Introducing **Situational Statements** as an integrating Data Structure for User Modeling, Context-Awareness and Resource-Adaptive Computing

(ABIS Workshop 2003, Karlsruhe, October 8th)

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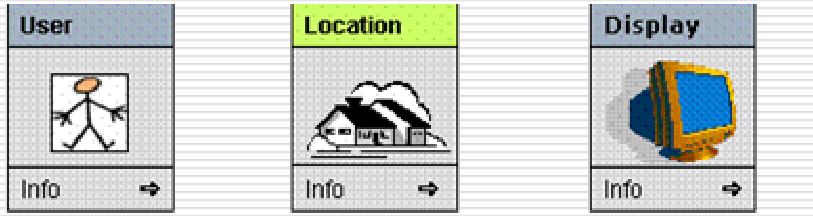
(Topic of my Thesis: „Ubiquitous User Modeling for Situated Interaction“)

Motivation (1): Uniform Data Structure

1. Property information about the object of interest is equally collected or inferred in User Modeling, Context-Awareness and Resource-Adaptive Computing.



Current Location	
Cognitive Load	high

Noise Level	medium
Weather	heavy rain

Screen Size	30“
Colours	no

2. Meta-level information like temporal-restrictions, creator, owner-of-information, evidence and confidence could be treated equally.

⇨ **Situational Statements**

(uniform, rdf-based, xml, privacy, ontology, database, supporting-tools,...)

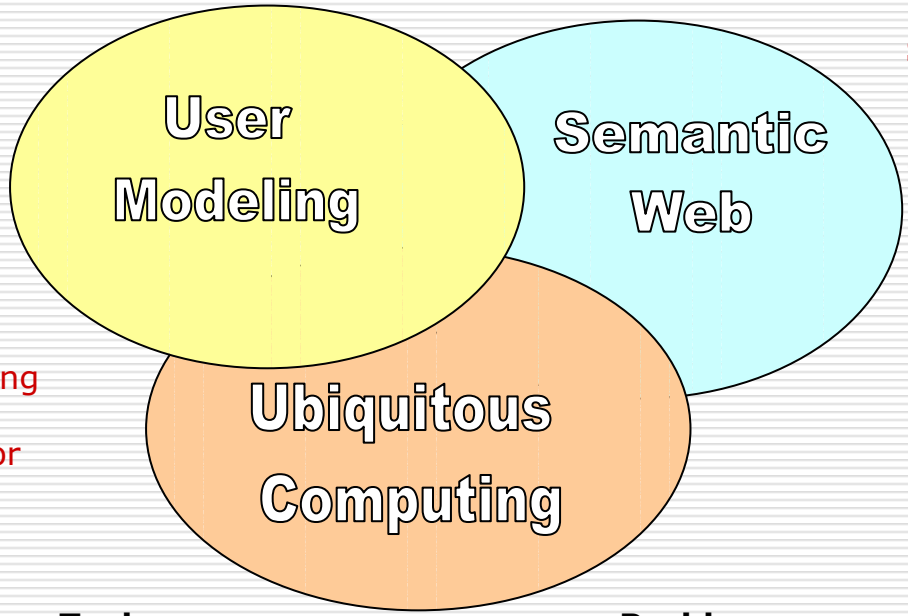
Motivation (2): Top Down Approach

New Task:
Integrating different
User/Situation-adaptive Systems

Problems:
- Representation: OIL, DAML, DAML+OIL, RDF(S), OWL
- Unique Referencing objects in an open world
- Distributed Ontologies, Distributed Knowledgebases

Problems:
- Communication
- Understanding
- Conflict Resolution
- new Privacy Issues

Solutions:
- UserML / UserQL
- SituationML / SituationQL
- UserOL & Ontology Mapping
- Strategies
- Model Inspector and Editor



Solutions:
- Automatic ontology generation
- Extended Uniform Resource Identifier System

New Task:
The mobile user interacts
with new, smart environments

(Strange) Scenarios:
The smart shoe of the user
communicates with the smart fridge
in the smart kitchen about ….

Problem:
This world only exists as prototypes,
so how can we use or test it?

Solution:
UbisWord, with the focus on
Spatial and Situational Modeling
for Simulation

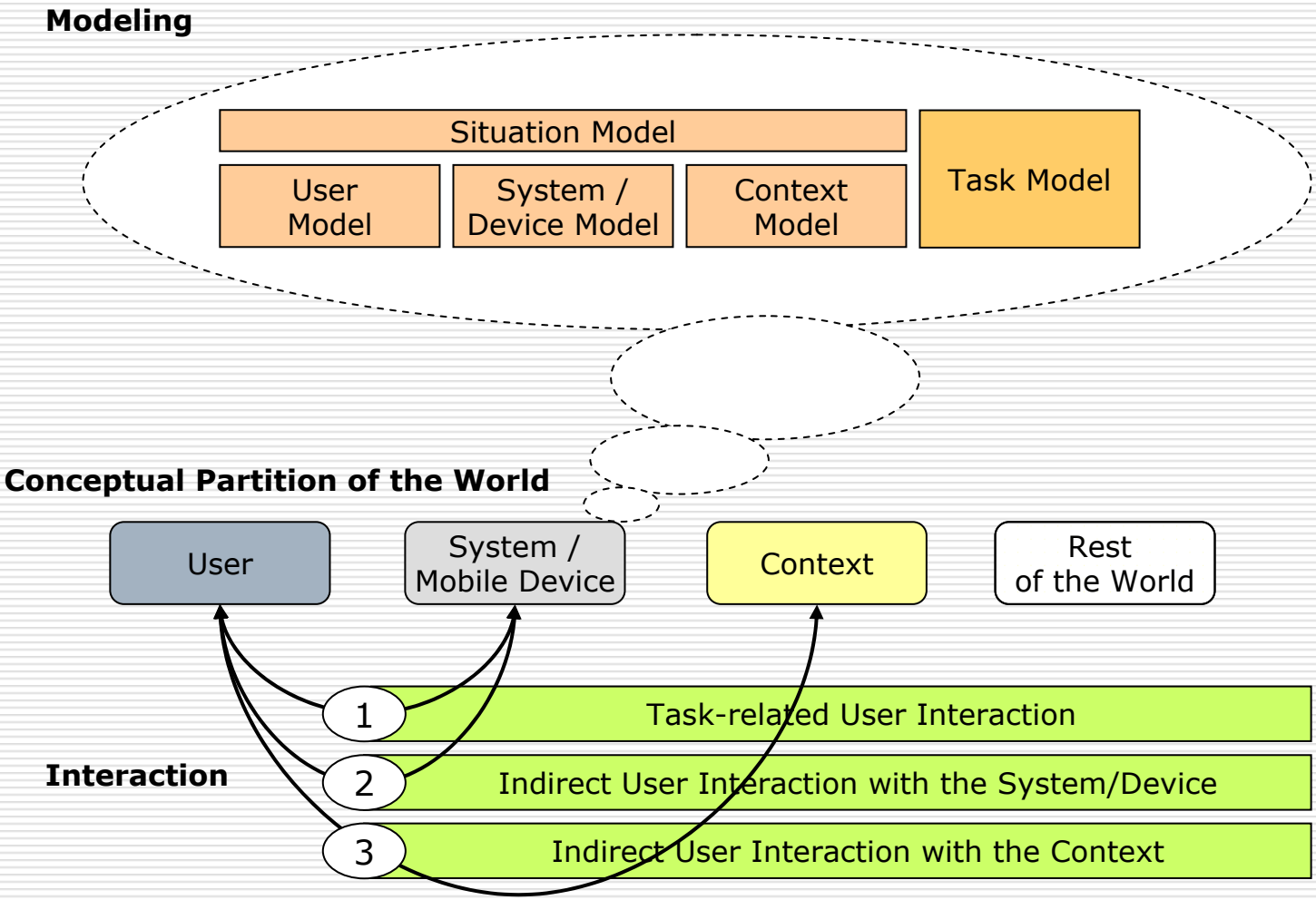
Outlook of the Talk …

1. Introduction
   - Motivation
   - Concept of Situated Interaction

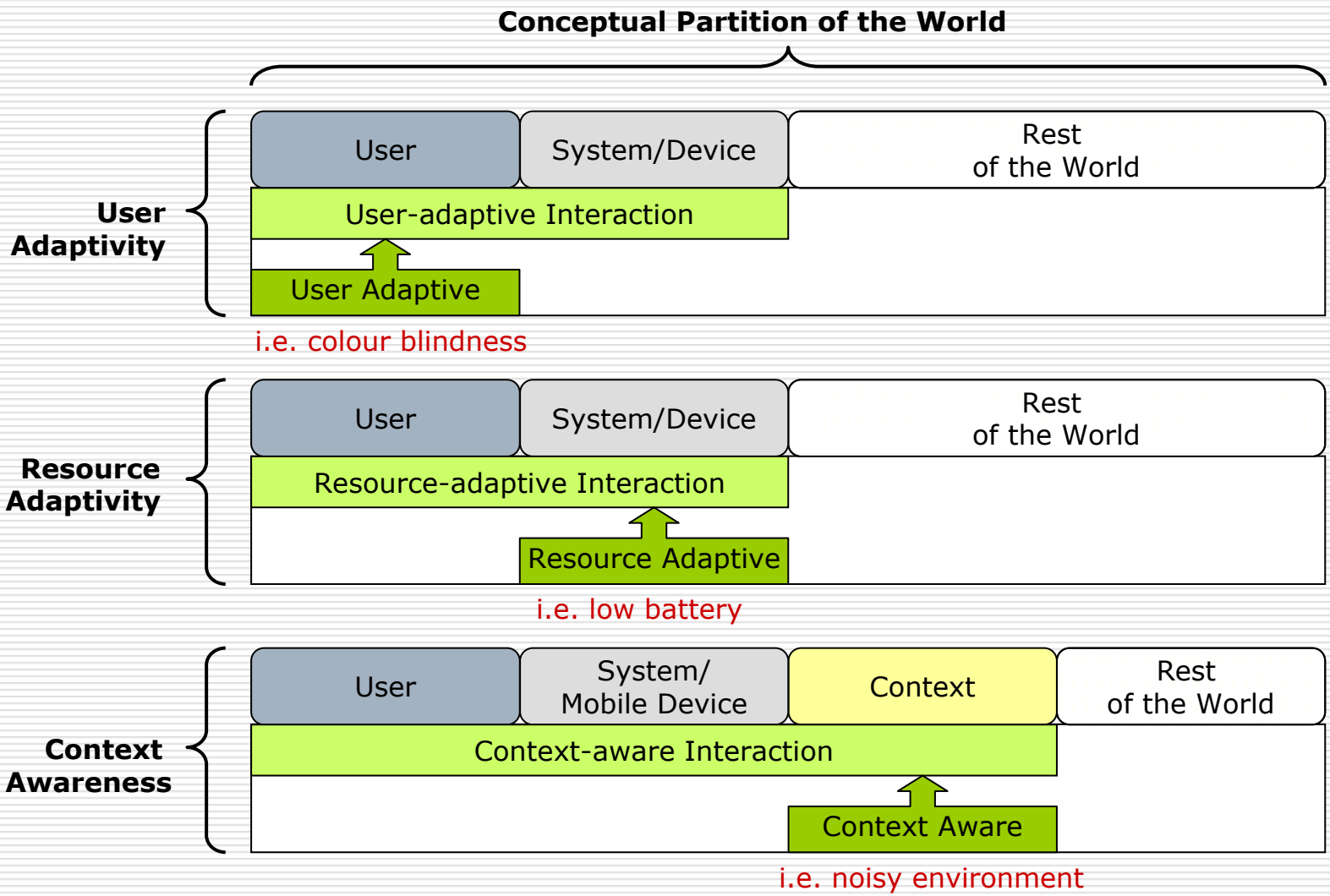
2. Situational Statements
   - RDF Triples
   - Model and Syntax of Situational Statements
   - Asking Queries to Sets of Situational Statements
   - Privacy Aspects
   - Placing Situational Statements into an Ontology

