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An extension of CityJSON for the support of point clouds

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Summary

- **Improvement** of the cartographic representation
- Following the **3.0 CityGML specifications**, some attributes and features are added to the core module of CityJSON
- Extension for the **CityJSON** encoding to support point clouds
- Two solutions are proposed: **inline complex geometries** and **external link to a remote file**.
- The extended schema is illustrated in **several examples** such as detailed features visualisation, fall-back solution in features reconstruction processes, etc.

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Methodology

How?

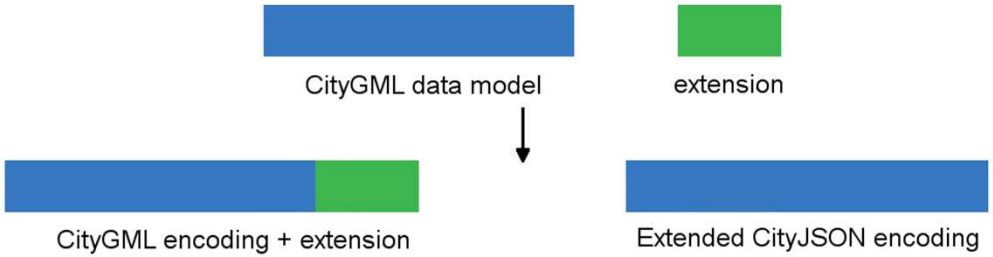
Context - CityJSON

- **CityGML 3.0 improvements :**
  - Space concept
  - Revision of the transportation module
  - …
  - Dynamizers
  - Point clouds
  - …
- **CityJSON 1.0.1 compliant with CityGML 2.0**

- Kutzner, T., Chaturvedi, K. & Kolbe, T.H. (2020) CityGML 3.0: New Functions Open Up New Applications. ***PFG*** 88**,** 43–61
- Ledoux H, Arroyo Ohori K, Kumar K, Dukai B, Labetski A, Vitalis S (2019). CityJSON: A compact and easy-to-use encoding of the CityGML data model. **Open Geospatial Data, Software and Standards**

Methodology

- Extending CityGML XML encoding imposes the **creation of an ADE**
- Extended CityJSON **are still** CityJSON files



Nys G-A, Poux F, Billen R. (2020) CityJSON Building Generation from Airborne LiDAR 3D Point Clouds. ***ISPRS International Journal of Geo-Information***. 9(9):521.

Conceptual model

- **Extending the model**
- Adding the support of **inline complex geometries**
  - MultiPoint geometric primitive

```
"_AbstractBuilding": {
   "geometry": {
      "type": "array",
      "items": {
         "oneOf":          [{          "+$ref":
"../geomptrimitives.schema.json#/MultiPoint" }]
      }
   }
}
```

Conceptual model

- *Extending the model*
- Adding the support of **nested object**
  - Proposition of a new object
    - mimeType
    - pointFile
    - pointFileSrsName

```
"+pointcloud-file": {
   "type": "object",
   "properties": {
      "mimeType": {
         "type": "string"
      },
      "pointFile": {
         "type": "string",
         "format": "uri-reference"
      },
      "pointFileSrsName": {
         "type": "string",
         "default": "EPSG:4326"
      }
   }
}
```

