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A Coloration Of Wimax Over Wi-Fi Technology

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***Abstract*— Within just a short period of time, WiMAX has become a disrupting vigor in the wireless industry. Over the past ten years, mobile communication and internet connection has become a daily necessitate trade like electricity and water. With this rapid expansion of users and services, the operators of the wireless networks are making money today and adding more and more users at rapid rates. India has the growth in between 20% and 30% year over year in mobile and internet addict. However, this dreadfully success brings the turning point of impending tragedy as these end users are expecting, demanding and consuming ever-escalating amounts of data over these same networks. As the operator's eye is on the incredible growth of data and pull on their networks, they must deliberately raise the question: When and how do I make the move to WIMAX-as an everlasting way out? It's no longer a question of 'if', but more a question of "when" and "how"? Hence this paper is purposely focus on the divergence of Wi-Fi technology and status of WiMAX technology in recent gravel.**

***Keywords*—WiMAX architecture framework, WiMAX Network Model, incongruity between WiMAX and Wi-Fi technology.**

I. INTRODUCTION

WiMAX is one of the most constructive wireless broadband technologies recently used. WiMax is a standardized wireless version of Ethernet which is projected as an alternative to wired technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises.

WiMAX is an ellipsis for Worldwide Interoperability for Microwave Access which is based on Wireless MAN technology. A wireless technology optimized for the delivery of IP centric services over a wide area. WiMAX is a scalable wireless platform for constructing alternative and complementary broadband networks. A certification that denotes interoperability of equipment built to the IEEE 802.16 or compatible standard. The IEEE 802.16 Working Group develops standards that address two types of usage models:

- A fixed usage model (IEEE 802.16-2004).
- A portable usage model (IEEE 802.16e).

WiMAX was formed in April 2001, in anticipation of the publication of the original 10-66 GHz IEEE 802.16 specifications. WiMAX is to 802.16 as the Wi-Fi Alliance is to 802.11which depicts, WiMAX is such an easy term that people tend to use it for the 802.16 standards and technology themselves, although strictly it applies only to systems that meet specific conformance criteria laid down by the WiMAX Forum. The 802.16a standard for 2-11 GHz is a wireless metropolitan area network (MAN) technology that will provide broadband wireless connectivity to Fixed, Portable and Nomadic devices. It can be used to connect 802.11 hot spots to the Internet, provide campus connectivity, and provide a wireless alternative to cable and DSL for last mile broadband access. [1]

In Short, WiMAX can equivalently operate as WiFi, but at more superior rate (speed), over larger legroom and for a bigger user size. WiMAX has ability to provide services in remote areas that are difficult to wire. These features can broadly distinguished WiMAX from Wi-Fi technology.

II. WIMAX INSIGHT

A WiMAX system composed of two major parts:
(a) A WiMAX base station. (b) A WiMAX receiver.

A WiMAX Base Station: It is a covered electronics component and its tower is alike with a tower cell-phone. At around a radius of 6 miles of coverage get covered by a WiMAX base station. Any wireless device within this coverage area can possibly able to access the Internet.

The WiMAX base stations probably using the MAC layer defined in the standard. According to needs of subscribers, a common interface makes the network interoperable and allocates uplink and downlink bandwidth. Each base station provides wireless coverage over an area called a cell. Notionally, 50 km or 30 miles is the maximum radius of a cell but even so, realistic considerations limit it to about 10 km or 6 miles.

A WiMAX Receiver: This is also referred as customer premise equipment (CPE). It could be equipped with a separate antenna or by a stand-alone box or a PCMCIA card sitting in our laptop or computer or any other device.

WiMAX base station is similar to accessing a wireless access point in a WiFi network, but its coverage is greater.

Backhaul: Backhaul refers both, the connection from the access point back to the base station and also the connection from the base station to the core network, as WiMAX tower station can connect directly to the Internet using a high-bandwidth, wired connection (for example, a T3 line). It can also connect to another WiMAX tower using a line-of-sight, microwave link. It is possible to connect several base stations to one another using high-speed backhaul microwave links. This would also allow for roaming by a WiMAX subscriber from one base station coverage area to another, similar to the roaming enabled by cell phones.