3. Appendix
   - Extended Uniform Resource Identifiers
   - UbisWorld with Ontology for User-Model-Parameter
   - SituationML Syntax Variations
   - Demo

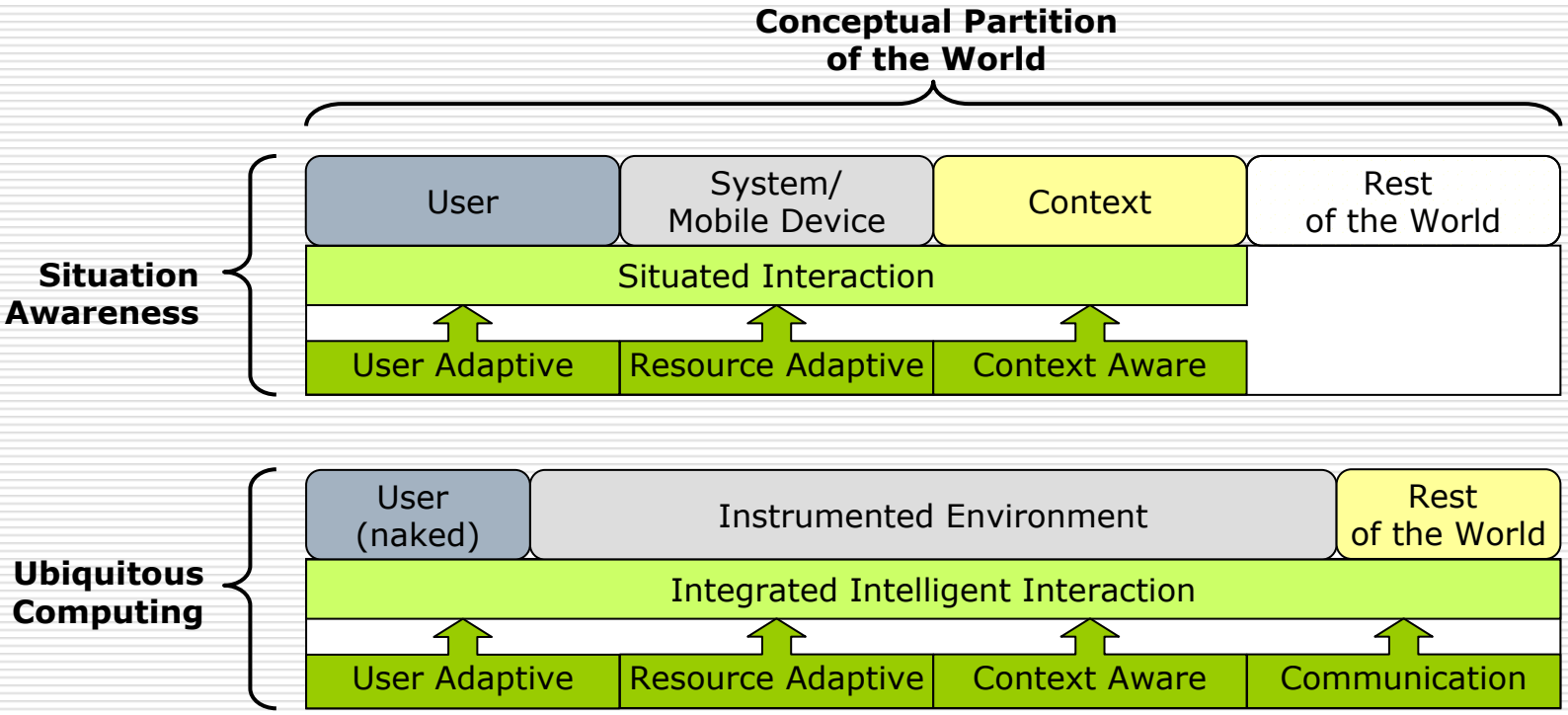
Situated Interaction



Identified Interaction Types and Conceptual Partitions of the World (1)



Interaction Types and Conceptual Partitions of the World (2)



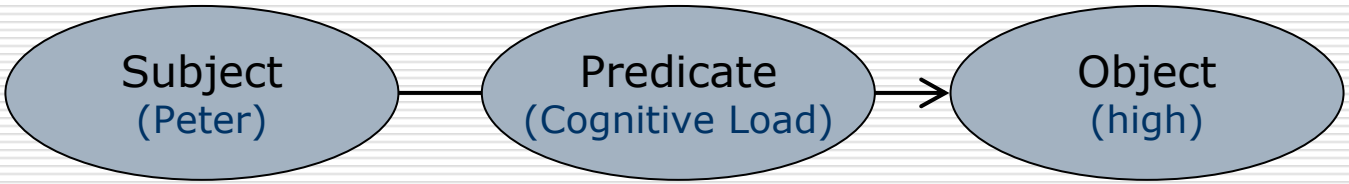
Situation/Description: Motivating Example

Situation / Description

Peter is now most probably under
"high time pressure"
because he is near the
duty-free shop of the airport,
while boarding of his flight
closes in a few minutes.
Additionally his
walkingspeed sensors report "fast-walking".
According to his privacy settings,
this information is freely available
only for preselected people and systems.

From RDF to Situational Statements

Basic RDF Triple



Situational Statement

Mainpart	Constraints	Explanation	Privacy
Subject Predicate Object Range	Start Duration Location Extent	Creator Method Evidence Confidence	Owner Access Purpose Retention

Situational Statement ⇨ RDF Graph(Reification)

Situational Statement / Box

Mainpart

Subject	=	M1
Predicate	=	M2
Object	=	M3
Range	=	M4

Constraints

Start	=	C1
Duration	=	C2
Location	=	C3
Extent	=	C4

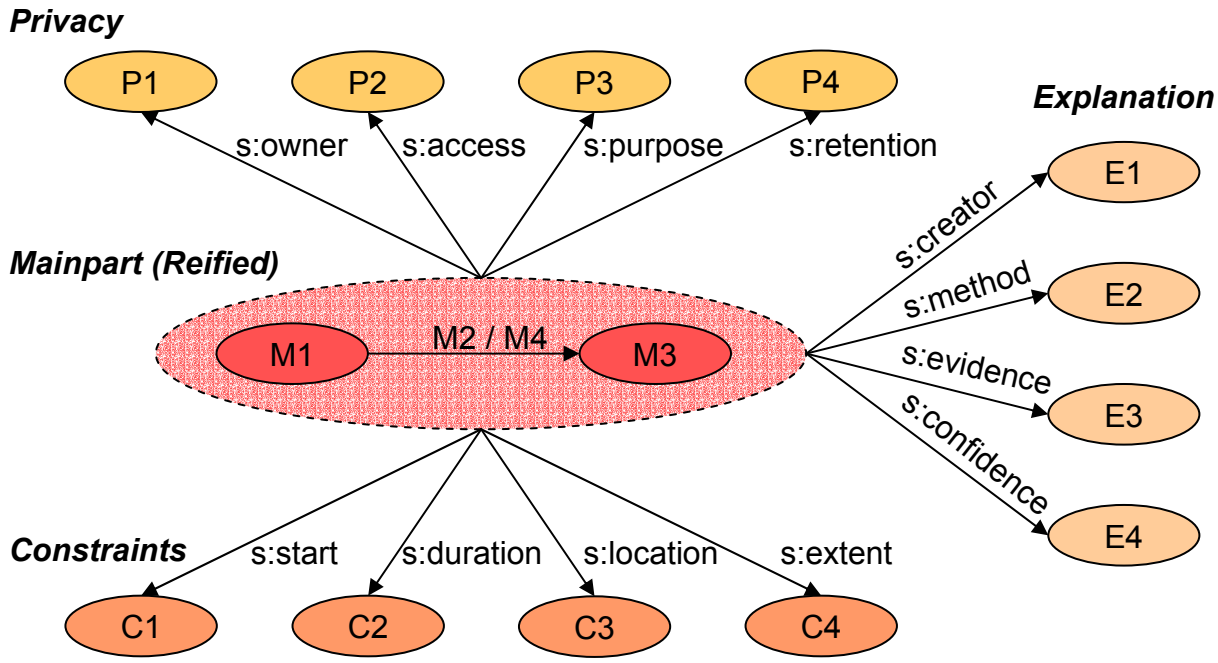
Explanation

Creator	=	E1
Method	=	E2
Evidence	=	E3
Confidence	=	E4

Privacy

Owner	=	P1
Access	=	P2
Purpose	=	P3
Retention	=	P4

Situational Statement / RDF Graph (Reification)



Namespace: s = "http://www.u2m.org/2003/situation#"

This extended RDF triple is a proper RDF graph with reification.
The reified topic is enriched with constraint, privacy and explanation.

Situational Statement ⇨ RDF Graph

Situational Statement / Box

Mainpart

Subject	=	M1
Predicate	=	M2
Object	=	M3
Range	=	M4

Constraints

Start	=	C1
Duration	=	C2
Location	=	C3
Extent	=	C4

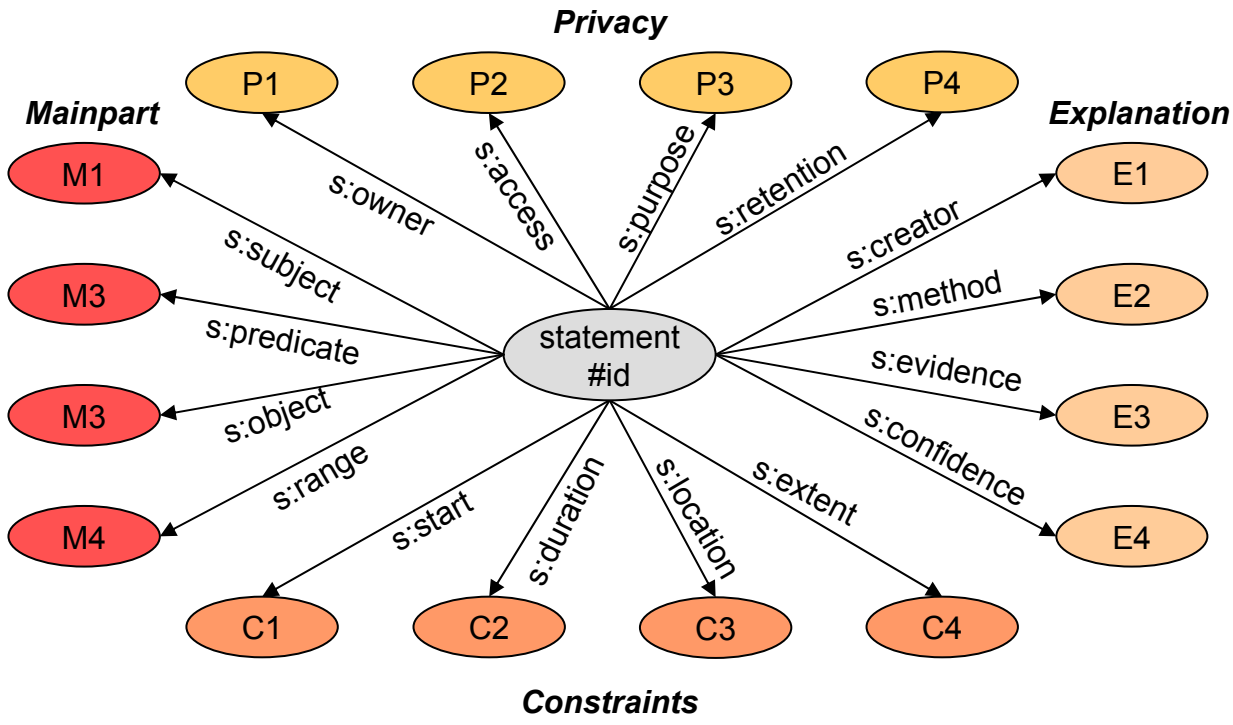
Explanation

Creator	=	E1
Method	=	E2
Evidence	=	E3
Confidence	=	E4

Privacy

Owner	=	P1
Access	=	P2
Purpose	=	P3
Retention	=	P4

Situational Statement / RDF Graph



Namespace: s = "http://www.u2m.org/2003/situation#"

This extended RDF triple is a proper RDF graph with reification.
The reified topic is enriched with constraint, privacy and explanation.

