Web 3D Service (W3DS)
Status Report

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Web 3D Service (W3DS) Status Report

1. W3DS Introduction
2. New Extensions
3. OWS-6 DSS Thread

W3DS Status

Current Status: OGC Discussion Paper (OGC 05-019)

Released: February 2005
Version: 0.3.0

Editors: Udo Quadt, Thomas Kolbe

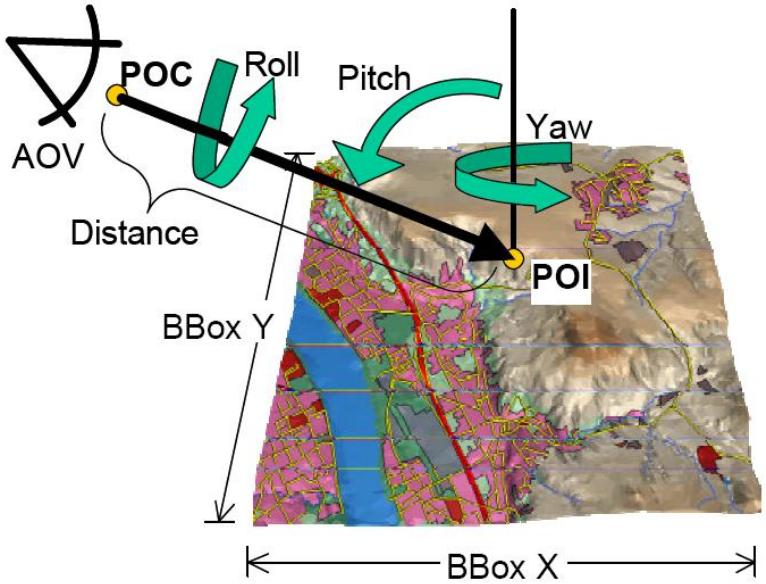
Presentations in TC Meetings:
January, 18th 2005, OGC TC meeting, New York City
November 7th 2005 OGC TC meeting, Bonn

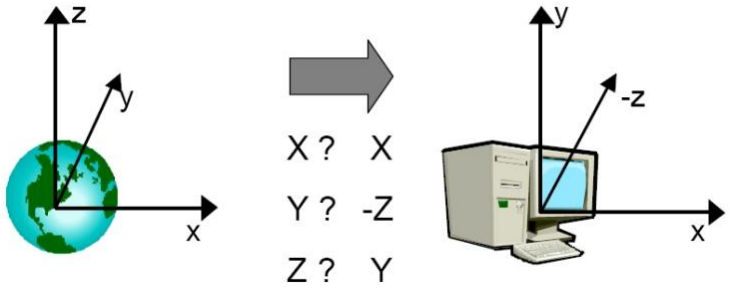
W3DS Scope

W3DS delivers 3D scenes of a selected region that can be explored interactively

What is a Scene?

1. A Scene is composed of data from one or multiple layers
2. A Scene may also contain map elements (title, compass, scale bar, legend etc.) -> “3D map”, and predefined viewpoints
3. A Scene must be provided in a CRS that can be used for visualization. NOT WGS84. Ideal: Cartesian coordinates. Large coordinates are also problematic.
4. A Scene is composed of “Display Elements” (geometries, triangles, materials, animations, lights, fog).
5. The structure of a Scene is not defined!
6. Semantics usually missing, depends on format





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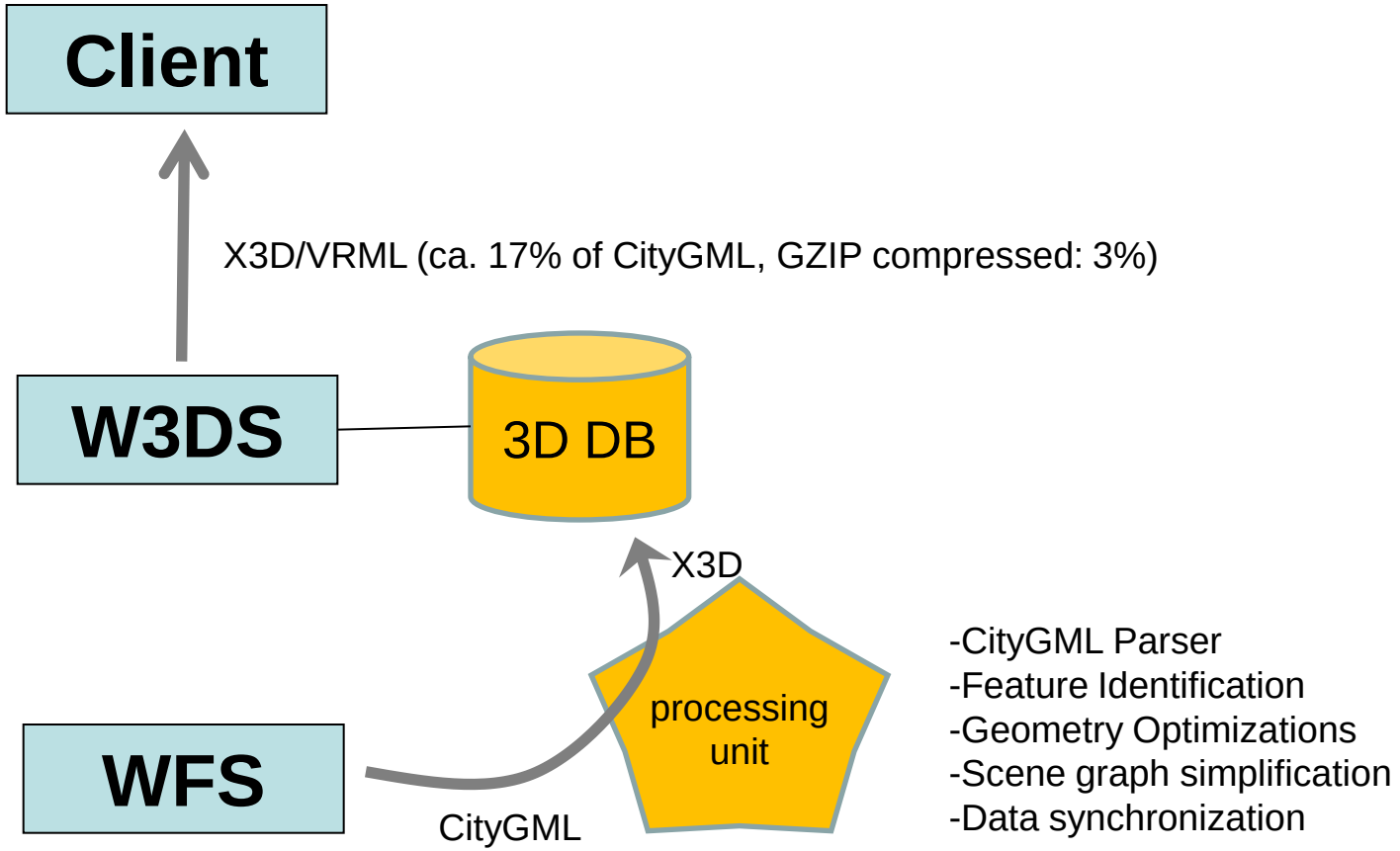
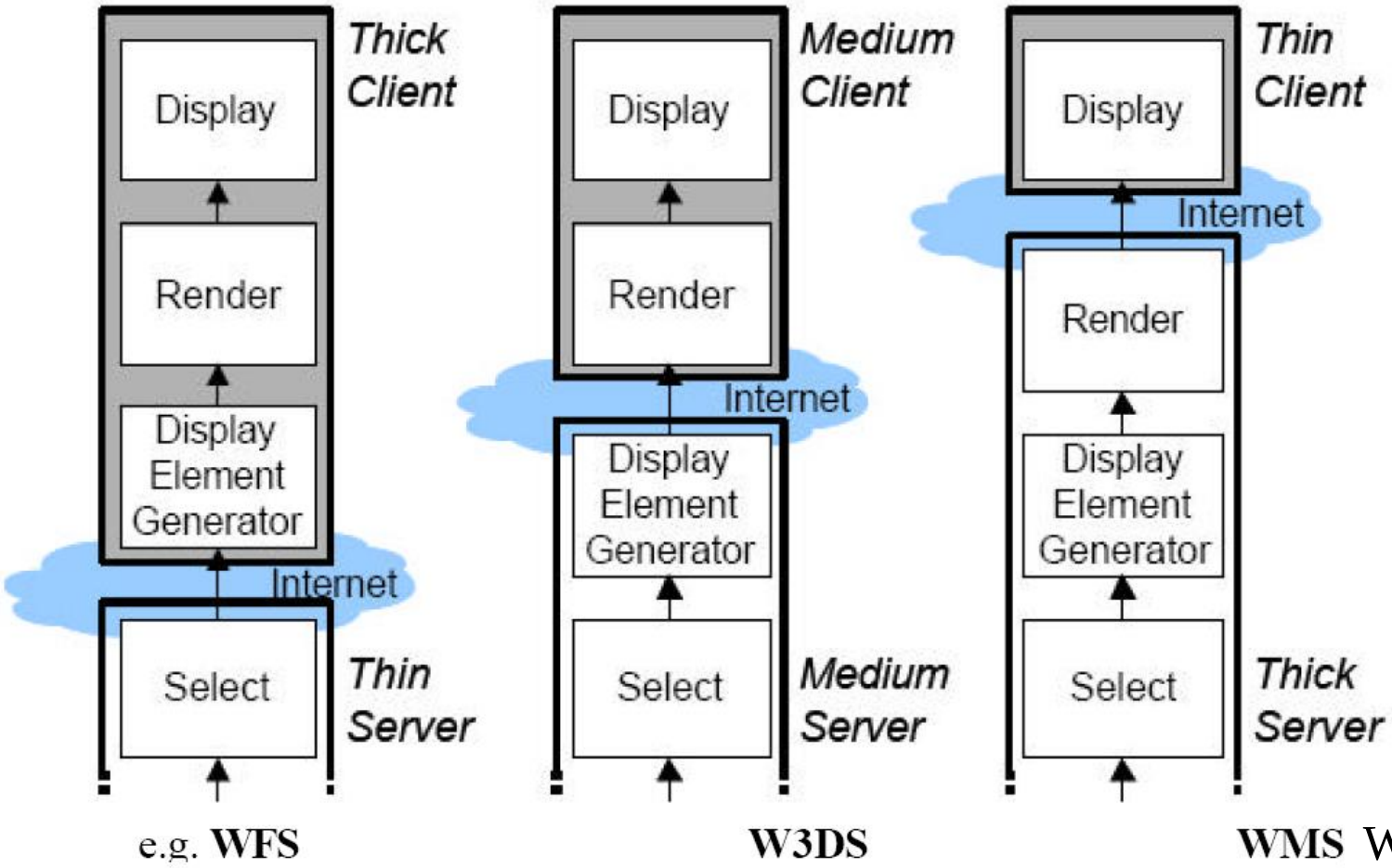
Optimization Techniques for efficient rendering

