



Situations in Conceptual Modeling of Context

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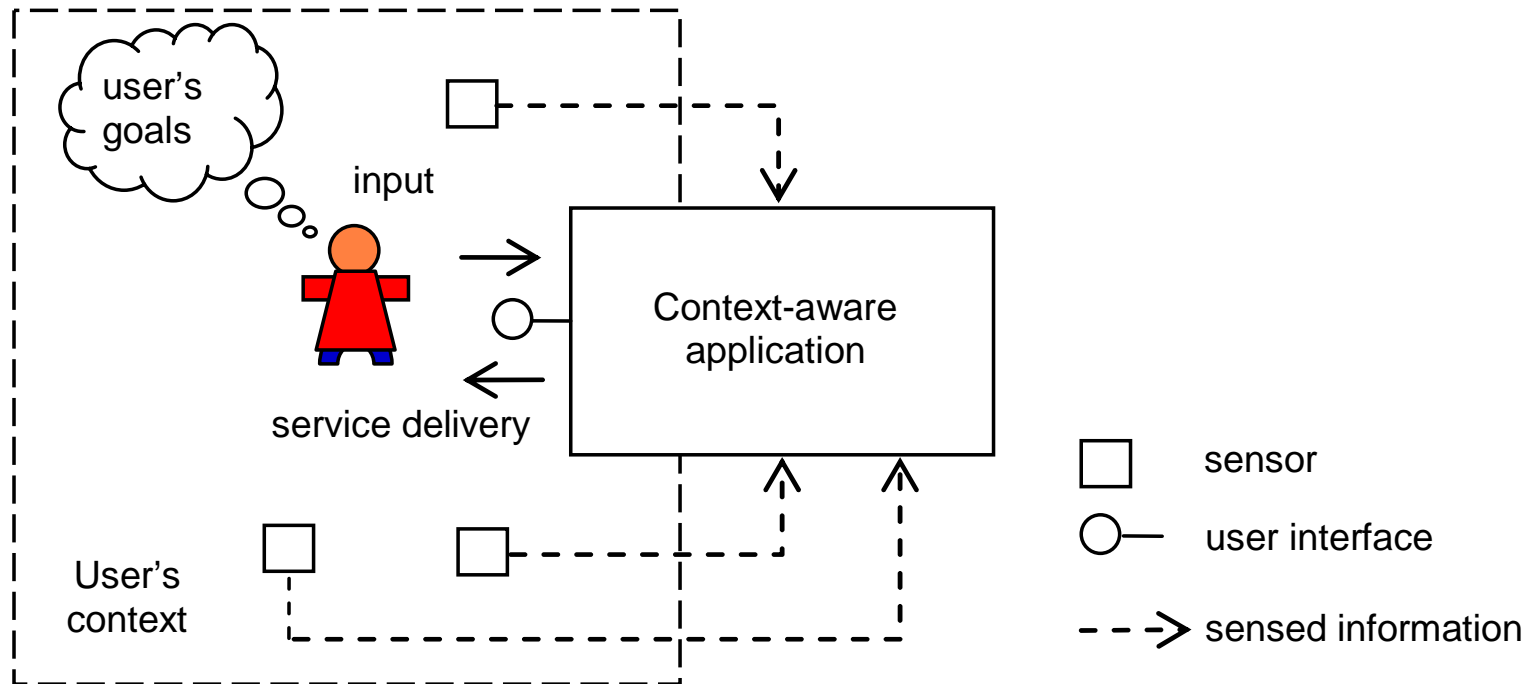
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Context-Aware Applications



Context versus Context Information

- Our view on context-awareness distinguishes explicitly **context** from **context information**

