WiMAX

The Personal Broadband Connection

4G Wireless

CellStrat Consulting Services
Atlanta, GA, USA

v1.0
Created: 04/25/2008
WiMAX – the new 4G technology

WiMAX (worldwide interoperability for microwave access) is a 4G wireless technology having service capabilities in regulated and unregulated spectrum (though operators and OEM partners are slowly moving away from using WiMAX in unregulated spectrum). WiMAX comes from IP/microwave side similar to its cousin WiFi (which is from IP world) as opposed to HSPA, GPRS and UMTS which are GSM flavors of 2.5G/3G wireless tech. The 4G version in GSM evolution path is LTE (Long Term Evolution) - something which is two years away but gaining traction with the largest mobile operators in the world eg AT&T and Verizon in USA have announced intention to adopt LTE rather than go the WiMAX way. But WiMAX has a first mover advantage in 4G world as it is available with large OEM and vendor support. So many folks around the world are trying this rather than wait out for a full-blown LTE rollout in another 2 years or so.

4G technology choices

LTE (Long Term Evolution) is the most prominent threat to WiMAX technology. LTE is the 4G flavor of GSM evolution path and hence more preferable by GSM carriers and some major CDMA vendors around the world. Since GSM is the dominant standard in the world in wireless networks, LTE is seen as a likely winner in 4G space especially among large operators around the world. Mobile WiMAX has had trials in 10Mbps range (over a 10Km distance) but Nokia has done trials of LTE in which it has achieved 100 Mbps data transfer speeds with LTE equipment.

UMB or Ultra Mobile Broadband is the CDMA version of 4G developed by Qualcomm which also promotes the CDMA standard. Verizon Wireless, the giant CDMA operator in United States, shocked the world when it announced an intention to migrate to LTE instead of UMB in the 4G evolution. Verizon may still go the UMB-way; one will see how this plays out. UMB can achieve the same speeds as LTE for wireless broadband access.

HSPA and HSPA+ are improvements over UMTS which is essentially a 3G wireless standard. HSPA offers a stop gap solution before the 4G comes around and is the strategy adopted by GSM carriers to compete with WiMAX or high speed CDMA until the LTE comes around. Eg AT&T Mobility in USA has adopted an HSPA/HSPA+ upgrade path from its current 2.5G-3G GPRS/UMTS offerings.

The table on the next page elucidates some salient differences between the various 4G wireless standards. It is clear that LTE and UMB are technologically superior at least in trials but WiMAX is also a blazing fast 4G technology which is available now. It has a speed to market advantage for carriers which adopt it now.
<table>
<thead>
<tr>
<th>3G/4G Technology</th>
<th>Maximum Speed</th>
<th>Availability</th>
<th>Pros</th>
<th>Most Popular in</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSPA+</td>
<td>28 Mbps</td>
<td>2008-09</td>
<td>Available now, GSM evolution path, software upgrade only, 3G</td>
<td>global GSM deployments</td>
</tr>
<tr>
<td>WiMAX</td>
<td>70 Mbps</td>
<td>2008-09</td>
<td>Available Now, 4G</td>
<td>Asia, Middle East (regionalized deployments), Sprint (USA) - tentative</td>
</tr>
<tr>
<td>LTE</td>
<td>150 Mbps (OEM trials)</td>
<td>2010-11</td>
<td>GSM evolution path, 80% of global wireless carriers have GSM, 4G</td>
<td>global (most larger carriers)</td>
</tr>
<tr>
<td>UMB</td>
<td>280 Mbps (theoretical)</td>
<td>2009-10</td>
<td>CDMA evolution path, 4G</td>
<td>Poor adoption</td>
</tr>
</tbody>
</table>

**WiMAX Deployments**

Recently, Reliance Globalcom announced an intention to roll out WiMAX network in 50 countries by year 2012. It is investing $500 million towards this effort. Some other large installations include Unwired, mobile broadband provider, in Australia which started with a Navini Networks (now Cisco) Mobile WiMAX solution way back in 2003.

Experts predict that high-growth emerging markets offer the biggest opportunity for WiMAX, but equipment and terminals will need to be ultra low-cost to make the service provider business viable, and there’s not yet enough product volume in the market to get prices where they need to be.