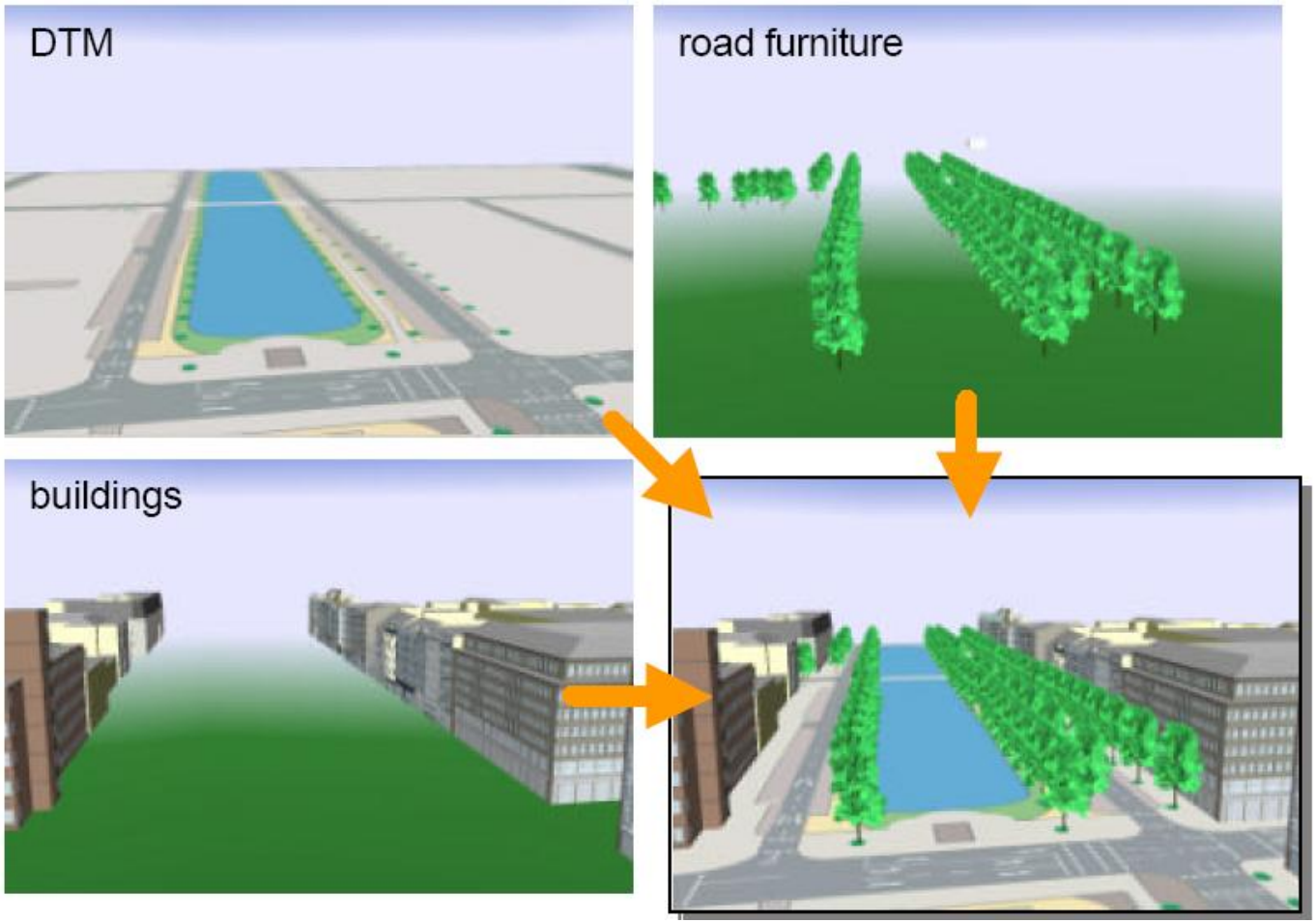
- 1) Reduce the depth of the scene graph
  - Combine nested Transform Groups, remove unnecessary Groups
- 2) Reference to existing Materials and Appearances
  - Instead of defining the same Material repeatedly for each object, re-use already defined materials -> less memory consuming
- 3) sort objects according to Material (Display Lists) **In Java3D: “compiling”**
  - Switching between materials during rendering is costly!
- 4) combine objects (3D Shapes) with same material
  - Instead of many 3D Shapes with each a geometry and a material: combine to few larger 3D Shapes. E.g. combine all roof geometries with same material into one larger geometry.
  - Structure of Scene gets lost!!!, no individual GIS objects any more!!
- 5) Create a Texture Atlas
  - Copy all textures into one large texture. Parts of the Texture Atlas are applied to the objects

Portrayal of GityGML



Portrayal Pipeline




DTM
road furniture
buildings

W3DS Operations

- GetCapabilities (mandatory)
  - -> very similar to WMS: layers, styles, bbox etc.
- GetScene (mandatory)
  - -> returns a 3D Scene / Scenegraph

W3DS Operations

- GetCapabilities (mandatory)
  - -> very similar to WMS: layers, styles, bbox etc.
- GetScene (mandatory)
  - -> returns a Scenegraph
- GetFeatureInfo (optional, Version 0.3.1)
  - -> returns attributes of selected features
- GetLayerInfo (optional, Version 0.3.1)
  - -> returns attribute names and values of selected layer

GetCapabilites Response

Scale Denominators

“The <MinScaleDenominator> and <MaxScaleDenominator> elements define the range of scales for which it is appropriate to generate a map of a Layer.”
“The scale denominator values are guidelines for clients, not firm limits.” (OGC 06-042)

<MinScaleDenominator>1e3</MinScaleDenominator>
<MaxScaleDenominator>1e6</MaxScaleDenominator>

