Floor plans in CityGML
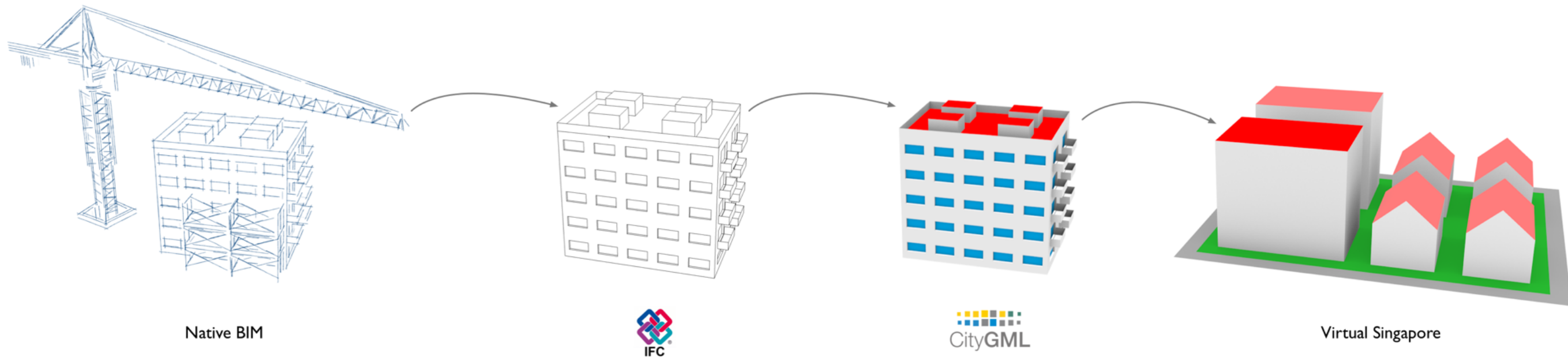
Amol Konde, Helga Tauscher, Filip Biljecki, James Crawford

IFC2CityGML & Virtual Singapore

Native BIM → IFC → CityGML → Virtual Singapore

- Project leaders: Rudi Stouffs, Patrick Janssen

- Funded by the Singapore National Research Foundation and coordinated by the Singapore Government Technology Agency

NUS National University of Singapore

OS Ordnance Survey

GOVTECH SINGAPORE

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jtc

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AULA CONGRESCENTRUM

02

Auditorium
Lift
Entresol
Senaatszaal
Collegezaal C
Collegezaal A
Frans van Hasseltzaal
Collegezaal D
Collegezaal B

01

Lift
Entresol
Foyer
Collegezaal C
Collegezaal A
Collegezaal D
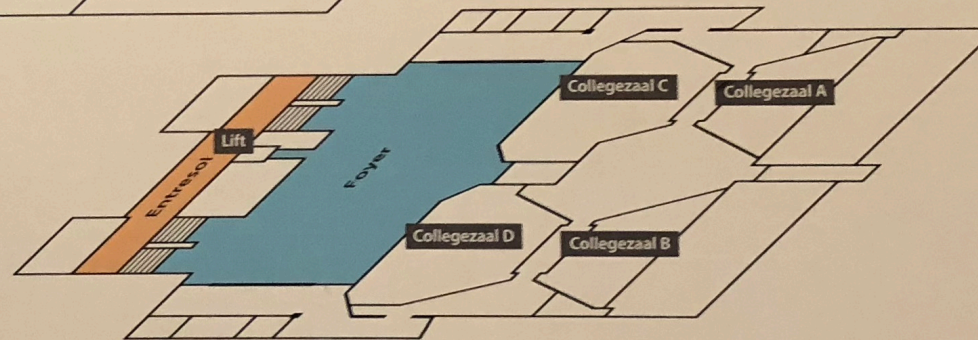Collegezaal B

BG

Entree
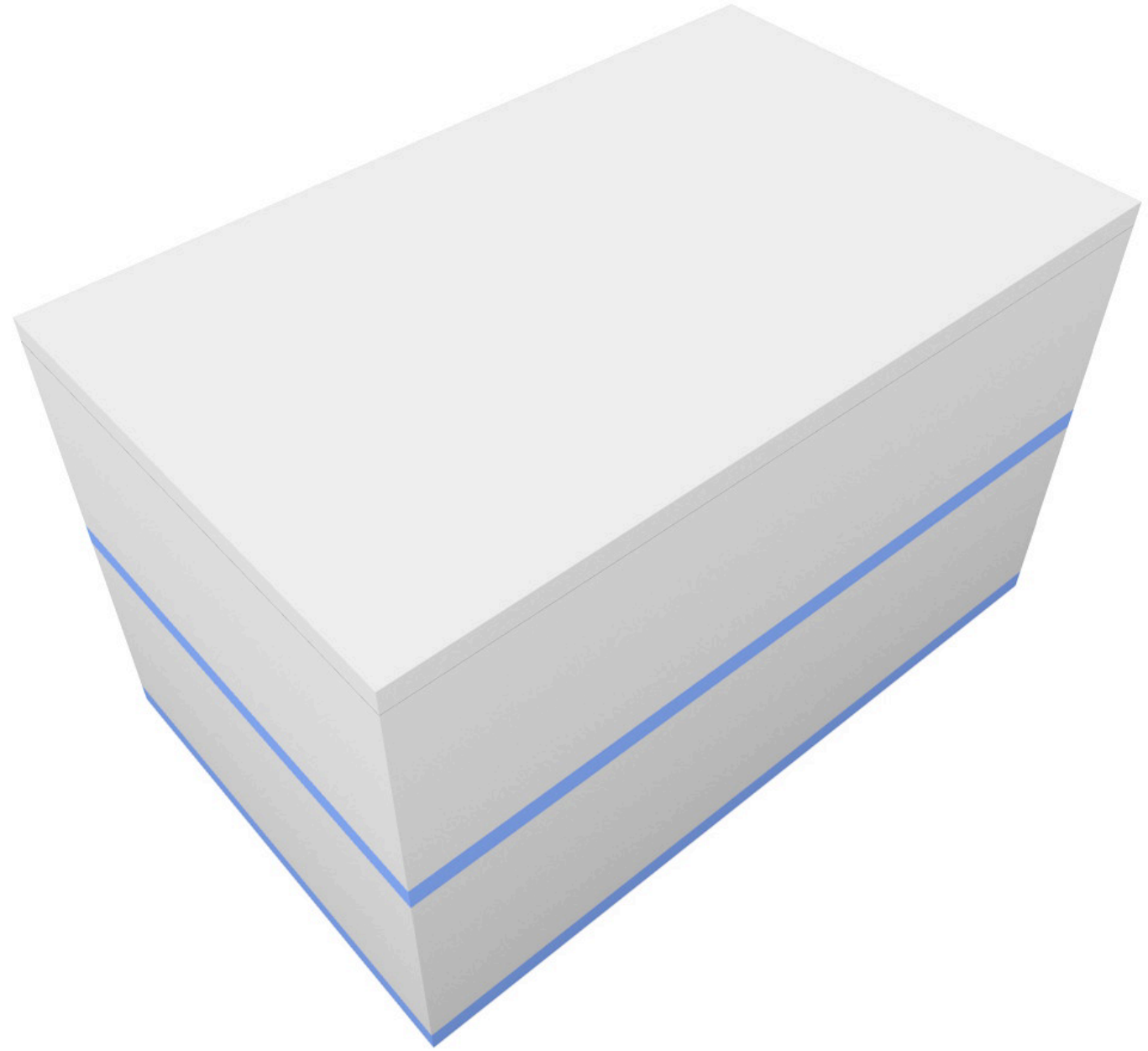Lift
Garderobe
Informatie
Restaurant
Entree
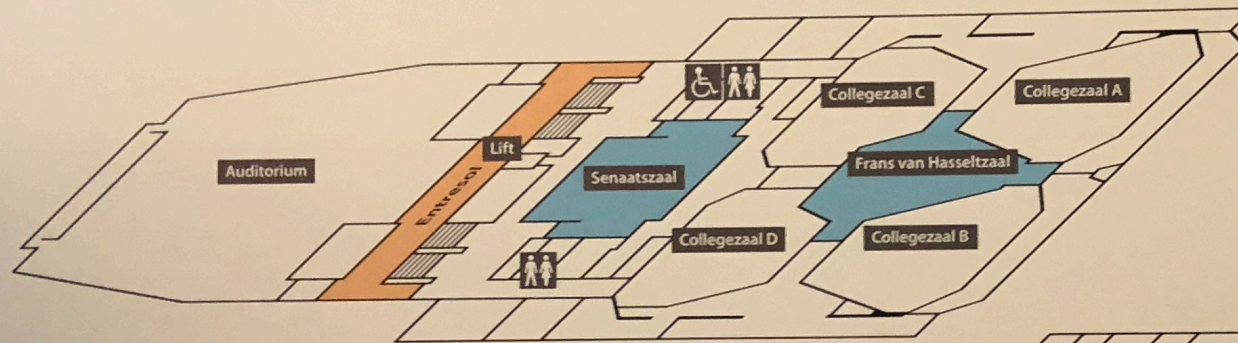
Motivation