Although, in developed countries like USA also, there are sporadic deployments of WiMAX networks being done on an experimental basis. In general, in these countries, one expects to see WiMAX deployments by regional or peripheral carriers. In the US, the primary nationwide deployment of a WiMAX network is expected to be done by Sprint in collaboration with ClearWire, via its Xohm service. But the regional carriers are going to beat Sprint on this subject. Eg even before Sprint comes out with its Xohm WiMAX service, TowerStream Corp may beat Sprint in USA on WiMAX deployment schedule with a preliminary launch starting in summer of 2008. Xanadoo (wireless broadband service provider) has already launched service in 20 locations in Texas using a Navini Networks (Cisco) Mobile WiMAX solution in the 2.5 GHz band.
That said, for USA, it is safe to say that success of WiMAX depends on Sprint continuing with its plans for a nationwide WiMAX service. We feel that a Sprint nationwide WiMAX rollout will validate this technology for other large carriers around the world and lead to much larger adoption of this technology in other countries as well. As well, a Sprint and ClearWire WiMAX rollout is expected to get large investments from the likes of cash-rich Google and Comcast, firms we know are looking for a backdoor way into the US wireless market. Intel is also aligned with WiMAX world with its next generation chip development but it may support dual mode strategy with a chip support for LTE as well.

So far, as compared to the developed world, WiMAX adoption is seeing better success rates in developing countries and regions of the world viz Middle East, Asia and South America.

**Why WiMAX**

WiMAX allows speeds of 2-4 Mbps in early trials on the downlink and 1-2 Mbps on the uplink in wireless communications from mobile phones, laptops, WiMAX CPE (customer modems) etc, in effect matching the DSL or lower end cable modem speeds of today. WiMAX offers personal broadband to folks who want high speed wireless connectivity anywhere, anytime. Of course one needs WiMAX compatible chip sets in laptops or WiMAX enabled phones for the mobility aspect of it. For home or office use, WiMAX can be deployed as a modem (called CPE or customer premise equipment) inside or outside a home or building. WiMAX equipment can communicate with WiMAX base stations in cell towers several miles away without signal degradation. As a result, we are talking about high speed wireless mobile TV, multimedia gaming, streaming media, P2P apps, VOIP etc on mobile phones or compatible laptops.

WiMAX standards are administered by a body called the WiMAX Forum which describes WiMAX as “a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL”.

WiMAX offers non-line-of-sight communication between Base Station and the customer CPE which is a great practical advantage and makes it a viable competitor to DSL or cable. Mobile WiMAX, or 802.16e, will bring the technology to mobile devices such as laptops, phones and PDAs, while Fixed WiMAX (802.16d) will likely be used to bring broadband connectivity to business and residential users. Mobile WiMAX includes Fixed WiMAX – in other words 802.16e WiMAX offers both fixed and mobile access over the same infrastructure, paving the way for personal broadband service that gives users continuous broadband Internet access at work, on the road or at home.
WiMAX Technology

There are two flavors of WiMAX - Fixed WiMAX and Mobile WiMAX - they are based on the IEEE 802.16d and 802.16e specifications respectively. In simple terms, Fixed WiMAX allows a cable or DSL line substitute but no mobility or roaming between cells. Mobile WiMAX allows mobility and handoff between Base Stations, thereby working like a true wireless network.

Fixed WiMAX is relevant to WiMAX laptops and offers a wireless environment akin to WiFi environment, whereby laptops in the area can access the WiMAX signals. It is also referred to as 802.16-2004 standard and depends on support of computer and chip manufacturers if they embed PCMCIA cards which are compatible with this standard. Wavesat and TeleCIS are some chip firms which have supported the idea of Fixed WiMAX.

Mobile WiMAX, also called 802.16-2005 standard allows WiMAX compatible mobile phones to handoff signal between the Base Stations when in a mobile mode. Mobile WiMAX supports both fixed and mobile WiMAX inherently. Mobile WiMAX is more expensive than Fixed WiMAX but is too compelling for telecom firms to ignore due to its mobility advantage. We believe that Fixed WiMAX will be marginalized as costs of Mobile WiMAX fall with increased adoption and volume production.

