatial data as the input and produce map images on the output.

However, contrary to WMS, FPS does not implement or use in any way the term “layer” – it produces an image whose layer-specific properties (such as its z-order among other layers in a complex map image) are not taken into account at all. FPS thus can be seen as a lower-level portrayal engine that can be used in more complex portrayal scenarios including one employing WMS.

Additionally, while WMS specification does not specifically define the data source for an implementation instance of the service, FPS does specify that the data source is a set of GML features. (FPS, for example, does not have the means to produce a map image from a raster map source)

Further, WMS can accept a styling document (SLD) that, besides the feature styling description, contains other context information: URL of the data source, Naming of the layers being part of the result, a cascaded raster image source, and others. On the other hand, FPS accepts styling documents (SE) that contain nothing but the feature style description. Any and all context information is elevated out of the style description. Some (like WFS data source URL) is part of the FPS request, and some (layers, cascaded WMS references) is not used at all.

Feature Portrayal Service can be seen as a fairly basic web engine for portraying GML features. The simplicity was an important goal in the design efforts – it allows for easy and straight-forward binding of arbitrary GML data sources and applicable styling rules.

FPS exposes two requests to the clients:

- GetCapabilities
- GetPortrayal

The distribution of the resources was an important goal as well. FPS allows a user to readily, quickly and dynamically compose requests that reference arbitrary GML data source (WFS) residing on the web, and an applicable feature style residing on the web as well thus efficiently utilizing the richness of the World Wide Web for the portrayal process.

5.5 Symbology Encoding documents and Symbols

Symbology Encoding (SE) is a subset of the Styled Layer Descriptor encoding and its focus is the encoding of the styling description for a feature type. This is narrower scope than that of SLD that provides means to encode styling information pertaining to WMS (named layers and styles), map context (URL of the source data service) and other styling aspects as well.

The goal in designing Symbology Encoding was to isolate the feature style description from other information relevant to map creation. The scope of the SE encoding can be visually depicted as in the following diagram:

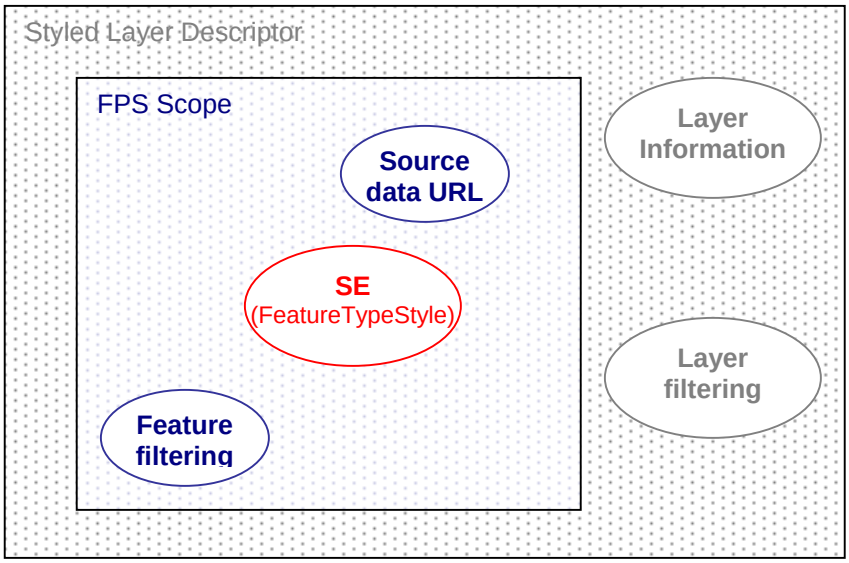

Figure 5 – Symbology Encoding scope and context

The definition of the Symbology Encoding, based on the previous portrayal work in OGC, is very simple: It is the sld:FeatureTypeStyle part of the SLD encoding.

5.6 Catalog Service for Web

The role of the Catalog Service for Web is to support registering, management, discovery and access Symbology Encoding style specifications. In addition, CS-W can store symbol libraries, but that capability was not the focus in the initiative and therefore has not been exercised in extensively. The service is required to provide the following functionality in the context of Style Management:

- Support for construction and publication of style type taxonomies
- Ability to publish and find metadata about styles.
- Ability to associate style instances to classification nodes in a style taxonomies
- Ability to bind styles to feature types

5.7 Web Feature Service

The role of the Web Feature Service is to serve as the data source in the context of a Symbology Management system. Thus, its role in this context does not differ from a general purpose of WFS in Web-based scenario. Clients send the feature requests to WFS service instance and receive data (features) in GML form.

However, it should be noted that the focus on portraying features (as opposed to other abstract data forms) is stronger in this initiative than in some previous ones, and subsequently the role of WFS is that much more significant.

Annex A
(normative)

Annex title

A.1 General

A paragraph.

A.2 Clause

A.2.1 Subclause (level 1)

A.2.1.1 Subclause (level 2)

A.2.1.1.1 Subclause (level 3)

A.2.1.1.1.1 Subclause (level 4)

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[http://portal.opengeospatial.org/files/?artifact_id=1313]

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[https://portal.opengeospatial.org/files/?artifact_id=7470]

[3] OGC 05-110 Feature Portrayal Service
[http://portal.opengeospatial.org/files/?artifact_id=11497]

[4] OGC 05-077 Symbology Encoding Implementation Specification
[http://portal.opengeospatial.org/files/?artifact_id=12636&version=1]