Situational Statement ⇨ RDF/XML

Situational Statement / Box

Mainpart

Subject	=	M1
Predicate	=	M2
Object	=	M3
Range	=	M4

Constraints

Start	=	C1
Duration	=	C2
Location	=	C3
Extent	=	C4

Explanation

Creator	=	E1
Method	=	E2
Evidence	=	E3
Confidence	=	E4

Privacy

Owner	=	P1
Access	=	P2
Purpose	=	P3
Retention	=	P4

Situational Statement / RDF/XML

```
<rdf:RDF
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:s="http://www.u2m.org/2003/situation#"
   xml:base="http://www.u2m.org/2003/statements">

<rdf:Description rdf:ID="Statement123">
        <s:subject> M1 </s:subject>
        <s:predicate> M2 </s:predicate>
        <s:object> M3 </s:object>
        <s:range> M4 </s:range>
        <s:start> C1 </s:start>
        <s:duration> C2 </s:duration>
        <s:location> C3 </s:location>
        <s:extent> C4 </s:extent>
        <s:creator> E1 </s:creator>
        <s:method> E2 </s:method>
        <s:evidence> E3 </s:evidence>
        <s:confidence> E4 </s:confidence>
        <s:owner> P1 </s:owner>
        <s:access> P2 </s:access>
        <s:purpose> P3 </s:purpose>
        <s:retention> P4 </s:retention>
</rdf:Description>

</rdf:RDF>
```

Situational Statement ⇨ XML

Situational Statement / Box

Mainpart

Subject	=	M1
Predicate	=	M2
Object	=	M3
Range	=	M4

Constraints

Start	=	C1
Duration	=	C2
Location	=	C3
Extent	=	C4

Explanation

Creator	=	E1
Method	=	E2
Evidence	=	E3
Confidence	=	E4

Privacy

Owner	=	P1
Access	=	P2
Purpose	=	P3
Retention	=	P4

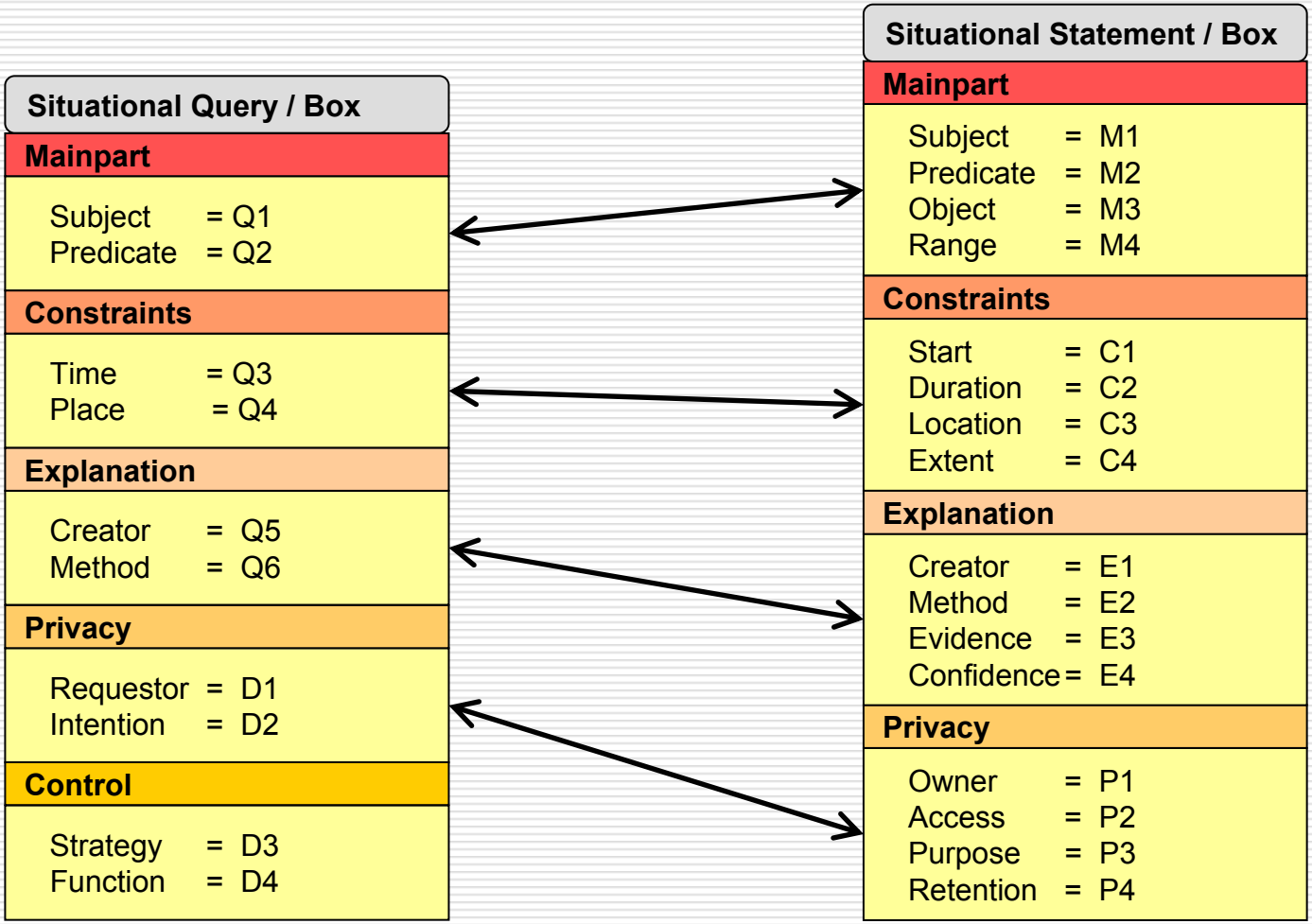
Situational Statement / XML (Min)

```
<statement  id="123"
        subject = "M1"
        predicate = "M2"
        object = "M3"
        range = "M4"
        start= "C1"
        duration = "C2"
        location = "C3"
        extent = "C4"
        creator = "E1"
        method = "E2"
        evidence = "E3"
        confidence = "E4"
        owner = "P1"
        access = "P2"
        purpose = "P3"
        retention = "P4"
/>
```

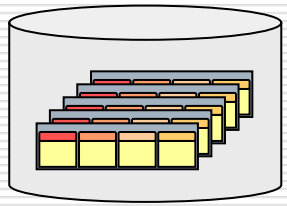
Situation / XML

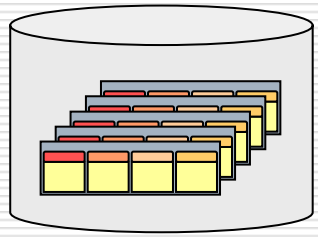
```
<situation>
    <statement .... />
    <statement .... />
    <statement .... />
    ....
</situation>
```

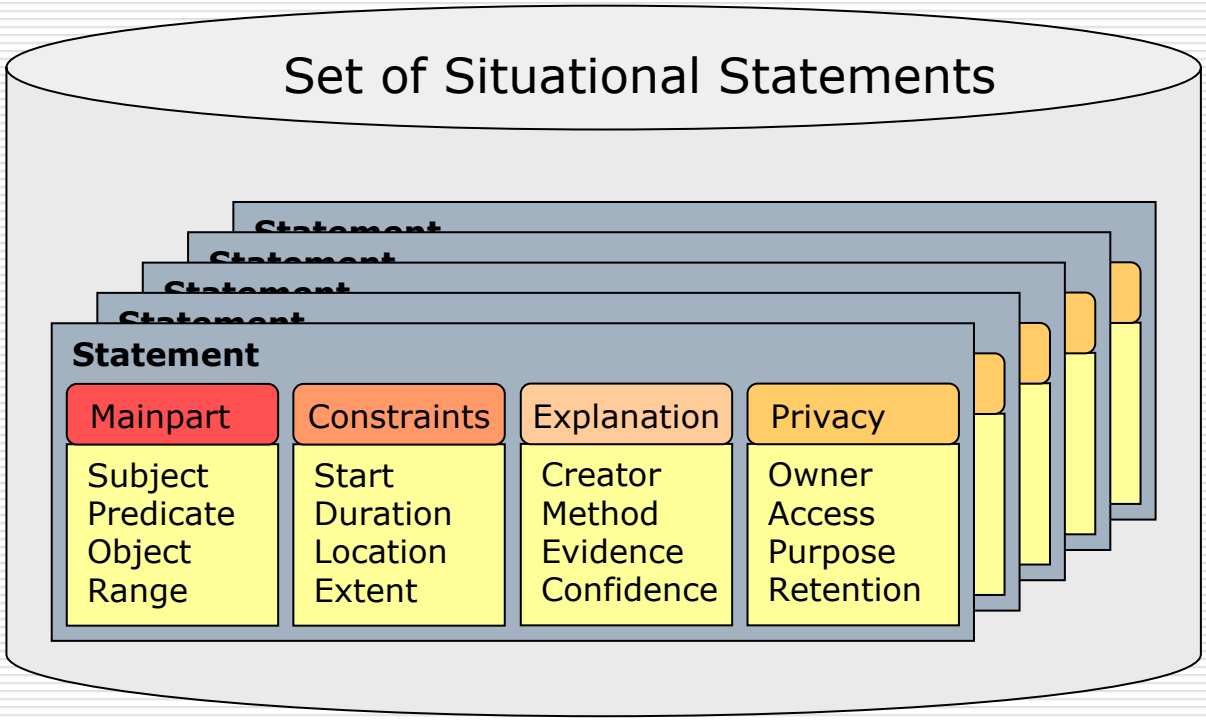
Situational Query / Situational Statement



