

### **New 3D standards and perspectives**

### THE NEW OGC API FAMILY

AM/FM-GIS Belux

Webinar 22 septembre 2020



## Focus on the urban built environment

### Last version of CityGML

Variety of new features and revisions of existing modules that will increase the usability of CityGML for more user groups and areas of application

### New community standard : CityJSON

A JSON-based encoding lightweight version of CityGML for storing 3D city models, also called digital maquettes or digital twins.





# The unavoidable CityGML

- CityGML is a data model.
- Implementation:
  - CityGML, the XML encoding
  - 3DCityDB, the relational schema model





# The unavoidable CityGML

Buildings are represented according to Levels-of-detail







# The unavoidable CityGML

Beyond research - open data usage in Belgium and Luxembourg :

Location	Year	Building LoD	Textures
Brussels	2014	LoD2	no
Namur	2018	LoD2	yes
Luxembourg	2017	LoD2.3	no



Variety of new features and revisions of existing modules that will increase the usability of CityGML for more user groups, areas of application and mainly simulations

Reference : Kutzner, T., Chaturvedi, K. Kolbe, T.H. CityGML 3.0: New Functions Open Up New Applications. *PFG* 88, 43–61 **2020**. https://doi.org/10.1007/s41064-020-00095-z&

Partially based on our work on 3D Space Concept

Reference : R. Billen, C. Zaki, M. Servières, G. Moreau & P. Hallot. Developing an ontology of space: Application to 3D city modeling. *Usage, Usability, and Utility of 3D City Models*, **2012** https://doi.org/10.1051/3u3d/201202007



#### Two classes of new functions :

- Revisions :
  - CityGML Core separation
  - Generics
  - Revised Building LoDs
  - Revised transportation module
- Addition :
  - Dynamizers
  - Versioning
  - PointCloud
  - Construction uppermodule





#### Clear separation of the conceptual model

- Distinction of spatial features: spaces and space boundaries
- OccupiedSpace and UnoccupiedSpace
- Depending on LoD, Spaces can evolve

#### Generics

- Other way of supporting extensions besides ADEs
- Does not change the XML schema
- Still not very suited because of namespace conflicts, schema validation, etc.





#### An improved modelling of constructions

- New module for common concepts of Buildings, Tunnels and Bridges
- Thematic surface, Openings, etc.
- Should facilitate merging with IFC

#### An improved representation of traffic infrastructure

- New module for Transportation
- TrafficSpace, TrafficArea, TransportationSpace, etc.
- Should facilitate traffic and driving simulations, driving assistance systems, autonomous driving, etc.



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#### Dynamizers are now native

- Integration of sensors data and time-dependent properties
  - tabulation of time/value pairs
  - patterns of time/value pairs based on statistical rules
- Retrieving observations from external sensor/IoT services

#### Multiple versions of cities

- Bitemporal timestamps for all objects
- Concurrent and successive models handled by multiple identifiers
- VersionTransition, validFrom, validTo, etc.





#### The representation of city objects by point clouds

- Geometries can be provided by 3D point clouds
- MultiPoints or external link to LAS/LAZ files



### Revised Levels-of-Detail

- Revised not refined !
- No more LoD4: interior is integrated to LoD 0/1/2/3



## CityGML 2.0 to CityGML 3.0

Conceptually not a problem but lack of tools

**Need the support of GML3 :** FME and GDAL for instance.

- citygml2-to-citygml3 : Conversion Java program
- citygml4j (JavaScript library) is currently being updated
- 3DCityDB should be updated



### **Possibilities create complexity !**



Number of features, ADEs, ...



## The little brother : CityJSON

- Based on the CityGML conceptual model
  - JSON encoding
- Lightweight and developers-friendly alternative to CityGML.
  - 6-7x more compact
- Considered for OGC Community standard Public comment closed on 5 March 2020

### BUT

- Native management of metadata
- Use of refined level of details
- Reference : Nys, G.-A.; Poux, F.; Billen, R. CityJSON Building Generation from Airborne LiDAR 3D Point Clouds. *ISPRS Int. J. Geo-Inf.* **2020**, 9, 521.

## **CityJSON tools**





#### FME importer/exporter – reader/writer

- ETL management and easy integration in workbenches
- CJIO
  - Python CLI to process and manipulate CityJSON files
- Val3dity
  - Validate 3D primitives according to the international standard ISO19107
- QGIS plugin
  - Python plugin for QGIS 3 which adds support for loading CityJSON datasets
- Blender plugin

Plugin to import/export 3D city models encoded in the CityJSON format

Can be transformed into CityGML by 3DCityDB also



### **CityJSON at the Geomatics Unit**

- Generation from SPW LiDAR and PICC building footprints
  - Buildings
  - TINRelief
  - Master thesis 2020-2021 : Roads.

#### Measur3D - Web application

- First management in database
- Viewer
- Attribute management
- 0.2.1 Version: Concurrent models



### Do not hesitate to contact us !

Stay safe



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