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Example of hybrid (indoor & outdoor routing)
based on use of IndoorGML for smarter city
services.

99th OGC Technical Committee

Dublin, Ireland

Giuseppe Conti

20 June 2016

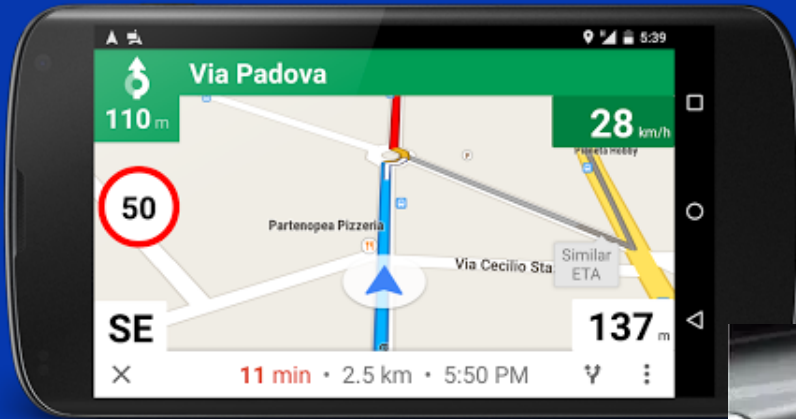
'classic' navigation







Current Outdoor Solutions



How do you do when indoor?



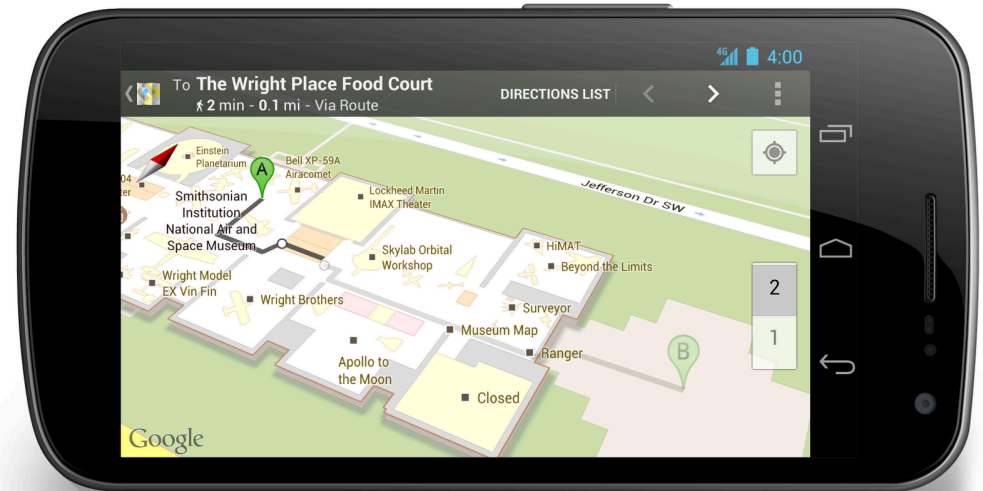
Indoor...



