

CHAPTER-9

Future of WiMAX

9.1 Introduction

Worldwide Interoperability for Microwave Access, or WiMAX for short, is a next generation open standard that seeks to serve users' increasing demands for high data throughput (broadband) services such as streaming media on the internet, live video conferencing, and mobile TV on computers as well as handsets and PDAs. WiMAX is expected to be integrated into the next generation mass market consumer devices and to offer something that does not exist today – speeds similar to cable and metropolitan area coverage while on the move, all for a much lower cost than we are used to today. WiMAX already offers broadband services in many emerging and rural markets which are not supported by wireline-based technologies and started its first deployment in developed countries replacing both commonly used Wi-Fi on one hand and traditional cellular standards such as 3G (third generation, based on "The Third Generation Partnership Project") on the other hand. In this article, we shall try to explain the technology behind WiMAX, which includes several features resembling existing wireless technologies as well as some revolutionary new features which will bring new and improved abilities to end-users. This article will also examine the current WiMAX status and will try to evaluate the future of the technology as it competes with other standards.

9.2 WiMAX and Wi-Fi Comparison

WiMAX is similar to the wireless standard known as Wi-Fi, but on a much larger scale and at faster speeds. A nomadic version would keep WiMAX-enabled devices connected over large areas, much like today's cell phones. We can compare it with Wi-Fi based on the following factors.

IEEE Standards:

Wi-Fi is based on IEEE 802.11 standard where as WiMAX is based on IEEE 802.16. However both are IEEE standards.

Range:

Wi-Fi typically provides local network access for around a few hundred feet with speeds of up to 54 Mbps, a single WiMAX antenna is expected to have a range of up to 40 miles with speeds of 70 Mbps or more. As such, WiMAX can bring the underlying Internet connection needed to service local Wi-Fi networks.

Scalability:

Wi-Fi is intended for LAN applications, users scale from one to tens with one subscriber for each CPE device. Fixed channel sizes (20MHz). WiMAX is designed to efficiently support from one to hundreds of Consumer premises equipments (CPE)s, with unlimited subscribers behind each CPE. Flexible channel sizes from 1.5MHz to 20MHz.

Bit rate:

Wi-Fi works at 2.7 bps/Hz and can peak up to 54 Mbps in 20 MHz channel.

WiMAX works at 5 bps/Hz and can peak up to 100 Mbps in a 20 MHz channel.

Quality of Service:

Wi-Fi does not guarantee any QoS but WiMAX will provide your several level of QoS.

As such, WiMAX can bring the underlying Internet connection needed to service local Wi-Fi networks. Wi-Fi does not provide ubiquitous broadband while WiMAX does.

9.3 Future development of WiMAX

WiMAX testing and pilot production will take place in 2006 and 2007 with massive network rollouts starting in the middle of 2008. WiMAX is promising a next-generation wireless communications technology with high throughput and coverage capabilities. This technology supports peak speed of up to 20 Mbit/s, and its average speed ranges from 1 Mbit/s to 4 Mbit/s. Transmission distances range from 1.5 km in densely-populated areas to 3.2 km in suburbs.

In addition to channel width, data transfer speed is highly dependent on distance. 802.16e standard mobile networks allow operation of five megabit channel with throughput of up to 15 Mbit/s for distances up to 5 km. Optimal channel width is 20Mhz. 802.16e standard support mobility. According to plans it will support both stationary and mobile wireless devices (notebook computers, cell phones etc.). The main hardware suppliers (including Airspan, Alvarion, Siemens Mobile, Aperto Networks, Ax Celera Broadband Wireless, Gemtek, Huawei, Proxim Corporation, Redline CommunicationsSR Telecom и ZTE) have announced their plans to manufacture Intel-based WiMAX products.

The end-user prices for hardware (radio modem etc.) are quite high today, ranging from \$350 to \$750. Therefore WiMAX products will become widespread only after the mobile version of this standard (802.16e) will be implemented and system-on-chip hardware (\$100-\$200 a piece) becomes available.

WiMAX will be a major success then estimated by In-Stat analytical agency, by 2009 about 30% of all broadband network subscribers or 80.5 million clients will use this wireless standard. About 40.5 million of them will be using VoWiMax (Voice over WiMAX) service that in addition to data transfer will enable voice communications. Intel is even more optimistic in its forecasts: It estimates that solutions based on its recently developed chip will provide internet connection to 1 billion new users. WiMAX supporters claim that this technology can compete with DSL-modem cable technology without requiring complex statutory regulations and management. Russia is unique in that it has vast distances between its regions and between subscribers within the regions. Many parts of the country lack cable infrastructure. All this dictates special requirements for a broadband information network.