1/6e06 – 1/12e06

1/500 – 1/3000

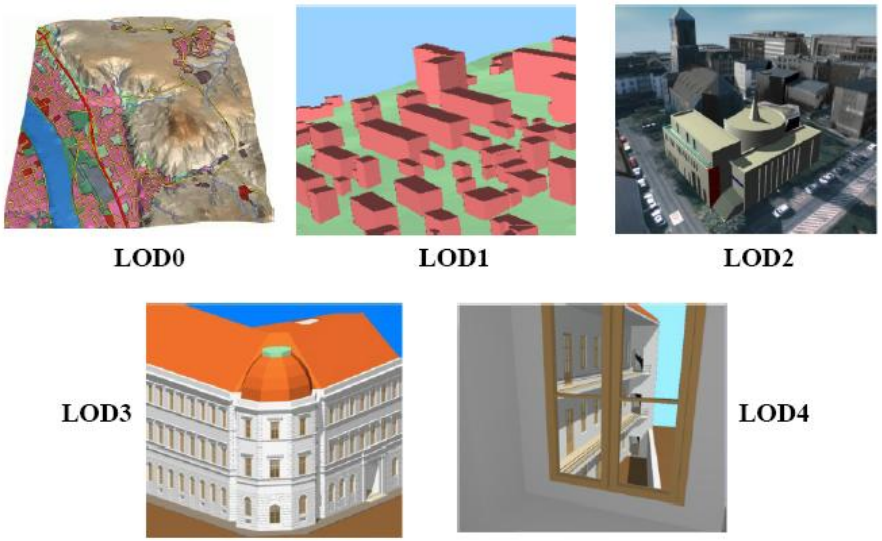
GetCapabilites Response

Levels of Detail

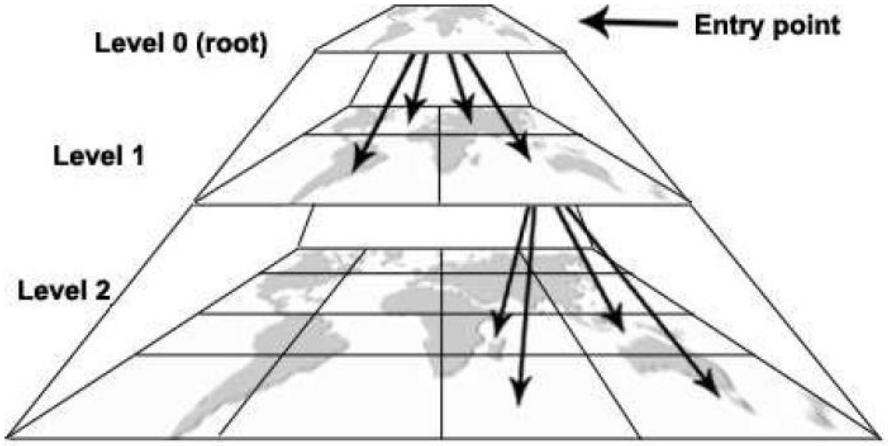
The optional <MinLevelOfDetail> and <MaxLevelOfDetail> elements describe the range of Levels of Detail that can be provided by the layer.

<MinLevelOfDetail>CityGML:1</MinLevelOfDetail>

<MaxLevelOfDetail>CityGML:4</MaxLevelOfDetail>



Extended LOD Concept



Misund, Grandlund, Kolas

Tile Level	Size	CityGML LOD	Scope
16	0,5 km	4 -indoor	Bus Stop
15	1 km	3	
14	2 km	2	Street Level
13	5 km	1	
12	10 km	0 - landscape	
11	20 km		
10	39 km		City
9	78 km		
8	156 km		
7	313 km		State
6	625 km		
5	1250 km		Country
4	2500 km		
3	45°		Continent
2	90°		
1	180°		
0	360°		Globe

GetScene Parameters

URL parameter	Required/ Optional/ Conditional	annotation
VERSION=<*version*>	R	requested version
REQUEST=GetScene	R	requested operation
SRS=namespace:identifier	R	spatial reference system
POI=<*point_of_interest*>	C	x,y,z point coordinates according to SRS
PITCH=<*pitch*>	C	angle of inclination [degree]
YAW=<*yaw*>	C	azimuth [degrees]
ROLL=<*roll*>	O	rotation around viewing vector [degree]
DISTANCE=<*distance*>	C	distance POI to POC [meter]

GetScene Parameters cont'd

POC=x, y, z	C	x,y,z coordinates of camera according to SRS
AOV=<*angle_of_view*>	C	angle of view [degree]
BBOX=*xmin,ymin,xmax,ymax*	R	2d bounding box
MINHEIGHT=<*lower_limit*>	O	displaying objects with height ≥ *lower_limit* according to SRS
MAXHEIGHT=<*upper_limit*>	**O**	displaying objects with height ≤ *upper_limit* according to SRS
LAYERS=<*layer list*>	O	comma separated list of 3D object sets
STYLES=<*style list*>	O	comma separated list of styles for each layer
FORMAT=<*format*>	R	MIME type of output
TIME=<*date_and_time*>	O	date and time
EXCEPTIONS=<*excepttype*>	O	exception format
TRANSLATE=*x,y,z*	C	translation vector that is applied to all 3D coordinates
ENVIRONMENT=on / off	O	switch on/off background elements like sky or light source
BGCOLOR=<*color*>	O	background color
BGIMAGE=<*image url*>	O	URL of background image

New GetScene Parameters in 0.3.1

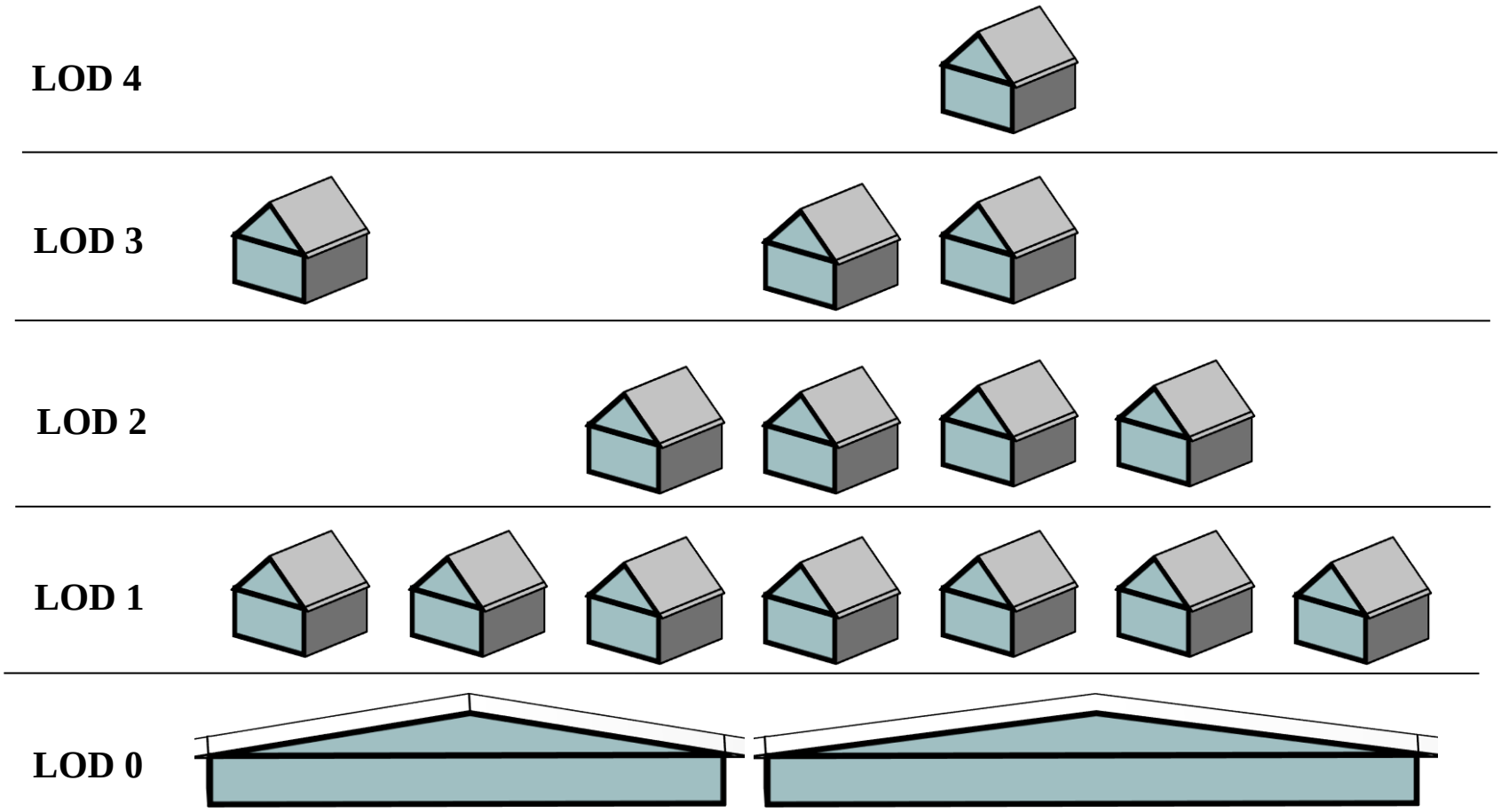
Level of Detail

- Objects of one layer may be available in multiple LODs, especially building models (block, w. roof shape, textured, detailed façade model, indoor model)
- Terrain layer may be also available in multiple resolutions (from global earth surface to very detailed local models showing ditches, dikes etc.

