

Section III

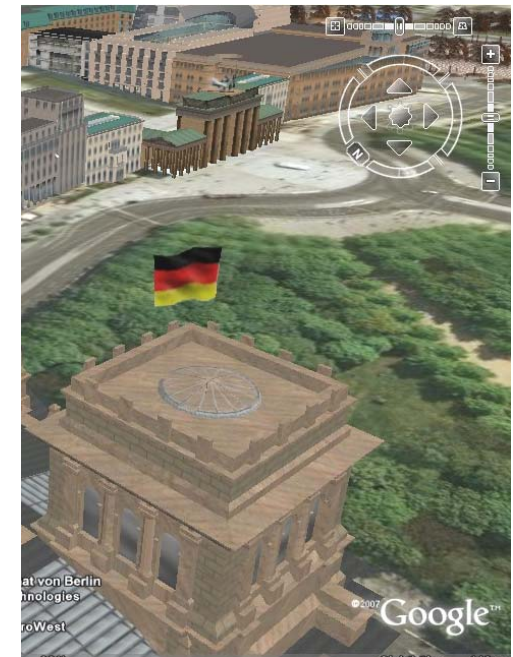
CityGML in Detail – Part 1

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EduServ6 Course on CityGML



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 - Introduction: Urban Information Modelling
 - CityGML Overview and Status
 - OGC Geography Markup Language (GML)
- ▶ Section II
 - Further GML Concepts and Application Modelling
- ▶ Section III – CityGML Details, Part 1
- ▶ Section IV – CityGML Details, Part 2
- ▶ Section V
 - Extending CityGML
 - Application Examples
- ▶ Section VI
 - Relations to Other Standards



