OPC UA Designer: A model driven toolset for Industry 4.0 systems design and deployment of OPC UA Information models

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INTRODUCTION

- There Is No Industrie 4.0 without OPC UA[1]

- Need for OPC UA CS for specific semantics description

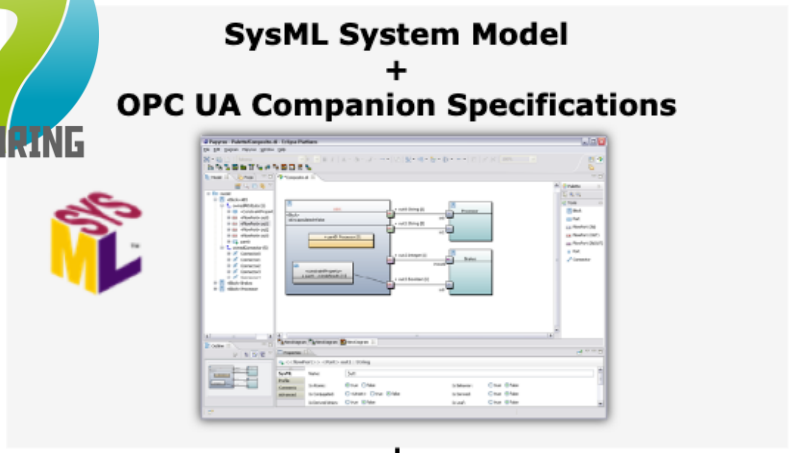
- Need for model driven tools for fastening the deployment of Industry 4.0 compliant systems

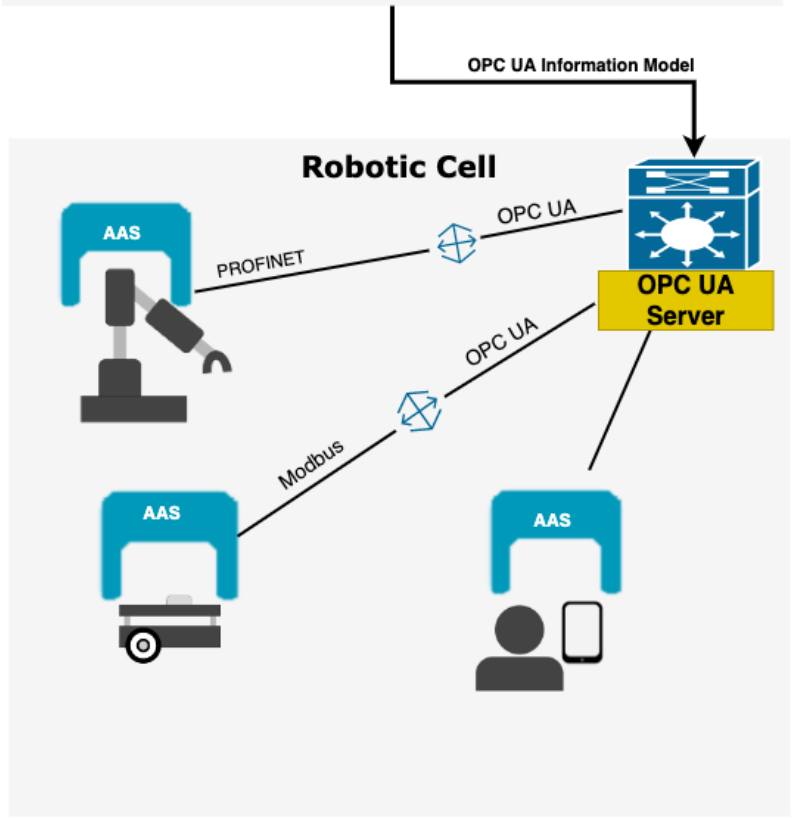
→ Choice of SysML as a modelling language and Model2Model transformation for automating the deployment of OPC-UA Information models

[1] Industry 4.0 and OPC UA: https://opcconnect.opcfoundation.org/2017/06/there-is-no-industrie-4-0-without-opc-ua/