Heterogeneous solutions



Heterogeneous solutions



Standards

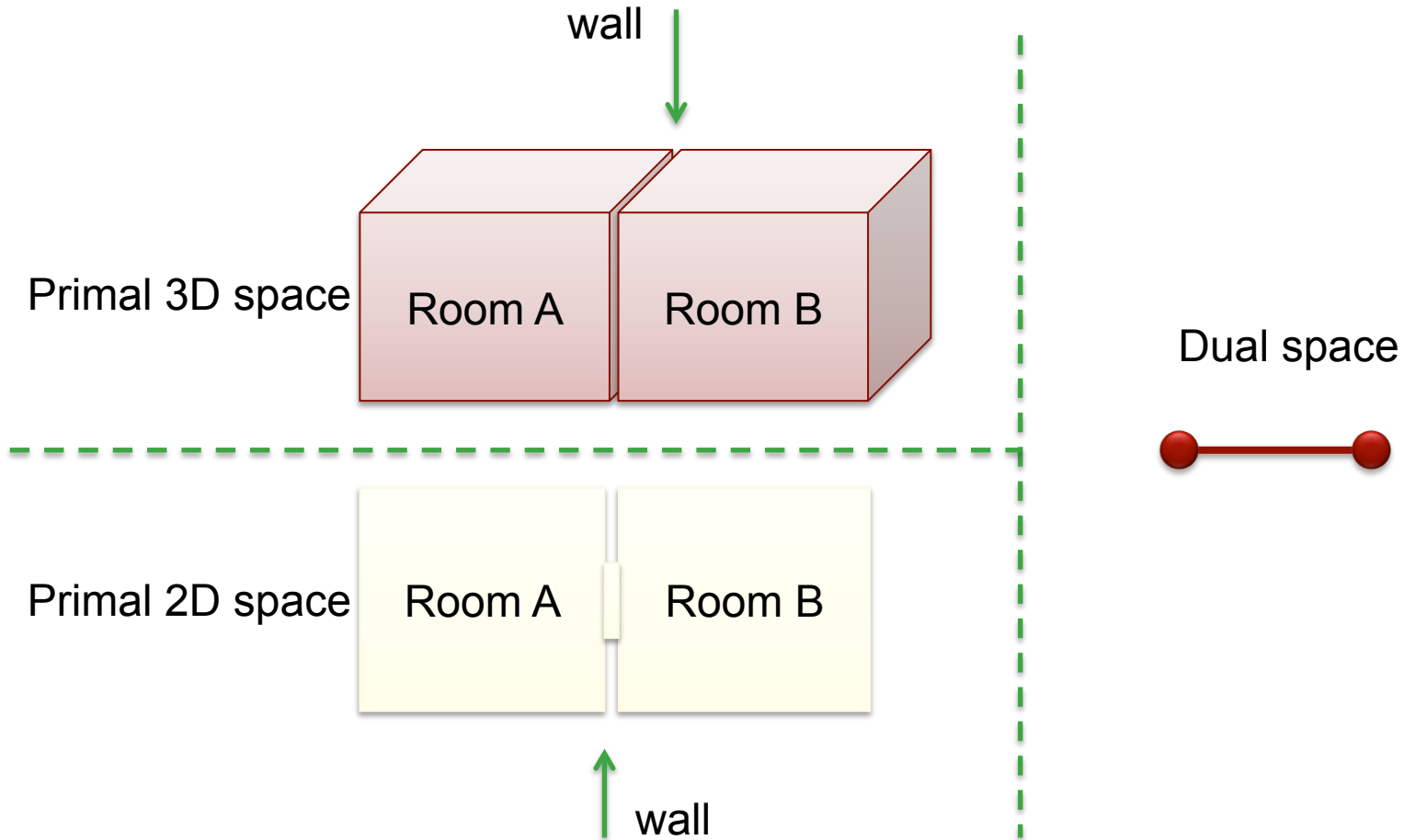




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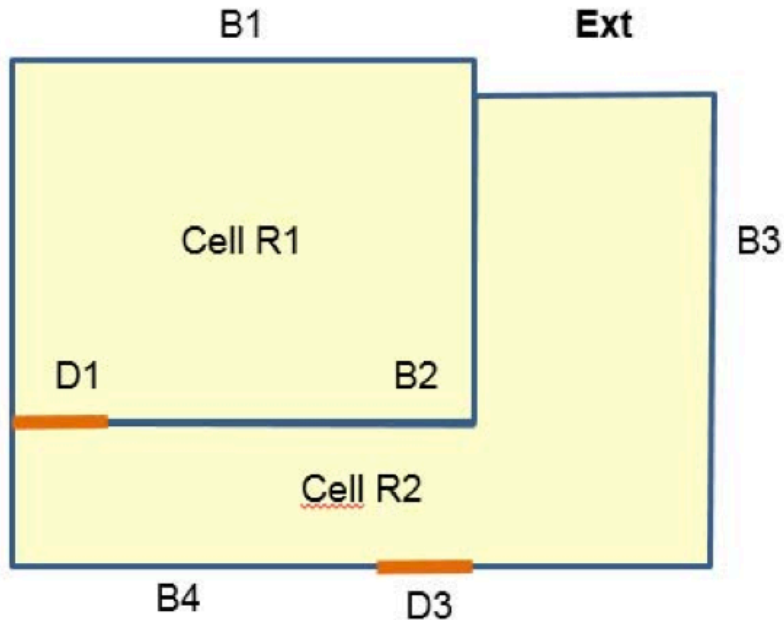
The basic idea



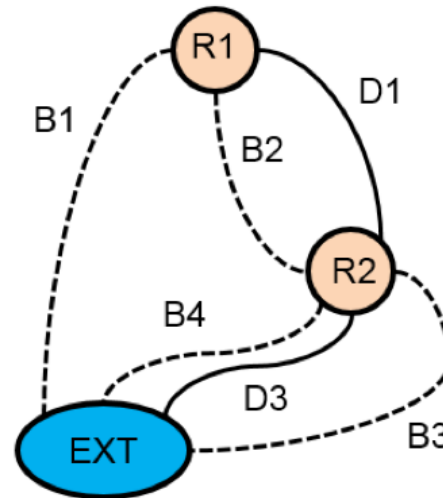
(Jules Henri) Poincaré duality (1854-1912)