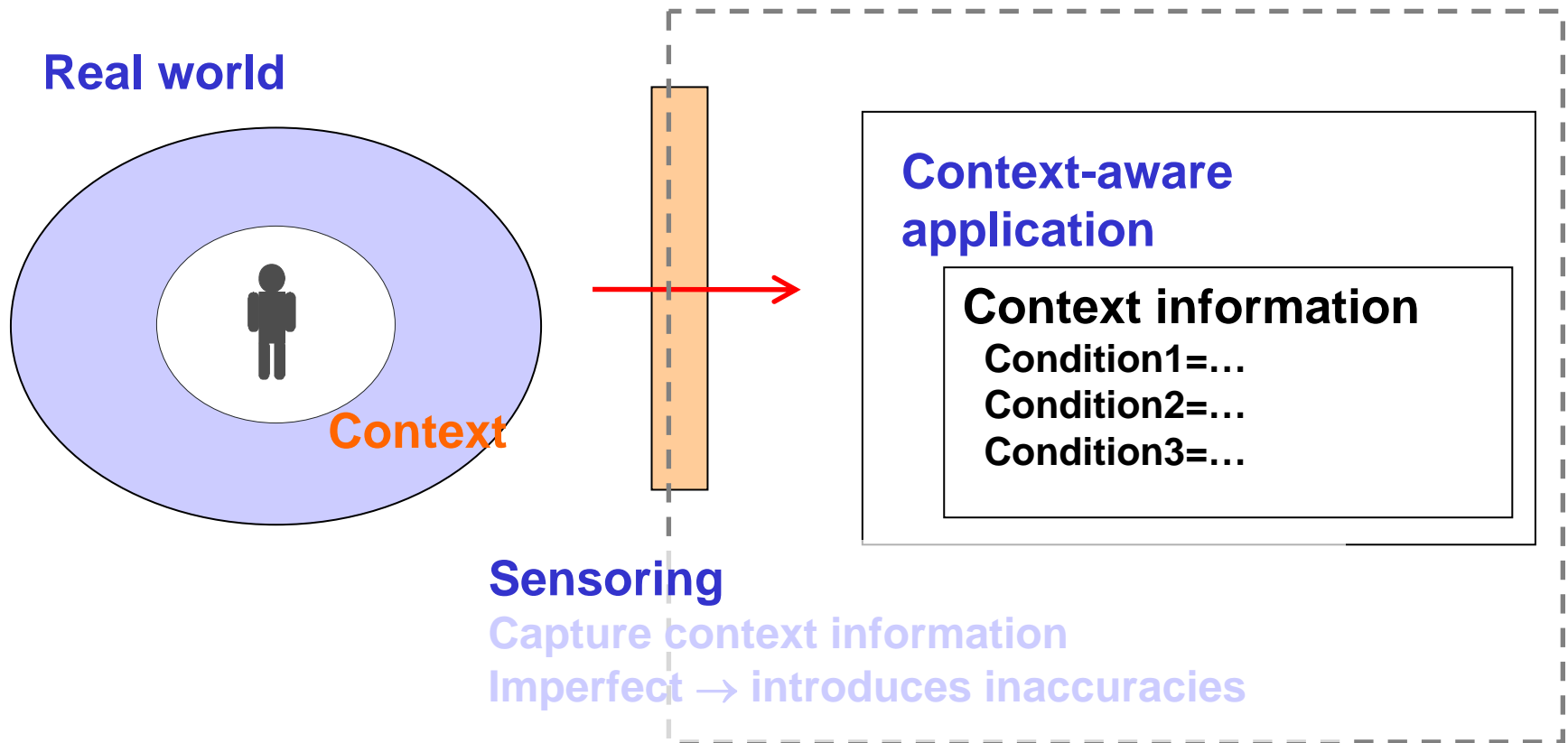
Context

- the **interrelated conditions** in which **something** exists or occurs

Context information

- information about context available in a system (context-aware application)

Context versus Context Information



CA Application Development

In order to support context-aware applications one needs amongst others (meta)models that define

1. context types and their relationships
2. the 'imperfection' of context information (Quality of context)

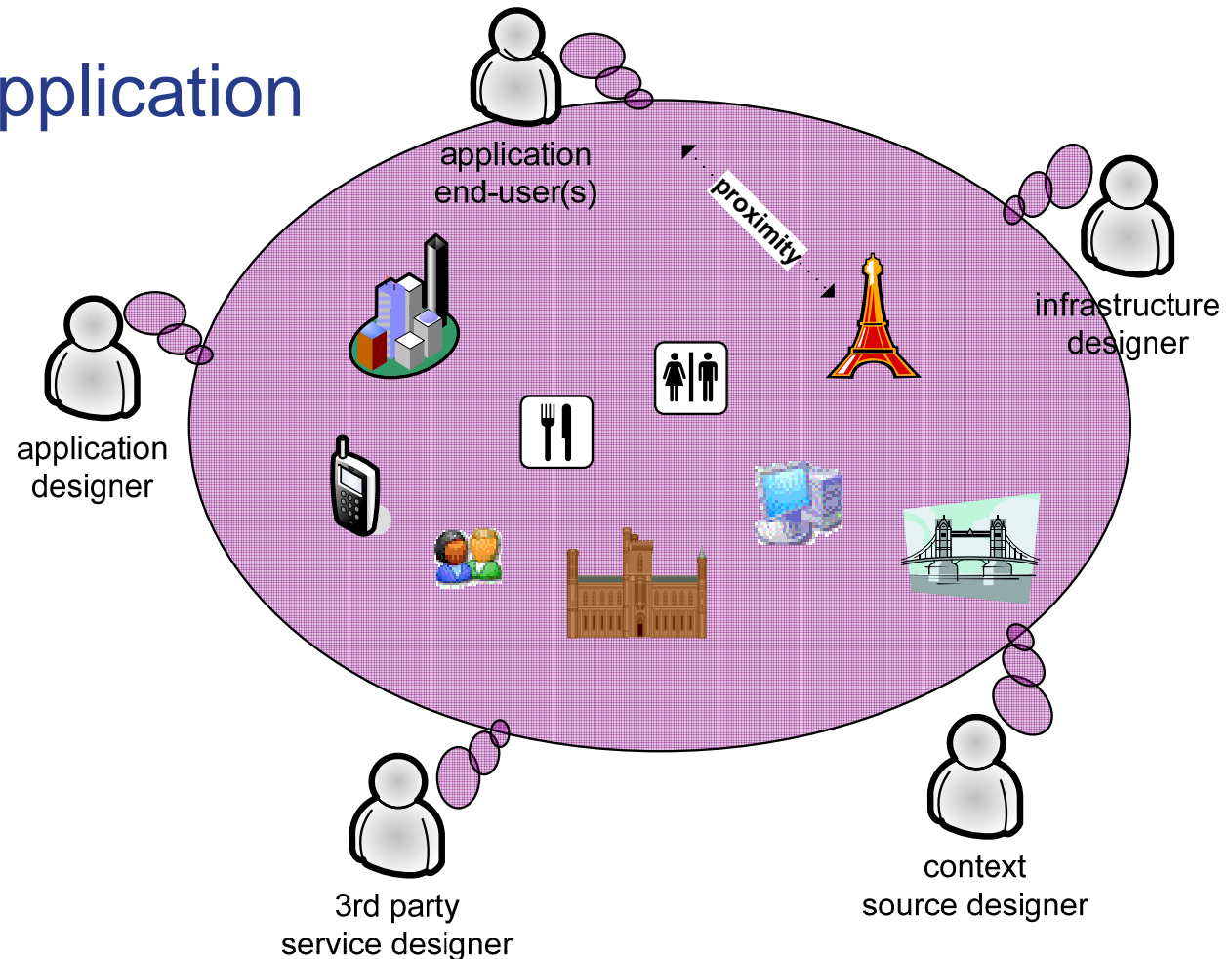
Presentation concentrates on first topic