1. Papers on floor plans in GIS: almost none

2. Modelling floor plans in CityGML: topical subject

3. Not much work on sourcing floor plans from BIM

4. Not much talk on use cases in the frame of 3D GIS

CityGML and floor plans

- Floor plans and storeys not much of a topic until the development of CityGML 3.0

- LOD4 is being phased out in favour of multiple indoor levels (i.e. LOD0/1/2/3 supporting interior)

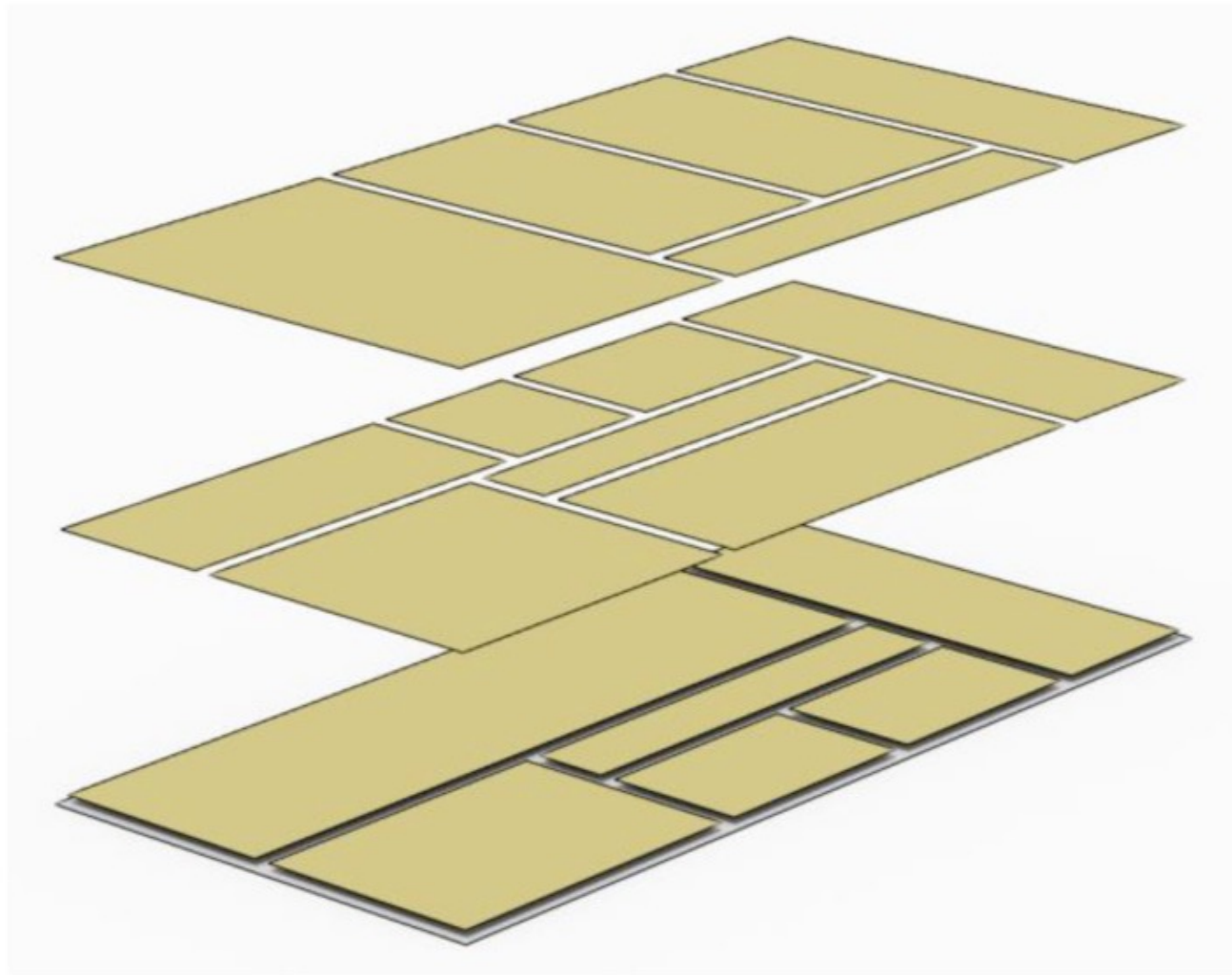- CityGML LOD0 interior = floor plans
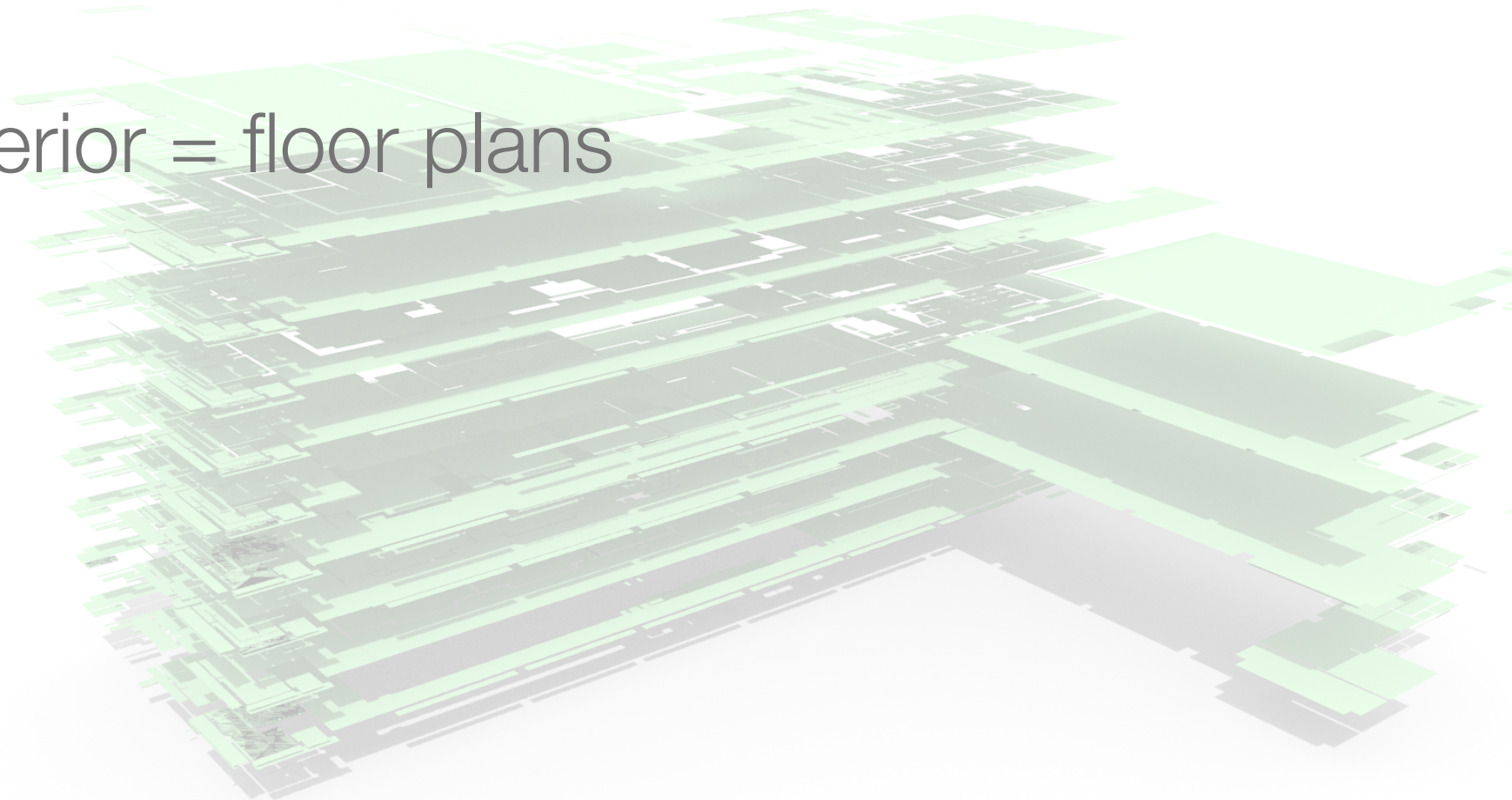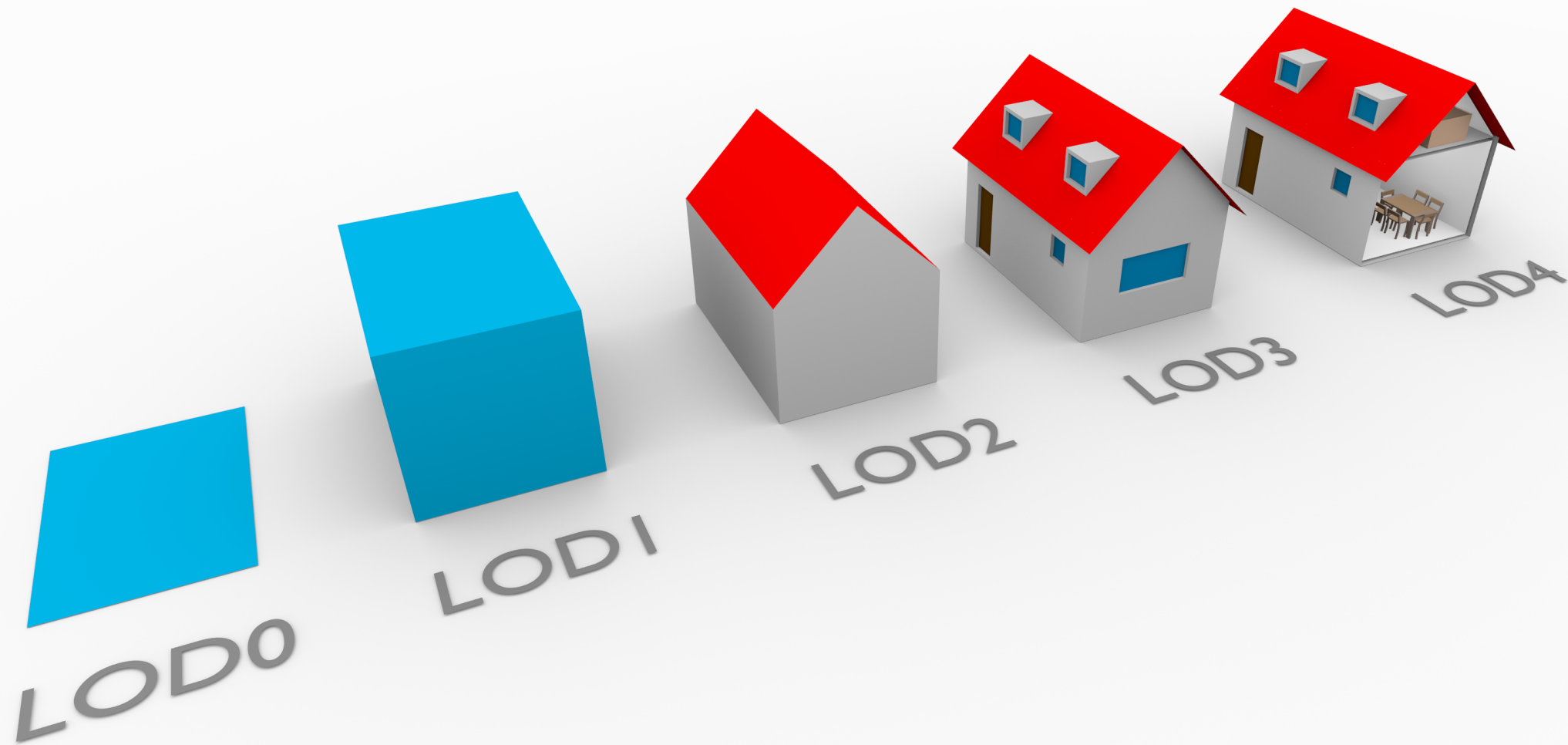
Current LOD proposal

