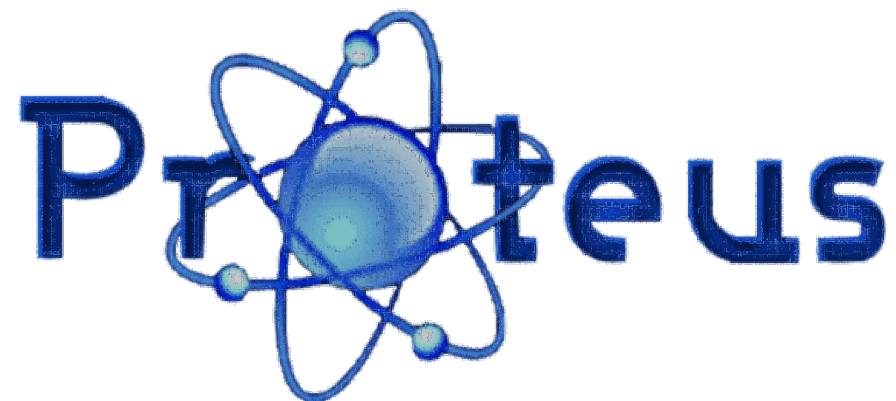




Integrating Ontological Domain Knowledge into a Robotic DSL

Gaëlle Lortal, Thales TRT (France)
Saadia Dhouib, CEA LIST (France)

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THALES



Outline

1. The Proteus Project
2. Ontology / DSL Comparison
3. From PROTEUS ontology to PROTEUS DSLs
4. The PROTEUS robotic Ontology
5. The PROTEUS Architecture DSL
6. Conclusion & Discussion

The Proteus Project

PROTEUS project

- Robotic Platform to facilitate transfer between Industries and academics

Goal

- To create a portal for the French robotic community
- Model based
 - The usage of models in the context of the robotics domain will be investigated into two forms within the project: ontologies and domain specific languages

Ontology / DSL Comparison (1/3)