→ **conceptual model for context**

Goal: support common understanding, problem-solving, and communication among the various stakeholders involved in application development (unambiguous representation)

Application's Universe of Discourse

- Tourist Application



Problem

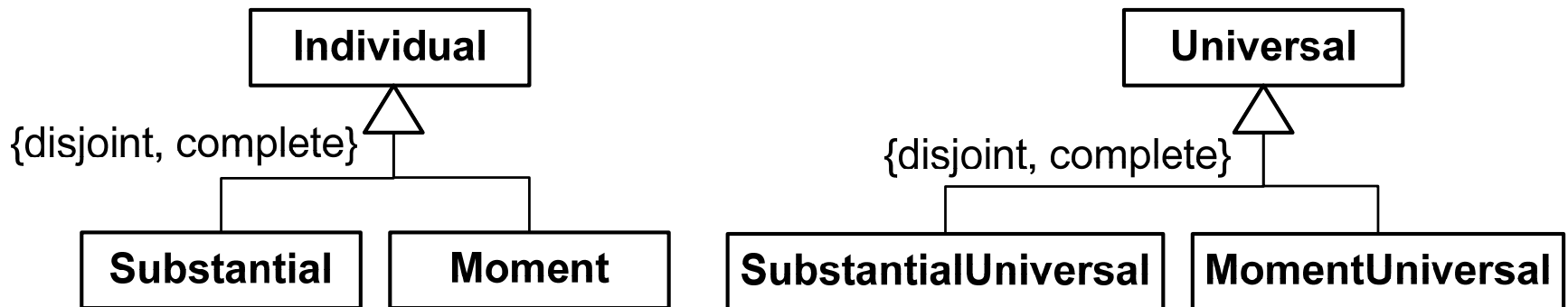
- Modeling languages, such as OWL and UML, do not offer adequate conceptual foundations for conceptual modeling (in particular context modeling)
- ⇒ they fall short in offering suitable abstractions for constructing conceptual models (Guizzardi 2005)
- We do not intend to replace these modeling languages!



Goal and Approach

- We aim at providing basic **conceptual foundations** for context modeling, which allow designers of context-aware applications to represent relevant elements of a context-aware application's universe of discourse
- We consider results from **foundational ontologies** to support our conceptual context modeling approaches

Ontological Foundations



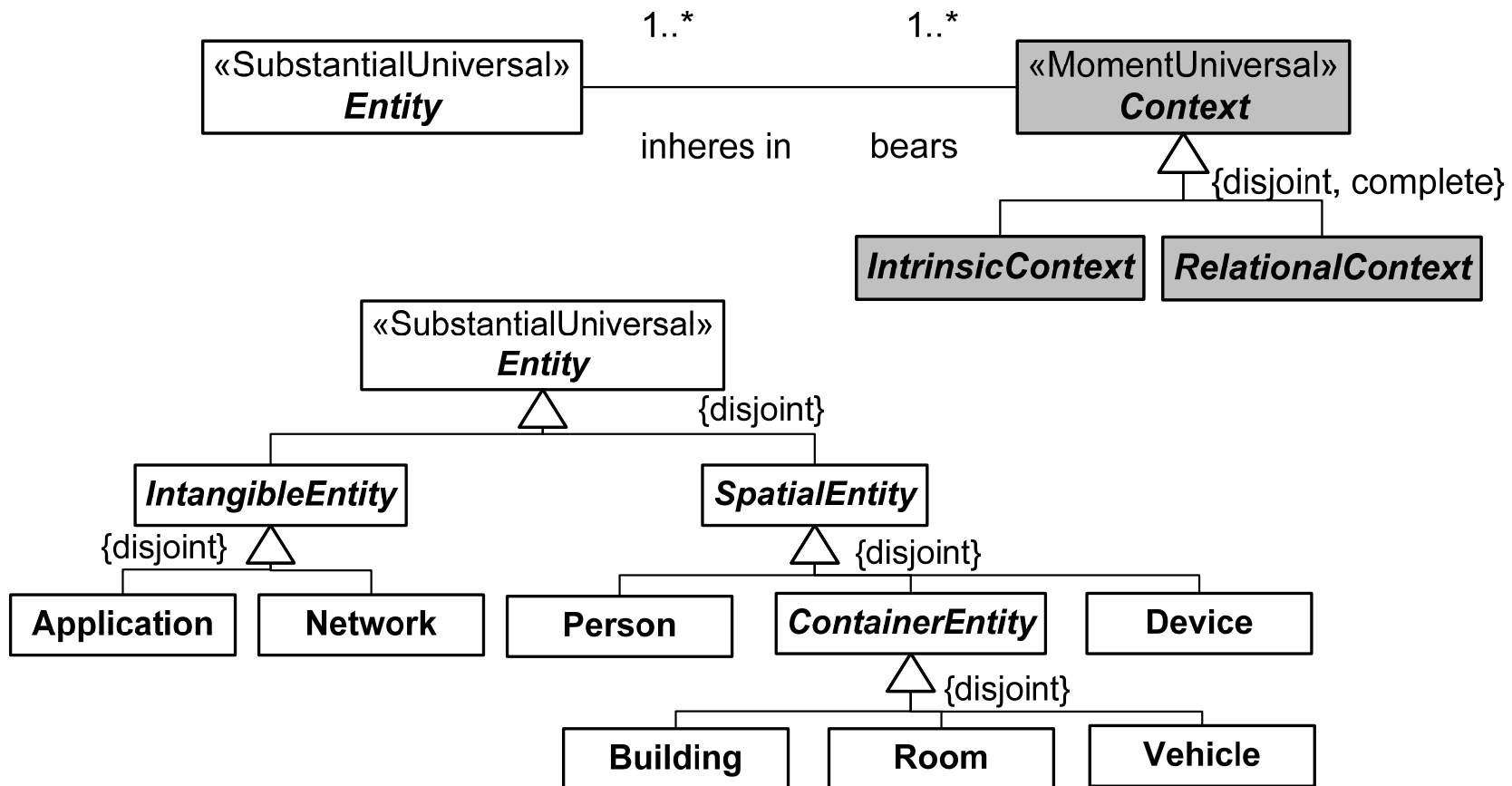
- **Moment** existentially depends (inheres) on other individuals, namely their *bearers*. An example is **mood**, which inheres in a person
- **Substantials** do not inhere in other individuals, i.e., they are individuals which are not moments

