

M U L T I P U L S E

WiFi/ WiMax technologies, Brief introduction and Market trend

A case study

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Table of contents

S/No	Description	Page
1	Introduction and Technology	3
2	Market Trend & Growth Rate	6
3	Deployment consideration	7
4	Our Services	8
5	References	8

M U L T I P U L S E

1. Introduction:

In the communication sector, the basic philosophy is based on the balance between cost and quality. Wireless communication technologies have the potential to reach current customers in a very cost effective way and also serve new customers in densely populated and remote areas who can't be reached practically using the existing technologies such as copper or fibre infrastructure. These emerging wireless technologies will enable various industries to discover new business models and generate new services demands.

Wireless communication technologies include various devices, and systems with different standards, protocols and techniques. These devices and system includes Very Small Aperture Terminals (VSAT) approach interconnecting large numbers of users in remote areas (DVB-RCS, DVB-S, DVB-S2), Wireless Fidelity (WiFi) which is radio technology and is quite analogous to a cordless telephone in function. This uses the spectrum 2.4 to 5.8 GHz based on IEEE 802.11 Standards, Orthogonal Frequency Division Multiple Access(OFDMA) multiplexing Worldwide Interoperability for Microwave Access (WiMax).

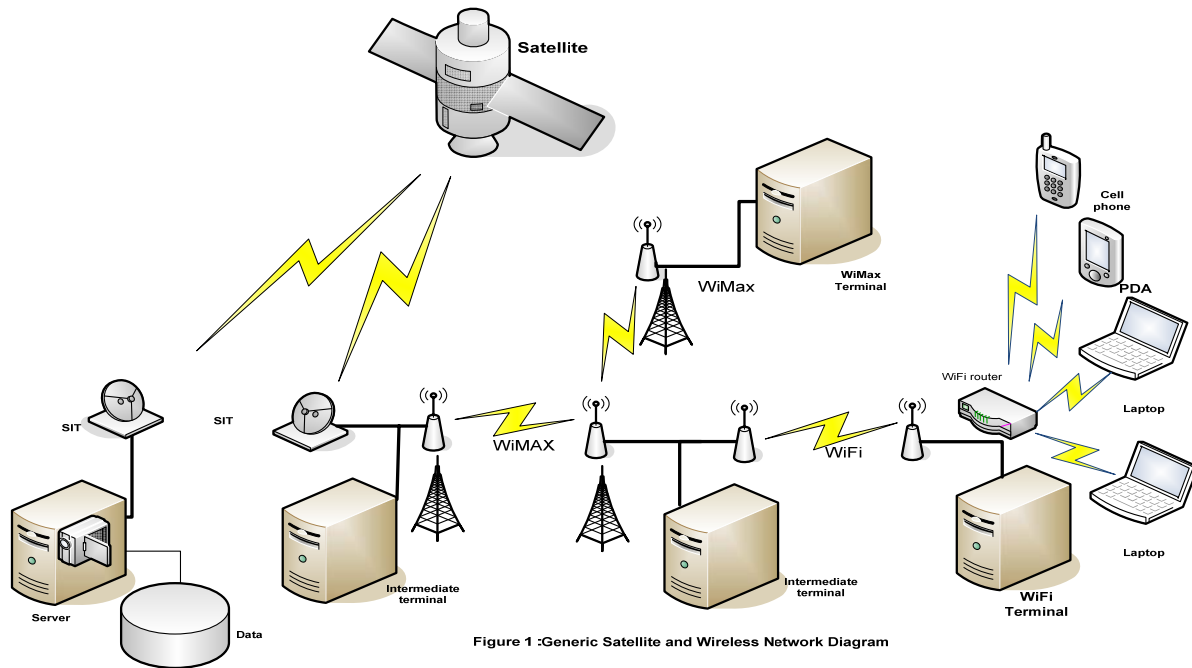


Figure 1 :Generic Satellite and Wireless Network Diagram

The future wireless networks will provide universal ubiquitous coverage across different radio technologies offering a rich range of services with variable bandwidth and quality of service

M U L T I P U L S E

(QoS), anytime, anywhere with anyone. Such features require connectivity across multiple networks with different radio technologies, over different geographic areas, and access to different types of services, raising the need for interoperable networks.

The major advantages of wireless communication technologies are as follow;

- Reach current customers more cost effectively.
- Serve new customers that can't be reached practically today using current technology.
- Provide universal coverage across a single terminal.
- Provides more bandwidth for video and data transmissions.
- Better Quality of Service (QoS), anytime, anywhere with anyone.
- More convenient and dynamic infrastructure.
- Satisfy the needs of mobility, relocation and wide coverage.

Wireless Communication Networks are classified in four different network types according to range [1].

- Wireless Personal Area Networks(WPAN),
- Wireless local Area Network(WLAN),
- Wireless Metropolitan Area Network(WMAN)
- Wireless Wide Area Network (WWAN).