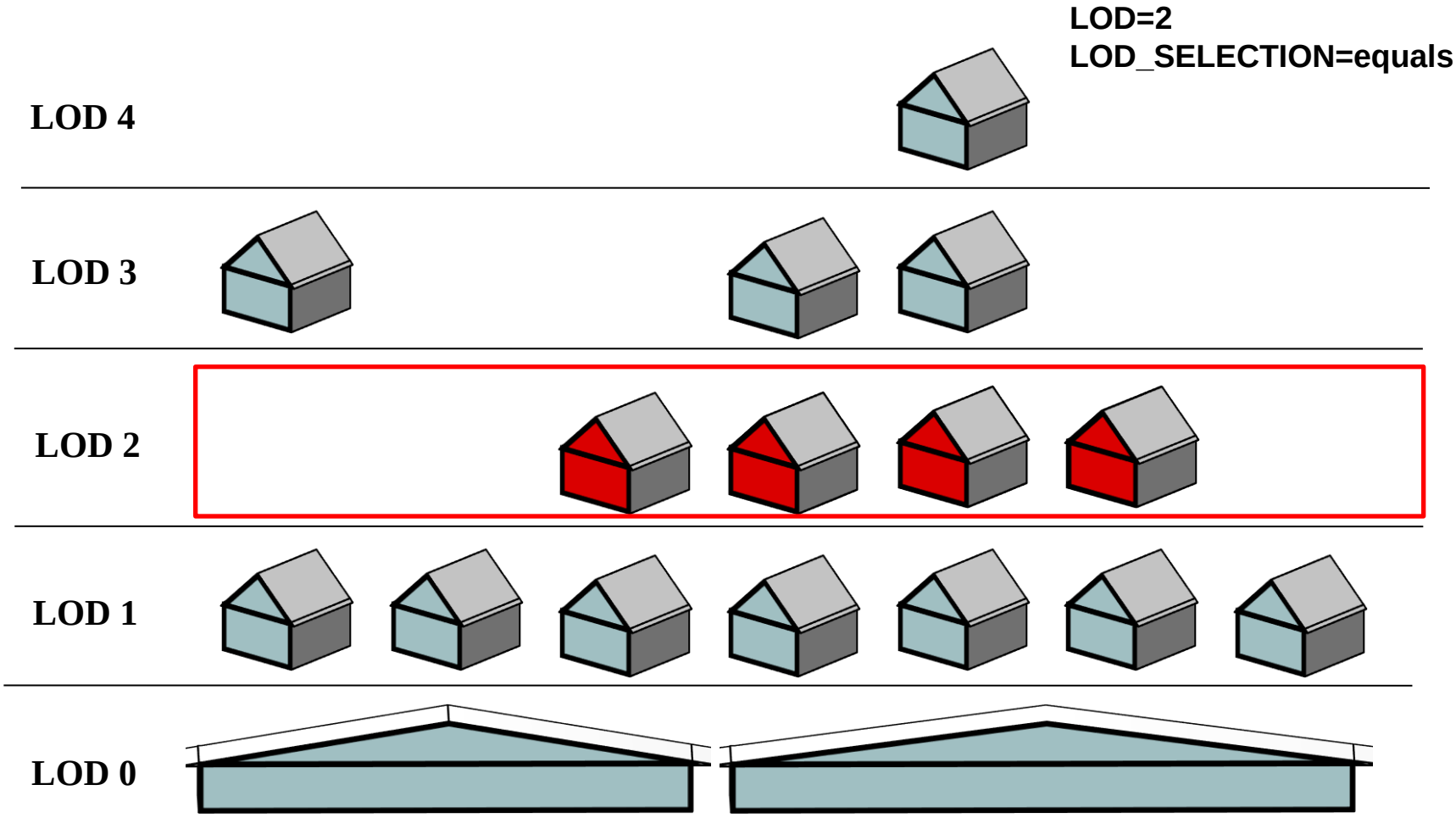
Parameters: LOD=<*string*> *(“qualifier:number”)*

LOD_SELECTION=<*string*> *(“equals”* | *“equals_or_smaller”)*

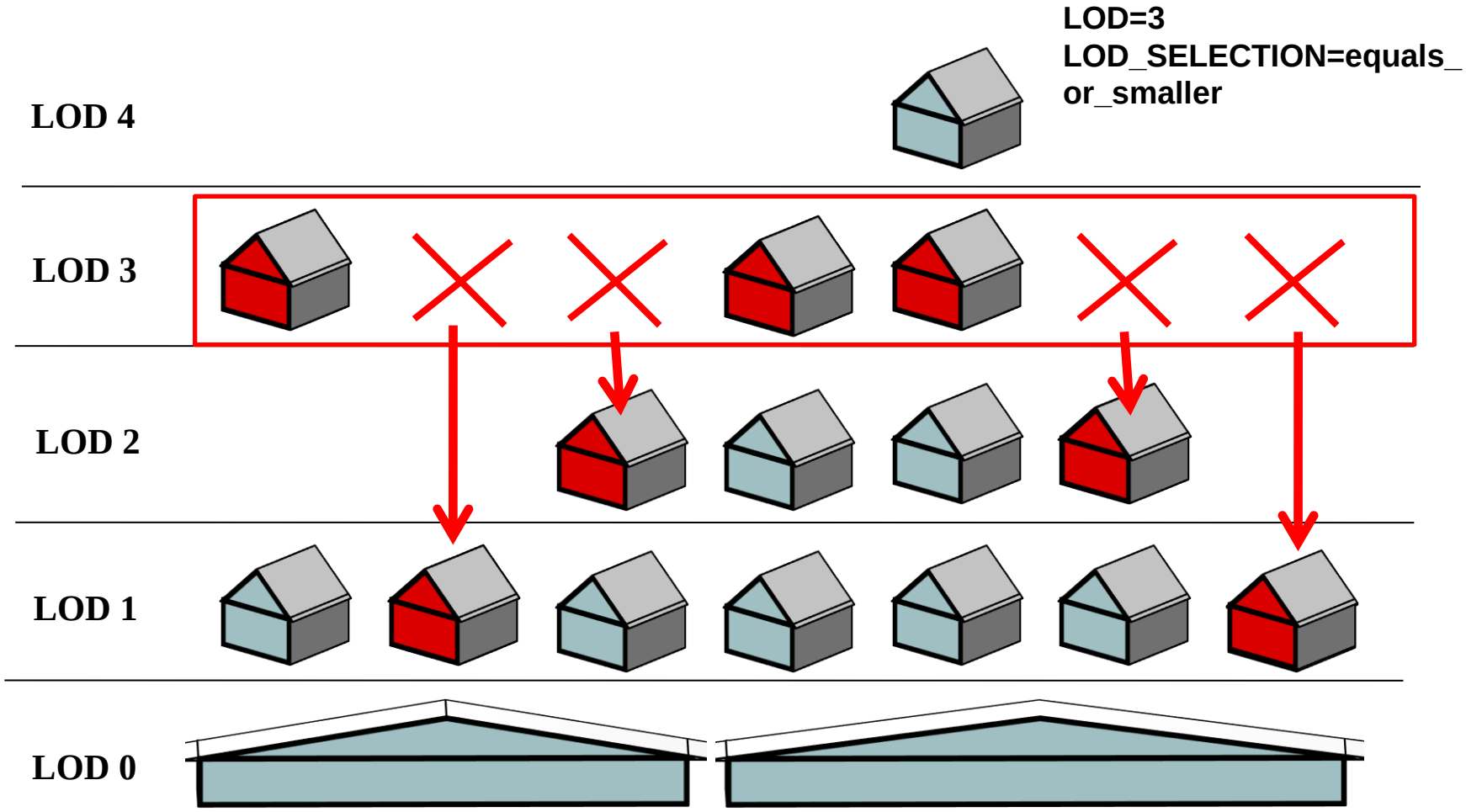
LOD Selection



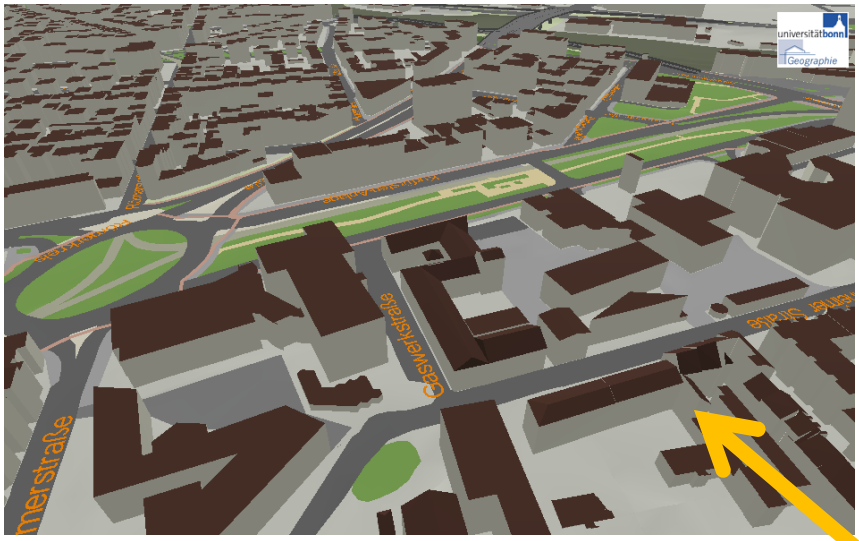
LOD Selection



LOD Selection



LOD Selection



LOD=1
LOD_SELECTION=equals

LOD=2
LOD_SELECTION=equals

LOD=2
LOD_SELECTION=equals_or_smaller

New GetScene Parameters in 0.3.1

Spatial Constraint

- Currently: a) BBOX=*xmin,ymin,xmax,ymax*
  b) MINHEIGHT=<double>, MAXHEIGHT=<double>

We need more flexibility !

