

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: IC1404 – Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS)

STSM title: Creation of a MPM4CPS Ontology

STSM start and end date: 22/10/2018 to 30/10/2018

Grantee name: Stefan Klikovits

PURPOSE OF THE STSM:

The purpose of the STSM was to work on the MPM4CPS ontology that is part of the Working Group 1 deliverable. Specifically, several tasks were planned for the work period. First, as one of the deliverables is a catalogue of formalisms, languages and tools that are currently used in cps modelling, the task at hand is to review, complete and extend the information that was scaffolded in previous iterations. Next, the ontology that was created so far needs to be reviewed to update the classifications to the additionally gathered insights.

Lastly, one more document, the Framework to Relate / Combine Modeling Languages and Techniques has to be reviewed. The existing framework proposal positions popular modelling approaches in well-needed context. However, vital parts of the document are yet to be filled (marked as TODOs) or missing entirely from the document. I want to add this information, as it provides the theoretical foundation of the modelling and cyber-physical systems approaches, as well as their combination.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

After my arrival at Telecom ParisTech, I started to review the existing information that was provided in the catalogue. The initial review showed, that most of the existing descriptions of the catalogue items were template copies, taken from Wikipedia or language/tool developer webpages. After the discussion with Dominique, we decided that it is essential for the deliverable to write descriptions for the existing items, while at the same time adding references to other resources. We removed certain items, as they were too generic

(e.g. general purpose programming languages), too specific (niche solutions, without general applicability) or for other reasons not fitting.

During the week, Moussa Amrani joined us at Telecom ParisTech for his STSM, and we combined our efforts to work towards an understandable formalisation of modelling paradigms and their relation to the MPM4CPS framework. We synchronised with the people from the MPM4CPS Meeting at Telecom ParisTech in September to include their feedback and further understand their concerns. We also had a group call with participants of the meeting in Potsdam to clarify some of their results. Based on this information we worked towards creating a merge of the available information and streamlining our approaches. We further explored the existing ontology's classification structure and identified missing concepts.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The work on the catalogue led to description and revision of the items within. It serves as a basis for the ontology and as a deliverable for the working group 1. The catalogue can be used by newcomers in the domains as a source for looking up information regarding individual concepts. Due to its ontological basis, it is also possible to explore the ontology (given an appropriate tool). The goal of making the ontology explorable led to the proposal of new classifications, object properties and relations, that can be used to more efficiently capture the knowledge that is shared in our domain.

The collaboration on the topic of the paradigm definition and the formalization of multi-paradigm modelling led to the draft of a formalization that will be presented to the MPM4CPS members at the meeting in Pisa.

Thirdly, the updated ontology serves as a basis for further exploration and as a foundation for a comprehensive collection of merging modelling and cyber-physical systems concepts.

FUTURE COLLABORATIONS (if applicable)

There are several points on which we want to collaborate in the future. First, the work on the catalogue and ontology is not finished. While the STSM succeeded in creating a solid foundation, there are many more formalisms, languages and tools that can be added to the catalogue and ontology in order to create a comprehensive knowledge base. We aim to present this work to our colleagues at the MPM4CPS training school and meeting in Pisa.

Concretely, we plan to publish our findings in the form of several publications.

- First, we aim to summarise the ontology and catalogue insights in a chapter of the upcoming MPM4CPS book.
- Next, we believe that the work is a solid foundation for work on a comprehensive ontology, that should be published at a conference or dedicated journal. At the moment we are still evaluating the exact format of publication.
- Finally, the work on the formal definition of the paradigm and multi-paradigm already led to the outline of a scientific article, which will most likely result in a publication.