Simulating Computer Networks by colored Petri Nets

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A Petri net is a powerful tool for verification of networking protocols and performance evaluation of networks. A Petri net represents a directed bipartite graph, whose sets of vertexes are called places and transitions, supplied with dynamic elements – tokens. A colored Petri net of modeling system CPN Tools represents a combination of a Petri net and a functional programming language ML. The system contains facilities to model time characteristics and create hierarchical constructs via substitution of transitions. Compared to known systems for simulating networks such as Opnet, NetSim, and ns, CPN Tools possesses certain advantages such as: flexibility and vivid graphical representation. CPN Tools is a good choice not only for simulating networks with a purpose to estimate their performance but also for design of new networking technology. A library for modeling various networks is distributed via CPN Tools official site. It contains examples of modeling Ethernet, IP, MPLS, Bluetooth, PBB and other networks having reusable components. The tutorial will cover basics of composing CPN Tools models with a case study for switched Ethernet, a technique for debugging models via tracing separate packets, and organization of simulation process on prolonged intervals of time. The advantage of our approach to modeling in CPN Tools consists in obtaining evaluations of characteristics directly in the process of simulation, without storing bulky initial statistical information. During the tutorial we consider composing measuring components for evaluation of the network bandwidth and such QoS characteristics as the packet delivery time and jitter.

Basic sources:

1. Zaitsev D.A. Clans of Petri Nets: Verification of protocols and performance evaluation of networks, LAP LAMBERT Academic Publishing, 2013, 292 p.
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3. Zaitsev D.A. Petri Nets for Modeling and Computing: Videolecture. USA: IGI-Global, August, 2015, 2 hrs 25 mins.
4. Tina, http://www.laas.fr/tina
5. CPN Tools, http://cpntools.org

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