Overview of *UltraSAN*

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Introduction *UltraSAN* [1, 2] is a software package for model-based evaluation of systems represented as stochastic activity networks (SANs). SANs incorporate features of both stochastic Petri nets and queueing models, where parameters in a model such as case distributions, activity times, state transition rules, and reward variables can be marking dependent. Users may build SAN models using an X-Windows-based user interface and choose from a variety of analytic and simulation modules for transient and steady-state performance, dependability, and performability measures. Furthermore, the tool facilitates graphical representation of the results obtained by its report generator.
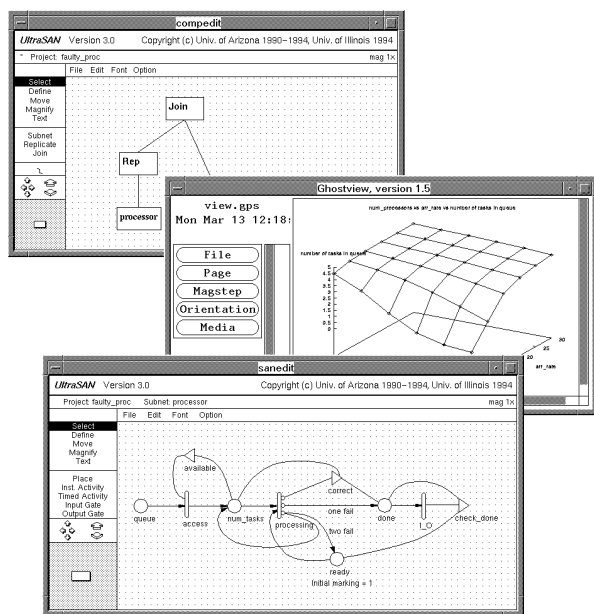
Model specification A control panel provides easy access to the rest of the tool's facilities. To specify a model, the user first specifies a set of subnets using the SAN editor and then connects the subnets together in a hierarchical way using the composed model editor. The composed models take advantage of any replication of subnets in the model to decrease the number of states in the generated Markov process or to increase time and memory performance for simulation solution techniques.

While specifying a model, modelers may use parameters called global variables, which can take on values or a range of values. A set of these values is called a study. The study editor provides a facility for specifying a study and managing multiple studies of the same SAN, making it easy to see the relation between input parameters and the behavior of the model. Finally, the modeler specifies the aspects of the model he wishes to measure, which we call reward variables.

Model solution For models in which times are exponentially distributed, *UltraSAN* provides seven analytic techniques for solving for transient or steady-state solutions. Steady-state solvers report the mean, variance, probability density, and distribution for each reward variable. Using uniformization, transient solvers can compute the mean and distribution at an instant in time, or mean, variance, density, and distribution over an interval of time.

A modeler may use simulation to solve for transient or steady-state solutions for models with generally distributed activity times. *UltraSAN* provides importance sampling to speed up transient solutions of some systems with rare events. *UltraSAN* also provides direct simulation for transient and steady-state solutions. Specification of confidence intervals ensures greater accuracy of the solution, while parallelization at the study level yields fast solutions. Finally, the report generator gathers and displays statistics and documents the model automatically.

For more information For more information about *UltraSAN*, contact us by e-mail at usan@crhc.uiuc.edu, or look on the World Wide Web at the address given above. *UltraSAN* is provided free to academics if used for educational or research purposes.

References

[1] W. H. Sanders, W. D. Obal II, M. A. Qureshi, and F. K. Widjanarko, "The *UltraSAN* modeling environment," *Performance Evaluation*, vol. 24, pp. 89–115, October – November 1995.

[2] Center for Reliable and High-Performance Computing, Coordinated Science Laboratory, University of Illinois, *UltraSAN Reference Manual*, 1995.