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## OGC<sup>®</sup> OWS-6 Styled Layer Descriptor (SLD) Changes

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## **Preface**

Suggested additions, changes, and comments on this draft report are welcome and encouraged. Such suggestions may be submitted by email message or by making suggested changes in an edited copy of this document.

The changes made in this document version, relative to the previous version, are tracked by OpenOffice.org, and can be viewed if desired. If you choose to submit suggested changes by editing this document, please first accept all the current changes, and then make your suggested changes with change tracking on.

## **Forward**

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## OWS-6 Testbed

OWS testbeds are part of OGC's Interoperability Program, a global, hands-on and collaborative prototyping program designed to rapidly develop, test and deliver Engineering Reports and Change Requests into the OGC Specification Program, where they are formalized for public release. In OGC's Interoperability Initiatives, international teams of technology providers work together to solve specific geoprocessing interoperability problems posed by the Initiative's sponsoring organizations. OGC Interoperability Initiatives include test beds, pilot projects, interoperability experiments and interoperability support services - all designed to encourage rapid development, testing, validation and adoption of OGC standards.

In April 2008, the OGC issued a call for sponsors for an OGC Web Services, Phase 6 (OWS-6) Testbed activity. The activity completed in June 2009. There is a series of on-line demonstrations available here: <http://www.opengeospatial.org/pub/www/ows6/index.html> The OWS-6 sponsors are organizations seeking open standards for their interoperability requirements. After analyzing their requirements, the OGC Interoperability Team recommended to the sponsors that the content of the OWS-6 initiative be organized around the following threads:

1. Sensor Web Enablement (SWE)
2. Geo Processing Workflow (GPW)
3. Aeronautical Information Management (AIM)
4. Decision Support Services (DSS)
5. Compliance Testing (CITE)

The OWS-6 sponsoring organizations were:

- U.S. National Geospatial-Intelligence Agency (NGA)
- Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD)
- GeoConnections - Natural Resources Canada
- U.S. Federal Aviation Agency (FAA)
- EUROCONTROL
- EADS Defence and Communications Systems
- US Geological Survey
- Lockheed Martin

- BAE Systems
- ERDAS, Inc.

The OWS-6 participating organizations were:

52North, AM Consult, Carbon Project, Charles Roswell, Compusult, con terra, CubeWerx, ESRI, FedEx, Galdos, Geomatys, GIS.FCU, Taiwan, GMU CSISS, Hitachi Ltd., Hitachi Advanced Systems Corp, Hitachi Software Engineering Co., Ltd., iGSI, GmbH, interactive instruments, lat/lon, GmbH, LISAsoft, Luciad, Lufthansa, NOAA MDL, Northrop Grumman TASC, OSS Nokalva, PCAvionics, Snowflake, Spot Image/ESA/Spacebel, STFC, UK, UAB CREAM, Univ Bonn Karto, Univ Bonn IGG, Univ Bunderswehr, Univ Muenster IfGI, Vightel, Yumetech.

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# OGC® OWS-6 Styled Layer Descriptor (SLD) Changes

## 1 Introduction

### 1.1 Scope

This OGC® document reports the results achieved in the Decision Support Services (DSS) subtask of the OWS-6 testbed initiative as it relates to the extension of the OGC Styled Layer Descriptor (SLD) symbology format for improved capability and harmonization with ISO 19117 symbology, International Hydrographic Organization S-52 symbology, USGS Topomap symbology, and Homeland Security Emergency Management symbology.

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## 1.2 Document contributor contact points

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

## 1.3 Revision history

Date	Release	Editor	Primary clauses modified	Description
2009-04-27	1.1.20	C. Bruce	Main body	OWS-6 project final release
07-29-09	0.3.0	C. Reed	Various	Prepare for publication

## 1.4 Future work

Improvements in this document are desirable to further improve the capability of the SLD format and improve its compatibility with ISO 19117 and other symbology standards.

## 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.

OGC 09-016 (April 2009), *OWS-6 Symbology Encoding (SE) Changes (Engineering Report)*, Craig Bruce (ed.)



OGC 05-078r4 (June 2007), *Styled Layer Descriptor profile of the Web Map Service Implementation Specification (version 1.1.0)*, Markus Lupp (ed.), <[http://portal.opengeospatial.org/files/?artifact\\_id=22364](http://portal.opengeospatial.org/files/?artifact_id=22364)>

OGC 05-077r4 (July 2006), *Symbology Encoding Implementation Specification (version 1.1.0)*, Markus Müller (ed.), <[http://portal.opengeospatial.org/files/?artifact\\_id=16700](http://portal.opengeospatial.org/files/?artifact_id=16700)>