The important wireless communication devices are Mobile telephones, wireless enabled, Personal Digital assistants (PDA), Networked smart homes Mobile entertainment systems (Mobile TV, DVB-H), WiFi and WiMax (more sophisticated computer systems supporting internet services).

The applications of wireless devices has expanded rapidly due to its key characteristics such as interoperability, mobility, flexibility and cost effective deployment which has led to its gaining vast support across enterprises, homes, data service providers and public sectors. In this case study we will address WiFi and WiMax current trend and future potential.

1.1 Wireless Fidelity (WiFi):

WiFi which is driven from wireless fidelity is an effective wireless local area network range upto 100 metres. In 1997 the IEEE 802.11 task group issued the first set of specifications for WiFi operating at 2.4 GHz. IEEE 802.11 groups created several task force named a,b,,e,h,l,n to address the needs of user security, speed, quality of service etc.

- IEEE 802.11b is undoubtedly the most popular WLAN standard uses 2.4 GHz Frequency having speed up to 5Mbps

M U L T I P U L S E

- IEEE 801.11a is a newer addition to the 802.11 family. It is a high speed LAN capable of providing speeds up to 54Mbps in the 5 GHz band. It uses the OFDM modulation to reduce the multipath interferences.
- 802.11 g is an extension of the 802.11b in the 2.4 GHz band. Due to superior modulation (combination of OFDM and complementary Code Keying (CCK) it can support up to 54Mbps. The range of 802.11 g is 100 meters indoor with speed of 5Mbps and about 250 meters outdoor. The advantages of OFDM include reduced multipath effects in reception and increased spectral efficiency.
- 802.11e come to fill the quality of service (QoS). Many real time application need to have higher priority over standard network traffic. 802.11 create different classes of transmission for different types of data transmitted data over a wireless link.
- 802.11 h is an enhancement of 802.11 a standard that improves coexistence with other WLANs operating in 5 GHz band ETSI promotes HIPERLAN/ that operates in the 5GHz band.
- 802.11i addresses the security issues that become very significant after several successful attacks made on the standard 802.11 encryption with weak or improper configuration.
- 802.11 n is to increase the bandwidth of 802.11 to at least 100 Mbps
- Another emerging standard 802.11n would be compatible with the technology standards 802.11 b& g with data speeds of up to 135 Mbps.

1.2 World Interoperability for Microwave Access (WiMax):

WiMax is the acronym for “**Worldwide Interoperability for Microwave Access**”. It is an effective metropolitan area access technique with many favourable features like flexibility, cost efficiency and fast networking, which not only provides wireless access, but also serves to expand the access to wired network.

The coverage area of WiMax is around 30 to 50 kilometre. It can provide high 100Mbps data rates in 20MHz bandwidth. WiMax is considered WiFi Big’s Brother[2].

WiMax is based on IEEE 802.16 standard. In standard 802.16d three different kinds of physical layer technologies are defined which are Single carrier (SC) applied in the 10-66GHz fixed wireless access system, OFDM 256 points is used in 2-11 GHz Fixed wireless access and OFDMA 2048 points which is the frequency up to 11 GHz (IEEE 802.16d/WiMax) for scenarios requiring long distance links between operator point of presence (POP) and Wireless Local Network (WLAN) Area cells.

M U L T I P U L S E

WiMax inter works with existing and emerging technologies both wired and wireless. WiMax also supports Voice over IP (Vo IP). WiMax can serve as a backbone for Wireless hotspots for connecting to the internet.

WiMax solves the problem of “last mile access”. The frequency 2.5 & 3.5 GHz require a license while 5.86 GHz is unlicensed band. WiMax offers true Broadband connections that support multiple usage scenarios including fixed, portable and mobile access using the same network infrastructure. Mobile WiMax is based on IEEE 802.16 e standards and operates in the frequency of 2.3 GHz, 2.5 GHz, 3.3GHz, and 3.4- 3.8 GHz spectrum bands.

WiMax which is Orthogonal Frequency Division Multiple Access(OFDMA) having a performance edge in delivering IP data services compared to 3G technologies. The main advantages of WiMax when compared to other access network technologies are the longer range and more sophisticated support of Quality of Service [3].

2. Market Trend and Growth rate :

Wi-Fi has experienced an unprecedented rate of market acceptance, growing faster than Ethernet did at the same evolutionary stage. The availability of low-cost Wi-Fi clients and the increasing trend towards built-in Wi-Fi on mobile computing platforms is accelerating this growth. Fixed Wireless, WiFi, and WiMAX markets at £1.3 billion in 2004 are anticipated to reach £6.5 billion by 2010 [6].

It is forecast that WiMAX subscribers to exceed 100 million by 2014.

