

# Integrating Ontological Domain Knowledge into a Robotic DSL

Saadia Dhouib, CEA LIST (France)

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THALES



# Outline

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1. The PROTEUS Project
2. From PROTEUS ontology to PROTEUS DSLs
3. The PROTEUS robotic Ontology
4. The PROTEUS Architecture DSL
5. Conclusion

# The Proteus Project

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## 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 is investigated into two forms: ontologies and domain specific languages

# Ontology

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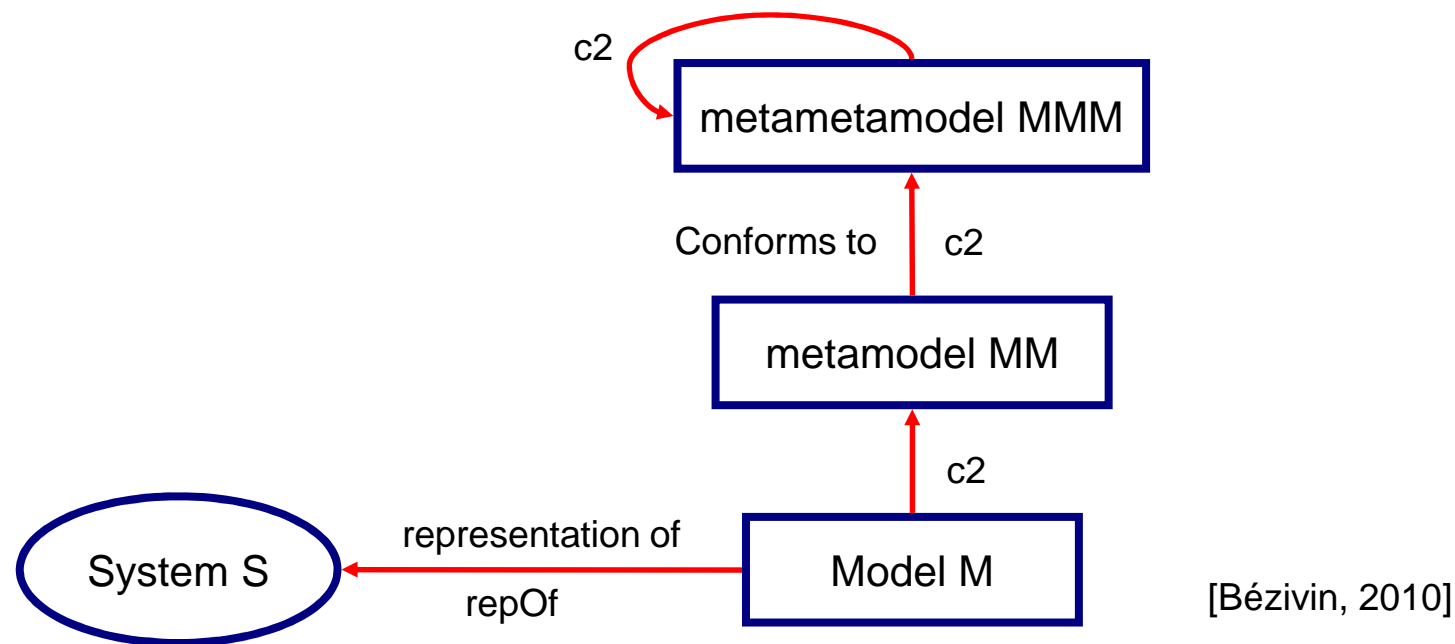
## Ontology