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

### 3 Terms and definitions

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

#### 3.1

##### **graphic**

Small icon picture drawn at a point or filling an area

#### 3.2

##### **layer**

User-selectable content for a map

#### 3.3

##### **map**

Pictorial representation of geographic data

#### 3.4

##### **style**

Determines the appearance geographic data

### 4 Conventions

#### 4.1 Abbreviated terms

HTTP	Hypertext Transfer Protocol
ISO	International Organization for Standardization
OGC	Open Geospatial Consortium
OWS	OGC Web Service
SE	Symbology Encoding
SLD	Styled Layer Descriptor
SVG	Scalable Vector Graphics

USGS	United States Geological Survey
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Mapping Tile Service
XML	Extensible Markup Language

## 4.2 Skeleton XML schemas

This document defines data types in XML Schema. A “skeleton” schema is one in which all comments and superfluous type definitions have been removed. The skeleton schemas included in the narrative are informative and the XML-Schema files distributed with this document are normative.

## 4.3 Narrative verb tenses

This document describes changes made for the proposed new design. Verb tenses are used saying that certain changes “have been” or that a change “is” made rather than saying that certain changes “should be” made to make this document easier to read. However, this document is only a proposal.

## 5 Styled layer descriptor overview

This OGC™ document reports the results achieved in the Decision Support Services (DSS) subtask of the OWS-6 testbed initiative as it relates to the extension of the OGC Styled Layer Descriptor (SLD) symbology format for improved capability and harmonization with ISO 19117 symbology, International Hydrographic Organization S-52 symbology, USGS Topomap symbology, and Homeland Security Emergency Management symbology.

This report details changes made to the SLD design at the map, layer, and style levels.

## 6 Styled layer descriptor

**StyledLayerDescriptor** has been updated to the following skeleton XML Schema:

```
<xsd:element name="StyledLayerDescriptor">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="se:Version"/>
      <xsd:element ref="se:Name" minOccurs="0"/>
      <xsd:element ref="se:Description" minOccurs="0"/>
      <xsd:element ref="sld:UseSLDLibrary" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element ref="sld:Layer" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

The **version** attribute has been changed into an **Version** element and its value is “1.1.20”. This is discussed with the Symbology Encoding Engineering Report [OGC 09-016] common elements.

## 7 Layer

The SLD **Layer** encoding has been updated to the following skeleton XML schema:

```
<xsd:element name="Layer">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="se:Name" minOccurs="0"/>
      <xsd:element ref="se:Description" minOccurs="0"/>
      <xsd:choice minOccurs="0">
        <xsd:element ref="sld:ExternalDataSource"/>
        <xsd:element ref="sld:InlineFeatureCollection"/>
      </xsd:choice>
      <xsd:choice minOccurs="0" maxOccurs="unbounded">
        <xsd:element ref="sld:NamedStyle"/>
        <xsd:element ref="sld:UserStyle"/>
      </xsd:choice>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

### 7.1 Layer element

The SLD 1.1.0 **NamedLayer** and **UserLayer** elements have been amalgamated and simplified to only identify the source of feature or coverage data and act as a container for the styling sub-elements. The SLD 1.1.0 design is over-complicated and redundant.

Amalgamating the existing layer elements produces no ambiguity and provides extra functionality. The main distinction between a **NamedLayer** and a **UserLayer** is that a **UserLayer** can reference an external data source such as a WFS and that a **UserLayer** can reference only **UserStyles**, not **NamedStyles**.

As CubeWerx has refined its internal structures that represent SLD information, we have found that it is very natural to represent both **NamedLayers** and **UserLayers** using exactly the same structure; the only distinction is that a named layer does not have all of its information filled in at SLD-parsing time; the fields are set to “unresolved” values. The missing information is resolved when processing is needed. In the case of layers, the only missing information is the data source. SLD defines missing sources to refer to the local or default data source.

Additional functionality can be realized by allowing user-defined layers to refer to a named style in the case that the user-defined layer refers to a remote WMS or WMTS.

### 7.2 External data source

**ExternalDataSource** has the following skeleton XML schema:

```

<xsd:element name="ExternalDataSource">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="sld:DataSourceType"/>
      <xsd:element ref="se:OnlineResource"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

```

The SLD 1.1.0 **RemoteOWS** element has an overly specific name. At CubeWerx, we use this mechanism to draw data from any kind of data source, such as a local Shapefile, which is neither “remote” nor an OGC Web Service. This element has been changed to the more generic name **ExternalDataSource**. The term “external” is also used in SE in **ExternalGraphic** in to refer to a graphic resource that is in an external format to the SE Standard.

**DataSourceType** has the following skeleton XML schema:

```

<xsd:element name="DataSourceType" type="xsd:string"/>

```

The SLD 1.1.0 **RemoteOWS** element included a **Service** sub-element that identified the remote-OWS type. This has been changed to the more generic name **DataSourceType**.

