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TOPIC

WIMAX: A NEW ERA OF CONVERGENT COMMUNICATIONS JUST WAITING TO HAPPEN. IS
IT AN IP REVOLUTION?

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WiMAX stands for the IEEE Standard 802.16 which concerns the Worldwide Interoperability for Microwave Access. IEEE 802.16 (WiMAX) is the universal air-interface standard that concerns the Physical and MAC (Medium Access Control) layers specifications for a Broadband wireless network communications protocol.(Bardazzi, Fantacci & Tarchi: 2006 p1789). As a fast growing broadband access technology it realizes the convergence of fixed and mobile broadband access in a single air interface and network architecture.(Eternad 2008: 31)

WiMAX is the commercial consortium which promotes the family of standards for broadband wireless access systems (Wang et. al.). WiMAX is the first step toward creating a full service Metropolitan Area Network (MAN). It is proposed that in the future such MANs could be created throughout urban and suburban and last mile areas – providing network access to buildings and residential areas through an external antennas system based on a central radio station (Base Station-BS with its own Subscriber Stations SS) and a variable number of user devices – offering a very useful alternative to cable connection (Tarchi 2006: 1790). Basically it is a less expensive high speed radio link communications.

From the transmission tower, WiMAX provides a 50 kilometer (31mile) linear service range. With point to multi point (PMP) connectivity making wireless access ubiquitous

and , as more free spectrum is opened up, in creating a major shake up to the traditional shape of the wireless and mobile communications sector. Fully realized it is a revolution in so far as it organizes conducts the communications infrastructure at the IP network layer level. (Bardazzi et. al. 2006: p. 1789)

There are many challenges to the realization of the possibilities in communication and its logical convergence offered by WiMAX. Firstly there are issues to do with QoS (Quality of Service) which are to be resolved primarily through the mapping of a robust architecture and the development of the technologies in terms of hardware, Base Stations (BS) and Handsets (VoIP, IPTV etc). Chiefly the idea is that WiMAX will not just facilitate mobile internet but also enable a full service mobile VoIP. IPTV is also possible although a less important priority in the literature. The technology and specifications have been evolving to provide optimisations for VoIP and multimedia IP based services with high mobility. (Eternad & Lai 2008: 26)

The research conducted for this Report raises a number of additional issues such as the technical side of not just QoS but also persistent resource allocation in mobile VoIP. There are additional issues to do with the integration of current 3GPP Networks with Mobile WiMAX – in other words a seamless integration of the infrastructure to support both 2G/3GPP and WiMAX (4G). The architecture to facilitate this integration may in the

developed world be a duplication of service or as a maintenance issue of providing “internetworking with legacy systems” (Taaghoh et al 2008: 74).

Yet from the standpoint of building an advanced and convergent communications infrastructure (say for instance in the developing world) It may just be the most advanced and simplest solution – with the scalability to provide maximum coverage in a Metropolitan Area Network (MAN). Integration or no integration, it remains the fact that “Mobile WiMAX is the only cellular technology that supports such an integrative approach to provide fixed, nomadic, Mobile IP and Ethernet Services out of the same network infrastructure.”(Eternad & Lai 2008: 28) In the future new core network infrastructure will be increasingly required to cope with much higher broadband traffic volumes that have become increasingly required by the broadband internet applications that are driving the demand for higher data rates and broadband mobility (Taaghoh et. al. 2008: 74).

Mobile WiMAX offers “flexible bandwidth and fast link adaptation, creating a highly efficient air interface that exceeds the capacity of existing and evolving 3G radio access networks (Eternad 2008: 31).The standard specifies the wireless air interface for wireless metropolitan area networks(MAN). Specifically, 802.16 is specified for the radio spectrum frequency range from 10-66 GHz. Non line of site is available below 11 GHz from 2 to 11GHz which supports licensed and unlicensed bands. At this lower frequency range the

capacity is enhanced especially for 2 way communications, such that are necessary for continuously varying traffic.

At the IP level it is possible that the next stage of convergence around 4G WiMAX will potentially revolutionise the communications infrastructure, architecture and delivery of mobile internet technologies. The architecture enables open access to Web-Based applications providing the basis for enhanced delivery capacity of interactive multimedia and communications over a high performance cost effective broadband wireless network. This has implications for the future of VoIP, mobile Broadband and IPTV. The latest amendments to the specifications IEEE 802.16REV2 address the prior problem of securing dynamic resource allocation necessary for voice. (Tarchi 2006: 1789).