- Using WKT: BOUNDS=*WKT* *(Polygon | PolyhedralSurface Z)*

Examples:

BOUNDS=Polygon((x,y, x,y,…..x,y), (x,y, x,y,…..x,y)) Polygon with Hole

BOUNDS=PolyhedralSurface Z (((x,y,z, x,y,z, x,y,z)), ((x,y,z, x,y,z, x,y,z)), ….. ((x,y,z, x,y,z, x,y,z)))

Condition: Surface must be closed!

Part of SFS 1.2 (OGC 06-103r3)

New GetScene Parameters in 0.3.1

Spatial Selection Method

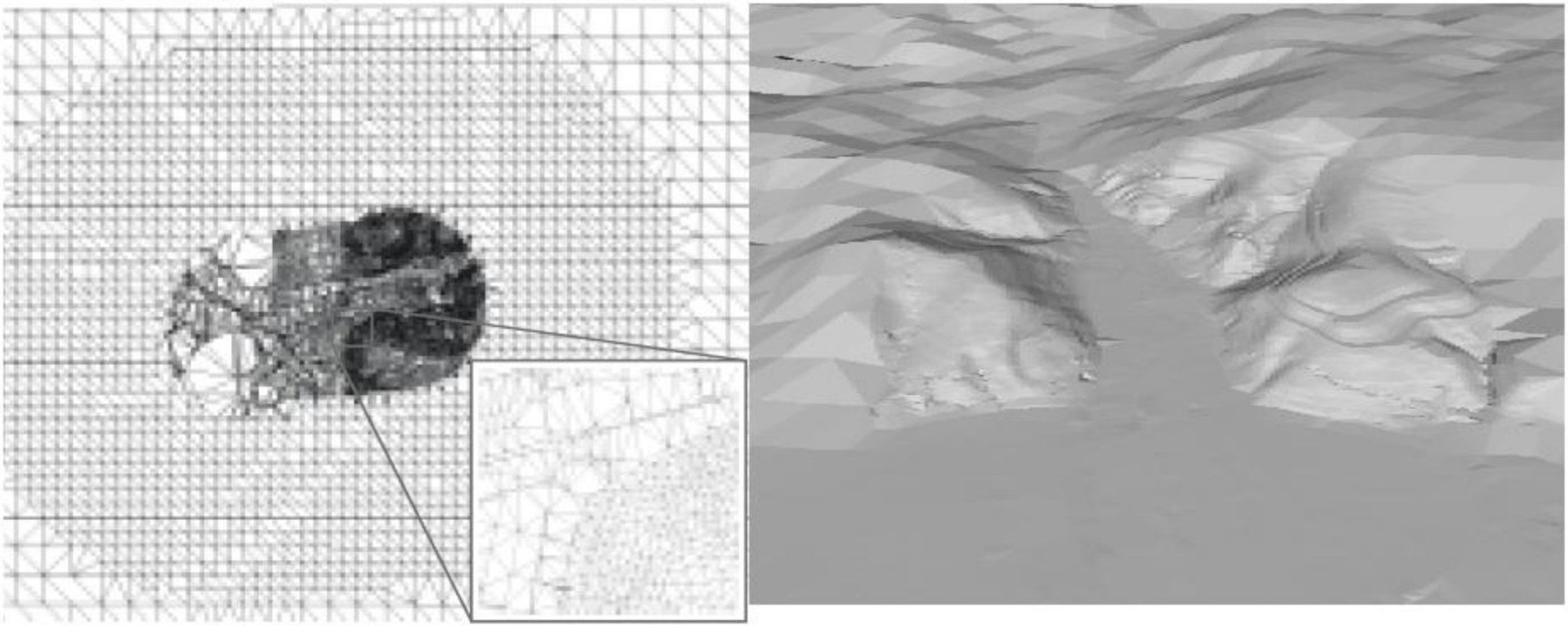
Currently: not defined! Depends on implementation

Parameter SELECTION_METHOD=<string> *(“intersection” | “by_center” | “crop”)*

Values:

- a) **intersection**: default operation, select features that touch, or intersect or are within BOUNDS
  - -> useful for static maps
- b) **by_center**: select features with center point being within BOUNDS
  - -> useful for selecting buildings displayed on a virtual globe
- c) **crop**: modify geometry of selected features (by intersection method) so that parts lying outside BOUNDS are cut away
  - -> useful for focus maps or subsets of terrain

New GetScene Parameters in 0.3.1



Focus Map: Multi-Resolution Terrain

New GetScene Parameters in 0.3.1

Styled Layer Descriptors (SLD)

- Enables user-defined Styling. Styles are defined as Styled Layer Descriptors. The Symbology Encoding (SE) needs extensions in order to style 3D objects.

One of 3 alternative parameters possible:

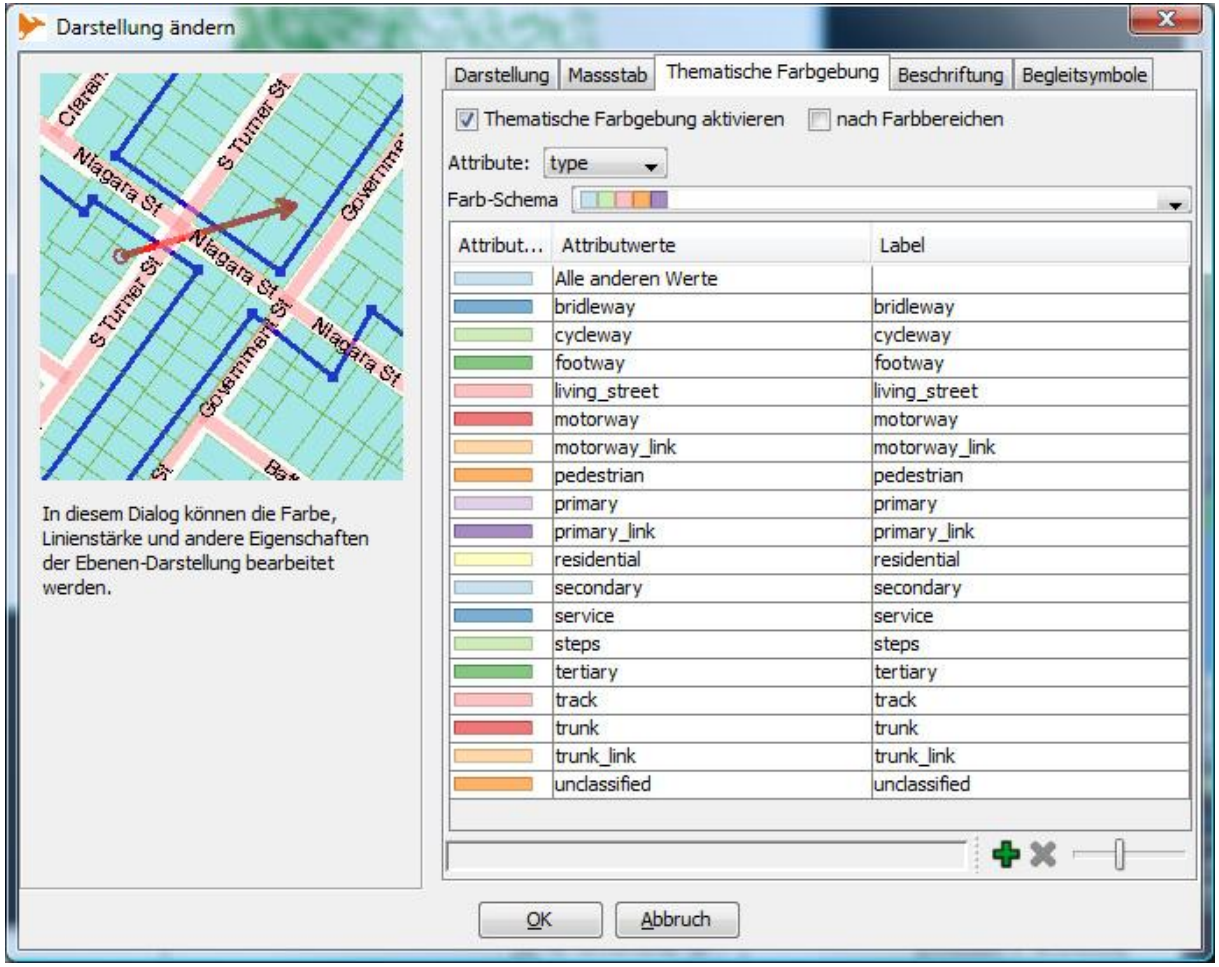
Parameters: SLD=<*string*>: *URL reference to SLD document*
SLD_BODY=<*string*>: *inline SLD Document in GET request*
StyledLayerDescriptor=<xml>: inline SLD Document in POST request

Defined in SLD profile of the WMS IS (OGC 05-078r4)

GetFeatureInfo Request

The GetFeatureInfo operation is designed to provide clients of a W3DS with more information about features within a scene that is currently displayed.