- *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

# Domain Specific Language

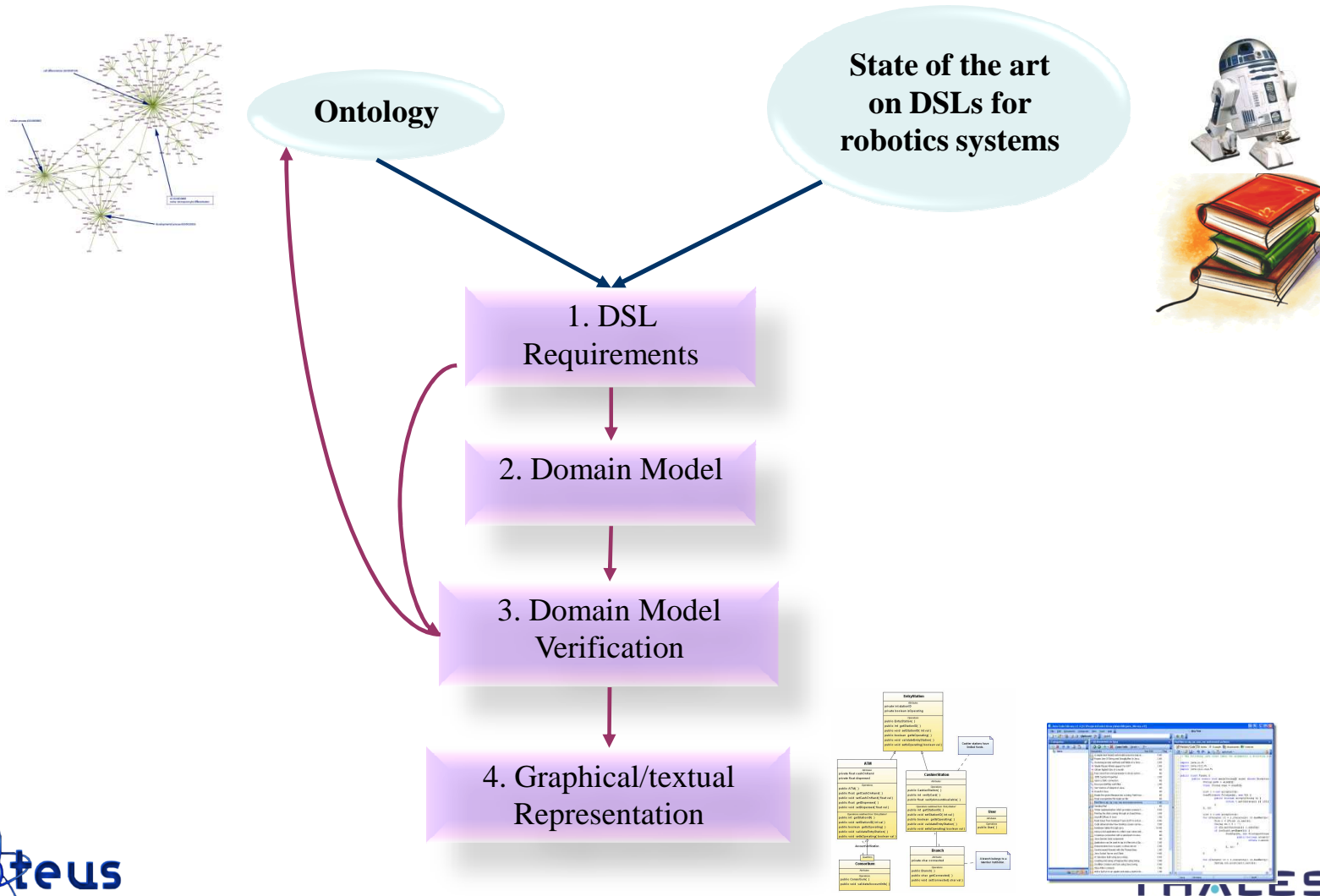
## DSL

- A formal language tailored to a specific application domain



- 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

# From PROTEUS ontology to PROTEUS DSLs



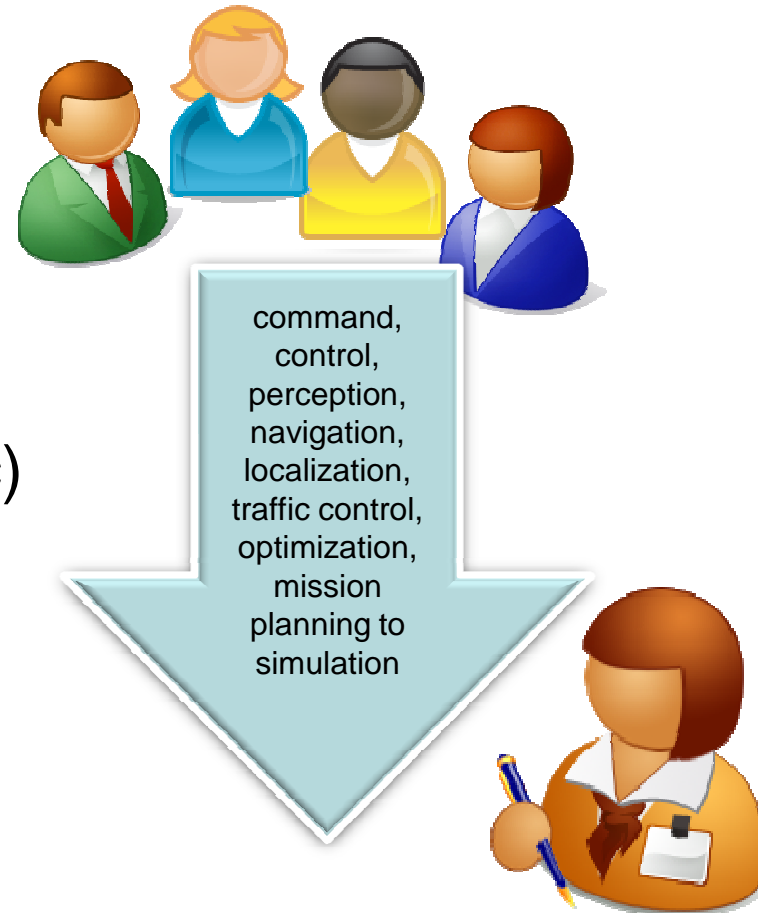