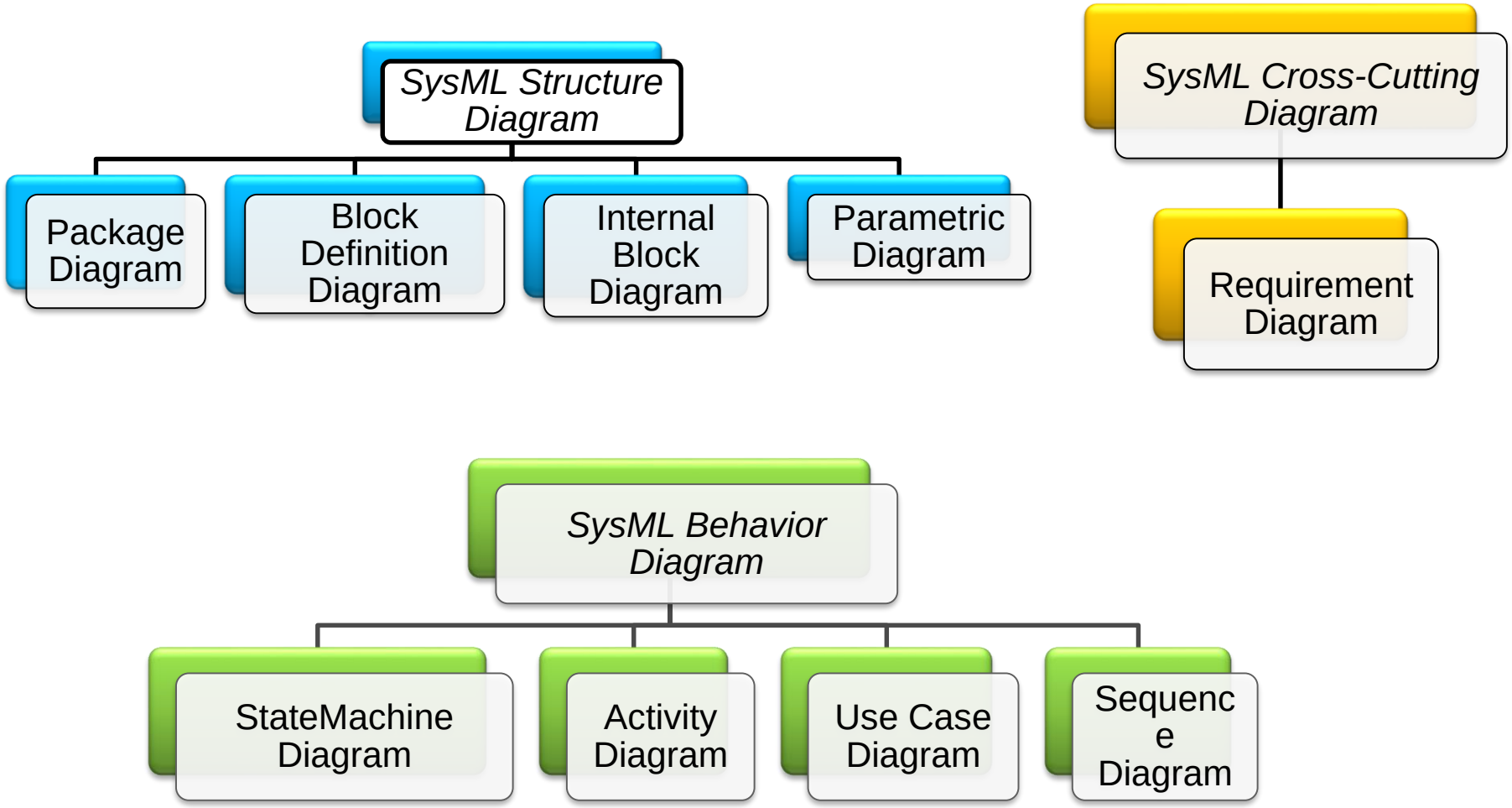
OPC UA DESIGNER

- **A Model Driven Tool providing:**
  - SysML Modelling Environment for Industry 4.0 systems design
  - OPC UA Companion Specification for adding standardized data models
  - Automatic deployment of OPC UA information models from SysML models