GetLayerInfo Request



Style Editor in OpenJUMP

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GetLayerInfo Request

The purpose of the GetLayerInfo request is to collect information on the available attribute names and the values in the attribute table of a specific layer

Table 4 — Parameters of the GetLayerInfo request

URL parameter	Required/ Optional/ Conditional	annotation
VERSION=0.3.1	M	Request version.
REQUEST=GetLayerInfo	M	Request name.
LAYER=<*layer*>	M	One Layer
COLUMNNAME=<column list>	O	Comma-separated list of one or more column to be queried.
FORMAT=output_format	M	Return format of feature information (MIME type).

GetLayerInfo Request

GetLayerInfo request:

http://www.myserver.de/W3DS?REQUEST=GetLayerInfo&VERSION=0.3.1&LAYER=Terrain&FORMAT=text/xml

GetLayerInfo response:

```
<GetLayerInfo>
    <Layer>
        <Name>Terrain</Name>
        <Attribute>
            <Name>id</Name>
        </Attribute>
        <Attribute>
            <Name>landuse</Name>
        </Attribute>
    </Layer>
</GetLayerInfo>
```

GetLayerInfo Request

GetLayerInfo request:

http://www.myserver.de/W3DS?REQUEST=GetLayerInfo&VERSION=0.3.1&LAYER=Terrain &**COLUMNNAME=landuse**&FORMAT=text/xml

GetLayerInfo response:

```
<GetLayerInfo>
    <Layer>
        <Name>Terrain</Name>
        <Attribute>
            <Name>landuse</Name>
            <Values>
                <Value>Bahn</Value>
                <Value>Baubloecke</Value>
                <Value>Gruenflaechen</Value>
                <Value>null</Value>
                <Value>Strassen</Value>
                <Value>Waldflaechen</Value>
                <Value>Wasserflaechen</Value>
            </Values>
        </Attribute>
    </Layer>
</GetLayerInfo>
```

Information Retrieval Concepts

W3DS is a Portrayal Service

- Result is optimized for efficient visualization
- no guarantee on the internal structure of the scene
- Access to attribute and meta data through additional server requests (GetFeatureInfo operation, OpenLS geocoder, directory service)
-Attribute are stored as tables, classic GIS Feature concept
-All CityGML tags can be transformed into attribute tables (including ID, address, object key, etc.)

OWS-6 Testbed DSS Thread

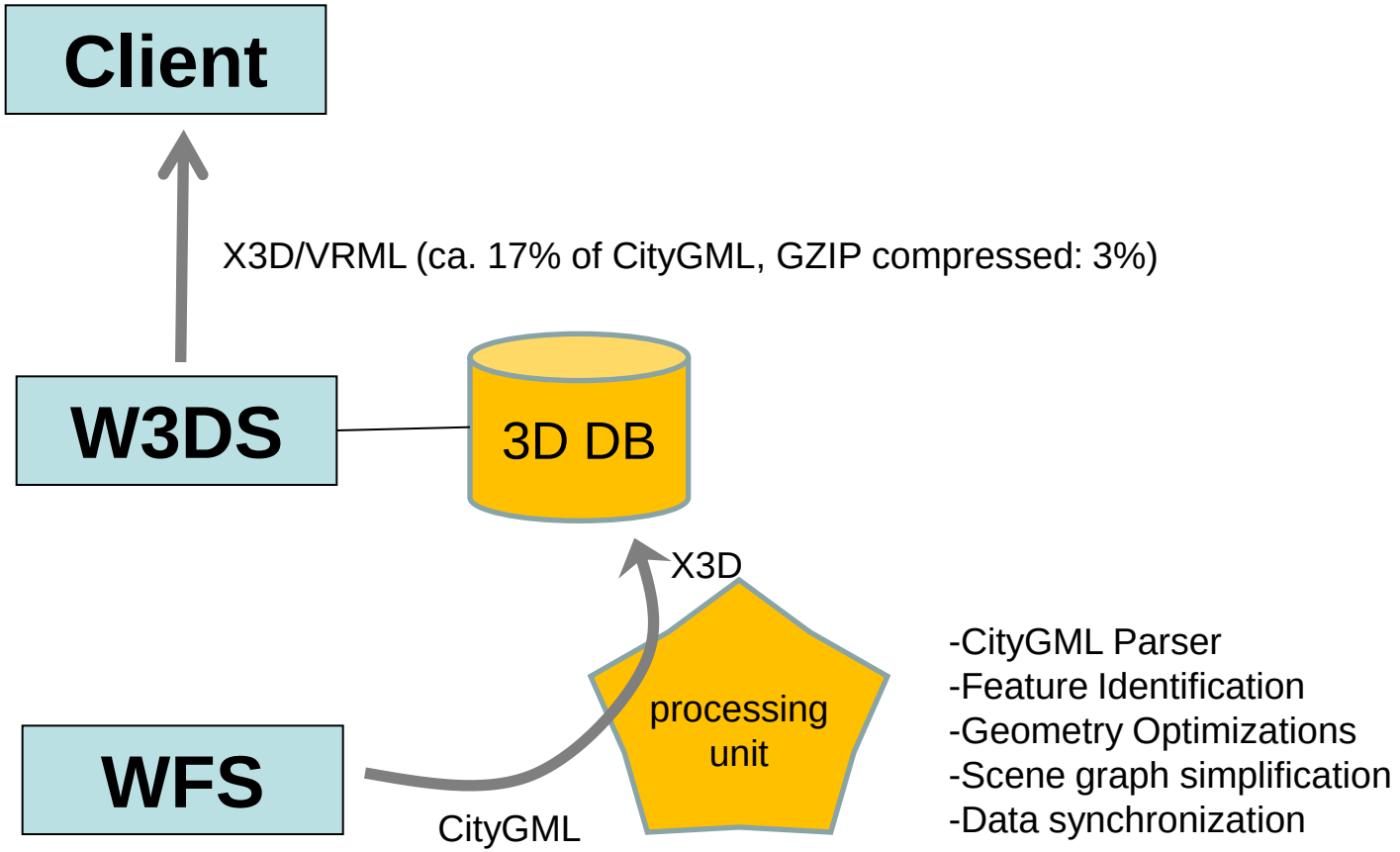
Scope

The focus for DSS in OWS-6 builds on portrayal, WMS Tiling, and integrated client work from OWS-3, OWS-4 and OWS-5, with additional work on 3D visualization and integration of the built environment and landscape. This thread will encompass these capabilities and task areas:

- ISO 19117 and OGC SLD Portrayal
- 3D Portrayal of GML with Fly-through
- Outdoor and indoor 3D route services
- WMS performance (tiling)
- Integrated Client for multiple OWS services