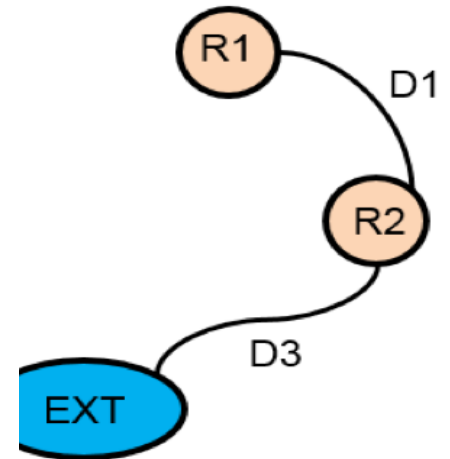
In practice



topographic space



adjacency graph
in dual space



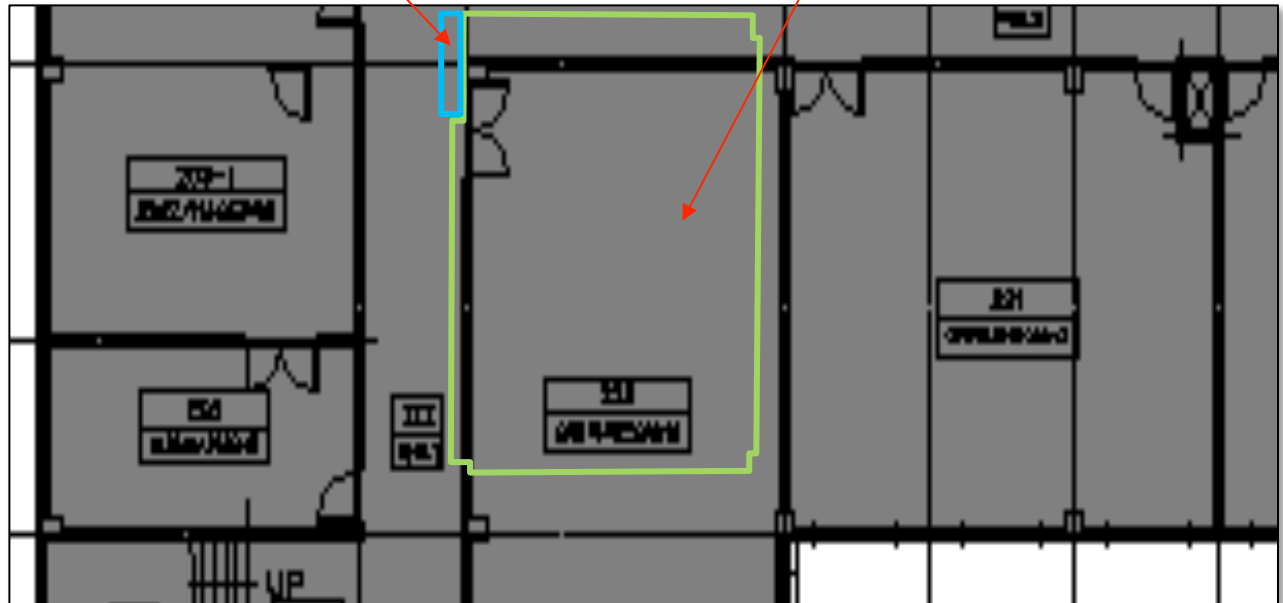
connectivity graph
in dual space

Cell Space

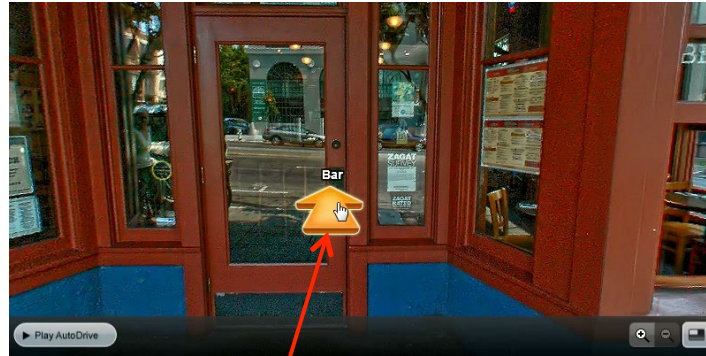


- 2D space -> A surface (ISO 19107)
 - No Cell Space overlapping
 - Union does not need to be the entire indoor space

Geometry of CellSpace (door) *Geometry of CellSpace (room)*

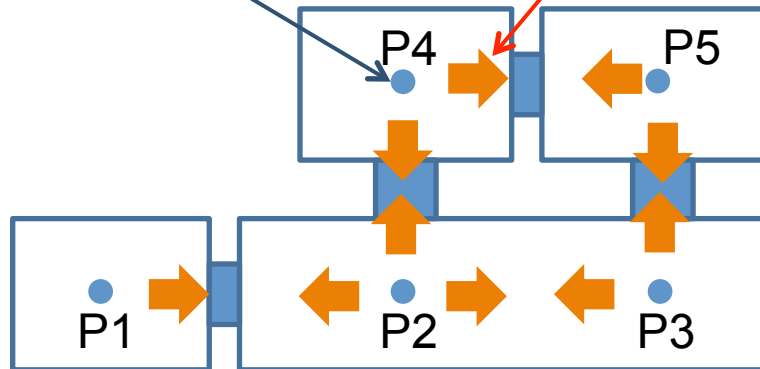


State



State (panoramic
image spot)