CityGML

Details

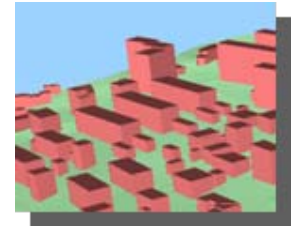
LOD 0 – Regional model

- ▶ 2.5D Digital Terrain Model



LOD 1 – City / Site model

- ▶ “block model” w/o roof structures



LOD 2 – City / Site model

- ▶ textured, differentiated roof structures



LOD 3 – City / Site model

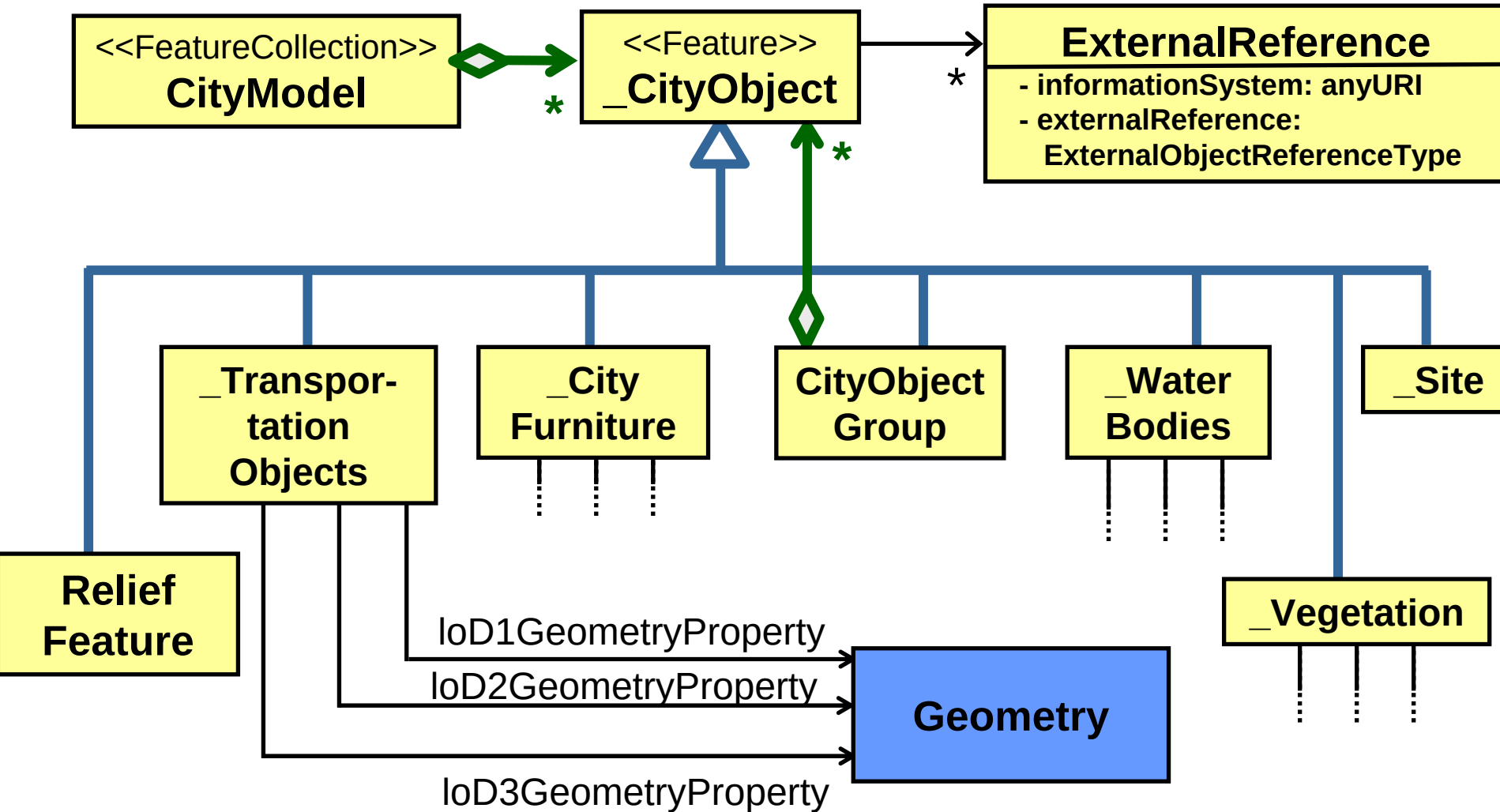
- ▶ detailed architecture model



LOD 4 – Interior model

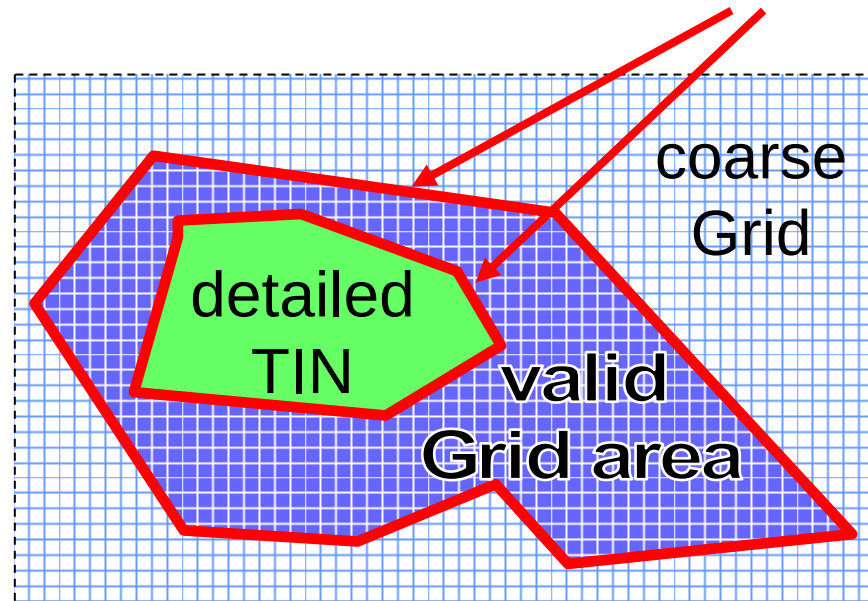
- ▶ “walkable” architecture models





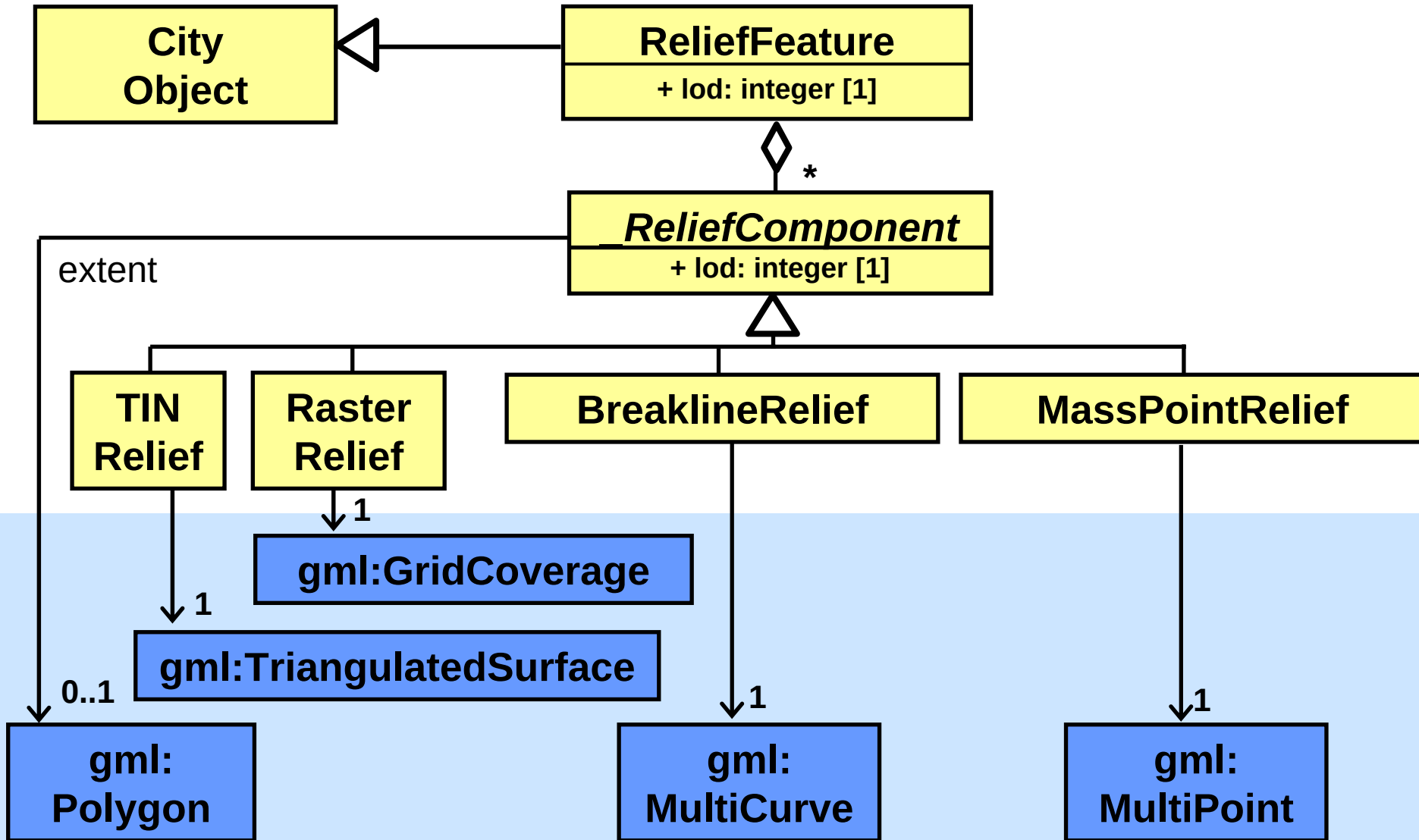
DTM for each Level of Detail can be composed of

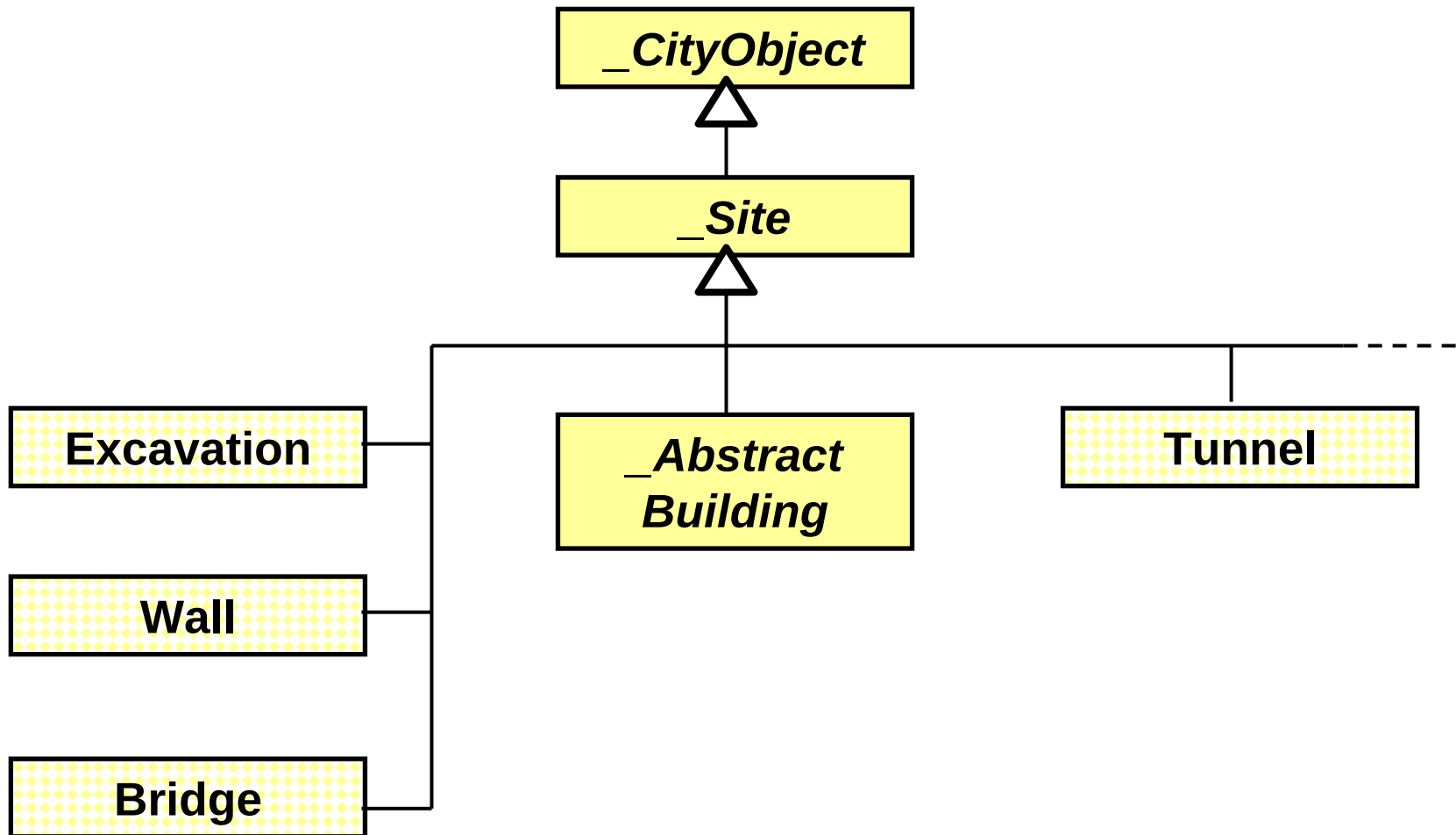
- ▶ **TINs** (Triangulated Irregular Network), **Grids**, **3D Breaklines**, and **3D Mass Points**
- ▶ Each DTM component may be restricted to be valid in a specific region by providing a **validity extent polygon**



