

Logic-inspired Query Processing Framework for Ubiquitous Computing



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What?

WE PRESENT a novel **query processing framework**, founded on model checking principles, that handles the query processing task of location-aware services. At its core is a modal logic-inspired language used to query *existing* symbolic location models.

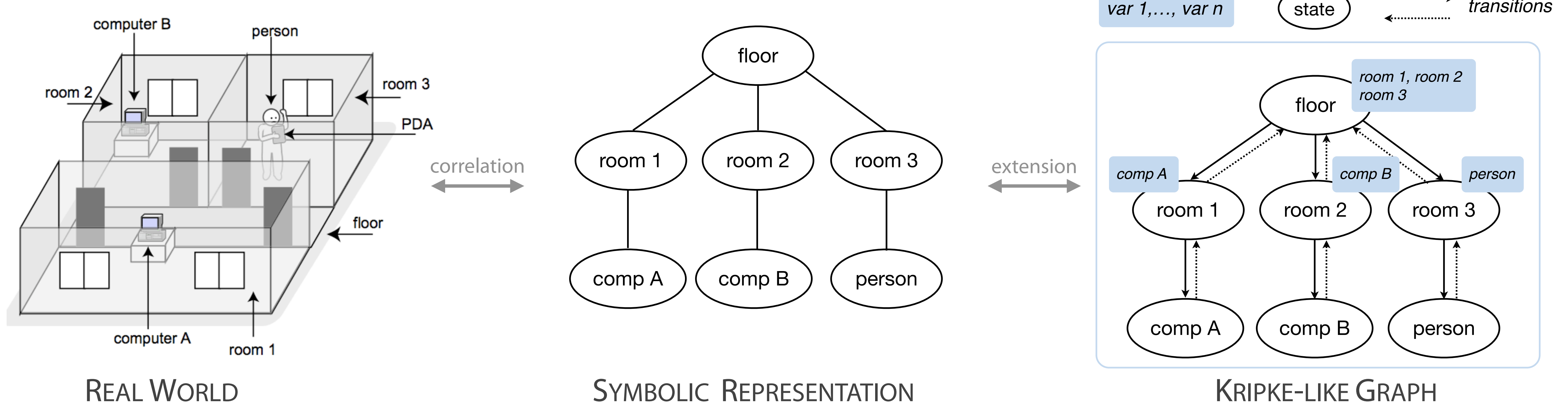
Why?

CONTEXT MODELING has been an extensively studied topic within the ubiquitous computing community. As a result a great variety of models have emerged, most of them representing the information, and its underlying semantics, by graph structures. However **none of these has been used as data models that can actually be queried.**

How?

FORMAL METHODS are needed for assuring the soundness of the queries and their results, just like relational algebra guarantees the consistency and correctness of SQL queries over relational databases.

Model Checking provides well-founded mechanisms to query graph structures, but needs to be extended to cope with the requirements of location-aware services.

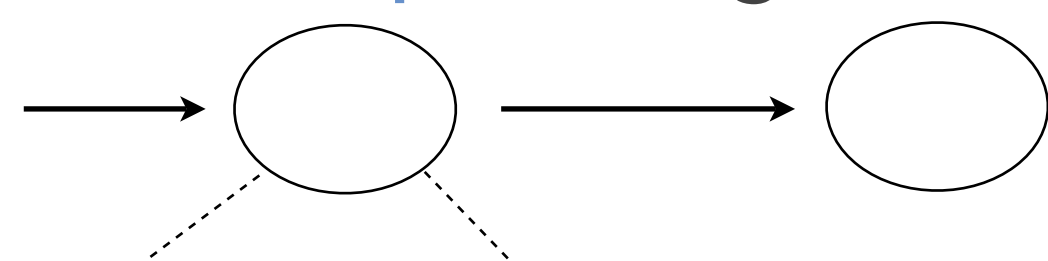


1- GRAPH DATABASE MODEL

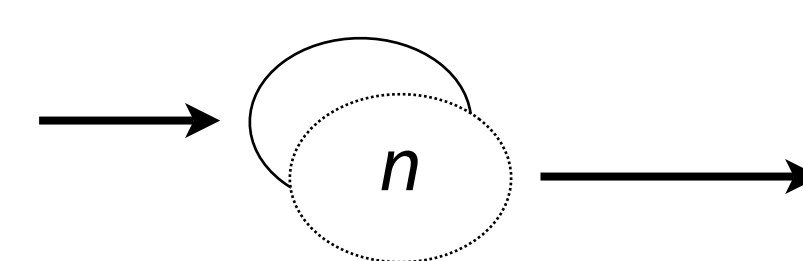
- Containment relationship between places
- Entities within the environment are mapped to propositional variables

2- QUERY LANGUAGE EXTENDING MODAL LOGIC

- **Nominals** are propositional variables true at exactly one node in the state graph
- **Access operator** gives random access to any node



- **Down-arrow binder** creates a new name and assigns it to the current node



3- QUERY PROCESSING

A query is a **satisfaction relation**, connecting the hierarchical graph with the formula:

$G \models E_1(\downarrow room.comp)$ returns all the rooms equipped with a computer.

Publications

- [1] *Query Language for Location-Based Services: a Model-Checking Approach*, Christian Hoareau and Ichiro Satoh. IEICE Transactions on Information and Systems, Special Issue on Knowledge-Based Software Engineering, Vol.J91-D, No.3, April 2008.
- [2] *Hybrid Logics and Model Checking: a Recipe for Query Processing in Location-Aware Environments*. Christian Hoareau and Ichiro Satoh. Proc. IEEE 22nd International Conference on Advanced Information Networking and Applications (AINA 2008), March 2008.
- [3] *A Model Checking-Based Approach for Location Query Processing in Pervasive Computing Environments*. Christian Hoareau and Ichiro Satoh. Proc. 2nd OTM International Workshop on Pervasive Systems (PerSys 2007), LNCS, November 2007.