Open Geospatial Consortium Inc.

Date: 2008-08-29

Reference number of this document: OGC 08-140

Version: 0.0.6

Category: OpenGIS® Discussion Paper

Editor(s):

Benjamin Hagedorn (Hasso-Plattner-Institut) benjamin.hagedorn@hpi.uni-potsdam.de

Alexander Zipf (University of Bonn, Department of Geography) zipf@geographie.uni-bonn.de

Arne Schilling (University of Bonn, Department of Geography) schilling@geographie.uni-bonn.de

Steffen Neubauer (University of Bonn, Department of Geography) neubauer@geographie.uni-bonn.de

3D Portrayal Services – Use Cases

Warning

This document is not an OGC Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an OGC Standard.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document type: OpenGIS® Discussion Paper
Document subtype: Use Cases
Document stage: Draft
Document language: English

TABLE OF CONTENTS

1 Introduction

1.1 Scope

This document reviews the family of 3D Portrayal Services (3DPS) and explains how they can be used in selected scenarios. The distinctive features of 3D portrayal is outlined that make it necessary to implement and standardize special interfaces for delivering 3D geo data in addition to the already existing international standards WMS and WFS. 3DPS aims at supporting visualization centric applications by providing perspective views as images or 3D display elements that can be rendered and interactively explored.. We assume a service-based software system which is capable of the integration, combination, management, and visualization of and interaction with 2D and/or 3D geo information. The portrayal functionality is exemplarily showed by several use cases.

1.2 Normative References

OGC 03-040	Percivall, G. (ed.), *OGC Reference Model*, Version 0.1.3, Sept. 2003.
OGC 05-0xx	Whiteside, A. (ed.), *OpenGIS® Web Perspective View Service (WPVS) Implementation Specification, Draft Version*, Oct. 2005.
OGC 05-019	Quadt, U., Kolbe, Th. (eds.), *Web 3D Service*, OGC Discussion Paper, Feburary 2005.
OGC 05-077r4	Müller, M. (ed.), *Symbology Encoding Implementation Specification*, Version 1.1.0 (revision 4), July 2006.
OGC 02-070	Lalonde, W. (ed.), *Styled Layer Descriptor Implementation Specification*, Version 1.0.0, Sept. 2002.
OGC 05-078r4	Lupp, M (ed.), *Styled Layer Descriptor profile of the Web Map Service Implementation Specification*, Version 1.1.0, June 2007.
OGC 04-095	Vretanos, P. A. (ed.),*OpenGIS® Filter Encoding Implementation Specification*, Version 1.1.0, May 2005

1.3 Abbreviations and Terms

3DVE	3D Virtual Environment
CS/W	Catalogue Service
FE	Filter Encoding
SE	Symbology Encoding
SDI	Spatial Data Infrastructure
SLD	Styled Layer Descriptor
W3DS	Web 3D Service
WFS	Web Feature Service
WMS	Web Map Service
WPVS	Web Perspective View Service

1.4 3D Portrayal Services Family

1.4.1 Portrayal Services

The overall aim of service-based geoinformation systems is to reach interoperability for geoinformation management, access, and usage. Geovisualization is a crucial part of such a geoinformation system. It allows for making complex geoinformation available for human users as it provides rapid comprehension and evaluation and thus supports geocommunication.

Equivalent to 2D geoinformation portrayal services, a family of 3D portrayal services targets at the visualization of 3D geovirtual environments (3DVEs) including 2.5D and/or 3D geoinformation in an interoperable manner, e.g., for the integration into workflows and processes in various business domains and scenarios. 3DVEs contain, e.g., terrain models, building models, vegetation models, traffic infrastructure models, land usage information, and other georeferenced information.

The major capability of 3D portrayal services is to generate perspective views of a 3DVE or to support the generation of these views. For example, a service consumer defines which geoinformation to include into the 3DVE and from where to look at the scenery. A 3D portrayal service than generates an image of the view and returns it to the requestor.

1.4.2 2D vs. 3D Portrayal

For 2D portrayal, the WMS represents the “work horse” for interoperable visualization of 2D maps. The service consumer is able to choose the information layers to include into the generated visualization and to influence the visual appearance of the visualized features. The SLD profile of the WMS allows for precise adjustment of 2D features representation. Such a WMS allows for requesting type descriptions of the represented features and for requesting additional information of a features at a specific image position.

