

# Proposals of SIG3D and KIT for new features in the *Building* module

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**Storey** – Class for representing the architectural concept of a storey

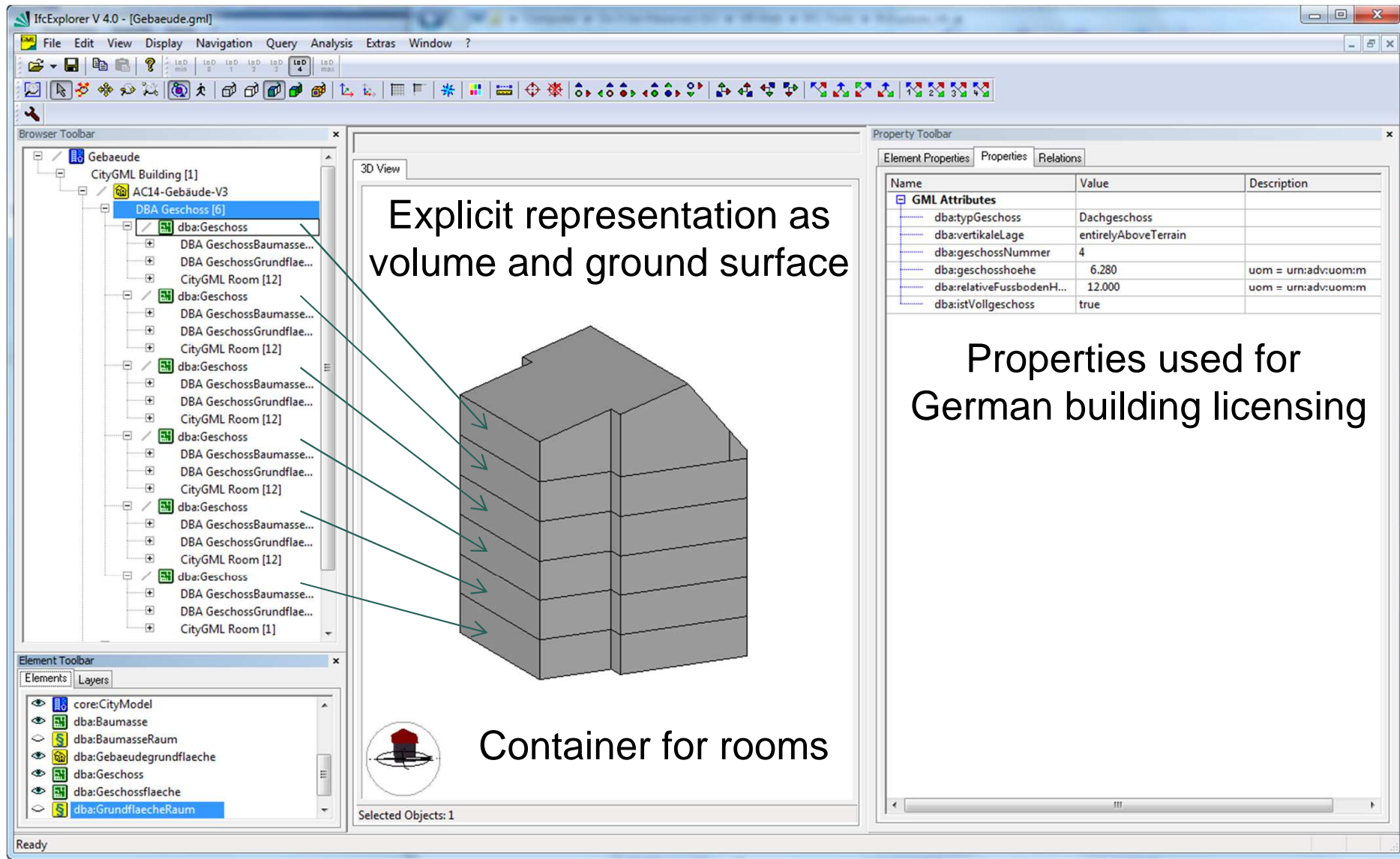
**BuildingUnit** – Class for representing zoning and aggregations in the interior of a building, e. g. to model apartments or temperature zones.

