Topological vs Metric Mapping

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SLAM Discussion (SLAM-2002)

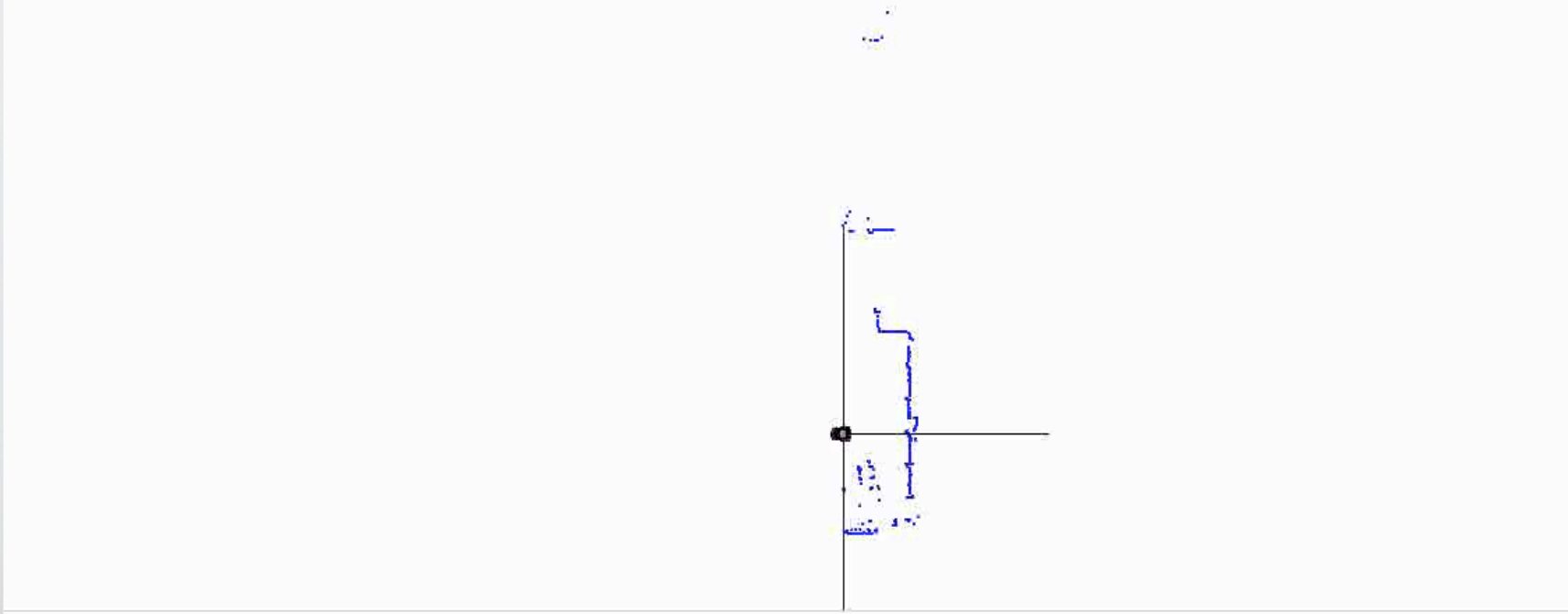
Discussion Outline

- Metric Mapping
- Topological Examples
- Challenges
- Discussion issues

Metric SLAM

- By now a relatively “mature” field
  - Std software for download
  - Most metric SLAM is based on “primitive” features
  - Scaling poses a challenge
  - Only recently has loop closing become manageable
    - More than a hack!
  - There are good solutions for bounded domains