Entity and Context

- We have decided to separate the concepts of entity and context from the top-level in our context model
- **Entities** are substantials, **contexts** are moments
- Modeling choice follows nicely from the definition of context
(**interrelated conditions** in which **something** exists or occurs)

Consequence → there is no context without an entity
(the ‘something’)

Context Categories and Entities



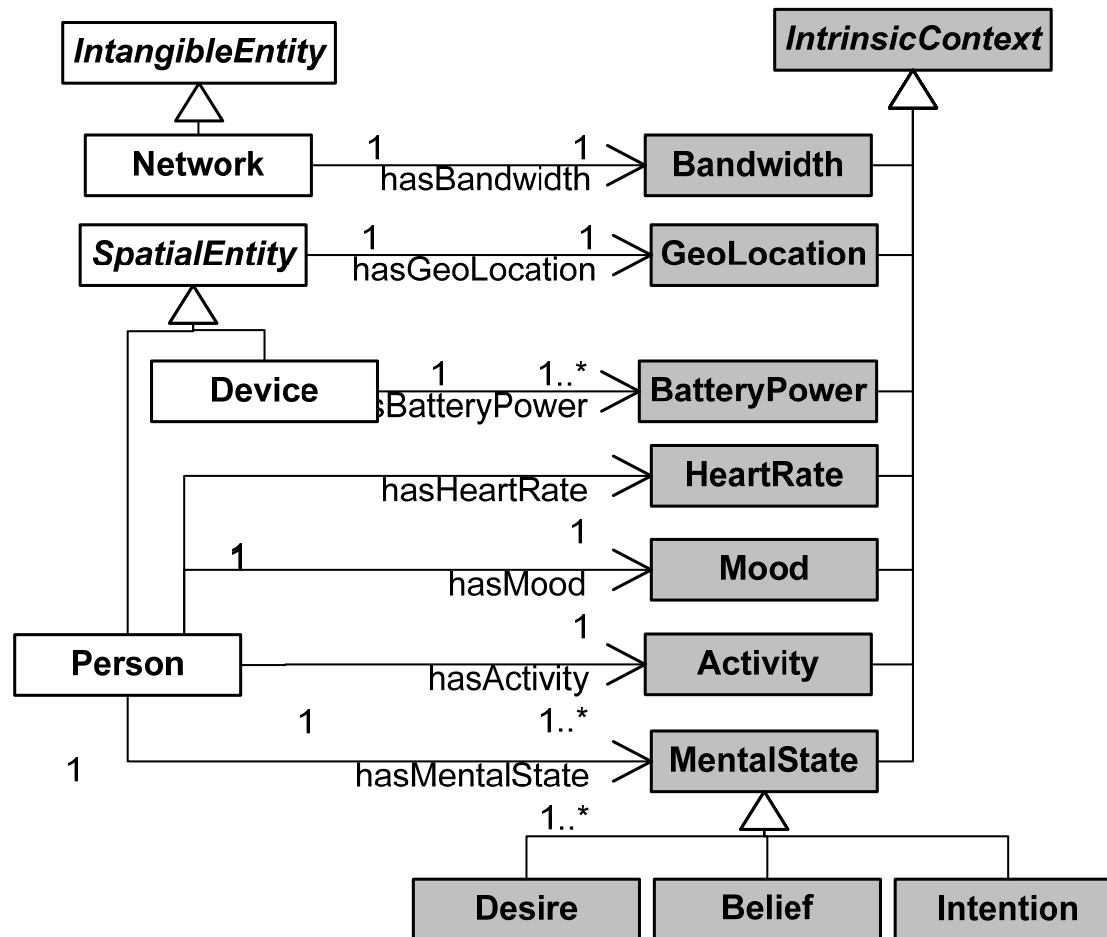
Intrinsic Context

- Some context conditions belong to the essential nature of a single entity
- In line with the ontological concept of ‘Intrinsic Moment Universal’
- Defined as ‘Quality’, which relate to a ‘Quality Dimension’

