Chapter 7

WiMAX and Wi-Fi Services through Mobile Networks: Issues on Network Planning, Optimization, and Sustainability

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ABSTRACT

WIFI and WiMAX became popular worldwide due to simplicity of installation and cost reduction compared with traditional DSL cable. The key challenge of WiFi is the restricted mobility of the user whereas mobile WiMAX (IEEE 802.16m) provides ubiquitous environment to the user. The recent challenges of WiMAX is managing radio resources (both licensed and unlicensed) efficiently through different QoS service classes, implementing proper modulation and coding schemes at PHY, proper antenna selection in MIMO to achieve better QOS. User can avail the benefits of speed and mobility through an integrated architecture comprising WiFi and WiMAX. This chapter provides an in depth performance evaluation of Mobile WiMAX and WiFi under various Modulation and Coding Schemes (MCS), cyclic prefixes and different path-loss models under integrated environment. Moreover, we present an optimized adaptive modulation scheme that senses the SNR and adaptively switches to required MCS to achieve desired level of QoS and link stability.

1. INTRODUCTION

The demand for connectivity and bandwidth is increasing day by day. WLAN or WiFi(1999) and Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMAX) which is also known as Wireless MAN, emerge as promising technology in the market to meet the requirement of the user in a ubiquitous environment.

DOI: 10.4018/978-1-5225-0239-5.ch007
LTE proposed in 2004 where as WiMAX and LTE proposed in 2001. Among them WIFI and WiMAX became popular worldwide among them due to simplicity of installation and cost reduction compared with traditional DSL cable.

There are three types of WiMAX systems are (Díaz, J. M., Del Río, L. V., Cárdenas, O. Á., & Baldivia, 2014) available:

A. Fixed WiMAX (IEEE 802.16-2004)
B. Mobile WiMAX (IEEE 802.16e/m-2005)
C. Mesh WiMAX (IEEE 802.16j-Mesh)

Fixed WiMAX (16-2005, 2005) system having coverage area 5-7 km and speed up to 48 Mbps (fixed downlink) and 7 Mbps (fixed uplink). It provides fixed connection between a base station (BS) and multiple subscriber station (SS) via point to multipoint link (PMP).

Mobile WiMAX (16-2005, 2005) is broadband wireless access solution (Jeffrey G. Andrews, Arunabhagosh, 2007), (J. Sachs, L. Muñoz, R. Aguero, J. Choque, G. Koudouridis, R. Karimi, L. Jorguseski, J. Gebert, 2004) that supports the connectivity of mobile node (MN) under the coverage of BS and provides mobile telephone service via VoIP. Mobile WiMAX provides speed up to 9.4 Mbps for downlink and 3.3 Mbps for uplink across the coverage area of 3 km (J. Sachs, L. Muñoz, R. Aguero, J. Choque, G. Koudouridis, R. Karimi, L. Jorguseski, J. Gebert, 2004).

In Mesh WiMAX network WiMAX BS is connected within its coverage area with additional BS’s with smaller coverage area to relay the connectivity. Sometimes received signal strength reduced due to Non Line of Site (NLOS) effect of obstacles and the additional BS’s which are called multihop relay stations (Narasimha & Sivalingam, 2009) having minimal functionality used to relay signals between BS and subscriber station (SS) to enhance the quality of the link to the end user. Figure 1 give an outline how fixed, mobile and mesh WiMAX works.

Figure 1. Fixed and Mobile WiMAX & Mesh WiMAX