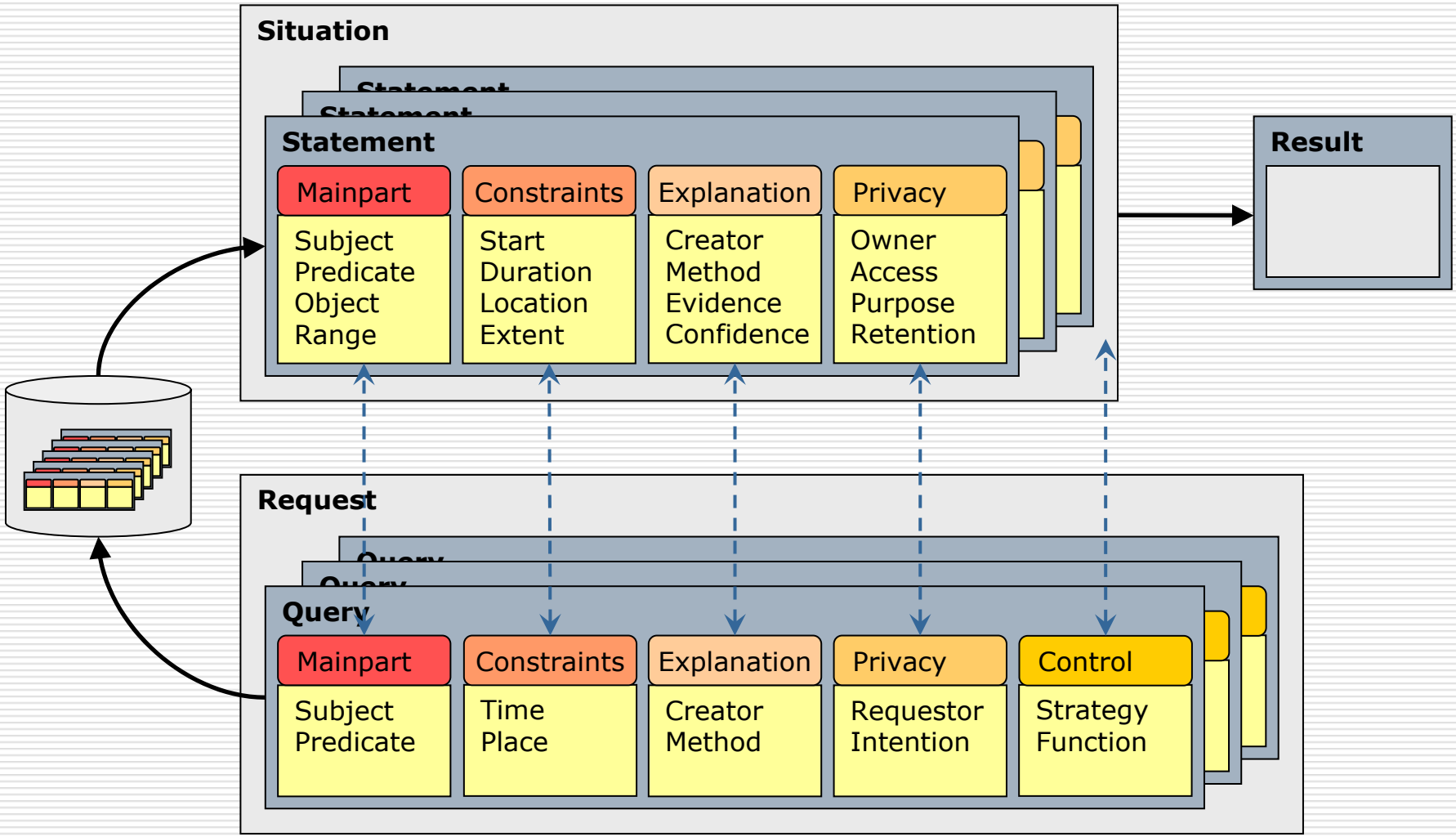
Knowledge Base: Distributed Sets of Situational Statements







Query Handling



Conflict Resolution Strategies {last-one, highest-confidence, creator-based,...}
Library Function {AVG, MAX, MIN, SUM, COUNT, DISTRIBUTION,... }

Situational Query ⇨ XML

Situational Query / Box

Mainpart

Subject = Q1
Predicate = Q2

Constraints

Time = Q3
Place = Q4

Explanation

Creator = Q5
Method = Q6

Privacy

Requestor = D1
Intention = D2

Control

Strategy = D3
Function = D4

Situational Query / XML

```
<query  id="234"
     subject = "Q1"
     predicate = "Q2"
     time = "Q3"
     place = "Q4"
     creator = "Q5"
     method = "Q6"
     requestor = "D1"
     intention = "D2"
     strategy = "D3"
     function = "D4"
/>
```

SituationQL / XML

```
<request>
     <query ... />
     <query ... />
     <query ... />
     ...
</request>
```

Privacy Aspects, embedded in SituationML and SituationQL

Representing, storing and communicating information about the user like her age, or her current blood pressure, skin conductivity or information about her interests, goals and plans needs special privacy treatment.

The most important one is that the user should be able to "control" the systems' private information handling. One point will be the *inspection* of the stored data, another point will be the possibility to *change* it.

Privacy in User Adaptive Systems

Apart from law-restrictions , there are four main arguments, (according to Kobsa) that influence the users' decisions about allowing personalization with their personal data.

1. What will be done with my personal data?
   - This question focuses on the *purpose/intention*
2. Who is going to use my personal data?
   - This question focuses on the *access* and the *recipient*
3. Which kind of personal data is used?
   - Thus a differentiation between the type of data is implied.
4. In which mood or situation is the user currently?
   - This last point suggests "user-adaptive useradaptivity"

Basic Privacy Treatment

Variables

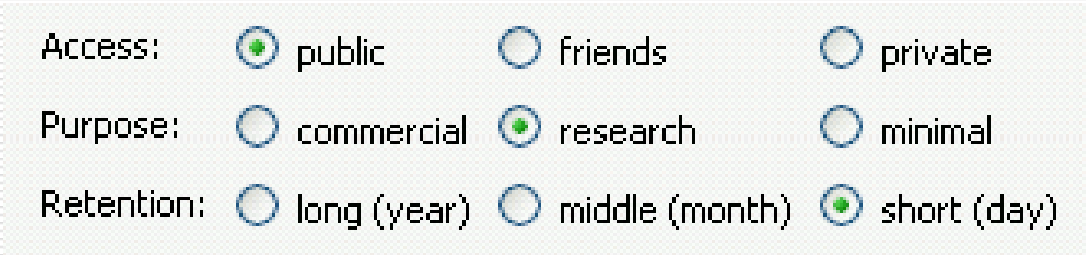
Statement

- owner
- access
- purpose
- retention

Query

- requestor
- intention

Example



"public access" means that everybody can be the recipient of this information.
"research purpose" means that this information should not be used for commercial purposes, but only for research issues.
"short retention" means that this information must be deleted within days.

User Model & Privacy Editor

ID - 200006

Joerg (Instance of class: Human)

Date & Time: [22.07.2003, 15:10:25] (now | 1 hour ago | 1 day ago)
Change view to: (XML | HTML)
Personalized view for: joerg

Current Goals (Joerg)

☑ Task 1 ☑ Task 2 ☐ Task 3 ☐ Task 4 ☐ Task 5

Temporal Restrictions: [Today, 15:08:05 | Today, 15:14:05]
Owner-Access-Purpose-Retention: Joerg - friends - research - middle
Evidence-Confidence: 1000040 - 0.00 Viewer: Joerg

manual change

Access: ○ public ◉ friends ○ pri
Purpose: ○ commercial ◉ research ○ mir
Retention: ○ long (year) ◉ middle (month) ○ sh

Blood Pressure (Joerg)

○ low ○ medium ◉ high

Temporal Restrictions: [Today, 15:10:15 | Today, 15:16:15]
Owner-Access-Purpose-Retention: Joerg - public - research - short
Evidence-Confidence: 1000040 - 0.75 Viewer: Joerg

manual change

Access: ○ public ○ friends ◉ pri
Purpose: ○ commercial ◉ research ○ mir
Retention: ◉ long (year) ○ middle (month) ○ sh

Physical Location (Joerg)

Instrumentierte Umgebung / WW-Floor / Building 36 /

Temporal Restrictions: [20.07.2003, 21:21:10 | 20.07.2003, 21:27:10] **Expired**
Owner-Access-Purpose-Retention: Joerg - public - research - short
Evidence-Confidence: 0 - 1.00 Viewer: Joerg

manual change

Access: ◉ public ○ friends ○ private
Purpose: ○ commercial ◉ research ○ minimal
Retention: ○ long (year) ○ middle (month) ◉ short (day)

Adapted View:

ID - 200006

Joerg (Instance of class: Human)

Date & Time: [22.07.2003, 15:30:41] (now | 1 hour ago | 1 day ago)
Change view to: (XML | HTML)

Current Goals (Joerg)

This information is not public.

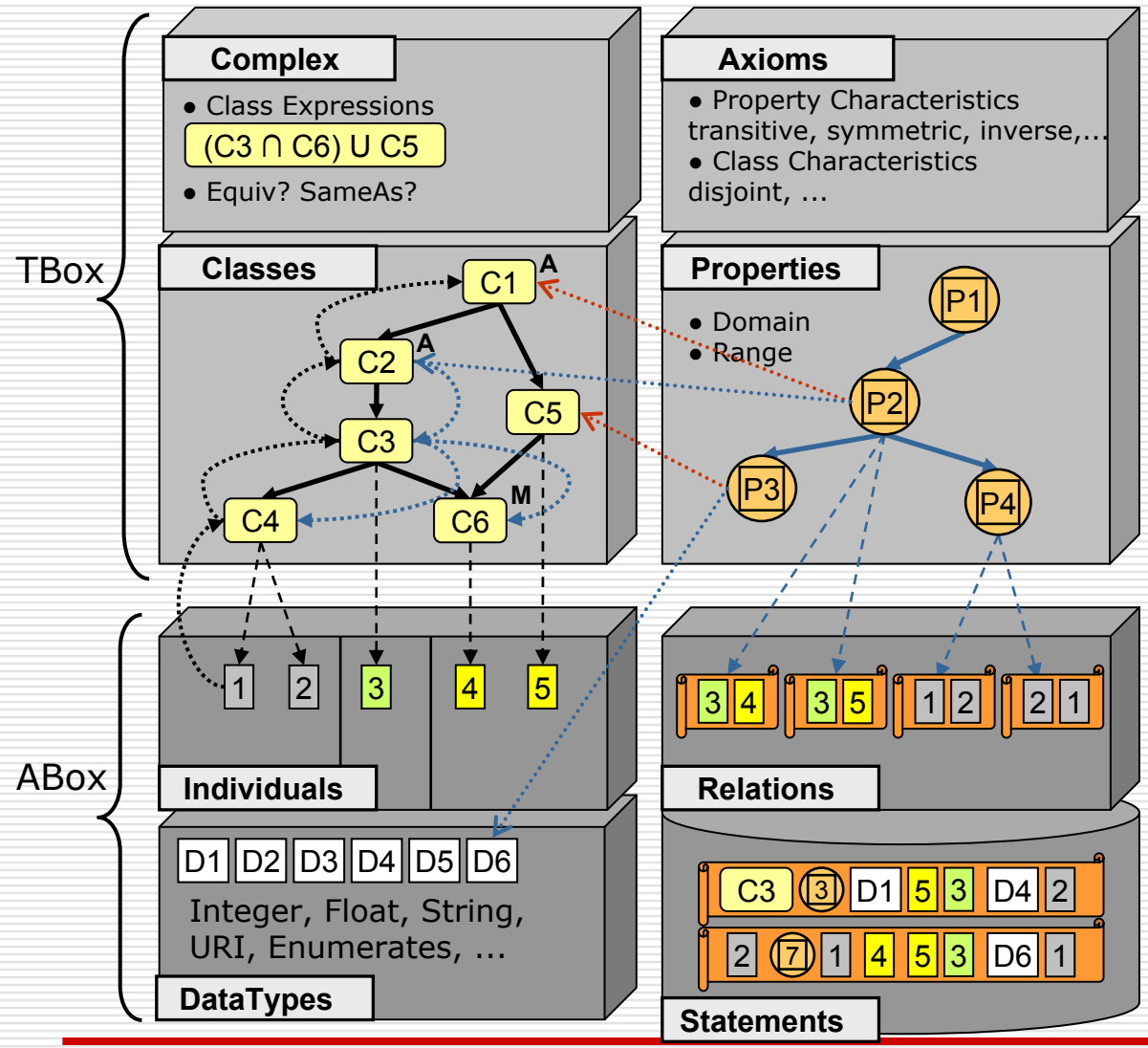
Temporal Restrictions: [Today, 15:26:40 | Today, 15:32:40]
Owner-Access-Purpose-Retention: Joerg - friends - research - middle
Evidence-Confidence: 1000040 - 0.00 Viewer: Anonym