Examples

- Bandwidth of a network
- Battery power of a device
- Location of a person

Intrinsic Context





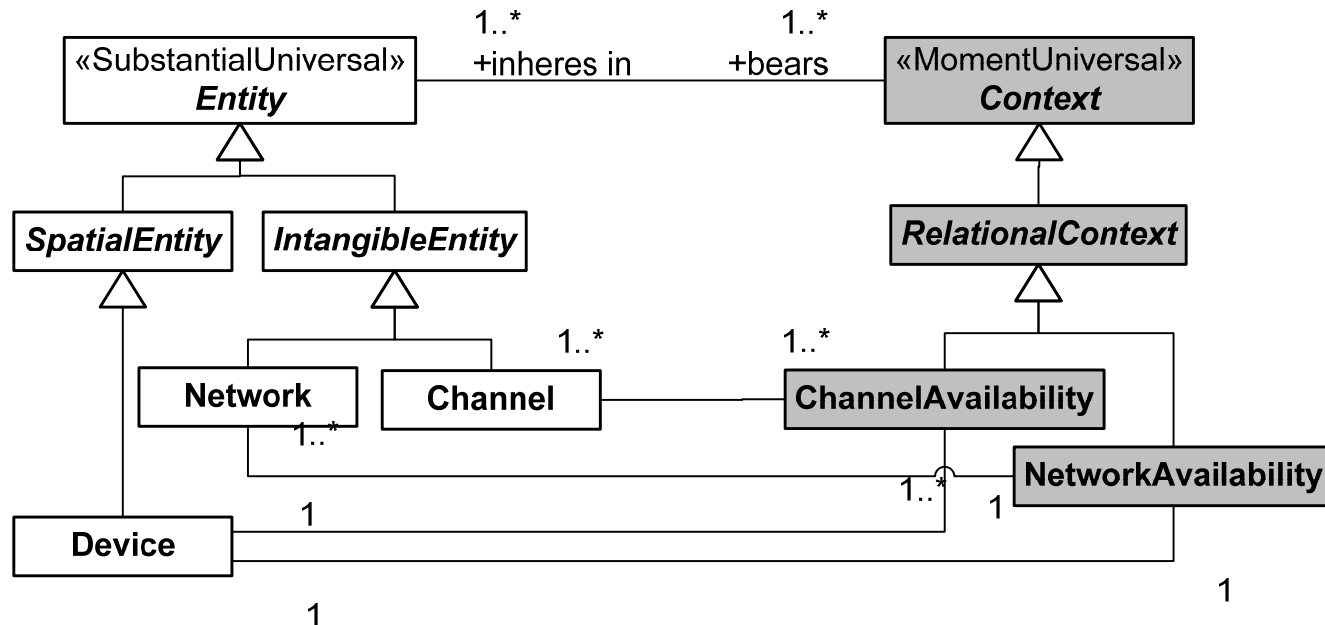
Relational Context

- Some context conditions relate an entity to a collection of entities that play a role in the entity's context
- Inhere in a **plurality** of entities

Examples

- Device availability of a person, relates a person to devices
- Channel availability of a device, relates channels to a device
- Network availability of a device, relates networks to a device

Relational Context





Formal Relations

- Holds directly between individuals
- The immediate relata are qualities

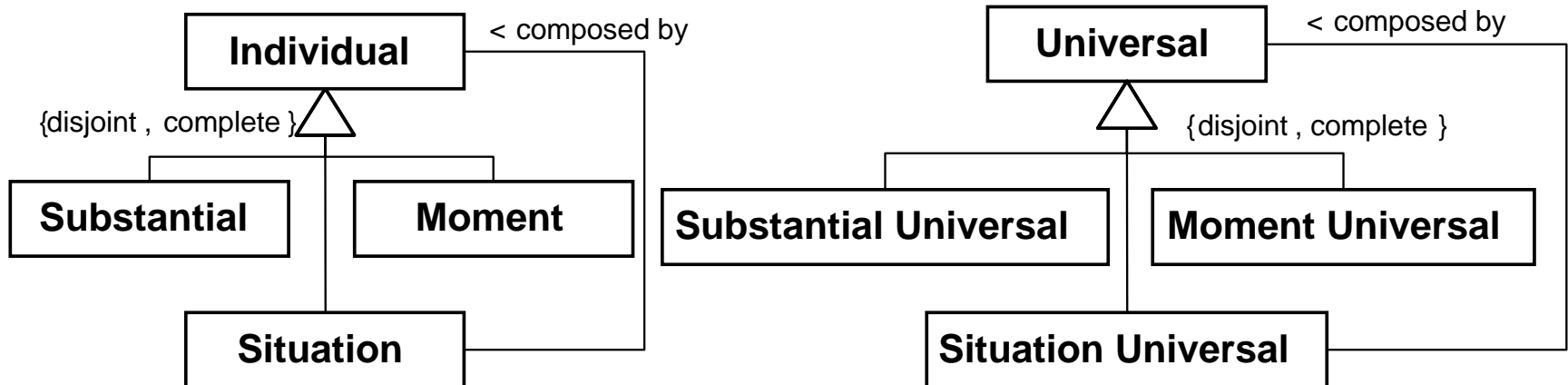
Examples

- Greater than, taller than, older than, etc.
 - Nearness (holds between locations)
 - Distance (logical construction of locations)
-
- Contrast with Relational Context (design decision)

