Web 3D Service (W3DS) in Geoserver

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Motivation

- The availability of 3D data “on demand”, through a service
  - The development of web clients where 3D data can be fully explored, while minimizing data communication
- Take advantage of the native WebGL support in recent browsers
  - No plug ins are necessary to see 3D in browsers
  - Browsers can be as fast as any native application to render 3D graphics
- Create and share a reference implementation of the W3DS draft
  - This implementation can be used for interoperability tests to improve the specification
OGC visualization models
Built on top of existing open source software stacks

- Built on top of GeoServer
  - Previous experience with GeoServer
- Advantages
  - Web Services protocol already implemented
  - Common GIS formats already supported
  - An extensible architecture
- Disadvantages
  - High initial difficulty (Maven, JAVA Spring development framework, Apache Wicket)
  - GeoServer dependencies (GeoTools for example)
  - Scarse developers documentation
Main implementation tasks

- Register the W3DS service in the GeoServer architecture
- Each operation implementation have three major steps:
  - Parse and represent the request
  - Execute it
  - Write the result in the requested output format
- Add the X3D as a new supported format
- Update the GeoServer Web interface accordingly to the W3DS requirements
- Extend GeoTools support (PostGIS, styles, etc)
GetCapabilities - Request

Request String

http://3dwebgis.di.uminho.pt/geoserver3D/w3ds?
VERSION=0.4.0&
SERVICE=w3ds&
REQUEST=GetCapabilities
As usual, GetCapabilities shows the available operations. In this case, the new GetScene operation is shown.

GetScene Description

(...)
<ows:Operation name="GetScene">
  <ows:DCP>
    <ows:HTTP>
        <ows:Constraint name="GetEncoding">
          <ows:AllowedValues>
            <ows:Value>KVP</ows:Value>
          </ows:AllowedValues>
        </ows:Constraint>
      </ows:Get>
    </ows:HTTP>
  </ows:DCP>
</ows:Operation>
(...)
GetCapabilities - Result

Part of the GetCapabilities result that show a layer description.

**Layer Description**

```xml
<ows:Contents>
  <ows:Layer>
    <ows:Title>buildings_3d</ows:Title>
    <ows:Abstract>Some 3D Buildings</ows:Abstract>
    <ows:Identifier>geoserver3D:buildings_3d</ows:Identifier>
    <ows:BoundingBox crs="EPSG:27492">
      <ows:LowerCorner>-17119.121 193602.0</ows:LowerCorner>
      <ows:UpperCorner>-10236.43 199013.891</ows:UpperCorner>
    </ows:BoundingBox>
    <ows:DefaultCRS>EPSG:27492</ows:DefaultCRS>
    <ows:Queriable>true</ows:Queriable>
    <ows:Tileable>false</ows:Tileable>
  </ows:Layer>
</ows:Contents>
```
Part of the GetCapabilities result that show a LOD Set definition.

**LOD Set Description**

(...)

<w3ds:LODSet>
  <w3ds:LOD>
    <ows:Title>LOD1</ows:Title>
    <ows:Abstract>prismatic building shells</ows:Abstract>
    <ows:Identifier>bldgs_lod1</ows:Identifier>
    <w3ds:LODValue>CityGML:1</w3ds:LODValue>
    <w3ds:DefaultRange>3000.0</w3ds:DefaultRange>
  </w3ds:LOD>
  <w3ds:LOD>
    <ows:Title>LOD2</ows:Title>
    <ows:Abstract>buildings with roof structures</ows:Abstract>
    <ows:Identifier>bldgs_lod2</ows:Identifier>
    <w3ds:LODValue>CityGML:2</w3ds:LODValue>
    <w3ds:DefaultRange>3000.0</w3ds:DefaultRange>
  </w3ds:LOD>
(...)

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Part of the GetCapabilities result that show a Tile Set definition.

Tile Set Description

...(...)<w3ds:TileSet><ows:Identifier>dem_tileset</ows:Identifier><w3ds:CRS>EPSG:27492</w3ds:CRS><w3ds:TileSizes>4000.0 2000.0 1000.0 500.0</w3ds:TileSizes><w3ds:LowerCorner>-17096.156000 193503.057000</w3ds:LowerCorner></w3ds:TileSet>...(...
GetScene - Request

Request String

http://3dwebgis.di.uminho.pt/cgi-bin/proxy.cgi?
url=http://3dwebgis.di.uminho.pt/geoserver3D/w3ds?
VERSION=0.4.0&
SERVICE=w3ds&
REQUEST=GetScene&
CRS=EPSG:4326&
FORMAT=text/html&
LAYERS=buildings_3d,dem_3d&
BOUNDINGBOX=-8.301200,41.437741,-8.294825,41.444161&
STYLES=buildings_by_type,dem_texture_igp
GetTile

Request String

http://3dwebgis.di.uminho.pt:8080/geoserver3D/w3ds?
version=0.4&
service=w3ds&
request=GetTile&
CRS=EPSG:27492&
FORMAT=model/x3d+xml&
LAYER=dem_tiled_3d&
TILELEVEL=0&
TILEROW=5&GetTile
TILECOL=7&
style=dem_texture_igp
GetTile - Result

X3D Tile Rendered with texture defined in the style
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W3DS in action

Movies

- file:videos/OSM_Postes_Cabos.mpeg
- file:videos/Predios_Camaras_Condutas.mpeg
Conclusions

- W3DS is necessary for 3D WebGIS applications as WMS has been for web mapping
- W3DS (open source) implementations are necessary to do interoperability experiments
- A fully operational W3DS implementation was presented
- The service can be downloaded (as WAR) or as source for local deployment
- A working demo service is available at http://3dwebgis.di.uminho.pt/geoserver3D/
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