Validity extent polygon can have holes which allow **nested DTMs!**

Digital Terrain Model: UML Diagram





► Coherent aggregation of spatial and semantical components

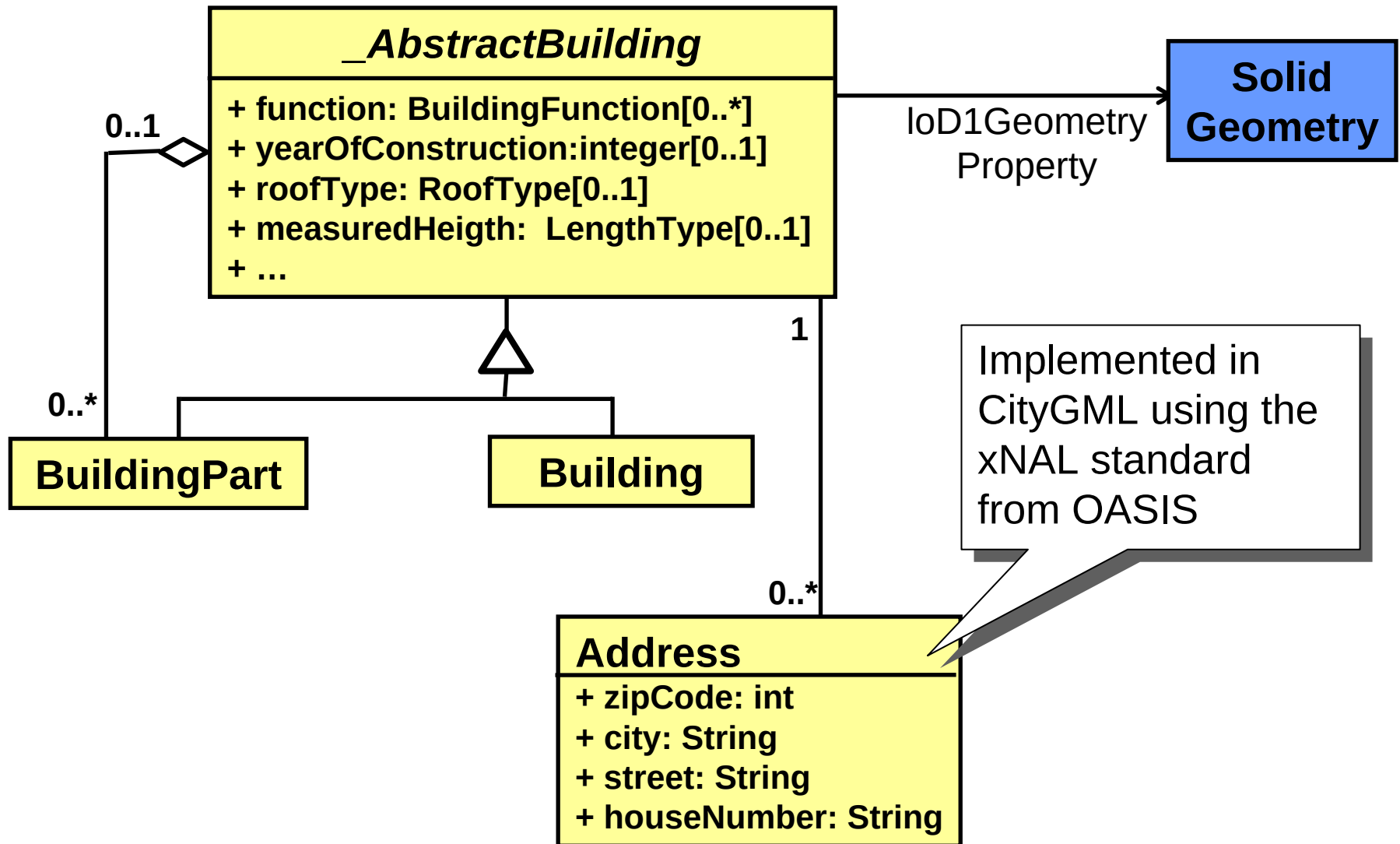
- (recursive) composition of **building parts**
- **thematic surfaces** (roof surface, wall surface, etc.) [from LOD2]
- **building installations** like dormers, stairs, balconies [from LOD2]
- **openings** like doors and windows [from LOD3]
- **rooms** and **furniture** [in LOD4]