Several activities within the OGC target at the interoperable description of 3D geoinformation. Those are, e.g., GML 3 (which allows for 3D geometries) and CityGML (which is a GML 3 profile for describing regional landscape models and city models). For the portrayal of this 3D geoinformation, W3DS and WTS (which will be replaced by the WPVS) represent primary specification. In addition to interoperable 2D map generation and access (by WMS), 3D portrayal becomes more and more important. Compared to 2D maps, perspective views can improve the perception and interpretation of complex spatial information: They show the height of geoobjects, included façades hint on the usage of buildings, etc. Perspective views become a generally known and accepted medium for spatial information[1]. Nevertheless, there are no standard approaches widely used for 3D geovisualization.

1.4.3 Portrayal Model

The OGC portrayal model (Fig. 1) can also be applied to 3D portrayal. Components of a 3D portrayal services family are arranged along that pipeline. Major aspects of these services and specification target at the generation of display elements (e.g., a scene graph), rendering images, and giving the possibility to influence the visual appearance of features by styling. While generating and serving display elements leads to client-site rendering, generating images represents fully server-side rendering.

---

[1] Examples of perspective views are shown in Annex A.

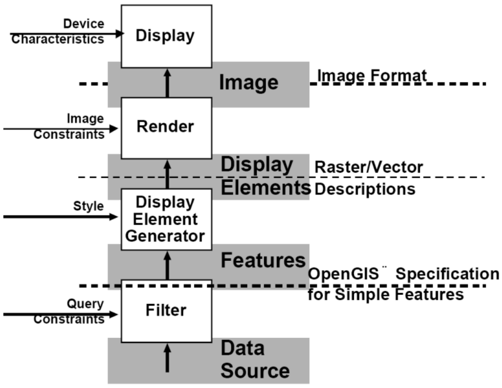


Fig. 1:– OGC portrayal model [OGC 03-40]

On-going efforts for 3D portrayal are the Web 3D Service (W3DS), the Web Perspective View Service (WPVS), and extensions to the Symbology Encoding (SE).

1.4.4 W3DS for Client-Side Rendering

The W3DS creates 3D scenes of landscape and city models that can be explored interactively on the client. It delivers graphical elements for displaying a complete 3D map or parts of it. The client, which is equipped with modern 3D graphics acceleration hardware can decide how to visualize and explore the scene and is not confined to certain viewpoints (like e.g. in panoramic images). The W3DS is suitable for a Medium Server Medium Client concept, which means that the Server collects the necessary geo data, and generates display elements which are streamed to the Client. The Client is responsible for rendering the display elements on the screen using the rendering techniques of his choice.

The W3DS is designed as Portrayal Service. It does not provide the raw geo data but a 3D representation of the data. The difference is that the geo data itself is organized in features and object with additional attributes, meta data, and semantics, and the result of a Portrayal Service is just something that can be viewed. There is no guarantee on the internal structure of the resulting scenes and attribute data is generally missing due to lacking support in current 3D internet formats (e.g. COLLADA, X3D). It is even advisable to re-organize the scene graph structure for a more efficient rendering. For retrieving fully GML compatible and attribute rich geo data, a WFS should be used. The advantage of using visualization-centric formats is that they support a wide range of features for controlling the visual appearance (e.g. textures, surface properties, animations, lighting, athmosphere) and that they can be more efficiently transmitted and encoded.

1.4.5 WPVS for Server-Side 3D Rendering

The WPVS targets at generating images of perspective view of a 3D scene and sending this to the service consumer. With this approach, we can set up a dedicated server with appropriate 3D hardware, i.e., we don't have to deal with incompatible, diverse 3D hardware configurations at the client-side. On the client-side, users get access to arbitrary complex geovirtual environments with high-quality graphics output and without having to install specialized 3D applications or streaming complex 3D data – only images are transferred. This leads to:

- Omitting incompatibility problems of 3D renderers and hardware,
- Reducing administration and maintenance costs,
- Simple integration of 3D geovisualizations into complex workflows.