Navigation arrow

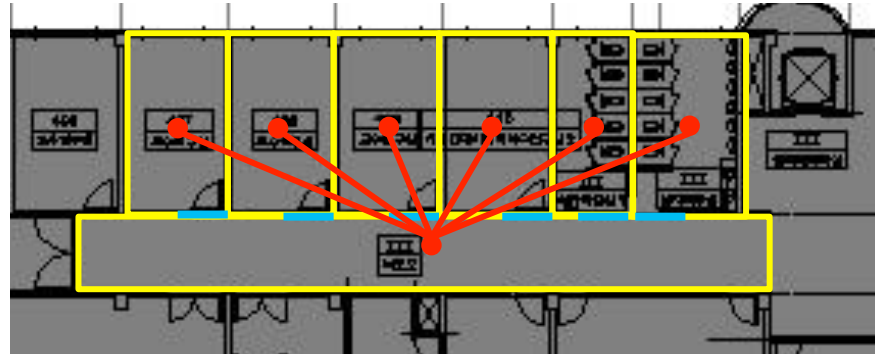


● State as a panoramic spot

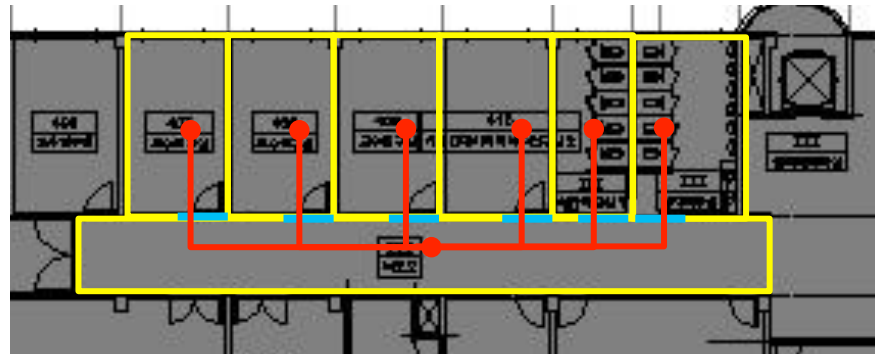
Transition



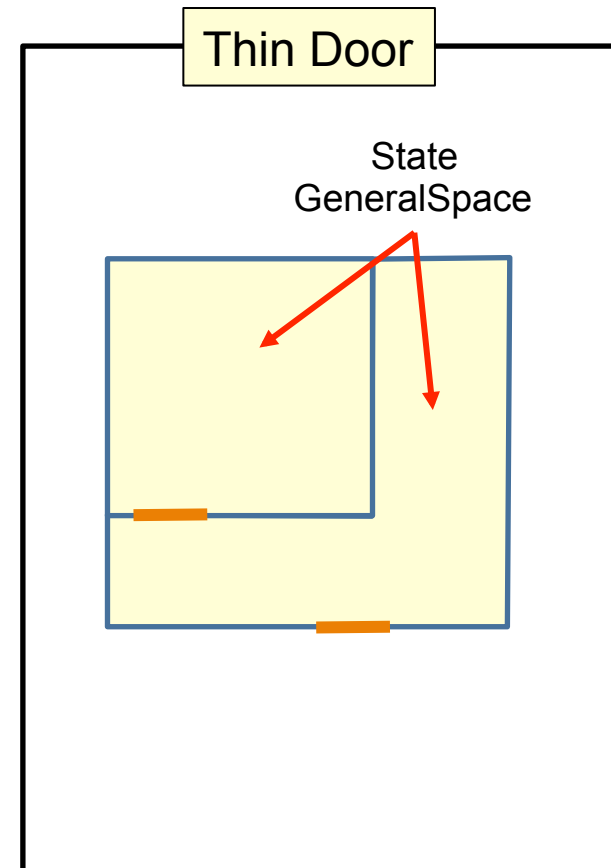
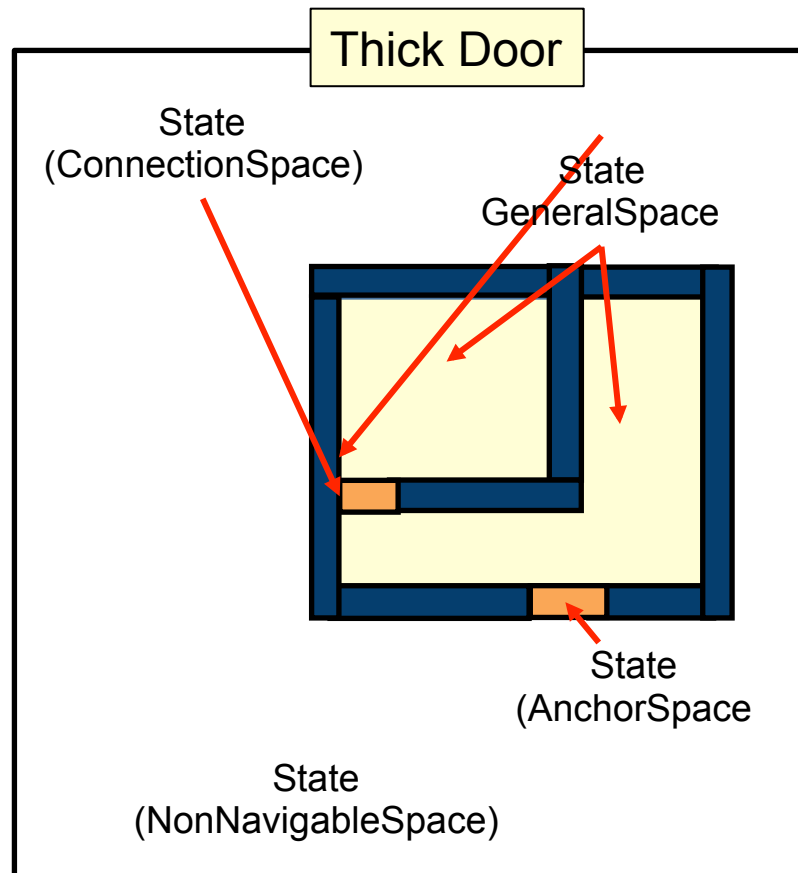
- As a straight line



- As a polyline: more properly reflects the path geometry

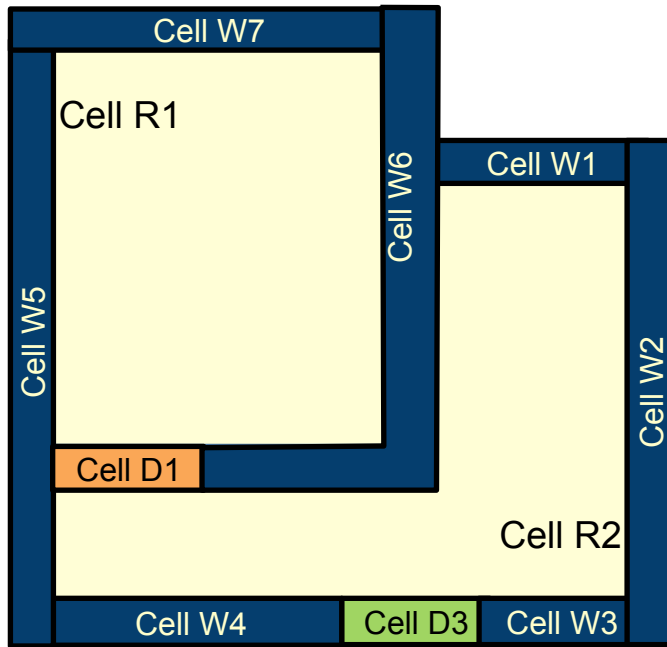


Thin vs Thick model

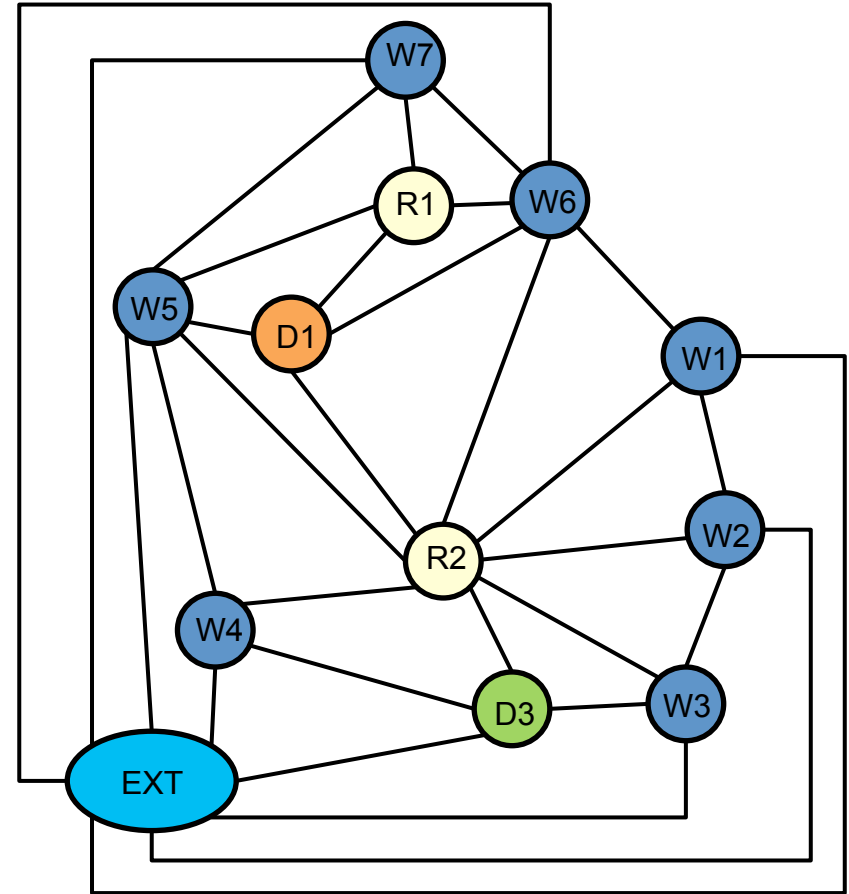


➡ If the thickness of doors and walls are to be represented, then thick door model is better.
If only simplified indoor structures are to be represented, then thin door model is better.