Situations

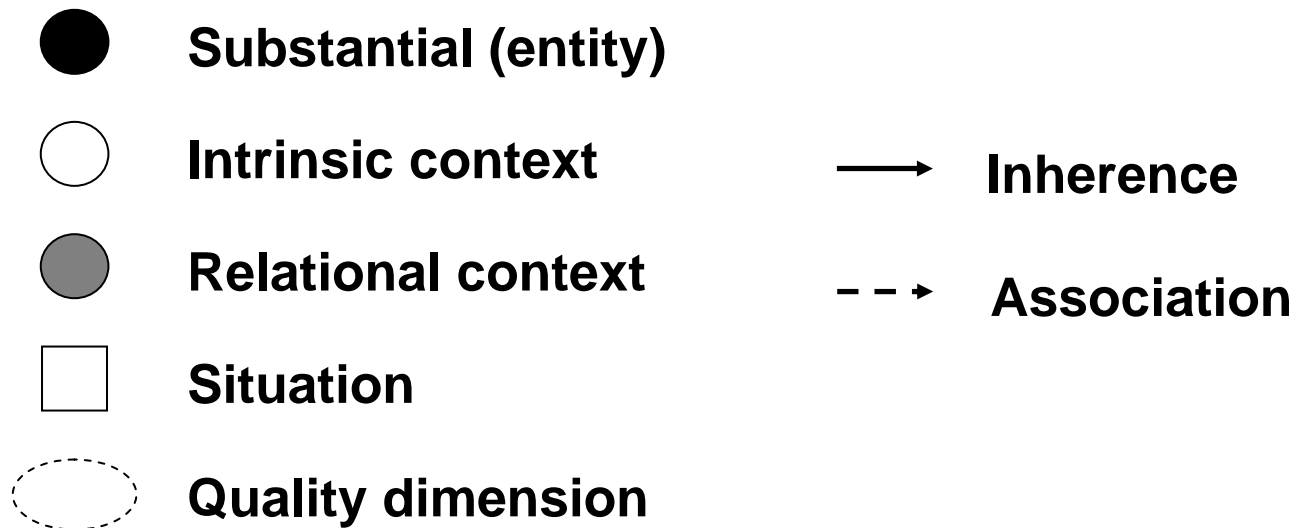
- Context model presented so far gives a **static view of context**, useful for ‘snapshots’
- Context-aware applications should be able to react on Situations → specific configurations of entities and context conditions
- We have extended our model to represent situations using the ‘vocabulary’ of the context model
- We have applied the ontological notion of Situation for that
→ **particular state-of-affairs**

Foundational Concepts



Context Situation Definition

- Represented graphically by using elements of the context model as ‘vocabulary’





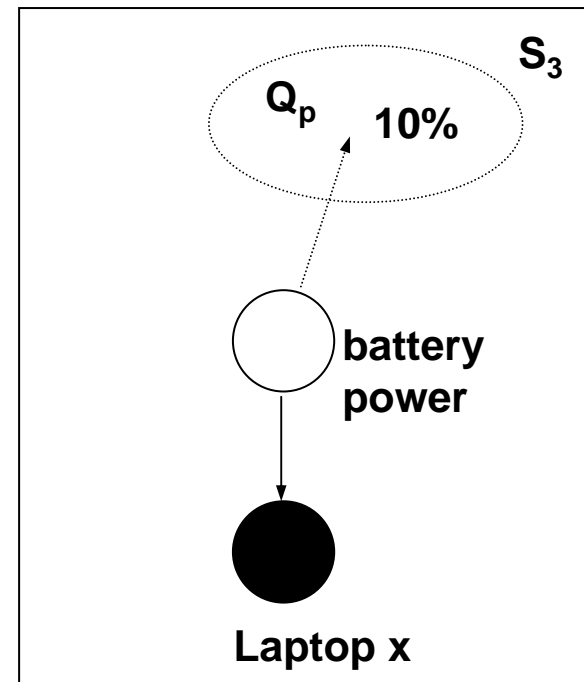
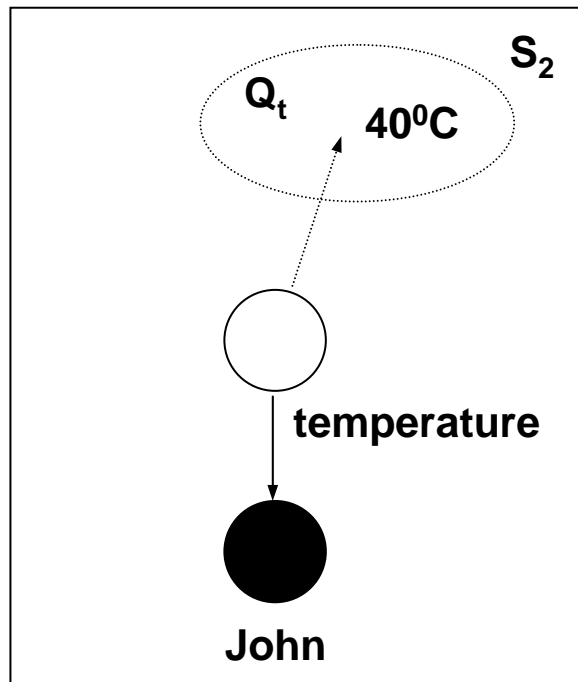
Situation Examples