1.4.6 Styling for 3D Portrayal

User defined styling capabilities were introduced as extension for the WMS according to the wish to control the visual appearance of maps (OGC 05-078r4). A standard WMS can already offer a list of available styles, which the client can choose from. However, it can only provide the style name which may not be self explanatory. Controlling the map appearance by user defined styles enables the generation of thematic maps of a specific domain (population densities, vegetation classes, GDP growth, religion etc.) and adjusting the coloring and symbology to personal preferences. User defined styles are described in a language called Symbology Encoding (SE). SE contains elements for how to draw the feature geometries on the screen like color, line width, fill patterns, stroke, transparency, icons etc. The simplest way of styling is to apply a single symbol to a complete dataset. A more meaningful styling includes many symbols that are applied to the features within a dataset according to selected feature attributes. This is achieved by using Filter Encoding (FE), which defines one or several categories of features. Each category can then be styled differently. FE includes spatial, comparison, and logical operators or any combination of these for selecting features. SE and FE are combined in Styled Layer Descriptor (SLD) documents which can be attached to requests to a Portrayal Service.

The same principles as stated above are valid for 3D Portrayal Services as well. W3DS and WPVS should be able to process user defined styles. The mechanisms of SE and FE can be adopted for 3D city and landscape models. In addition to the 2D styling options also the way of how 3D objects are rendered on the screen must be taken into account. An extension of SE which can be used in conjunction with 3D Portayal Services (SE3D) must provide capabilities to describe materials, texture mapping, prototypic 3D models (in addition to or in place of icons), rendering methods, terrain elevation or slope, 3D transformations, and other things. Also the spatial operators and SRS handling in FE must be reviewed. The additional styling and filter options are formulated as an extension to the international standard SE (SE3D). An SLD document containing SE3D elements is called SLD3D and can be attached to a GetScene or GetView request to a W3DS or WPVS.

Fig. 2**:** User-defined Styling. The buildings are colored according to the usage type (public, mixed, private). Trees are portrayed as prototypic inline objects whose size is controlled by an attribute.

The benefit of using SLD is that the map appearance can be controlled by the user. The versatile styling options allow adjusting the appearance to the personal preferences, or to a specific application domain. Some scenarios include highlighting particular objects with a specific function or meeting pre-defined criteria. This could be for instance buildings that can be used as shelters in case of a disaster. Just placing a marker over the selected object is inefficient, since other objects can still occlude it or distract from the actual information to be communicated. It is much more convenient to use 3D SLD and to style unimportant objects e.g. in grey, transparently, or as wireframe model and to use an opaque style for selected objects.

Another benefit is that the integration of different Portrayal Services within an SDI becomes easier. In some cases the necessary data is distributed on several Portrayal Services.

2 Scenarios

3D portrayal is an issue for various application domains and within those for various application scenarios. This section describes selected scenarios in several domains. The following list targets at giving an idea of what might be possible by the help of 3D portrayal services and is not complete. Furthermore, the functionality described in the scenarios is often relevant for more than one application domain and slightly overlaps.

2.1 Civil Service

2.1.1 Use a 3D view for processing a building application

A civil service agent can generate a perspective view for a specific address for getting an idea of the current building situation around that address. By picking buildings in the image further building information are displayed.

2.1.2 Use perspective views as interface for notifications of claim

A citizen can generate a perspective view for a specific address, can navigate for defining a specific view, can pick a position in that image, and can leave a notification of claim, e.g., about an out-of-order fire hydrant.

2.1.3 Show a city planning to the public

For public participation, the municipality of a city can make a city planning available to the public by 3D portrayal services. Via web portal, citizens can view this planning, select and investigate planning alternatives. Either interesting views are offered, or the users can navigate freely.

2.1.4 Access city planning data easily

By picking at interesting parts of the perspective view, citizens can request relevant city planning data, e.g., planned size of buildings, planned usage, etc.

2.1.5 Allow for commenting a city planning

Citizens can comment a city planning by annotating a specific perspective view by text or even drawing or by selecting and annotating a specific position or object in the view.

2.1.6 Inspect underground infrastructure

Engineers and department heads responsible for the maintenance of telecommunication or power cables, sewers, gas pipes, or fresh water pipes can inspect the current situation underground. When a new subways line is planned, the underground infrastructure must be analyzed and checked for conflicts.

