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Towards a Generic Contextual Elements Model to Support Context Management

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Outline

- **Motivation**
- CEManTIKA Project
- Context-Oriented Model
- Final Considerations
- Perspectives

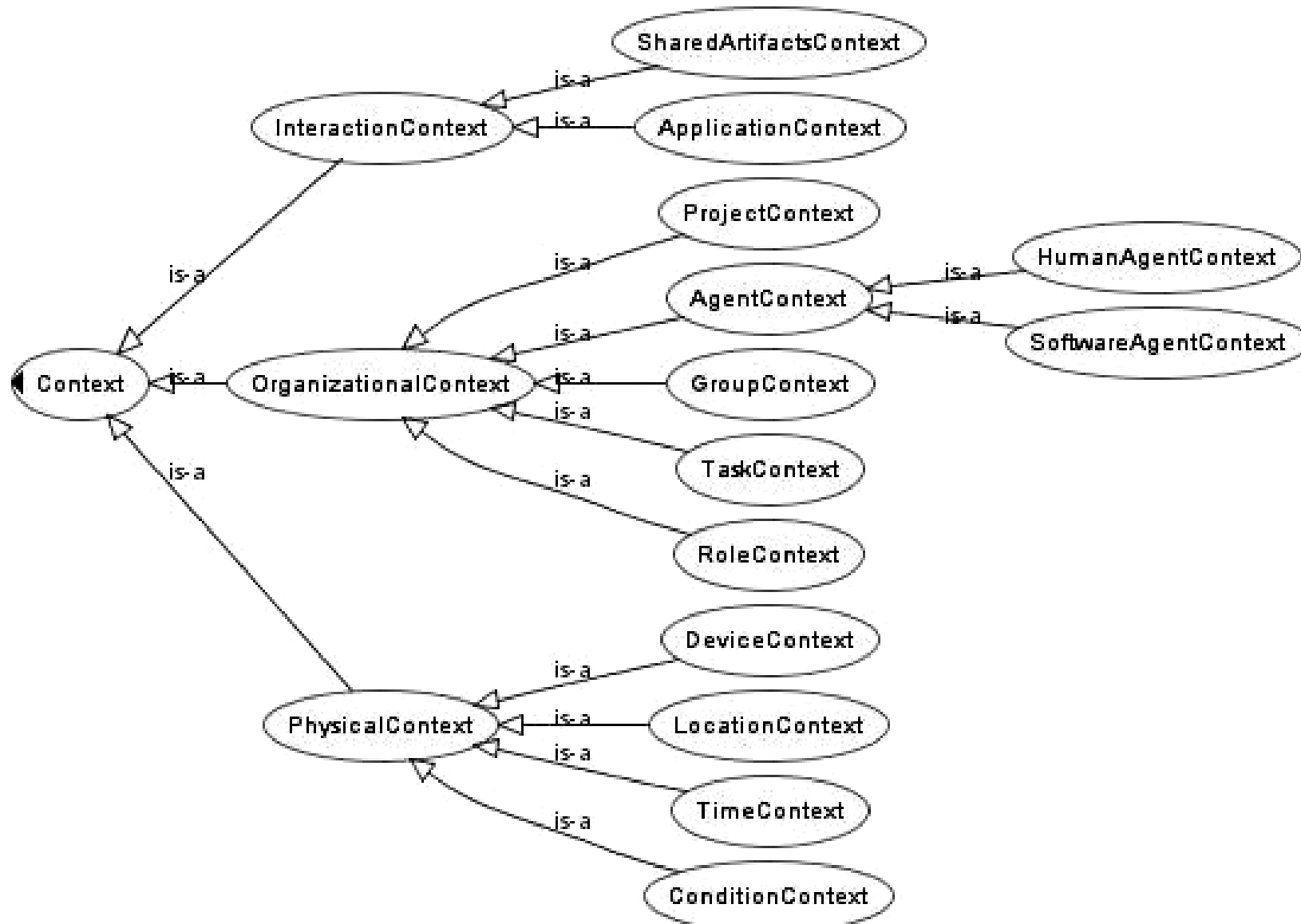
Generic Context Model

- Context Modeling is a **key factor** in developing context-sensitive systems
- **Generic context models** are of interest
 - ✓ **Support developers** modeling context in their systems
 - ✓ Enable systems' **interoperability**
 - ✓ Ease knowledge **sharing**
 - Between humans
 - Between systems

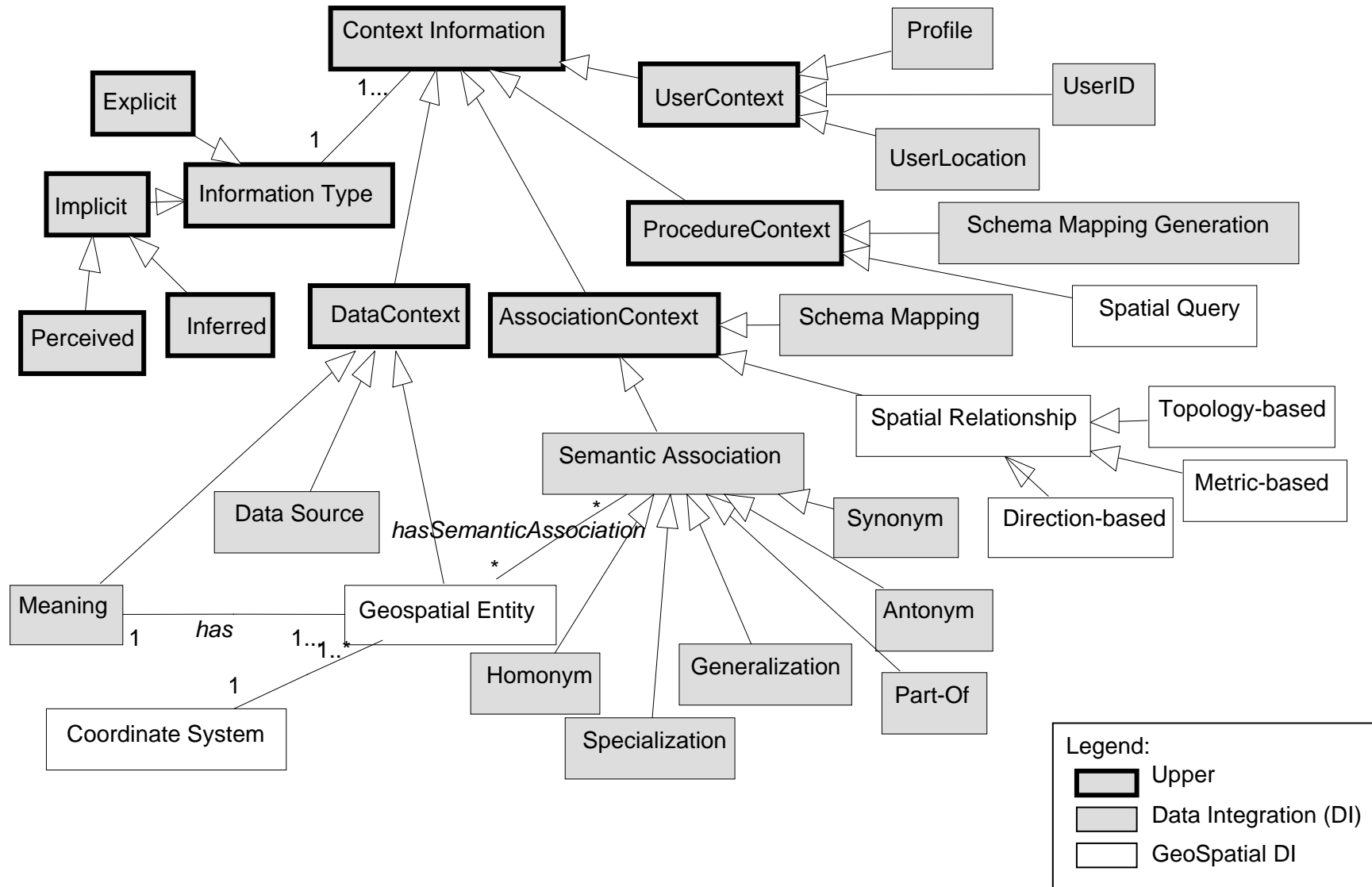
Challenges in Modeling Context

- Need of common language
 - ✓ Several **heterogeneous** context **sources**
 - ✓ **Different** context **consumers**
 - ✓ **Sharing** and **integration** is difficult
- Context definition strongly **dependent**
 - ✓ On the **domain**
 - ✓ On the **user**
 - ✓ On the **task** at hand
- Context is **complex** and **dynamic**

Model 1 :: Context Ontology for Context Modeling in Groupware Systems [Vieira et al. 2005]



Model 2 :: Context Ontology for Geographical Data Integration [Souza et al. 2006]



Problems we observed

- **Lack of formalism** in representing context concepts
 - ✓ Context is modeled according to **developers' point of view**
 - ✓ **Different views** of
 - **What** to be considered as context
 - How to **manage** it
 - ✓ Usually a **restricted subset** of elements
 - acquired through **sensors** or **user's profile**
- Models generally **misinterpret**
 - ✓ **Domain** concepts X **context-related** concepts