# The PROTEUS robotic Ontology

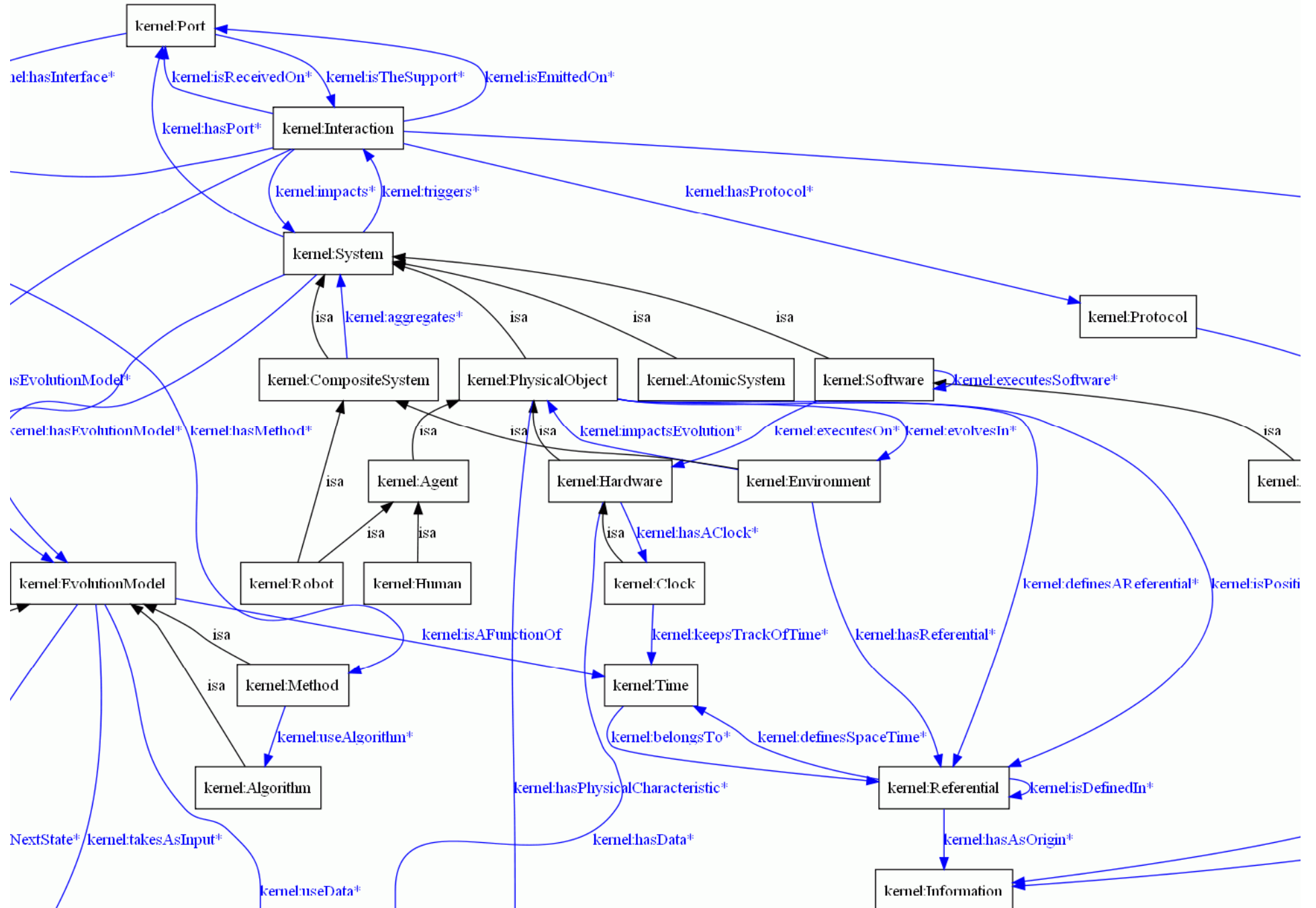
## Building methodology

- Scenarii
- Expert interviews

## Ontology Format

- OWL DL (Description Logic)
- 205 concepts
- 73 relationships (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