2.2 Business Development

2.2.1 Present an urban space to an investor

For attracting an investor, a 3D city model can help to investigate interesting urban spaces. It shows the general surrounding, transportation infrastructure, etc. This reduces the number of on-site inspections and, thus, saves time and money.

2.2.2 Color buildings according to their usage

For judging the surrounding of an object of interest, the agent defines to color the buildings in the perspective view according to their usage type, e.g., living space in green, public buildings in blue, and industrial buildings in red.

2.2.3 Measure distances and areas

The perspective view can support simple analysis functionality. E.g., distances to nearby building areas or the overall size of a specific area could be calculated and displayed.

2.3 Real Estate Business

2.3.1 Offering interesting buildings to a customer

An estate agent can use the 3D portrayal services for showing buildings to customers. The perspective views show the appearance of the building, including detailed building structures (doors, windows, balconies, etc.) and real façades. Furthermore the agent can show, describe, and investigate the urban surrounding of these buildings to the potential buyer by help of specific navigation techniques supported by the client application.

2.3.2 Highlight buildings to sell

Within an interesting building area, the estate agent can influence the visual appearance of buildings that can be rent or bought. He selects some buildings by their address and others by their owner and defines which color to use for their representation. Furthermore he highlights all nearby public buildings in a different color.

2.3.3 Access BIM information easily

For all the buildings in the view, the agent can request additional BIM information such as the age of the building, usage, number of rooms, room sizes, its renovation state, land parcel information, etc. This is done by easily picking the object of interest in the image.

2.3.4 Allow for looking inside buildings

Within a city model the agent can select a single building of interest and request a building-specific visualization which allows, for looking into the building and, e.g., see the structure of the rooms at each floor.

2.3.5 Calculate and display the visibility of objects

For installing a hotel, an investor looks for a building with a good view, i.e., from where a set of relevant points of interests (e.g., church, market place, monuments, palace garden, etc.) have a high visibility. The system allows the agent to define the points of interest and the area in which to search for suitable buildings. Then, the system calculates the visibility of these POIs for each building, maps this information to the building façades, and generates new perspective views.

2.4 Security and Safety

2.4.1 Introduce an operational area to a mobile action force

In preparation for safeguarding a demonstration, action forces need to get an overview of the operation area, including size and topology of street, danger spots, etc. The presentation of the city by 3D portrayal can replace on-site inspections, and thereby reduce cost. If necessary, perspective views can be accessed by mobile devices.

2.4.2 Generate views containing escape routes

For a mass event, escape routes have to be defined and must be visualized to the security personnel as well as to the visitors. By help of a styling tool, the safety officer can enrich a perspective view of that area by additional path objects representing these escape routes. This styling description is then published and used by end users.

2.4.3 Help Fire Fighters

The fire department requests a detailed indoor building model in case of a fire incident. The 3D indoor model is analyzed in the command center before the fire fighters reach the site. Possibly the visibility in the building is limited due to the smoke. Possible access and escape routes are determined to help the fire fighter evacuating the building.

2.5 Tourism

2.5.1 Investigate a vacation spot

A tourist can use web-based 3D portrayal for investigating a vacation spot already from home. For example, this could support the decision for a specific accommodation according to the appearance of the surrounding.

2.5.2 Generate a specific touristic 3D city map

For a city tour, a tourist needs specific information such as the location of bus stops, railway stations, hotels, museums, theaters, hotels, bars, restaurants, the tourist information, etc. By an authoring tool, a municipality clerk can create a specific touristic 3D city map containing this information. A styling tool allows him to define how the integrated information shall be represented.

2.5.3 Show the current environmental situation

For making a virtual city model more appealing and more realistic, they can include sun and clouds, which could be in accordance with the real weather conditions.

2.5.4 Generate a video tour negotiating selected points of interest

For tourists a virtual city tour can give an impression about important points of interest, shopping facilities, etc. By an authoring tool a municipality clerk can define such points of interests, which are used as way points for the virtual tour. The tourist can select some or all of these way points for generating an individual video tour, e.g., a flight or a city walk.

2.6 Car and Pedestrian Navigation

2.6.1 Illustrate a track by sequences of perspective views

For illustrating a path description, perspective views along that path can be generated. Even the individual path can be embedded into the visualization. The path illustrations can be derived automatically from the defined path.