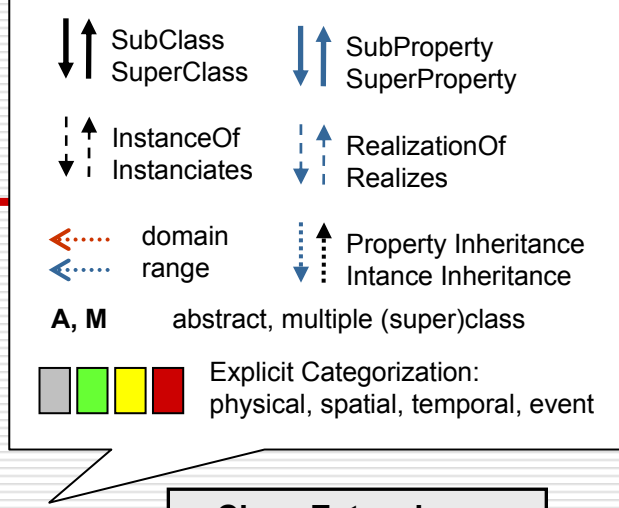
Physical Location (Joerg)

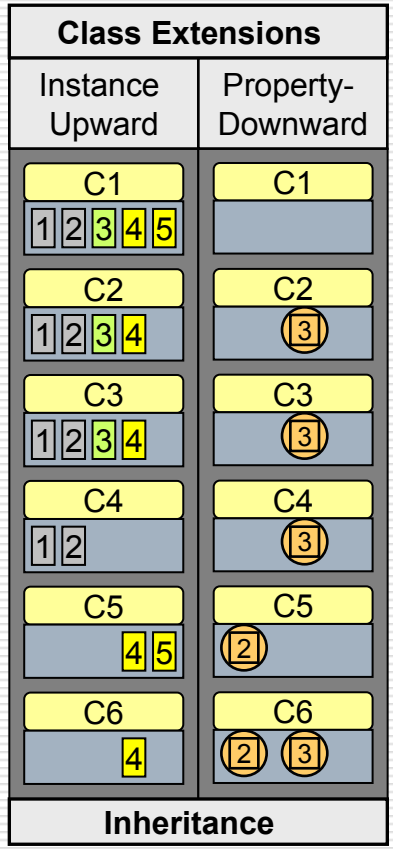
Instrumentierte Umgebung / WW-Floor / Building 36 /

Temporal Restrictions: [20.07.2003, 21:21:10 | 20.07.2003, 21:27:10] **Expired**
Owner-Access-Purpose-Retention: Joerg - public - research - short
Evidence-Confidence: 0 - 1.00 Viewer: Anonym

Placing Situational Statements into the Rest of the Ontology







Summary of the Talk …

1. Introduction
   - Motivation
   - Concept of Situated Interaction

2. Situational Statements
   - RDF Triples
   - Model and Syntax of Situational Statements
   - Asking Queries to Sets of Situational Statements
   - Privacy Aspects
   - Placing SituationalStatements into an Ontology

3. Appendix
   - Extended Uniform Resource Identifiers
   - UbisWorld with Ontology for User-Model-Parameter
   - SituationML Syntax Variations
   - Demo

Appendix 1:
Extended Uniform Resource Identifiers (URI)

Extended URIs from Semantic Web

denotes

Professor Wahlster — Local Name

unique identifier

http://w5.cs.uni-sb.de/people#30719 — URI (with Personal Number)

unique identifier reference

UniSB:30719 — URIref (with Namespace)

labelled unique identifier reference

Professor Wahlster (UniSB#30719) — URI.extended

labelled based unique identifier reference

Professor Wahlster (#30719) — URI.extended.base

labelled based mapped unique identifier reference

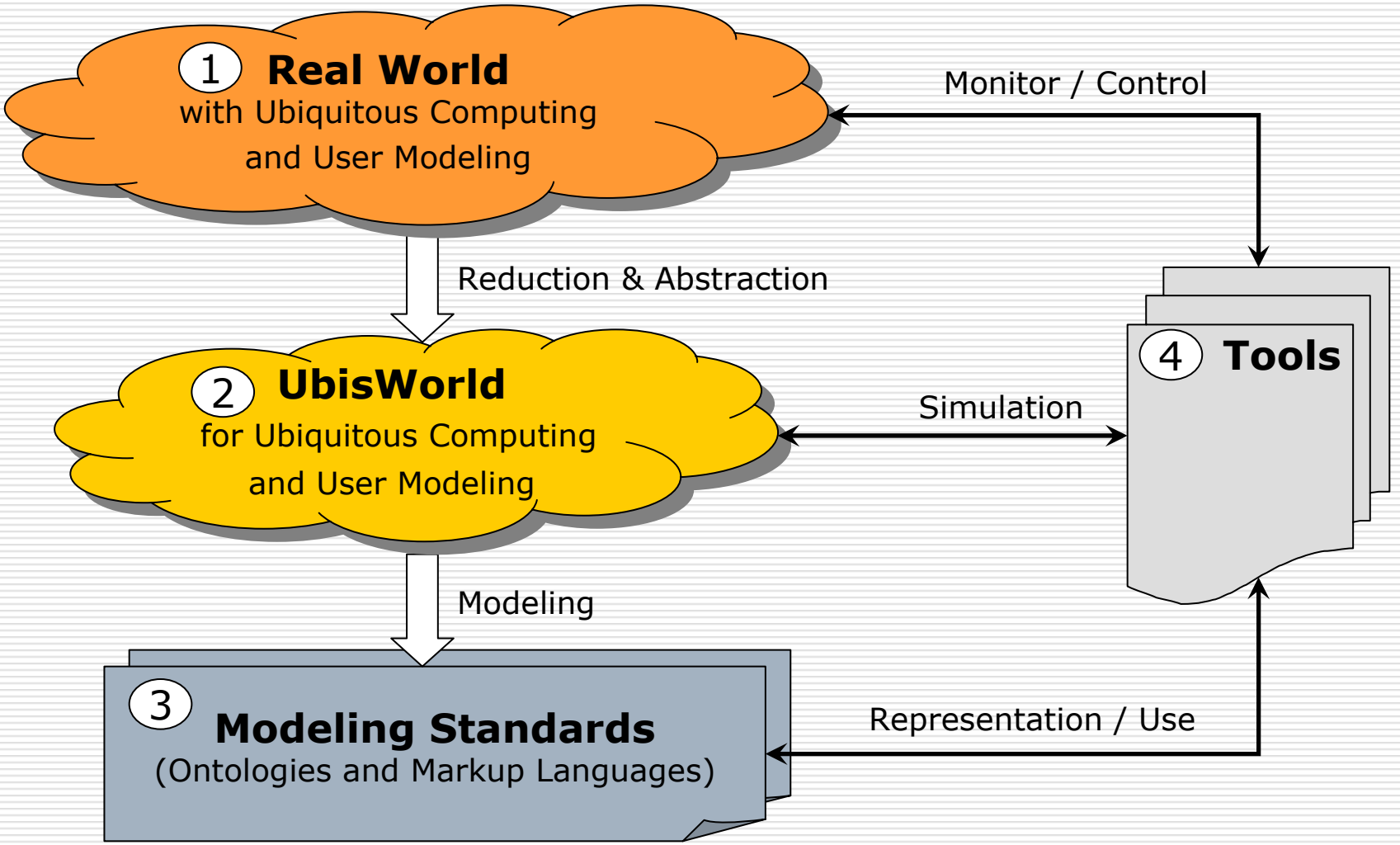
Professor Wahlster — URI.extended.base.mapped

Identifiers

- Motivating Problem:
  - distributed ontological knowledge
  - distributed data sets by different creators
- Two different Systems talk about the age of a user
  - range 1 i.e. {kid, teenager, adult, elderly}
  - range 2 i.e. {1,2,3,4,5,…}
- We need (world-wide) unique identifiers for
  - concepts
  - objects
- These identifiers should also be
  - human readable