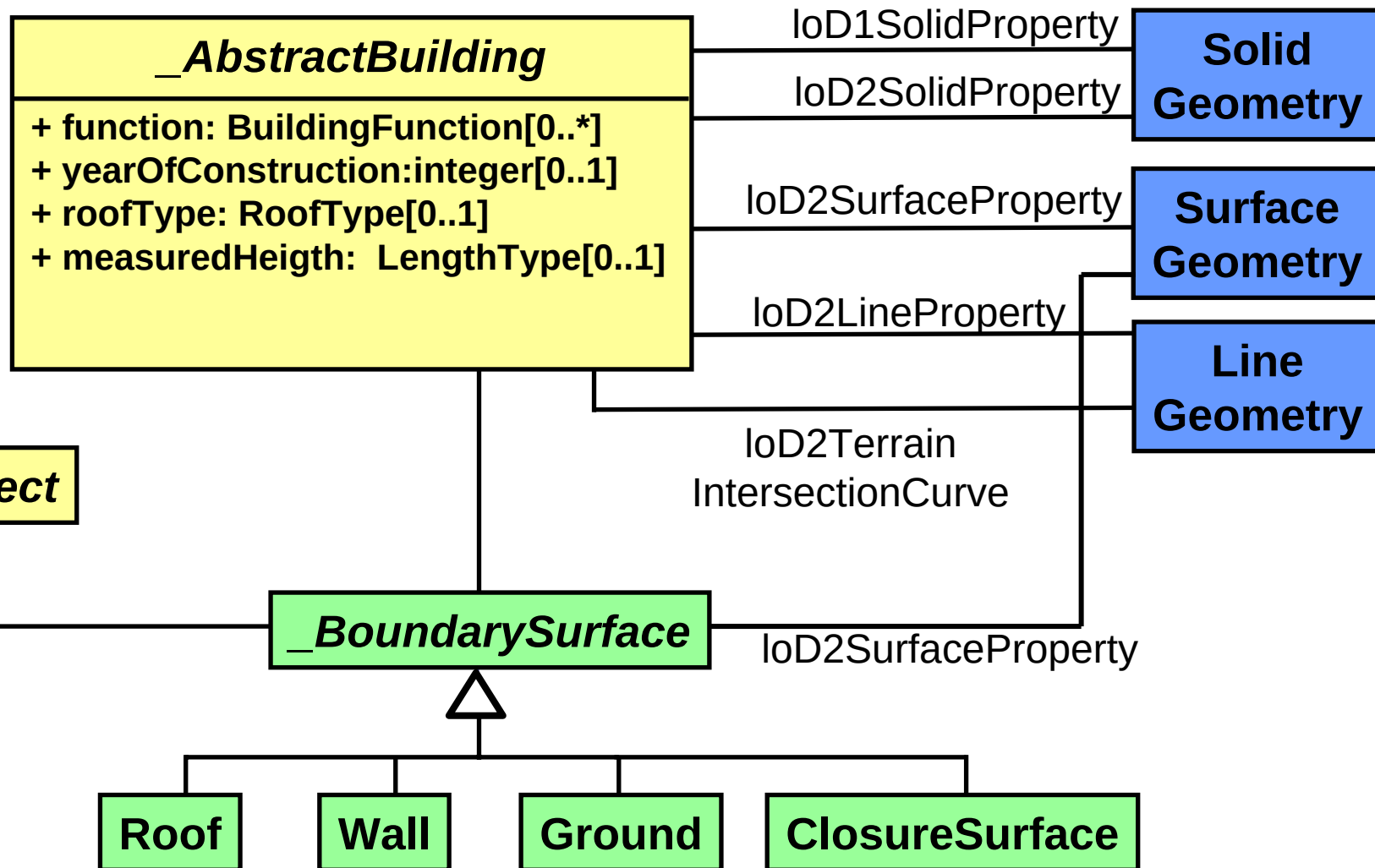
► Components contain relevant **thematic attributes**

- name, class, function, usage, construction and demolition date, roof type, address
- no. of storeys above / below ground, storey heights