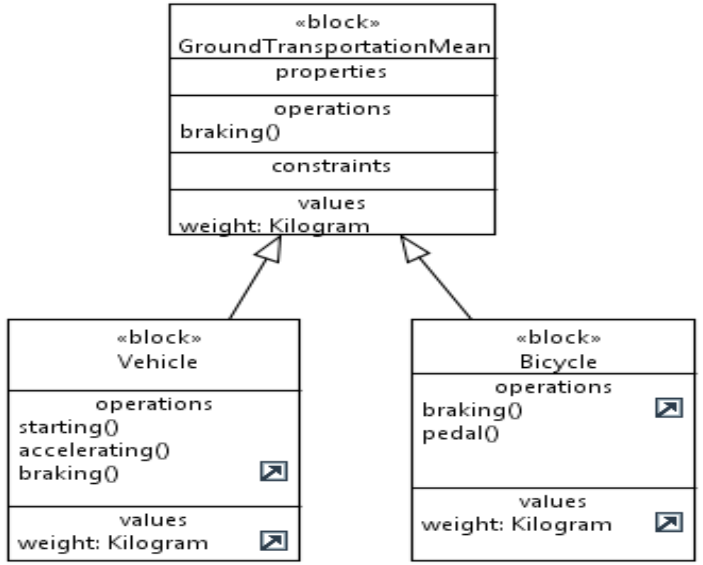


SYSML Introduction

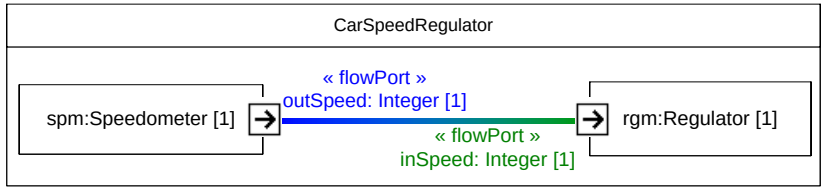


SysML: Multiple dedicated viewpoints

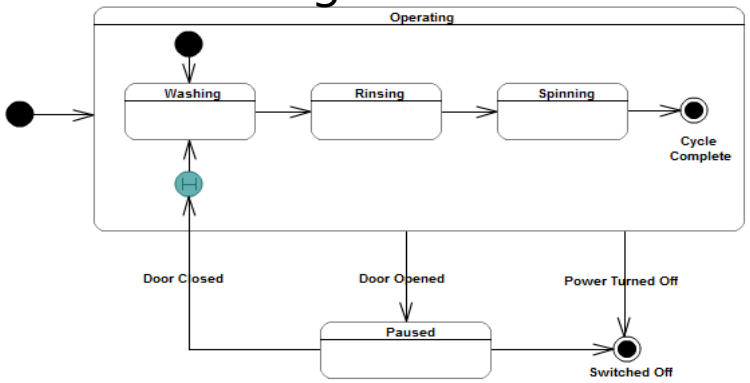
Block Definition Diagram



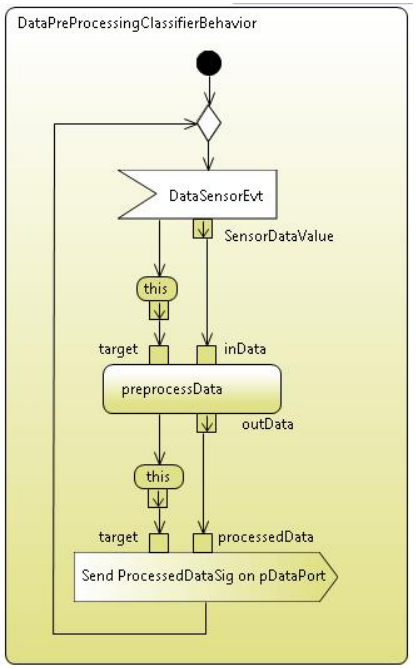
Internal Block Diagram



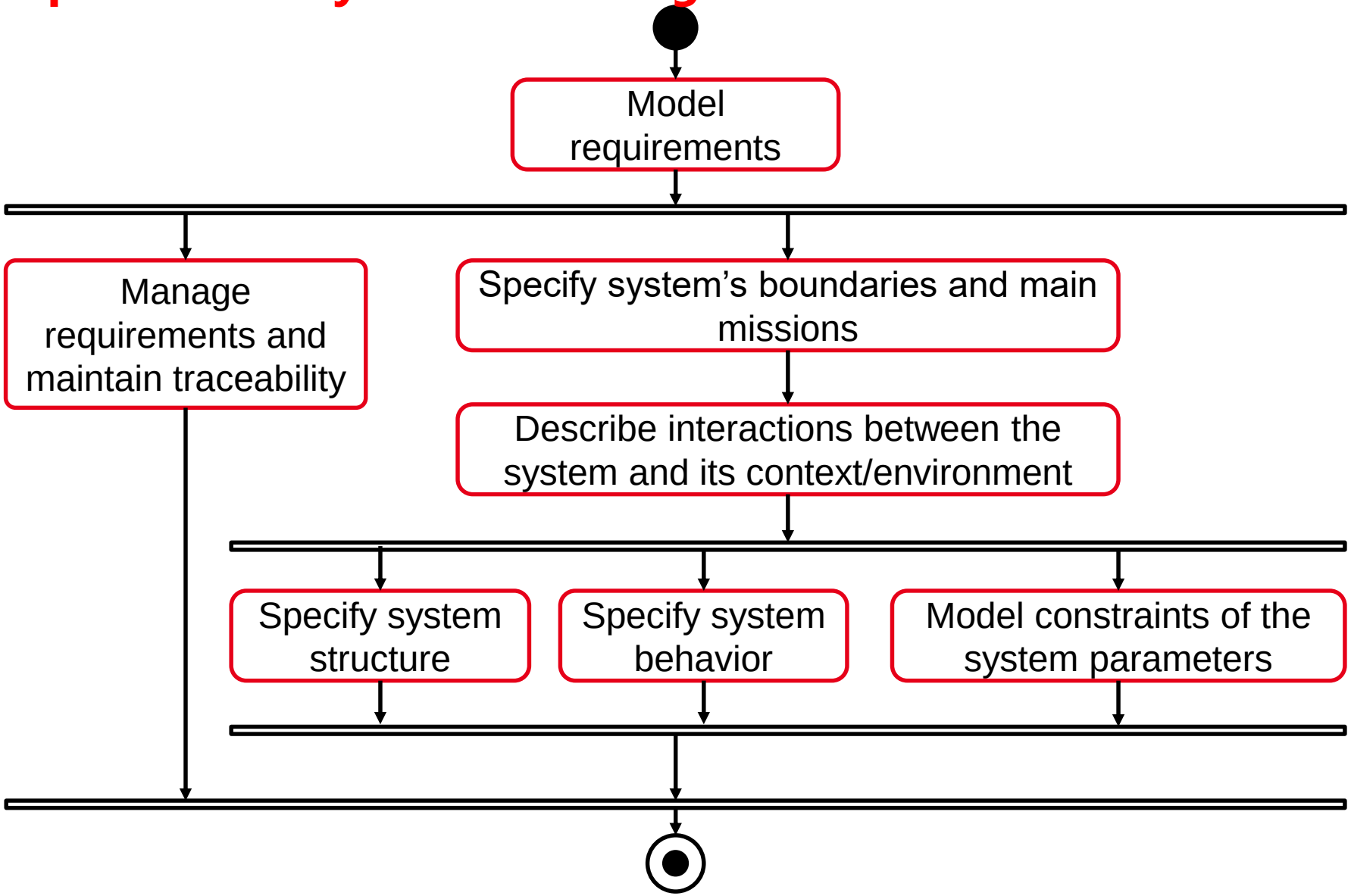
Statemachine Diagram



Activity Diagram



A process for system modeling



SysML for robotic cells modelling

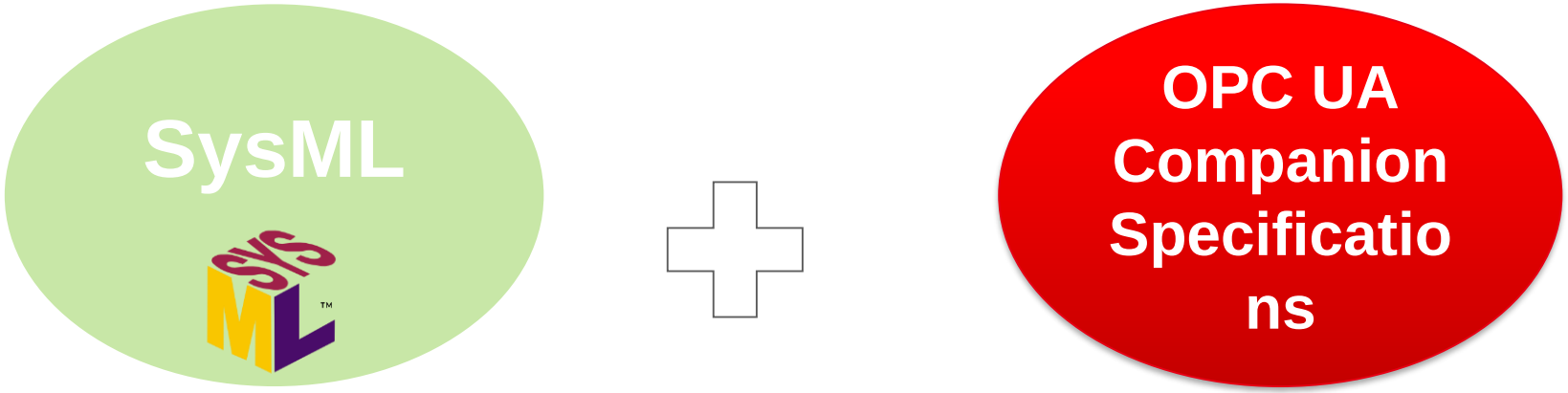
1. **Specification:**
   Use Case diagrams, Requirements diagrams

2. **Functional Design:**
   Structure: BDD, IBD
   Behavior: State Machine diagrams, activitiy diagrams, sequence diagrams