Figure 2. LoD0 representation of the exterior and the interior (rooms) of buildings.
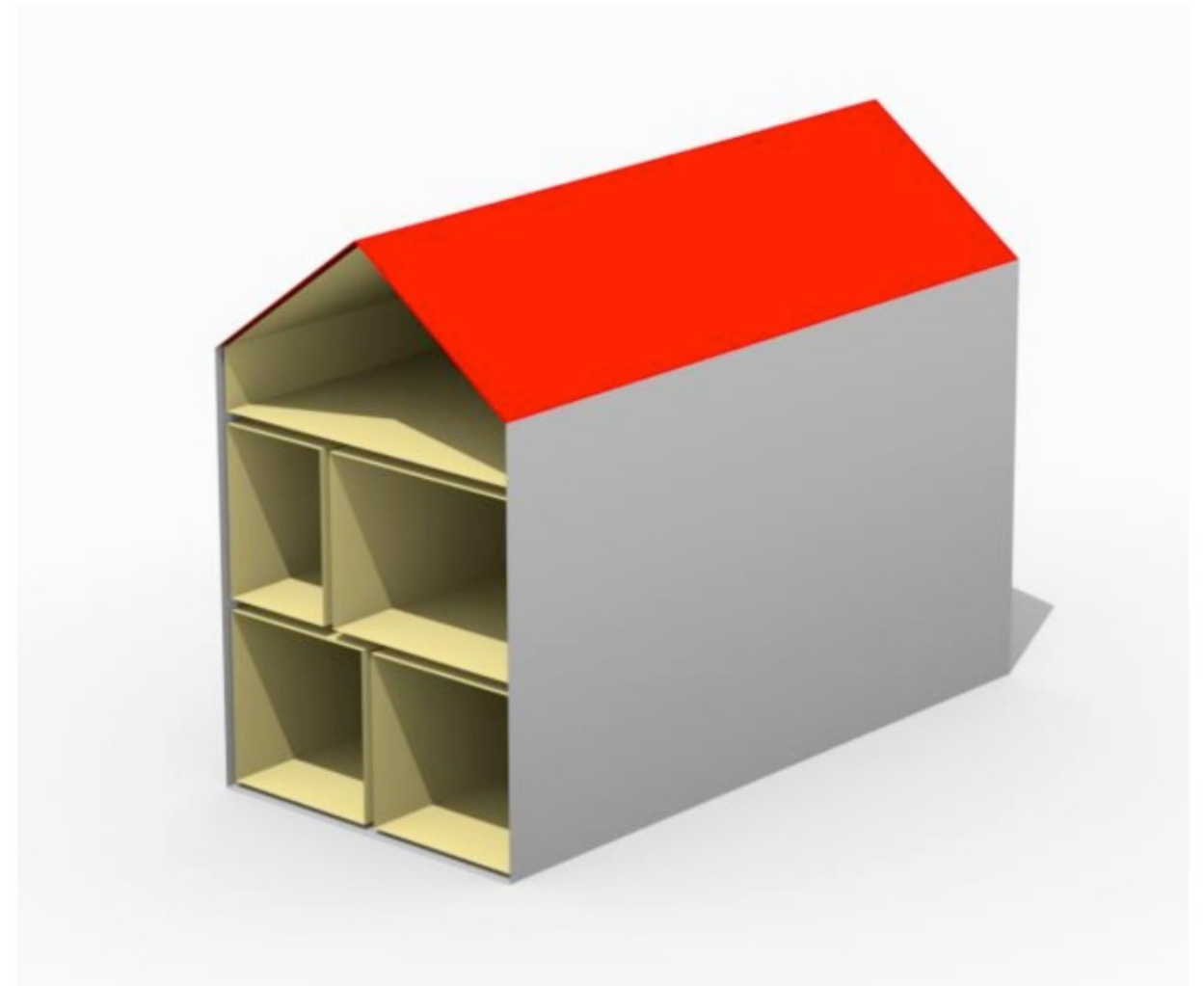

Figure 3.. LoD2 representation of a building (exterior) and of rooms.

Löwner, M. O., Gröger, G., Benner, J., Biljecki, F., & Nagel, C. (2016). Proposal for a new LOD and multi-representation concept for CityGML. ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci., IV-2/W1, 3–12. http://doi.org/10.5194/isprs-annals-IV-2-W1-3-2016

