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### Open Geospatial Consortium

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## OGC City Geography Markup Language (CityGML) Encoding Standard

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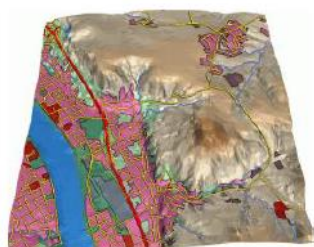
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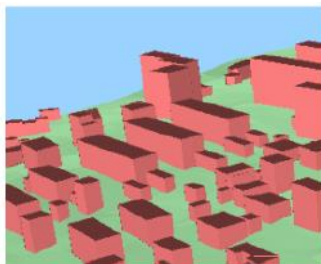
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# LOD: Level of Detail

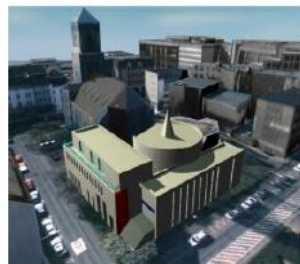
- CityGML 2.0で取り扱うLODはLOD0～LOD4の5段階



LOD0



LOD1



LOD2

LOD3



LOD4



	LOD0	LOD1	LOD2	LOD3	LOD4
Model scale description	regional, landscape	city, region	city, city districts, projects	city districts, architectural models (exterior), landmark	architectural models (interior), landmark
Class of accuracy	lowest	low	middle	high	very high
Absolute 3D point accuracy (position / height)	lower than LOD1	5/5m	2/2m	0.5/0.5m	0.2/0.2m
Generalisation	maximal generalisation	object blocks as generalised features; > 6*6m/3m	objects as generalised features; > 4*4m/2m	object as real features; > 2*2m/1m	constructive elements and openings are represented
Building installations	no	no	yes	representative exterior features	real object form
Roof structure/representation	yes	flat	differentiated roof structures	real object form	real object form
Roof overhanging parts	yes	no	yes, if known	yes	yes
CityFurniture	no	important objects	prototypes, generalized objects	real object form	real object form
SolitaryVegetationObject	no	important objects	prototypes, higher 6m	prototypes, higher 2m	prototypes, real object form
PlantCover	no	>50*50m	>5*5m	< LOD2	<LOD2
...to be continued for the other feature themes					

Tab. 3: LOD 0-4 of CityGML with their proposed accuracy requirements (discussion proposal, based on: Albert et al. 2003).

