

## Monthly Progress Report for April 2004

STUDENT NAME: Ritabrata Roy

ADVISOR: Dr. Wade Trappe

PROJECT TITLE: Tomography Techniques for Estimating Network Internal State

BACKGROUND / PRIOR WORK: Interested in ad-hoc network problems as well as unlicensed band routing and spectrum management issues.

PROGRESS DURING APRIL 2004:

- Continued working on network tomography, which deals with the study of estimating internal characteristics of a network from its end-point measurements.
  - Reformulated analysis of link success probabilities for three nodes, and extended it to a general case of  $K$  nodes.
  - Performed MATLAB simulations for the three-node network. The results after the first iteration were found to be quite accurate, but “improved” estimates were found to overshoot the true value because of the nature of the formulation.
  - Extended the problem to account for a network with multiple sources.
  - Analyzed the method to determine link characteristics using maximum likelihood estimation (MLE) in R. Caceres, N.G. Duffield, J. Horowitz, and D.F. Towsley. “Multicast-Based Inference of Network Internal Loss Characteristics.” *IEEE Trans. Info. Theory*, pages 2462–2480, November 1999 and proposed a way to reduce our particular network tomography problem to a more general class of problems so that existing results could be applied. This includes the application of the maximum likelihood estimate (MLE) to our problem. Compared the MLE results obtained from existing papers to that obtained from our approach.
- Presented poster at the IEEE Sarnoff Symposium. Title of paper: “Performance Analysis of Downlink Power Control in CDMA Systems”. Co-authors: Soumya Das, Sachin Ganu, Natalia Rivera.
- Attended talks by other members of the Network/RRM group to learn about different projects.
- Attended the ECE Colloquium (Distinguished Lecture Series).
- Updated personal and central WINLAB websites.

WORK PLANNED FOR MAY 2004:

- To continue working on the Network Tomography problem.
  - Improve simulation model to obtain better estimates of the network parameters.
  - Obtain algorithm to estimate link success probabilities as they vary with time, and a procedure to vary the sampling rate as the link success probabilities change with time.
  - Consider the use of the EM (expectation maximization) algorithm for the tomography problem.
  - Prepare poster for IAB meeting (May 13 and 14, 2004).
- To attend colloquia organized by WINLAB and weekly Network/RRM group meetings.
- To attend the ECE Colloquium (Distinguished Lecture Series).
- To continue maintaining personal and central WINLAB websites.