

Assistance for Spatio-Temporal Planning in Ubiquitous Computing Environments Based on Mental Models

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Trade fair scenario



1: There are very interesting booths in hall number 14!

Decision making in a dynamic spatio-temporal environment



spatial constraints

- location
- spatial preferences
- environment structure

spatio-temporal constraints

underspecified premises

- temporal order, sequence
- temporal priorities
- point in time

user preferences

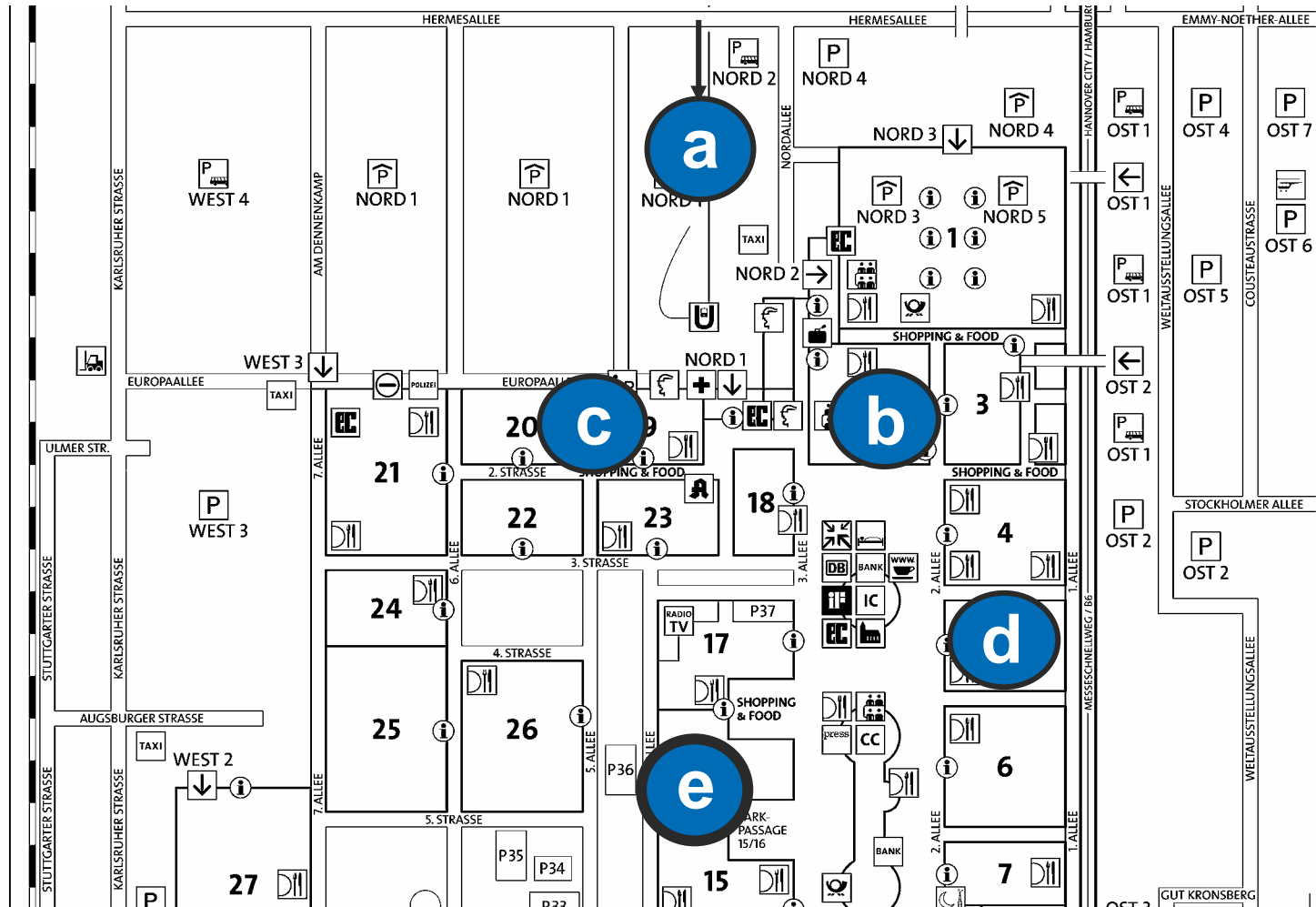
- partial priorities
- personal preferences
- emotions