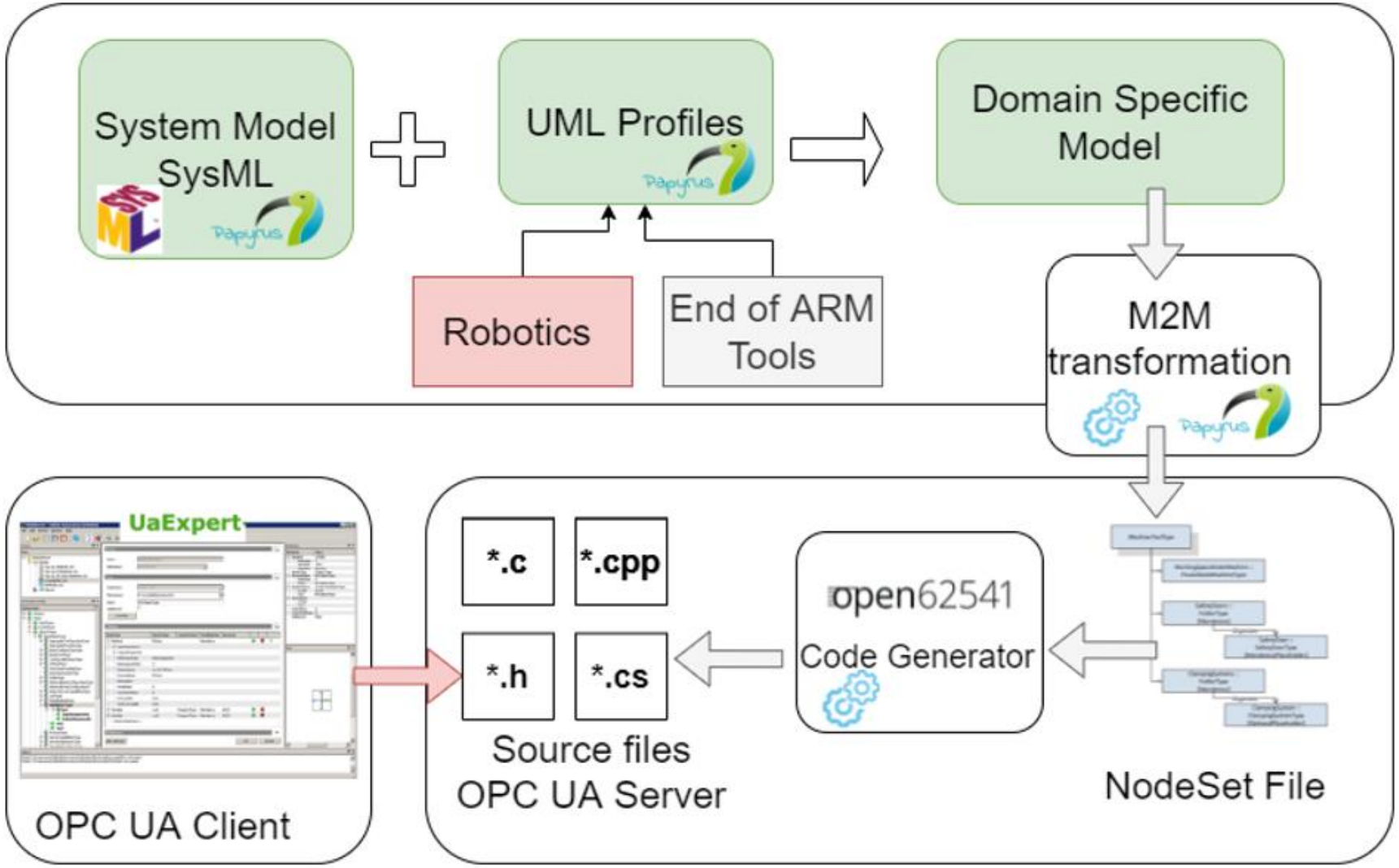
Extending SysML with Robotics Information Models

SysML Blocks are generic and do not contain meta data specific to robotic systems

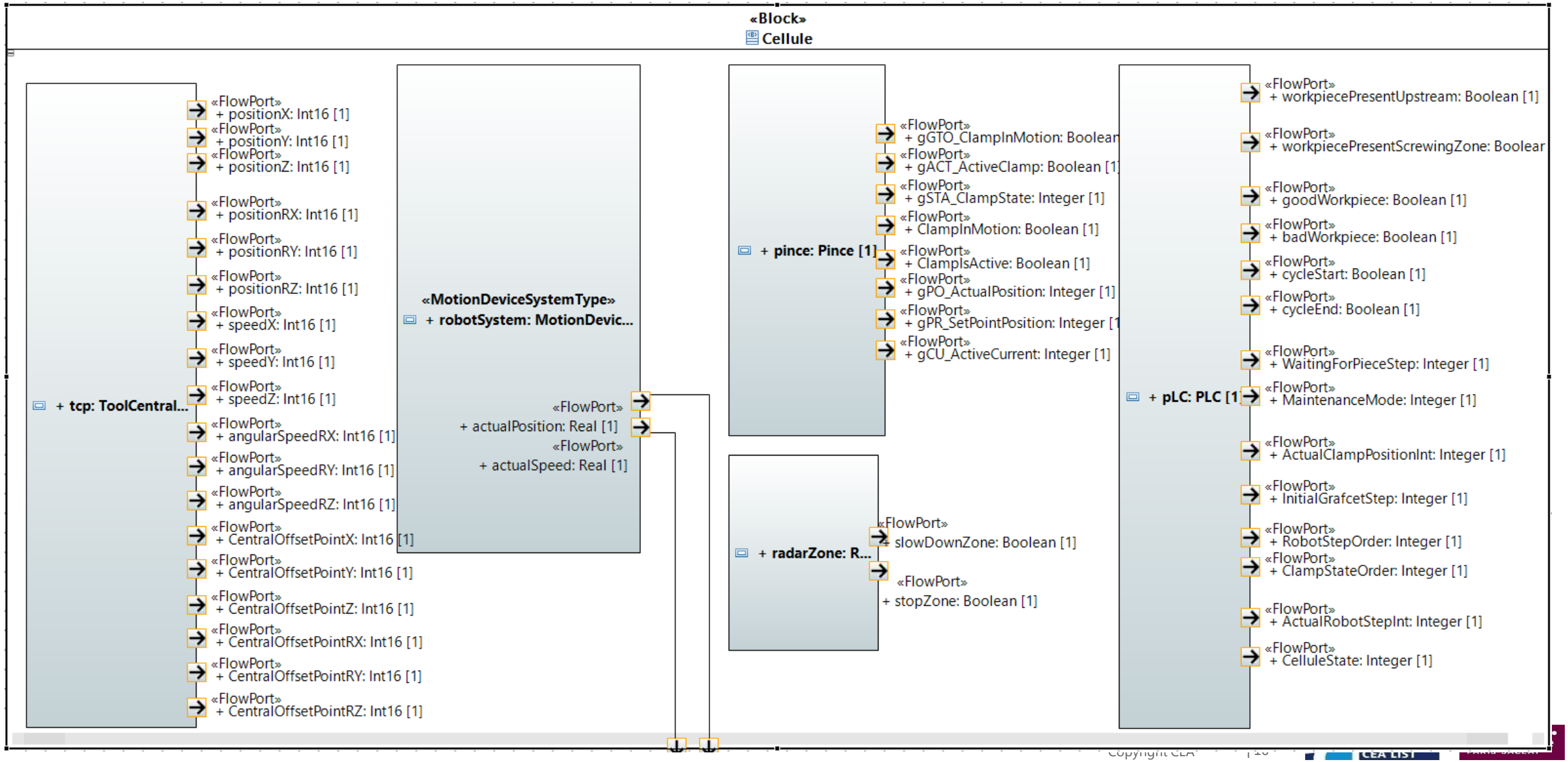
Extension of SysML by adding OPC-UA Companion Specifications as UML Profiles