OWS-6 Testbed DSS Thread

Portrayal of CityGML with 3D Fly-through



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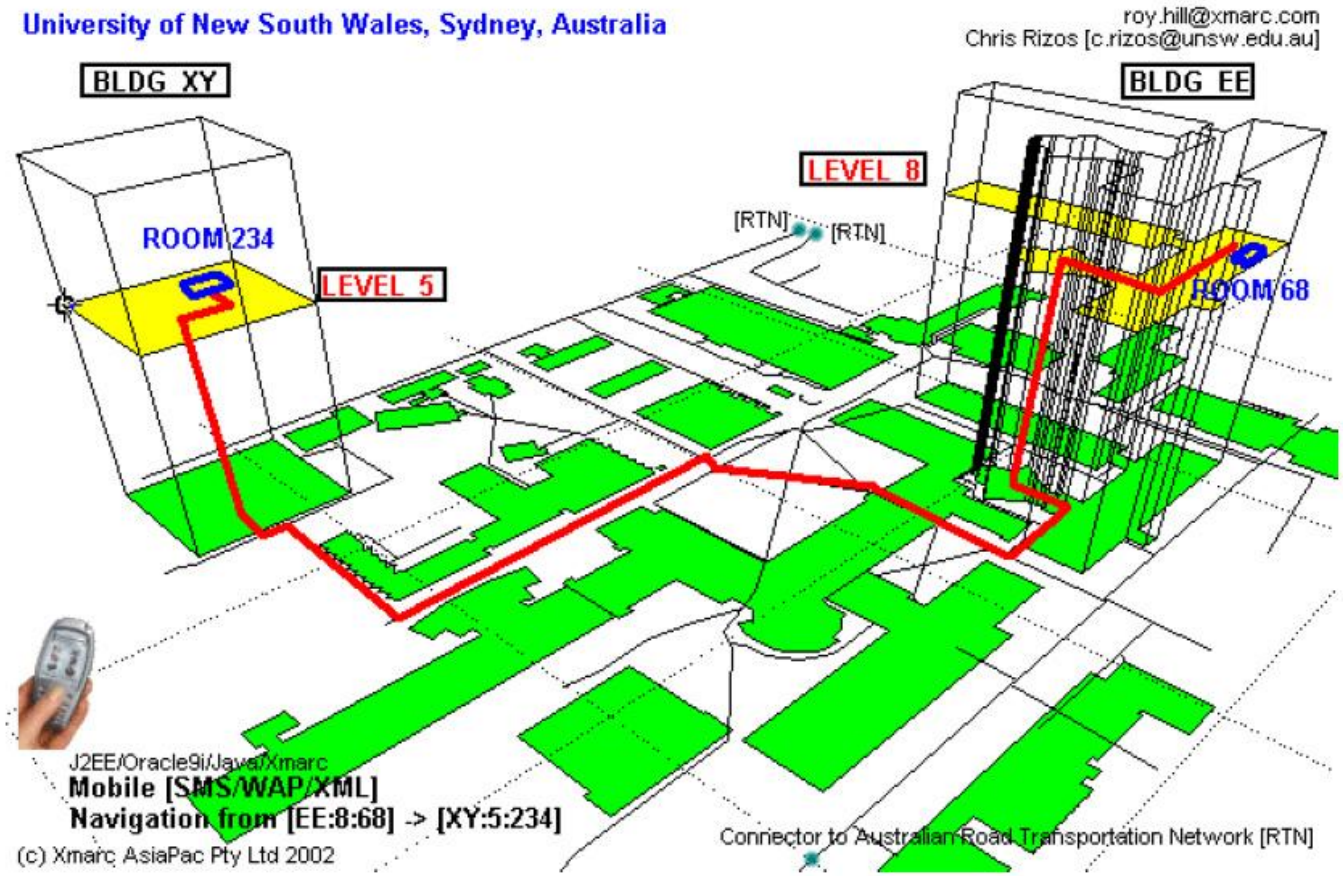
3D Indoor and Outdoor Routing



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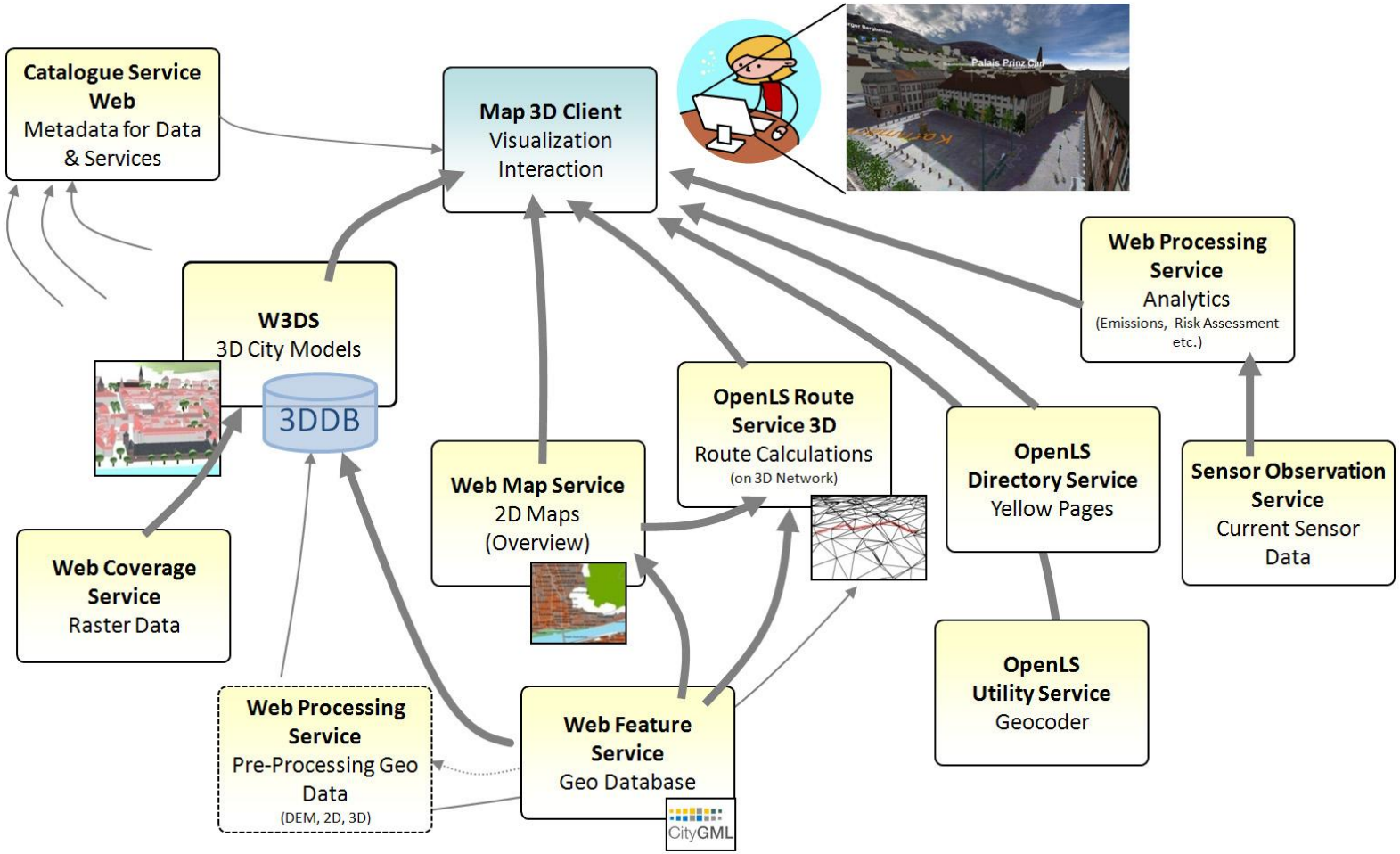
Integrated Client for multiple OWS Services: XNavigator (Uni Bonn Karto)



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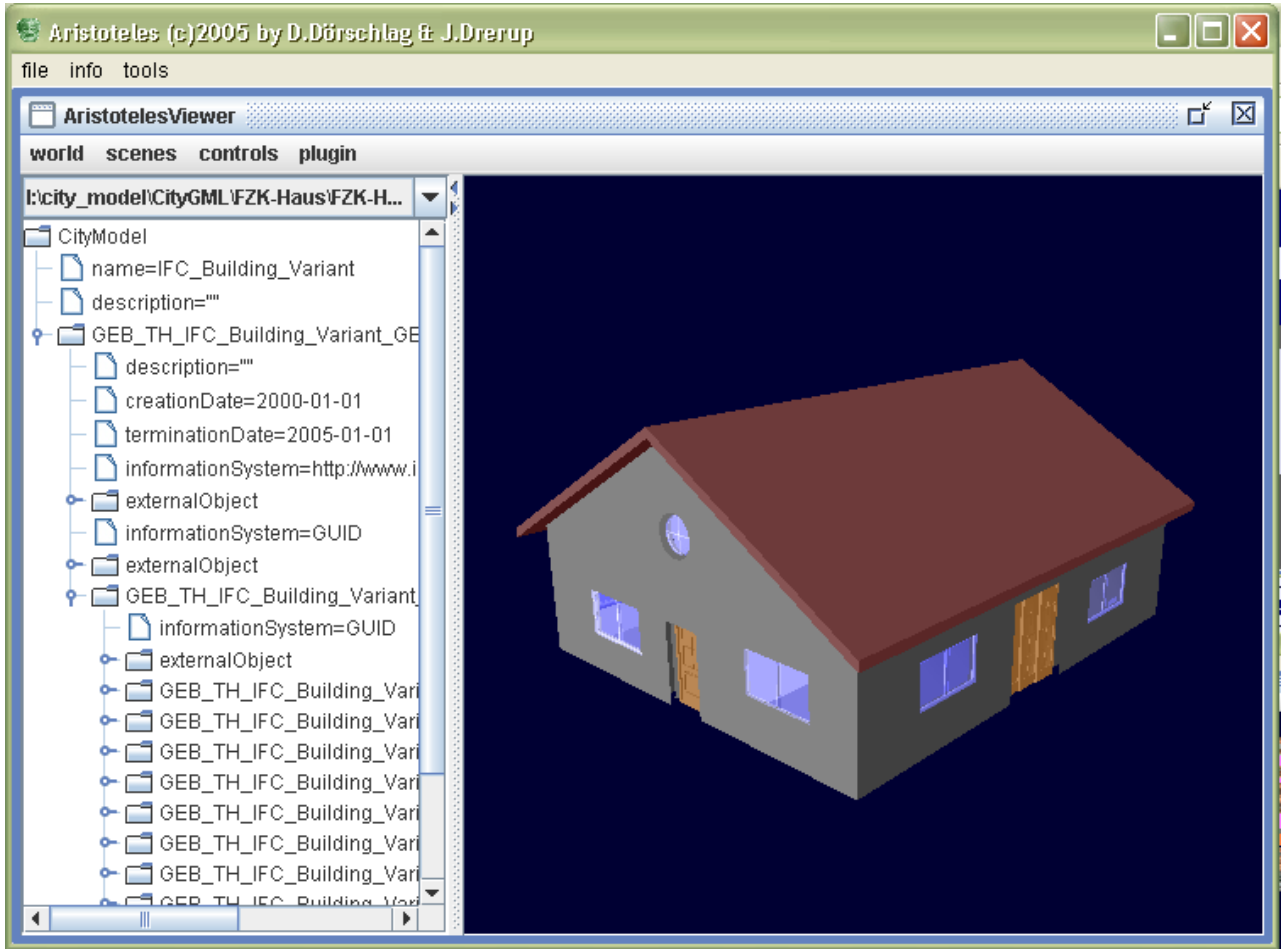
OWS-6 Testbed DSS Thread