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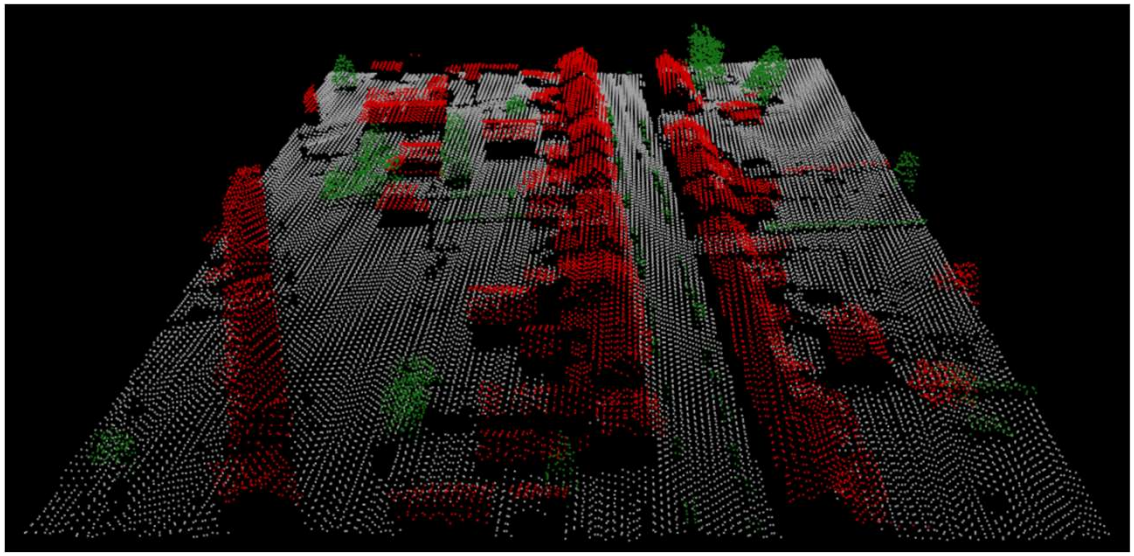
QUALITATIVE RESULTS TAKE-AWAY

Highlights on new capabilities

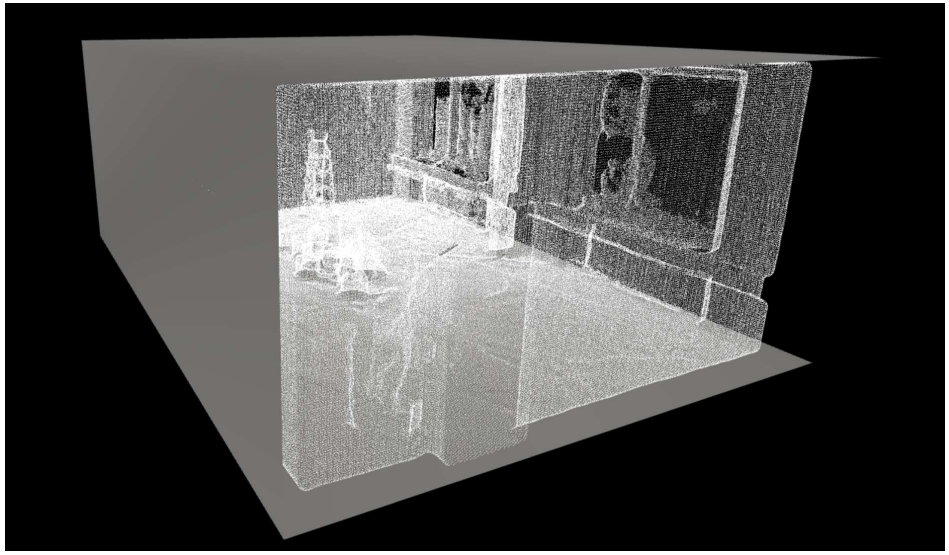
A world of points

- In theory, a model can be **entirely made up of points**.



Added details

- **More accurate level** of details can be delivered thanks to point clouds.



More accurate representation

- Vegetation can be represented **more accurately.**

In short

- **Point clouds** can be stored:
  - Inline geometries
  - Link to external ressource
- Open **new possibilities**:
  - Representation
  - Back-up solution

  - And certainly many others …

Ressources

- **Official website**
  - https://www.cityjson.org/extensions/
- **Extension**
  - https://github.com/GANys/cityjson-pointcloud
- **Viewer and storage**
  - https://github.com/GANys/Measur3D

Thank you

Stay safe

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