

# Coordination with Performance Guarantees

## Reo2MC tool

Farhad Arbab, Rob van der Mei, Sun Meng, Young-Joo Moon, Chretien Verhoef  
 {Farhad.Arbab, R.D.van.der.Mei, M.Sun, Y.J.Moon, C.G.Verhoef}@cwi.nl  
<http://www.cwi.nl/projects/CooPer>

### Introduction

The growing complexity and importance of coordination models in software applications necessarily lead to a higher relevance of performance issues for coordinators during development of systems. In this context, the performance of such models plays an important role in the quality of the final software system. Unfortunately, the lack of tools that support the performance analysis of coordination models makes it difficult to automatically verify the performance properties of coordination models. Hence, CWI researchers have introduced a quantitative channel-based coordination model, *stochastic Reo*, together with its semantic model, *Quantitative Intentional Automata (QIA)*, and its translation to a stochastic model: *Continuous-time Markov Chains (CTMCs)* [3]. Based on these formalisms, we have implemented a tool, called *Reo2MC*, which translates a Reo connector to its corresponding CTMC model, and generates an input file for third party tools for stochastic analysis.



Figure 1: Reo2MC Graphical Interface

### Tool usage

Reo2MC works as an Eclipse application through a graphical user interface (see Figure 1) [1]. Its architecture is shown in Figure 2.



Figure 2: Architecture of Reo2MC

### Example

In order to demonstrate the tool, we use a small example: SyncManager between two components transfers data from CM1 (a legacy component) to CM2 (a new component), which is modelled in the Reo Editor [4].



Figure 3: SyncManager scenario in Reo2MC

Figure 4 and Figure 5 show the derived semantic model and the generated input file for PRISM [2] by Reo2MC, respectively. From there, we can do experiments, for example, Figure 6 shows the probability of completing the transmission of data by SyncManager within different time intervals (T).

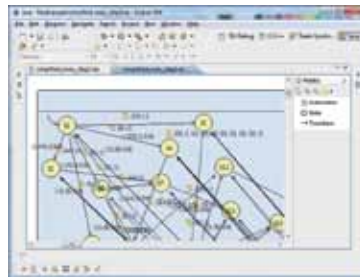


Figure 4: QIA of SyncManagerConclusion

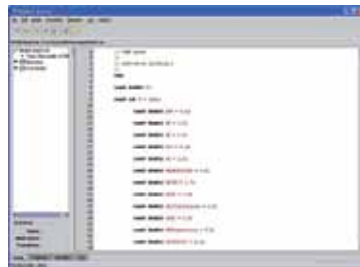


Figure 5: PRISM file derived from Figure 3

### Conclusion

Reo2MC is a tool for stochastic analysis of coordination models which are specified as Stochastic Reo and Quantitative Intentional Automata. This tool provides an integrated framework from a specification of system behaviour to stochastic model for its performance analysis. As future work we want to use semi-Markov chains or phase-type approximations to handle non-exponential distributions as well.

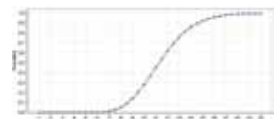


Figure 6: Experiment results

### Acknowledgement

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### References

- [1] Eclipse Coordination Tools. <http://reo.project.cwi.nl/>.
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- [4] F. Arbab, S. Meng, Y.J. Moon, M. Z. Kwiatkowska, and H. Qu. Reo2mc: a tool chain for performance analysis of coordination models. In *ESEC/SIGSOFT FSE*, pages 287-288, 2009.