Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Optimal Scheduling of CDMA Systems

Sudhir Ramakrishna

Lucent Technologies-Bell Labs Innovations

Abstract— Present cellular systems have mainly been designed to allow mobile users to interface to fixed telephone networks, and hence, have primarily been optimized for voice transmission. Future wireless systems, however, will be required to support non-voice sources with a variety of rates and quality-of-service requirements, which differ significantly from voice sources in their properties. Consequently, attempts to accommodate such sources in current wireless systems, which have been designed from a voice-centric point of view, could lead to mismatch problems and inefficiencies.

In this talk, we take CDMA (Code Division Multiple Access) to be the wireless multiple access mechanism, and propose to modify it so as to exploit some of the properties of non-voice sources to achieve throughput gains. The simplest case, namely, the uplink (mobile to base station link) of a CDMA system with two user classes is considered. One of the classes, emulating voice, consists of delay intolerant users requiring support for a constant information bit rate. The other class, emulating non-voice sources, consists of delay tolerant users needing support for an information bit rate larger than a specified value. Certain synchronization requirements, inherent to the CDMA system, are imposed on users of both classes. The objective is to maximize the throughput of the delay tolerant users. Starting from the constraints defining a conventional CDMA system, we propose a modification wherein the transmissions of the delay tolerant users are scheduled, so that only a limited number of them are transmitting information at any given time instant. It is shown that the proposed transmission scheme provides throughput gains as compared to conventional CDMA under many conditions. These conditions are identified in terms of the various system parameters. It is also shown that the proposed transmission scheme imposes the same or lesser average transmit power requirements, and identical peak power requirements, as compared to conventional CDMA.

Extensions of the basic scheme to include further constraints on the inter-cell interference are presented. A general result that follows is that given a set of delay tolerant users with certain (average and peak) power constraints, and certain inter-cell interference constraints, the per-user throughput may be maximized by time-scheduling a certain subset of the users.

The behavior of the scheme in the presence of system imperfections, such as imperfect

power control, and implementation issues and strategies, given knowledge of certain system parameters, are also indicated.

Date: **Thursday, 25 March 1999, 13:30 - 14:30**
Place: **Room 117 EE Building**
Info: `http://www.ee.lsu.edu/seminar`