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RESEARCH ARTICLE

Latest Trends towards 3G Technologies - WiFi vs WiMax

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Abstract- There is lots of confusion among both WiMax and WiFi technologies. There are many reasons for that one could be both technologies starts with W letter that makes some people think that they both are same technologies with different names. There is one more major reason why it makes confusing, they both belong from standard setter IEEE and there standards first 3 letter are same "802", and both WiFi and WiMax technologies belong from Wireless connectivity family. In this paper, We have explained these two technologies may have few visible similarities but how much they are different from each other when considered practically? No doubt the real success of WiMax is yet to come but this technology has surely given the resource persons a field for research and to work out something new with this technology.

Keywords: WiFi; WiMax; OFDM; BWA; DSL

I. INTRODUCTION

Comparing WiMax to WiFi is akin to comparing apples to oranges. Initially it's easy to see why the comparison would exist, as most people think WiMax is merely a more robust version of WiFi. Indeed they are both wireless broadband technologies, but they differ in the technical execution and ultimately their business case is very different. In addition to the technical differences that exist, the marketplace difference is that equipment is more or less non-existent for WiMax and certainly not geared towards a residential environment with very high pricing to be expected. It will take at least 2 years to see equipment of mass market uptake pricing. WiMax is term given to worldwide interoperability for microwave access, while WiFi is wireless fidelity suggested by the WiFi Alliance. WiMax is the telecommunication technology which is used to transfer data over different transmission modes like point to point and multi point modes.

Comparison of WiMax and Wi-Fi Technologies

	WiMax (802.16a)	Wi-Fi (802.11b)	Wi-Fi (802.11a/g)
Primary Application	Broadband Wireless Access	Wireless LAN	Wireless LAN
Frequency Band	Licensed/Unlicensed 2 G to 11 GHz	2.4 GHz ISM	2.4 GHz ISM (g) 5 GHz U-NII (a)
Channel Bandwidth	Adjustable 1.25 M to 20 MHz	25 MHz	20 MHz
Half/Full Duplex	Full	Half	Half
Radio Technology	OFDM (256-channels)	Direct Sequence Spread Spectrum	OFDM (64-channels)
Bandwidth Efficiency	≤5 bps/Hz	≤0.44 bps/Hz	≤2.7 bps/Hz
Modulation	BPSK, QPSK, 16-, 64-, 256-QAM	QPSK	BPSK, QPSK, 16-, 64-QAM
FEC	Convolutional Code Reed-Solomon	None	Convolutional Code
Encryption	Mandatory- 3DES Optional- AES	Optional- RC4 (AES in 802.11i)	Optional- RC4 (AES in 802.11i)
Access Protocol	Request/Grant	CSMA/CA	CSMA/CA
- Best Effot	Yes	Yes	Yes
- Data Priority	Yes	802.11e WME	802.11e WME
- Consistent Delay	Yes	802.11e WSM	802.11e WSM
Mobility	Mobile WiMax (802.16e)	In development	In development
Mesh	Yes	Vendor Proprietary	Vendor Proprietary

II. RADIO TECHNOLOGY

Besides the obvious difference in transmission range, there are a number of improvements in the radio link technology that distinguish WiMax from WiFi. The IEEE 802.11 wireless LAN standards describe four radio link interfaces that operate in the 2.4 G or 5 GHz unlicensed radio bands; the four are summarized in Table 1. The WiMax standards include a much wider range of potential implementations to address the requirements of carriers around the world. The original version of the 802.16 standard released in December 2001, addressed systems operating in the 10- 66 GHz frequency band. Those high-frequency systems require line-of-sight (LOS) to the base station, which increases cost and limits the customer base. Further, in line-of-sight systems, customer antennas must be realigned when a new cell is added to the network. We will focus primarily on the 802.16a standard released in January 2003 that describes systems operating between 2 GHz and 11 GHz. The lower frequency bands support non-line-of-sight (NLOS), eliminating the need to align the customer unit with the base station

IEEE 802.11 WLAN Radio Link Interfaces

Standard	Maximum Bit Rate	Fallback Rates	Channels Provided	Frequency Band	Radio Technique
802.11	2 Mbps	1 Mbps	3	2.4 GHz	FHSS or DSSS
802.11b	11 Mbps	5.5 Mbps 2 Mbps 1 Mbps	3	2.4 GHz	DSSS
802.11a	54 Mbps	48 Mbps 36 Mbps 24 Mbps 18 Mbps 12 Mbps 9 Mbps 6 Mbps	12	5 GHz	OFDM
802.11g	54 Mbps	Same as 802.11a	3	2.4 GHz	OFDM