Also, the SLD 1.1.0 **Service** element had the specific enumerated values of “**WFS**” and “**WCS**”. The OGC service types of “**WMS**” and “**WMTS**” should be added to allow the additional functionality of cascading maps from remote WMS and WMTS services. Keep in mind that SLDs are useful outside of WMSes. For instance, it could be used as a map definition within a client application. The client will be directed to draw the map from various sources, perhaps including WMSes.

This mechanism could also be used for any number of additional source formats, though no canonical names are defined for them. The XML Schema type has been changed to use a generic **xsd:string** type to keep it open.

### 7.3 Inline feature collection

**InlineFeatureCollection** has the following skeleton XML schema:

```

<xsd:element name="InlineFeatureCollection">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="gml:FeatureCollection"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

```

The SLD 1.1.0 **InlineFeature** element was misnamed. It allowed inline GML feature collections instead of just a single feature, so it has been renamed to **InlineFeatureCollection**.

The **InlineFeature** element also included an unbounded number of GML feature collections. This is both unnecessary and awkward. It is unnecessary since a GML feature collection may include any number of features of any type, so no benefit is obtained from allowing more than one GML feature collection to be present. It is awkward since GML documents and WFS responses include exactly one GML feature collection, so implementations will be organized to process a single GML feature collection as a complete data store; requiring them to process multiple GML features collections would require new functionality. The **InlineFeatureCollection** element includes exactly one GML feature collection.

#### 7.4 Layer feature constraints and layer coverage constraints

The SLD 1.1.0 **LayerFeatureConstraints** and **LayerCoverageConstraints** elements have been removed. The layer constraints are redundant with respect to the necessary filtering capabilities of the **Rule** element in Symbology Encoding. The capability was originally included in SLD because one participant asked for it, but it is unclear if the capability was ever used and the participant is no longer active in OGC.

One could argue that these constraints allow one to define precisely which features and/or coverage elements are present in a layer; however, defining the data contents of abstract feature agglomerations is not the purpose of SLD. Layers exist only to serve as a convenient user-selection package for drawing maps.

One could also argue that the constraints make it more convenient for a client to request a custom map in an environment that uses a catalog of **FeatureTypeStyles**. I.e., one could construct a **StyledLayerDescriptor** that references predefined **FeatureTypeStyles** but where additional feature constraints are provided in the **Layer** level using the **LayerFeatureConstraint** element. This allows the cataloged feature styles to be used as-is, but this use case does not justify the additional implementation burden on all implementers to support it.

If the client wants more complicated functionality, then it should take on the burden itself by fetching the **FeatureTypeStyle** definitions from the catalog and altering the contained **Rules** as needed to achieve the additional feature-selection constraints. This way, only the clients that need this additional functionality end up paying for it.

## 8 User style

The **UserStyle** element has the following skeleton XML Schema:

```
<xsd:element name="UserStyle">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="se:Name" minOccurs="0"/>
      <xsd:element ref="se:Description" minOccurs="0"/>
      <xsd:element ref="sld:IsDefault" minOccurs="0"/>
      <xsd:choice maxOccurs="unbounded">
        <xsd:element ref="se:FeatureTypeStyle"/>
        <xsd:element ref="se:FeatureTypeStyleReference"/>
      </xsd:choice>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

```
<xsd:element ref="se:CoverageStyle"/>
  <xsd:element ref="se:CoverageStyleReference"/>
</xsd:choice>
</xsd:sequence>
</xsd:complexType>
</xsd:element>
<xsd:element name="IsDefault" type="xsd:boolean"/>
```

An SLD 1.1.0 **UserStyle** could contain a mix of one or more **FeatureTypeStyle**, **CoverageStyle**, or **OnlineResource** elements. The use of a “naked” **OnlineResource** element here is problematic in that neither the user nor the SLD processor can know which type of style is being included without fetching it. In general, naked **OnlineResource** elements should be replaced by special reference elements to be explicit about what is being included.

The new SE design adds the **FeatureTypeStyleReference** and **CoverageStyleReference** elements that are made use of here.

## **Annex A**

### **XML Schema Documents**

In addition to this document, this report includes several XML Schema Documents. These XML Schema Documents are bundled in a zip file with the present document.

The symbology abilities now specified in this document use symbology specified XML Schema Documents included in the zip file with this document. These XML Schema Documents combine the XML schema fragments listed in various subclauses of this document, eliminating duplications. The main XML Schema Document is named:

StyledLayerDescriptor.xsd

These XML Schema Documents use and build on other OGC XML Schema Documents.

## Bibliography

- [1] OGC 09-012 (April 2009), *OWS-6 Symbology-Encoding Harmonization (Engineering Report)*, Craig Bruce (ed.)
- [2] ISO 19117:2005 (2005), *Geographic information — Portrayal*, <[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=40395](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=40395)>
- [3] ISO 19117 Revision Draft (January 2009), *Geographic information — Portrayal*