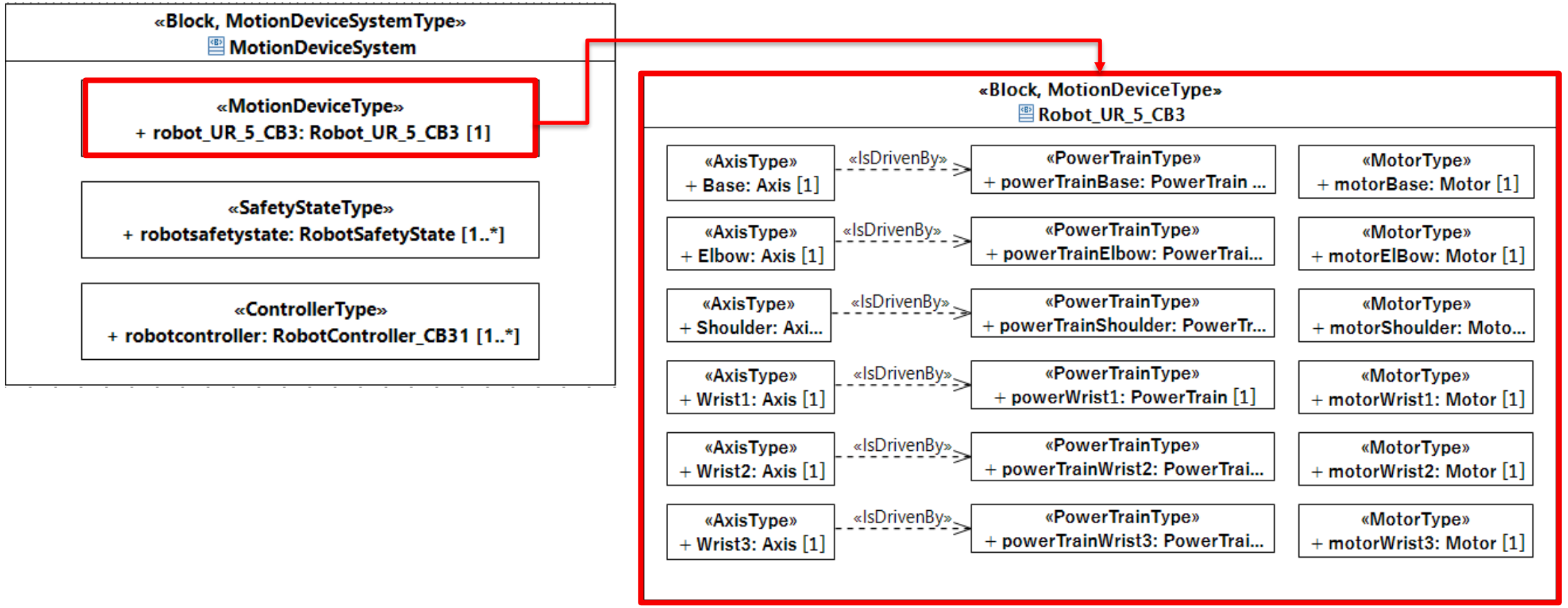
MODEL DRIVEN TOOL-CHAIN ARCHITECTURE



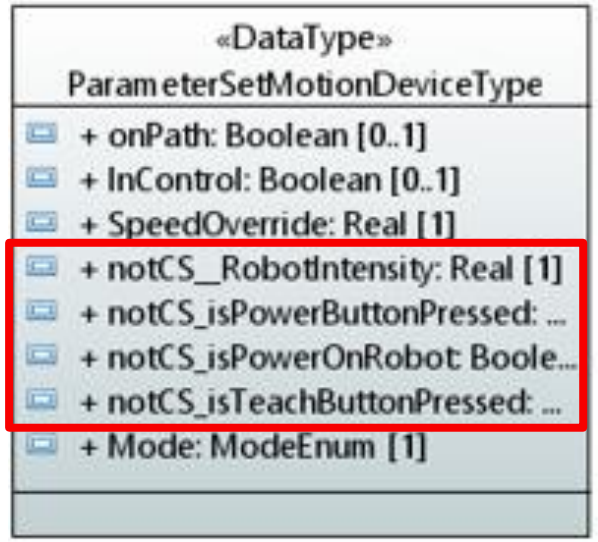
ROBOTIC CELL SYSML MODEL : IBD

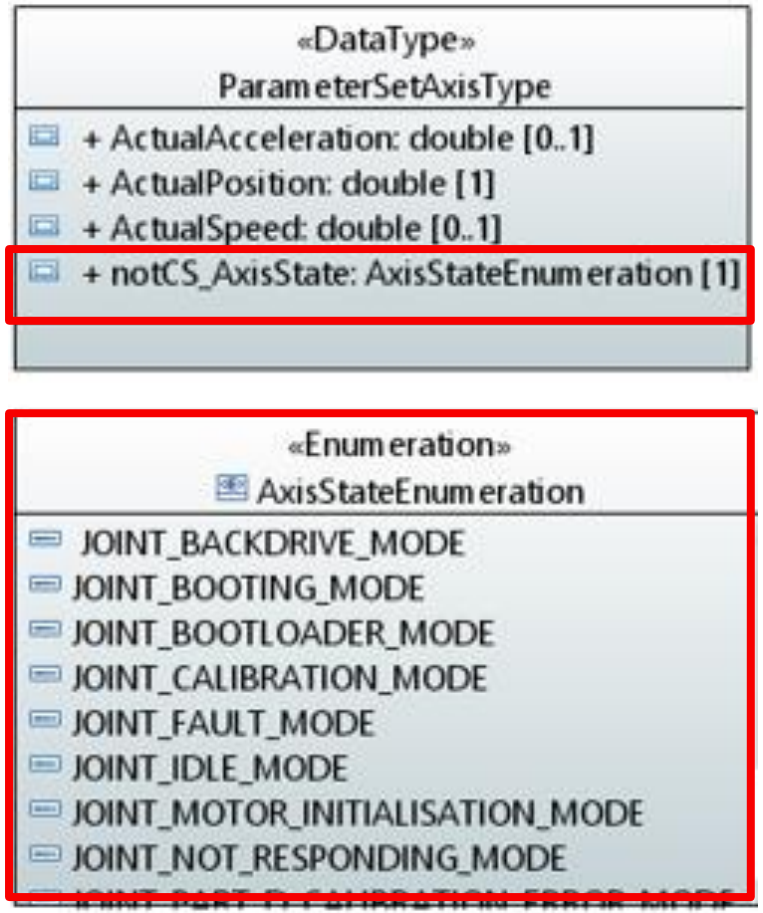


Motion Device System Model

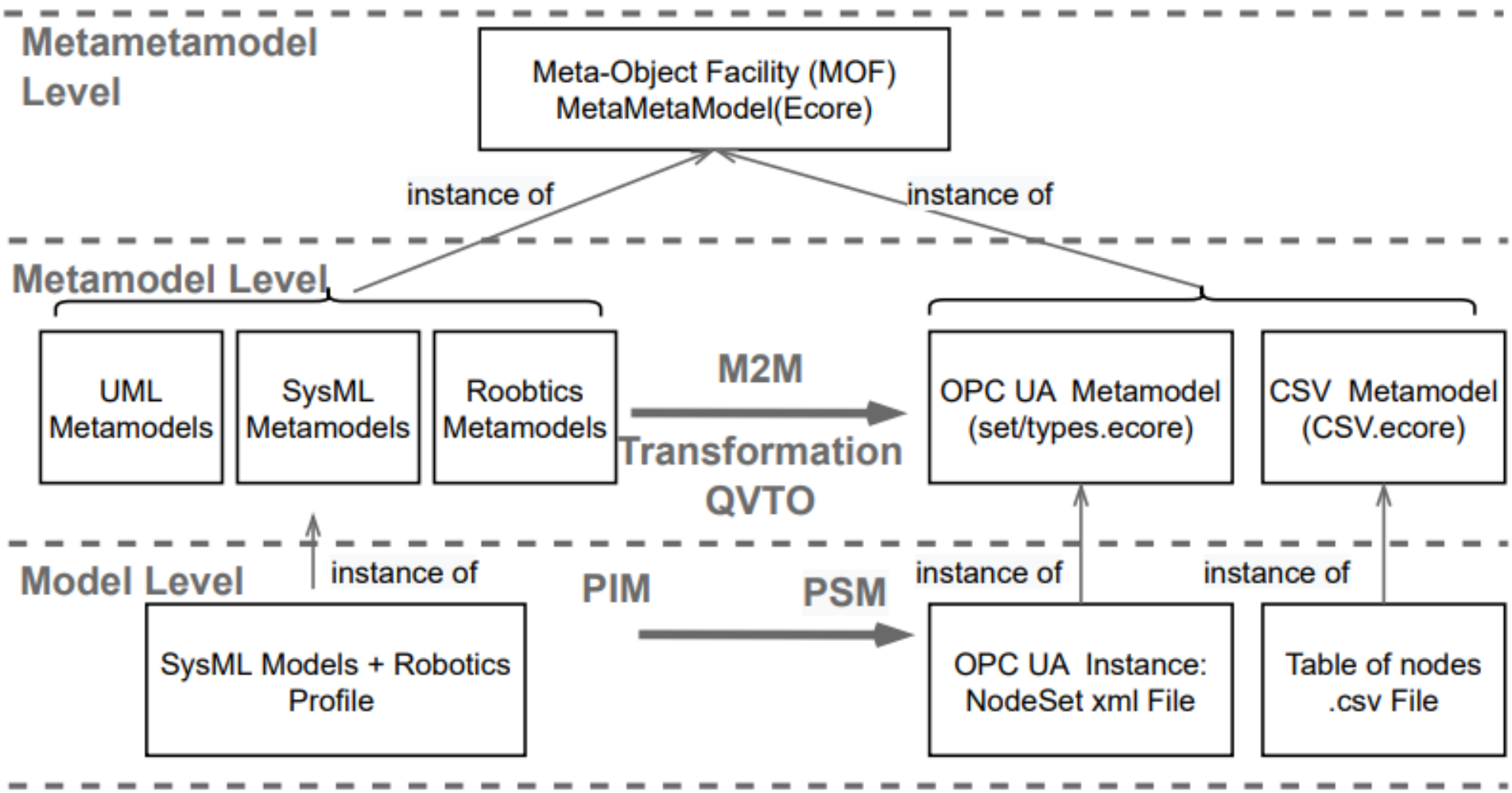


Extendingthe CS Robotics Profile

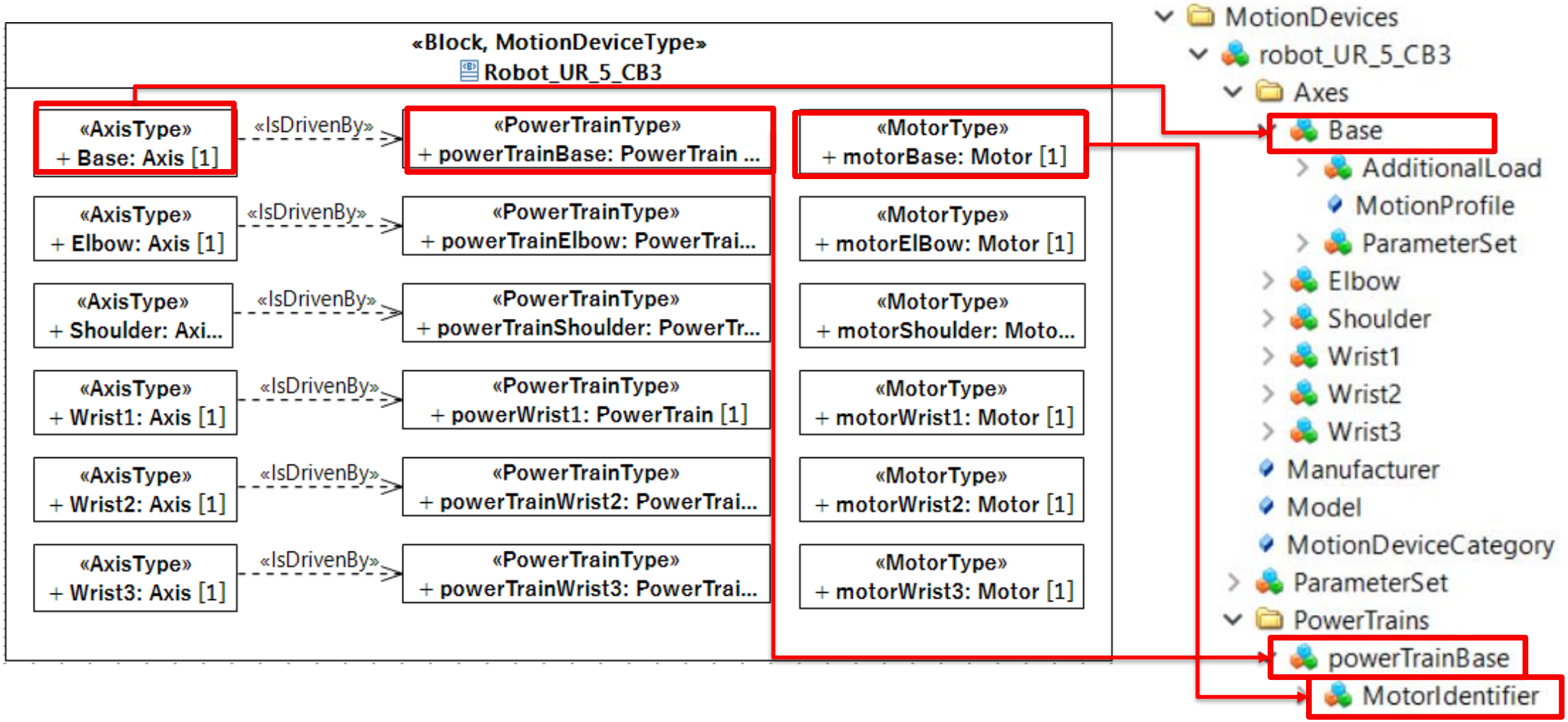


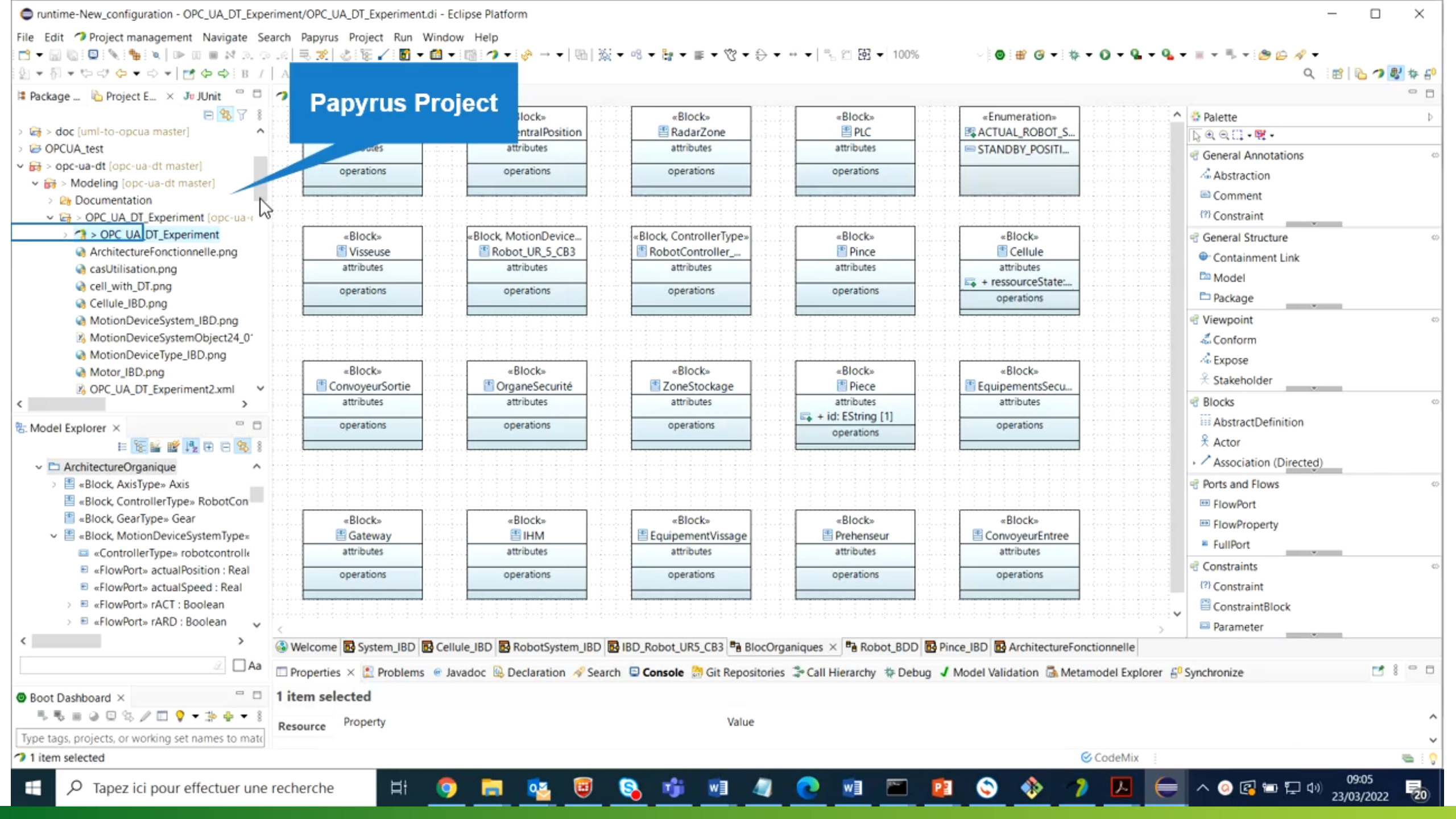


QVTo Transformation



Modelling and Transformation of the MotionDeviceType instance

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File Edit Project management Navigate Search Papyrus Project Run Window Help
Papyrus Project
Package ... Project E... JUnit
doc [uml-to-opcua master]
OPCUA_test