III. WIMAX NETWORK MODEL

The IEEE 802.16e-2005 standard provides the air interface for WiMAX but does not define the full end-to-end WiMAX network. The WiMAX Forum's Network Working Group (NWG) is responsible for developing the end-to-end network requirements, architecture, and protocols for WiMAX, using IEEE 802.16e-2005 as the air interface. [6]

The WiMAX NWG has developed a network reference model to serve as an architecture framework for WiMAX deployments and to ensure interoperability among various WiMAX equipment and operators.

The network reference model envisions unified network architecture for supporting fixed, nomadic, and mobile deployments and is based on an IP service model. Below is simplified illustration of IP-based WiMAX network architecture. The overall network may be logically divided into three parts:

1. **Mobile Stations (MS)** used by the end user to access the network.
2. **The access service network (ASN),** which comprises one or more base stations and one or more ASN gateways that form the radio access network at the edge.
3. **Connectivity service network (CSN),** which provides IP connectivity and all the IP core network functions.

The network reference model developed by the WiMAX Forum NWG defines a number of functional entities and interfaces between those entities. Fig below shows some of the more important functional entities.

Base station (BS): The BS is responsible for providing the air interface to the MS. Additional functions that may be part of the BS are micro-mobility management functions, such as handoff triggering and tunnel establishment, radio resource management, QoS (quality of service) policy enforcement, traffic classification, DHCP (Dynamic Host Control Protocol) proxy, key management, session management, and multicast group management.

Access service network gateway (ASN-GW): The ASN gateway typically acts as a layer 2 traffic aggregation points within an ASN. Additional functions that may be part of the ASN gateway include intra-ASN location management and paging, radio resource management and admission control, caching of subscriber profiles and encryption keys, AAA client functionality, establishment and management of mobility tunnel with base stations, QoS (quality of service) and policy enforcement, foreign agent functionality for mobile IP, and routing to the selected CSN.

Connectivity service network (CSN): The CSN provides connectivity to the Internet, ASP, other public networks, and corporate networks. The CSN is owned by the NSP and includes AAA servers that support authentication for the devices, users, and specific services. The CSN also provides per user policy management of QoS (quality of service) and security. The CSN is also responsible for IP address management, support for roaming between different NSPs, location management between ASNs, and mobility and roaming between ASNs.

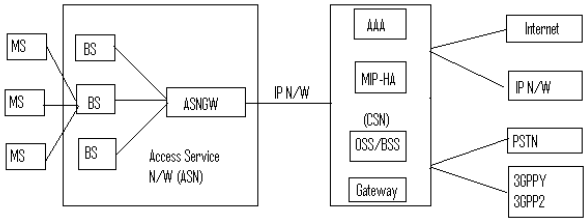

Fig.1 IP based WiMAX Architecture

The WiMAX architecture framework allows for the flexible decomposition and/or combination of functional entities when building the physical entities. For example, the ASN may be decomposed into base station transceivers (BST), base station controllers (BSC), and an ASNGW analogous to the GSM model of BTS, BSC, and Serving GPRS Support Node (SGSN). [3]

IV. WIMAX SPEED AND RANGE

WiMAX is expected to offer initially up to about 40 Mbps capacity per wireless channel for both fixed and portable applications, depending on the particular technical configuration chosen, enough to support hundreds of businesses with T-1 speed connectivity and thousands of residences with DSL speed connectivity. WiMAX can support voice and video as well as Internet data.

WiMax will be to provide wireless broadband access to buildings, either in competition to existing wired

networks or alone in currently unserved rural or thinly populated areas. It can also be used to connect WLAN hotspots to the Internet. WiMAX is also intended to provide broadband connectivity to mobile devices. It would not be as fast as in these fixed applications, but expectations are for about 15 Mbps capacity in a 3 km cell coverage area. With WiMAX users could really cut free from today's Internet access arrangements and be able to go online at broadband speeds, almost wherever they like from within a Metro-Zone. WiMAX could potentially be deployed in a variety of spectrum bands: 2.3GHz, 2.5GHz, 3.5GHz, and 5.8GHz.