LOD2

LOD3

LOD4

Biljecki, F., Ledoux, H., & Stoter, J. (2016). An improved LOD specification for 3D building models. Computers, Environment and Urban Systems, 59, 25–37. http://doi.org/10.1016/j.compenvurbsys.2016.04.005
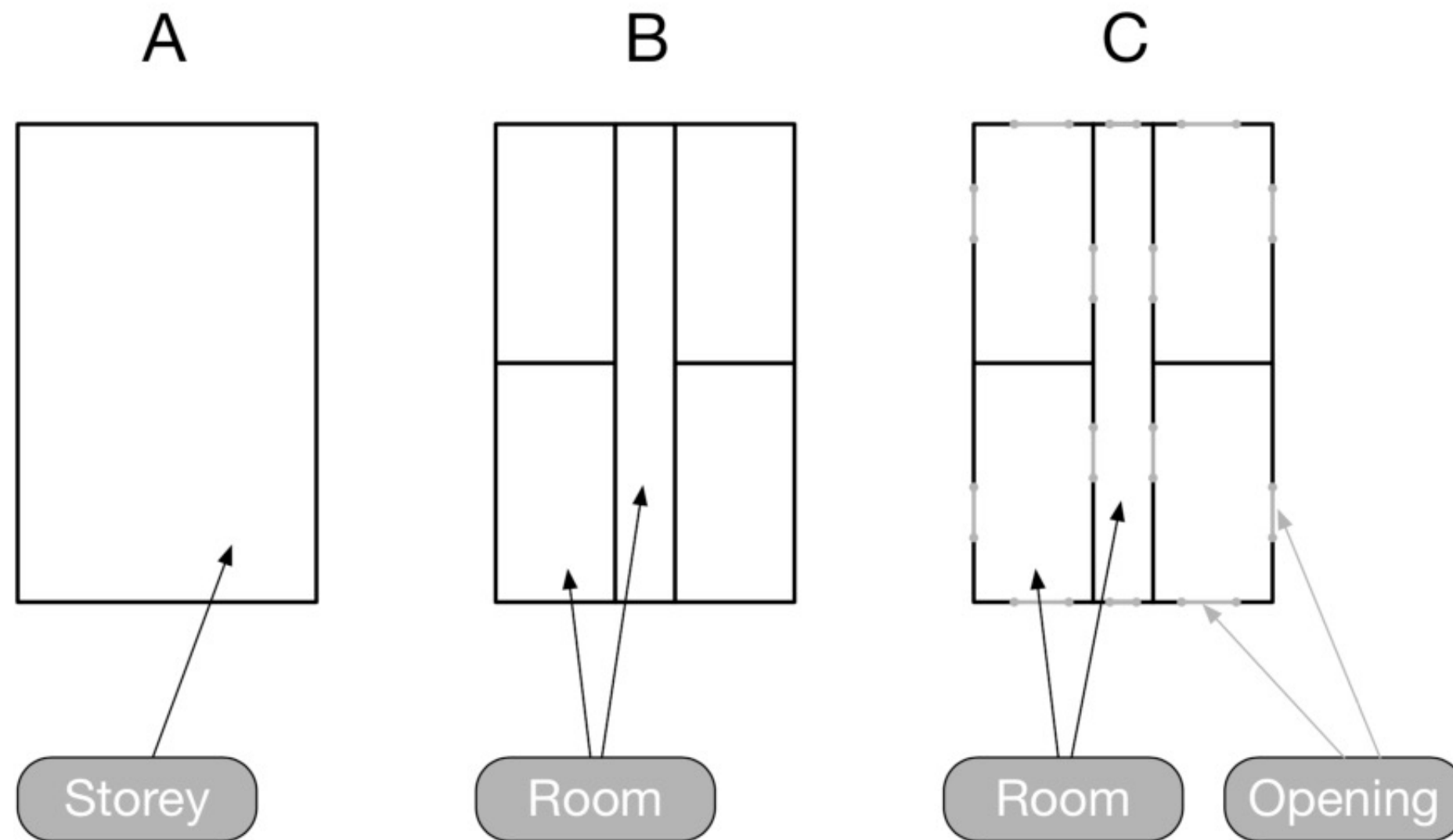
Extension of the current LOD0 proposal

Figure 2. Multiple variants of the realisation of the LoD0 of floor plans. This conceptual illustration does not imply the different ways of the geometric realisation of the features. That is topic is subject of Fig. 3.