Connectivity (Thick)



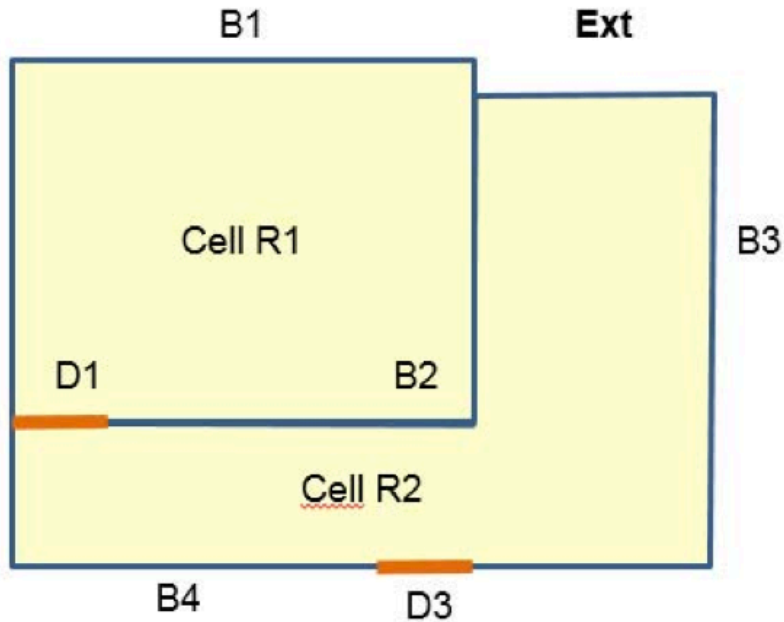
Original Space



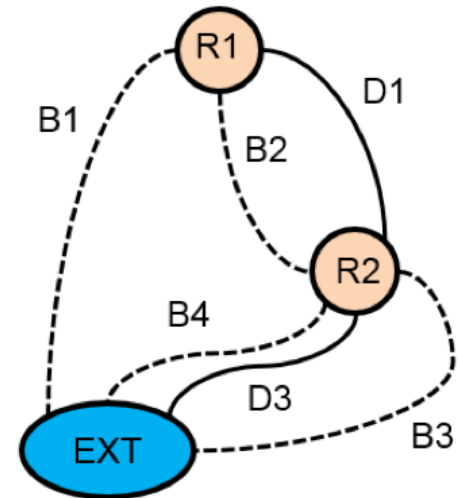
Adjacency Relationship of Transformed Graph

- Non-Navigable Space (wall)
- Navigable Space (room)
- Connection Space (door)
- Anchor Space (gate)

Connectivity (Thin)



