Post Doc
Smart 3D space subdivision for indoor navigation

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TU Delft Delft University of Technology

cnrs

CSTB le futur en construction

LIRIS

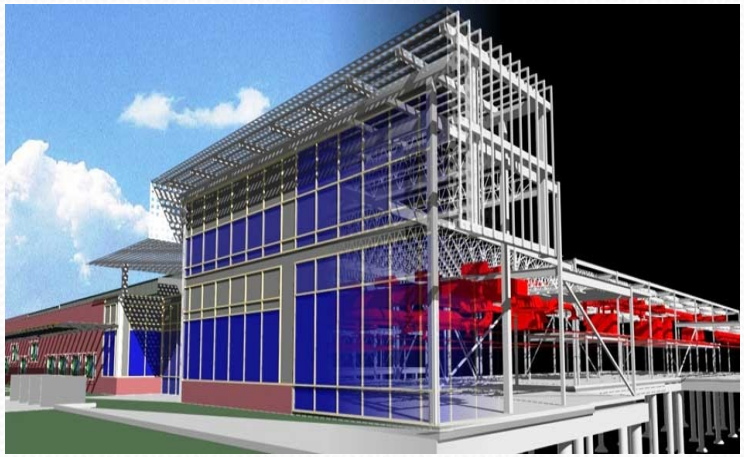
TopoBuilding (My PhD Project)

Context & Approach

- Engineers cannot use models from architects to perform simulation...
- Geometric, topological and semantical information needed
- IFC & CityGML: semantic-oriented standards: not always consistent...