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## Architecture DSL

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

## Communication/Control DSL

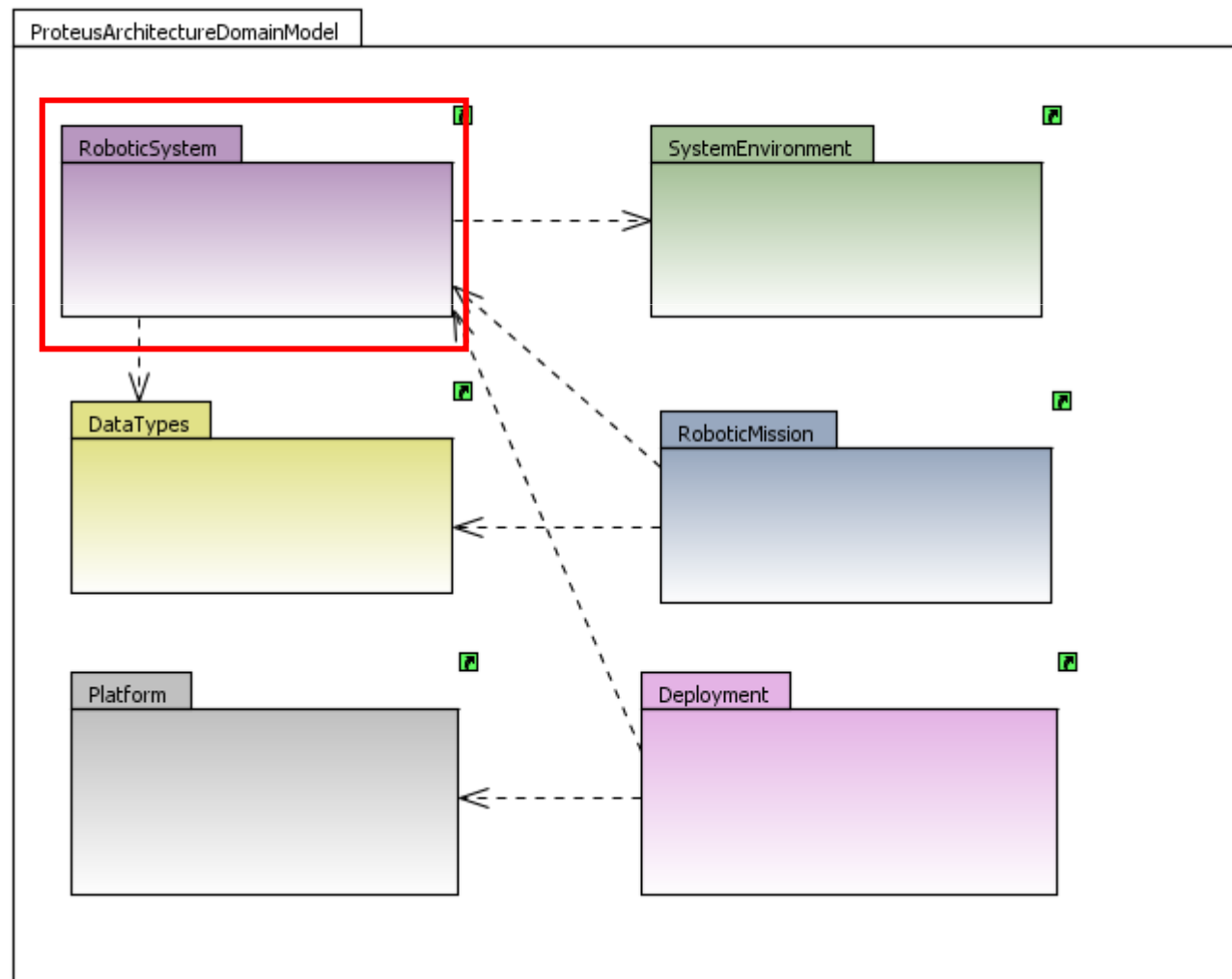
- control the robotic components
- ease the definition of communication mechanisms between components (data flow, client/server)