Metric SLAM example



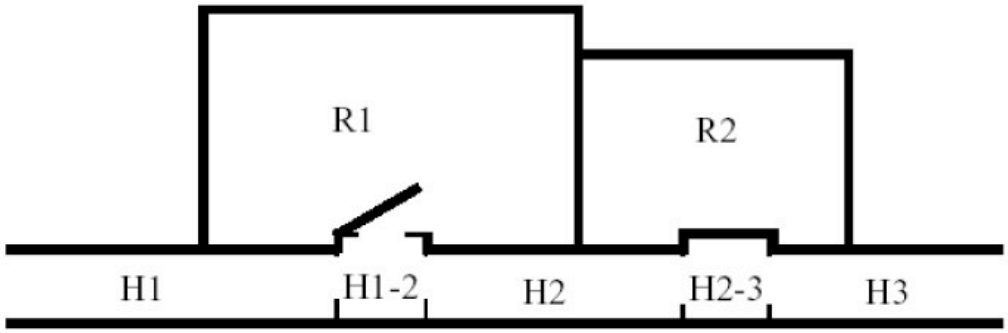
Challenges

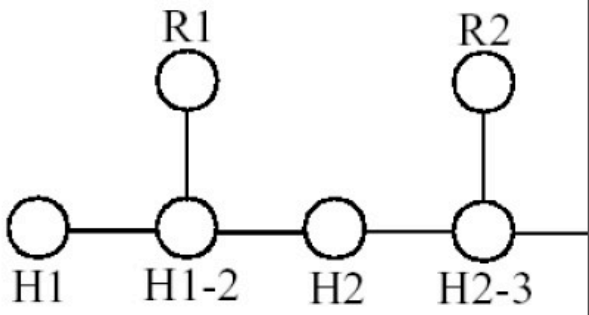
- Modeling of systems
- Scalability
- No/limited semantics

Topological Methods

- Widely used for planning
- Based on detection of places, room, ...
- A variety of methods for estimation
  - Graphical (Voronoi, ...) -> from good geometry
  - Event/place detection (Martinez - Mosoz ...)
  - Places a la Fox et al (this morning)

“Old” stuff (Dervish)





	Wall	Closed door	Open door	Open hallway	Foyer
Nothing detected	0.70	0.40	0.05	0.001	0.30
Closed door detected	0.30	0.60	0	0	0.05
Open door detected	0	0	0.90	0.10	0.15
Open hallway detected	0	0	0.001	0.90	0.50

Topological Mapping

- Learning of place-graphs a la Dieter Fox
- Classification of spaces a la Oscar / Wolfram
- Graph Tesselation

- What is the right level of granularity?
- When it is a Graph model and when is it topology?
- Do we really care?

Topological models

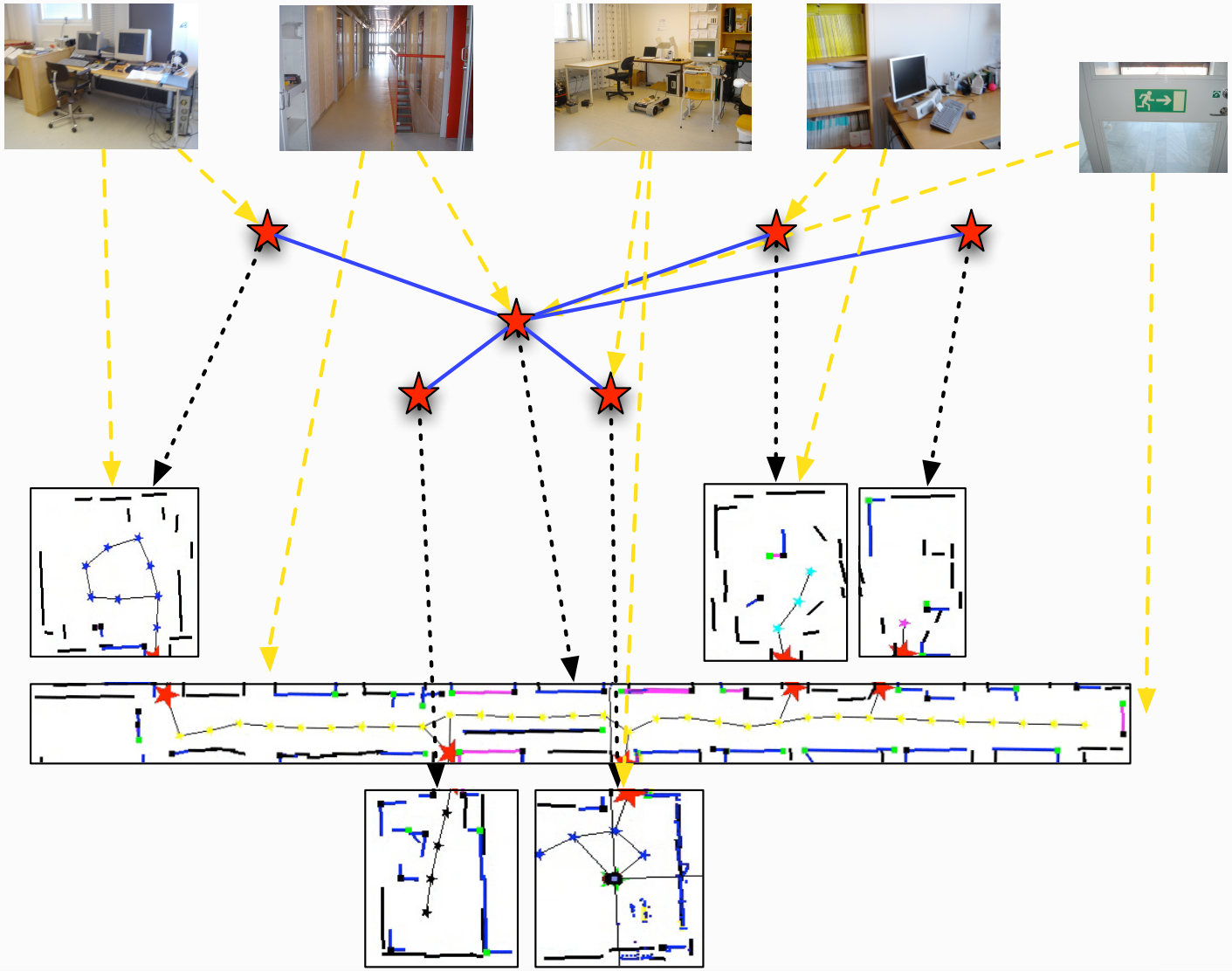
- Less of a complexity problem
- The localization is qualitative
  - In many cases that might be enough for “robot not to get lost”
- Estimation of the model might be harder