III. WiFi Vs WiMax RANGE

The range of WiFi over antenna is 32 meters for indoor networks and 95 meters for outdoor networks. However this range is correlated to the frequency band. It is said that the WiFi with frequency range in 5 GHz is lower in performance as compared to the 2.4 GHz frequency range. However this range can be improved using wireless routers and antennas situated at a distance of few kilometers. As compared to the WiFi, WiMax covers the much greater range. WiMax can operate on the range of frequencies from 2.3 GHz to 3.5 GHz. Hence a wireless WiMax is capable of covering an area range of up to 10miles.WiMax is also subject to provide the broadband speed of more than 10Mbps.WiFi is applied to OFDM while WiMax is making use of an extended version of OFDM and that is scalable orthogonal frequency division multiple access. WiMax is what is known as a Metropolitan Area Network (MAN), which basically means that it is designed to provide wireless network coverage to a metropolitan area. One WiMax access point has a rough signal range of anything from 3 miles to 30 miles (even more depending on who you talk to). Compare that to WiFi, which is a Local Area Network (LAN) and designed to provide coverage to a local area with a range of only a few hundred meters at best.

IV. SPEED

WiMax's capability of transferring data at speeds of up to 75 Megabits per second (Mbps), as opposed to WiFi's broadband speeds of around 1.5Mbps and you can start to see why there is a growing buzz in the wireless industry for WiMax. Not only does WiMax offer faster speeds and wider coverage than WiFi, it also offers a better quality of connection. WiFi connections are constantly competing with one another to connect to the wireless network – you may have seen people in hotel lobbies or cafes moving their laptops around in peculiar ways trying to get a stronger wireless signal to connect to. WiMax users only need to connect once to the network and they get an allocated amount of bandwidth to use that remains constant as long as the user stays connected to the network. WiMax works at a higher frequency than WiFi and as such is able to offer higher data transfer speeds and Quality of Service. It is able to use licensed frequencies between 2GHz and 11GHz (WiFi uses 2.4GHz and 5GHz) and even unlicensed frequencies up to 66GHz (In the realm of Television signals).

V. COST

If try to compare the cost and effectiveness of both wireless technologies we shall end up rating WiMax high. WiFi is considered to be the end users technology while the expense of WiMax has limited its use. WiMax technology was not very popular even after 2006. This was due to the controlled commercial availability and standardization concerns. The major businesses make use of it, because it replaced major technologies like DSL and repeaters. WiMax is still unable to replace the small commercial networks and home based networks because WiFi are much swift and reliable. WiFi is the need and demand of hotspots, and it is hard for the WiMax to substitute it. The reason it that people are more used to the WiFi technology and they are now trained to use this technology. Switching to WiMax is not only expensive but also need expertise to use the WiMax technology. The expense of WiMax technology doubles when it is hard to find the equipments and machinery compatible to work with WiMax technology. If we do a market survey for wireless technologies, we would find that most of the mobile equipments like smart phones, laptops and palm tops are loaded with WiFi components at large. WiFi technology is more conform to the IEEE802.11 standards. Hence this is the reason why PDAs and other digital devices nowadays must possess the WiFi components. WiMax conform to 802.16 IEEE standards.

VI. WiMax/Wi-Fi MARKET OVERVIEW

The most fundamental difference between WiMax and Wi-Fi is that they are designed for totally different applications. Wi-Fi is a local network technology designed to add mobility to private wired LANs. WiMax, on the other hand, was designed to deliver a metro area broadband wireless access (BWA) service. The idea behind BWA is to provide a fixed location wireless Internet access service to compete with cable modems and DSL. So, while Wi-Fi supports transmission ranges up to a few hundred meters, WiMax systems could support users at ranges up to 30 miles. This difference in focus helps to explain why there has been less "market buzz" surrounding WiMax. Where Wi-Fi marketing targeted the end user, WiMax is intended as the basis of a carrier service. As a result, the WiMax Forum has been working primarily with component and equipment suppliers to develop base stations and

premises equipment that carriers will use to deliver the service. The market view of WiMax has also been confused by the range of applications for which it has been proposed. According to Margaret LeBrecque, Marketing Manager for the Broadband Wireless Division at Intel Capital, and former president of the WiMax Forum, three major phases in development are anticipated:

* Phase 1--Fixed Location Private Line Services or Hot Spot Back-haul

* Phase 2--Broadband Wireless Access/Wireless DSL:

* Phase 3- Mobile/Nomadic Users:

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