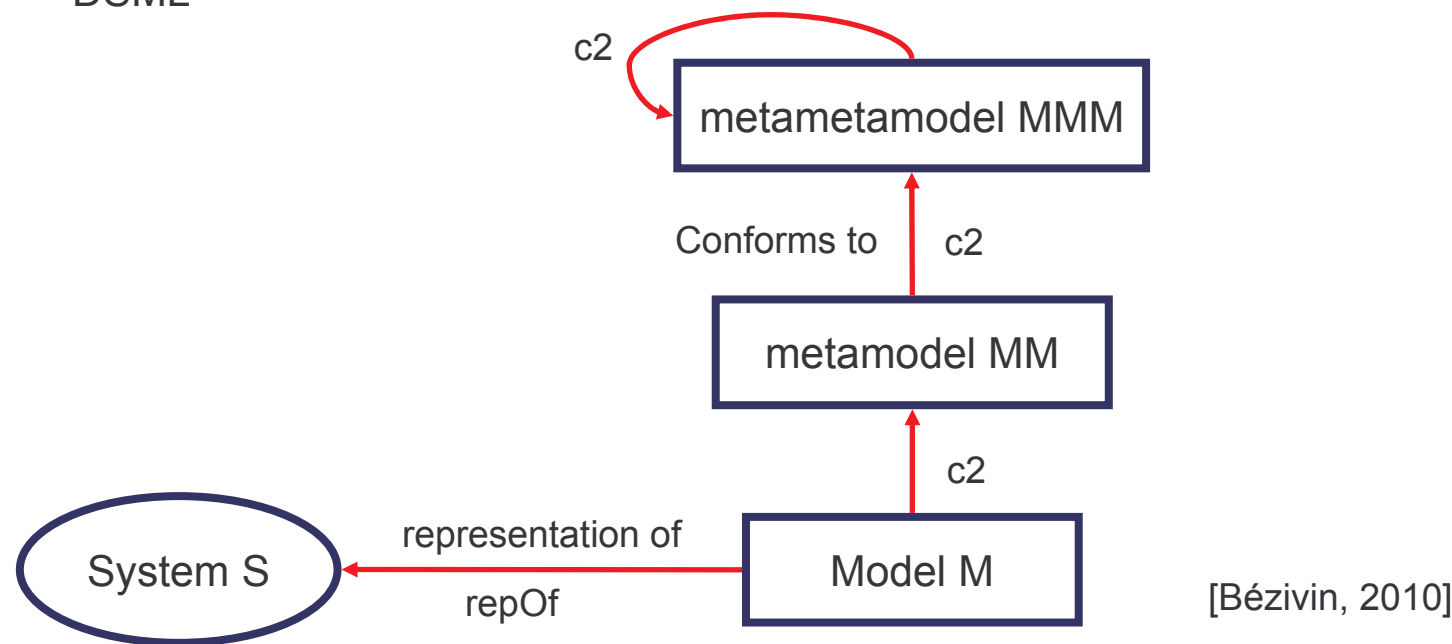
Ontology

- *A specification of a conceptualization (Gruber, 1992)*
- An ontology is a description of the concepts and relationships that can exist for a community of agents
 - A set-of-concept-definitions
 - A syntactic layer added to data and is claimed to be a semantic enrichment

Ontology / DSL Comparison (2/3)

DSL

- A formal language tailored to a specific application domain
- DSML

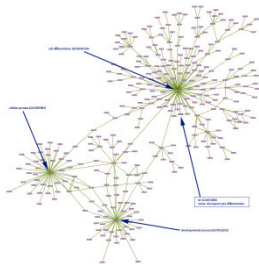


- A model is an abstraction of the reality and therefore is only a specific viewpoint on the reality
 - The semantics of the Models are not straightforwardly available

Ontology / DSL Comparison (3/3)

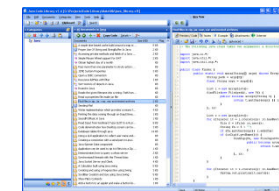
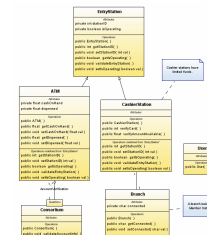
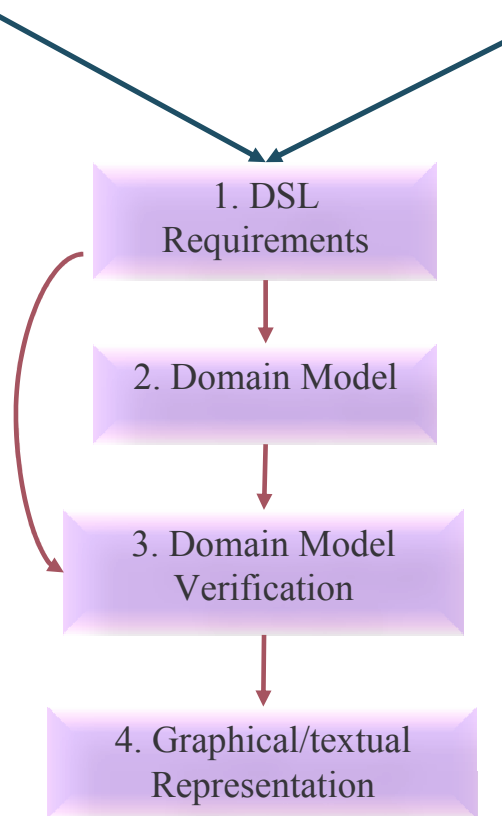
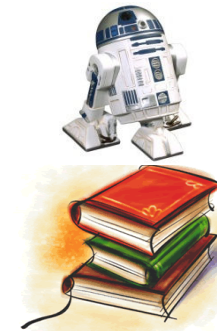
Criteria	Ontology	DSL
Design Domain	Knowledge Engineering	Engineering (Computer science, Electronics - RT embedded systems, robotics, avionics-)
Building Development Methodology	Ontology Building •User need and requirements capture •Reuse possibilities •Domain knowledge and structuring relations •Evaluation	DSL development •User need and requirements capture •Reuse possibilities •Domain knowledge and structuring relations •Implementation of executable DSL tools (i.e. a compiler or translator, ...) •Evaluation
Application Domains	Classification, Automatic Annotation, Web-Services Orchestration, Knowledge Base, Dictionaries, Natural Language Generation, ...	Systems modelling, Code Generation, Functional and non-functional verification, Simulations, ...
Technologies and Tools	Ontology GUI, inference engine, ontology editor, reasoning engines, ...	DSL development framework (AMMA, Eclipse GMT,...), DSL development graphical environment (DSL Toolkit Microsoft, Papyrus,...), Code generator, Model checker, transformation languages (ATL,...),...
Format	RDF, OWL, Topic Maps,...	MOF, EMF, EMOF, CMOF,