2.6.2 Guide vehicles and pedestrians on the road.

Mobile users are supported by providing 3D animations or interactive visualizations of the course of the route, which has been calculated by an OpenLS route Service. 3D Visualizations are especially useful for pedestrians using their PDAs, since they can get a better idea of where to go if the system contains also landmarks.

3 Use Cases

3.1 Use Case #1: Get 3D Map

<table>
<tr><td>Use Case Identifier: P3D#1</td><td>Use Case Name: Get 3D Map</td></tr>
<tr><td>Use Case Domain: P3D</td><td>Status: Draft 2008-08-11</td></tr>
<tr><td colspan="2">Use Case Description: Retrieve a complete static 3D Scene for exploration and analysis using a standard internet browser</td></tr>
<tr><td>Actors (Initiators): End-User, e.g. Analyst</td><td>Actors (Receivers) Same as initiator</td></tr>
<tr><td>Pre-Conditions:
- User has a standard internet browser
- Internet browser has a 3D plug-in installed
- User has access to a W3DS found on a CS/W or published otherwise</td><td>Post-Conditions:
Browser shows a complete 3D scene containing landscapes, city models, or any kind of geo data, lights, viewpoints, background, environment, and a legend. The scene is ready for exploration and publishing.</td></tr>
<tr><td colspan="2">System Components
- Browser
- Plug-in for the requested and supported format
- W3DS</td></tr>
<tr><td colspan="2">Basic Course of Action:
1. User sends a GetCapabilites request to the W3DS and receives information on available data, styles, and other options
2. User formulates a URL containing all desired request parameters
3. User sends a GetScene request to the W3DS
4. W3DS collects all required data either by connecting to its own data store or by sending a request to a WFS.
5. W3DS adds additional lights, viewpoints, legend etc. and encodes everything into the requested format.
6. Scene is received by the browser and presented by the 3D plug-in</td></tr>
</table>

3.2 Use Case #2: Get Perspective View on 3D Map

Use Case Identifier: P3D#2	Use Case Name: Get Perspective View on 3D Map

Use Case Domain: P3D	Status: Draft 2008-08-11
Use Case Description: Retrieve a rendered image showing a perspective view on a 3D map or scene that can be displayed on thin clients without 3D rendering capabilities.	
Actors (Initiators): End-User, e.g. publishing expert	Actors (Receivers) Same as initiator
Pre-Conditions: - User has a standard internet browser - User has access to a WPVS found on a CS/W or published otherwise	Post-Conditions: Browser shows a rendered image of a complete 3D scene containing landscapes, city models, or any kind of geo data, with correct lighting, background, environment, and a legend. The image is ready for publishing.
System Components - Browser - WPVS	
Basic Course of Action: 1. User sends a GetCapabilites request to the WPVS and receives information on available data, styles, and other options 2. User formulates a URL containing viewpoint parameters, desired data, rendering method, and other parameters. 3. User sends a GetView request to the WPVS 4. WPVS decides which data is necessary in order to render the described view. 5. WPVS collects the data either by connecting to its own data store, or by sending a request to a WFS or W3DS. 6. WPVS adds additional lights, legend etc. and renders everything from the defined viewpoint using the selected rendering method. 7. Scene is received and presented in the browser.	

3.3 Use Case #3: Serve Virtual Globe Application

Use Case Identifier: P3D#3	Use Case Name: Serve Virtual Globe Application
Use Case Domain: P3D	Status: Draft 2008-08-11
Use Case Description: Interactively explore 3D geo data by using a virtual globe application which automatically triggers requests for downloading missing data. Downloaded data is integrated seamlessly into the existing earth model.	
Actors (Initiators): End-User	Actors (Receivers) Same as initiator
Pre-Conditions: - Virtual Globe application is installed on the client's computer - The Virtual Globe application has access to a W3DS - The Virtual Globe application has already downloaded data from the W3DS that is necessary to display the globe from the current viewpoint at a reasonable level of detail.	Post-Conditions: The Virtual Globe application has updated the display according to a new viewpoint
System Components - Virtual Globe application	

- W3DS
Basic Course of Action: 1. End-User moves the viewpoint to a new position and/or requests additional layers. 2. The Virtual Globe application recognizes automatically that new data needs to be downloaded from the W3DS 3. The Virtual Globe application identifies missing parts that are needed to update the globe and to display it from the new viewpoint at a reasonable level of detail. 4. The Virtual Globe application formulates according GetScene requests and sends them to the W3DS. 5. The received data is seamlessly integrated into the current scene without gaps or operlaps.