Enrich a geometric model with topological and semantic information

BIM

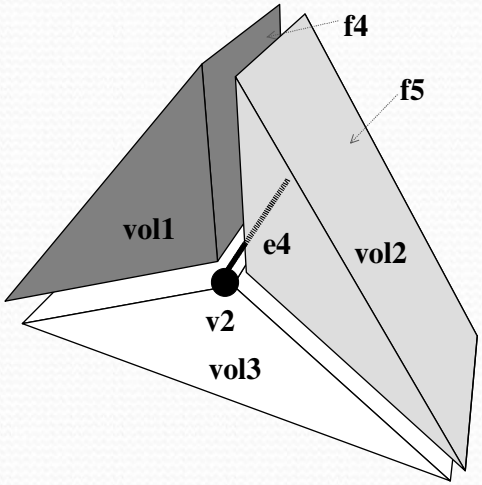


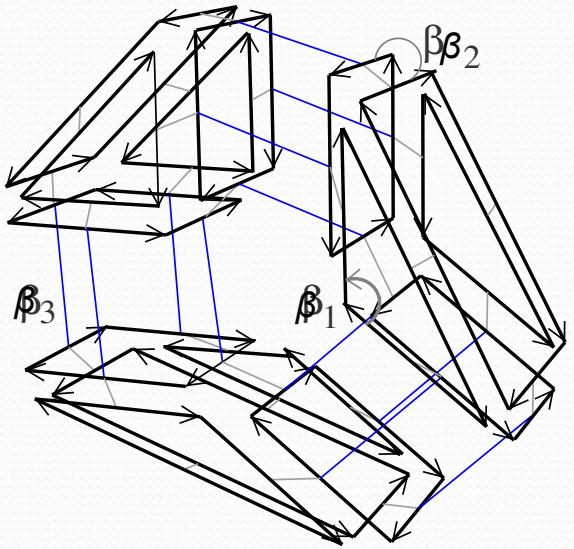
GIS

Topological Reconstruction

Combinatorial Maps

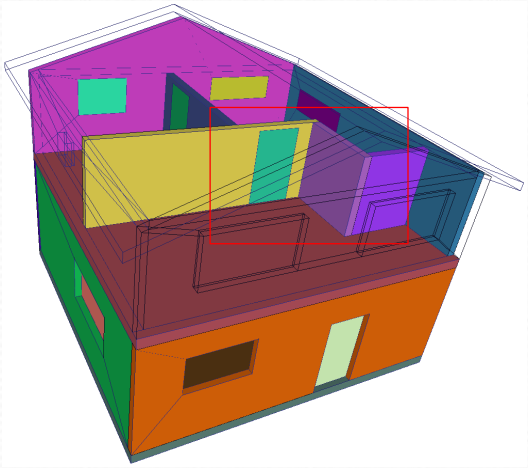
- Edge-centered data structure to represent *d*D orientable objects subdivided in cells.
- Representation of incidence and adjacency relationships. The i-cells are linked by β_i thanks to the i-sew operations
- Attributes are associated to the cells for information storage (geometry, semantic, etc).