From PROTEUS ontology to PROTEUS DSLs



Ontology

State of the art
on DSLs for
robotics systems



PROTEUS



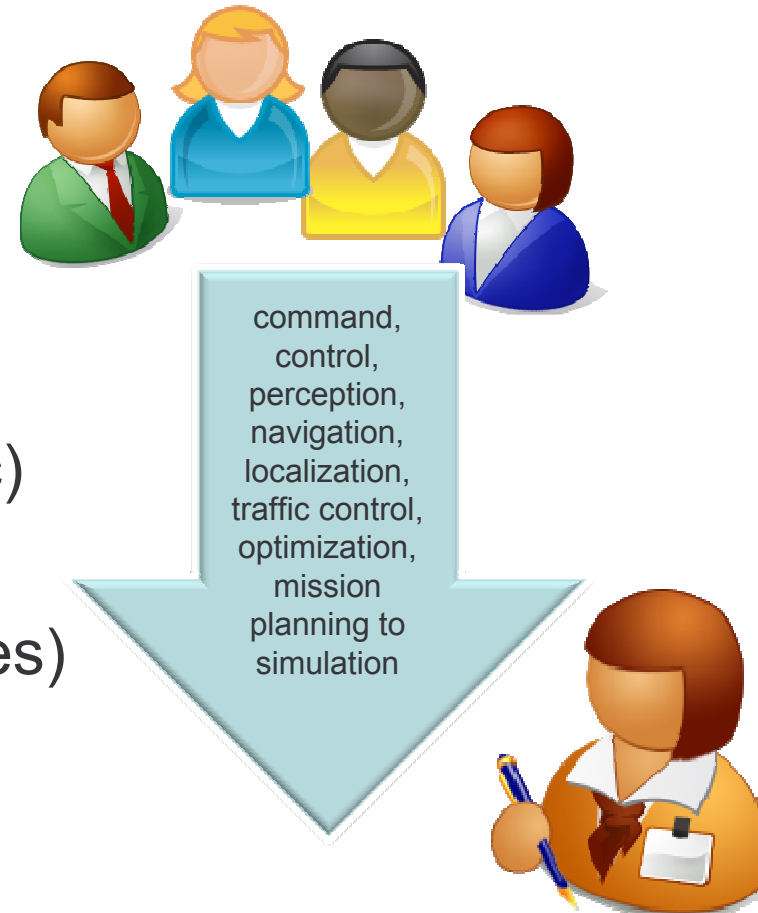
The PROTEUS robotic Ontology

Building methodology

- Scenarii
- Expert interviews

Ontology Format

- OWL DL (Description Logic)
- 205 concepts
- 73 relations (OWL properties)



From ontology to DSL

- Mapping from the ontology to the DSL domain model

Ontology (OWL)	Domain model (UML class diagram)
Concept	Class
subClassOf	Generalization
Property	Association
Property:IsA	Inheritance
Property:HasA	Composition
Cardinality	Multiplicity

The PROTEUS DSLs

Architecture DSL

- specific robotic architectures (reactive, deliberative, hybrid)
- specific components that form those architectures (sensors, actuators, planners)