Building Model in LoD1: UML Diagram



Building Model in LoD2



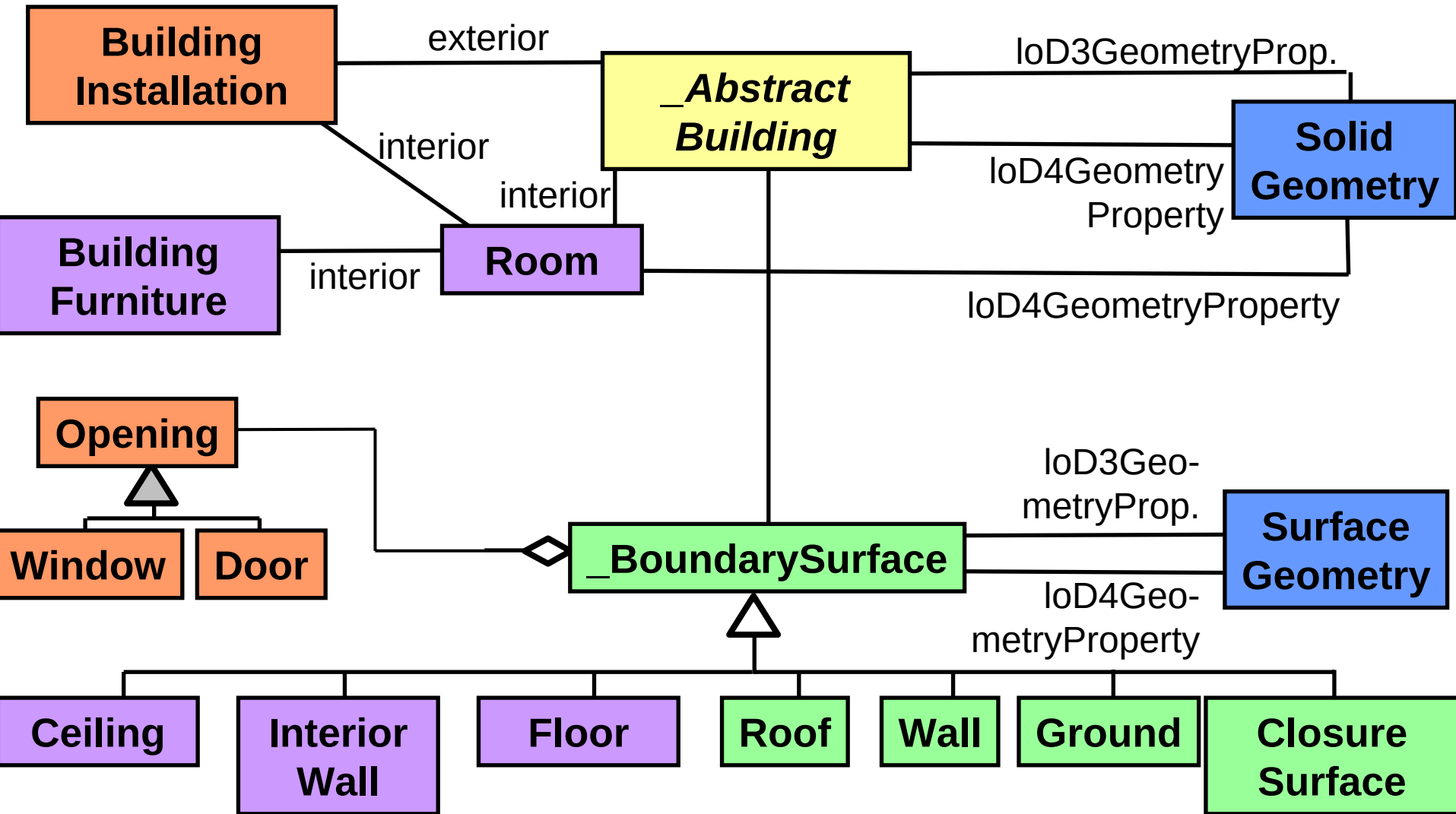
Building Model in LoD3+4

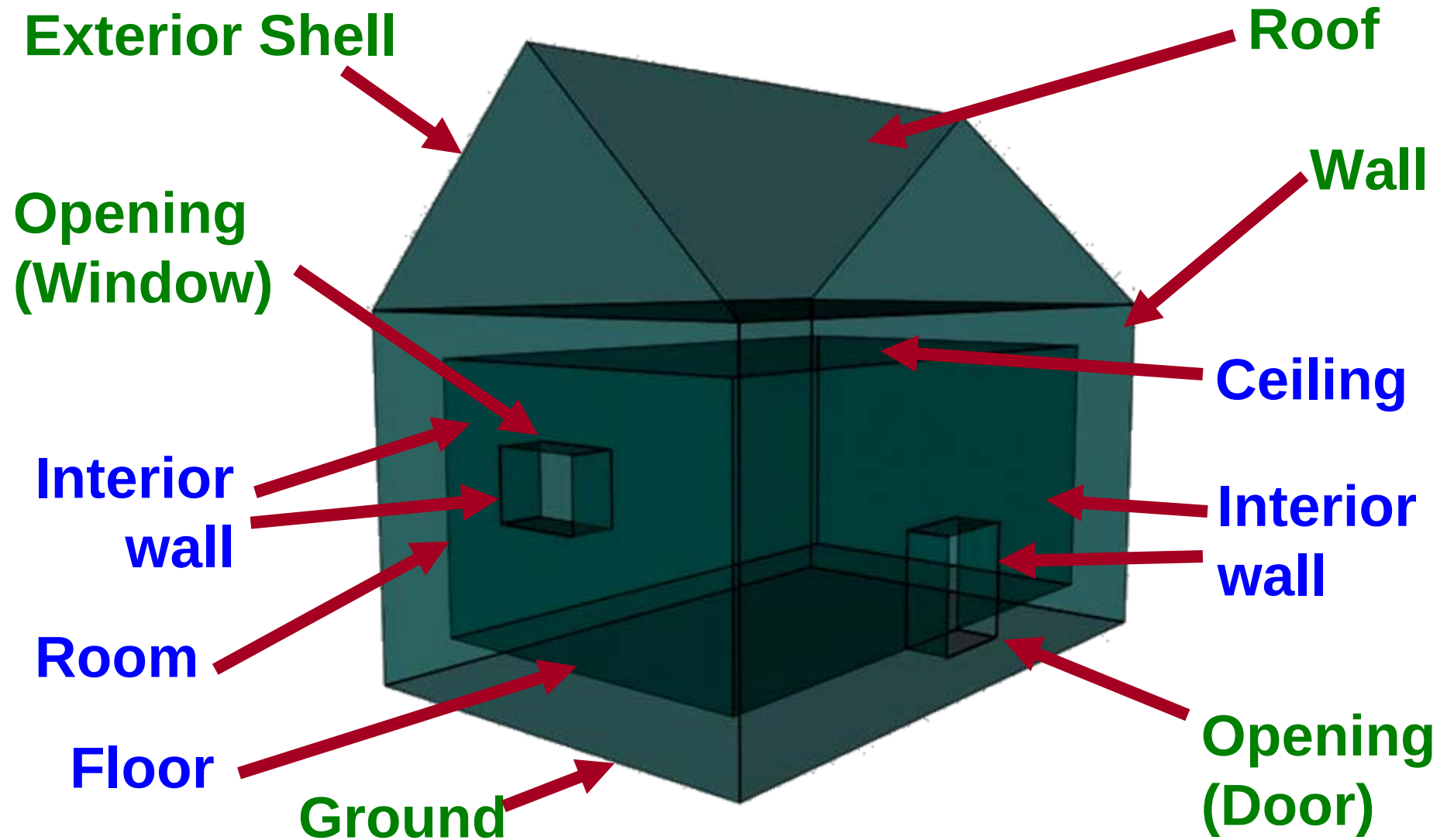
LoD1

LoD2

LoD3

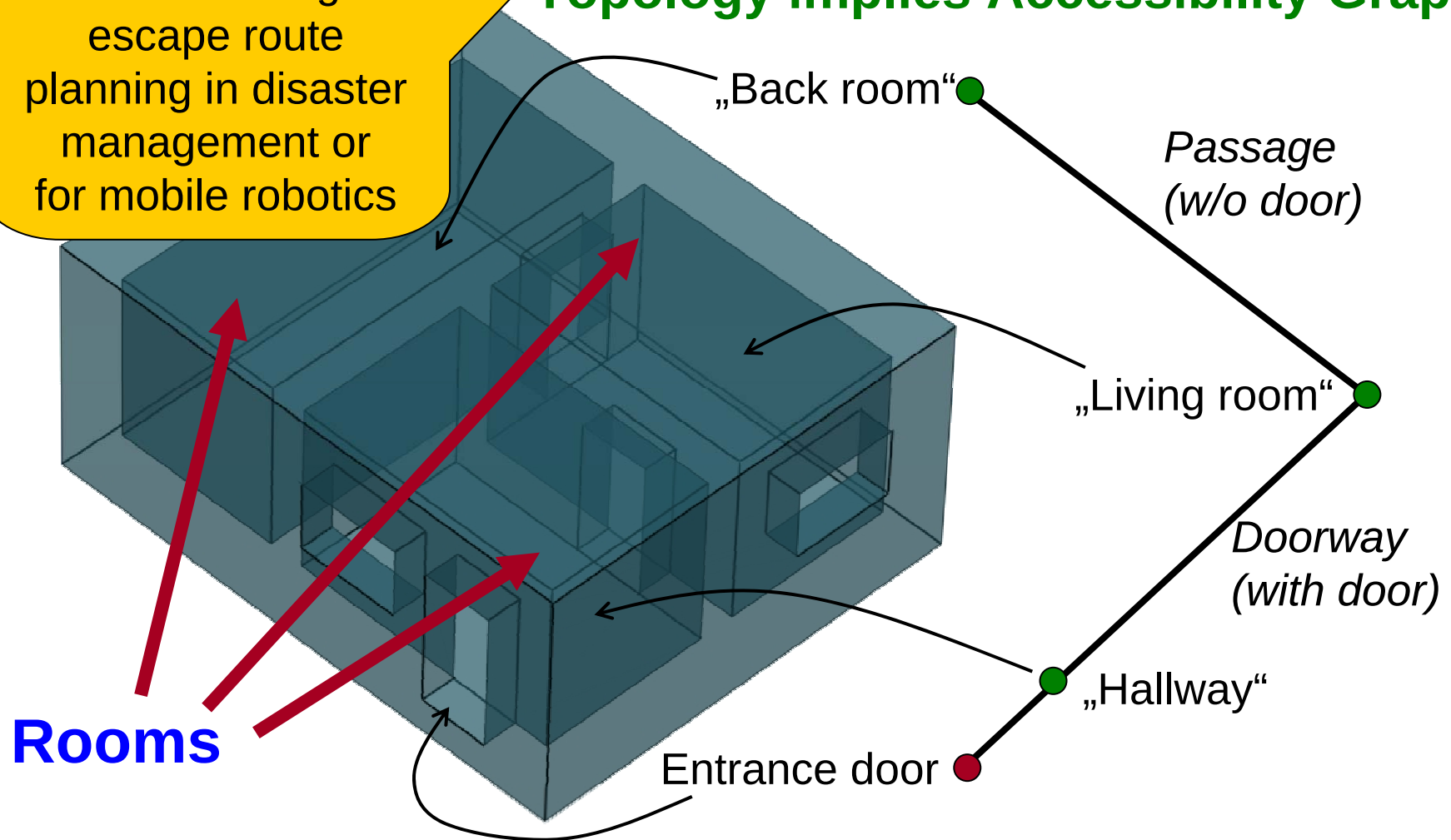
LoD4





Can be used e.g. for
escape route
planning in disaster
management or
for mobile robotics

Topology implies Accessibility Graph !



Example for CityGML file structure

```
<?xml version="1.0" encoding="UTF-8"?>
<CityModel xmlns="http://www.citygml.org/citygml/1/0/0" ...further namespaces omitted>
  <gml:name>Cologne</gml:name>
  <gml:boundedBy>
    <gml:Envelope
      srsName="urn:ogc:def:crs,crs:EPSG:6.12:31466,crs:EPSG:6.12:5783">
      <gml:pos> 5659800.0 2561800.0 15.9 </gml:pos>
      <gml:pos> 5662200.0 2564200.0 95.7</gml:pos>
    </gml:Envelope>
  </gml:boundedBy>
  <!-- now come the CityObjects like Buildings, DTM, Roads etc. -->
  <cityObjectMember>
    <Building gml:id="Building0815">
      <!-- shown on following slides -->
    </Building>
  </cityObjectMember>
  <!-- more CityObjects here -->
</CityModel >
```

Combined horizontal and vertical CRS