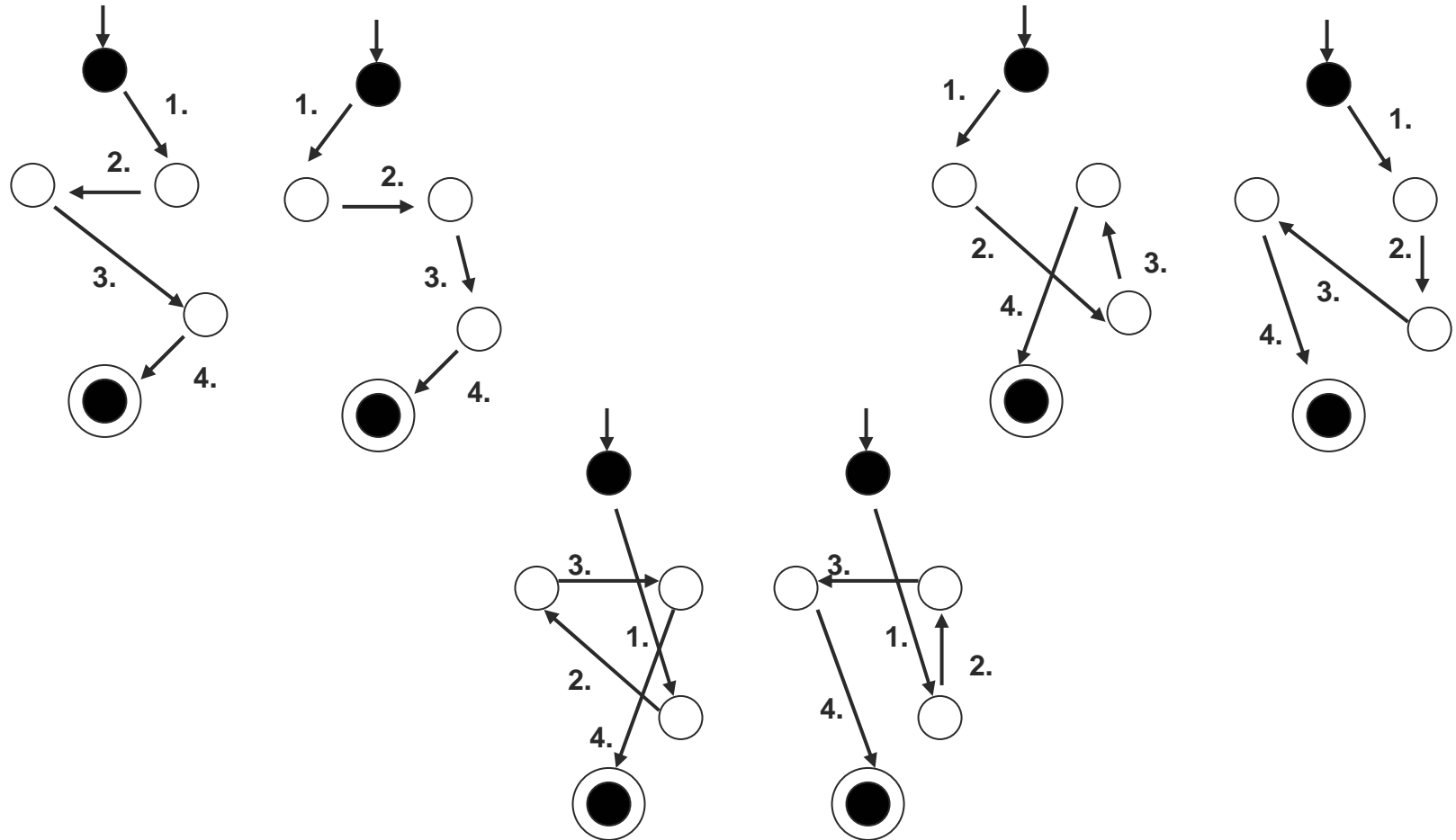
Mental problem solving

- Construction of mental models: instantiations of constraints
 - many models are possible – only few are preferred and get constructed
- Mental model instantiation