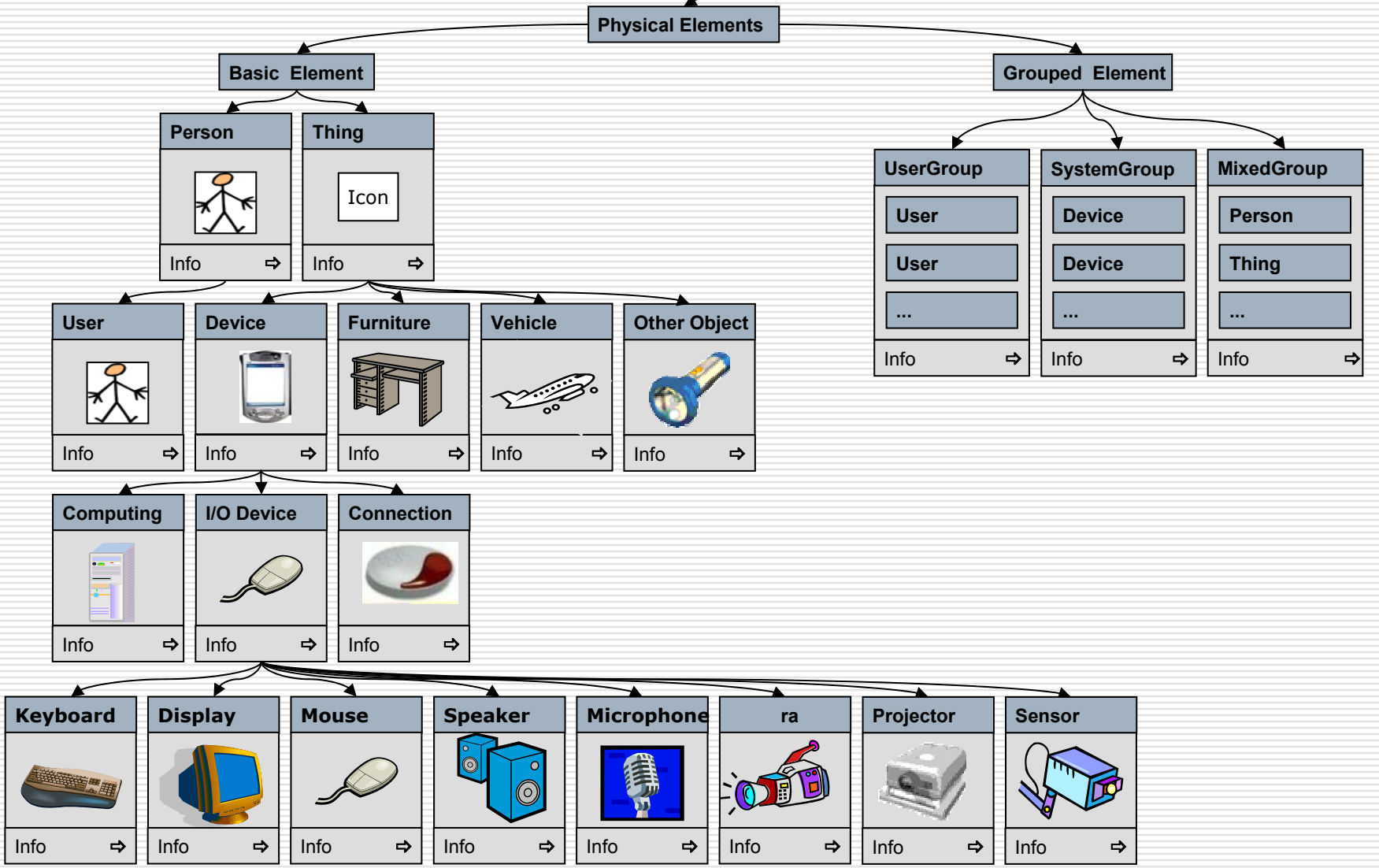
Appendix 2: UbisWorld

From Real World to UbisWorld



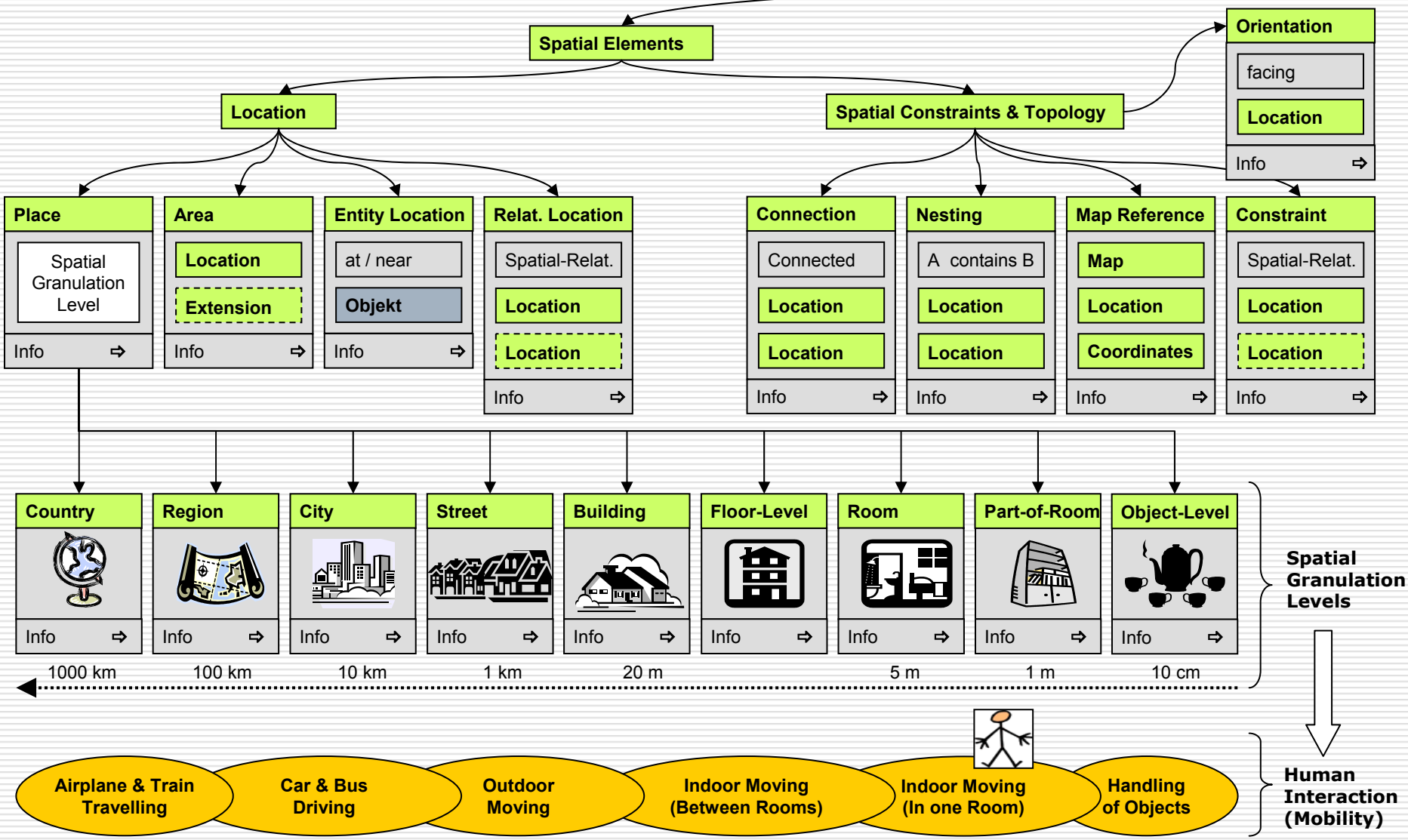
2 Ubis World

Elements of the Mini-World



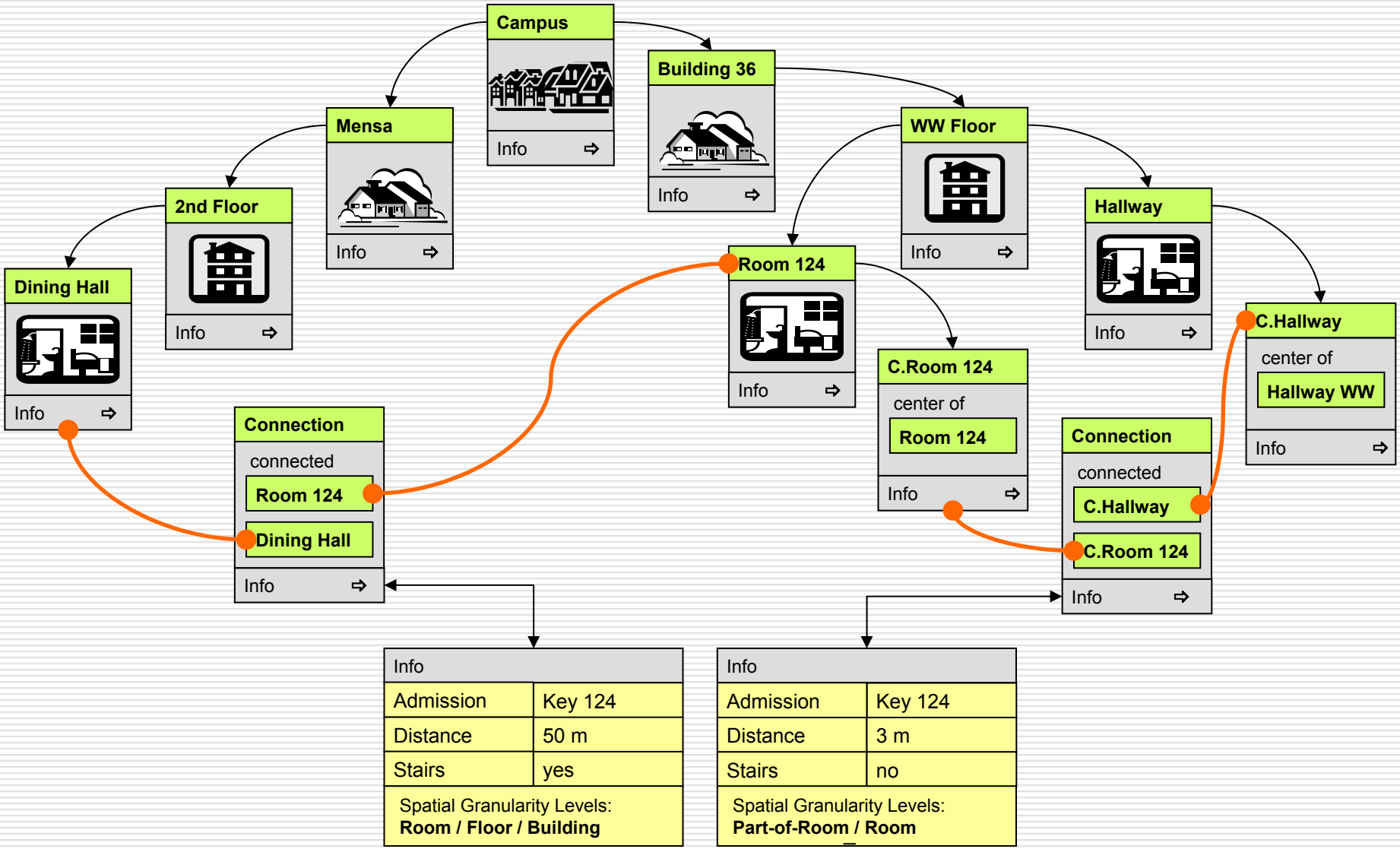
2 Ubis World

Qualitative Spatial Elements



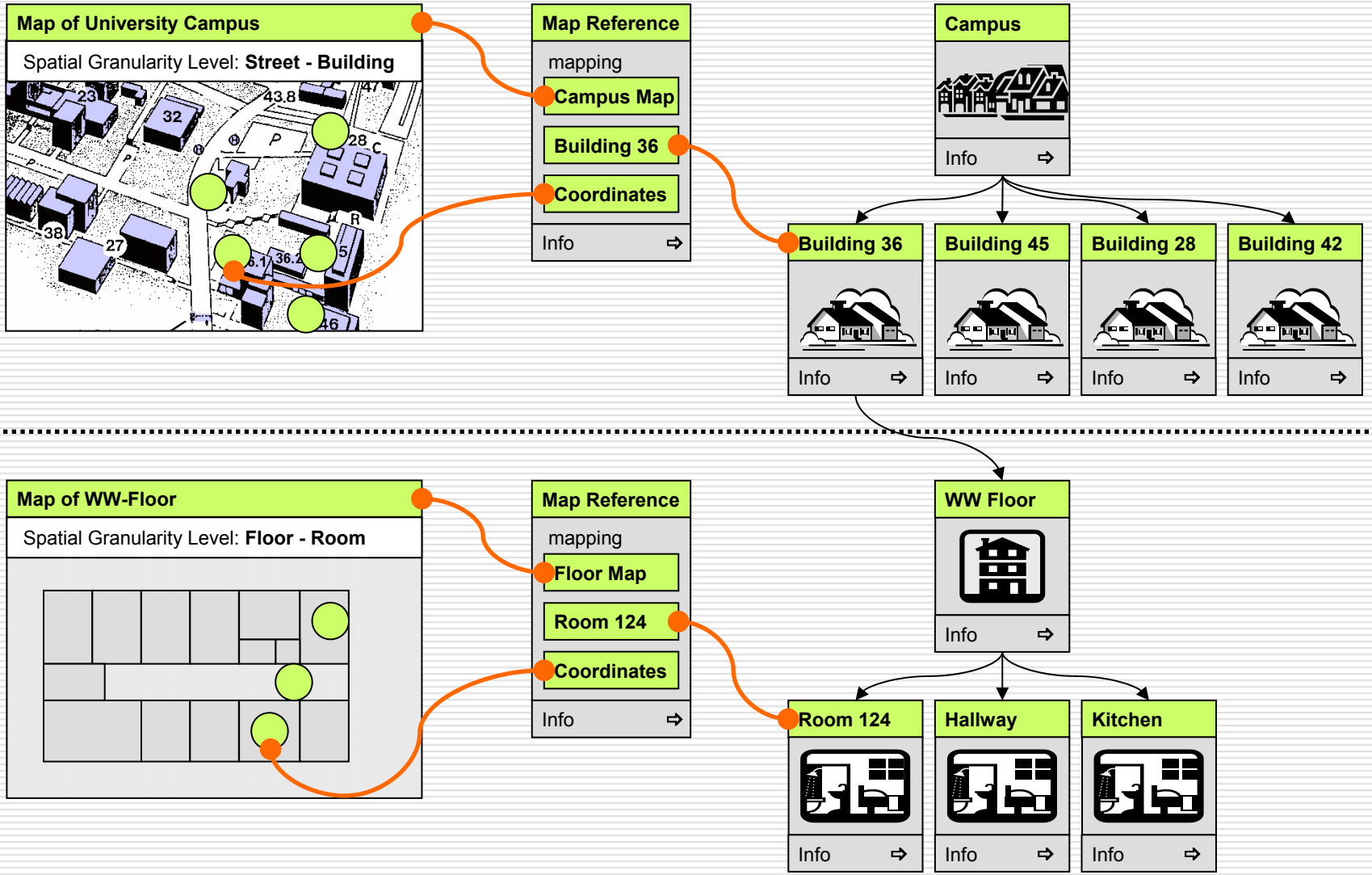
2 Ubis World

Topology: Nesting and Connections

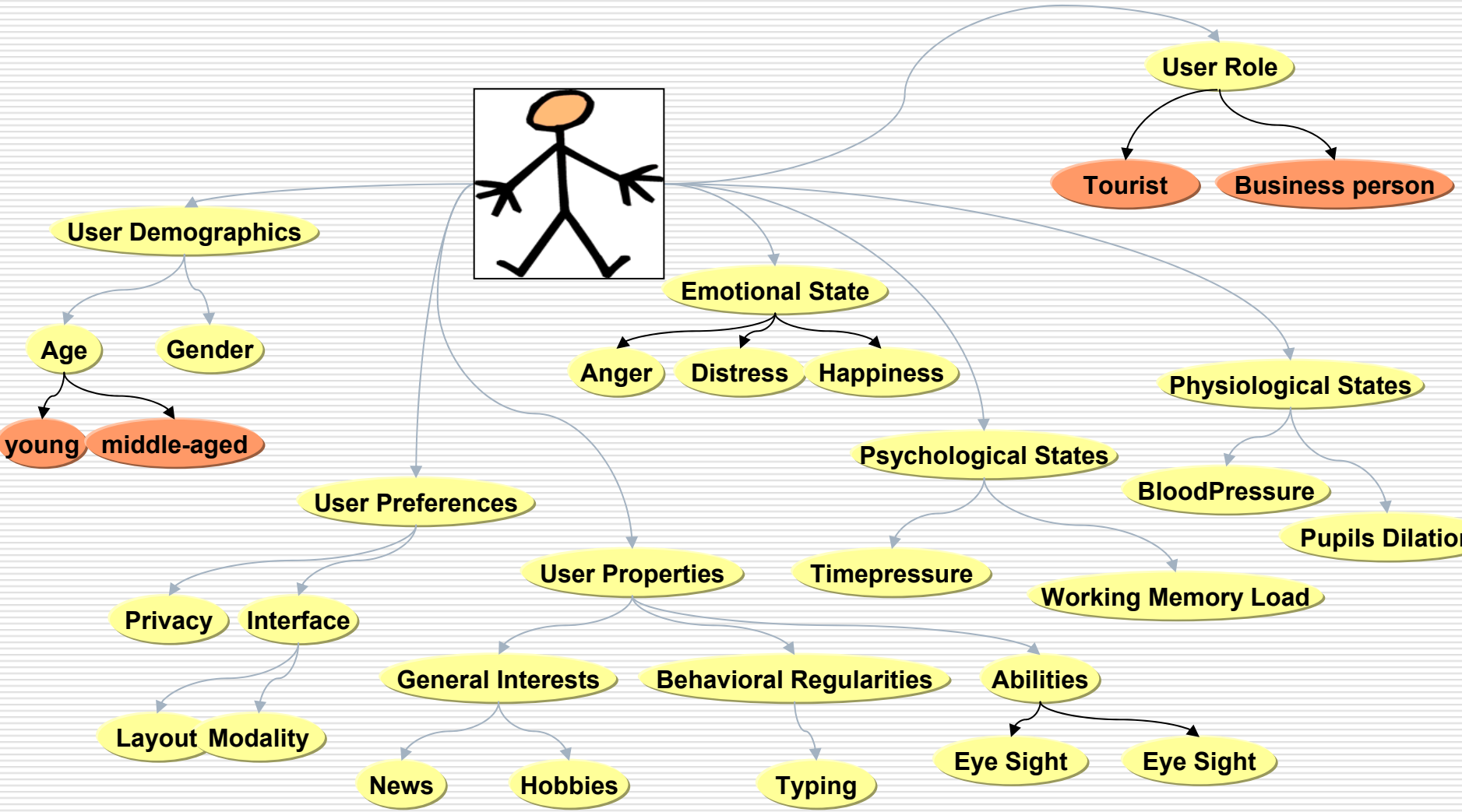


2 Ubis World

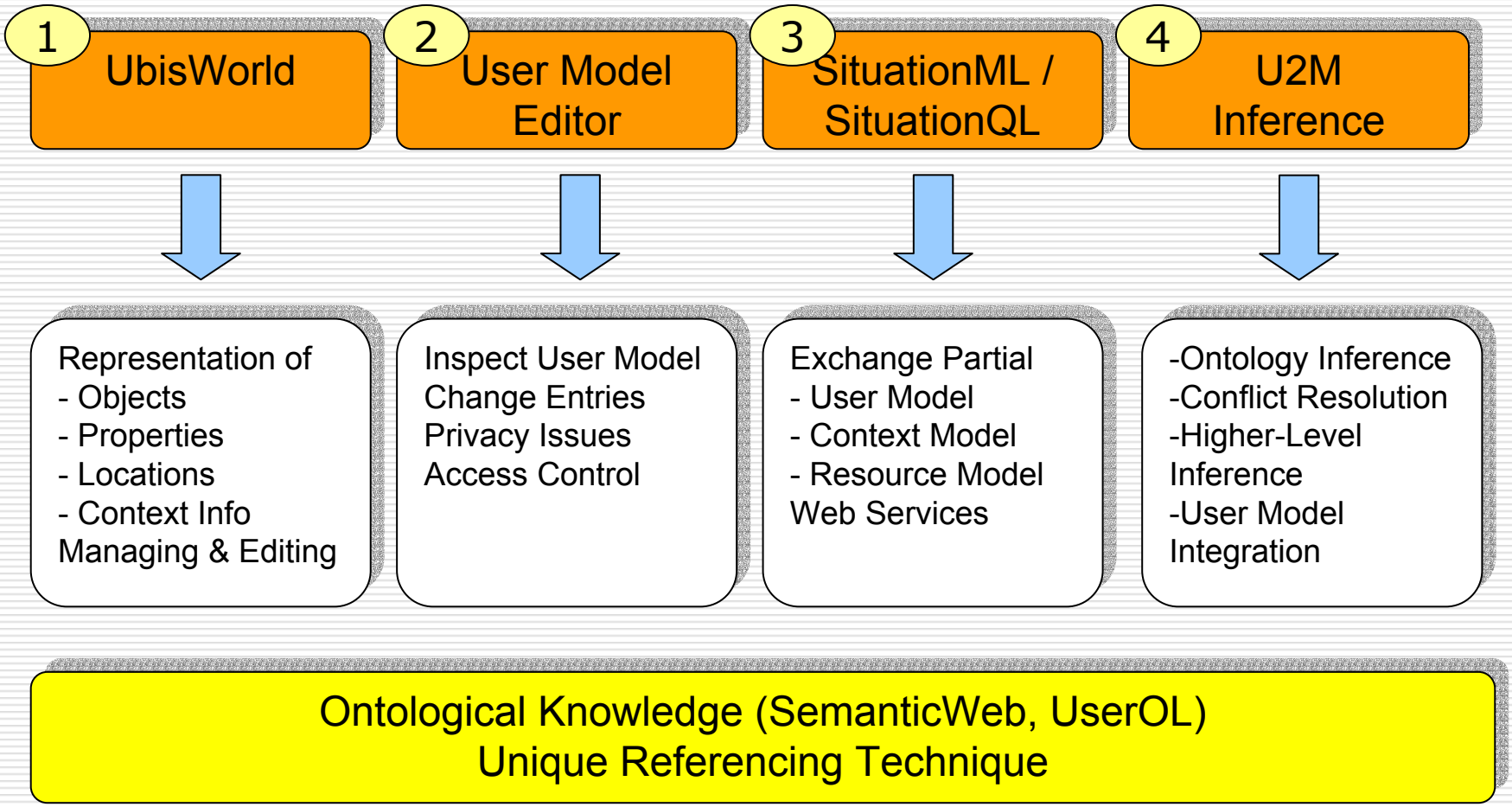
Map-Referencing in the Mini-World



User Properties / Parameters

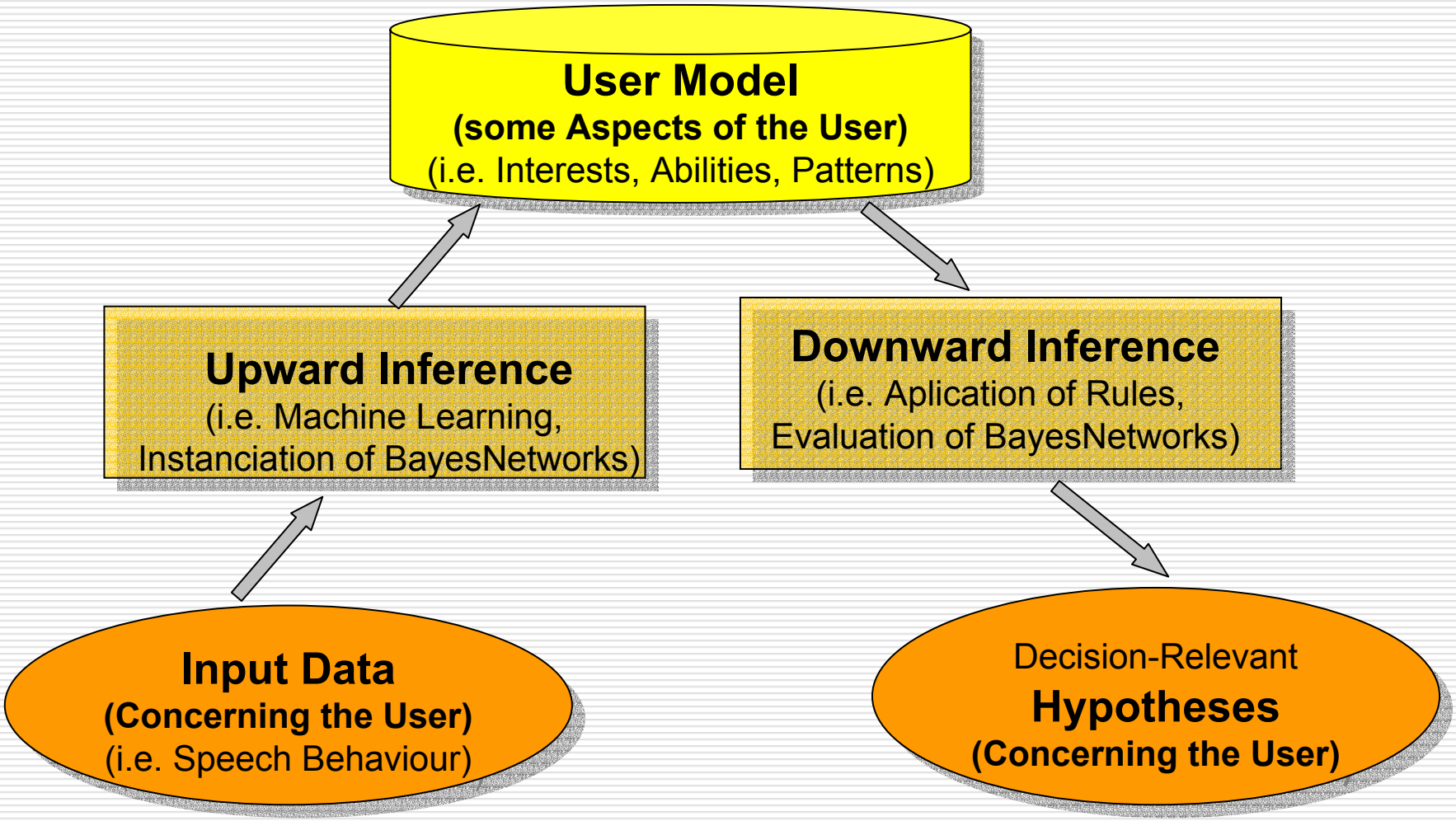


Conceptual Overview …… over the Modules

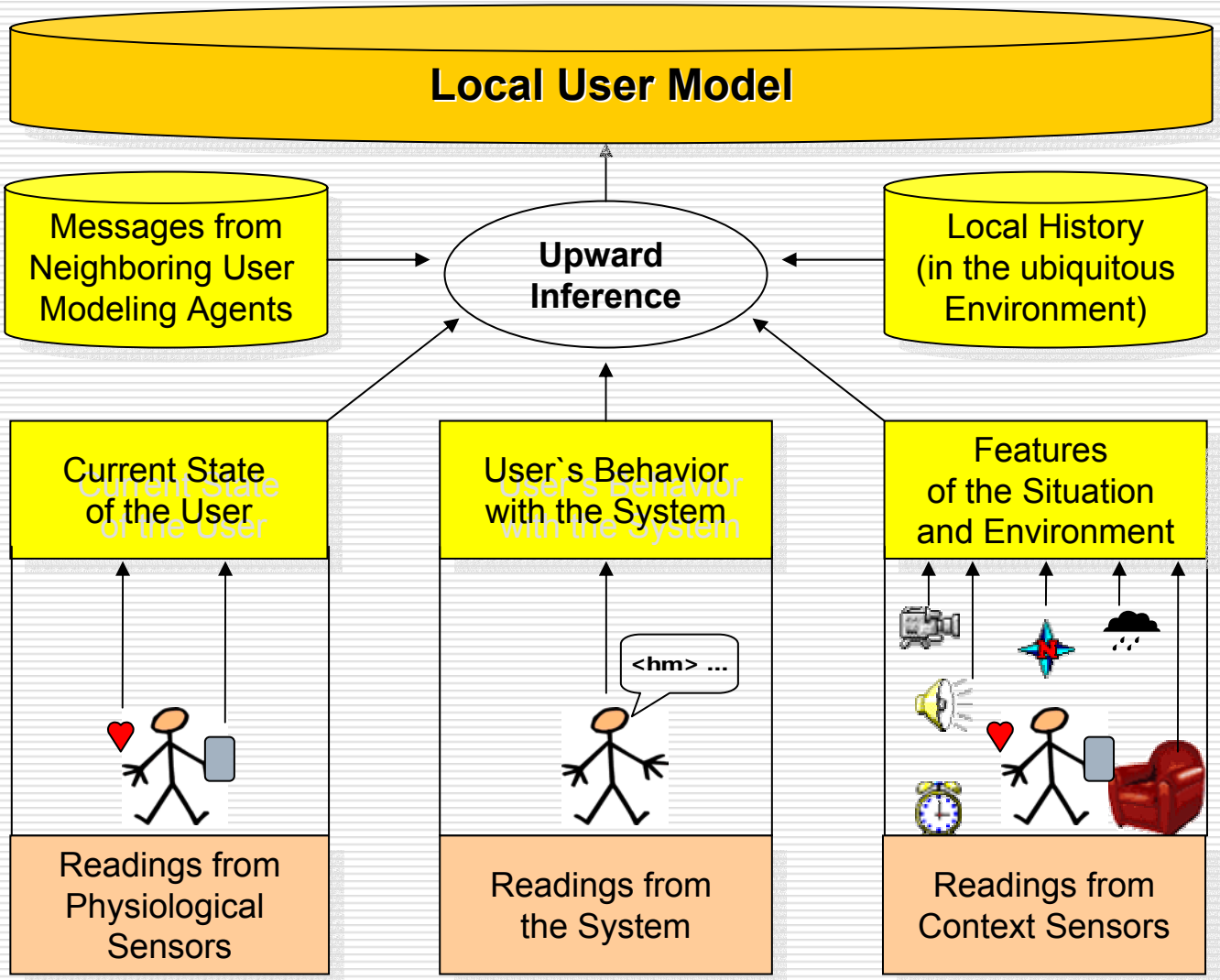


Appendix 3: User Modeling

General Schema of User Modeling

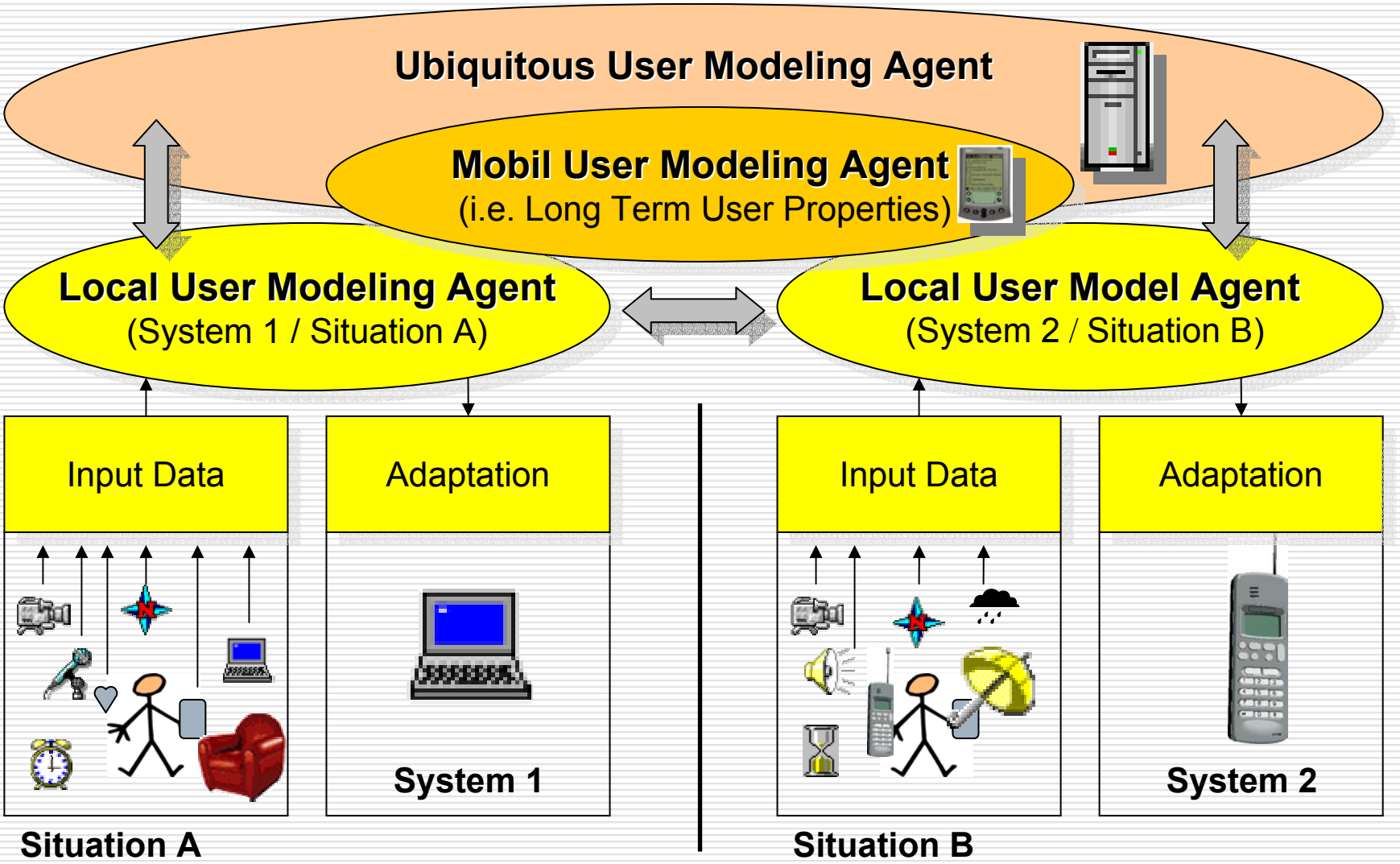


Enhanced Input Data for Upward Inference



1

Architechture of the "Ubiquitous User Modeling for Situated Interaction"



Appendix 4: Syntax Variation

Syntax Variation ⇨ XML (Max/Mix/Min)

Situational Statement / XML (Max)

```
<statement  id="123">
    <mainpart>
        <subject> M1 </subject>
        <predicate> M2 </predicate>
        <object> M3 </object>
        <range> M4 </range>
    </mainpart>
    <constraints>
        <start> C1 </start>
        <duration> C2 </duration>
        <location> C3 </location>
        <extent> C4 </extent>
    </constraints>
    <explanation>