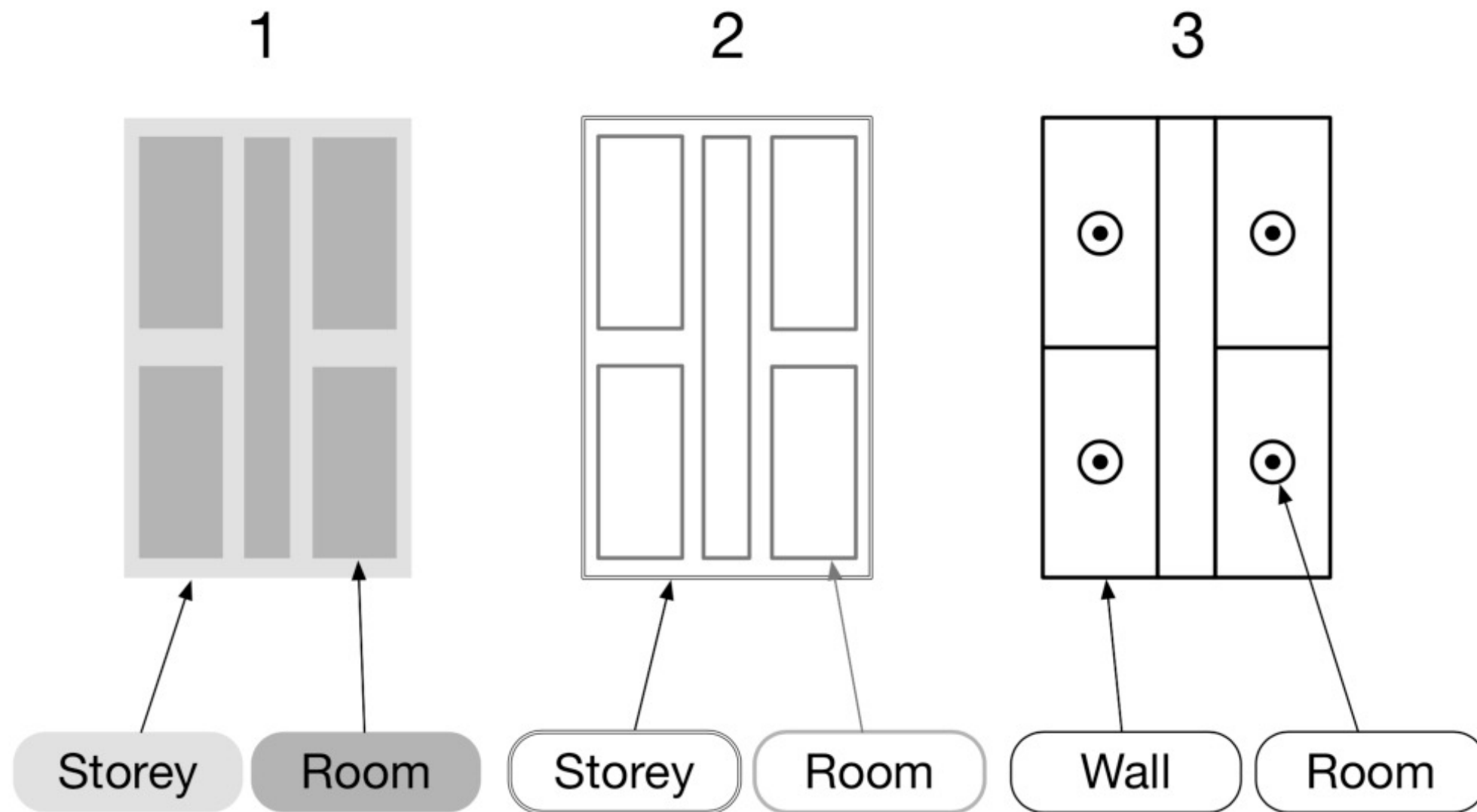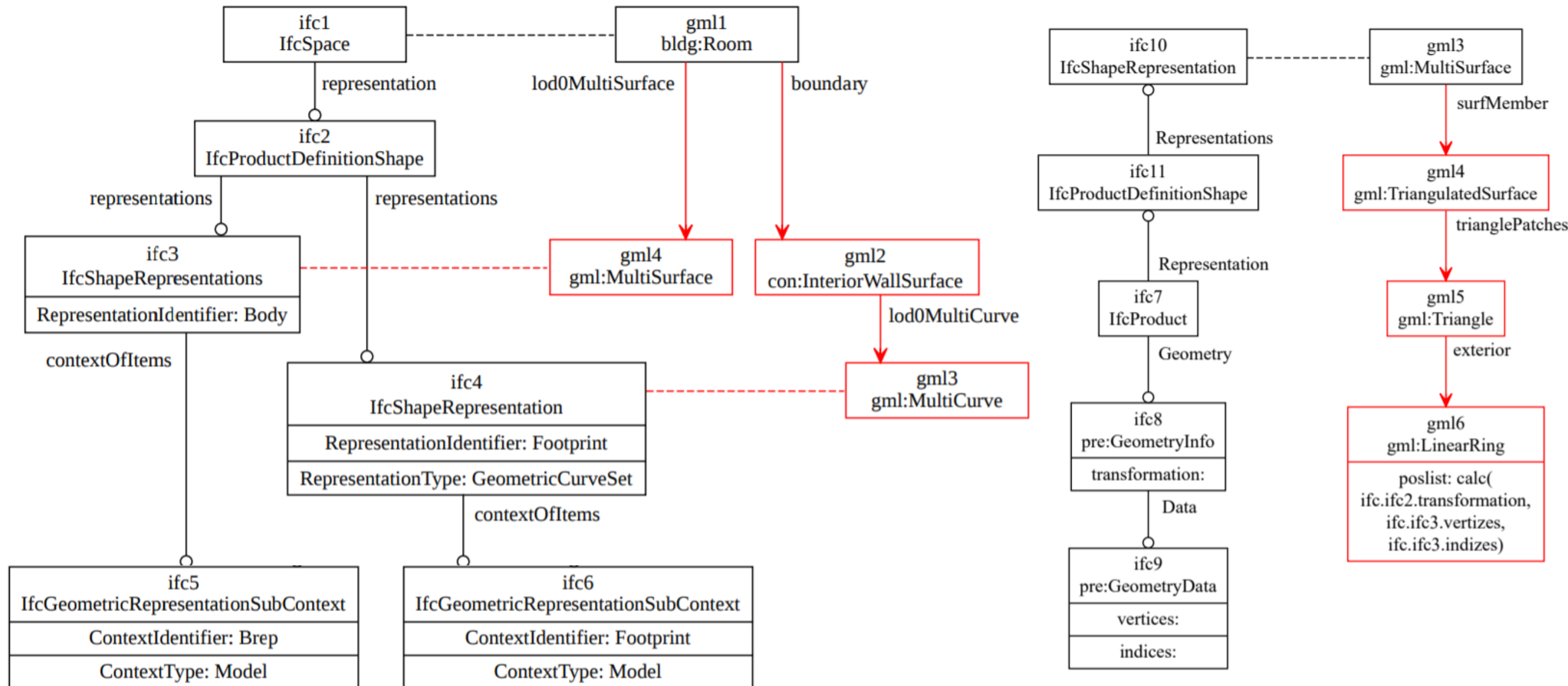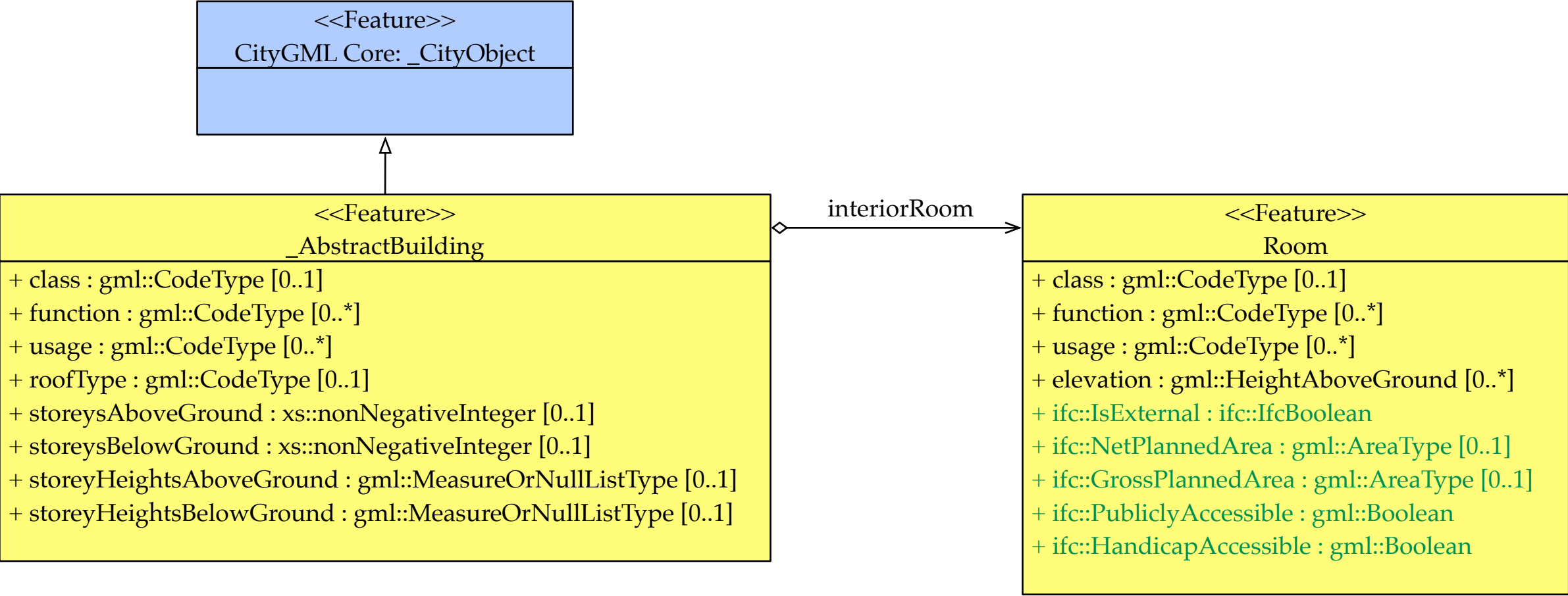