 - resembles non-exhaustive depth-first search with non-systematic backtracking
 - stops when constraints are fulfilled to a tolerable degree
- Restricted to simple cases

Example: spatio-temporal configuration

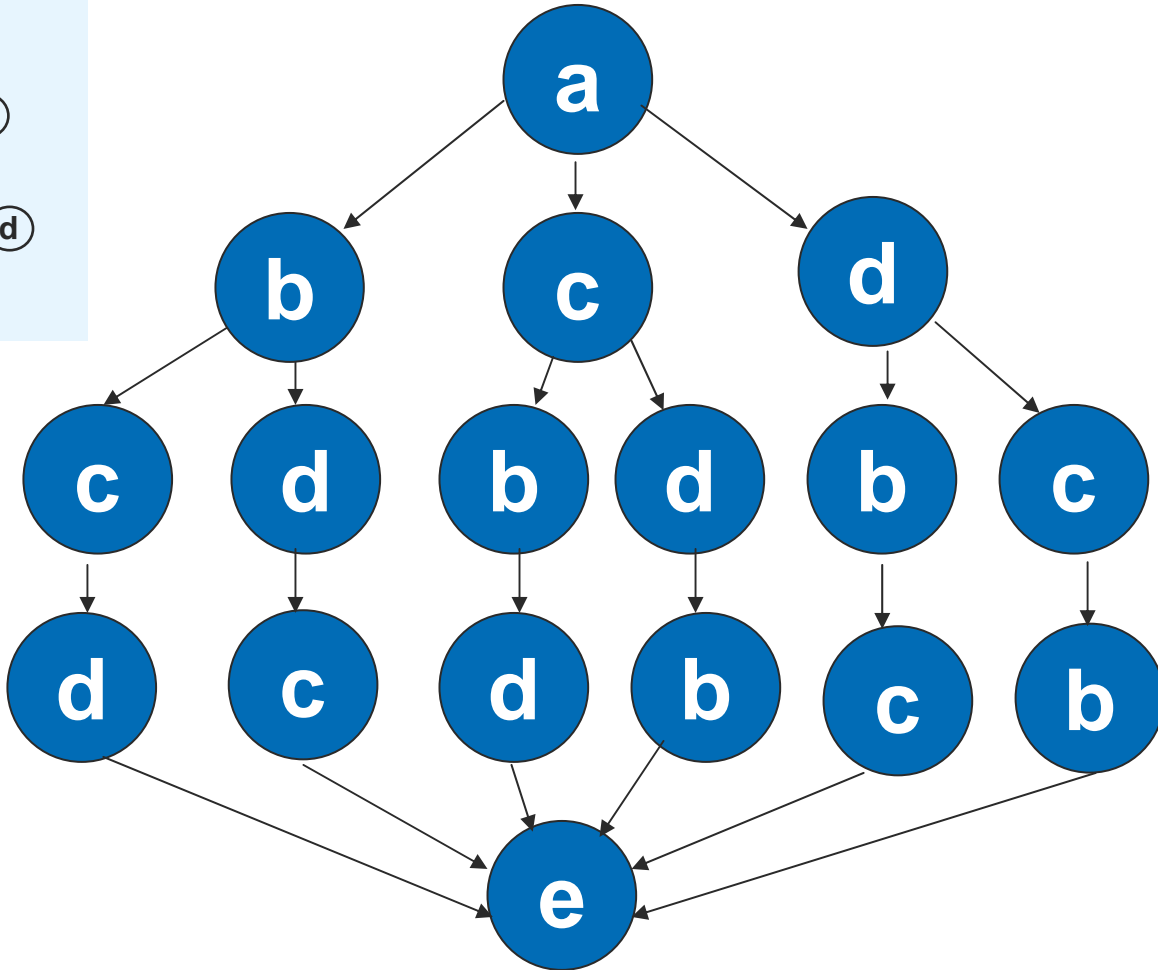
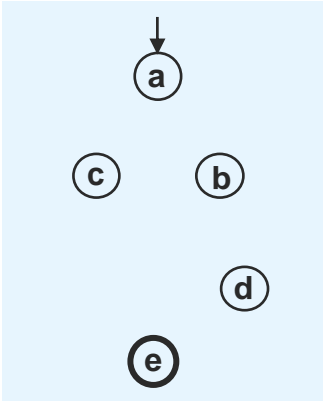


