PORGY : a Visual Analytics Platform for System Modelling and Analysis Based on Graph Rewriting

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Abstract. PORGY is a visual environment for rule-based modelling based on port graphs and port graph rewrite rules whose application is steered by rewriting strategies. The focus of this demonstration is the visual and interactive features offered by PORGY, which facilitate an exploratory approach to model, simulate and analyse different ways of applying the rules while recording the model evolution, as well as tracking and plotting system parameters.

1 Introduction

We propose PORGY [1] (Fernández, Kirchner, and Pinaud, 2016) a general visual modelling framework (Fig. 1) based on graph rewriting (or graph rewriting) for complex systems. PORGY is based on the use of *port graphs with attributes* to represent system states. In a port graph, edges connect to nodes at specific points, called ports. Nodes, ports and edges describe system components and their relationships, while attributes encapsulate the data values associated with each entity. We use graph transformations based on port graph rewrite rules to describe the evolution of the system.

Graph transformations are usually specified by means of rules (Ehrig, Engels, Kreowski, and Rozenberg, 1997) and have been implemented in a variety of modelling tools, e.g., BioNetGen (Faeder, Blinov, and Hlavacek, 2009) or RuleBender (Smith, Xu, Sun, Faeder, and Marai, 2012). Such tools integrate visualisation with modelling and simulation of rule-based biochemical models with an emphasis on visual model exploration and integrated execution of simulations. States are represented by graphs describing the system components; their interactions are defined by rules governed by associated rate constants, which determine how frequently the rules apply. BioNetGen explicitly uses the structure of port graphs, while the other tools use graph-based structures with labels.

Generally speaking, port graph rewrite rules are graphical representations of transformations in the system, thus they provide a direct, visual mechanism to observe the system's behaviour. In addition to port graphs and rewrite rules our modelling approach includes *strategy expressions* to steer rule applications. Strategies allow using operators to combine graph

1. `http://porgy.labri.fr`