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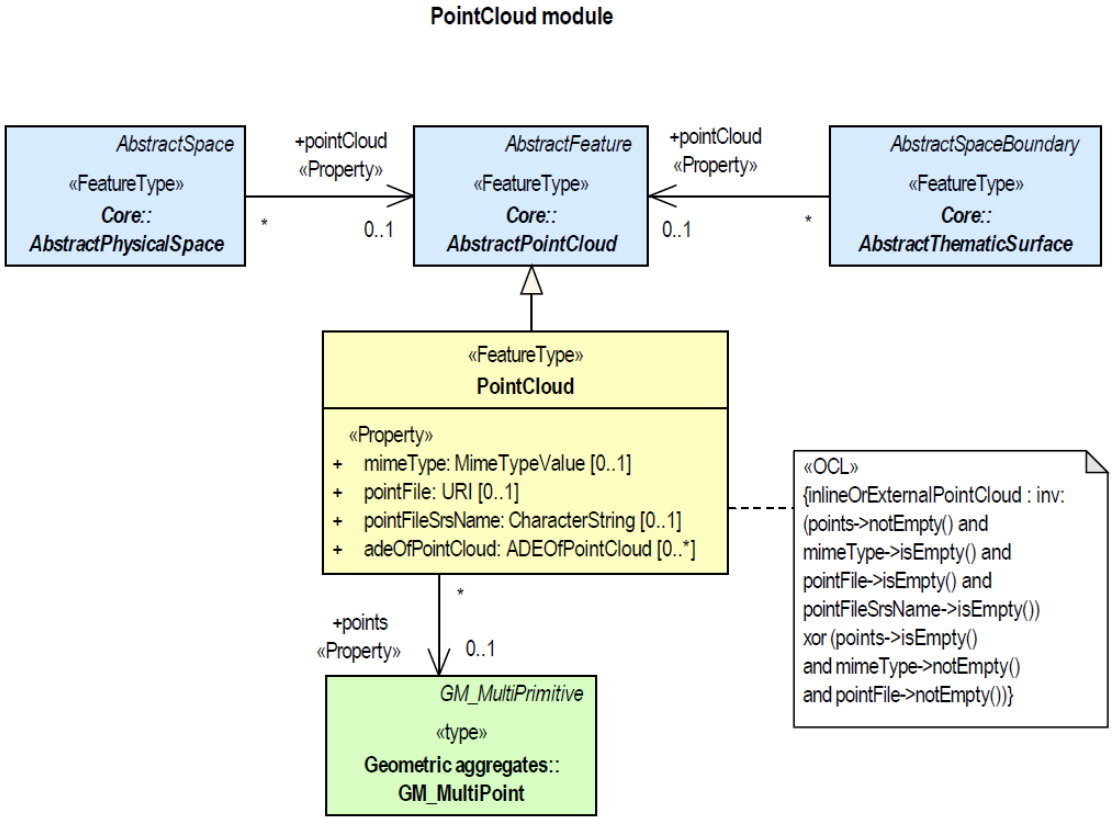
CityGML 3.0 Buildings with point cloud representation

Explanatory slides for the three test data sets provided on https://github.com/opengeospatial/CityGML-3.0Encodings/tree/master/CityGML/Examples/PointCloud

Test data – PointCloud module

- The PointCloud module allows for representing the geometries of city objects by 3D point clouds:
  - either as MultiPoint geometry inline with the CityGML file
  - or by referencing an external point cloud file (e.g. LAS or LAZ file)