# Spatial model

- CityGMLでは、ポリゴンやTINなどの面から構成される固体（Solid）を幾何形状として扱う

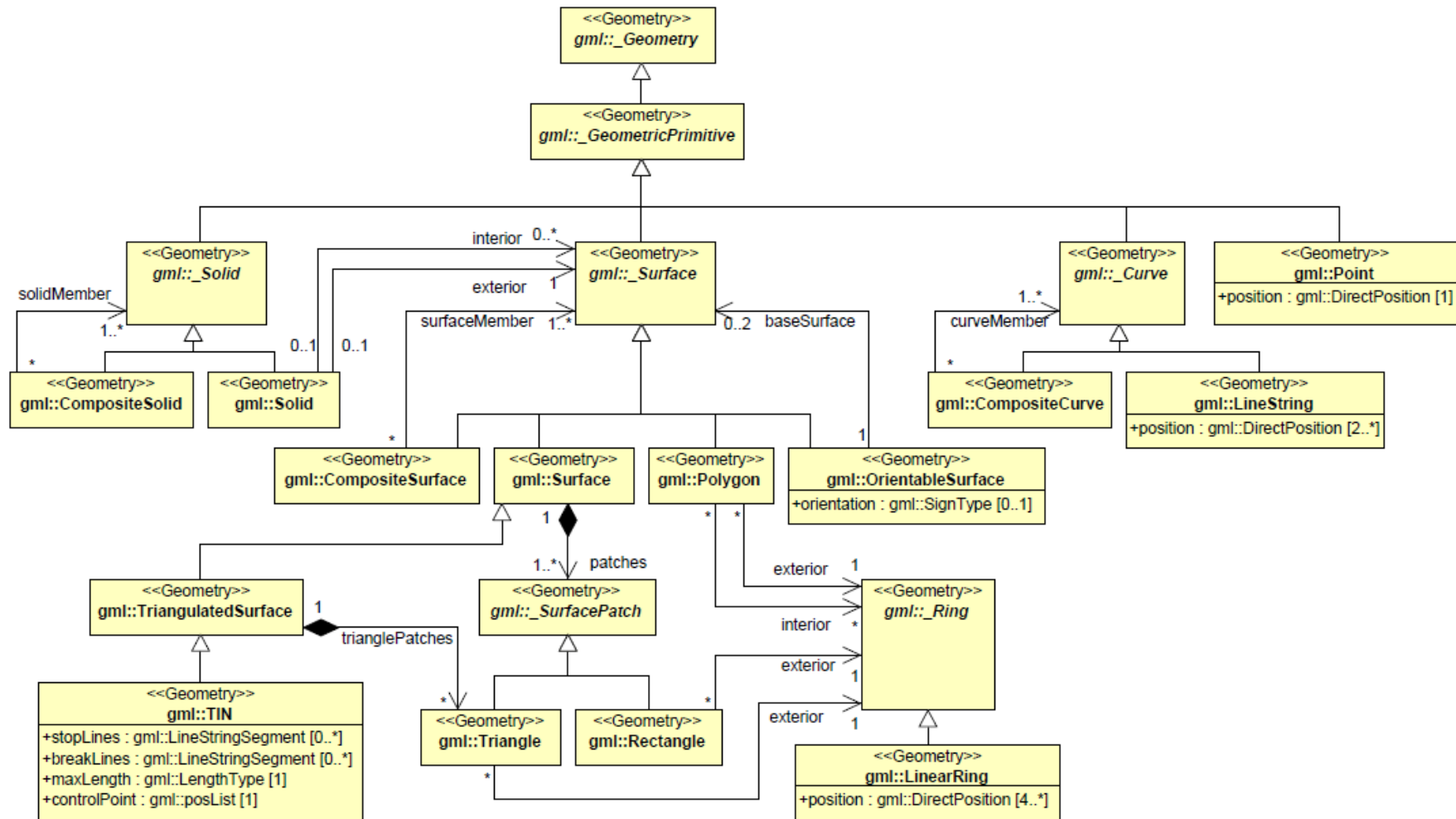
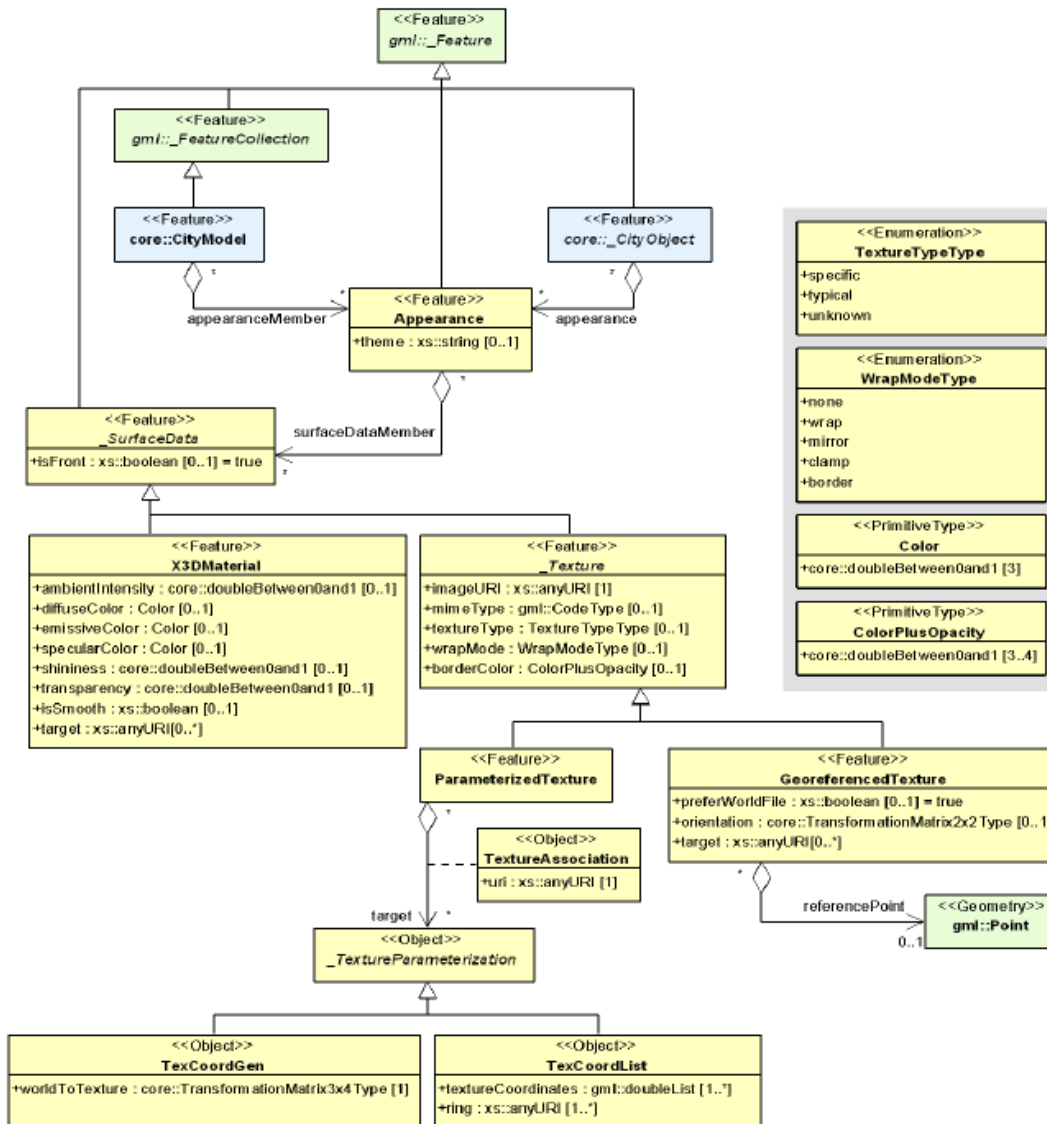