Our objective

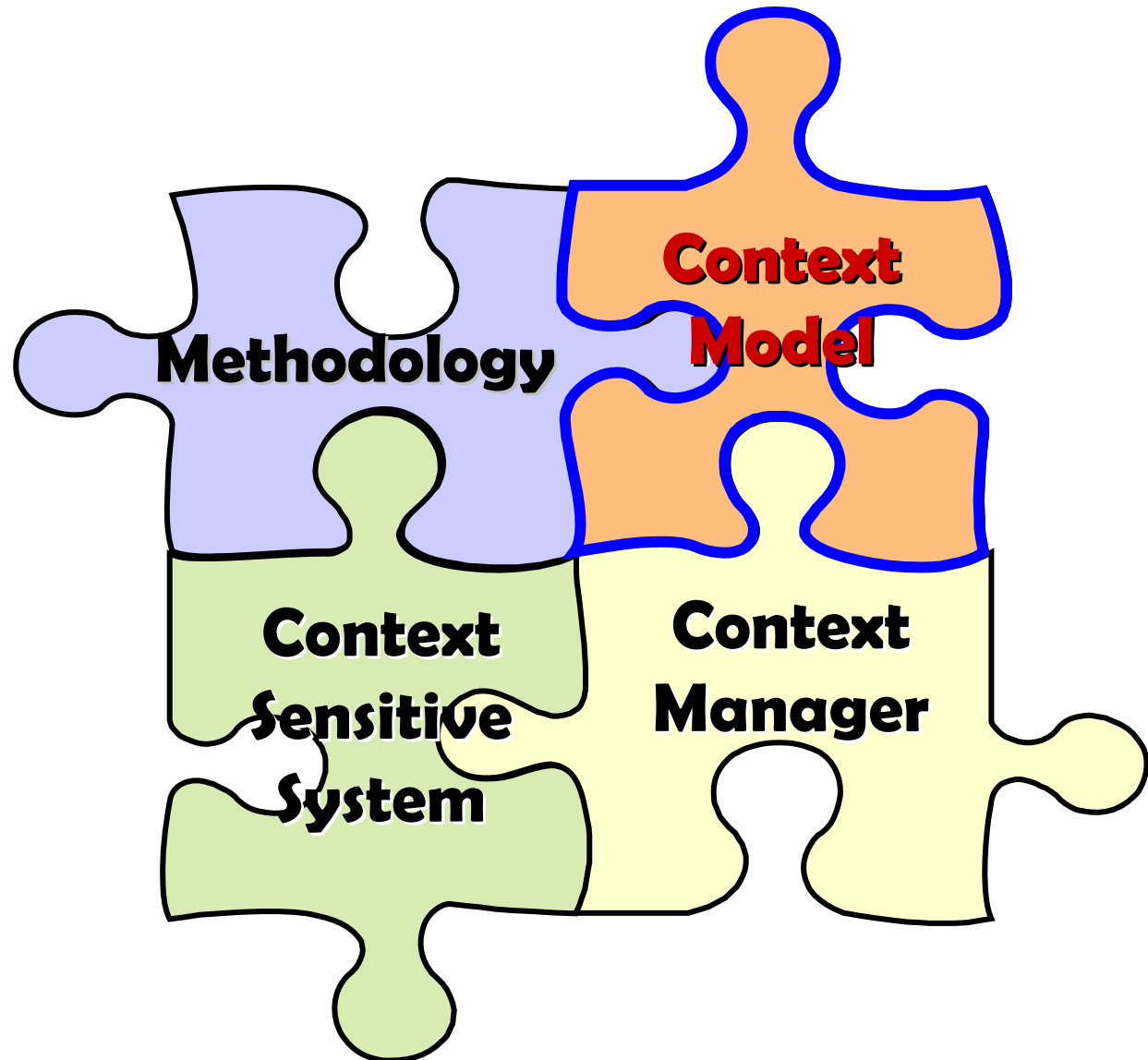
- Define a **generic context model**
 - ✓ Take into account **context nature**
 - Complex, Dynamic, dependent on the domain, user, focus
 - ✓ Can be **manipulated** by a context manager
 - domain independent
 - ✓ Enable **incremental** definition of the context model
 - according to the system usage

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CEManTIKA Approach

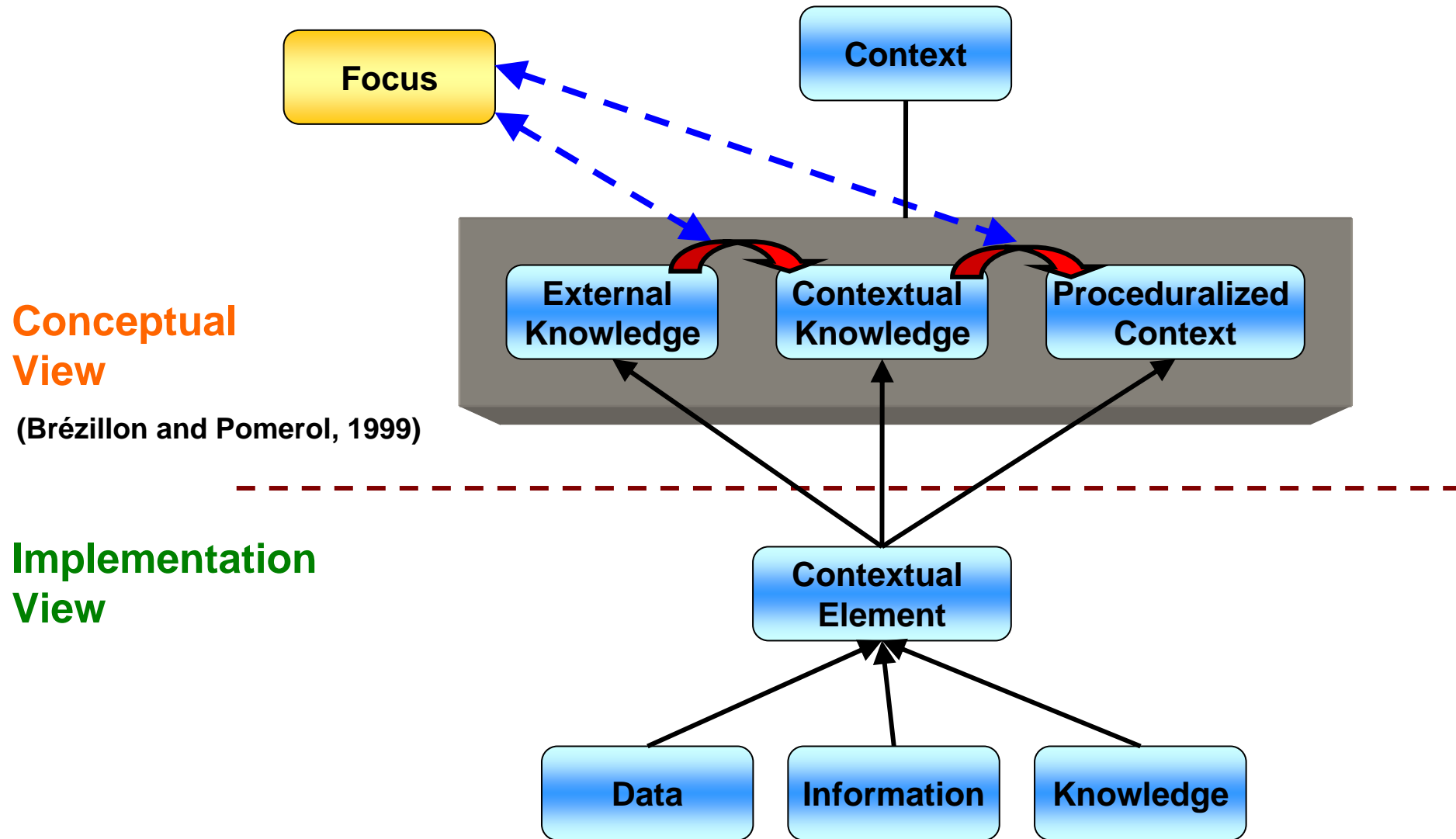
*C*ontextual
*E*lements
*M*anagement
*T*hrough
*I*ncremental
*K*nowledge
*A*cquisition



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Our Working Definition of Context



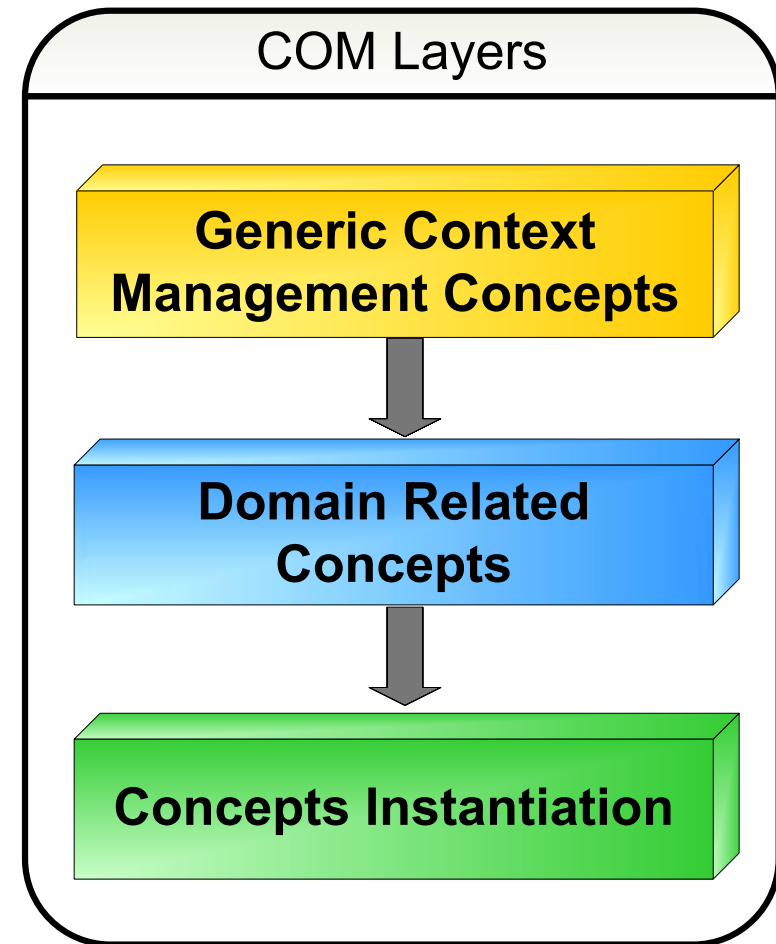
Conceptual View

(Brézillon and Pomerol, 1999)