Communication/Control DSL

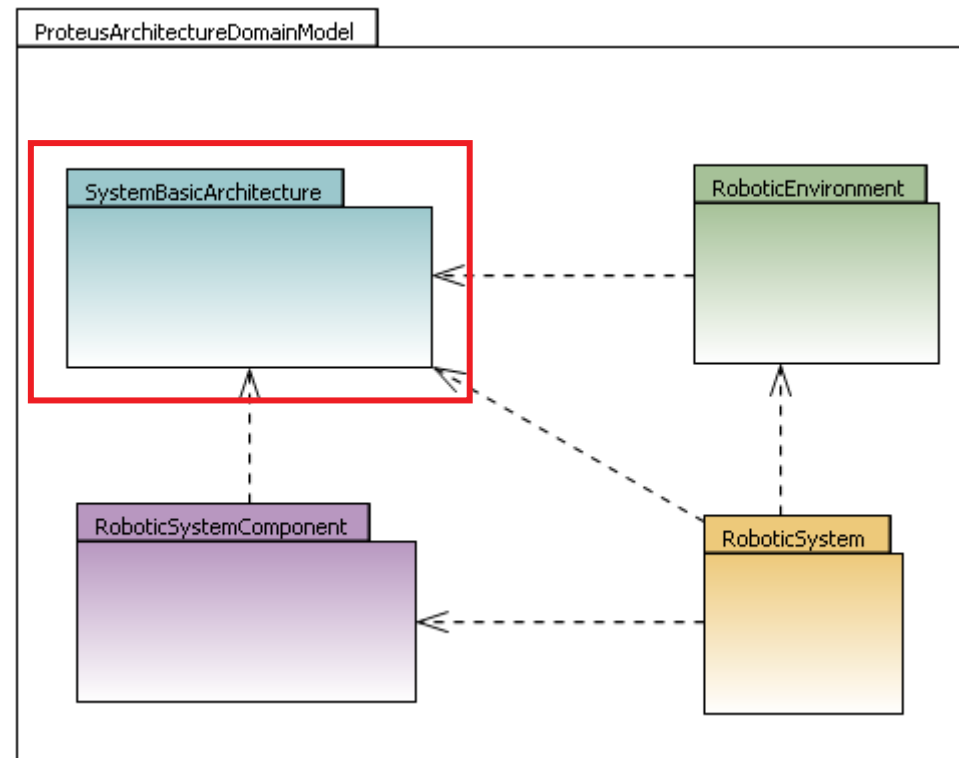
- control the robotic components
- ease the definition of communication mechanisms between components (sending/receiving of events and data)

Algorithms DSL

- algorithms triggered with the “Control & Communication DSL”
- for implementing behaviours in the different components of an architecture described with the “Architecture DSL”