We have developed a collection of situation examples involving

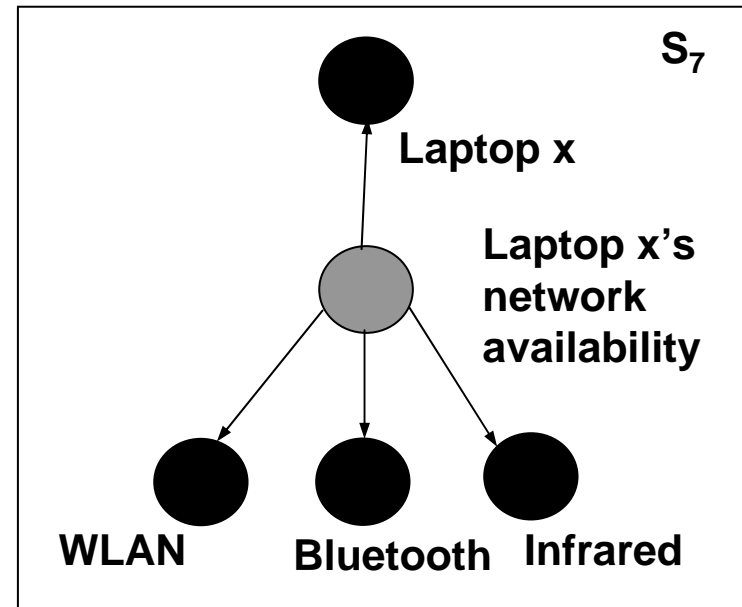
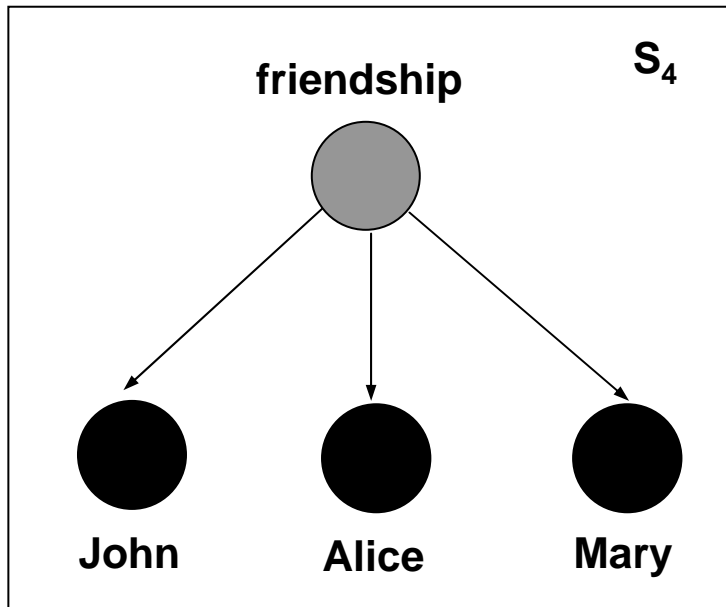
- Intrinsic context
- Relational context
- Formal relations
- Combined context categories
- Situations of situations

Only a **selection of these situations** is presented here

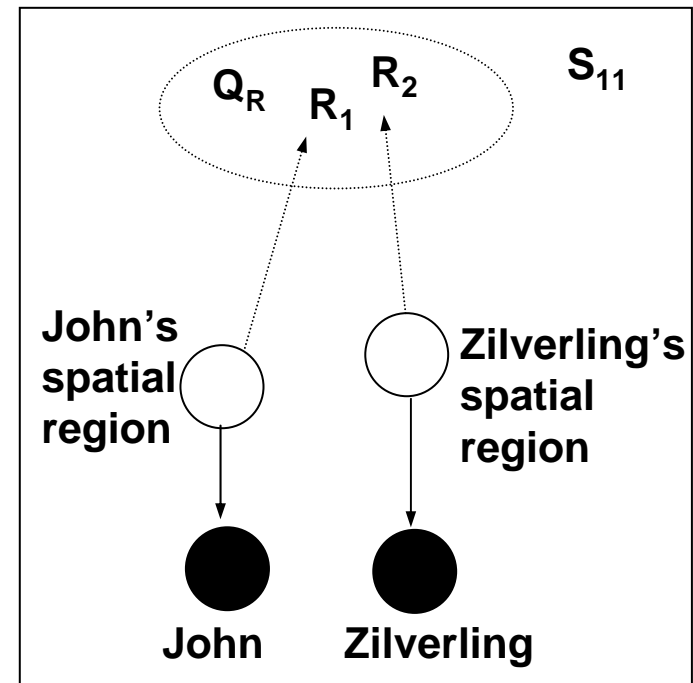
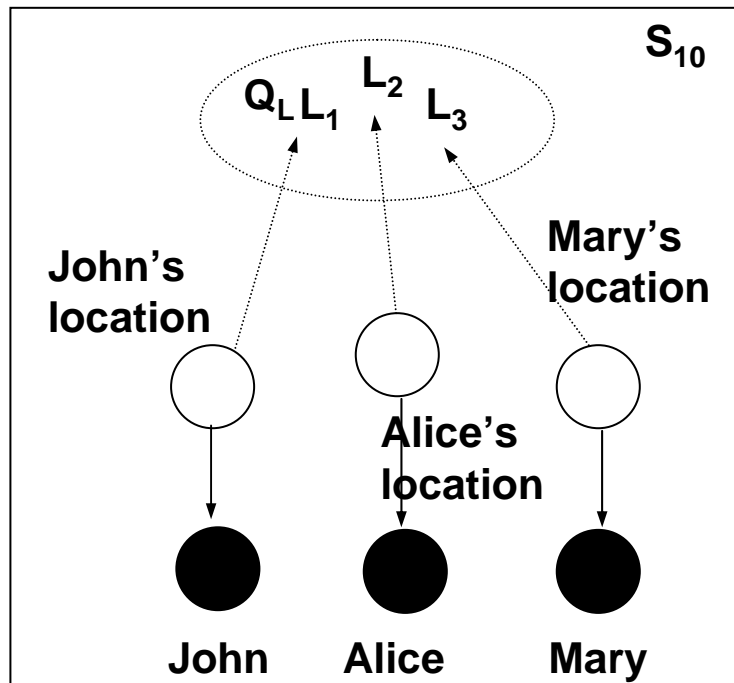
Intrinsic Context Situations



