

Comparison of LTE & WiMAX

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Abstract— WiMAX has approved non-cell communication technology as a majority of IEEE 3G standard IEEE 3G in 2.6GHz frequency bands by the International Telecommunications Union (ITU). Next-generation mobile wireless system. Under the same technology evolution of various mobile systems, everything converges into air interfaces based on Core network of OFDMA and all packet switches. For example, from a radio point of view, there is a general support for the adoption of OFDMA in the long-term evolution (LTE) of 3G, and at a high level, there are similarities between WiMAX and the proposals for 3G LTE. However, it is necessary to be careful to group all the OFDMA technologies in the large region, because there are probably substantial differences in detail between the different wireless systems of next generation in evolution such as WiMAX and LTE [2]. This paper examines technical evolution of LTE over WiMAX.

Index Terms- LTE, OFDM WiMAX, 4G

I. INTRODUCTION

Both WiMAX and LTE have evolved to become ‘evolutionary frameworks’ that are based on the same core wireless and network technologies. Many of the differences can be viewed as specializations upon that core theme: WiMAX has its roots in the wireless broadband access industry which had used a hodge-podge of non-standard technologies. LTE (Long Term Evolution) is a wireless broadband technology designed to support roaming Internet access via cell phones and handheld devices. Because LTE offers significant improvements over older cellular communication standards, some refer to it as a 4G (fourth generation) technology along with WiMax. With its architecture based on Internet Protocol (IP) unlike many other cellular Internet protocols, Long Term Evolution supports browsing Web sites, VoIP and other IP-based services well [3].

LTE can theoretically support downloads at 300 Megabits per second (Mbps) or more based on

experimental trials. However, the actual bandwidth available to an individual LTE subscriber sharing the service provider's network with other customers is significantly less. Long Term Evolution service is only available in limited geographic areas, but telecommunications providers have been actively expanding their LTE services. “Fig.1” shows the Migration to OFDMA & Flat All-IP Wireless Networks [4].

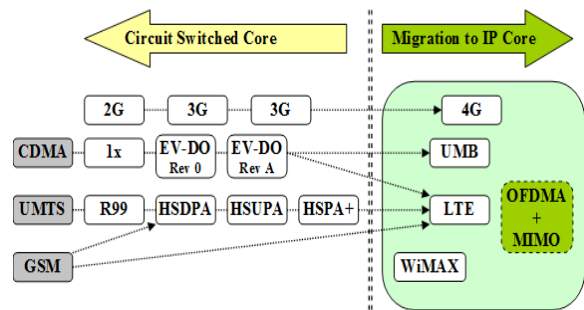


Fig.1: Migration to OFDMA & Flat All-IP Wireless Networks

II. QUALITY OF SERVICE SUPPORT

QoS in WiMAX inherited from the standard and also from an end-to-end network view [5]. Providing QoS between two end-points in broadband wireless networks like WiMAX requires connecting many links with intermediate components like routers, switches, etc. “Fig.2” shows the general flow of QoS in mobile WiMAX.

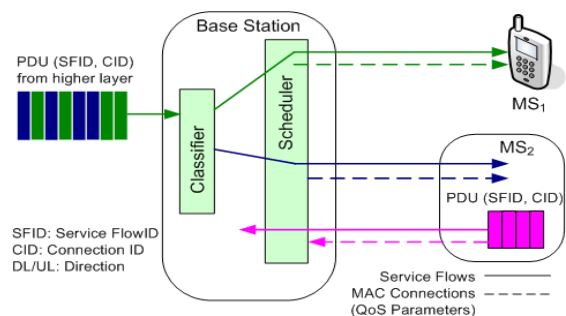


Fig. 2: General Flow of QoS WiMAX

Since WiMAX is envisioned to provide end-to-end IP services and will likely be deployed using an IP core network, IP QoS and its interaction with the wireless link layer are what is most relevant to WiMAX network performance. The QoS provided by a network is a performance level indicator, typically specified in terms of throughput, packet loss, delay, and jitter, and the requirements vary, based on the application and service. There are more components and functionalities in an end-to-end network providing QoS than the air interface QoS features discussed above, such as policy control and charging (PCC) functions in QoS provisioning. “Fig.3” shows the general flow of QoS in LTE. We show the comparison of the QoS framework between LTE and IEEE 802.16e/IEEE 802.16m at the air interface [6]:

- QoS transport unit: The basic QoS transport unit in the IEEE 802.16e/IEEE 802.16m system is an SF, which is a unidirectional flow of packets either UL from the MS/AMS or DL packets from the BS/ABS [7]. The basic QoS transport in LTE is a bearer between UE and the PDNGW. All packets mapped to the same bearer receive the same treatment.
- QoS scheduling types: There are six scheduling service types in IEEE 802.16m including UGS, ertPS, rtPS, nrtPS, and BE from IEEE 802.16e and the newly defined aGP service. LTE supports GBR and non-GBR bearers. The GBR bearer will be provided by the network with a guaranteed service rate, and its mechanism is like rtPS; the non-GBR has no such requirement and performs like BE in IEEE 802.16e/IEEE 802.16m [7].
- QoS parameters per transport unit: Depending on the SF type, IEEE 802.16e/ IEEE 802.16m can control maximum packet delay and jitter, maximum sustained traffic rate (MSTR), minimum reserved traffic rate (MRTR), and traffic priority. LTE MBR and GBR are similar to IEEE 802.16e/IEEE 802.16m MSTR and MRTR, respectively. However, MBR and GBR are only attributes of GBR bearers, while in IEEE 802.16e/IEEE 802.16m even a BE SF can be rate limited using its MSTR. Also, with 3GPP Release 8, GBR and MBR are set equal, while IEEE 802.16e/IEEE 802.16m allows the operator to select independent values for MSTR and MRTR. On the other hand, LTE AMBR allows the operator

to rate cap the total non-GBR bearers of a subscriber [7].

- QoS handling in the control plane: The SF QoS parameters are signaled in IEEE 802.16e/IEEE 802.16m via DSx/AAI-DSx messages. In LTE the QCI and associated nine standardized characteristics are not signaled on any interface. Network initiated or client initiated QoS are both supported in IEEE 802.16e/IEEE 802.16m systems. Therefore, both operator managed service and unmanaged service can be supported. The flexible architecture gives the mobile client opportunities for differentiation. LTE only supports network initiated QoS control [7].
- QoS user plane treatment: The ARP parameter in LTE provides the following flexibilities to the operator: –Accept or reject establishment or modification of bearers during the call admission control decision based on not only the requested bandwidth, available bandwidth, or number of established bearers, but also the priority of the bearer –Selectively tear down bearers based on their priorities during an overload situation [7].

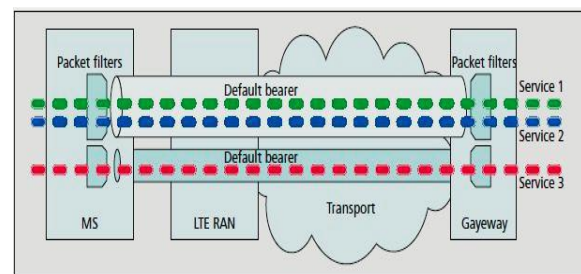


Fig.3: General Flow of QoS in LTE

III. LTE VS WIMAX

The primary difference between LTE and WiMAX are the differences in upbringing: like close cousins, there are deep blood ties between the two standards, (similar frameworks of technology), but the ‘families’ that have raised them are different: different goals and different means. But as each group has now prepared their standards to fulfill proposal requirements mandated by ITU, International Telecommunications Union, IMT-Advanced, the two standards are seeking jobs at the same huge ‘factory’ – the factory of open IP unified communications [8].

So, when the discussion is about ‘What is WiMAX (or LTE)’ the answer should also include a statement that “these are two systems developing along the same lines but optimized to work somewhat differently. WiMAX is primarily aimed at Greenfield (new) fixed to mobile deployments while LTE is mostly aimed at incumbent (existing) deployments that must work with existing networks and business practices” as shown in “Fig.4” [9].

But you can quickly see even that is a simplification that does not completely fit the current state of development: Sprint now sells dongles with mobile devices soon to appear that will support both Clear wire’s WiMAX and Sprint’s 3G EVDO [10] – [11]. And they are working on doing seamless hand-offs of voice and other communications. That will soon mean users of Google Android or other phones and mobile devices will be able to start a VoIP call on the WiMAX network and keep on talking as they travel to a Sprint or collaborating 3G network. Chips are in the works to also allow that to happen across WiMAX and HSPA/GSM. Likewise, some LTE developers say it will be used for fixed networks as well as for mobile networks.