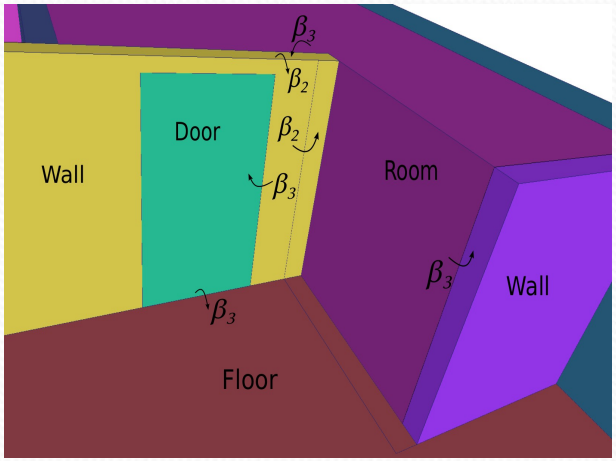


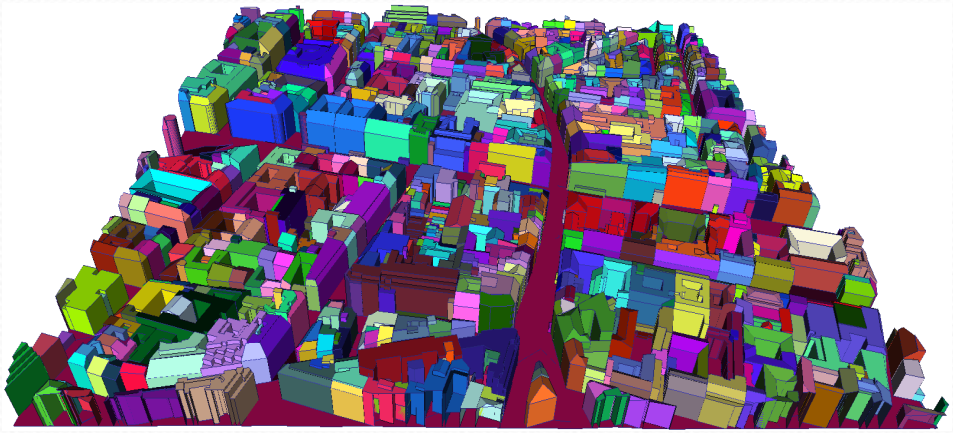


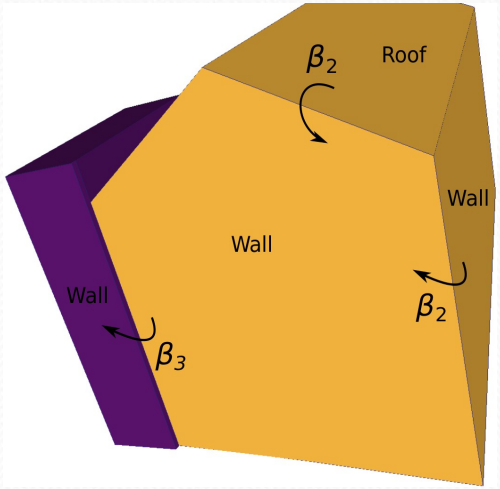
Topological Reconstruction

Proper Formalism for BIM and GIS



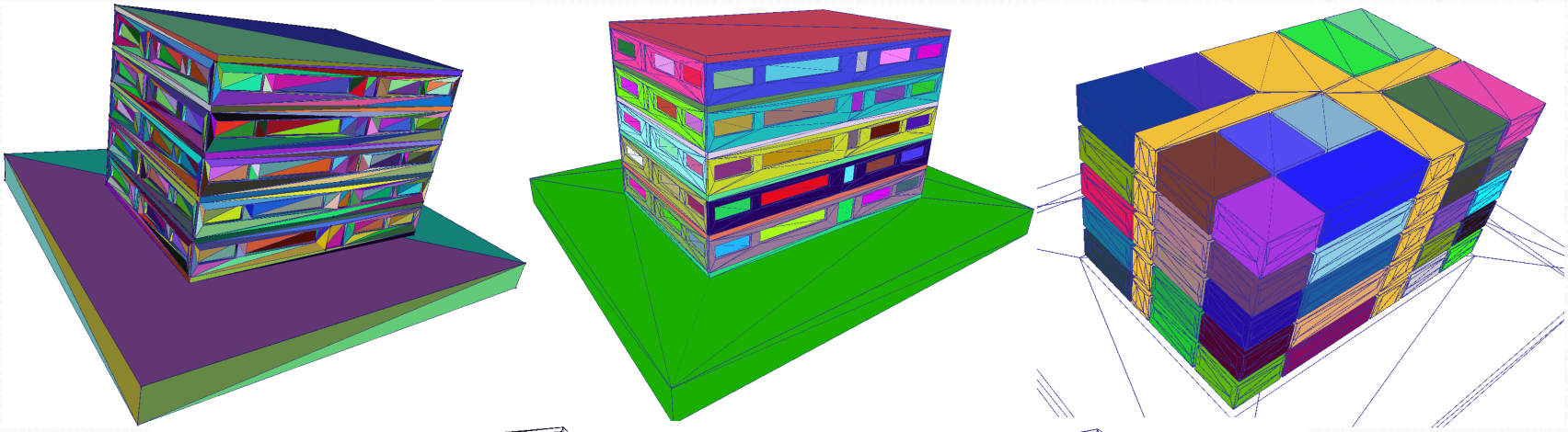






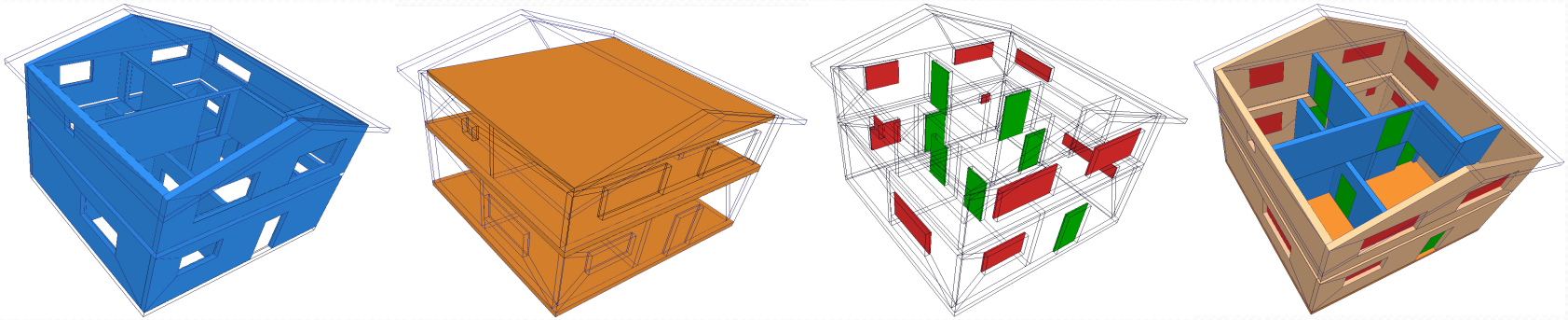
Topological Reconstruction

Creation of the β_2 and β_3 Links

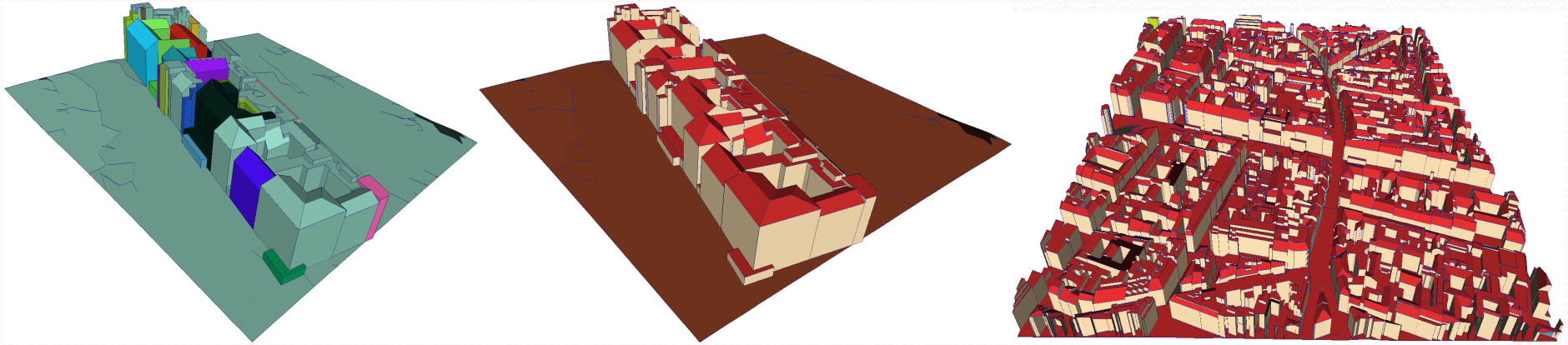