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Modeling [opc-ua-dt master]
Documentation
OPC_UA_DT_Experiment [opc-ua-
OPC_UA_DT_Experiment
ArchitectureFonctionnelle.png
casUtilisation.png
cell_with_DT.png
Cellule_IBD.png
MotionDeviceSystem_IBD.png
MotionDeviceSystemObject24_0
MotionDeviceType_IBD.png
Motor_IBD.png
OPC_UA_DT_Experiment2.xml
Model Explorer
ArchitectureOrganique
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«Block, ControllerType» RobotCon
«Block, GearType» Gear
«Block, MotionDeviceSystemType»
«ControllerType» robotcontroll
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«FlowPort» actualSpeed : Real
«FlowPort» rACT : Boolean
«FlowPort» rARD : Boolean
Boot Dashboard
Type tags, projects, or working set names to mat
1 item selected
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«Block» PLC
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STANDBY_POSITI...
«Block» Visseuse
«Block, MotionDevice... Robot_UR_5_CB3
«Block, ControllerType» RobotController_...
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«Block» ZoneStockage
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attributes
operations
Palette
General Annotations
Abstraction
Comment
Constraint
General Structure
Containment Link
Model
Package
Viewpoint
Conform
Expose
Stakeholder
Blocks
AbstractDefinition
Actor
Association (Directed)
Ports and Flows
FlowPort
FlowProperty
FullPort
Constraints
Constraint
ConstraintBlock
Parameter