Example: generation of alternatives

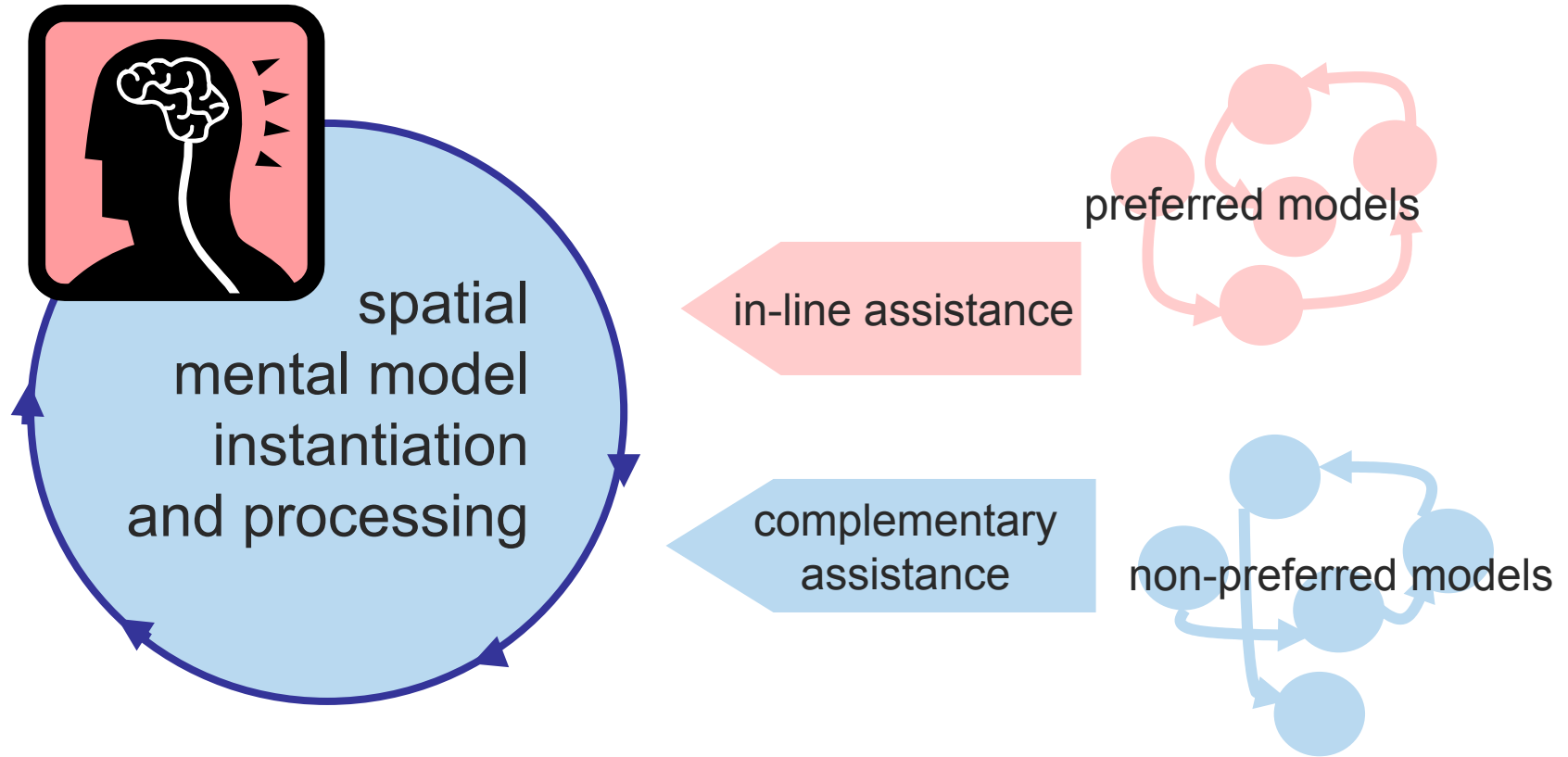




Example: mental problem space



Collaborative Assistance System



Generation of preferred mental models



- Conceptual neighborhoods (cf. C. Freksa)
- Simplification of large problem spaces
 - avoid large branching factors
- Empirical investigations



Context for assistance

- Time: pressure or availability
- Awareness of changes: communication devices
- Tasks: important conversation or being in a hurry
- Location: structure of a spatial environment

