

Securely Implementing Open Geospatial Consortium Web Service Interface Standards in Oracle Spatial

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ABSTRACT

In this paper, we briefly describe the implementation of various Open Geospatial Consortium Web Service Interface Standards in Oracle Spatial 11g. We highlight how we utilize Oracle’s implementation of OASIS Web Services Security (WSS) to provide a robust security framework for these OGC Web Services. We also discuss our future direction in supporting OGC Web Service Interface Standards.

Categories and Subject Descriptors

H.3.5 [Information Storage and Retrieval]: Online Information Services – *Web-based services*.

General Terms: Standardization, Design, Security.

Keywords: OGC Web Service Interface Standards, Geospatial, Oracle Spatial, Security.

1. INTRODUCTION

The Open Geospatial Consortium (OGC) Web Service Interface Standards are developed to create self-contained, standards-based, interoperable geospatial web services that can be published, discovered and invoked across the web. Implementing these services and enabling them to integrate with non-spatial web services will help bring the value of geospatial applications to a much broader community.

“In repeated surveys, IDC has found that Oracle is used in 80-90% of medium-sized and large enterprise spatial information systems.”[7] As a primary Spatial Information Management Software vendor, Oracle plays an important role to help drive the adoption of the OGC Web Service standards.

In Oracle 11g, we have implemented following Open Geospatial Consortium (OGC) Web Service Interface Standards: Web Feature Service Interface Standard (WFS)[5], Catalogue Services Interface Standard (CS-W) [2], Open Location Services Interface Standard (OpenLS)[3], and Web Map Service Interface Standard (WMS) [6]. In the following sections, we will describe our implementation and discuss how to leverage the underlying Oracle security framework to provide security for OGC Web Services.

2. ORACLE SPATIAL WEB SERVICES

We implement OGC Web Services in Oracle Fusion Middleware as shown in Figure 1. Since this implementation is J2EE-based and built with standards-based technologies, it can be deployed to other application servers.

In addition to the mandated XML interfaces, Oracle Spatial WFS, Oracle Spatial CSW and Oracle Spatial OpenLS also support SOAP interfaces. To improve performance, Oracle Spatial WFS and Oracle Spatial CSW also implement caching mechanism to support retrieving records from a single query across different web requests.

Below, we describe each of supported OGC Web Services in Oracle Spatial. Due to space limits, we will emphasize Oracle Spatial WFS support to illustrate our unique implementation.

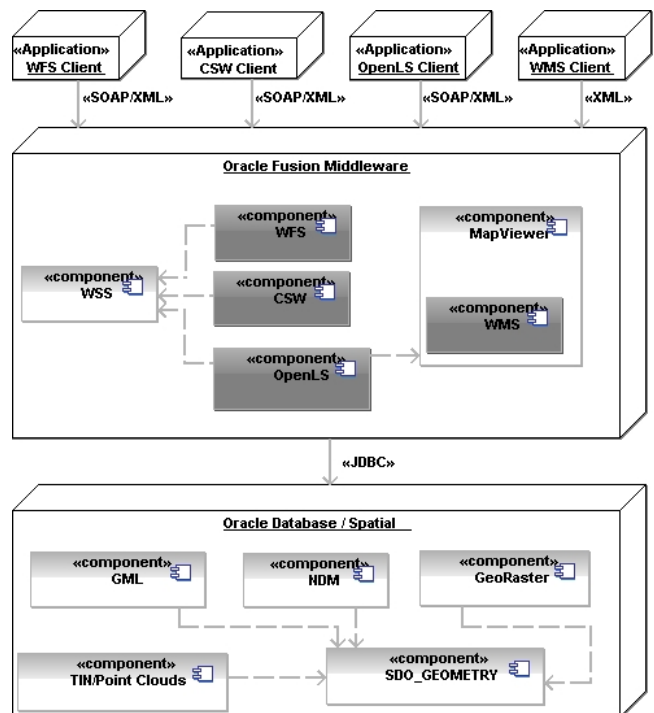


Figure 1. UML Deployment Diagram of Oracle Spatial Web Services Framework

2.1 Oracle Spatial WFS

The OGC WFS provides interfaces for executing data manipulation operations on geographic features over HTTP in a distributed computing environment.

Oracle Spatial WFS supports transactional WFS operations. As Web connections are inherently stateless, the semantics of serialized transactions are not preserved. One way to ensure serializability is to use locks to control data access. Defining LockFeature and GetFeatureWithLock, OGC WFS provides a long-term feature locking mechanism to ensure consistency of transactions (insert/update/delete feature instances). Oracle Spatial WFS implements a locking module in Oracle Fusion Middleware on top

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of the PL/SQL Long Transaction Locking package. This module will enable Oracle Database to hold exclusive update locks on rows of a table for a certain specified period of time across database sessions.