V. WIMAX AND WIFI COMPARISON

Feature	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 1.25M 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)
Mobility	Mobile WiMax (802.16e)	In development	In development
Mesh	Yes	Vendor Proprietary	Vendor Proprietary
Access Protocol	Request/Grant	CSMA/CA	CSMA/CA

Table1. Comparison of WiMAX with Wi-Fi

Quality of Service:

Wi-Fi does not guarantee any QoS (quality of service) but WiMAX will provide us several levels of QoS (quality of service). As such, WiMAX can bring the underlying Internet connection needed to service local Wi-Fi networks. Wi-Fi cannot provide ubiquitous broadband while WiMAX can ever perform. [4]

VI. STIPULATION OF WIMAX

WiMAX can satisfy a variety of access needs. Potential applications include extending broadband capabilities to bring them closer to subscribers, filling gaps in cable, DSL and T1 services, Wi-Fi and cellular backhaul, providing last-100 meter access from fibre to the curb and giving service providers another cost-effective option for supporting broadband services. WiMAX can support very high bandwidth solutions where large spectrum deployments (i.e. >10 MHz) are desired using existing infrastructure keeping costs down while delivering the bandwidth needed to support a full range of high-value, multimedia services. WiMAX can help service providers meet many of the challenges they face due to increasing customer demands without discarding their existing infrastructure investments because it has the ability to seamlessly interoperate across various network types.

WiMAX can provide wide area coverage and quality of service capabilities for applications ranging from real-time delay-sensitive voice-over-IP (VoIP) to real-time streaming video and non-real-time downloads, ensuring that subscribers obtain the performance they expect for all types of communications. WiMAX, which is an IP-based wireless broadband technology, can be integrated into both wide-area third-generation (3G) mobile and wireless and wire-line networks, allowing it to become part of a seamless anytime, anywhere broadband access solution.

Ultimately, WiMAX is intended to serve as the next step in the evolution of 3G mobile phones, via a potential combination of WiMAX and CDMA standards called 4G.

VII. WiMAX Scopes

A standard by itself is not enough to enable mass adoption. WiMAX has stepped forward to help solve barriers to adoption, such as interoperability and cost of deployment. WiMAX will help ignite the wireless MAN industry, by defining and conducting interoperability testing and labeling vendor systems with a "WiMAX Certified™" label once testing has been completed successfully.

Clearly, WiMAX and Wi-Fi are complementary technologies and will remain so for the upcoming future. The widely available Wi-Fi technology used in hotspots in hotels, restaurants, airports and even larger Wi-Fi zones in some cities will continue to grow for many years. The recent flurry of municipal Wi-Fi mesh networks has only served to cement the technology into the wireless equation. Wi-Fi is not going away any time soon.

As the WiMAX standard grows into its first highs scale deployment with Clear wire in 2009 and continues to gain acceptance and drive cost reductions, new chipsets that incorporate the ability to function across multiple platforms will become more common in general with the MAN portion of this network technology slowly being converted to the more robust WiMAX systems, as the business cases for hotspot venues merit. Basically, this means that WiMAX users in a few years will be able to not only access Wi-Fi hotspots at a café, but could also have mobile citywide WiMAX access as well, along with access to other existing cellular technologies.

However, other LAN technology standards such as Bluetooth, UHF Whitespace frequencies, Ultra-wide band and the 802.11n specification that offer value in shorter range hotspot networks will all grow and necessitate chipsets and laptop radios that will eventually be able to seamlessly cross these shorter range data networks as well as cellular networks and WiMAX citywide networks. The WiMAX standard is a major part of the very bright vision of the broadband wireless future that flexibility like this promises.

Conclusion:

During these few years, multiple network potential in a particular device is acquiring a tremendous grip. Just the once, this facet depicts the complementary aspect to the two technologies. In real, the factual mobile access users not always require the level of bandwidth that they may need when in a fixed location. Actually, the two technologies will fulfill differing needs for consumers. Even if the diligence often refers to the impending for true software, laptop or other devices essentially scan for the best connection for the location and spectrum available. The industry is slowly moving in this direction; expecting that the full development of such type of flawless technology will soon arriving in these few years. Continuous sensible improvements in this direction perhaps will afford consumers benefits that are really not feasible with wire-line technologies.

WiMAX is in wallop due to its precursor over WiFi like True broad-band connectivity, IP ‑ based technology, Carrier ‑ grade reliability and security, QoS and traffic prioritization mechanisms, Lower cost ‑ per ‑ bit than cellular networks and a wide range of devices with WiMAX chipsets embedded along with Wi ‑ Fi, at a very low additional cost. This overall foundation gives the strength for greater flexibility in choosing the best ‑ suited devices that are within the customer's budget.

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