3.4 Use Case #4: Get Custom Styled 3D Map

Use Case Identifier: P3D#4	Use Case Name: Get Custom Styled 3D Map
Use Case Domain: P3D	Status: Draft 2008-08-11
Use Case Description: create a 3D map with custom cartographic styling. The styling defines how to render the map contents, e.g. with different colors, materials, textures, rendering methods. The styling also involves knowledge about the available attribute names and values so that different styles can be applied to domain specific categories (e.g. population density, vegetation types, usage types of buildings etc.).	
Actors (Initiators): End-User	Actors (Receivers) Same as initiator
Pre-Conditions: - Map application is installed on the client’s computer - The map application has access to a Portrayal Service - The map application has a style editor with a GUI	Post-Conditions: The map application shows the custom styled map that can be used for exploration or publishing.
System Components - Map application - Style Editor - Portrayal Service (W3DS or WPVS)	
Basic Course of Action: 1. End-User enters the address of a Portrayal Service. 2. Map application sends a GetCapabilites request to the Portrayal Service and receives information on available layers, styles, and other options 3. User selects a layer and opens the Style Editor 4. Style Editor sends a GetLayerInfo request to the Portrayal Service and receives information on available attribute names for this layer. 5. User picks an attribute that shall be used for thematic styling and a color ramp 6. Style Editor sends a GetLayerInfo request for the specific layer and attribute name to the portrayal Service and receives information on available attribute values. 7. User adjusts the styling to his needs, he changes the distribution of values (quantile, equidistant, etc.), he changes the style of some categories (color, material, rendering method). 8. The Style Editor encodes the styling into Symbology Encoding (SE) and Filter Encoding (FE) and	

creates a Styled Layer Descriptor (SLD) document. 9. The Map application sends a HTTP POST request to the Portrayal Service containing the bounding box, layers, CRS, other parameters and appends the SLD document. 10. The Portrayal Service collects the necessary data and applies the styling according to the SLD document 11. The Portrayal Service encodes everything into the requested format and sends it back to the client 12. The map application displays the finished map

3.5 Use Case #5: Integrate Planned Object into 3D Map

Use Case Identifier: P3D#5	Use Case Name: Integrate Planned Object into 3D Map
Use Case Domain: P3D	Status: Draft 2008-08-11
Use Case Description: An Architect wishes to combine his own 3D model of a planned building with the available city model from a Portrayal Service. The 3D model was made with COTS software and exported into a CityGML file. The existing building needs to be identified so that it can be replaced by the new one. The replacing is done by Filter Encoding (FE) encapsulated into a Styled Layer Descriptor (SLD) document which can be submitted to a Portrayal Service. The CityGML is also sent to the Portrayal Service as attachment so that it can be integrated into the 3D scene.	
Actors (Initiators): End-User (e.g. architect)	Actors (Receivers) Same as initiator
Pre-Conditions: - Map application is installed on the client's computer - The map application has access to a Portrayal Service - User has a 3D model of a planned object (e.g. building) that will be built in place of an existing object. - The model is available as CityGMLfile and correctly geo-referenced.	Post-Conditions: Map application shows a complete 3D scene containing the existing landscape, city model, city furniture, lights, viewpoints, background, environment, a legend, and additionally the model of the planned object seamlessly integrated into the scene. The scene is ready for exploration and publishing.
System Components - Map application - Portrayal Service (W3DS or WPVS)	
Basic Course of Action: 1. End-User enters the address of a Portrayal Service. 2. Map application sends a GetCapabilites request to the Portrayal Service and receives information on available layers, styles, and other options 3. The user defines a region surrounding the planned object and selects layers that shall be visualized together with the object 4. Map application sends a GetScene or GetView request to the Portrayal Service. 5. Portrayal Service generates a 3D Map or perspective view according to the parameters and sends it back to the client. 6. Map application displays the result. 7. User identifies the object that shall be replaced by his own model. 8. Map application sends a GetFeatureInfo request to the Portrayal Service and receives all attributes	