**OpeningSurface** – Class for representing voids in interior or exterior boundary surfaces (KIT proposal)

- In the actual CityGML standard, both concepts can only rudimentally be represented by *CityObjectGroups*.
- Both concepts are extensively used in the Building Information Modeling (BIM) area
- There exist a lot of applications which potentially would benefit from these classes
  - Heating demand simulations
  - Real estate applications
  - Building licensing
  - Indoor-Navigation
  - ...

- **Proposed attributes**
  - *name* (Text) and *number* (Float)
  - *class* und *usage* (CodeLists)
  - *storeyHeight* (Length)
- **Proposed relations(0..\*)**
  - *Room*
  - *BuildingUnit*
  - *BoundarySurfaces* (?)
  - *BuildingInstallation* (?)
- **Explicit geometric representation in 4 geometrical LODs (in analogy to *Building/BuildingPart*)**

# Storeys Example (ADE Building Licensing)



The screenshot shows the IfcExplorer V 4.0 interface. The left pane displays a tree view of the building model, with 'DBA Geschoss [6]' selected. The central 3D view shows a grey building model with arrows pointing to its volume and ground surface. The right pane shows a 'Property Toolbar' with a table of GML attributes.

**Explicit representation as volume and ground surface**

**Properties used for German building licensing**

Name	Value	Description
<b>GML Attributes</b>		
dba:typGeschoss	Dachgeschoss	
dba:vertikaleLage	entirelyAboveTerrain	
dba:geschossNummer	4	
dba:geschosshoehe	6.280	uom = urn:adv:uom:m
dba:relativeFussbodenH...	12.000	uom = urn:adv:uom:m
dba:istVollgeschoss	true	

**Container for rooms**

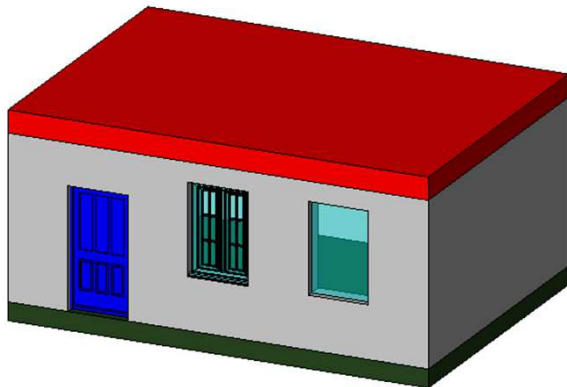
Selected Objects: 1

- **Proposed attributes**
  - *class* and *usage* (CodeLists)
- **Proposed relations (0..\*)**
  - *Address*
  - *Room*
  - *Storey*
  - *BuildingInstallation* (?)
- **Explicit geometric representation in 4 geometrical LODs (in analogy to *Room*)**

- CityGML does not represent (volumetric) building elements like walls or roofs, but only the outside and inside visible **Boundary Surfaces** of these elements.
- In an LOD4 models, therefore there exist two geometrically different surfaces representing the "voids" in the exterior shell (Feature *WallSurface*) and the room wall (Feature *InteriorWallSurface*), which both are related with the same **Opening** (*Door* or *Window*).
- The situation where a void in an interior or exterior wall is neither filled by a door nor by a window cannot be handled adequately.
- There is an inconsistency in nomenclature (*WallSurface*  $\leftrightarrow$  *Window*), as well as frequently an inconsistency in modeling style:
  - Boundary Surfaces are geometrically represented as **surfaces**, totally belonging either to the building's exterior or to the interior
  - Openings are frequently modeled as complex **geometric sets**, containing geometry parts belonging to the building's exterior and to the interior.