Fig. 9: UML diagram of CityGML's geometry model (subset and profile of GML3): Primitives and Composites.

- 3Dモデルの外観として、マテリアルとテクスチャを扱う



## マテリアル (Material)



## テクスチャ (Texture)

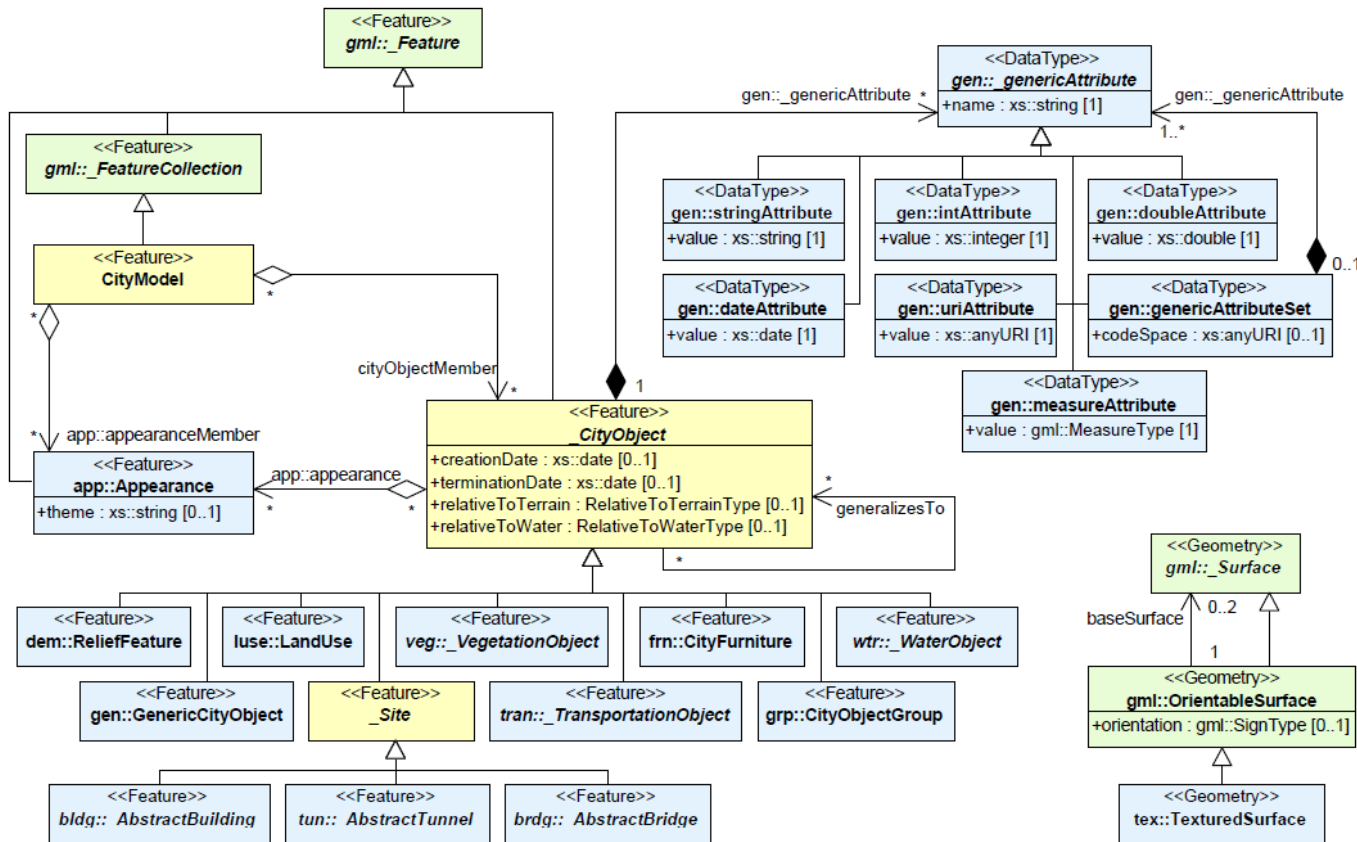


Fig. 14: UML diagram of CityGML's appearance model. Prefixes are used to indicate XML namespaces associated with model elements. Element names without a prefix are defined within the CityGML Appearance module.

Fig. 16: A georeferenced texture applied to ground and roof surfaces (source: Senate of Berlin, Hasso-Plattner-Institute).

# Thematic model 全体像

- CityGMLで取り扱う地物種類の全体像
- 各地物には属性を持たせることができる



## 地物種類

- DTM 数値地形モデル
- Building 建物
- Tunnel トンネル
- Bridge 橋梁
- Vegetation 植生
- Water Bodies 水部
- Transportation facilities 交通施設
- Land use 土地利用
- City furniture 付属施設

Fig. 23: CityGML's top level class hierarchy. Prefixes are used to indicate XML namespaces associated with model elements. Element names without a prefix are defined within the *CityGML Core* module.