Implementation View

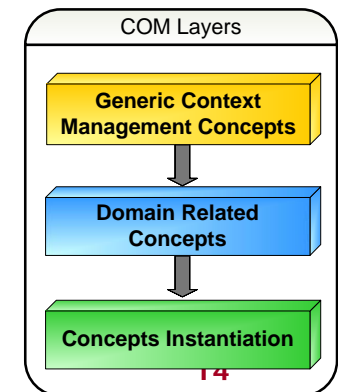
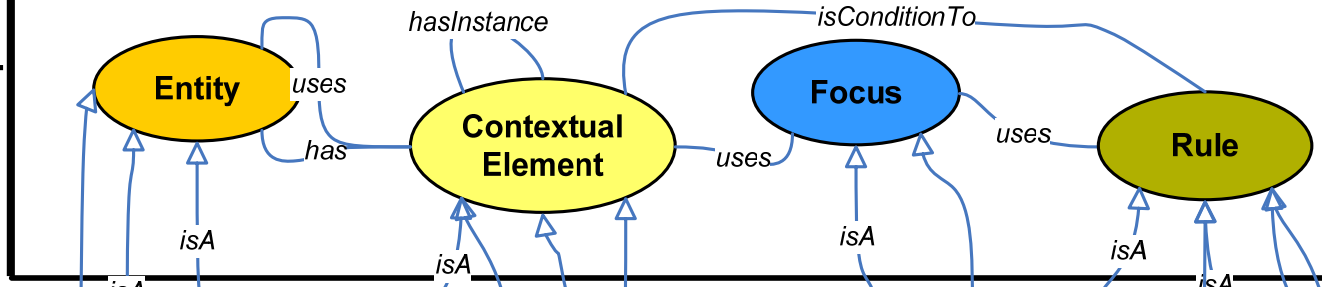
Context-Oriented Model (COM)

- Context-Aware System is **hard to model**
- Distinguish CAS as a **new paradigm** of programming
 - ✓ As OO model, AOP model...
 - ✓ **Separate context manipulation concepts** from application or domain specific concepts