        <creator> E1 </owner>
        <method> E2 </privacy>
        <evidence> E3 </evidence>
        <confidence> E4 </confidence>
    </explanation>
    <privacy>
        <owner> P1 </owner>
        <access> P2 </access>
        <purpose> P3 </purpose>
        <retention> P4 </retention>
    </privacy>
</statemtent>
```

Situational Statement / XML (Mix)

```
<statement  id="123" >
        <mainpart
                subject = "M1"
                predicate = "M2"
                object = "M3"
                range = "M4" />
        <constraints
                start= "C1"
                duration = "C2"
                location = "C3"
                extent = "C4" />
        <explanation
                creator = "E1"
                method = "E2"
                evidence = "E3"
                confidence = "E4" />
        <privacy
                owner = "P1"
                access = "P2"
                purpose = "P3"
                retention = "P4" />
</statement-mix>
```

Situational Statement / XML (Min)

```
<statement  id="123"
        subject = "M1"
        predicate = "M2"
        object = "M3"
        range = "M4"
        start= "C1"
        duration = "C2"
        location = "C3"
        extent = "C4"
        creator = "E1"
        method = "E2"
        evidence = "E3"
        confidence = "E4"
        owner = "P1"
        access = "P2"
        purpose = "P3"
        retention = "P4"
/>
```

Situational Statement: Description ⇨ Box

Situation / Description

Peter is now most probably under high time pressure, because he is in the duty-free shop of the airport, while boarding of his flight closes in a few minutes [(and his walking speed sensors report “fast-walking“)]. According to his privacy settings, this information is freely available only for preselected people and systems.

Situation / Annotated Text

Peter (subject) is now (start) most probably (confidence) under high time pressure (predicate, range, duration, extent), because he is in the duty-free shop of the airport (location), while boarding of his flight closes in a few minutes (evidence) [(and his walking speed sensors report “fast-walking“)]. According to his (owner) privacy settings (privacy), this information is freely available only for preselected people and systems.

Situational Statement 3 / Box

Situational Statement 2 / Box

Situational Statement 1 / Box

Content

subject	=	Peter
predicate	=	time pressure
object	=	high
range	=	low-medium-high

Restrictions

start	=	now
duration	=	few minutes
location	=	duty-free shop
extent	=	airport building

Metadata

owner	=	Peter
privacy	=	friends-only
evidence	=	⇨ evidence-ref
confidence	=	most-probably