Bounding volume of the whole city model

...

```
<Building gml:id="Building0815">
  <gml:name>My nice building</gml:name>
  <externalReference>
    <informationSystem>http://www.adv-online.de</informationSystem>
    <externalObject>
      <uri>urn:adv:oid:DEHE123400007001</uri>
    </externalObject>
  </externalReference>
  <function>1012</function>
  <yearOfConstruction>1985</yearOfConstruction>
  <roofType>3100</roofType>
  <measuredHeight uom="m">8.0</measuredHeight>
  <lod2Solid>
    <!-- geometry (for Level of Detail 2) see next slide -->
  </lod2Solid>
</Building>
```

...

<!-- continued from previous slide -->

<lod2Solid>

<gml:Solid gml:id="solid0815" >

<gml:exterior>

<gml:CompositeSurface>

<gml:surfaceMember>

<gml:Polygon gml:id="polygon4711">

<gml:exterior>

<gml:LinearRing>

<gml:pos> 5660398.399 2562509.711 41.79 </gml:pos>

<gml:pos> 5660402.019 2562514.546 41.79 </gml:pos>

.....

</gml:LinearRing>

</gml:exterior>

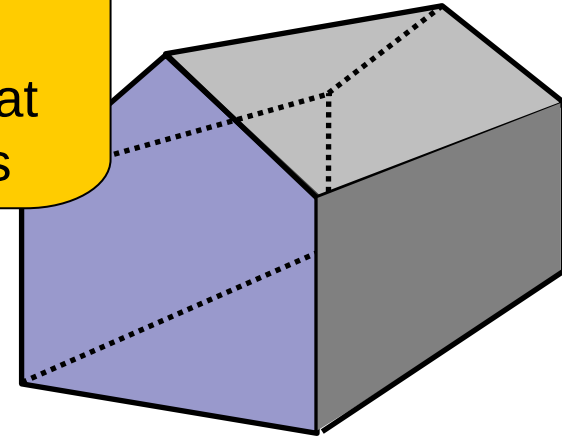
</gml:Polygon>

<gml:surfaceMember>

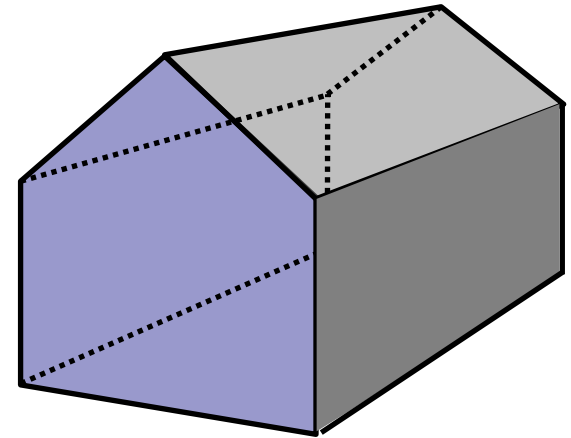
<!-- further surfaces of the solid; closing tags omitted due to limited space -->