Automatic Semantic Labelling

On BIM



On GIS



The SIMs3D Project

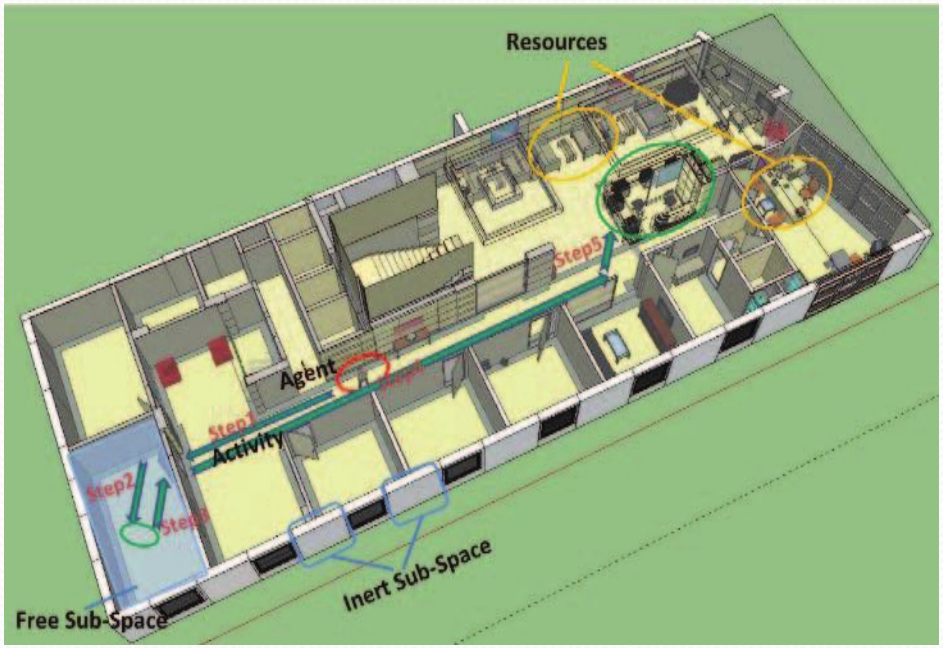
SIMs3D

Conceptual framework for indoor navigation

The approach fits well to the framework proposed in Zlatanova et al. (2013)

3-Cells
- Space
- Sub-spaces
- Partitions

Attributes
- Activities
- Resources
- Modifiers
- States
- Other ...



