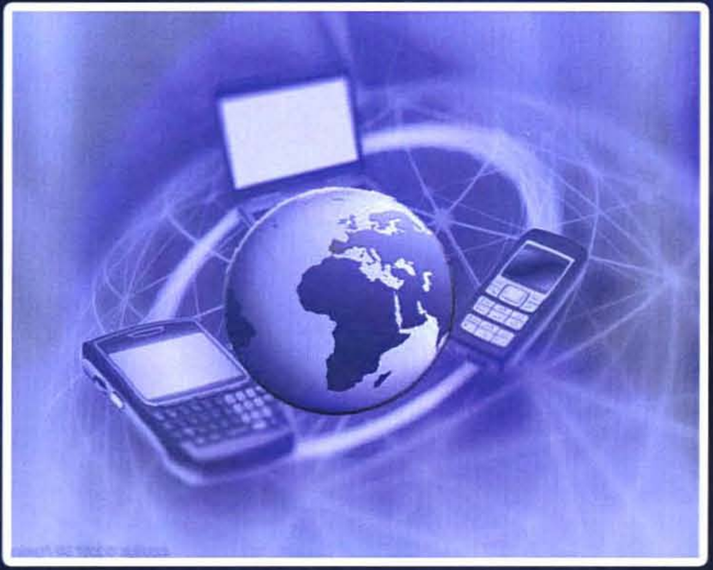
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



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CHAPTER 7

RELIABLE COOPERATIVE MULTICASTING FOR WiMAX

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7.1 INTRODUCTION

To achieve a reliable downlink transmission for MBMS traffic and to extend the coverage outside the transmission area, three energy efficient re-multicasting techniques were proposed in [2] for properly selecting RAs in a two phase cooperative transmission model. At phase I, the BS multicasts data to all SSs at high transmission rate R1, where only subscribers in a good channel state (SSGCS), e.g., as defined by their CINR threshold, can successfully receive the data, and the remaining group of subscribers in a bad channel state (SSsBCS) fail to receive the data. BS preselects some of SSGCS to be RAs using one of the selection algorithms in (Elrabiei et.al. [2]. Upon receiving signals from BS, each RA decodes the received signals and then forwards them to SSsBCS at a proper rate R2 in phase II. By exploiting the channel state information (CSI) and the location based service (LBS), a Nearest-Neighbor Discovery Protocol (NNP), and two other optimized versions of it, based on RA's transmission range and instantaneous CSI, were simulated and studied in the context of WiMAX single frequency networks. Details of these protocols can be found in [2, 4, 7].

The above mentioned schemes were found to considerably reduce the amount of energy consumed [2], providing a lower cost coverage solution with no dereliction in achieved throughput for all multicast group members. In this study, we have assumed throughout our proposed work that in each frame, the BS selects the proper RAs for re-multicasting depending on one of the selection techniques discussed above and that the RA's battery capacity reduces due to re-multicasting process only. But no prior formulation was made to estimate the energy consumption levels or to predict the network energy map. There have been several attempts to address the above issue mentioned especially in the context of wireless sensor networks, where the main source of energy is batteries.

7.2 PROPOSED BATTERY-AWARE RA SELECTION SCHEME

The power consumption and the duration of how long the SS should work as a RA can be adjusted dynamically by the BS. The accurate knowledge of the available energy levels in each SS in the network (i.e., energy map of the whole network) is important information for the BS to make its selection. This can be implemented either by allowing the SS to report its battery energy level as extra information sent to the BS, or estimated by default as the BS runs the RA selection algorithms and has a priori knowledge of the RAs selection frequency rate. We have resorted to the first assumption in our simulation study.

All SSs are involved in aggregating the CSI map of the network to the BS. Therefore, it is similarly possible to map the network mobile SSs battery draining levels at least in a coarse grained fashion. Selected RAs can be considered based on their CSI, geographic locations in the cell, and their battery draining levels. SSsGCS that have low battery levels can be spared from the down-link phase II re-multicasting process until recharged. SSs with stationery position and infinite power supply can act as RAs similarly to stationary RSs proposed in 16j standard, although they don't have to re-multicast continuously on every frame. Similar schemes are used extensively in routing network traffic over wireless links. Therefore we