Example: spatial structure

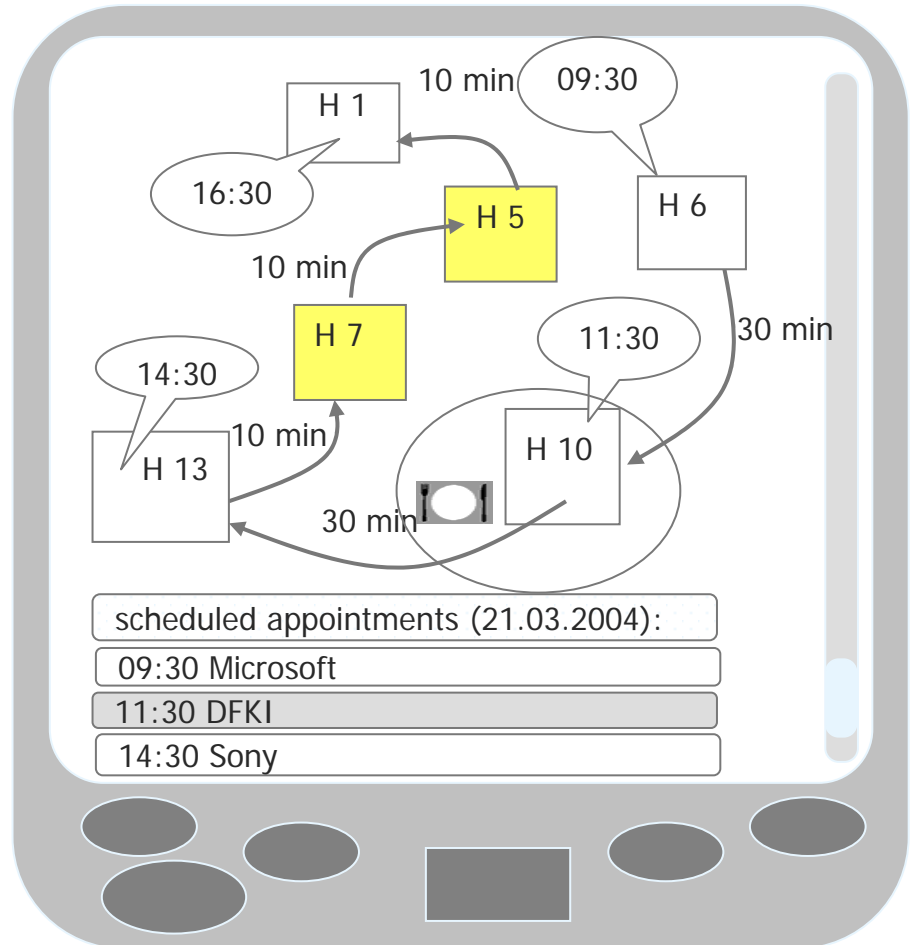