9.4 Benefits of WiMAX

-Benefits for Mobile WiMAX System

- The frequency spectrum of WiMAX should be cheaper than 3G system frequencies in many countries. The UMTS license sales in Europe, and specifically in Germany and the UK, reached surprisingly high amounts.
- WiMAX is a very open system as frequently seen in this book: many algorithms are left for the vendor, which opens the door to optimization, and connections between different business units operating on different parts of the network (core network, radio access network, services providers, etc.), possibly in the same country, are made easy.
- The WiMAX Physical Layer is based on OFDM, a transmission technique known to have a relatively high spectrum-use efficiency (with regard to SC CDMA). There are plans to upgrade 3G by including OFDM and MIMO in it. This evolution is called, for the moment, LTE (Long-Term Evolution). This gives a time advance for WiMAX in the implementation of OFDM.
- WiMAX is an all-IP technology. This is not the case for the 3G system where many intermediate protocols (tunneling, etc.) made for the first versions of 3G are not all-IP. However, evolution of 3G should provide end-to-end IP (or all-IP).
- WiMAX has a strong support of some industry giants, such as Intel, KT, Samsung and many others. Taking into account all these observations, it is very difficult to decide between the two systems.

-Benefits to Component Makers:

- Creates a volume opportunity for silicon suppliers.

-Benefits to Equipment Makers:

- Innovate more rapidly because there exists a standards-based, stable platform upon which to rapidly add new capabilities.
- No longer need to develop every piece of the end-to-end solution.

-Benefits to Operators:

- A common platform which drives down the cost of equipment and accelerates price/performance improvements unachievable with proprietary approaches.
- Generate revenue by filling broadband access gaps.
- Quickly provision T1 / E1 level and "on demand" high margin broadband services.
- Reduce the dollar risk associated with deployment as equipment will be less expensive due to economies of scale.
- No longer be locked into a single vendor since base stations will interoperate with multiple vendors' CPEs.

-Benefits to Consumers:

- More broadband access choices, especially in areas where there are gaps: worldwide urban centers where building access is difficult; in suburban areas where the subscriber is too far from the central office; and in rural and low population density areas where infrastructure is poor.
- More choices for broadband access will create competition which will result in lower monthly subscription prices.

-Internet-oriented systems

- Early WirelessMAN standards, the European standard HiperMAN and Korean standard WiBr have been harmonized as part of WiMAX and are no longer seen as competition but as complementary. All networks now being deployed in South Korea, the home of the WiBro standard, are now WiMAX.

9.5 WiMAX Applications

- This figure shows some of the applications that WiMAX systems can be used for. This diagram shows that WiMAX can provide wireless broadband Internet access, telephone access services, television service access and mobile telephone services.

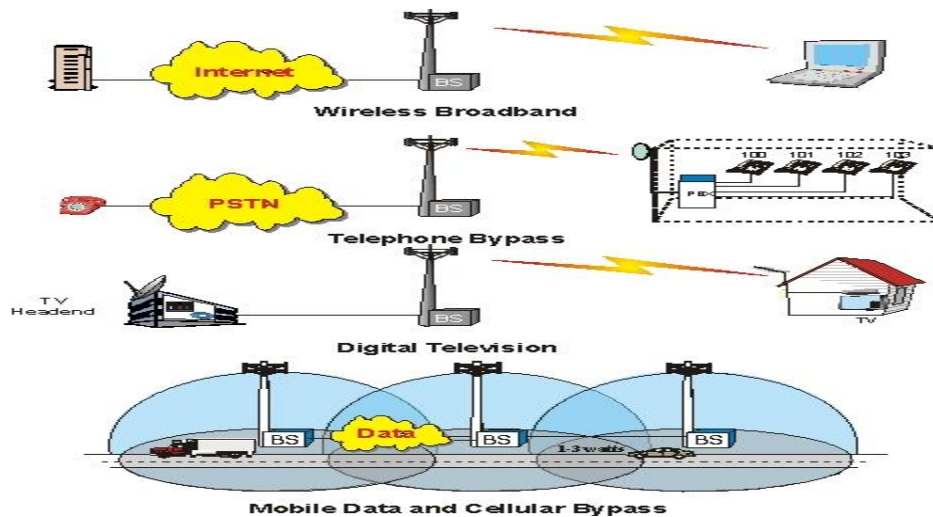


Fig: 9.5 WiMAX Applications

- Urban wireless access networks (multi-beam radio paths, higher percentage of closed paths);
- Access in sparsely populated areas (lack of cable infrastructure is a well-known issue for the sub-urban and rural areas);
- Remote areas (natural and man-made obstacles on the way of cable routes, high costs);
- On demand broadband networking (quick high-speed channel solutions including Level E1 for various even organizers);

Best-connected, wireless service (access outside of office, home, in transit between random access points).