And navigation graph can be directly derived from the topology!

SIMs3D

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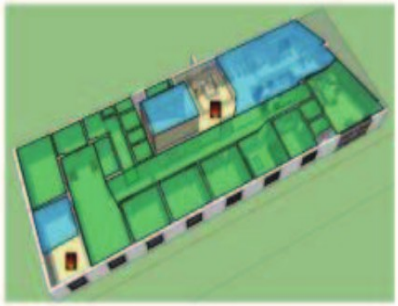
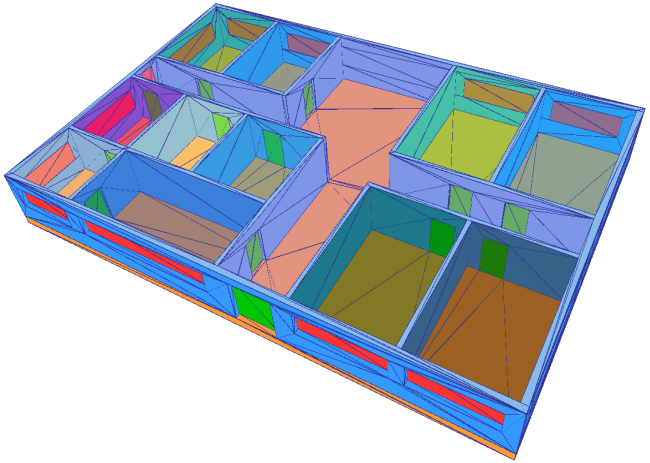
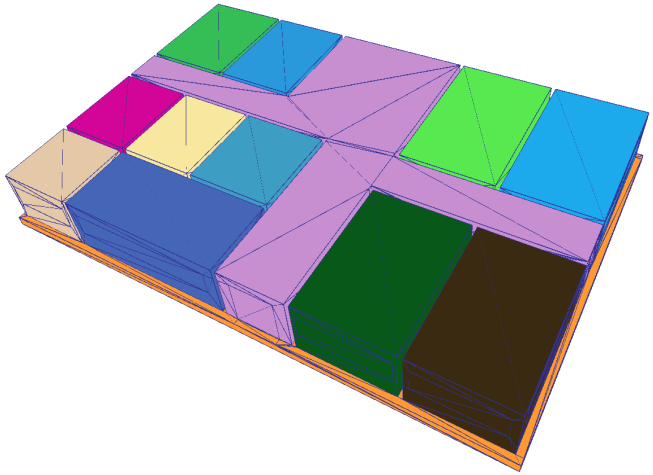


If the initial partition is proper → attributes can be used to label spaces as safe, navigable, etc or not.