Oracle Spatial WFS supports both relational and document-based feature types: 1) relational feature types expose the content of database tables as feature instances. They are well suited for those who use Oracle Spatial to manage their geospatial data and use Oracle Database to manage other business data; 2) document-based feature types expose XML schema-based XML content as feature instances. Document-based feature types are well suited for those who use XML as their main data source and who might not currently use Oracle Spatial with such data. For this data, the Spatial WFS implementation extracts the geometry components and stores them using the SDO_GEOMETRY type; it stores the remaining XML components in Oracle XDB and builds appropriate XMLIndex indexes for them.

2.2 Oracle Spatial CSW

OGC CSW provides interfaces for publishing and accessing digital catalogues of metadata for geospatial data, services, and related resource information using XML over HTTP in a distributed computing environment.

The Oracle Spatial CSW implementation supports brief/summary/full output views of record instances. It also supports custom views of record instances by dynamically generating and applying XSL transformations to response records based on the CSW query specification.

2.3 Oracle Spatial OpenLS

OGC OpenLS Services include the Location Utility Service, Presentation Service, Route Service, Directory Service, and Gateway Service. The first four are implemented using the following Oracle Spatial components, respectively: Oracle Geocoder, Oracle MapViewer, Oracle Router, and Oracle Business Directory. Oracle Spatial OpenLS does not currently support the OGC OpenLS Gateway Service (mobile positioning).

2.4 Oracle Spatial WMS

Oracle MapViewer is preconfigured to run as a WMS service, and it supports the rendering of data delivered using the OGC WMS protocol. Internally, MapViewer translates all incoming WMS requests into proper XML requests to the MapViewer server. MapViewer supports GetMap, GetFeatureInfo, and GetCapabilities requests as defined by the OGC.

3. SECURITY FRAMEWORK

Since OGC Web Services are designed for an open environment, security is always a major concern. When accessing Oracle Spatial OGC Web Services, a user can take full advantage of the underlying security framework provided by Oracle Fusion Middleware and Oracle Database. We utilize Oracle Fusion Middleware's implementation of WSS [1] to ensure message transport security

and provide authentication and authorization at the middle tier. Virtual Private Database functionality [8] further offers security and privacy protection in Oracle Database. Figure 2 illustrates how an OGC WS request is executed securely.

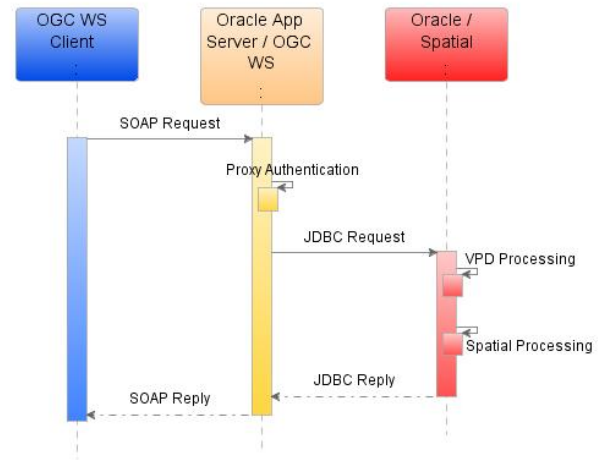


Figure 2. UML Sequence Diagram for Securely Processing an OGC WS Request

4. FUTURE WORK

In the near future, we will focus on improving the usability of our implementation to meet real customer needs. We also plan to support more OGC Web Service Interface standards, such as WCS [4].

5. REFERENCES

- [1] OASIS Web Services Security. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss.
- [2] OpenGIS® Catalogue Services Interface Standard (CSW). <http://www.opengeospatial.org/standards/cat>.
- [3] OpenGIS® Open Location Services Interface Standard (OpenLS). <http://www.opengeospatial.org/standards/ols>.
- [4] OpenGIS® Web Coverage Service Interface Standard (WCS). <http://www.opengeospatial.org/standards/wcs>.
- [5] OpenGIS® Web Feature Service Interface Standard (WFS). <http://www.opengeospatial.org/standards/wfs>.
- [6] OpenGIS® Web Map Service Interface Standard (WMS). <http://www.opengeospatial.org/standards/wms>.
- [7] Sonnen, D. and Vesset D. Worldwide Spatial Information Management Software 2008-2012 Forecast and 2007 Vendor Shares, International Data Corporation (IDC), Market Analysis, Doc# 213930, September 2008.
- [8] Virtual Private Database. Oracle® Label Security Administrator's Guide.