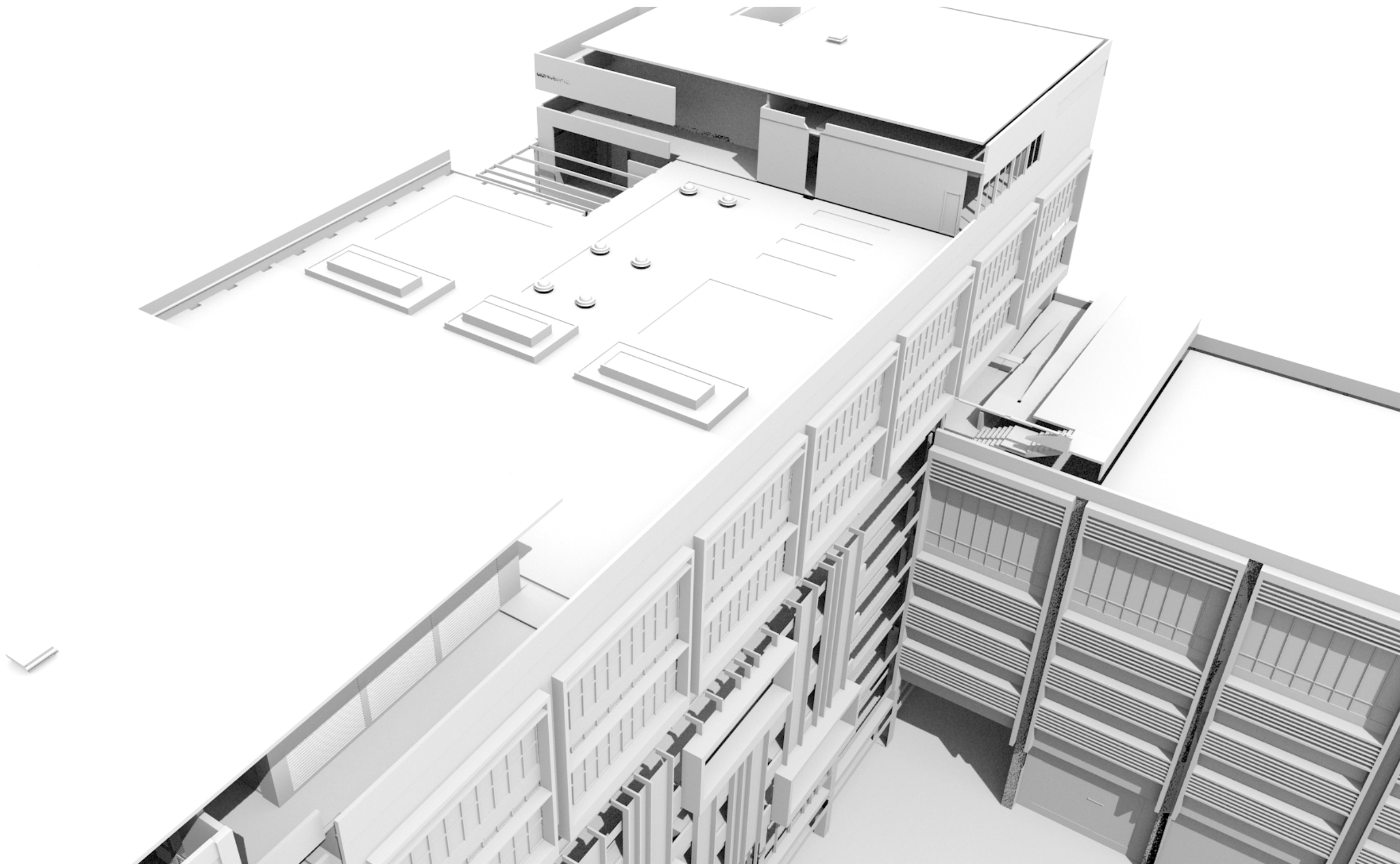# Extension of the current LOD0 proposal