## Algorithms DSL

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

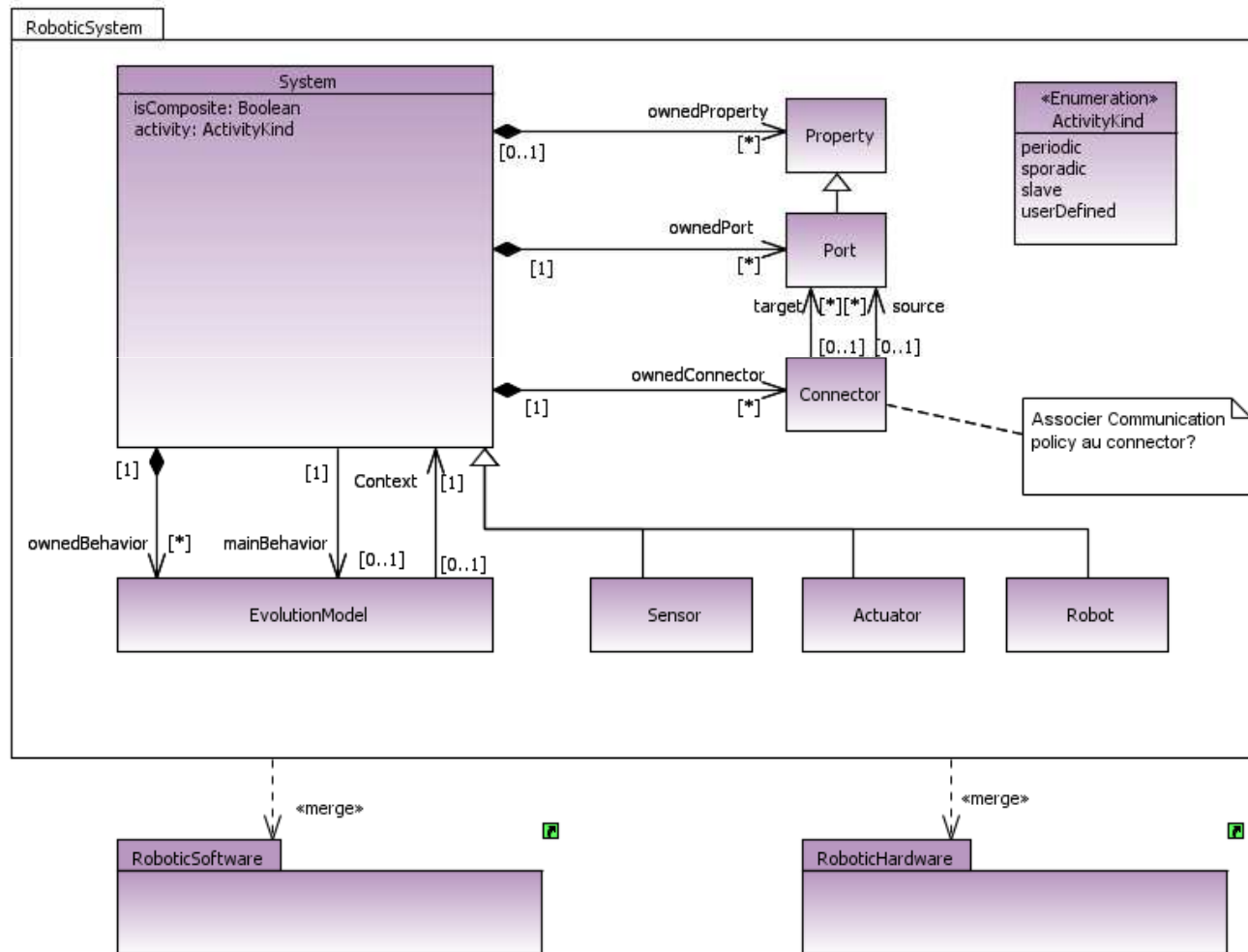
# The PROTEUS Architecture DSL (1/3)