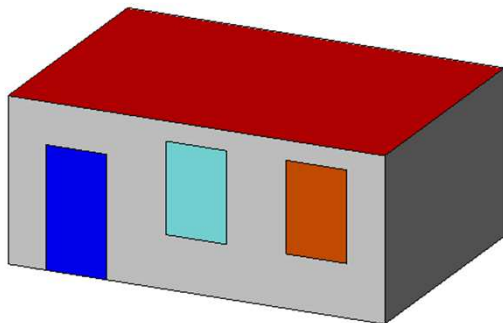
## IFC

**IFC Entities**  
Volumes or Geometry Sets



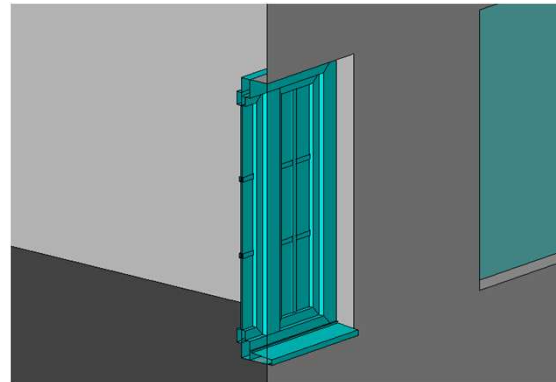
Relations

**IFC Space Boundaries**  
Surfaces

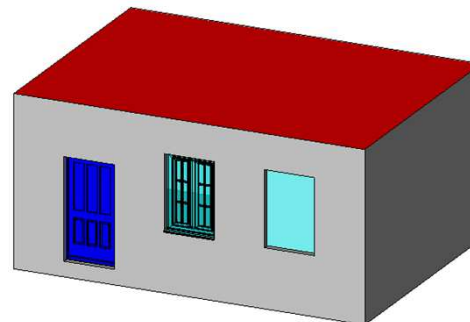


## CityGML 2.0

**Openings**  
Geometry Set