- DTMは、点群データ、ブレイクライン、TINの組合せで構成することができる

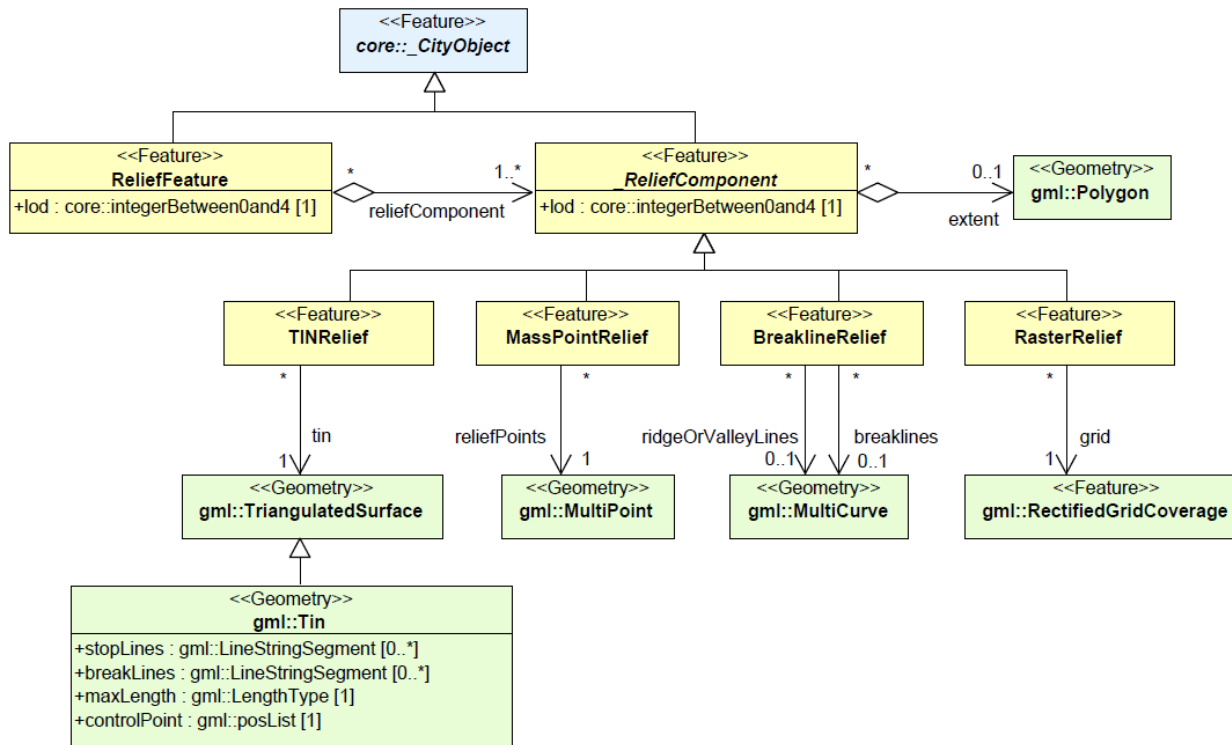


Fig. 24: UML diagram of the Digital Terrain Model in CityGML. Prefixes are used to indicate XML namespaces associated with model elements. Element names without a prefix are defined within the CityGML *Relief* module.



- 建物はLOD0~LOD4により、定義する建物の構成要素が変わる

Geometric / semantic theme	Property type	LOD0	LOD1	LOD2	LOD3	LOD4
Building footprint and roof edge	<i>gml:MultiSurfaceType</i>	•				
Volume part of the building shell	<i>gml:SolidType</i>		•	•	•	•
Surface part of the building shell	<i>gml:MultiSurfaceType</i>		•	•	•	•
Terrain intersection curve	<i>gml:MultiCurveType</i>		•	•	•	•
Curve part of the building shell	<i>gml:MultiCurveType</i>			•	•	•
Building parts	<i>BuildingPartType</i>		•	•	•	•
Boundary surfaces (chapter 10.3.3)	<i>AbstractBoundarySurfaceType</i>			•	•	•
Outer building installations (chapter 10.3.2)	<i>BuildingInstallationType</i>			•	•	•
Openings (chapter 10.3.4)	<i>AbstractOpeningType</i>				•	•
Rooms (chapter 10.3.5)	<i>RoomType</i>					•
Interior building installations (chapter 10.3.5)	<i>IntBuildingInstallationType</i>					•

Tab. 5: Semantic themes of the class *\_AbstractBuilding*.

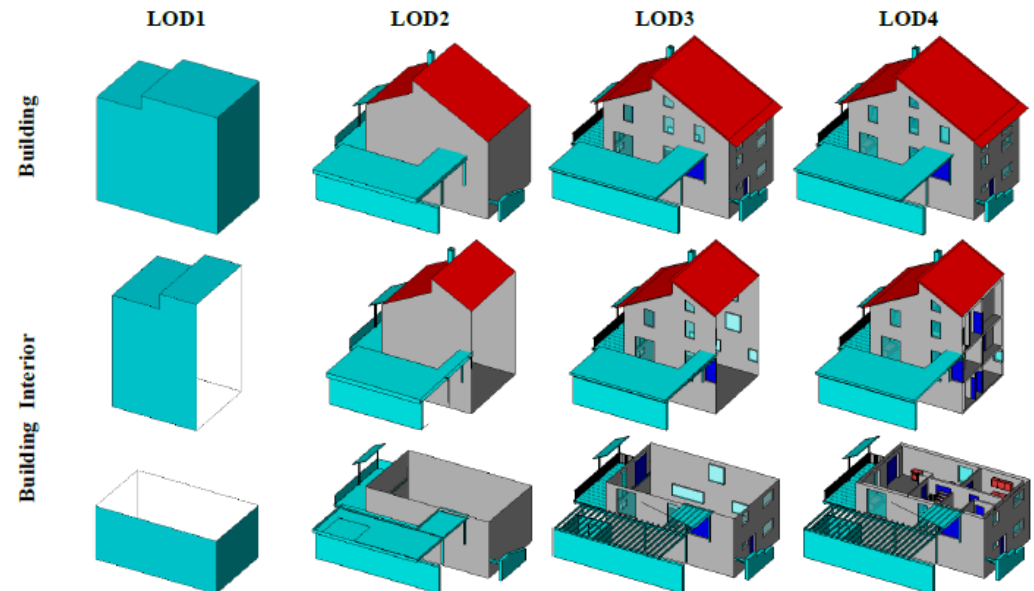


Fig. 30: Building model in LOD1 – LOD4 (source: Karlsruhe Institute of Technology (KIT), courtesy of Franz-Josef Kaiser).



