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New OGC 3D standards in urban built environment

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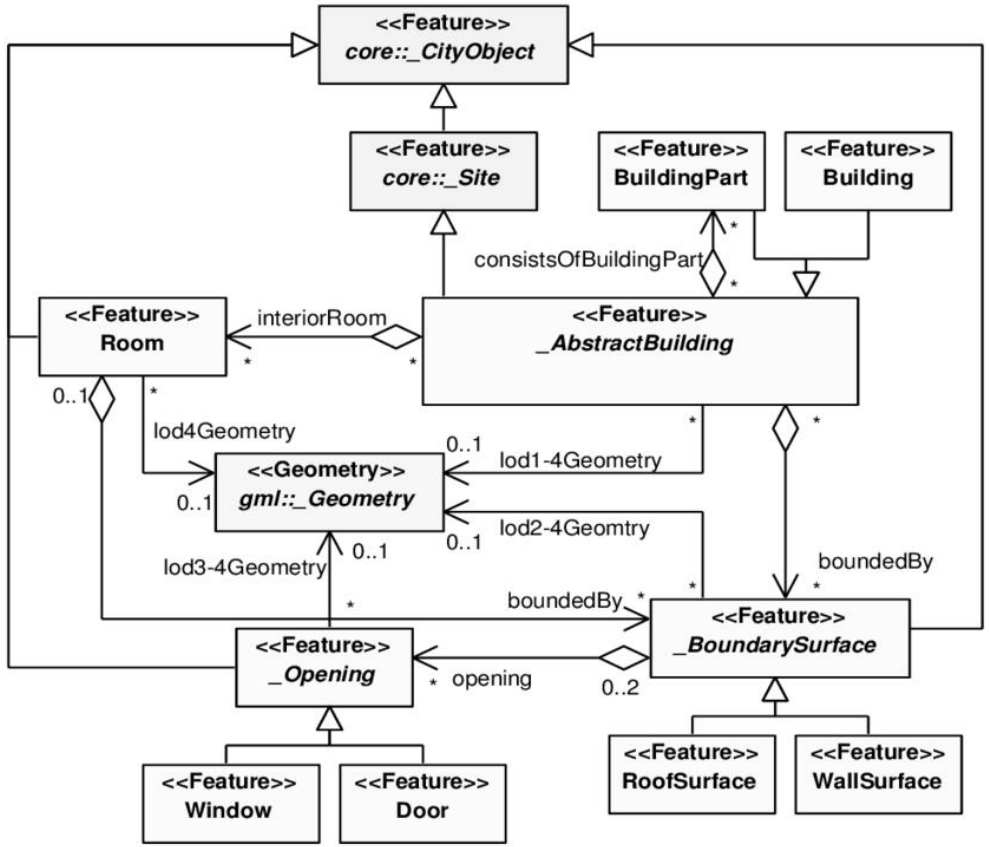
IGN Institut Géographique National
LIÈGE université Geomatics
.AGORIA co-founding partner

The unavoidable CityGML

- CityGML is a **data model.**

- Implementation:
  - CityGML, the XML encoding
  - 3DCityDB, the relational schema model



CityGML 3.0: New Functions Open Up New Applications

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, 43–612020. https://doi.org/10.1007/s41064-020-00095-z&

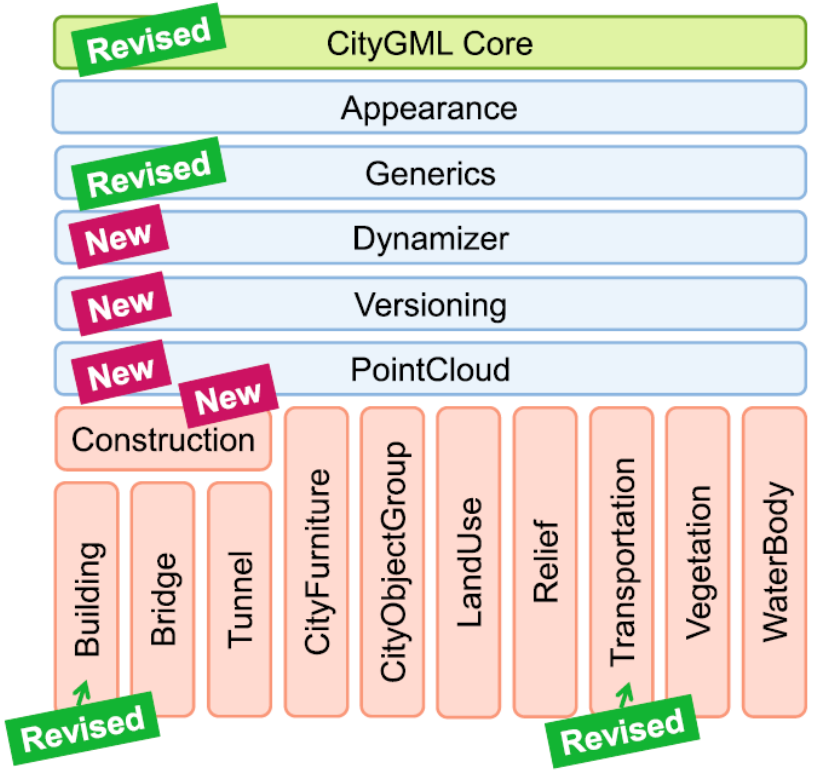
Partially based on our work on 3D Space Concept