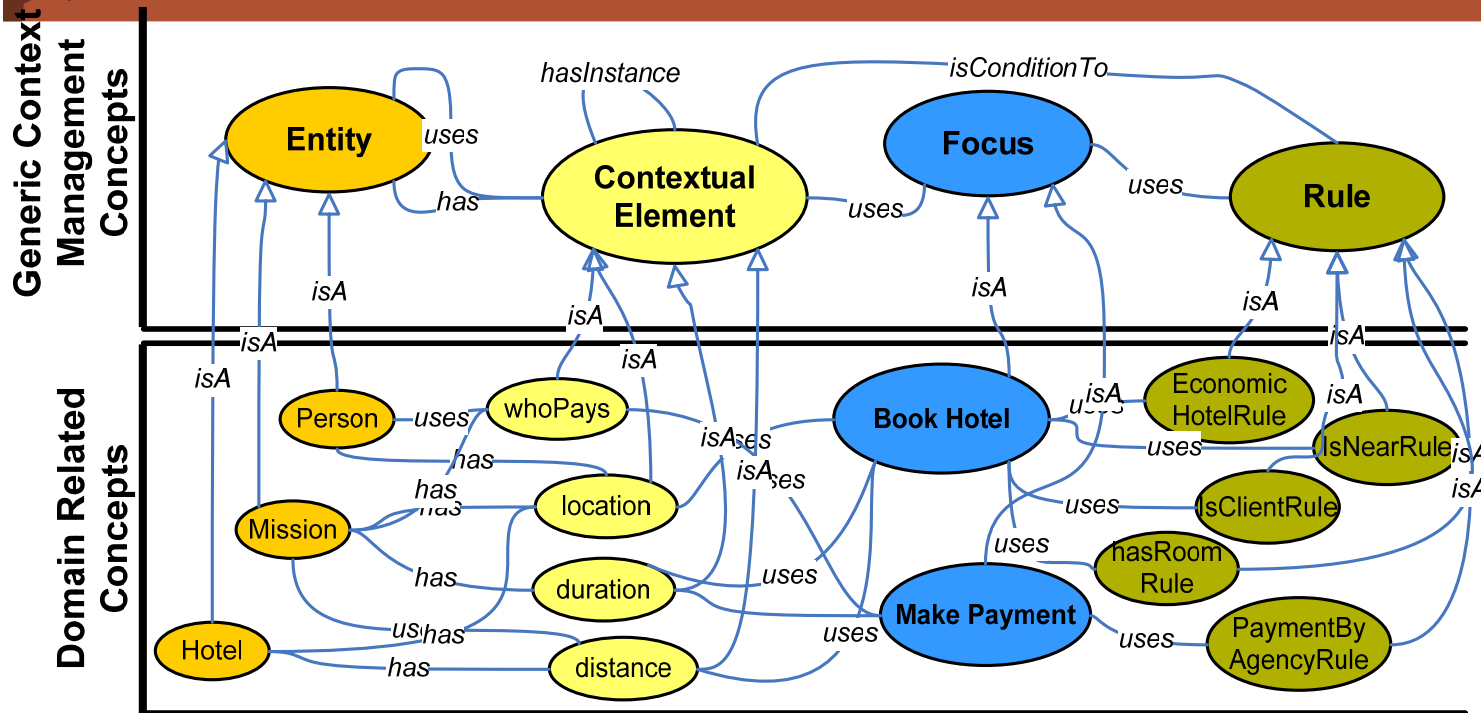


Example of Instantiation of the Three Layers

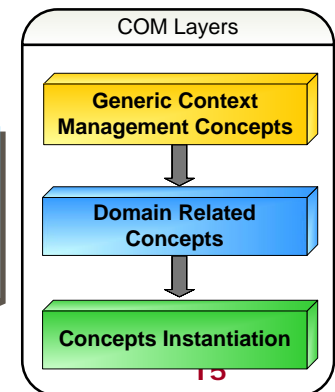
Generic Context
Management
Concepts



Example of Instantiation of the Three Layers

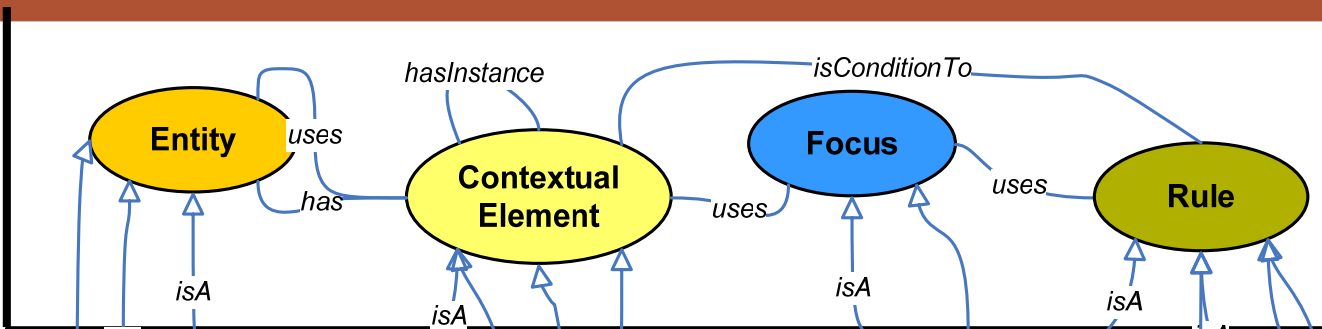


**Domain:
Academic Mission**

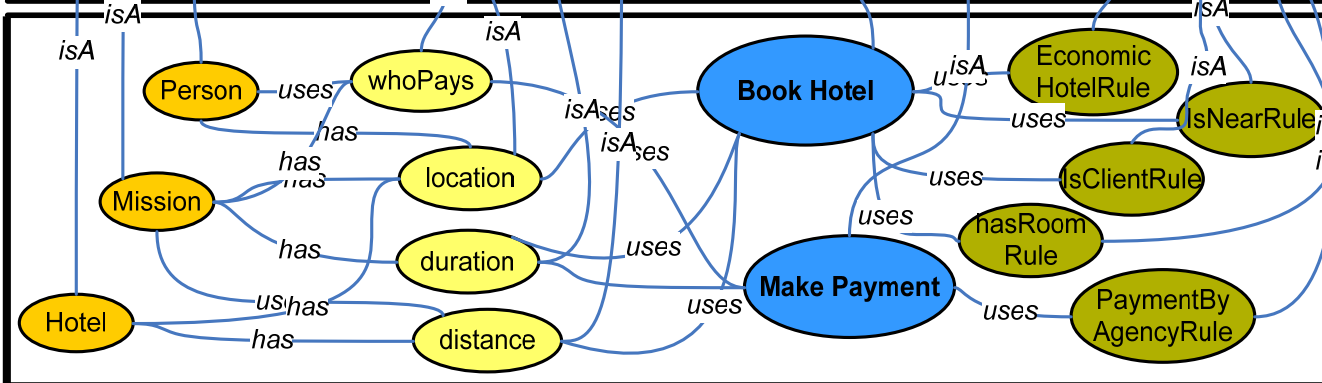


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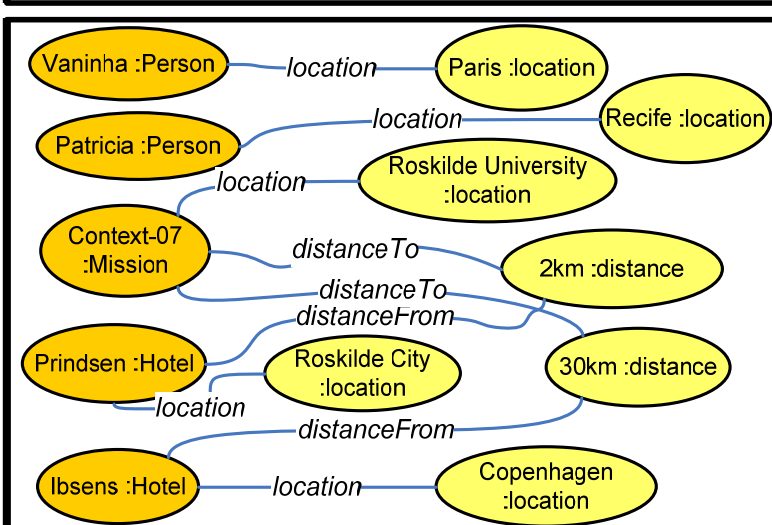
Generic Context Management Concepts



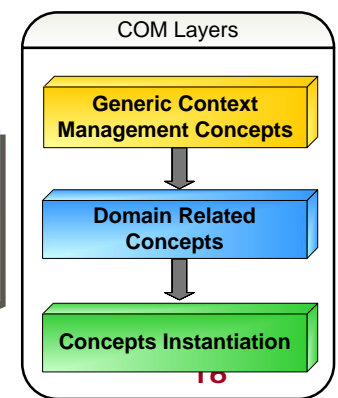
Domain Related Concepts



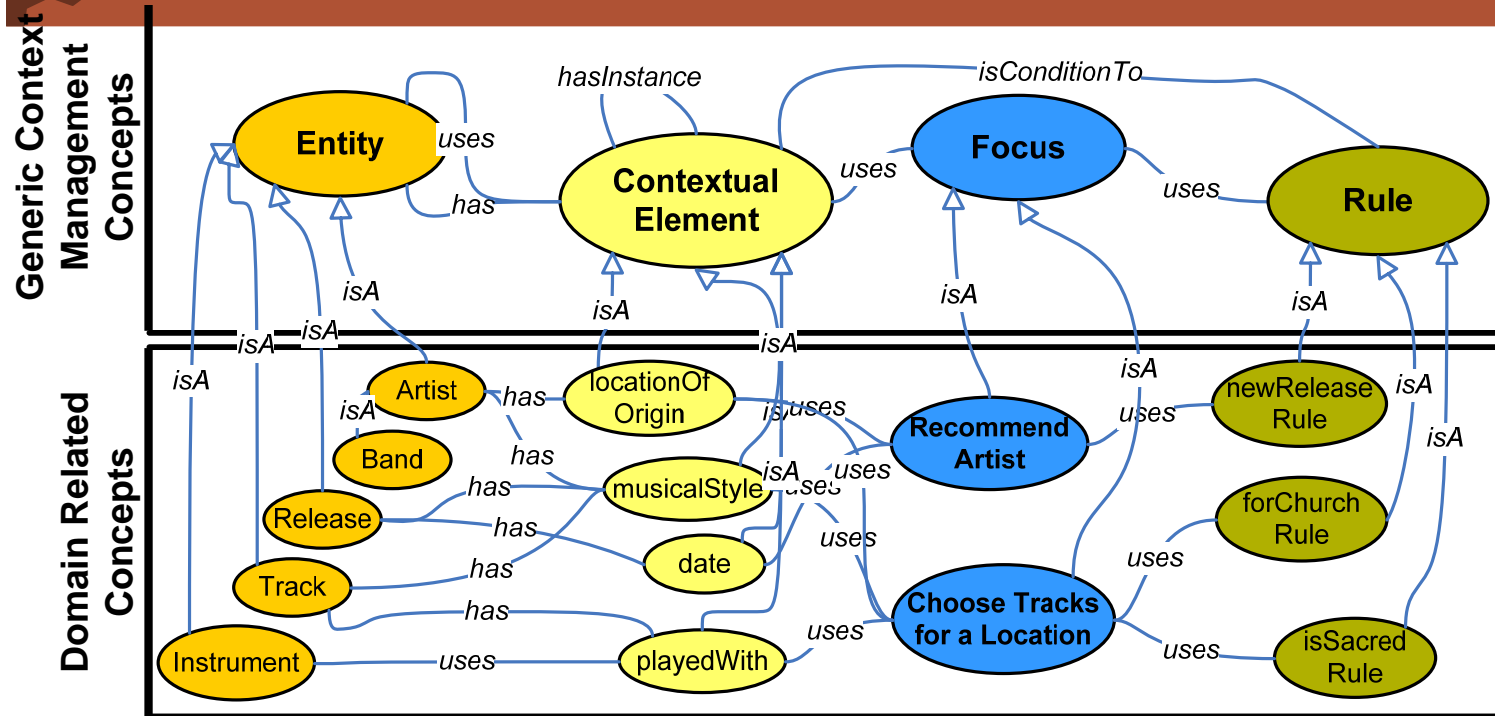
Concepts Instantiation



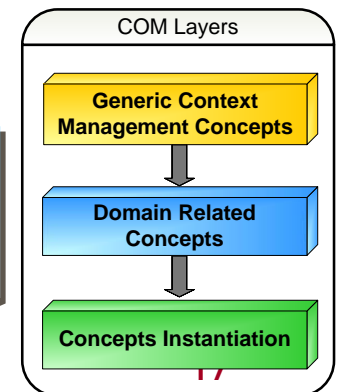
**Domain:
Academic Mission**



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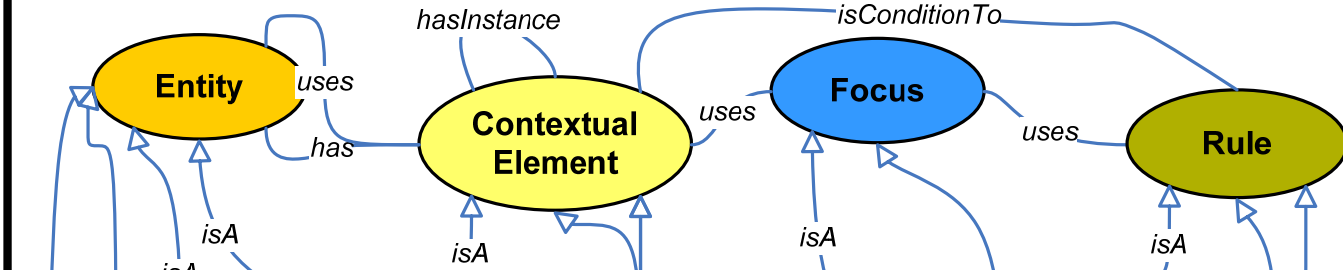


Domain: Music

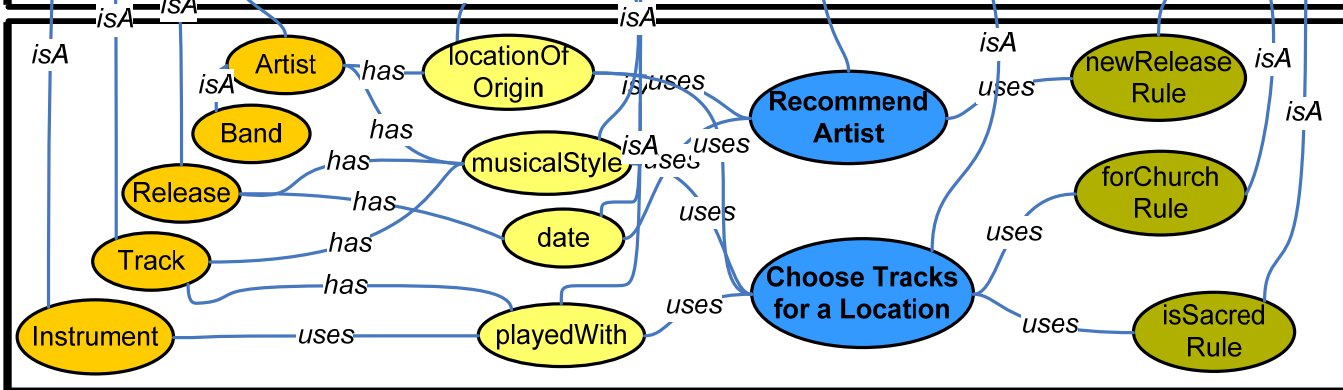


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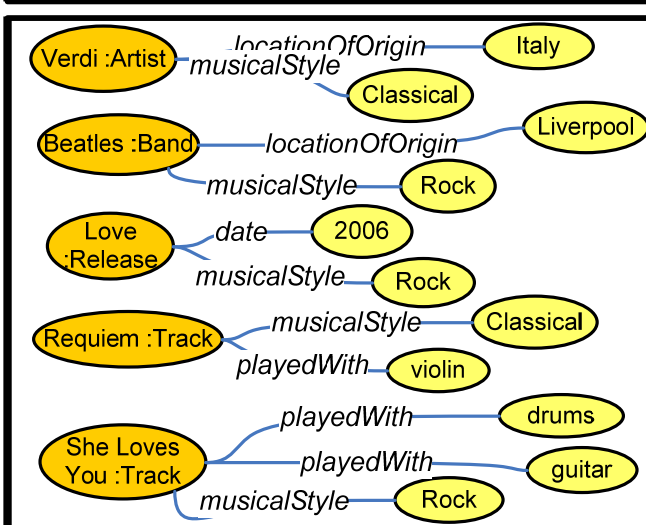
Generic Context Management Concepts