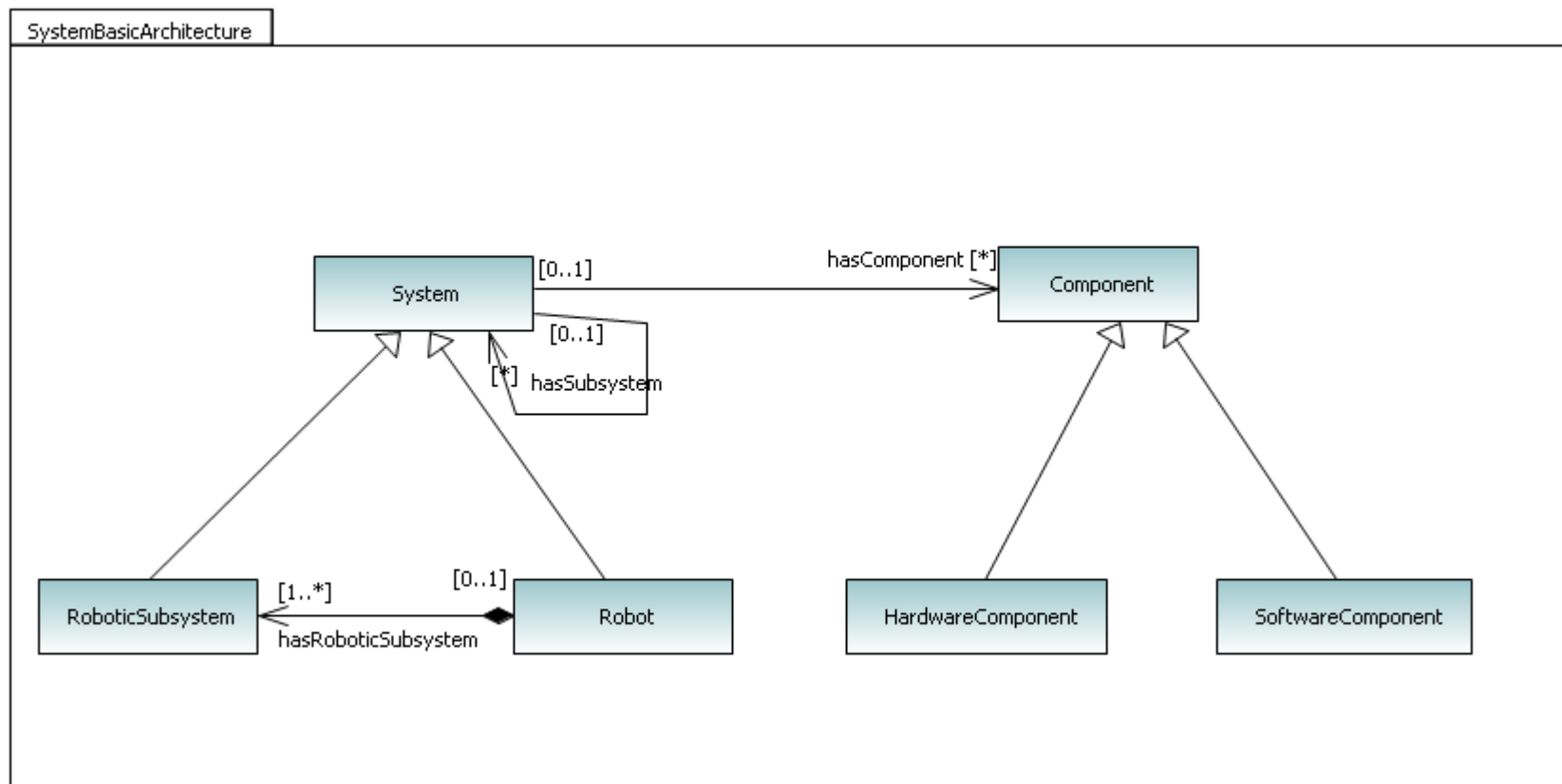
The PROTEUS Architecture DSL (1/3)

- Proteus Architecture domain model



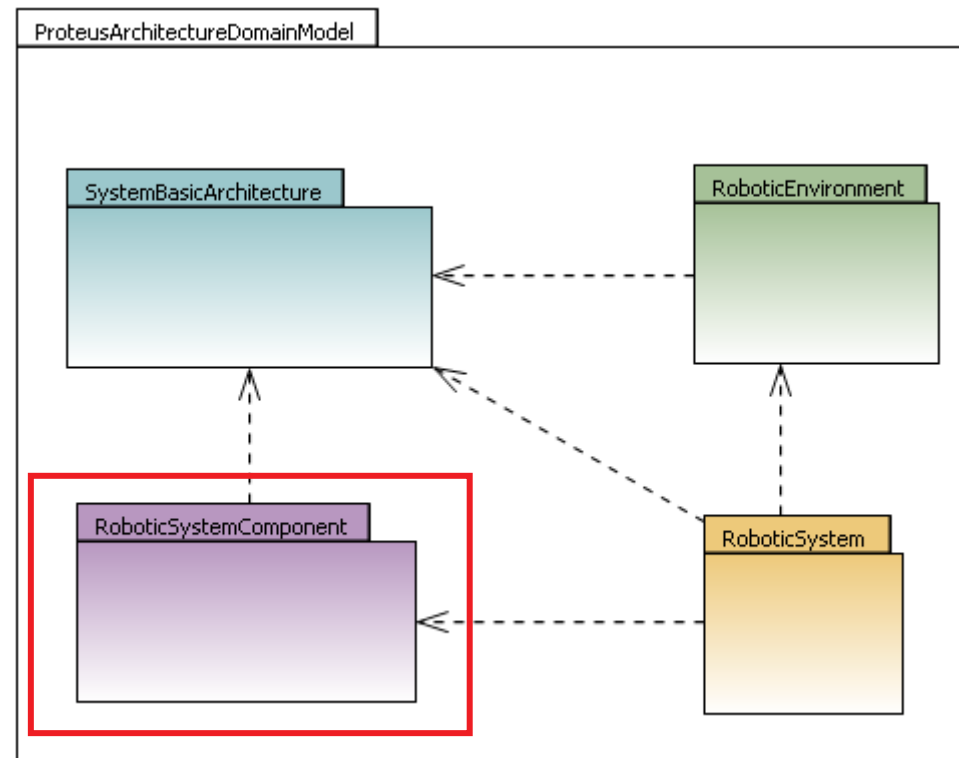
The PROTEUS Architecture DSL (2/3)