9.5.1 WiMAX & IPTV

The third leg of the triple play is Internet Protocol Television (IPTV). IPTV enables a WiMAX service provider to offer the same programming as cable or satellite TV service providers. IPTV, depending on compression algorithms, requires at least 1 Mbps of bandwidth between the WMAX base station and the subscriber.

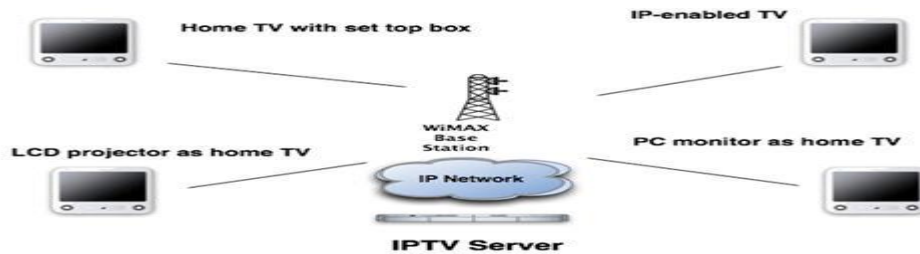


Figure: 9.5.1 IPTV and Video on Demand enable a WiMAX service provider to offer programming identical to cable and satellite providers

In addition to IPTV programming, the service provider can also offer a variety of video on demand (VoD) services. The subscriber can select programming a la carte for their television, both home and mobile, viewing needs. This may be more desirable to the sub-scriber as they pay only for what they want to watch as opposed to having to pay for dozens of channels they don't want to watch. IPTV over WiMAX also enables the service provider to offer local programming as well as revenue generating local advertising.

9.5.2 Cable Modem

Only cable TV operators can use this technology. In order for this to be a means of access the coaxial cable networks must be bi-directional. Not every operator has made that up-grade or has the financial means to upgrade their network (or at least a portion of it) to bi-directional service capable of supporting cable modem service.

So, the chief limitations of cable modem as an access service are:

- 1) requires the network to be bi-directional
- 2) it's a fixed, wire line technology that offers no mobility.

9.6 Drawbacks of WiMAX

A commonly-held misconception is that WiMAX will deliver 70 Mbit/s over 31 miles/50 kilometers. In reality, WiMAX can only do one or the other — operating over maximum range (31 miles/50 km) increases bit error rate and thus must use a lower bit rate. Lowering the range allows a device to operate at higher bitrates.

Hesitancy: Companies are very hesitant of setting up WiMAX base station. One solution to this problem is Intel making their centrino laptop processors WiMAX enabled within the next few years. All laptops are expected to have WiMAX by 2008.

Exclusion: Even though cost provides a low barrier to entry. None of the startup companies are projected to be major player in the development of WiMAX.

Research and Development: In order for WiMAX to successes. New products must be researched and developed to incorporate WiMAX

WiMAX Network rearrange: Fixed WiMAX networks have a higher-gain directional antenna installed near the client (customer) which results in greatly increased range and throughput. Mobile WiMAX networks are usually made of indoor "customer premises equipment" (CPE) such as desktop modems, laptops with integrated Mobile WiMAX or other Mobile WiMAX devices. Mobile WiMAX devices typically have an omni-directional antenna which is of lower-gain compared to directional antennas but are more portable. In practice, this means that in a line-of-sight environment with a portable Mobile WiMAX CPE, speeds of 10 Mbit/s at 6 miles/10 km could be delivered. However, in urban environments they may not have line-of-sight and therefore users may only receive 10 Mbit/s over 2 km. In current deployments, throughputs are often closer to 2 Mbit/s symmetric at 10 km with fixed WiMAX and a high gain antenna. Higher-gain directional antennas can be used with a Mobile WiMAX network with range and throughput benefits but the obvious loss of practical mobility.