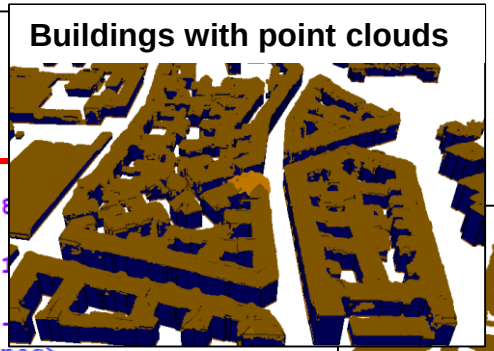


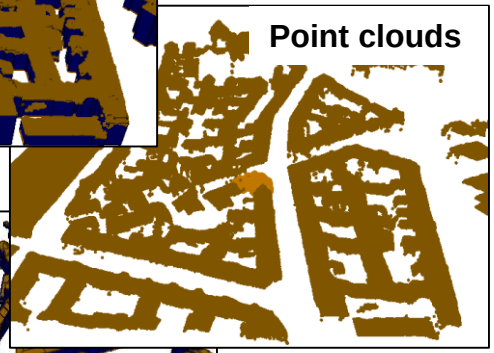
Test data – PointCloud module

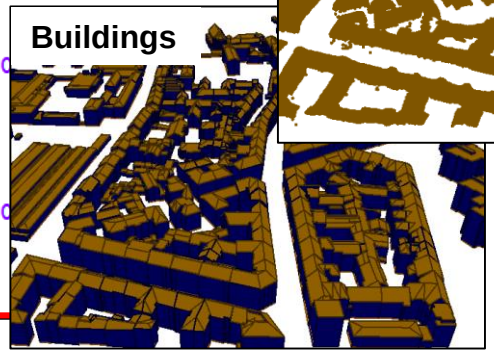
Representation option 1

- The point clouds are represented inline within the buildings in the CityGML file

```
<bldg:Building gml:id="DEBY_LOD2_4903217">
    <gml:name>DEBY_LOD2_4903217</gml:name>
    <core:creationDate>2015-09-24T00:00:00</core:creationDate>
    <core:boundary> ... </core:boundary>
    ...
    <core:pointCloud>
        <pcl:PointCloud gml:id="DEBY_LOD2_4903217_39c13ad4-9110-4d77-8
            <pcl:points>
                <gml:MultiPoint gml:id="DEBY_LOD2_4903217_39c13ad4-911
                    <gml:pointMember>
                        <gml:Point gml:id="DEBY_LOD2_4903217_39c13ad4-
                            <gml:pos>4467308.6 5331553.4 539.28</gml:pos>
                        </gml:Point>
                    </gml:pointMember>
                    <gml:pointMember>
                        <gml:Point gml:id="DEBY_LOD2_4903217_39c13ad4-9110
                            <gml:pos>4467308.6 5331553 539.62</gml:pos>
                        </gml:Point>
                    </gml:pointMember>
                    <gml:pointMember>
                        <gml:Point gml:id="DEBY_LOD2_4903217_39c13ad4-9110
                            <gml:pos>4467309 5331553 539.66</gml:pos>
                        </gml:Point>
                    </gml:pointMember>
```





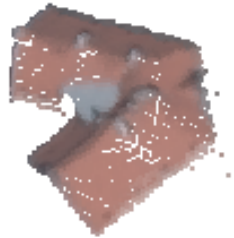


Test data – PointCloud module

Representation option 2

- A separate point cloud file is provided for every building
- Each building in the CityGML file references the corresponding point cloud file

```
<bldg:Building gml:id="DEBY_LOD2_4903217">
    <gml:name>DEBY_LOD2_4903217</gml:name>
    <core:creationDate>2015-09-24T00:00:00</core:creationDate>
    <core:boundary> ... </core:boundary>
    ...
    <core:pointCloud>
        <pcl:PointCloud gml:id="DEBY_LOD2_4903217_c0e8322c-8cf4-4fdd-8ddc-4780566814a5">
            <pcl:pointFile>..\pointcloud\DEBY_LOD2_4903217.laz</pcl:pointFile>
        </pcl:PointCloud>
    </core:pointCloud>
    <con:height>
        <con:Height>
            <con:highReference>topOfConstruction</con:highReference>
            <con:lowReference>lowestGroundPoint</con:lowReference>
            <con:status>measured</con:status>
            <con:value uom="urn:adv:uom:m">24.709</con:value>
        </con:Height>
    </con:height>
    <bldg:function>99999_1001</bldg:function>
    <bldg:roofType>3100</bldg:roofType>
</bldg:Building>
```



Test data – PointCloud module

Representation option 3

- One point cloud file is provided that contains all points from a specific area.
- In the point cloud file, all points belonging to a specific building have the same value set in the attribute “point_source_id”
- Each building in the CityGML file references the point cloud file and all points with the corresponding value in the attribute “point_source_id”

Component	Value
x	4467320.6
y	5331535
z	544.030009765625
intensity	0
return	0
number_of_returns	0
scan_direction	0
flight_line_edge	0
classification	6
angle	0
user_data	228
point_source_id	132
color_red	45605
color_green	31620
color_blue	29835

```
<bldg:Building gml:id="DEBY_LOD2_4903217">
    <gml:name>DEBY_LOD2_4903217</gml:name>
    <core:creationDate>2015-09-24T00:00:00</core:creationDate>
    <core:boundary> ... </core:boundary>
    <core:pointCloud>
        <pcl:PointCloud gml:id="DEBY_LOD2_4903217_5e7144be-258f-4d58-8f0c-bd10cb1387a5">
            <pcl:pointFile>..\pointcloud\4467_5331_40_bDOM_classified.laz?idattr=point_source_id&amp;id=132</pcl:p
        </pcl:PointCloud>
    </core:pointCloud>
    <con:height>
        <con:Height>
            <con:highReference>topOfConstruction</con:highReference>
            <con:lowReference>lowestGroundPoint</con:lowReference>
            <con:status>measured</con:status>
            <con:value uom="urn:adv:uom:m">24.709</con:value>
        </con:Height>
    </con:height>
    <bldg:function>99999_1001</bldg:function>
    <bldg:roofType>3100</bldg:roofType>
</bldg:Building>
```

Test data – PointCloud module

Representation option 3

- Here, the point cloud file is visualized by colouring the points according to the point attribute “point_source_id” to show which points belong to which semantic 3D building model in the CityGML 3.0 file.
- All points coloured in light blue are not linked with a CityGML feature