- System Basic Architecture Package



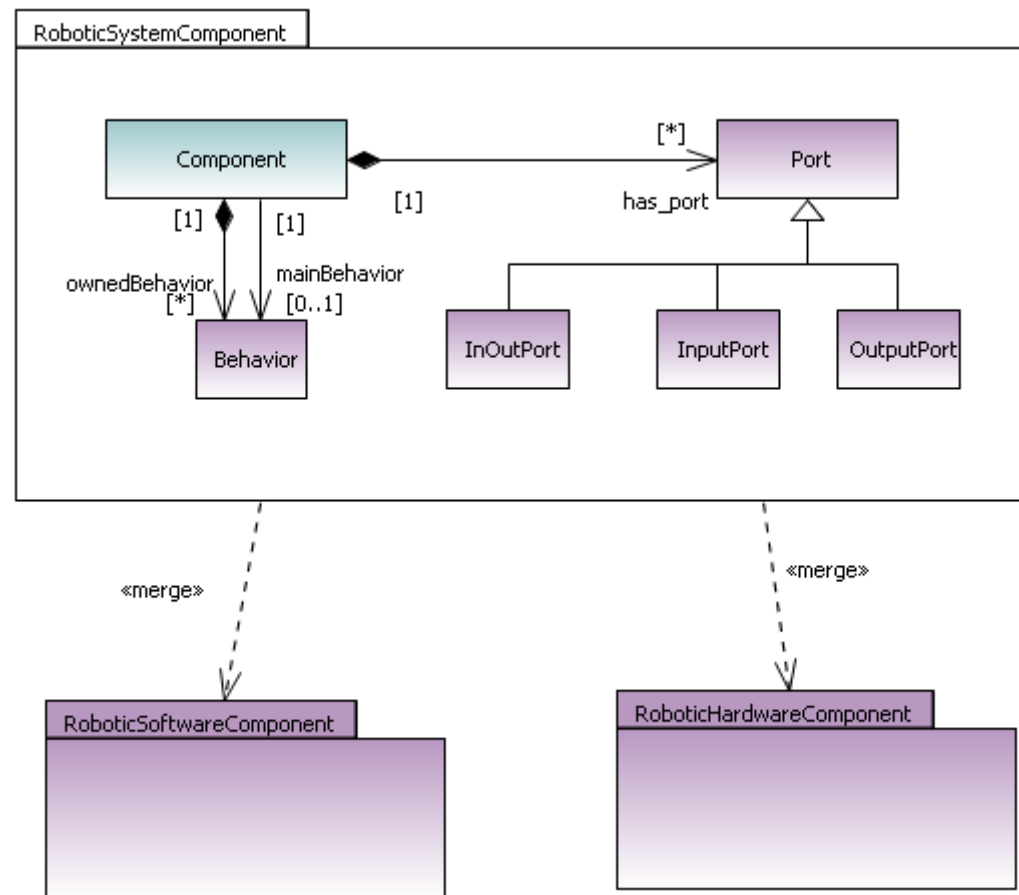
The PROTEUS Architecture DSL

- Proteus Architecture domain model



The PROTEUS Architecture DSL (3/3)

- Robotic System Component



Conclusion & Discussion

Ontology

- to classify things of the World

DSL

- to build engineering artifacts

Methodology for reusing ontologies in the development process of domain specific languages

- Guiding the definition of the domain model of the PROTEUS Robotic Architecture DSL
- Comparison methodology will be set up for validation on the ontology

Conclusion & Discussion

To handle an ontology guided approach to delimitate the borders of these three DSLs from the ontology

To delimitate the scope of the architecture viewpoint

Isn't a DSL an engineering viewpoint on a larger domain in itself?