Chapter LVII
Traffic Management System (TMS) using WiMAX

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ABSTRACT

Mobile WiMAX has gained extensive support in the industry. Demand on wireless Internet bandwidth is increasing. Mobile WiMAX, also called WirelessMAN (Wireless Metropolitan Area Networks.), is Wi-Fi (Wireless Fidelity) of the Metro. Mobile WiMAX will offer wireless internet experience within the city as Wi-Fi offers within your office or home. Imagine making VoIP (Voice over Internet Protocol) calls from home and continuing to talk as you travel to work in the train or travel in the car on a freeway. Mobile WiMAX can make that happen. In this chapter the authors would describe what is Mobile WiMAX, how it can be combined with GPS (Global Positioning System) for Traffic Management, solve traffic related offences and help in providing a clear way for PSV's (Public safety vehicles) like fire brigades and ambulances.

WHAT IS MOBILE WIMAX

IEEE (**Institute of Electrical and Electronics Engineers**, Inc) defined 802.16 standard (known as WiMAX) for point to multipoint wireless broadband communication operating in 10-66GHz band. 802.16 need LOS (*Line of Sight*) to function. It underwent several enhancements. Finally, IEEE

802.16e-2005 (or *IEEE 802.16e)* popularly known as Mobile WiMAX, defined mobility extensions to IEEE 802.16 standard. IEEE 802.16e included capability for high data rate, quality of service, mobility etc.

Mobile WiMAX offers flexible network architecture for wireless broadband based on both fixed and mobile broadband networks using a common wide area broadband radio access technology (WiMax Forum 2006, 'A Technical Overview and Performance Evaluation')

The Mobile WiMAX certification program, managed by WiMAX Forum with 471 members from all across the industry, is helping in gaining acceptance of the technology all around the world. Recently it has also been ratified as a 3G standard by ITU (*International Telecommunication Union*).

WHY MOBILE WIMAX?

Mobile WiMAX is way ahead of other competing technologies in defining and adapting standards using efficient multiplexing techniques, advance antenna techniques, mobility features etc. Mobile WiMAX is coming close to 4G (4^{th} *generation*) wireless broadband features (Santhi & Kumaran, 2006).

Key features and advantages of Mobile WiMAX technology, which make it the technology of choice for wireless internet connectivity and its suitability for TMS are:

- Physical Layer uses multiplexing technique OFDMA (*Orthogonal Frequency Division Multiple Access*). OFDMA offers better indoor coverage (*non Line of Sight capability*), higher capacity and throughput for Network companies. (Wimax Forum, 2006, 'The Best Personal Broadband Experience')
- Mobile WiMAX Network Architecture is based on all-IP (*Internet Protocol*) right from start (Iyer et al, 2007). Therefore, it can offer end-to-end services using IP based QoS, session management security and mobility. (Santhi & Kumaran 2006).
- High Data rates of 63Mbps for downlink and 25Mbps for uplink in a 10 MHz channel are achieved because of MIMO (*Multiple Input, Multiple Output*) antenna techniques together with flexible sub-canalisation schemes, Advanced Coding and Modulation (WiMax Forum, 2006, 'A Technical Overview and Performance Evaluation, P10-11)
- Mobile WiMAX focused on QoS in MAC (*Medium Access Control*) Layer from the start. The WiMAX connection-oriented protocol is specified for each service flow and it can effectively support the end-to-end QoS control. (WiMax Forum, 2006, 'Mobile_WiMAX_Part2_Comparative_Analysis')
- Worldwide roaming and Interoperability: WiMAX Forum has setup a Network Working Group which is working on ways to make Roaming and interworking with other operators and technologies easier. It has recently defined interworking standards for 3GPP (*3rd Generation Partnership Project*), DSL (*Digital Subscriber Line*) etc. Mobile WiMAX equipments, complying with standards, are interoperable with other equipments in the same band (WiMax Forum, 2006, 'The Best Personal Broadband Experience', P2, 5,7)
- WiMAX supports both soft (with make-before-break links) and hard handoffs (with break-before-make links). Latencies less than 50 milliseconds is achieved that helps mobility. High-speed handoffs will be supported later on. (WiMax Forum, 2006, 'The Best Personal Broadband Experience', P7)
- Availability of Wi-Fi and WiMAX on a single chip (notebooks to have this built-in by early 2008), will increase popularity of WiMAX and will reduce the cost significantly for end-users. (WiMax Forum, 2006, 'The Best Personal Broadband Experience', P12)