

ECE/CS 541: COMPUTER SYSTEM ANALYSIS

Project

The goal of this project is to apply what you have learned regarding analytic solution methods and modeling to the performance/dependability evaluation of a specific computer system or network. The project is a substantial portion of your grade in the course, and you should expect to spend a substantial amount of time on it. You may work in groups of 1 or 2 students.

In short, I expect you to find some system design that would be interesting to model, model it as a stochastic activity network, Buckets and Ball model and/or PEPA Stochastic Process Algebra, and solve the model using the **analytic/numerical** solvers in *Mobius*. An alternative is to develop a simulation model using SSF. You must determine the specific system you wish to model. I suggest two possibilities: 1) some design that you are interested in for your own work (e.g., research with your advisor, or algorithm, hardware or software design that you have learned about in another class), or 2) an extension of a model that you have found from the literature. Many models of systems are reported on in journals and conference proceedings, and you may be able to extend one of these models making it more realistic, or considering a case that the author of the paper did not consider. For example, many authors have constructed Markov models directly at the state level, without the benefit of a higher level description such as SANs. You may be able to use their greater descriptive power to construct a more realistic model, which is solvable numerically, than the authors could be directly using Markov processes. Of course, you may construct a model that is very realistic, but results in a state space that is much too large to solve. This is the biggest challenge you must overcome in this project: designing a model which is realistic and can be used to say something useful about the performance, dependability, or performability of a system, which at the same time building a model that is solvable. Finally, I expect the work to be original and presented in a professional manner.

Literature Sources

Papers concerning modeling methods and their application to specific systems can be found in many places. I list some of these below, with some comments on their content.

- IEEE Workshop on Petri Nets and Performance Models, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003. This series of workshops is devoted mainly to models of systems built using stochastic Petri nets. You will find application papers here, as well as papers of a more theoretical nature.
- *Performance Evaluation* This journal focus on methods of performance evaluation, mostly limited to queueing and Markov process theory, although some application work is presented.
- *ACM SIGMETRICS Conferences* This series on conferences addresses a large and wide range of issues related to performance evaluation of computer systems. Both application and theory papers can be found. The proceedings are published as a special issue of *Performance Evaluation Review*.

The following journals/conferences present papers that are more design oriented, although modeling studies are also presented. You may find specific system designs to model, or examples of models that are simplistic, and could be extended.

- IEEE Fault-Tolerant Computing Symp. Now known as the IEEE Dependable Systems and Networks Conference (DSN)
- IEEE Computer Architecture Symp.
- INFOCOMM (IEEE Computer Network Conf.)
- IEEE Reliable Distributed Systems Symp.
- IEEE Int. Conf. of Distributed Computing Systems
- IEEE Workshop on Local Computer Networks
- IEEE Real Time Systems Symp.
- IEEE Symp. on Reliability and Maintainability
- ACM Workshop on Principles of Operating Systems
- IEEE Trans. on Computers

- IEEE Trans. on Communications
- IEEE Journal on Selected Areas of Communications
- IEEE Transactions on Reliability
- IEEE Transactions on Software Engineering
- ACM Transactions on Computer Systems

Outline

Your project report should follow the following outline:

1. Introduction -- State why the problem you are studying is important, why modeling can aid in the study, what others have done in this regard, and why what you do is a further contribution.
2. Problem Description -- Explain, in more detail than the introduction, the study to be made.
3. Model Description -- Motivate, Explain, and Justify your model development and the assumptions made in doing so. Give SAN diagrams for all models built (or as appropriate, representative), so the reader can understand what was done.
4. Results - Provide and Explain the results of the of the study, offering insight into the problem studied.
5. Conclusions and Suggestions for Further work -- Offer final conclusions and suggestions for further work.
6. References -- Provide all relevant references, in IEEE Transactions format.
7. Appendix -- Provide project documentation (using the document feature), of your model(s).

Misc. Rules

- Write your report at a level so another classmate could understand it, assume that the reader is familiar with modeling methods and basic computer engineering and science topics, but may not be an expert in the topic you have selected.
- All reports must be typed (both draft and final), one and a half or double spacing, 11-pt, and no more than 20 pages, including all figures and tables, but not including the Appendix. I suggest you use a format that would be typical for a submitted conference paper. I'll provide a style file for those that would like to use LaTeX (I encourage this.)

Final Comments

The write-up needs to be presented to me by 5 p.m. December 7, 2007.

Please see me as much as you desire for help, I will do everything possible to help you develop a successful project. Go to the library and start thinking about project topics immediately, come see me before you write your draft (or send me email) if you would like to discuss possible topics and alternatives. Good projects can be the basis for Master's theses or journal or conference papers, I will be happy to discuss these possibilities with you.