topographic space

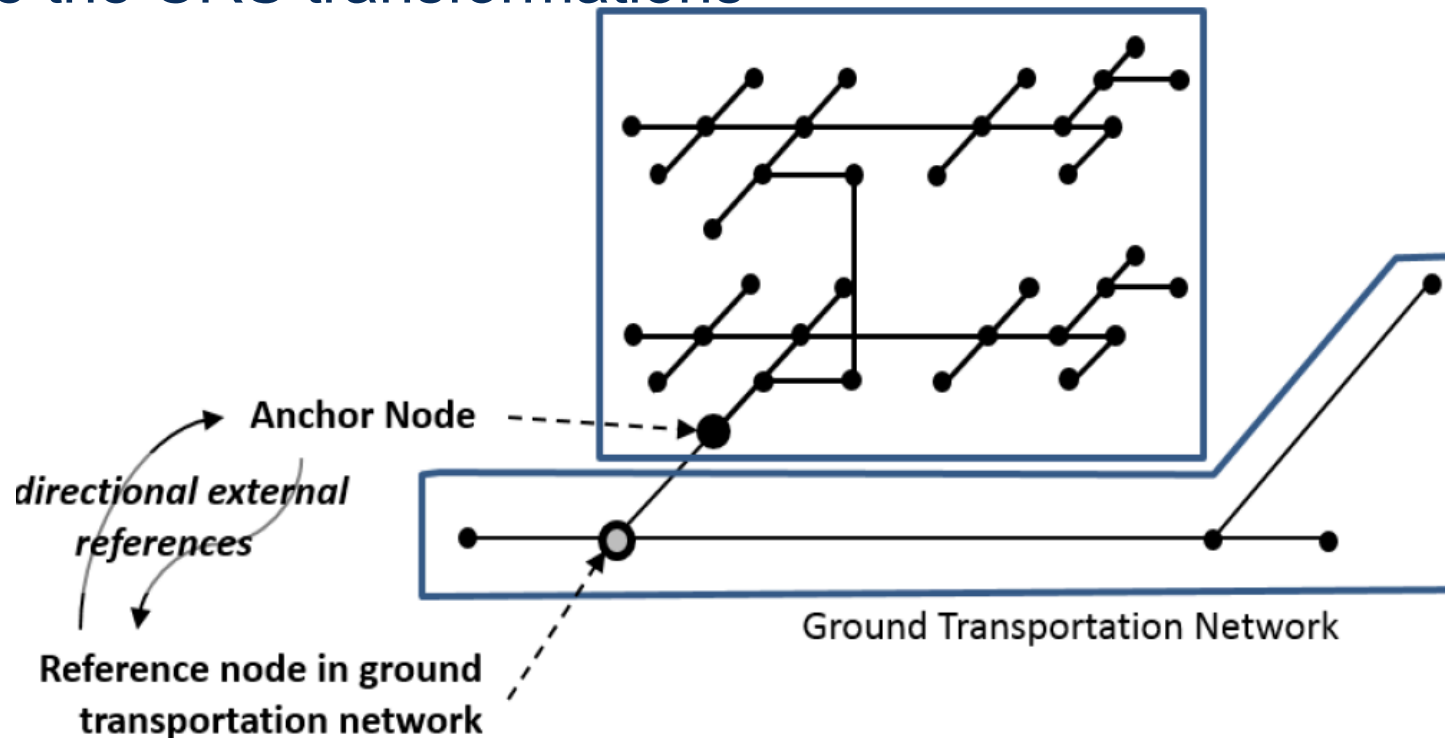


adjacency graph
in dual space

Anchor Node



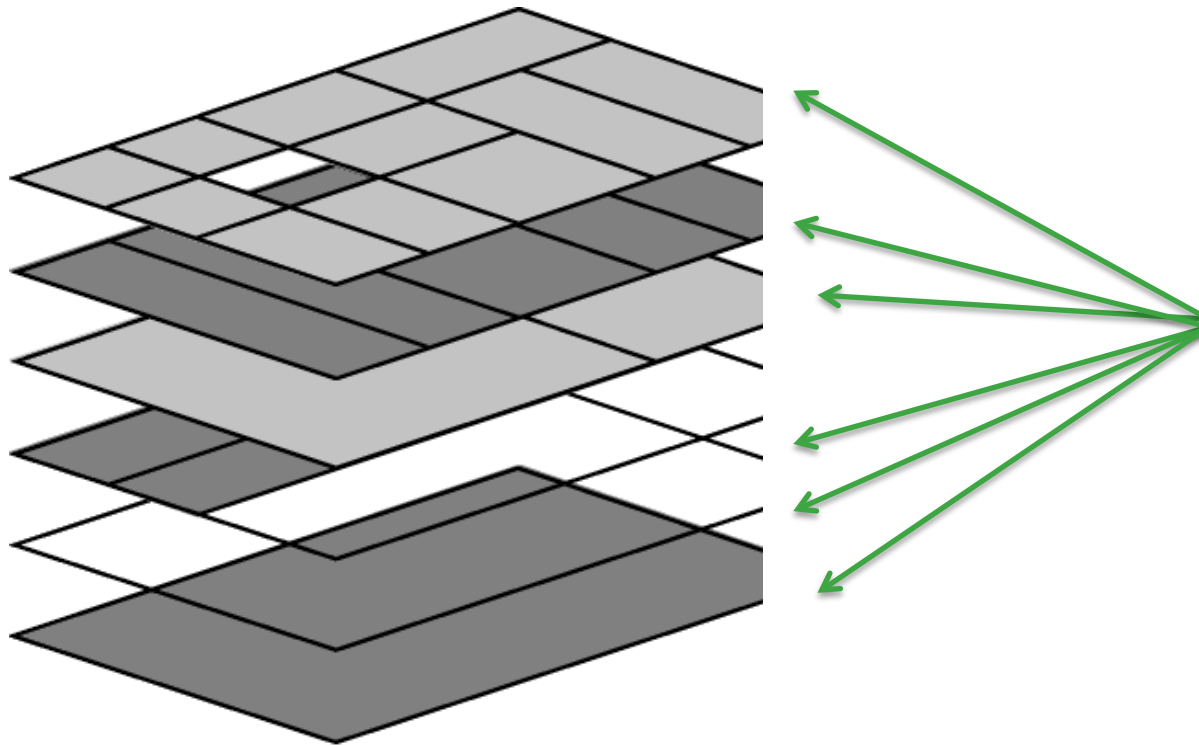
- Connect indoor and outdoor
- Define meta-data of the indoor space
- To define the CRS transformations



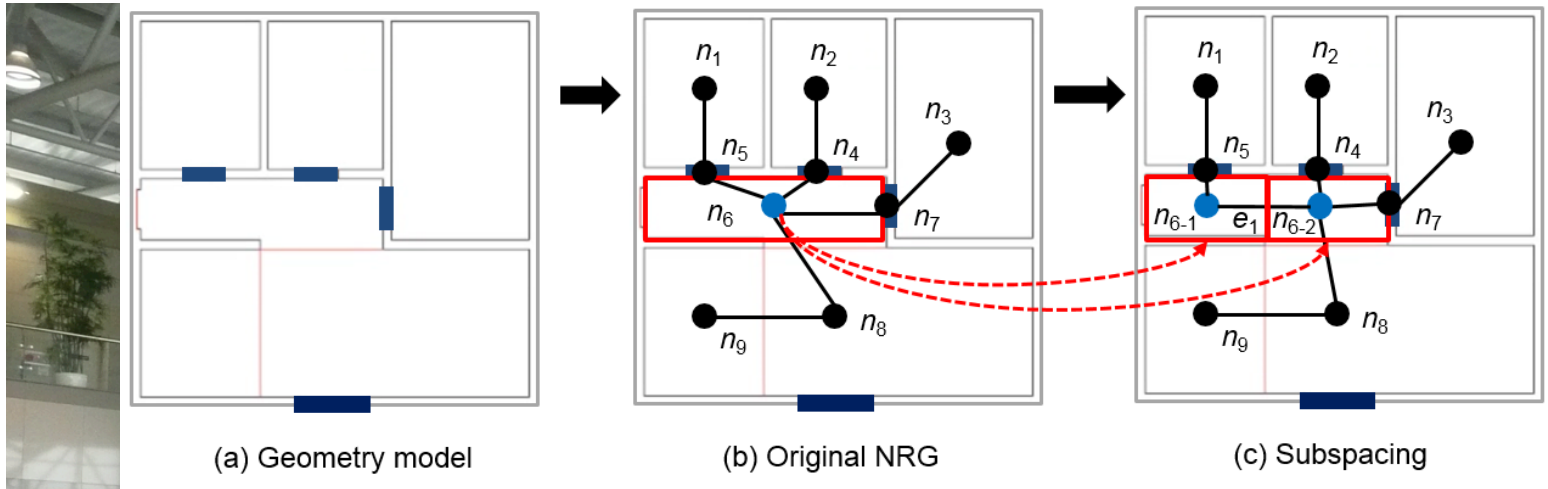
MLS (Multiple Layered Space representation)