</lod2Solid>

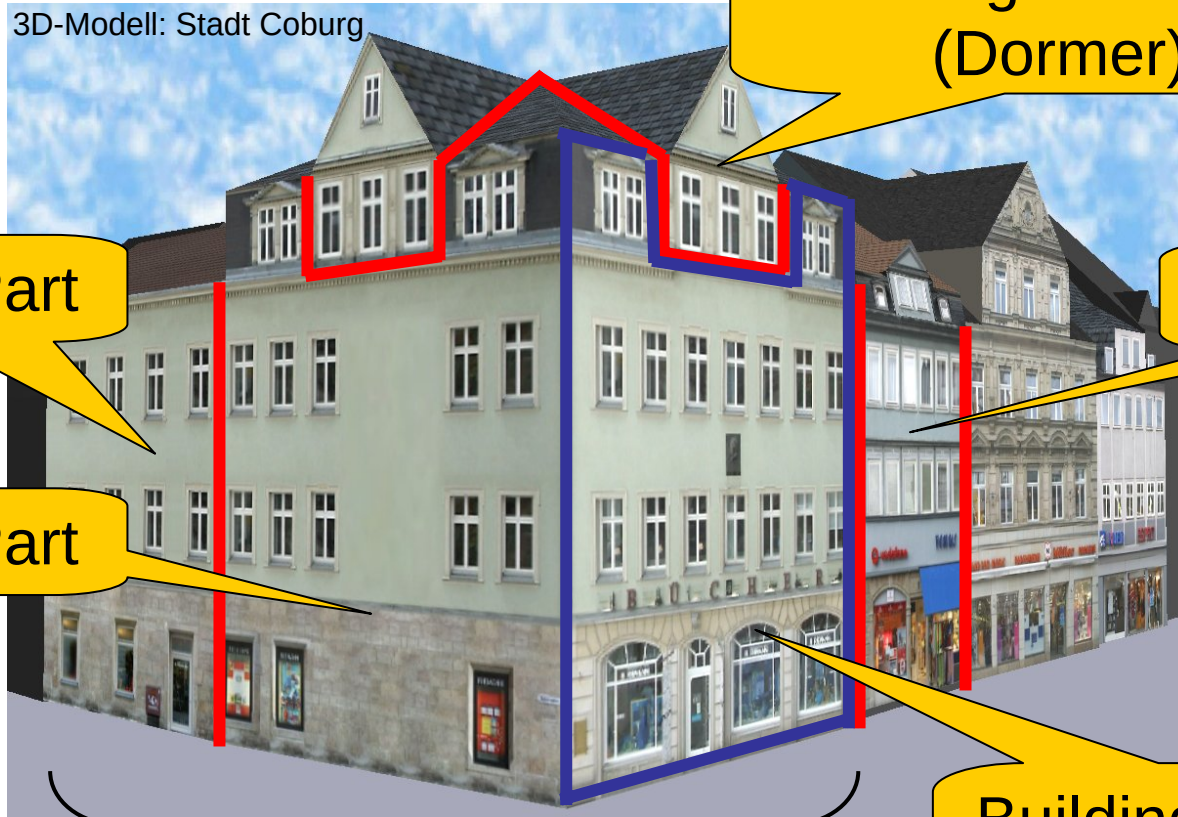
Please note that geometries are objects that can have IDs



```
<Building gml:id="Building0815">
  <lod2Solid>
    <gml:Solid>
      <gml:exterior>
        <gml:CompositeSurface>
          <gml:surfaceMember>
            <!-- front surface as in
              previous slide -->
          </gml:surfaceMember>
          <gml:surfaceMember>
            <!-- side surface -->
          </gml:surfaceMember>
          <!-- here come side, back, roof, and ground surfaces -->
        </gml:CompositeSurface>
      </gml:exterior>
    </gml:Solid>
  </lod2Solid>
</Building>
```



3D-Modell: Stadt Coburg



BuildingInstallation
(Dormer)