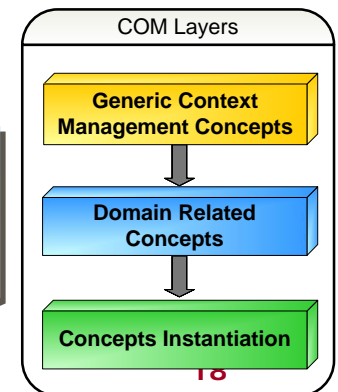
Domain Related Concepts



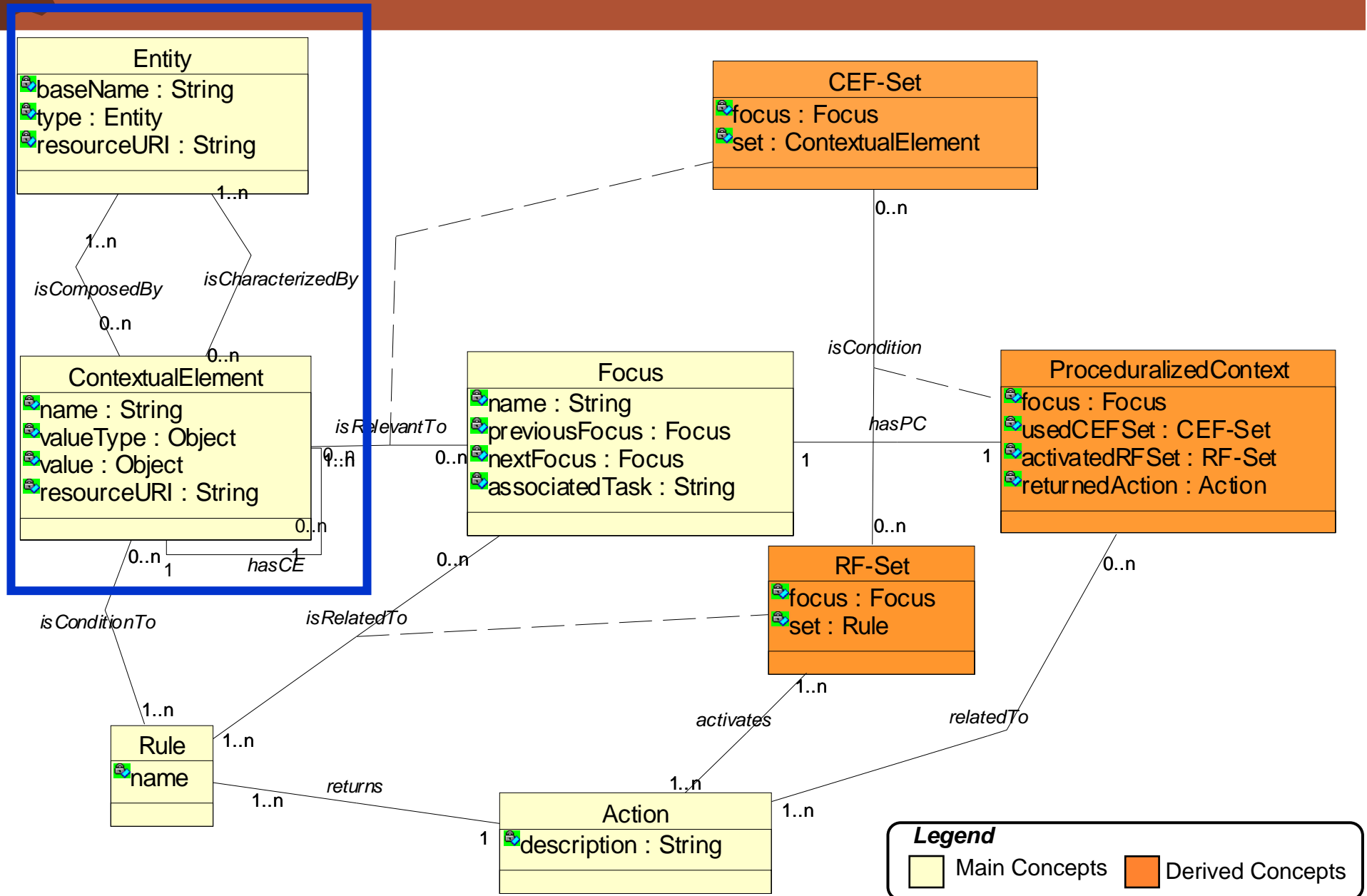
Concepts Instantiation



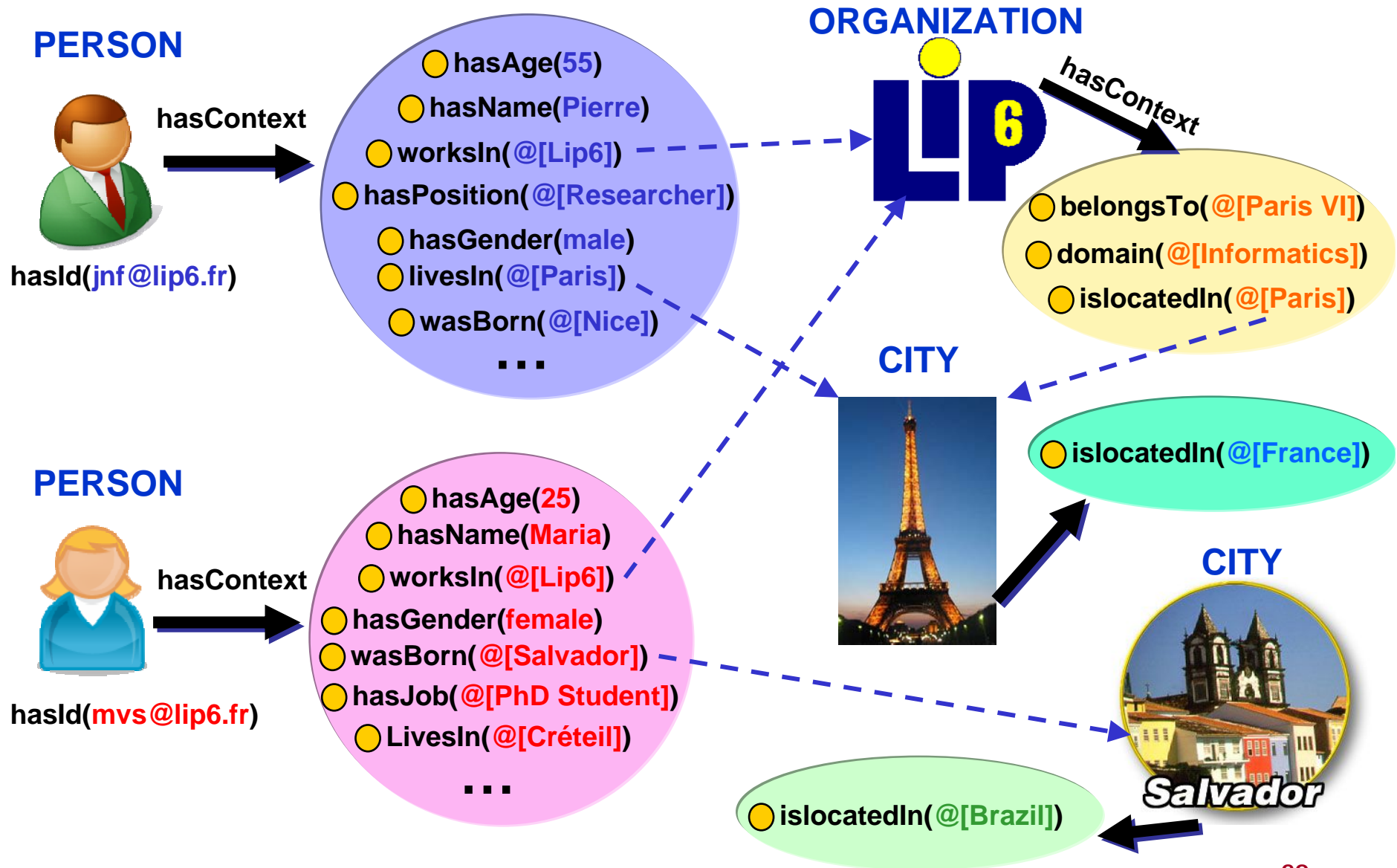
Domain: Music



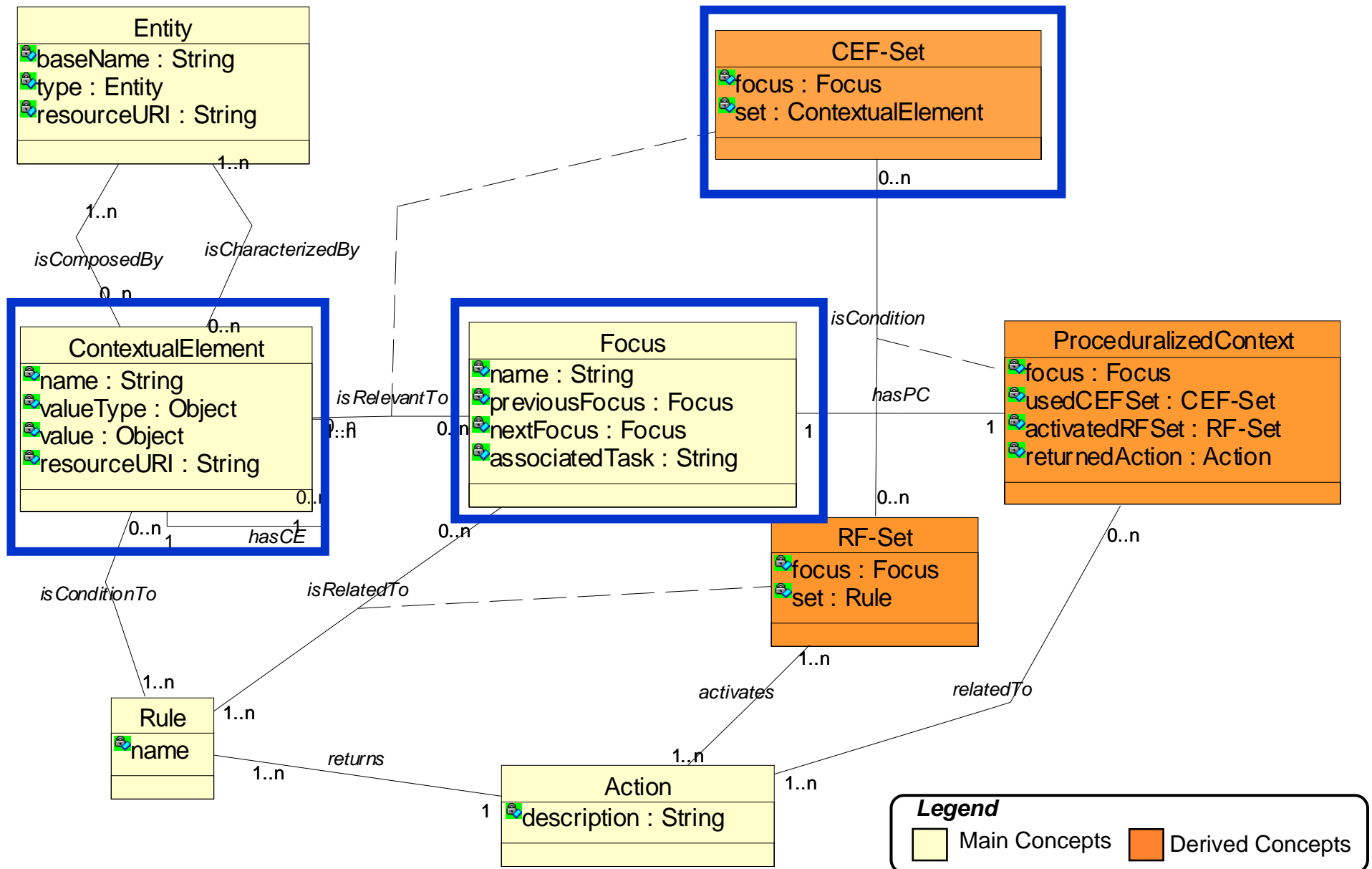
Generic Context Management Concepts



Example : Entities x Contextual Elements

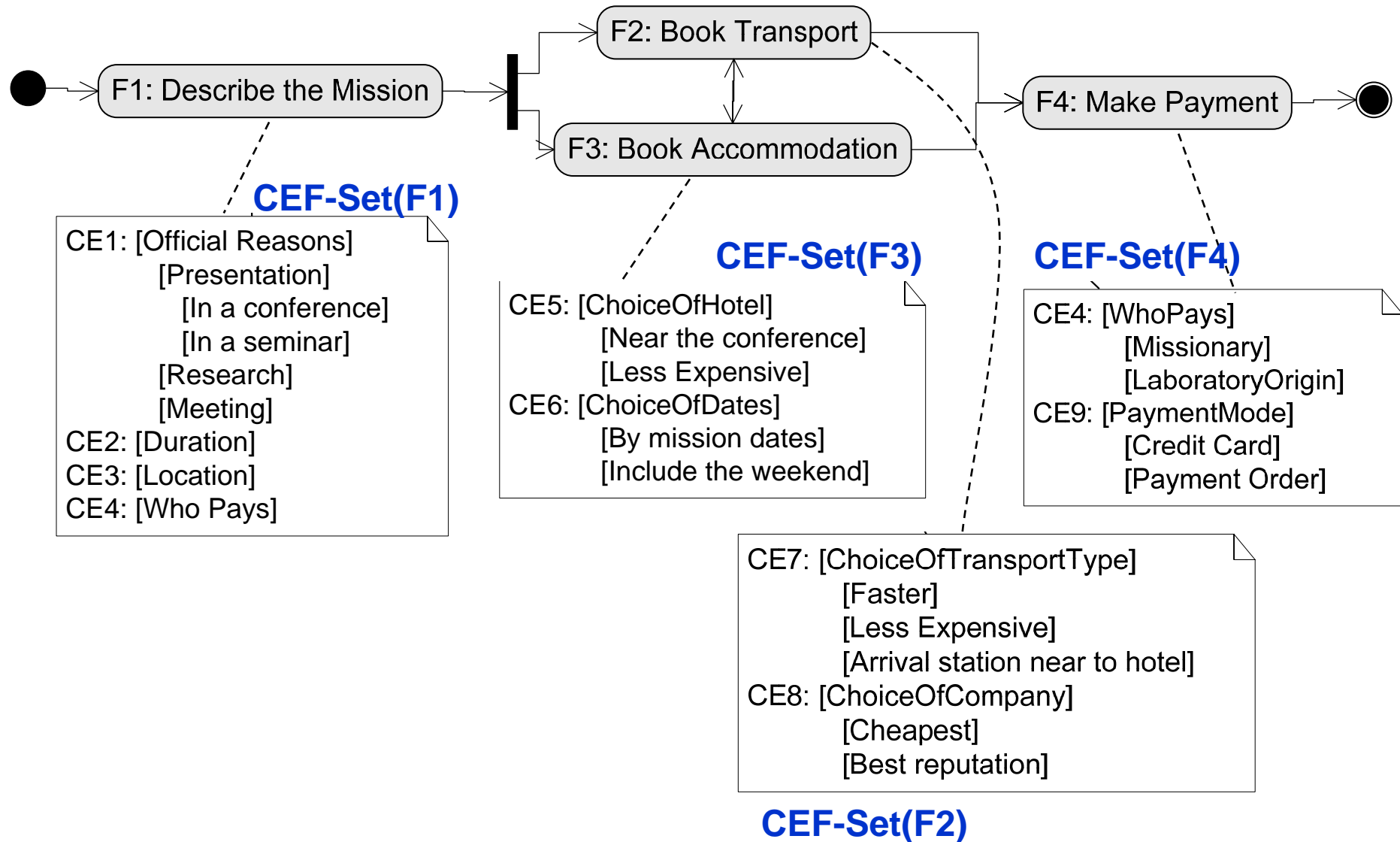


Generic Context Management Concepts

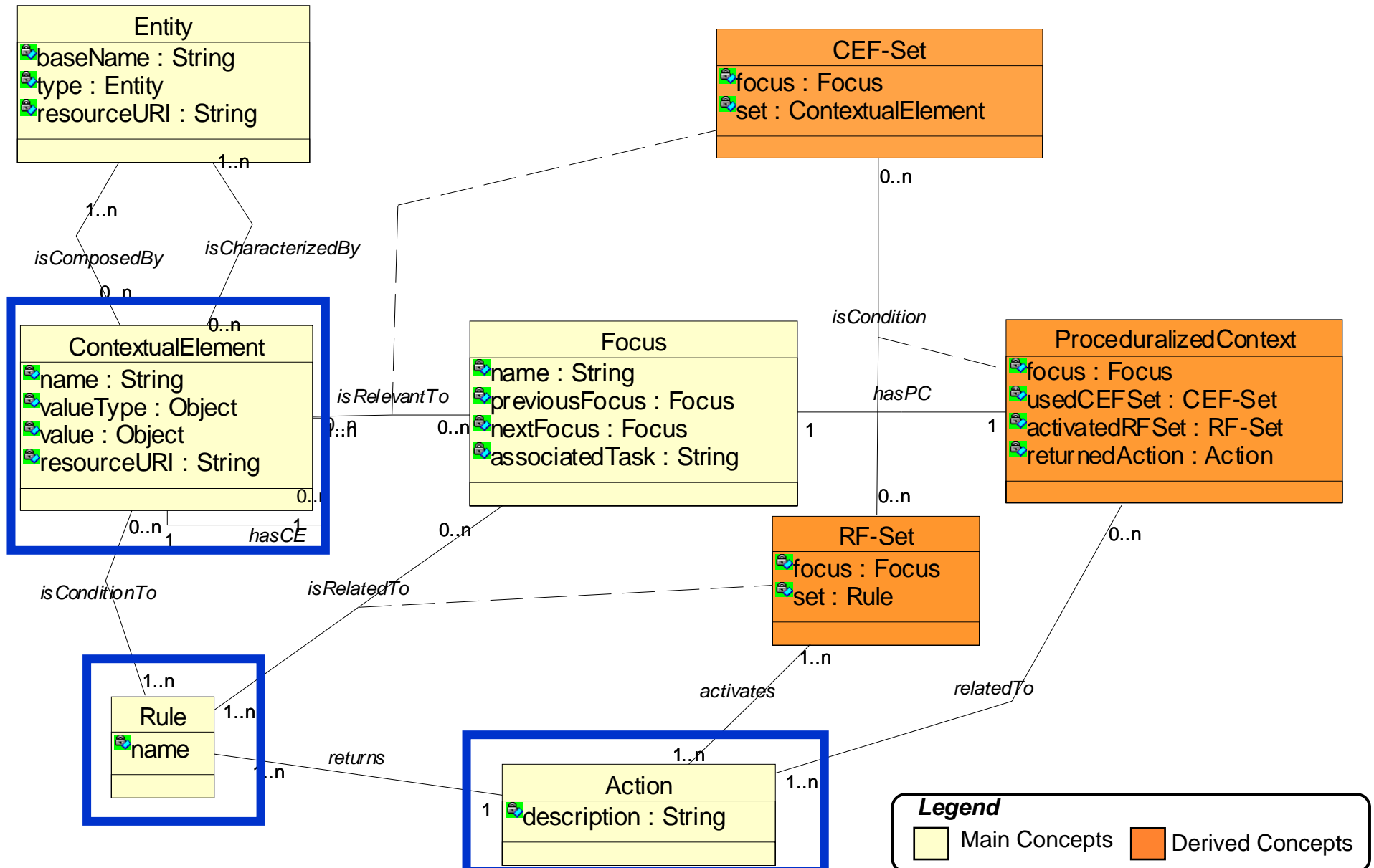


Example : Focus x CEF-Set

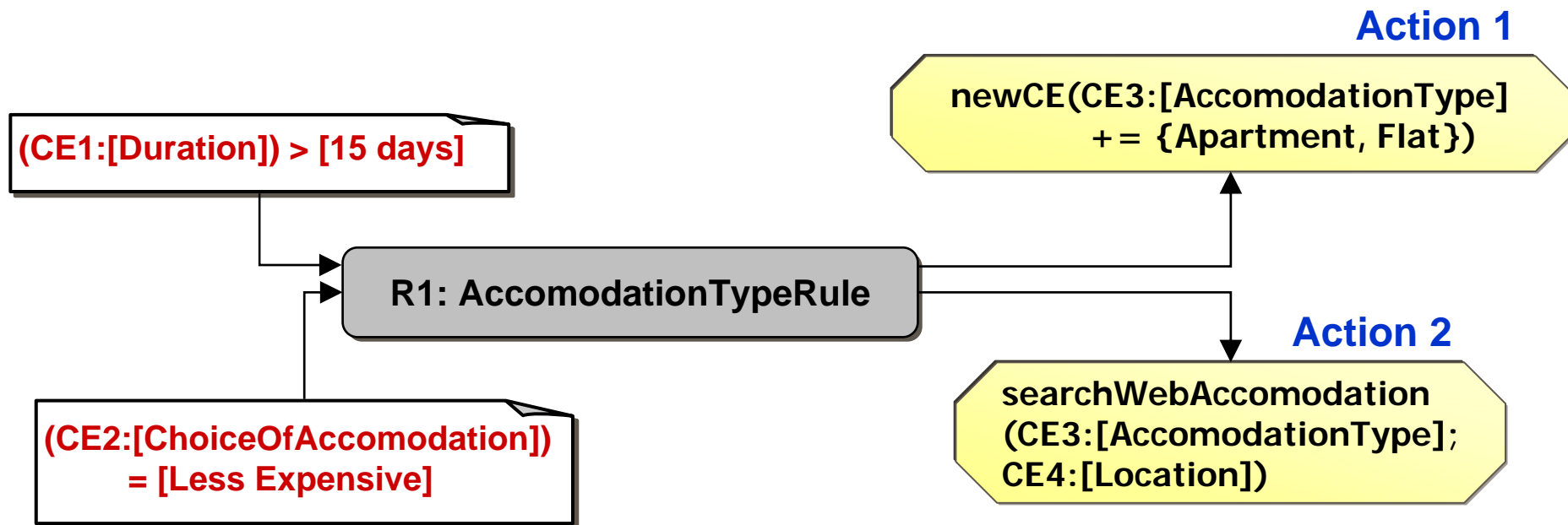
Domain = Academic Mission