Welcome System_IBD Cellule_IBD RobotSystem_IBD IBD_Robot_UR5_CB3 BlocOrganiques Robot_BDD Pince_IBD ArchitectureFonctionnelle
Properties Problems Javadoc Declaration Search Console Git Repositories Call Hierarchy Debug Model Validation Metamodel Explorer Synchronize
1 item selected
Resource Property Value
CodeMix
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23/03/2022

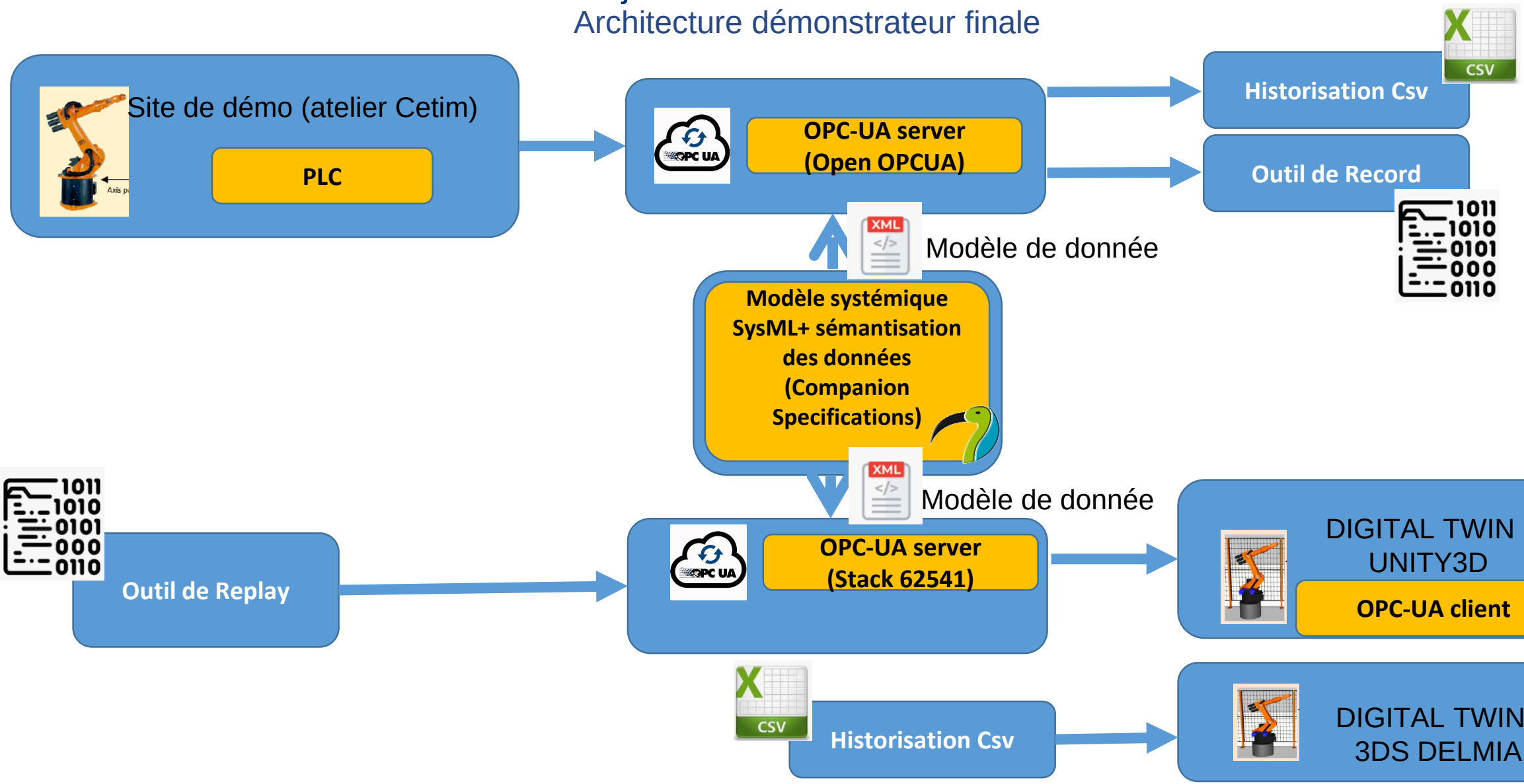
Future Work

- Take into consideration other Companion Specification (PLC, End Of Arms Tools…)
- Generation of Companion Specification from SysML Models
- Automatically deploy the OPC-UA clients (3D DT) from the SysML model

Questions

Projet « OPCUA CS-DT »

Architecture démonstrateur finale



FactoryLab