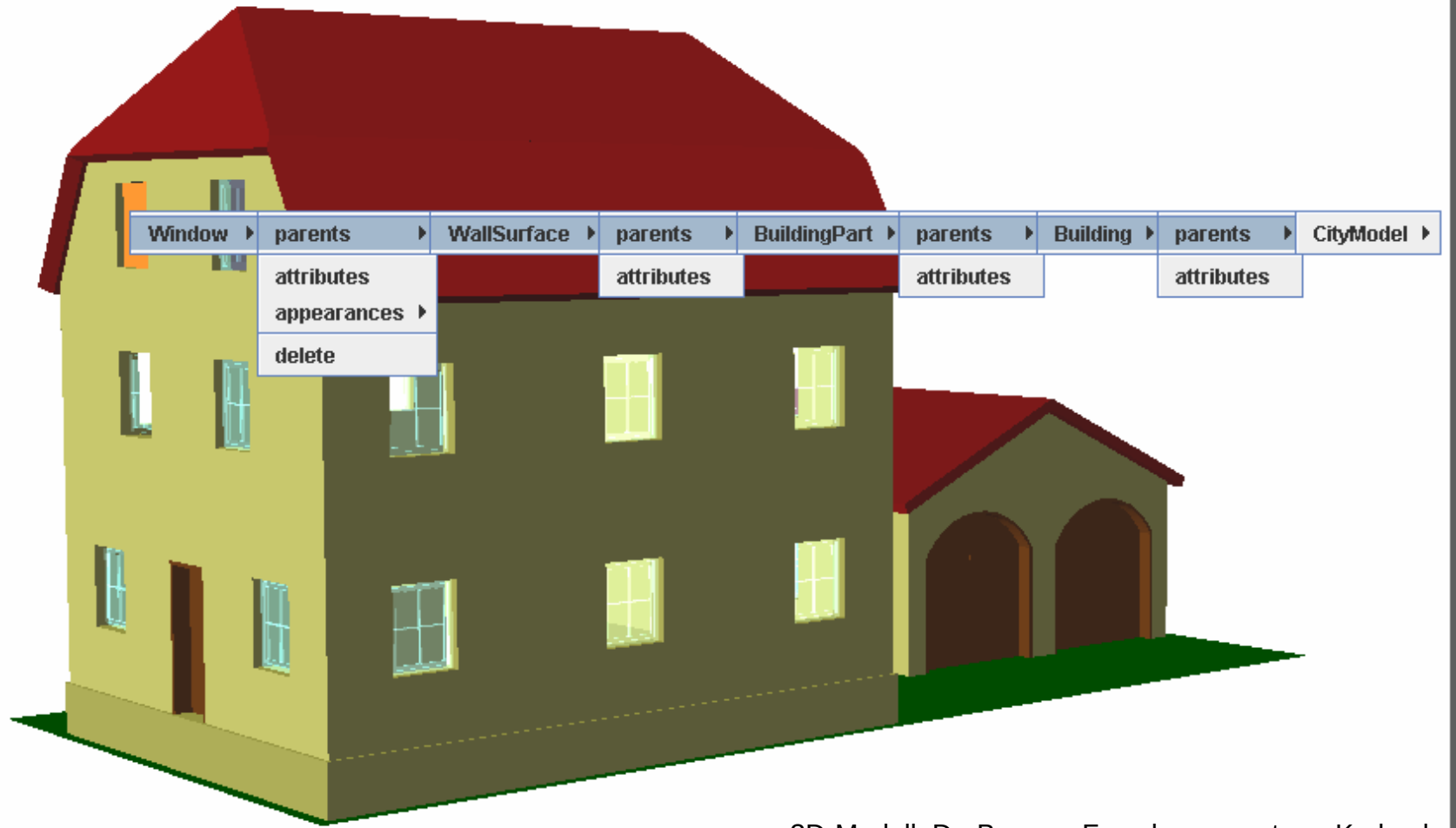
BuildingPart

Building

BuildingPart

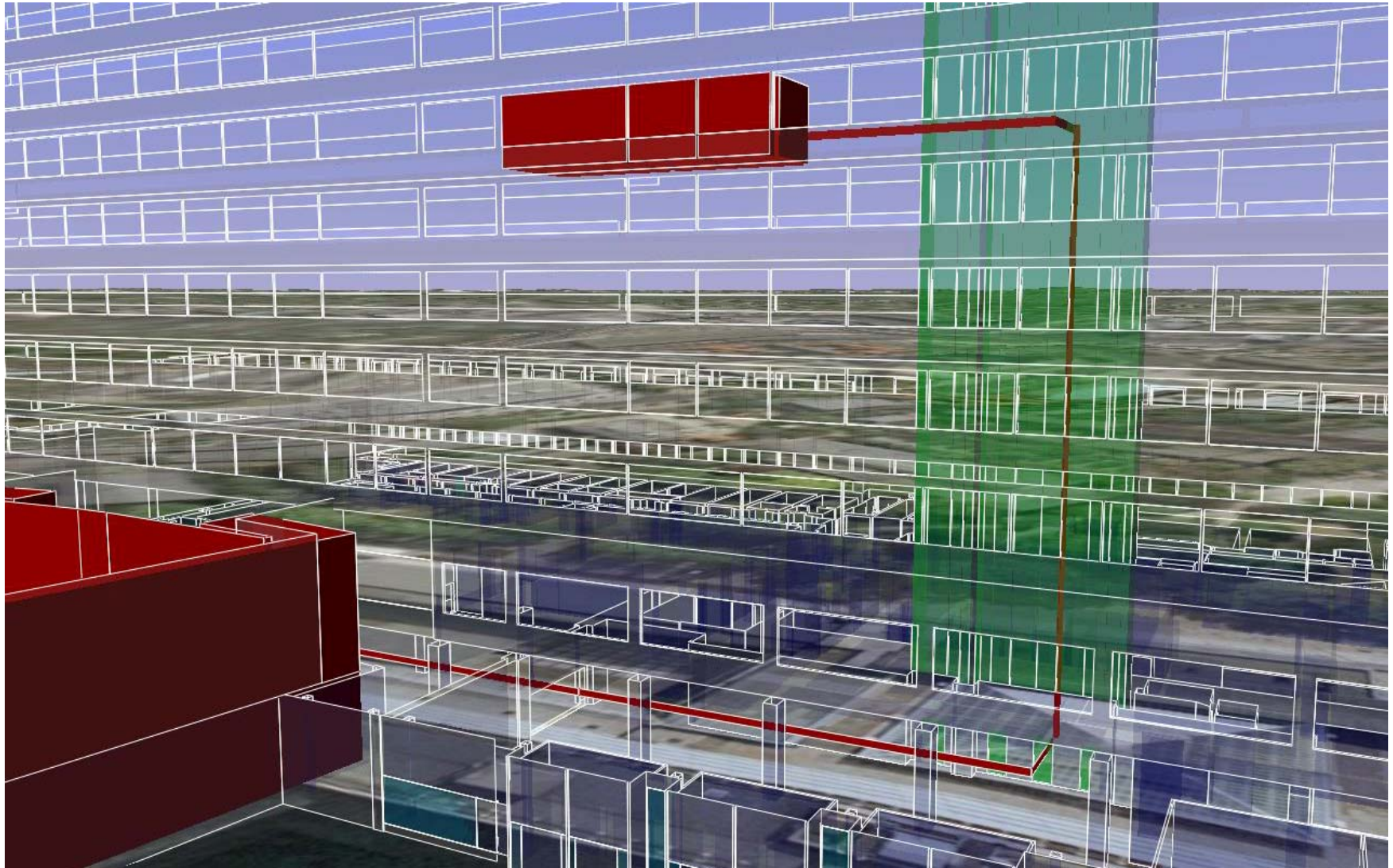
Building surface
(WallSurface)

Building

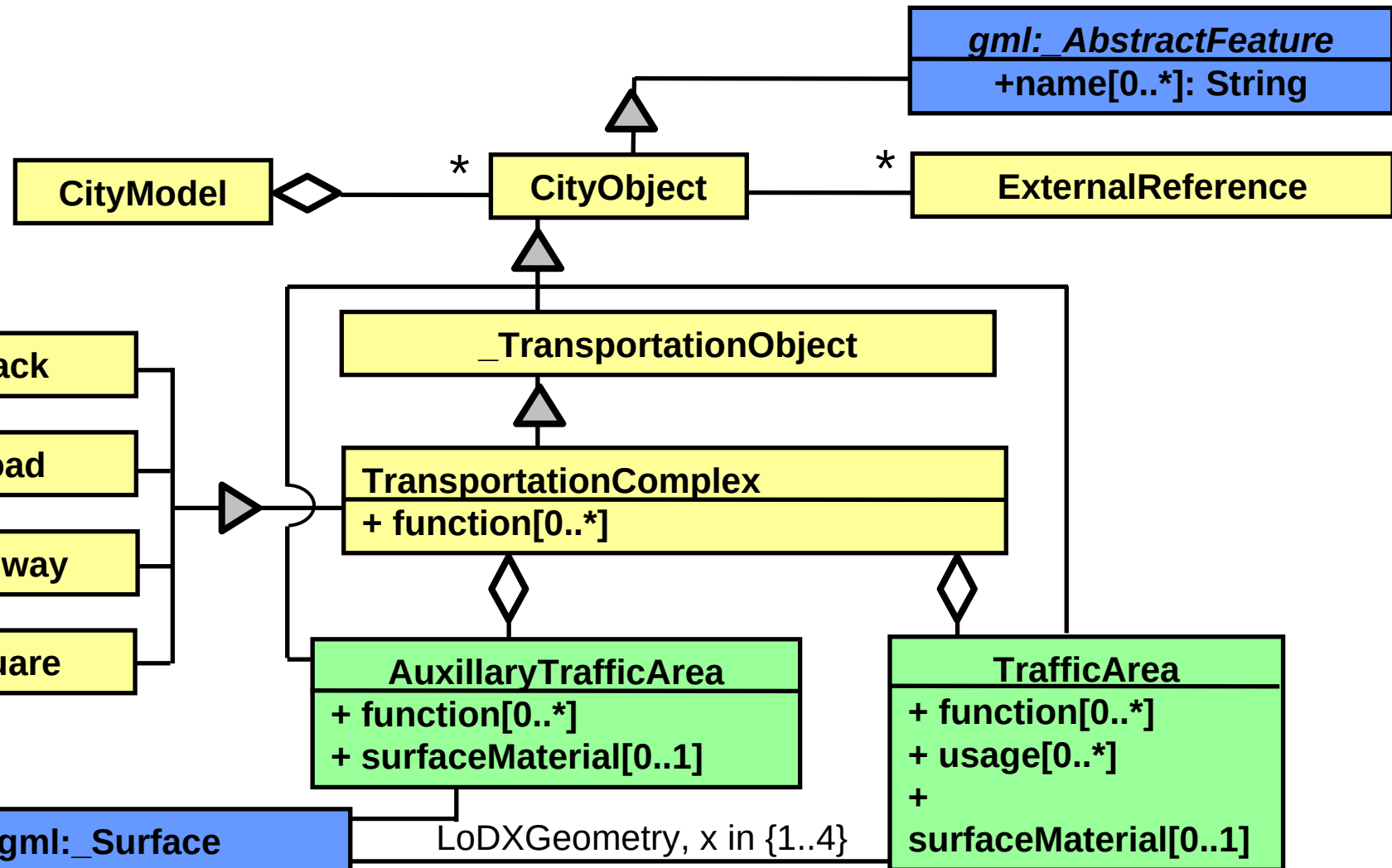


3D-Modell: Dr. Benner, Forschungszentrum Karlsruhe

Coherent Building Model in Level of Detail 4



Transportation Objects



Example: Transportation Model in LoD2