“an object is at any given time exactly in one cell (named state) in each layer simultaneously. This overall state is thereby denoted by the combination of active states from all space layers”



Subspacing as subgraphs



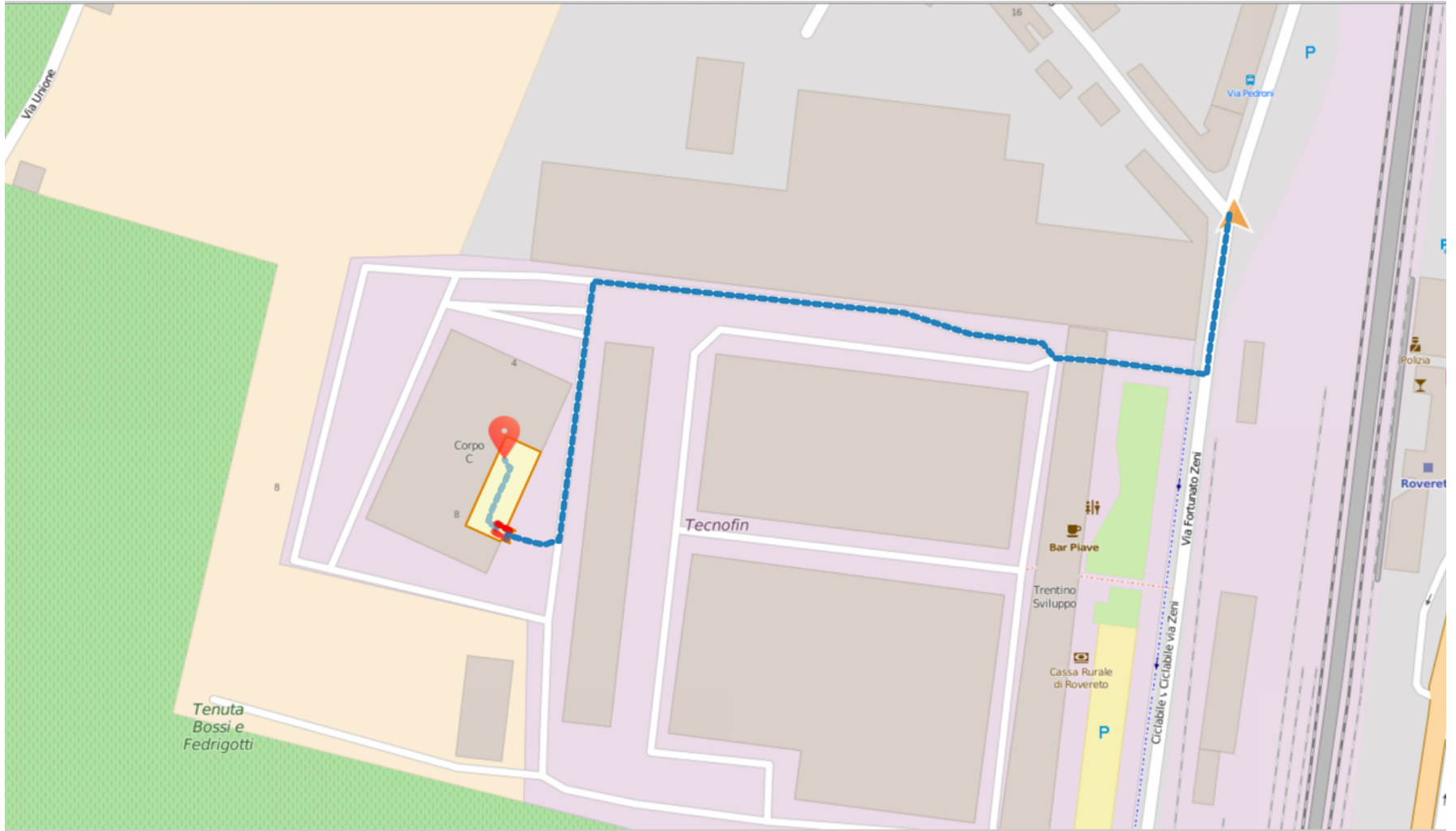
Support different navigation patterns



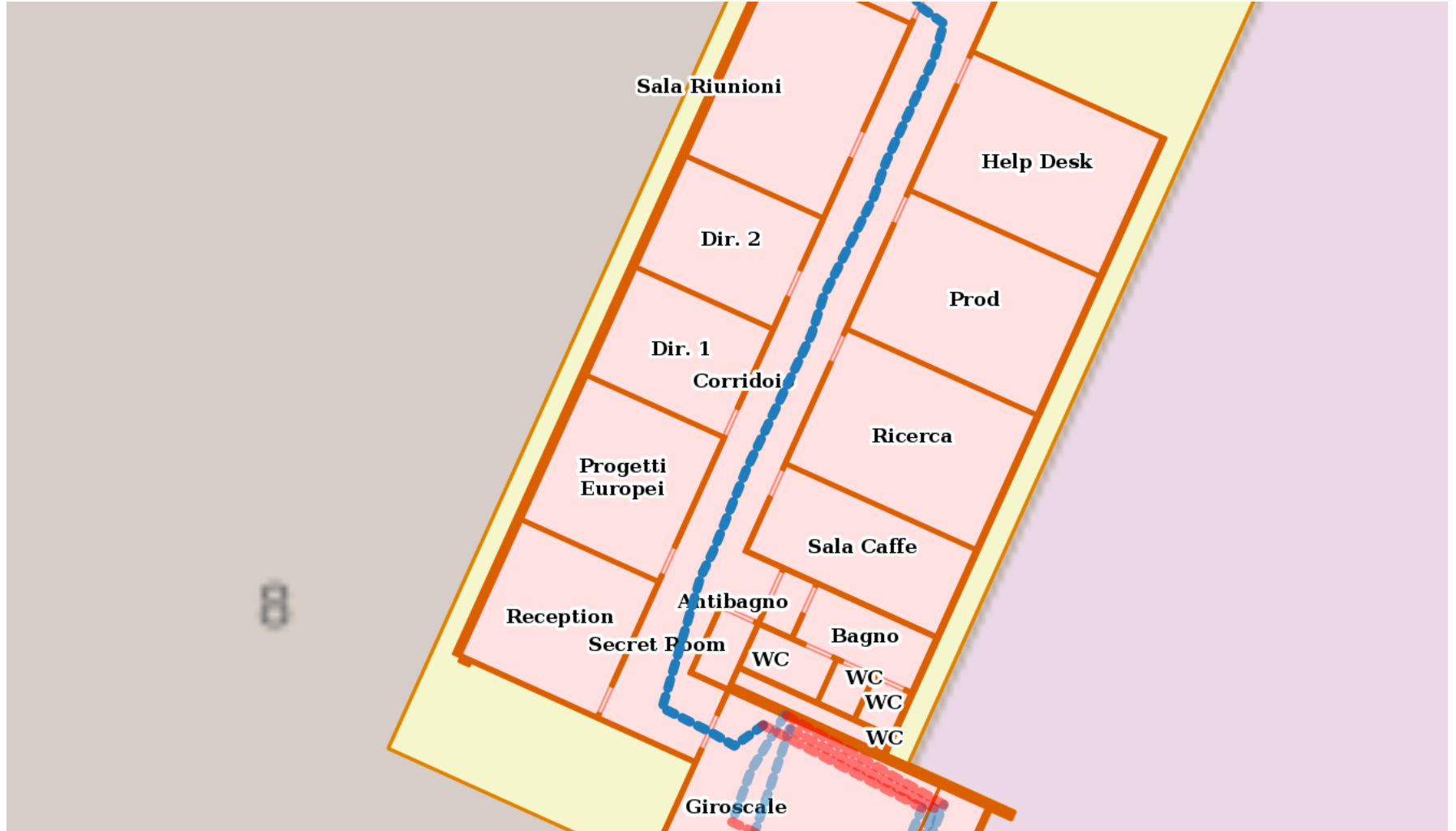