Figure 3. Variants for the geometric representation of floorplan features. This illustration does not imply presence or absence of specific features. For each variant, rooms could be removed or openings could be added (Fig. 2).
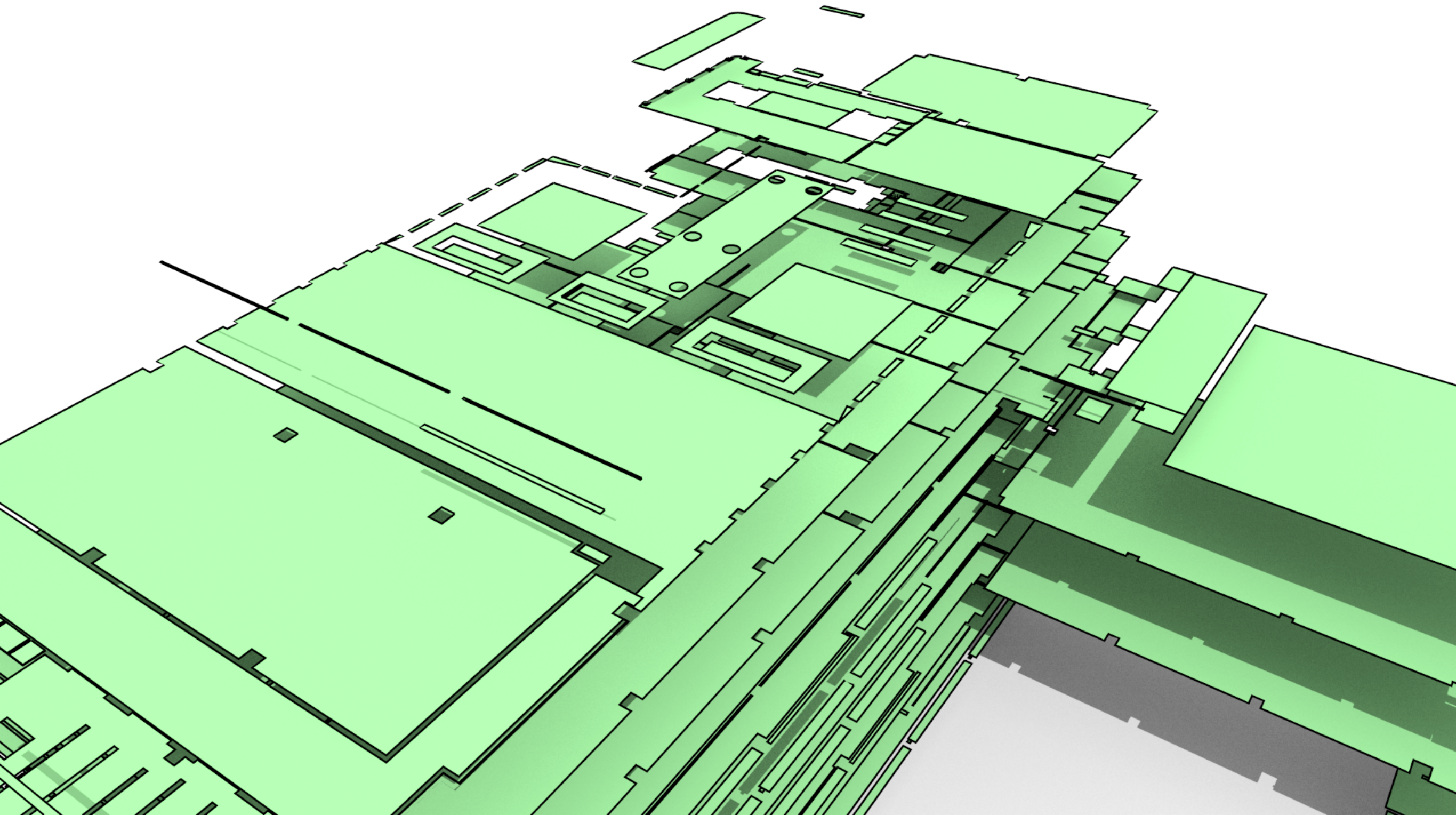
Implementation

```
                    ┌─────────────────────────────┐
                    │        <<Feature>>          │
                    │  CityGML Core: _CityObject  │
                    ├─────────────────────────────┤
                    │                             │
                    └─────────────────────────────┘
                                  △
                                  │
```