- Proteus Architecture domain model



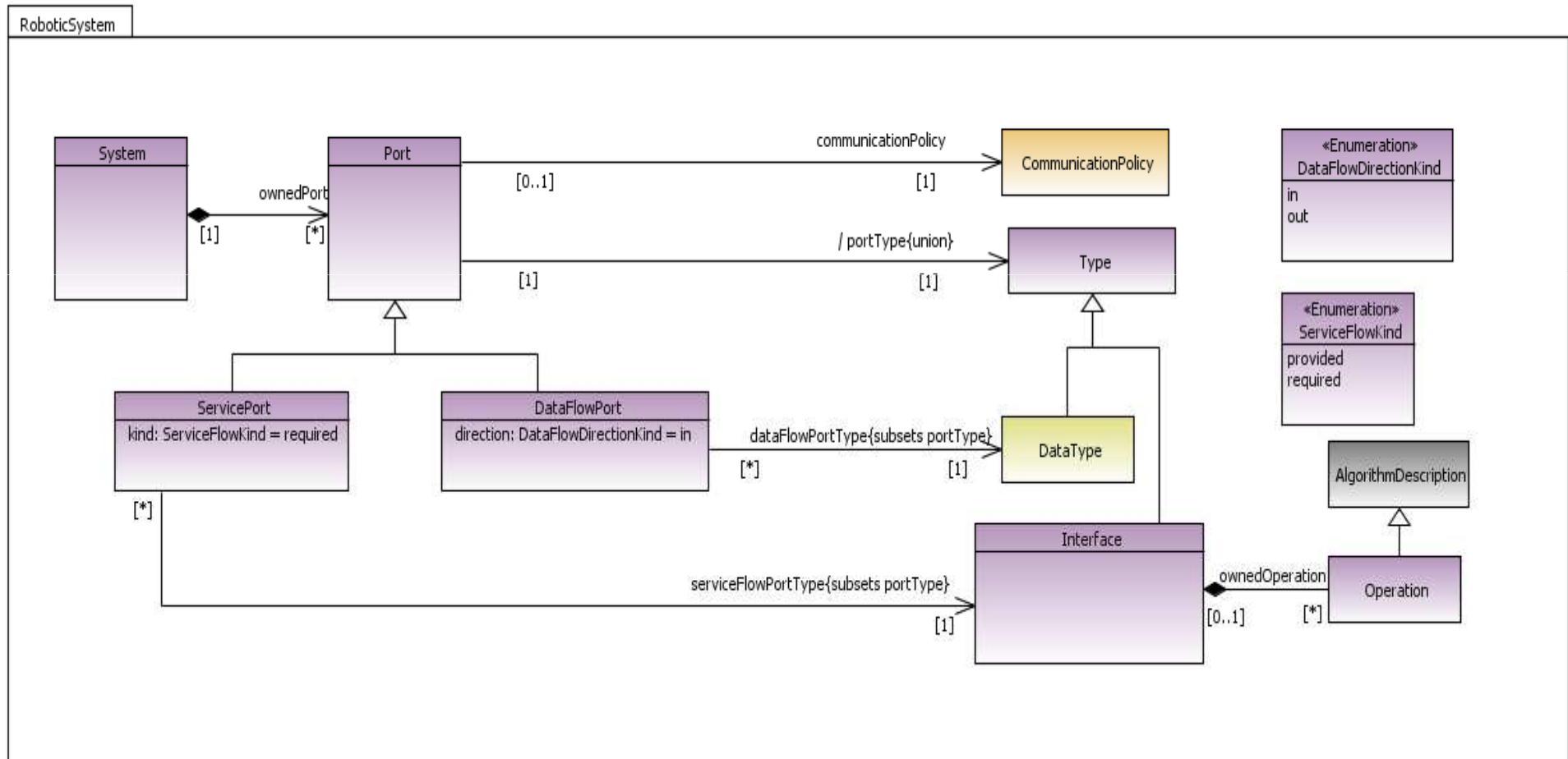
# The PROTEUS Architecture DSL (2/3)