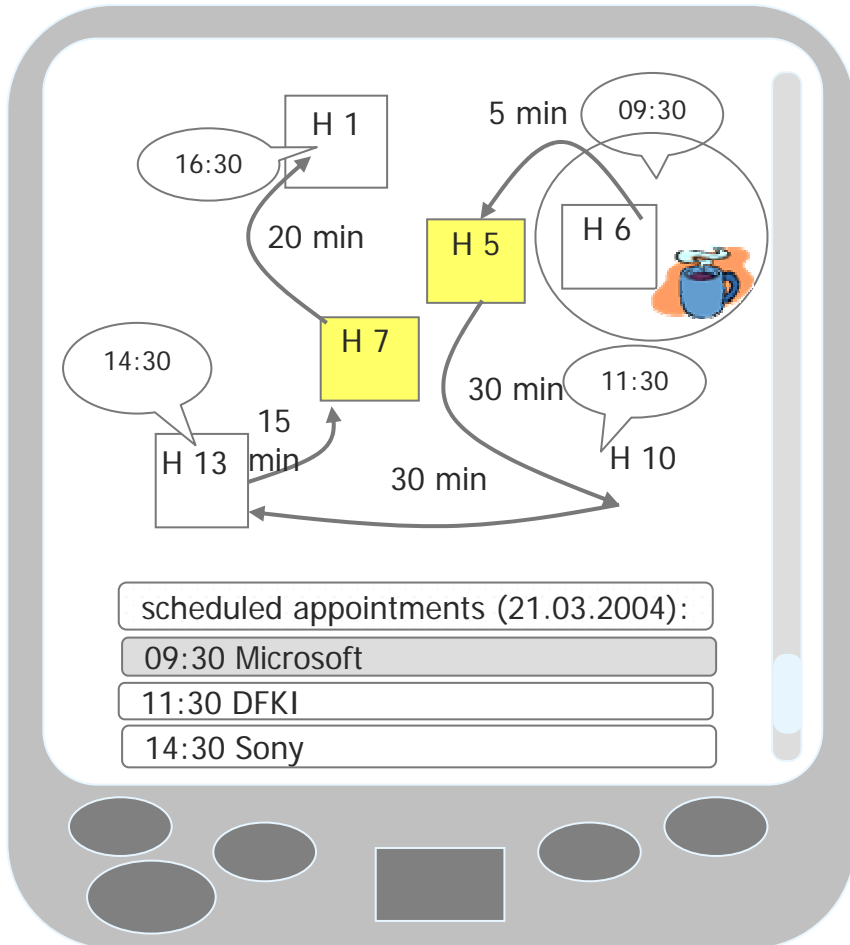