- Different connectivity graphs at the same time
 - Walking user
 - Wheelchair user
 - Robots
 - Etc.



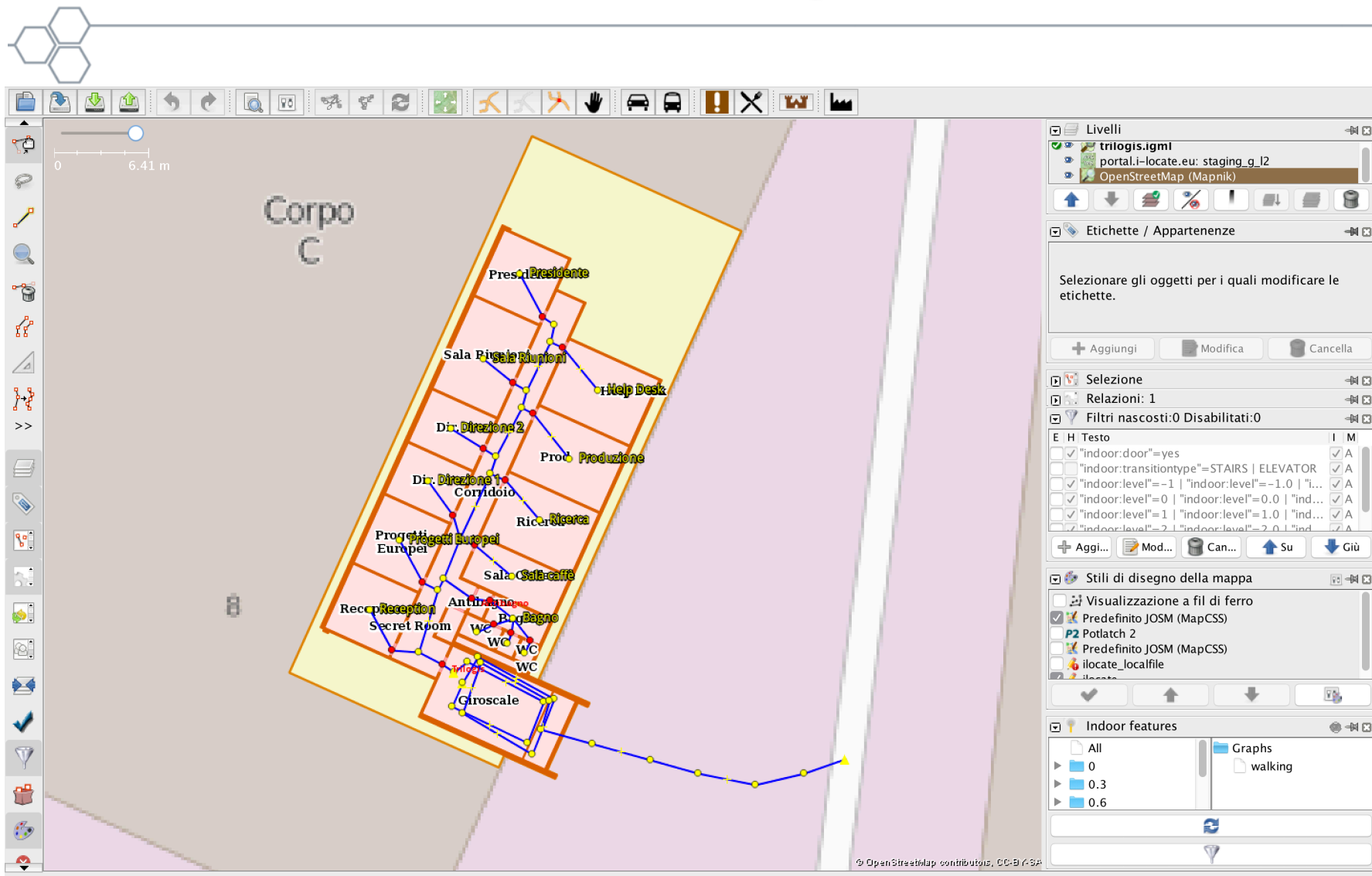
Out/Indoor navigation



Further examples



JOSM Plugin



It can get complex





Demo Video



Conclusions





Thank you

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