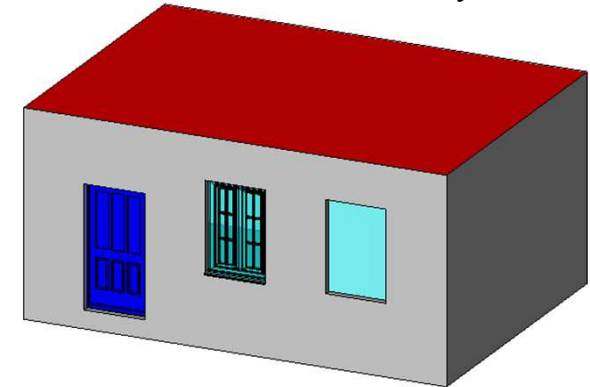


**Boundary Surfaces**  
Surfaces

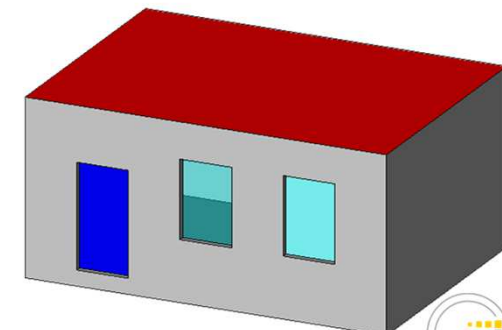


## CityGML 3.0

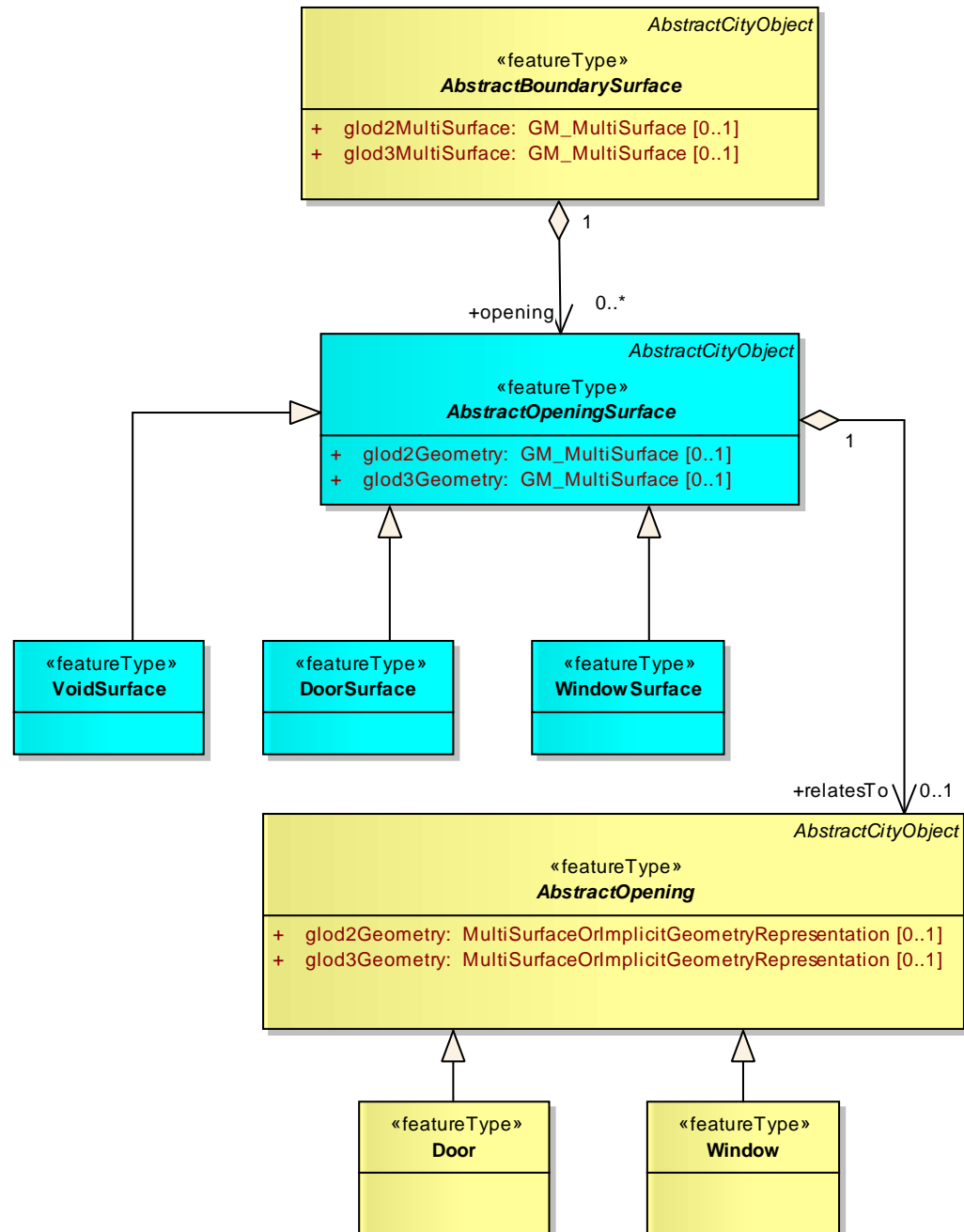
**Boundary Objects ?**  
**Openings**  
Volumes or Geometry Sets