SIMs3D

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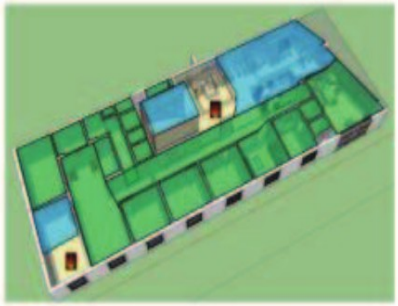
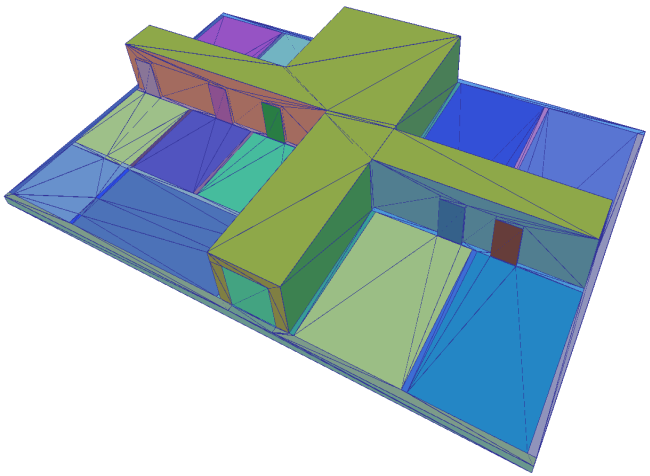
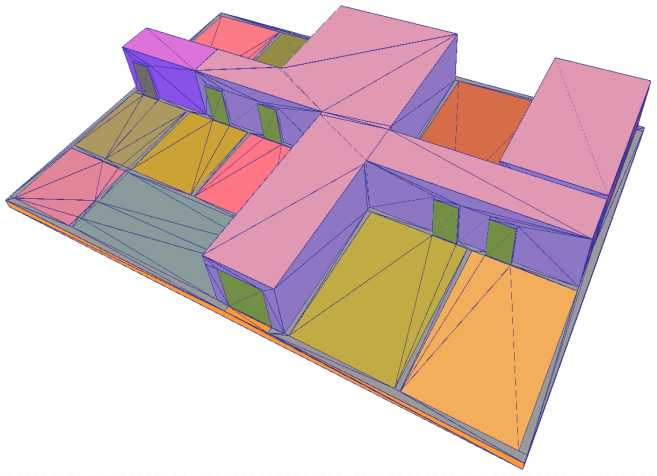


If the initial partition is not proper → change the subdivision by splitting / merging cells to define adequate spaces.



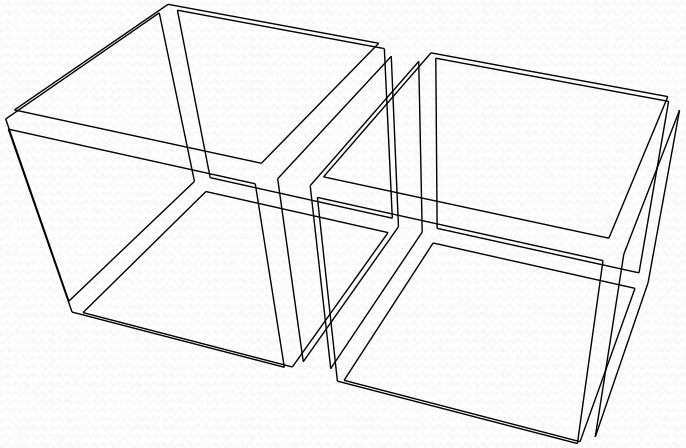


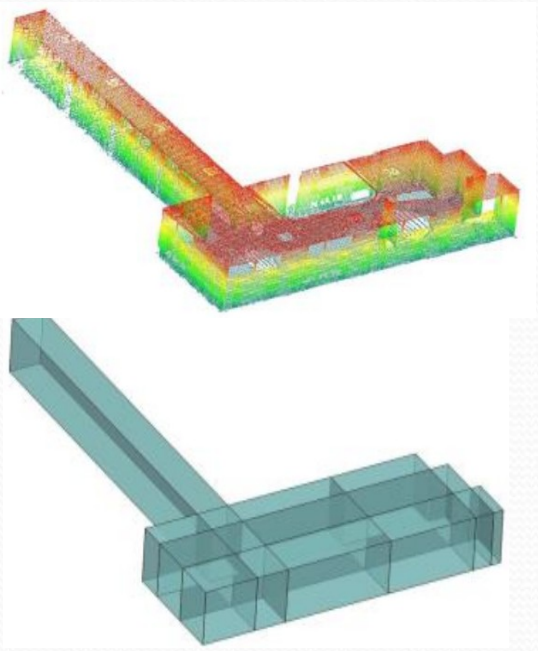
SIMs3D

What if we want to work on point cloud?

3-maps can also fit to the method proposed by Khoshelham et al. (2014)

Define a 3-cell as the unit cube: starting shape





Proposed Grammar Rules can be applied to the 3-cells

Thanks!