Basic requirements of ubiquitous assistance

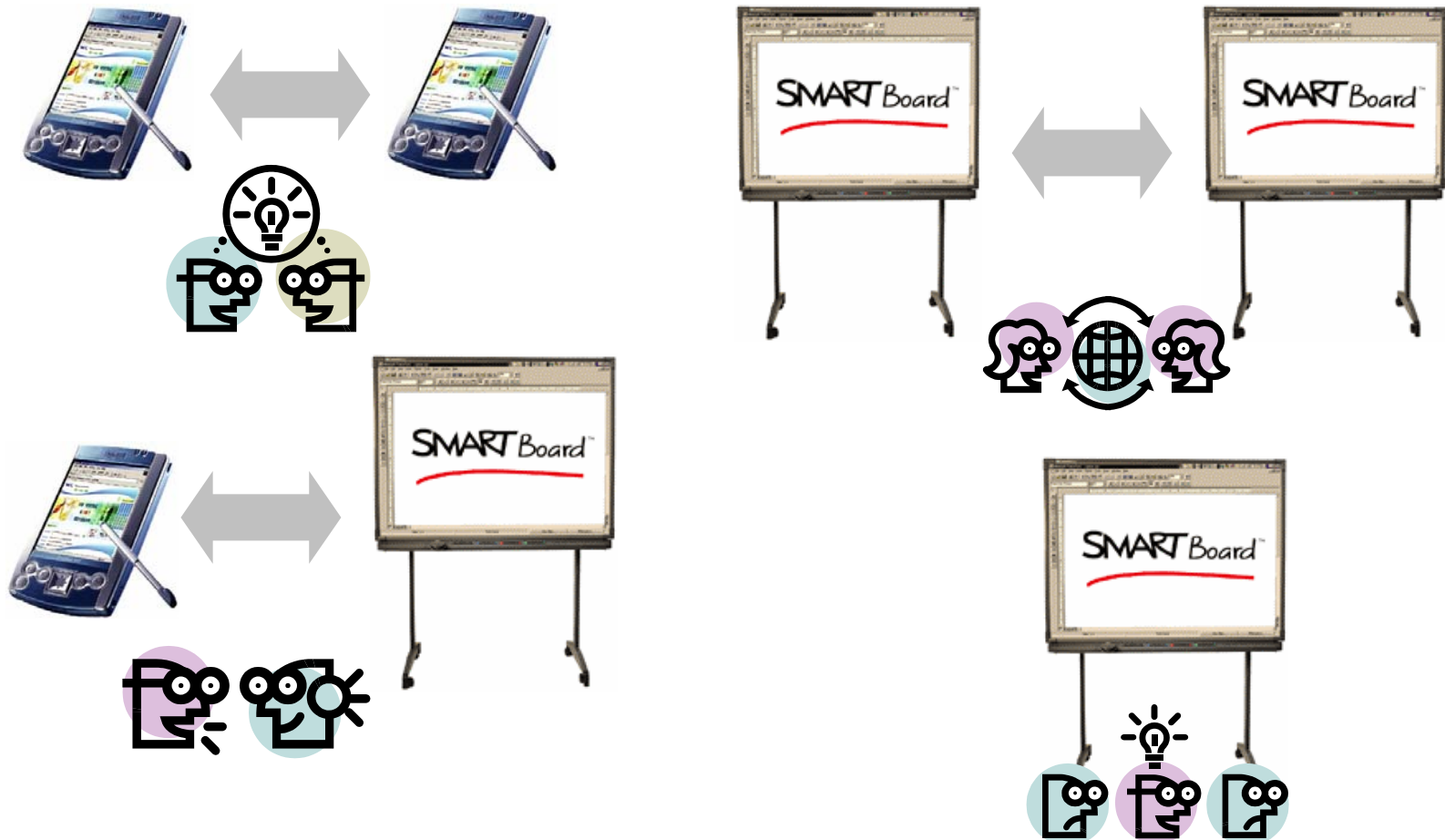


- Smart devices:
 - PDA
 - smart boards
- Seamless communication over heterogeneous networks
 - WLAN, Bluetooth
- Positioning information
 - WLAN positioning
 - self-localization

A PDA example



Example: communication scenarios





Outlook and future work

- Mental model-based approach reduces cognitive complexity in underspecified spatio-temporal planning tasks
- Idea of mental model-based assistance in ubiquitous computing environment – implementation follows

Conclusion