of the selected object. The attributes are presented in tabular form to the user 9. User identifies a unique ID that can be used to filter out the object 10. Map application generates a Styled Layer Descriptor (SLD) document containing a Filter Encoding (FE) elements. The FE has an ELSE Filter with the selected ID, which means that all objects except the one with the selected ID will be chosen for visualization. 11. User selects the CityGML file replacing the identified object. 12. Map application sends a GetScene or GetView request via HTTP POST to the Portrayal Service containing the previous parameters and additionally the SLD document plus the CityGML file. 13. Portrayal Service generates new 3D map or perspective view, applies the FE for removing the selected object, integrates the CityGML file into the scene and encodes everything into the requested format. 14. Map application displays the result.

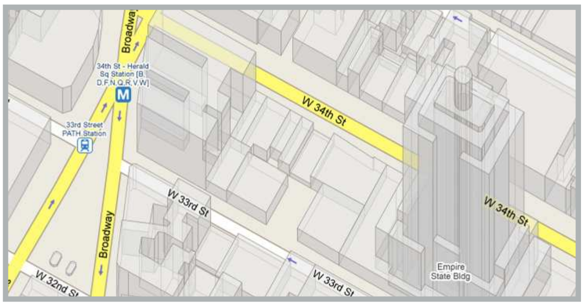
3.6 Use Case #6: Roaming between Portrayal Services

Use Case Identifier: P3D#6	Use Case Name: Roaming between Portrayal Services
Use Case Domain: P3D	Status: Draft 2008-08-11
Use Case Description: A Routing Application installed on a mobile device is used in order to guide the End-User to a selected destination. The application is designed for vehicle or pedestrian navigation and can be used for guiding the user on the road or for providing a virtual preview. The actual route calculation is carried out by an OpenLS Route Service. We assume that several 3D Portrayal Services from different providers are available. There may be e.g. one which can be used for visualizing the region of the start position, one for the destination position, and one that is best suited for visualizing intermediate high ways. The Routing Application must switch between the 3D Portrayal Services along the route in order to provide the best possible presentation (Roaming). Also the map styling must be kept consistent in order to reduce distracting cuts while switching between services.	
Actors (Initiators): End-User	Actors (Receivers) Same as initiator
Pre-Conditions: - Routing Application is installed on the client's mobile device - Routing Application has access to a OpenLS Routes Service - Routing Application has access to a Catalogue Service - CS/W contains a list 3D Portrayal Services covering different areas.	Post-Conditions: - User has been guided to his destination either virtually or in his vehicle. - The Routing Application shows the directions to the destination
System Components: - Routing application - OpenLS Route Service (RS) - Catalogue Service (CS/W) - 3D Portrayal Services (W3DS or WPVS)	
Basic Course of Action: 1. End-User enters the address of the start position and the desired destination 2. Routing Application sends a GetRoute request to the RS 3. RS calculates the route geometry and instructions and sends it back to the Route application 4. The Routing Application collects information on available 3D Portrayal Services that can be used	

in order to visualize the region at the start position using the CS/W

5. The Routing Application automatically selects the 3DPS that best meets the requirements of the current task. It must cover the current position, it should provide a high level of detail, it should support SLD3D.
6. The Routing Application creates an SLD3D document according to the application or user preferences and the available layers on the 3DPS
7. The Routing Application sends GetView or GetScene request(s) to the 3DPS in order to visualize the vicinity of the current position. The SLD3D document is attached to the request(s).
8. The user starts moving along the route either virtually or in his vehicle. Requests are continuously sent to the 3DPS in order to update the visualization. The Routing Application presents driving/walking instructions to the User.
9. The user reaches the border of the spatial extent of the currently selected 3DPS.
10. The Routing Application collects information on available 3D Portrayal Services that can be used in order to visualize the regions at the following route segments using the CS/W.
11. Steps 5 to 10 are repeated until the destination is reached.

4 Annex A: Examples of perspective views



Google Maps


Windows Live Search Maps


Virtual Earth

Intellinav car navigation sys

Google Street View