<<Feature>>
_AbstractBuilding

+ class : gml::CodeType [0..1]
+ function : gml::CodeType [0..*]
+ usage : gml::CodeType [0..*]
+ roofType : gml::CodeType [0..1]
+ storeysAboveGround : xs::nonNegativeInteger [0..1]
+ storeysBelowGround : xs::nonNegativeInteger [0..1]
+ storeyHeightsAboveGround : gml::MeasureOrNullListType [0..1]
+ storeyHeightsBelowGround : gml::MeasureOrNullListType [0..1]

interiorRoom

<<Feature>>
Room

+ class : gml::CodeType [0..1]
+ function : gml::CodeType [0..*]
+ usage : gml::CodeType [0..*]
+ elevation : gml::HeightAboveGround [0..*]
+ ifc::IsExternal : ifc::IfcBoolean
+ ifc::NetPlannedArea : gml::AreaType [0..1]
+ ifc::GrossPlannedArea : gml::AreaType [0..1]
+ ifc::PubliclyAccessible : gml::Boolean
+ ifc::HandicapAccessible : gml::Boolean

Results

Results

Results

(a)

(b)

(c)
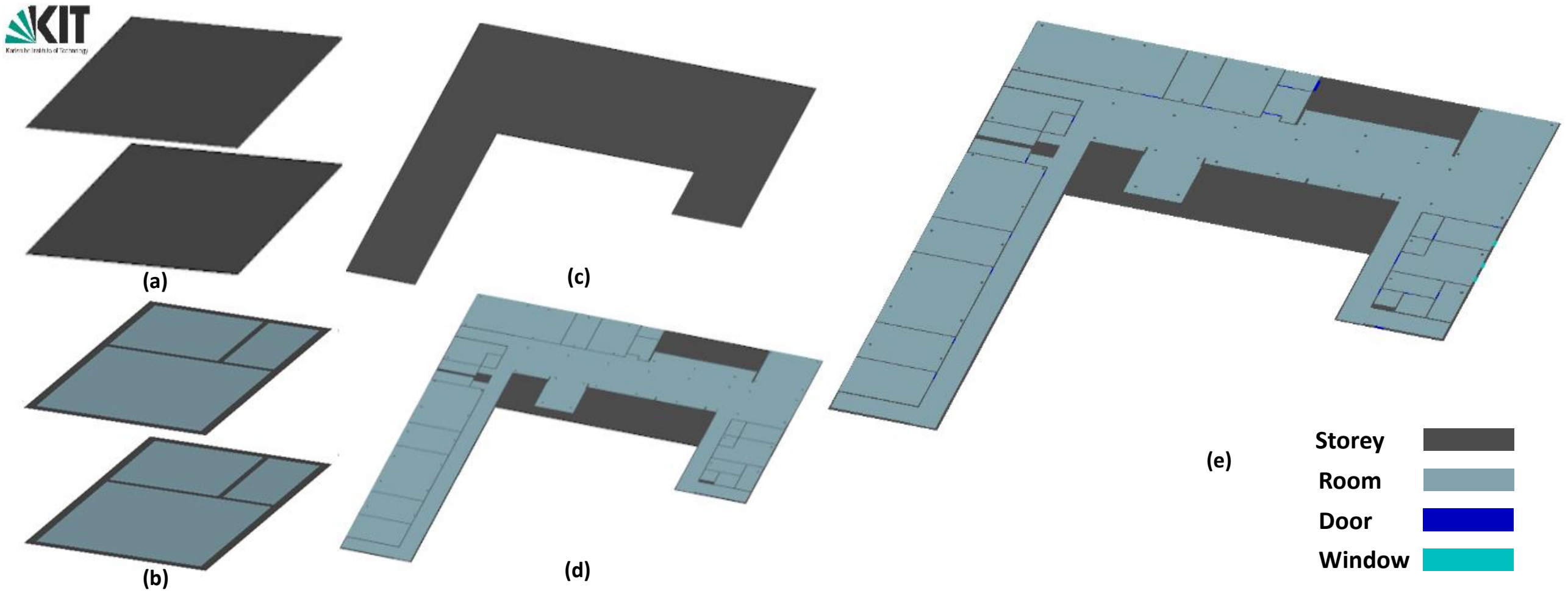
(d)

(e)

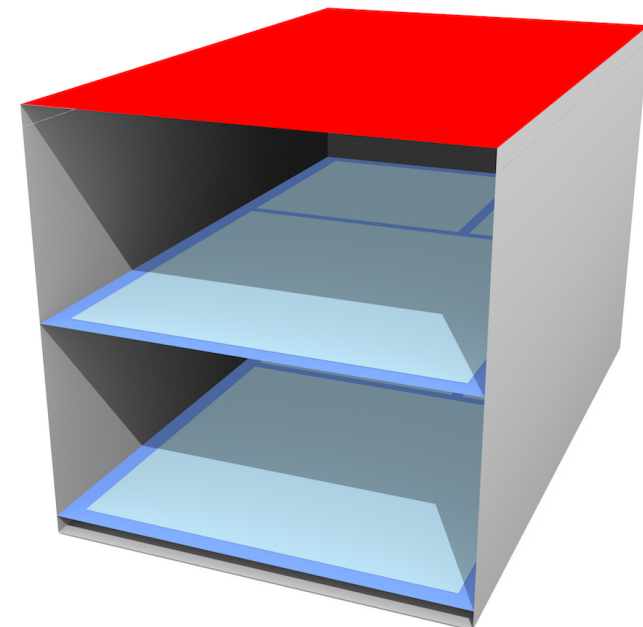| Storey	
Room	
Door	
Window	

Use cases

- Emergency, resilience and safety planning

- Indoor navigation

- Macro-scale energy demand estimation

Conclusions

- Floor plans may sound simple, but there are many ways to model them and not many ways to find data

- BIM/IFC is obviously one of the principal channels to source floor plans

- First CityGML 3.0 LOD0 dataset?

- Future work: explore integration with exterior (leading to multiple combos)

Thanks

http://ifc2citygml.github.io

transformation rules

| native BIM requirements | → | IFC requirements | ← | CityGML target specification | ⇠ | use cases |

verify · inform · conform

| native BIM model | → | IFC model | → | CityGML target model | ⇢ | |

conversion process