Actor-Based Modeling Patterns for Flow Management

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Abstract

I explain modeling in two different contexts of science and engineering, and where we may have different goals of synthesis or analysis, and how we may move in opposite directions of abstraction and refinement. I focus on the domain of track-based flow management of automated systems, and the two different modeling views of Eulerian and Lagrangian in this domain. I discuss how the features of the system, like having centralized or decentralized control, and the required infrastructure affect our choice, and how the choice between these two models affects modeling efficiency. Moreover, different goals in building the model guide us in choosing Eulerian or Lagrangian views. Generally, if the optimization goal and the properties of interest like safety have a more global nature then an Eulerian model is more convenient, and if the goal and properties concern the moving object the Lagrangian view is the one to choose. The same argument hold for adaptation. In many cases we need a combination of both to achieve all the goals of our modeling.

The idea is mainly originated in our collective experience in modeling different applications using actors. In a range of seemingly different applications, we distinguish a comman pattern of flow management in the problem domain and created two different templates track-as-actor, and moving-object-as-actor for modeling and analysis. I show these two actor-based templates, using an example of an automated quarry site.

Biography

Marjan Sirjani is a Professor at School of Innovation, Design and Engineering at Malardalen University, Sweden, and also a part-time professor at School of Computer Science at Reykjavik University, Iceland. Her main research interest is applying formal methods in Software Engineering. She works on modeling and verification of concurrent and distributed systems. Marjan and her research group are pioneers in building model checking tools, compositional verification theories, and state-space reduction techniques for actor-based models. She has been working on analyzing actors since 2001 using the modeling language Rebeca. Rebeca and its extensions are designed to bridge the gap between model-based software development and formal analysis, and has been used for analyzing different network and system applications. She has also worked on coordination languages and is the co-author of the paper proposing Constraint Automata as the compositional formal semantics for the coordination language Reo.

Marjan is a co-founder of Icelandic Center for Research on Software Engineering at Reykjavik University, and the founder of Formal Methods Laboratory at University of Tehran. She has been a member of expert panel on Engineering and Physical Sciences at RANNÍS, The National Icelandic Centre for Research. Marjan has been the PC member and PC chair of several international conferences including Coordination, FM, FMICS, ICFEM, FSEN, and guest editor for special issues of the journals Science of Computer Programming and Fundamenta Informaticae.