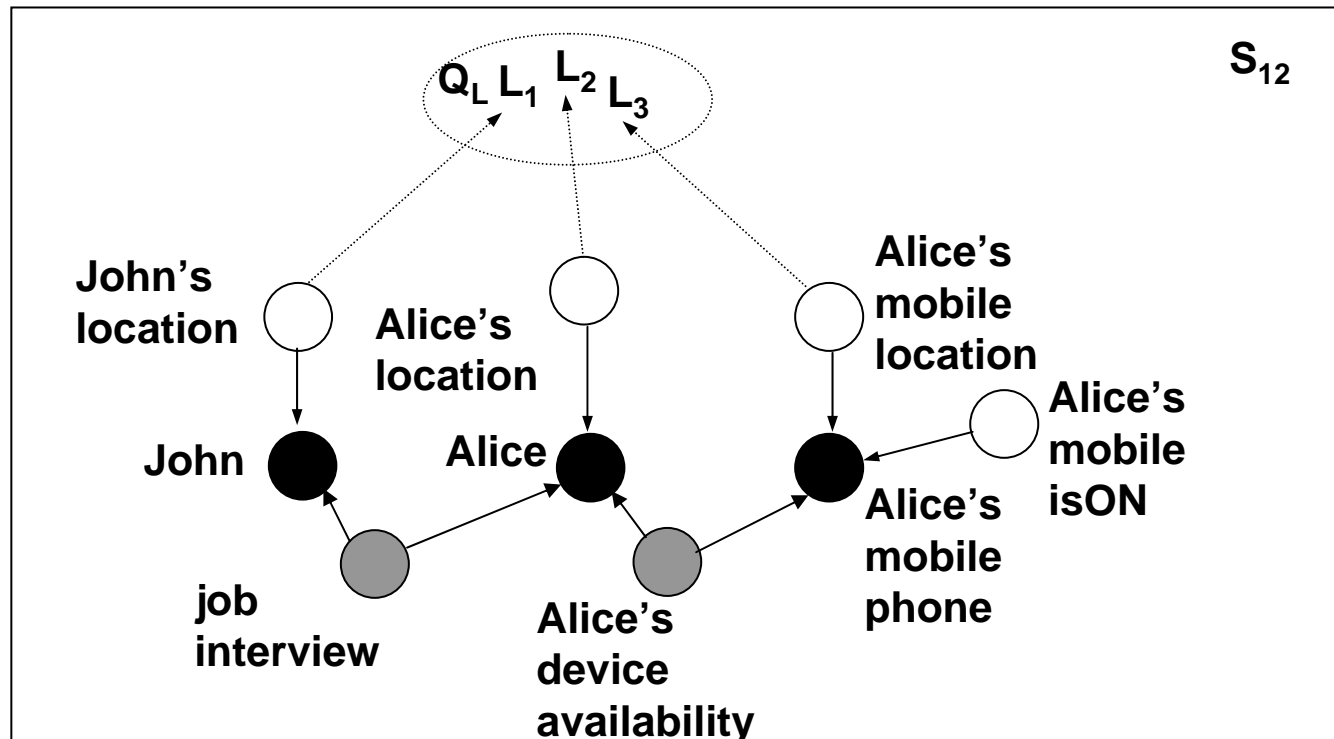
Relational Context Situations



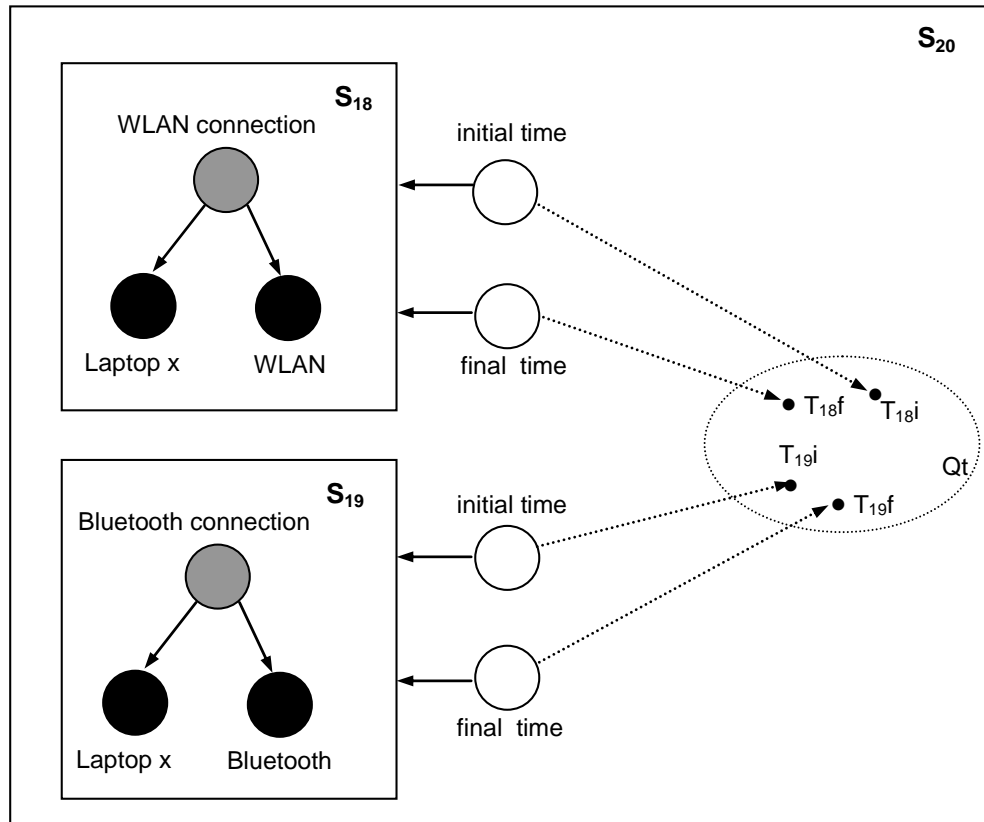
Formal Relations Situations



Combined Situations



Situations of Situations



Conclusions

- **Context models** help understanding context concepts and how they relate to each other
- Context models are static
- **Situations** allow one to define **state-of-affairs of concern** for context-aware applications
- **Behaviors** can be defined in terms of how the system evolves from situation to situation!
- Situations can be used to define **conditions that trigger a rule system**



Current Work

- Situation types using UML and OCL
- Situation reasoning using a rule-based approach (Jess language)
- Distribution of situation detection in the AWARENESS infrastructure
- Extending context models with quality of context aspects