**Boundary Surfaces**  
**Opening Surfaces**  
Surfaces







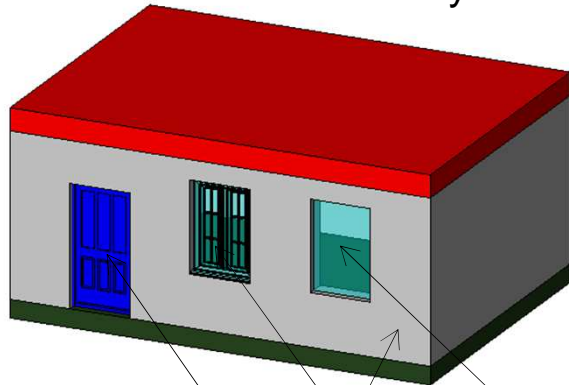
- Addition of a new feature *Storey* for representing storeys
- Addition of a new feature *BuildingUnit* for representing apartments, temperature zones, ...
- Addition of new features for Opening Surfaces (*DoorSurface*, *WindowSurface* and *VoidSurface*,) providing a geometrically generalized representation of voids in Boundary Surfaces.
- Modification of the schema to realize a relation between an Opening Surface and an Opening (Door or Window)



## IFC

### IFC Entities

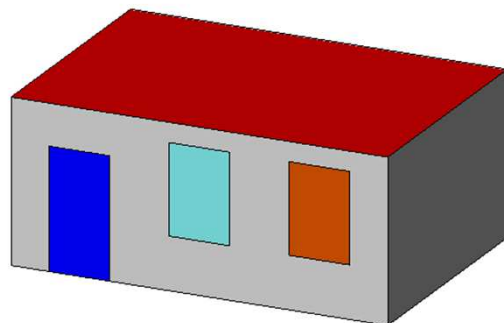
Volumes or Geometry Sets



Relations between wall and Opening  
(filled with door, window or nothing)

### IFC Space Boundaries

Simplified Surfaces

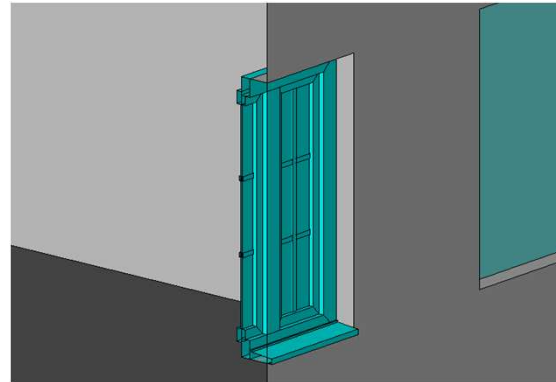


boundedBy door, window,  
and virtual surfaces

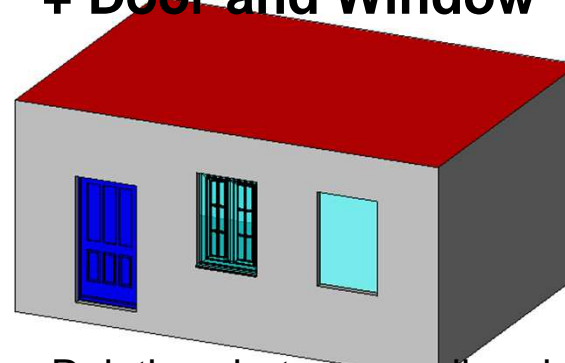
## CityGML 2.0

### CityGML Features

Surfaces and Geometry



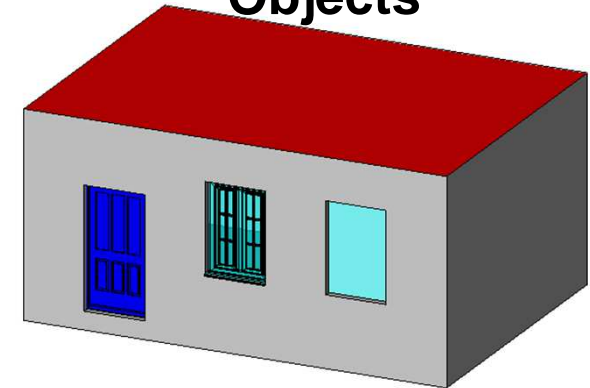
### Boundaries Surfaces + Door and Window



Relations between wall and  
door/window (not to ClosureSurface)

## CityGML 3.0

### Door and Window Objects



### DoorSurf., WindowSurf. and VoidSurface

