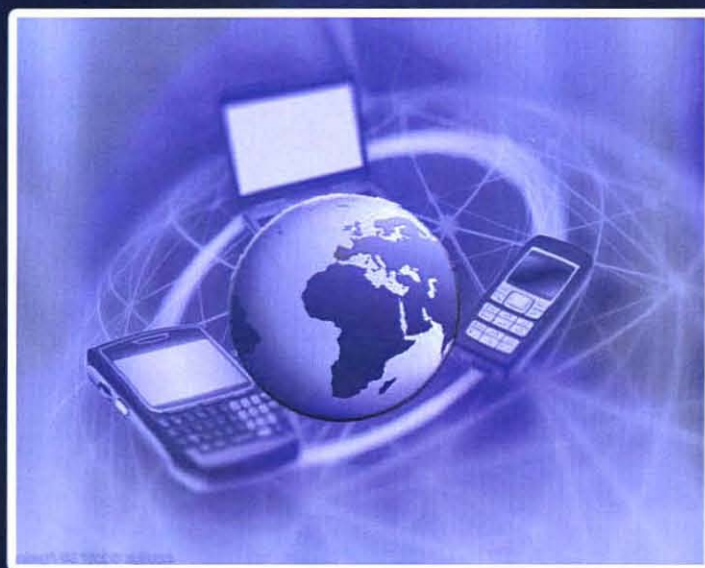


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Communications and Networking

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Wajdi Al-Khateeb



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CHAPTER 11

WiMAX MULTIHOP-RELAY

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11.1 INTRODUCTION

IEEE 802.16j Multihop Relay (MR) is an optional deployment introduced to enhance the coverage and performance of WiMAX network without the need for deploying costly Base Stations (BSs). Multihop Relay network comprises Multihop Relay BS (MRBS) and Relay Stations (RSs). This chapter proposes mesh topology for IEEE 802.16j using adaptive RS group scheduling. The proposed scheduling algorithm introduces new signalling to support functions such as soft and hard horizontal-RS neighbour scanning, bandwidth request, forwarding of PDUs and connection management. The proposed model is evaluated using NS-2 network simulation. The simulation results show that the proposed scheduling achieves higher throughput performance compared to IEEE 802.16j tree-topology.

IEEE 802.16j Multihop Relay (MR) is an optional deployment introduced to enhance coverage and performance for WiMAX network while eliminating the need for deploying costly BSs. Multihop Relay network is a combination of Multihop Relay BS (MRBS) and Relay Stations (RSs) [1]. Each RS is under the supervision of an MRBS. The standard defines and organizes RSs in a tree structure topology with the MRBS in the tree root. Each branch in the tree is identified as RS group. Data and signalling traffics scheduled for each RS group use the same path which is performed by the RS paging group updates. The main distinguishable characteristic of mesh and relay networks is the possibility of a multi-hop communication [2].

Multi-hop communication occurs when data traverse from the source node to the destination node is done via more than two hops. This feature will significantly extend the range of the network without the need for other costly BSs. The maximum allowable number of hops must be carefully considered because transmission time will increase with higher number of hops which lead to degradation in the throughput. Multi-hop based network may also improve the system performance by using a cooperative relay technique. This is accomplished by sending the information simultaneously via multiple paths and combining the received information at the receiver side [3].

IEEE 802.16j is an extension to 802.16e which is a mobile WiMAX. The main objective of IEEE 802.16j is to increase the coverage and data rate for the nodes in the cell edge using relay station (RS) which will forward the messages based on "amplify and forward" (AF) or "coding and forward" (CF) [4]. The RS is totally transparent for the mobile nodes. The RS can be transparent or non-transparent based on the intelligence that the RS has. In this case the transparent RS does not have a preamble or FCH in the frame structure. While the non-transparent RS frame structure has all the parts that the BS has. IEEE 802.16j (multi-hop relay, MR) standard is intended to enhance the performance of the existing 802.16-2005 products by introducing the relay stations (RSs). The primary goals are to extend the coverage area, enhance the throughput and the system capacity, save the battery life of SSs and minimize the RS complexity [5].

This standard is backward compatible with IEEE 802.16e, so that conventional 802.16 SSs terminals will function normally in MR enhanced infrastructure. On the other hand, some modifications to BS should be made to allow for communication with RSs and support of