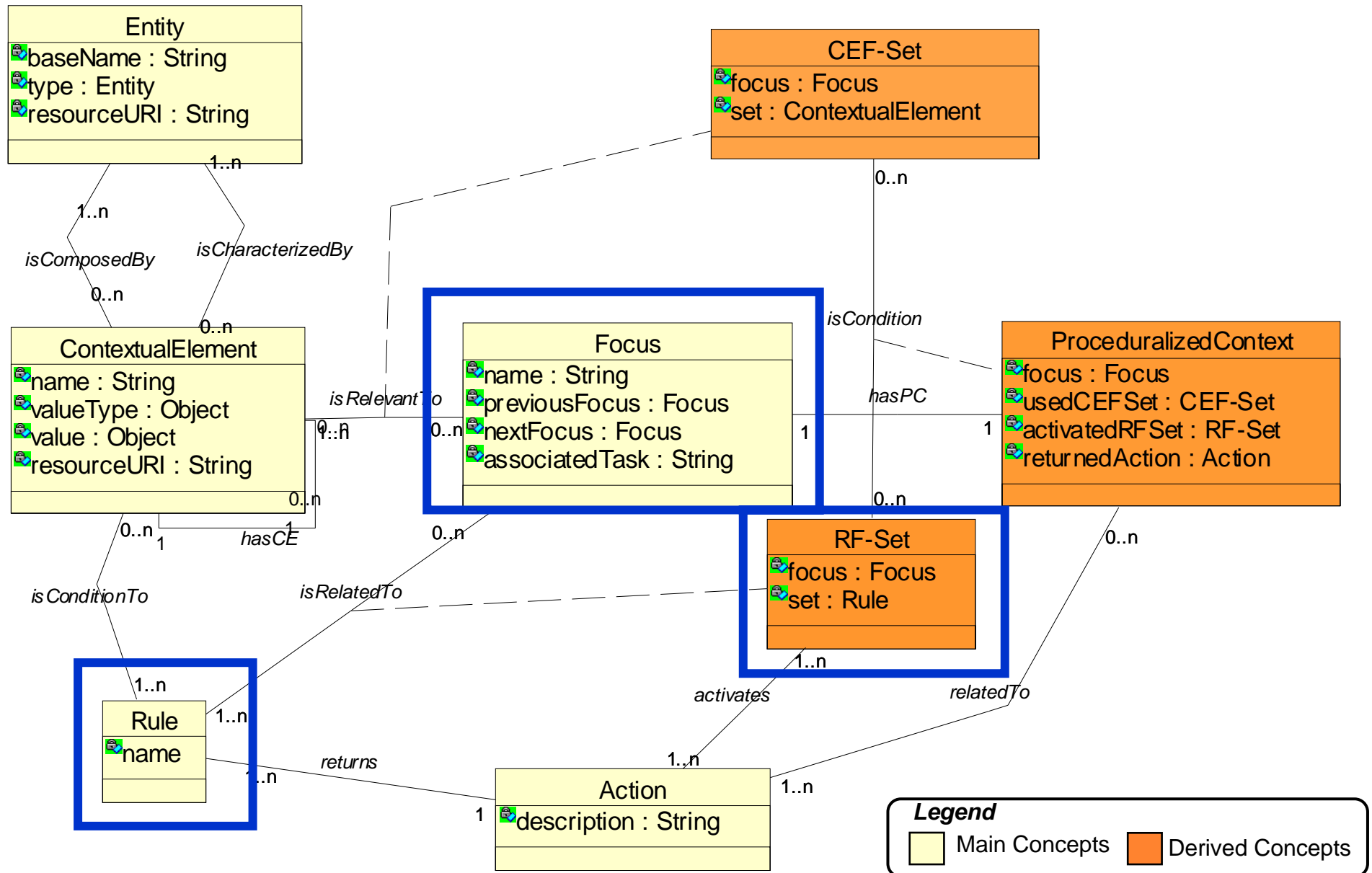
Generic Context Management Concepts



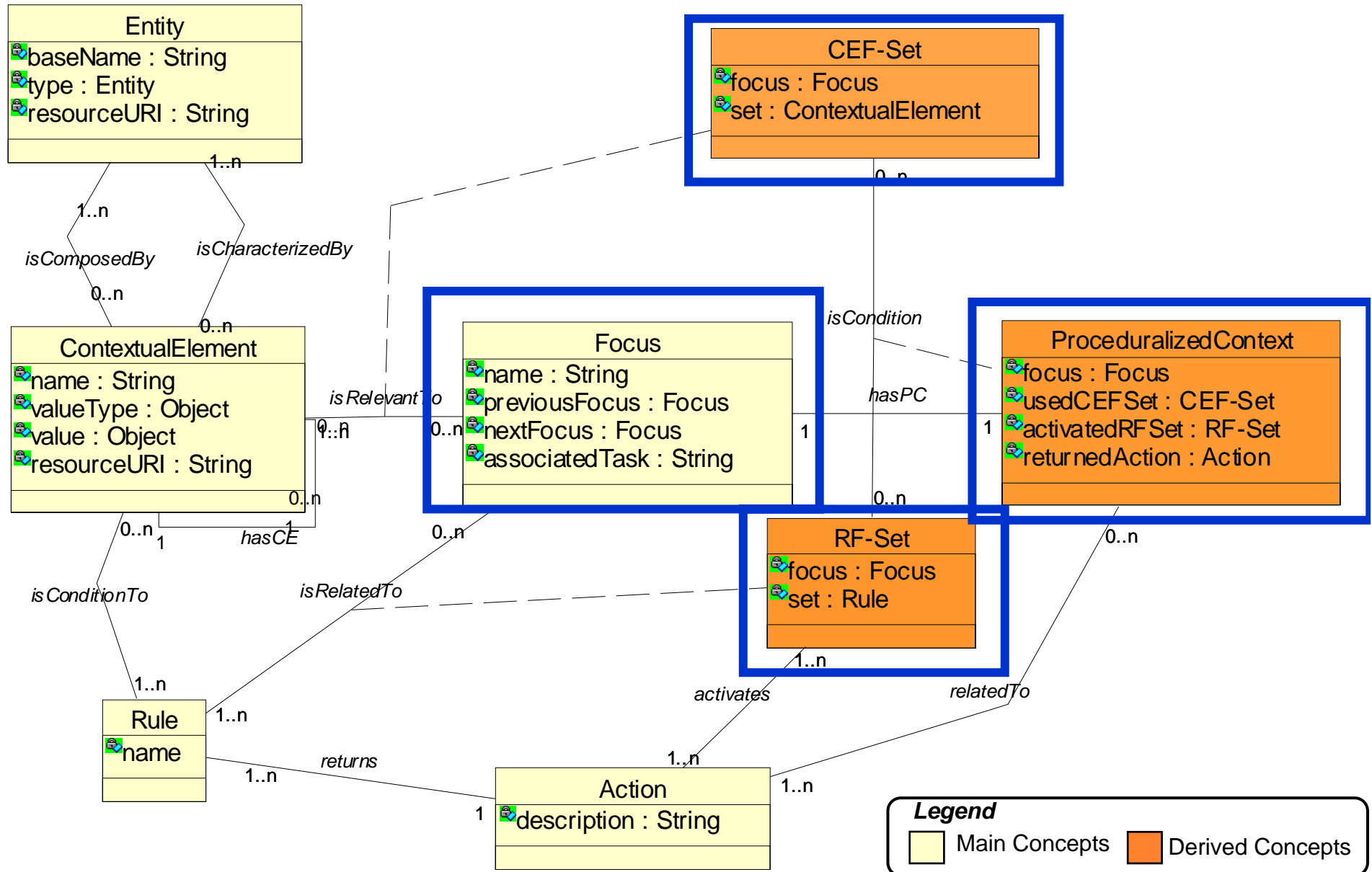
Example : CEs x Rules x Actions



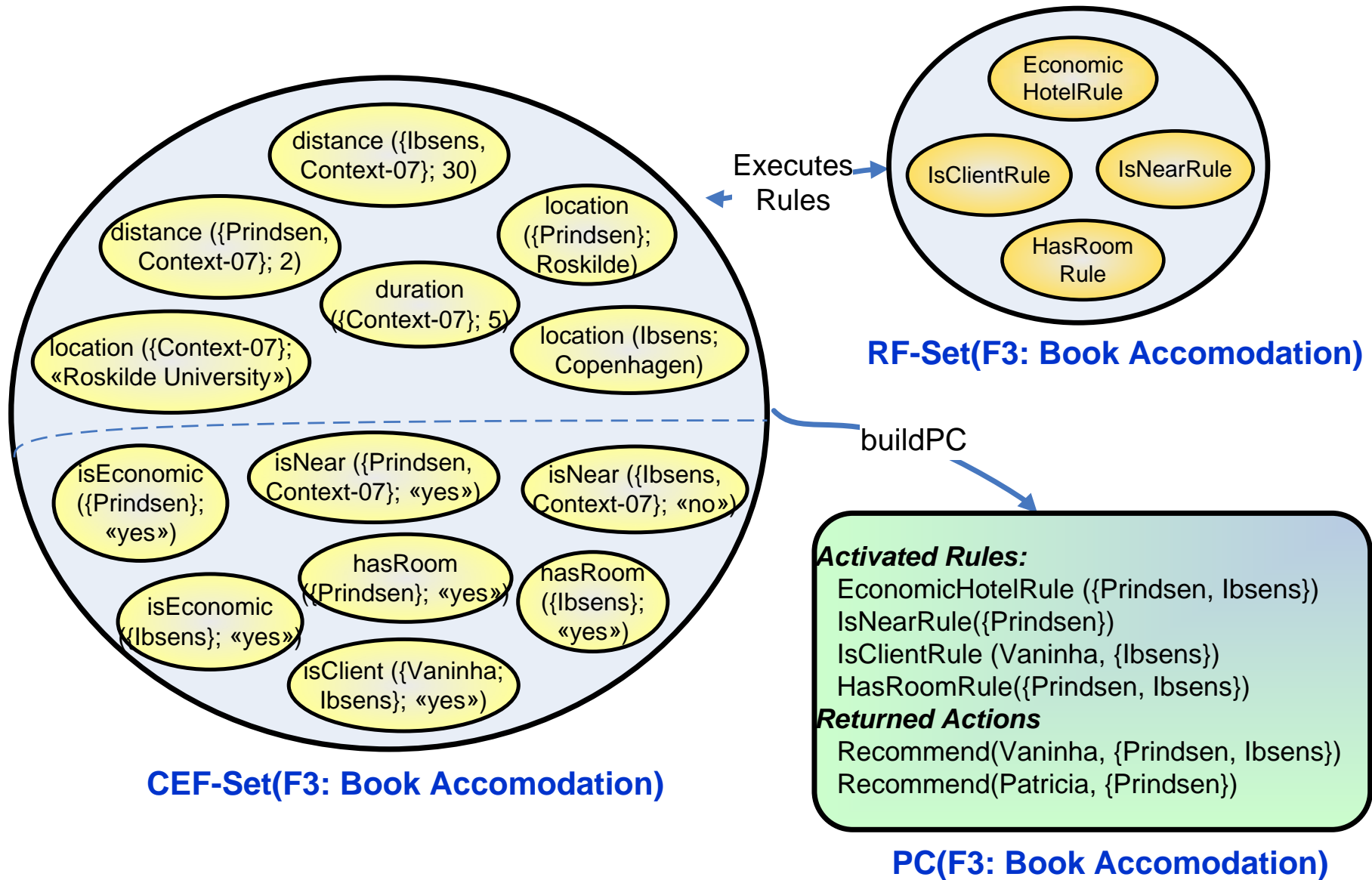
Generic Context Management Concepts



Generic Context Management Concepts



Example : CEF-Set x RF-Set x PC



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Discussion about Model Implementation

➤ Meta Model

- ✓ Implementation using different approaches

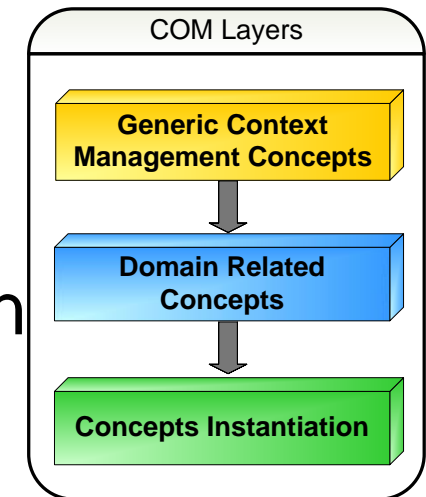
➤ Evaluation of the **example** implementation

✓ OWL

- Limitation defining domain concepts
- Not possible to define **hierarchies in Instances**

✓ Topic Maps

- All **concepts** (in all layers) can be described as **topic types**
- Free association with one another
- Representation without a rigid hierarchical format



Final Considerations

- Follow **conceptual ideas** from other paradigms
 - ✓ OO model; ER model
- Context **modelling** in terms of entities, contextual elements, focus, rules and actions
- Context **usage** based on focus and proceduralized contexts

Current Work and Perspectives

- Evaluation of model **correctness** and **completeness**
 - ✓ **instantiation** of scenarios in different domains
 - ✓ **Specification** of concepts
- Specification of **context relevancy** to a focus
- Specification of the **PC** concept and its **usage**
- Specification of a **methodology** to support systems' integration with CEManTIKA and COM
 - ✓ Support developers to build the connections with the applications and business logic



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