The accumulated market size for combined demand and supply of WiMAX equipment will reach £22 billion by 2014. There were over 1,650,000 Broadband Wireless Access (BWA) subscribers, including 635,000 WiMAX subscribers, at the end of 2007 [7].

Motorola was the leader in BWA and WiMAX combined equipment markets, with a 23% market share, followed by Alvarion at 18%. CPE shipments totaled £350 million, while base stations were valued at £300 million, for a total BWA and WiMAX market of £0.7 billion in 2007. WiMAX Forum Certified (802.16-2004) equipment market size reached £92 million in 2007.

Europe and Asia represented the largest BWA and WiMAX market opportunities in 2007. Initial 802.16m proof-of-concept systems will appear in early 2010, with certification of commercial systems possibly as early as the first half of 2011.

Delays in realising WiMAX Forum Certified products based on IEEE 802.16e-2005 during 2007 didn't slow infrastructure or device manufacturers from introducing both traditional and innovative solutions.

M U L T I P U L S E

The largest mobile WiMAX network, based on the IEEE 802.16e-2005 standard is 145,000 subscribers for KT in South Korea and 10,000 subscribers for Wateen in Pakistan.

South Korea's WiBro service runs at 2.3GHz while Wateen's service uses 3.5GHz. Intel is uncommitted to the 2.3GHz and 3.5GHz bands with its Echo Peak. Echo Peak is tuned specifically to 2.5GHz to 2.7GHz operation, limiting the markets where it can be applied.

Countries with existing 2.5GHz operators offering WiMAX besides the United States include: Brazil, India, Ireland, Japan, Mexico, Morocco, Peru, Russia, Singapore, Taiwan, Thailand and Venezuela. Those markets will eventually grow the business case for the Intel module, but they are not a consideration for accelerating Echo Peak's availability.

3. Deployment Consideration:

Because all the different technologies are operating in different environments there is a specific environmental requirements for cooling, fire, water proofing, EMC shielding, connectors and cabling. [4]

Since WiMax compliant products are available in a range of configurations therefore multi varied performance parameters can be expected. Variation in system gain will affect the range and channel capacity in deployment.

For limited capacity deployment it is also necessary to consider demographic information including population, household and businesses in urban, suburban and rural areas etc.

The base station infrastructure cost per customer is a good metric for providing a quantitative comparison between various deployment options use to achieve the data density. The base station capital expense (CAPEX) has two major components a Fixed and a Variable.

The fixed portion includes all the elements required to acquire and prepare the base station prior to installation of any WiMax equipment. This includes site acquisition, civil works, backhaul interface equipment, antenna mast etc. There can be a great deal of variables in the fixed cost depending on the above factors. For example the cost can be very low when WiMax equipment is installed on existing towers or near an existing node. Therefore installation cost can significantly decreased by proper planning [5].

The WiMax equipment cost can vary from vendor to vendor and also vary according to equipment specific features. The long term goal of most operators for fixed wireless access is to deploy them indoors, self installable CPEs. Fully integrated indoor systems will be less expensive and more secure than the Outdoor version. Some operators prefer outdoor systems but there are other considerations such as power requirement, EMC, cooling, security, interconnectivity and interoperability with existing technologies which all require consideration before deploying the appropriate system.

M U L T I P U L S E

3.1 Problems areas and considerations:

- Initial design problems and interoperability issues.
- Planning issues.
- Deployment issues.
- Maintenance problems particularly different operating conditions.
- Power requirement and power supplies issues.
- EMC problems.
- Environmental problems & dust etc. and cooling requirement.
- Security issues

4. Our services:

Multipulse Group offers its services for consultancy, plan, design, site survey, Antenna specifications, Frequency planning, installation, testing, configuration, cabling, EMC, cooling, maintenance and technical support.

References:

- [1] Fourty N, Val T, Fraisse P, Mercier J. "Comparative analysis of new high data rate wireless communication technologies "from Wi-Fi to WiMax". (ICAS/ICNS 2005) 2005.
- [2] Arunabha Ghosh, David R. Wolter, Jeffrey G. Andrews, Runhua Chen. "Broadband wireless access with WiMax/802.16: current performance benchmarks and future potential". 2005 February 2005:129-136.
- [3] Alexander Sayenko, Olli Alanen, Juha Karhula, Timo Hamalainen. "Ensuring the QoS requirements in 802.16 scheduling. 2006 2-6 October 2006:108-116."
- [4] Wahab Almuhtadi." Rural/remote WiFi wireless broadband system". pp.1-9.
- [5] "WiMax network planning and system's performance evaluation". 2007 8th IEEE Wireless Communications and Networking Conference; 11-15 March 2007; Kowloon, China: IEEE; 2007.
- [6] http://www.researchandmarkets.com/reportinfo.asp?report_id=296310 , accessed in August 2008.
- [7] <http://www.maravedis-bwa.com/PressRelease-and-LTE-Converge.html> , accessed in August 2008.