Representations

- What are the problems where metric is enough?
- When is topological adequate for the task?

- What is the next step in evolution?

Mixed representations?

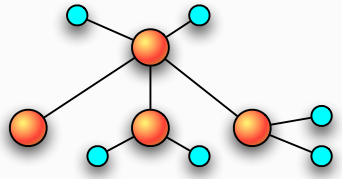


- How do we ensure consistency in mixed maps?
- Is this merely a graphical estimation problem

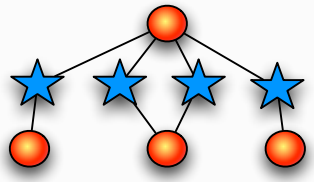
- Is mixed topology / metric really the answer?

- Mixed representations

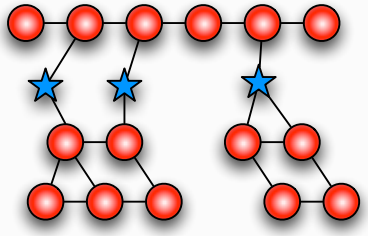
User / Semantic Model



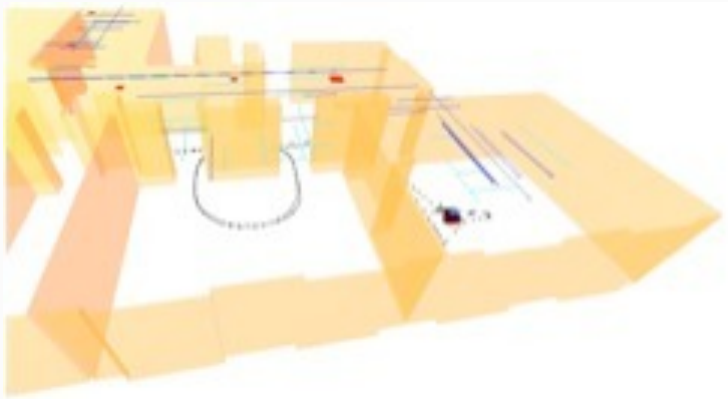
Topological Model



Coarse Grid Model



Geometric Model



Discussion

- When will we start to integrate “objects” into our maps?
- Should the next SLAM SS have presentation on object based models?
- Is EKF SLAM to mature/well known to be the basis for our discussions?
- Is anyone using topological maps?
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