Integrated Client for multiple OWS Services: Aristoteles (Uni Bonn IGG)



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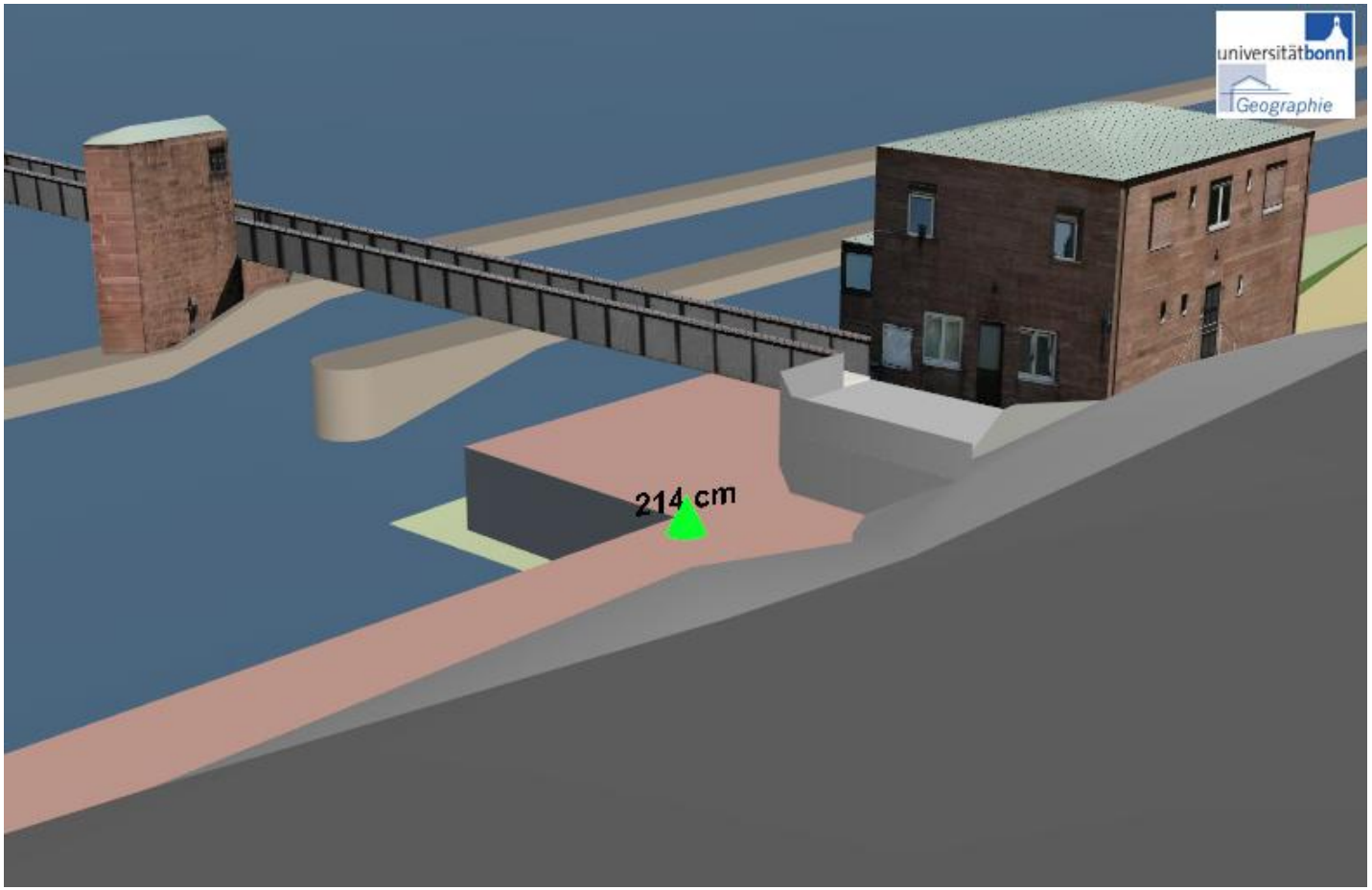
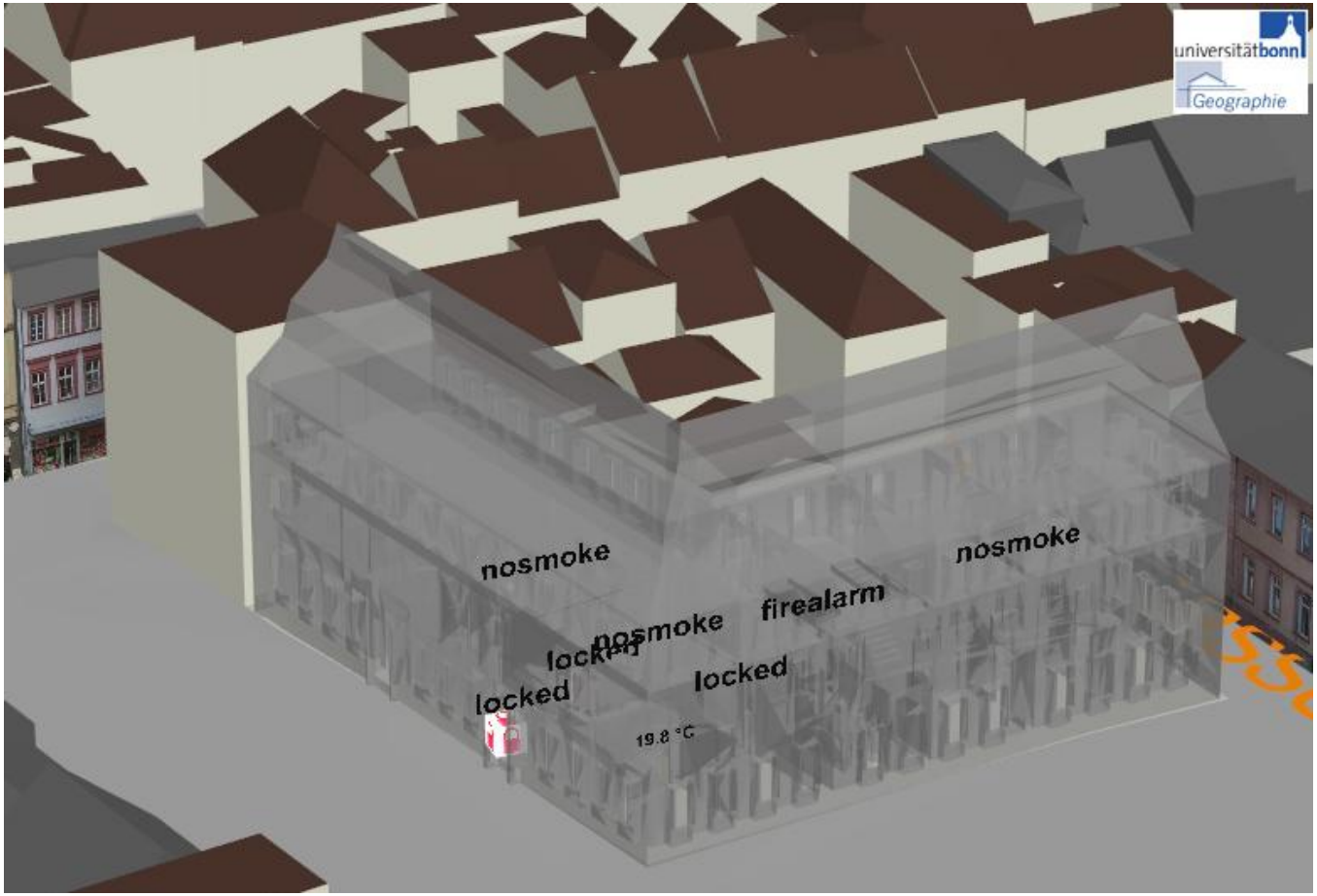
Sensor Data Integration



OWS-6 Testbed DSS Thread

Sensor Data Integration



The End

Thank you for your Attention