Asymptotic Behavior of Petri Nets

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In this talk, we will first introduce Timed Petri nets and show how they can be used to model discrete event dynamic systems. We will then review the techniques which can be used to predict its asymptotic behavior, depending on the assumptions made on the distribution of the time variables.

This problem is actually three-fold. The first issue concerns the existence of a asymptotic "rate" of transition firings (also called first order limits). A more involved problem concerns the existence of an asymptotic or stationary state (also called a second order limit). Finally, the most difficult problem is the computation of these limits (first and second order).

The first mathematical tool used to describe the behavior of Timed Petri nets is the Continuous Time (semi)-Markov Chains, when the timing is essentially exponentially distributed. In this classical framework, one can solve the existence and computation problems.

The second model is valid under general distributions of the time variables and involves the so-called (Max,Plus) Algebra. It can be used as a long as the Petri net is an event graph or a one-bounded net. The computation of the limits is known to be difficult in this case.

The more general technique to prove the existence of asymptotic properties is the Saturation Principle which can be used under very weak assumptions on the net.