- Robotic System Package

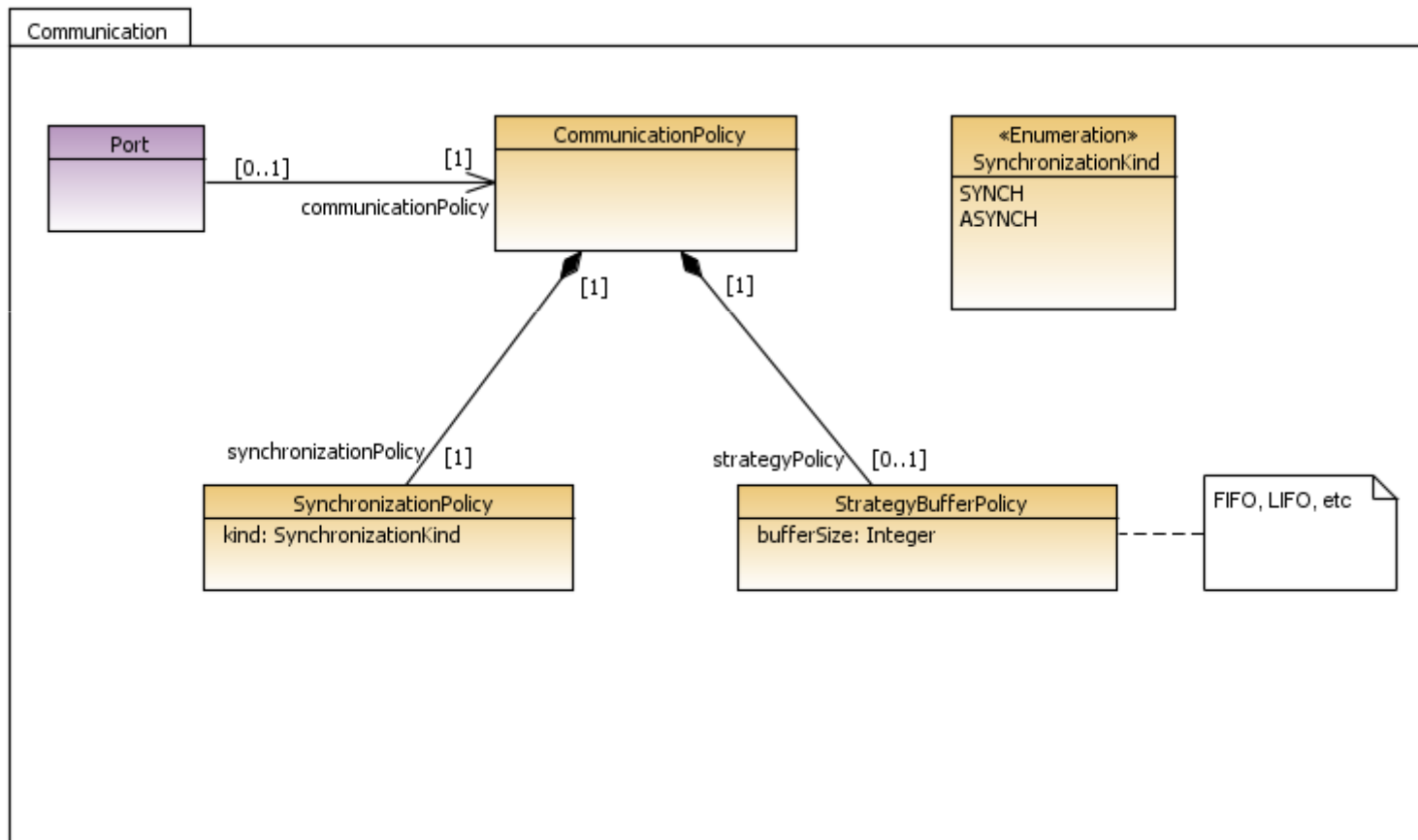


# The PROTEUS Architecture DSL (3/3)

- Robotic System Package



# Proteus Communication



# Conclusion

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## 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 is set up for validation on the ontology