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

CityGML 3.0: New Functions Open Up New Applications

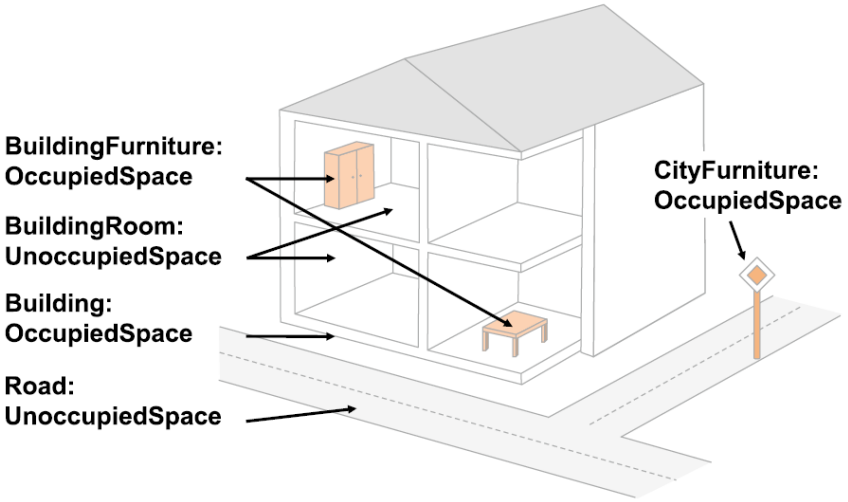
Two classes of new functions :

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



CityGML 3.0: New Functions Open Up New Applications

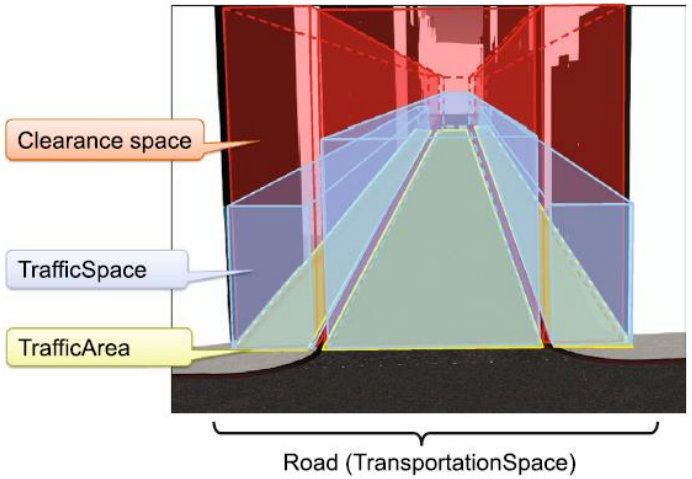
- Clear separation of the conceptual model
  - Distinction of spatial features: spaces and space boundaries
  - OccupiedSpace and UnoccupiedSpace
  - Depending on LoD, Spaces can evolve



- 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.

CityGML 3.0: New Functions Open Up New Applications

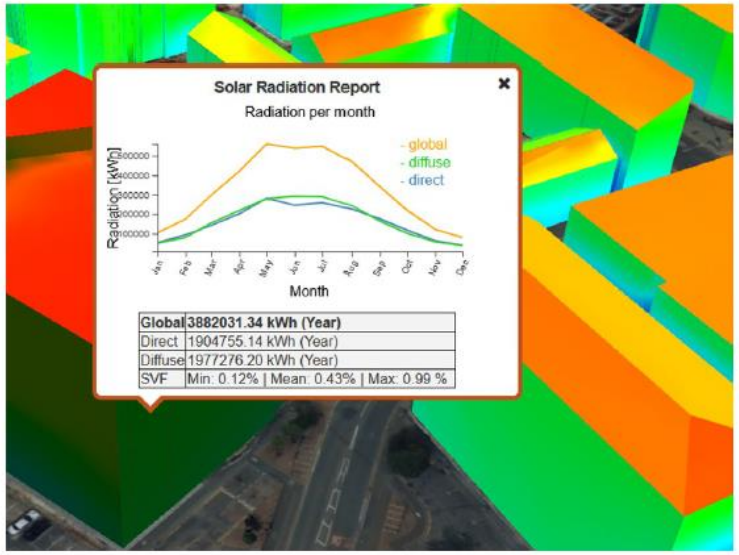
- An improved modelling of constructions
  - New module for common concepts of Buildings, Tunnels and Bridges
  - Thematic surface, Openings, etc.
  - Should facilitate merging with IFC



- 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.

CityGML 3.0: New Functions Open Up New Applications

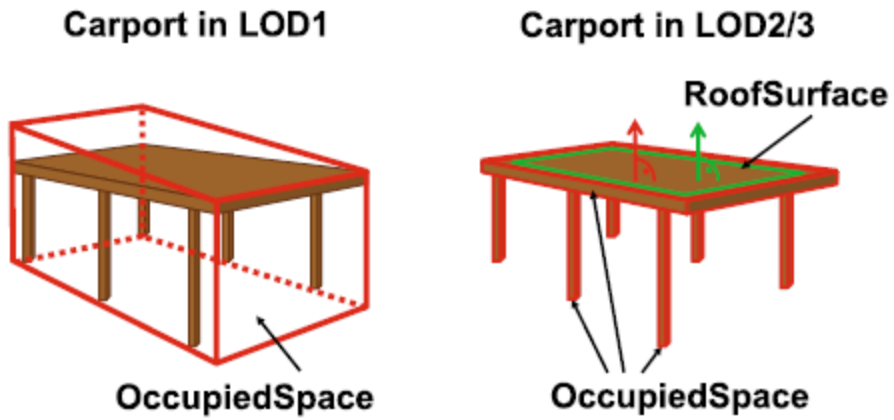
- Dynamizers are now native
  - Integration of sensors data and time-dependent properties
    - tabulation of time/value pairs
    - patterns of time/value pairs based on statistical rules
  - Retrieving observations from external sensor/IoT services



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

CityGML 3.0: New Functions Open Up New Applications

- 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

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

Do not hesitate to contact me !

Stay safe

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