Typically, WiMAX is being deployed in the 2.5-2.7 GHz range in USA and 3.3-3.5 GHz range in Europe and Asia but there are exceptions to this rule.

WiMAX involves the following equipment - Base Stations on cell towers and CPE or customer premise equipment or receivers. CPE are similar to our DSL modems or cable modems housed within the homes; or they can be installed externally outside the home or office buildings. In-building/In-home WiMAX modems promise to revolutionize broadband access for homes and businesses and serve as a compelling replacement for DSL or cable internet service.

Intel has made available WiMAX chips in laptops (though one hears different versions as to level of interest of Intel in this area). As to mobile phones, several mobile phone manufacturers have announced intention to make WiMAX phones in large numbers.

WiMAX is a last mile wireless access solution. It needs a backhaul network or the core transmission over the larger area - the backhaul can be T1 lines from local TELCOs, line-of-sight WiMAX towers themselves or even satellite communication for remote areas. WiMAX does require more advanced backhaul than traditional wireless networks hence fiber-based backhaul or microwave point-to-point backhaul is very appropriate for WiMAX. WiMAX, itself has been considered as a back haul technology, in which case it could replace T1 lines in urban areas or satellite for remote areas.
WiMAX can operate in regulated and unregulated spectrum. QOS management may be harder in unregulated spectrum however. In WiMAX, one can control the bandwidth provided to the customer unlike today’s wireless services or even WiFi networks. Consequently billing of WiMAX services can be tied to QOS levels, bandwidth provided and uplink/downlink speeds. This “managed” aspect is a welcome change from today’s unmanaged DSL / cable based internet access solutions.

WiMAX can interoperate with 3GPP, 3GPP2, WiFi and wireline using IETF (Internet Engineering Task Force) protocols – ie the fundamental protocols used in IP networks (or the internet).

**WiMAX Frequency Spectrum**

There is no uniform global licensed spectrum for WiMAX, although the WiMAX Forum has published three licensed spectrum profiles: 2.3 GHz, 2.5 GHz and 3.5 GHz

In the unlicensed band, 5.x GHz is the approved profile. Telecom companies are unlikely to use this spectrum widely other than for backhaul, as they do not own and control the spectrum.

In the USA, the biggest segment available is around 2.5 GHz and is already assigned, primarily to Sprint Nextel and ClearWire. Elsewhere in the world, the most-likely bands used will be the Forum approved ones, with 2.3 GHz probably being most important in Asia. Some countries in Asia like India and Indonesia will use a mix of 2.5 GHz, 3.3 GHz and other frequencies.

**Femtocells**

WiMAX can use the Femtocell base stations which are currently being deployed by Verizon. Other US carriers like AT&T will launch them soon. Femtocell is a small cellular base station meant to boost service quality and provide value added services within a home or a small business. It connects to the service provider’s network via broadband (such as DSL or cable); current designs typically support 2 to 5 mobile phones in a residential setting. A Femtocell essentially routes mobile calls over the internet.

A Femtocell allows service providers to extend service coverage indoors, especially where access would otherwise be limited or unavailable. This is true in many homes where wireless signal cannot reach inside or there is poor signal strength due to security or physical obstructions. Femtocells are considered an important element of Fixed Mobile Convergence (FMC). Traditional Fixed Mobile convergence requires use of dual mode (WiFi) handsets but with Femtocell, ordinary cellphones can be used for FMC.
One of the most significant advantages of Femtocell for the wireless operator is that by directing home mobile calls on the internet, operators can free up the wireless network. In emerging markets, wireless network congestion rates point to the idea that Femtocells would be a boon.

CellStrat is a full service management consulting and system integration firm helping clients in areas of mobile strategy, mobile applications and mobile marketing. CellStrat assists firms in understanding the new wireless standards, mobile enablement of their workforce, development of a powerful mobile marketing strategy, implementing mobile banking and payment solutions.

For a custom analysis of your mobile business environment, your mobile strategy and development of mobile applications within your business setting, please feel free to contact us at contact@cellstrat.com or call us at (678) 643-6750.