DEVS Formalism for Modeling and Analysis of Discrete Systems

Ing. Marek Houšť

October, 17, 2011

Abstract

DEVS (Discrete EVent System Specification) formalism is a tool for general and formal description intended for modeling, analysis and simulation of a discrete system. Each system consists of an universe (a finite set of elements) and system characteristics (a union of all connections elements). The discrete system is characterized by the fact that all its elements have a discrete behavior. The discrete behavior of an element is described by a time set. It can be finite or countable. The time set gives us all time instants at which there are defined values of input, state and output variables of an element.

Modelling activity is generally simplification of a system description into a model. This simplification is performed using an abstraction from all unimportant facts with respect to goals and a purpose of the model. A state of the discrete system model is represented by state variables. Changes of state variables then cause changes of a state of the model of discrete system. These changes are called events and have zero duration. DEVS models have a coherent timeline, but during a bounded time interval can occur only a finite number of changes [1].

DEVS formalism allows description of a system on two levels. The lower level is called an atomic formalism. The atomic formalism models elementary parts of a systems. System behavior in atomic formalism is a sequence of deterministic transitions between sequential states of a model, also reaction of a model to external inputs and way of generating an output from a model. The atomic DEVS formalism is defined as a seven-tuple. The higher level description is called a coupled formalism. The coupled formalism describes a system as a network of interconnected components. The basic component is an atomic DEVS model. The coupled DEVS formalism is defined as a seven-tuple. This report describes formally atomic DEVS components and coupled DEVS components and presents their possible usage [2].

One can find many extensions of DEVS formalism, but in the field of distributed systems, the most suited variant is parallel DEVS (P-DEVS). A distributed system benefits from division of tasks among a grid of less efficient components that communicate and interact with each other. Therefore, distributed systems can be simulated as several communicating discrete systems. In the P-DEVS formalism are all sequential dependencies removed and the definition of atomic and coupled components is modified. This report describes differences of these components.

My topic of PhD thesis is called “Artificial agents for wireless sensor networks (WSN)”. WSN can be considered as a new class of distributed system, because it uses the potential of many units with a lower computational performance that communicate with each other.

Reference

[1] SLAVÍČEK, Pavel. Distributed simulation environment. Brno, 2006. 100 s. PhD thesis. BRNO UNIVERSITY OF TECHNOLOGY Faculty of information technology.

[2] ZEIGLER, Bernard P.; PRAEHOFER, Herbert; KIM, Tag Gon. Theory of Modeling and Simulation. San Diego : Academic Press, 2000. 510 s. ISBN 0-12-778455-1.