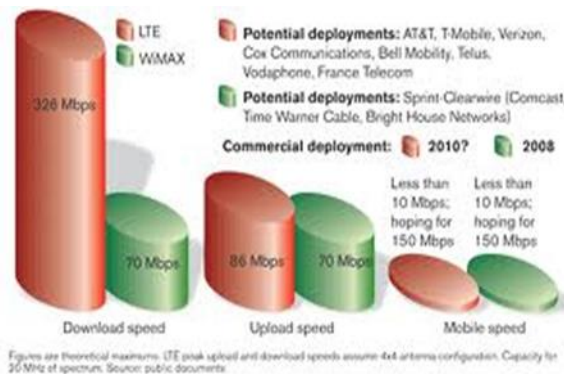


Fig.4: Potential Deployment of WiMax & LTE

The next versions of both, 802.16m WiMAXm and LTE-Advanced [12], are being designed to meet the same guidelines for IMT-Advanced which calls for an adaptive framework that can be used from local area fixed networks to large scale mobile networks and to use multiple carriers across multiple bands of spectrum. “Fig.5” shows that, how latency in decreased and capacity in increased over the year for LTE.

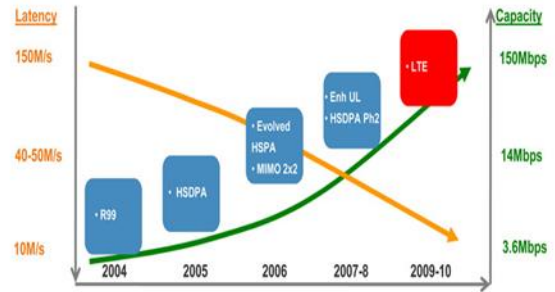


Fig.5: Performance of LTE Over the Year

The 4G LTE network is only available in 38 cities in the USA, covering about 35% of the current Verizon subscribers. The company is quickly building more towers across the country, but it will not be nationwide until 2013.

Carriers can choose to deploy LTE networks either in FDD (frequency division duplex) or TDD (time division duplex) versions. Since WiMax is a TD technology and shares more assets with the latter, TD-LTE presents a more efficient migration option for WiMax operators. Those with broad spectrum rights such as Clear wire in the US have the option of dividing up that spectrum between WiMax and TD-LTE so that they can enter the LTE market without cutting off their existing subscriber base. .

There are upcoming spectrum auctions for 2.3 GHz and 2.5 GHz spectrum bands that is better suited for TDD. Operators so far found little interest in the TDD band and WiMax had positioned itself very well for the TDD band. Operators are in general opposed to the WiMax roll out as it encourages open ecosystem and moreover was an entirely different technology with no evolutionary path from either GSM or CDMA. WiMAX is controlled by IEEE, the consumer electronics industry, which is far more open than telecom/3GPP. However, now operators see a clear synergy in rolling out TD-LTE networks if the TDD spectrum comes up for auction. In India, the operators may actually be bidding for BWA to roll-out TD-LTE rather than WiMax. [13] – [14].

CONCLUSION

Mobile WiMAX has advantages over LTE in terms of security in mobile enterprise networks, as well as speed and low cost of deployment. In addition, it is more effective in general energy consumption. In addition, the current development and coating of WiMAX Mobile is much higher. However, with the recent start of LTE deployment, an increasing number of operators are choosing the LTE/SAE architecture for their future wireless communication networks, primarily because most operators use 3GPP GSM or UMTS networks and are participating within 3GPP in the development of future 3GPP networks [15]. LTE-Advanced and Wireless MAN-Advanced provide future extensions of the current approach, therefore both technologies are future-proof. Competition scenarios vary and depend on the deployment region. LTE dominates the Western European market, while Mobile WiMAX is the only 4G technology in India. Finally, just like the previous generation of communication networks, LTE and Mobile WiMAX will coexist globally and continue to develop in the future. We also discussed the mapping of QoS parameters between WiMAX and LTE to provide guaranteed QoS to end users.

According to the comparison table, it is very important that both Mobile WiMAX and LTE have advantages from each other, so Mobile WiMAX and LTE technologies can coexist.

While 100 million global LTE users is a considerable increase on a figure that was 30 million twelve months ago, it is assumed that LTE adoption rocketing past 300 million by 2014. "Fig.6" shows the subscriber forecasting for 4G over the world. This work can be used to prioritize future research directions in WiMax/802.16e and LTE.

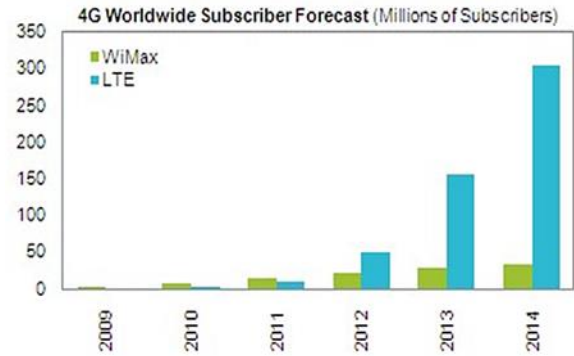


Fig.6: Worldwide Subscriber Forecast of WiMAX & LTE

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