- LOD2以上の建物を作成する際に、屋根や壁などの各ポリゴンを、CityGMLのどの構成要素で定義するか細かく設定ができる

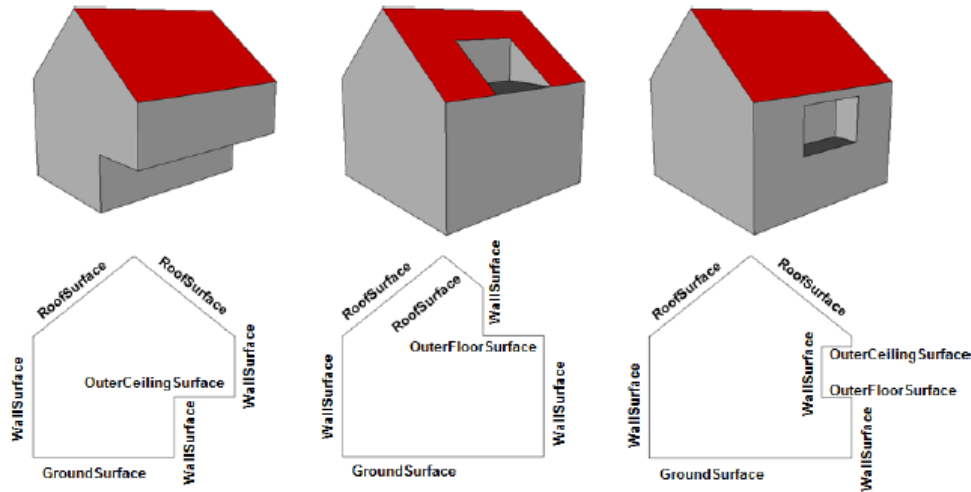


Fig. 31: Examples of the classification of *BoundarySurfaces* of the outer building shell (source: Karlsruhe Institute of Technology (KIT))

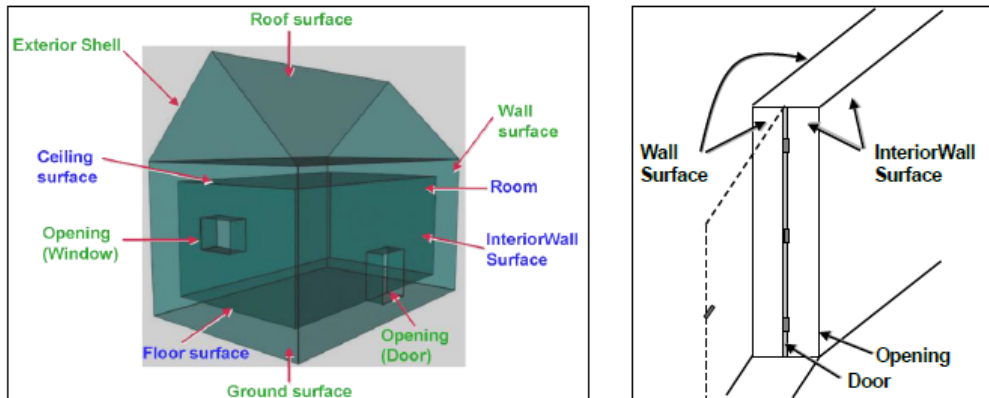


Fig. 32: Classification of *BoundarySurfaces* (left), in particular for *Openings* (right) (graphic: IGG Uni Bonn).

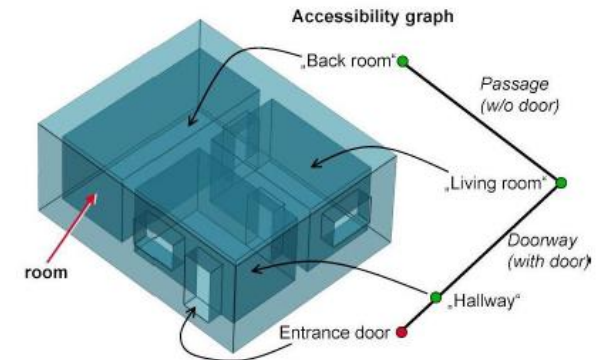


Fig. 33: Accessibility graph derived from topological adjacencies of room surfaces (graphic: IGG Uni Bonn).

