Christopher Dabrowski
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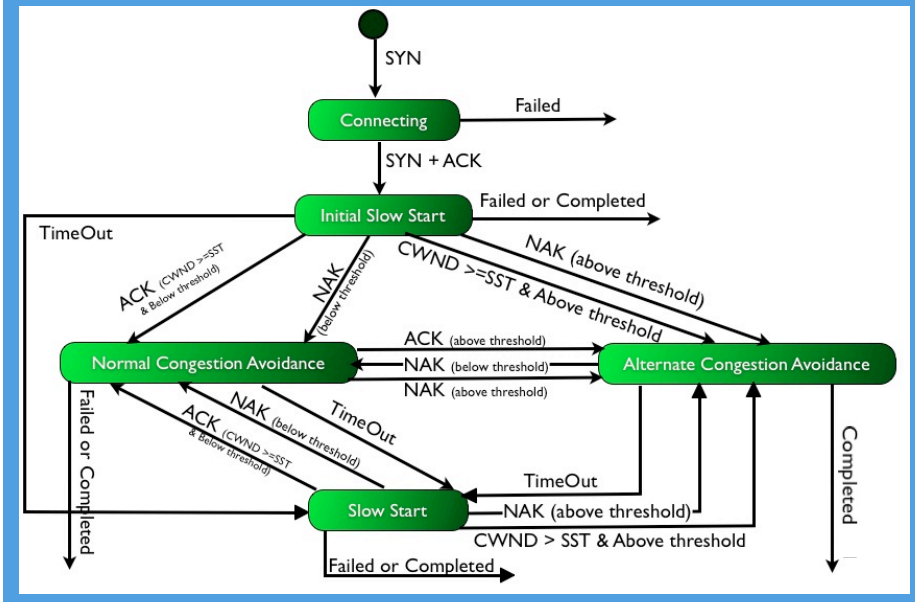
complex systems

IMAGE OF THE MONTH

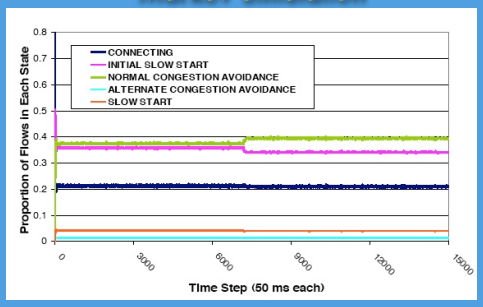
August

Extending Markov Chain Analysis for Application to Additional Problems

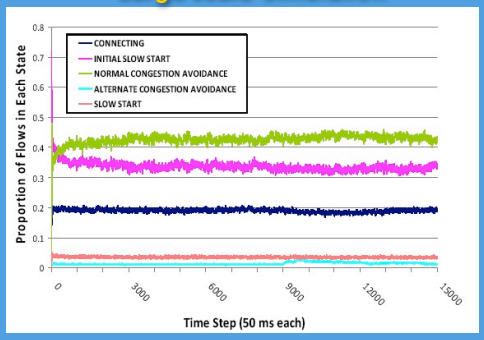
State diagram showing Markov chains for network congestion control processes



Markov Simulation

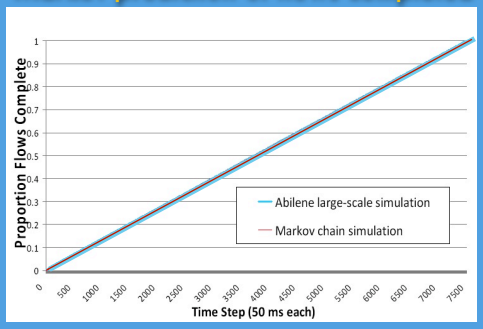


Large-scale Simulation



In the January, 2009 Image of the Month, we showed that Markov chain simulation provides a rapid, scalable representation of system dynamics in a computing grid and can be used to predict system behavior at substantially lower computing costs than detailed simulation models. Expanding on this, we show how Markov chain analysis can be used to model system operation in a new domain: congestion control algorithms for network data flows.

Markov prediction of flows completed



More information at: http://www.itl.nist.gov/ITLPrograms/ComplexSystems/Papers.html

A piece-wise homogeneous Discrete Time Markov chain can be used to simulate flow completion in a network.

Markov chain simulation provides an accurate approximation of large-scale simulation as evidenced by the curves produced by the respective simulations. However, Markov chain analysis is more than two orders of magnitude faster.

Information Technology Laboratory

NIST National Institute of Standards and Technology U.S. Department of Commerce

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The Complex Systems Program is part of the National Institute of Standards and Technology's Information Technology Laboratory. Complex Systems are composed of large interrelated, interacting entities which taken together, exhibit macroscopic behavior which is not predictable by examination of the individual entities. The Complex Systems program seeks to understand the fundamental science of these systems and develop rigorous descriptions (analytic, statistical, or semantic) that enable prediction and control of their behavior.

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