In each country there are currently different ownership and control issues around these frequencies. Some are owned by commercial television others by government or telecommunications. Just as the shift from analogue to digital communications often required legislation to decide the share between commercial, military, and other communications authorities, so too 4G WiMAX will require a standardised allocation of frequencies for each specific area of commercial and strategic communications sectors (military, public broadcasting, public carriers). In Australia licenses have been sold already that now prohibit the possibility of a ubiquitous 4G network – unless if the TV stations that own parts of the spectrum decided then to become a WiMAX ISP.

In many ways 4G is unnecessary for countries like Australia as the infrastructure of communications is highly developed 2G/3GPP - even last mile is already now covered - a magnificent achievement really given the size of the country. Yet for the developing world WiMAX might just be the communications revolution that would spur a whole new era in communications. Do these countries require a communications revolution is another question? There is a lot to be said for the simple life. Yet when we see the town to city migration of young seeking work in increasingly industrialized cities we can appreciate the importance of communications as a preserver of familial relations.

Although the actual deployment of WiMAX Base Stations (BS) and Subscriber Stations (SS) is simple there are iterations to the standard. IEEE 802.16REV2 is now the most advanced specification to the standard that addresses (Quality of Service) QoS issues for VoIP and other real time applications as well as general mobile broadband. The IEEE 802.16 now 802.16REV2 is so standardized in specifications decided by the IEEE , that it will serve to promote interoperability among equipment vendors and system operators this should be achieved by ensuring roaming of retail devices across different networks (Eternad 2008: 31; Wang et. al. 2008:42) whilst also facilitating multi-vendor plug and play network infrastructure deployments (Eternad 2008: 33). The anticipated final completion of specifications for IEEE 802.16m is early 2011. This will bring major enhancements in spectrum efficiency, latency and scalability of the access technology to wider bandwidths

(Eternad 2008: 34). At the same time WiMAX has been designed as a complementary technology to WiFi and Bluetooth.

It will take a couple of years before the manufacturers build the hardware components in any truly competitive market that offers tested reliability. Yet the IP revolution has begun. Already voice apps such as IM Skype are available on Nokia and iPhone. Millions use Skype daily (As a Third party VoIP engine) Yet there will come a time when VoIP Handsets (and USBs) simply transmit microwave sound in packets across the IP Protocol and telecommunications could easily become virtually free. Now that is an IP Revolution.

Currently there are just over 260 service providers deploying fixed, portable and mixed WiMAX networks around the world (Wang et. al. 2008: 41). The extent of how much of this is actually full coverage Metropolitan Area Networks (MANs), or simply proprietary extension of last mile or intranet WANs or “walled gardens”, is not documented in the literature. Suffice to say, in spite of such large scale deployments in Korea, The US, Japan and Europe, that the current state of the deployments of the technologies can largely be considered as initial trials. Until 2001 when the final completion of specifications for IEEE 802.16m (REV2) are complete, the extent of the ongoing phase of deployment of mobile WiMAX systems, will then begin the evolutionary process toward interoperable and ubiquitous Microwave access WiMAX MANs. (Eternad & Lai 2008: 26)

WiMAX realises the convergence of mobile and fixed broadband access, in a single air interface and network architecture. It represents a paradigm shift in traditional cellular architecture to an IP based flat network architecture (Eternad 2008: 31 & 41). Increasingly WiMAX is becoming the viable future of a fully realized convergent communications system that includes not only broadband and wireless mobility but the dynamic resources allocation and quality of service (QoS) required for voice (VoIP). It is without a doubt that bandwidth and wireless mobility will further converge with the shift to this new and robust air interface for communications. It is revolutionary because the infrastructure is affordable for emerging operators as well as efficient to construct and deploy.

References

- Barbazzi, M, Fantacci, R. & Tarchi, D. 2008 'Performance Evaluation of the MAC Protocol in IEEE 802.16 Systems with Data and VoIP Traffic scheduling' *Wireless Communications and Mobile Computing* 2009, 9: 35-46
- Barbazzi, M, Fantacci, R. & Tarchi, D. 2006 'Quality of Service Management in IEEE 802.16 Wireless Metropolitan Area Networks, IEEE ICC 2006 proceedings
- Etemad, Kamran. 2008 'Overview of Mobile WiMAX Technology and Evolution' *IEEE Communications Magazine*, Oct. 2008
- Etemad, Kamran. & Lai, Ming. 2009 'Mobile WiMAX: A Technology Update' Guest Editorial, *IEEE Communications Magazine* Oct. 2008
- Fong, M., McBeath, S., Novak, R. Srinivasan, R. 2008 'Improved VoIP Capacity in Mobile WiMAX Systems Using Persistent Resource Allocation', *IEEE Communications Magazine*, Oct. 2008
- Hong, S. & Kwon, O. 2006 'Considerations for VoIP Services in IEEE 802.16 Broadband Wireless Access Systems' *Broadcast Systems Research Group, Electronics and Telecommunications Research Institute Korea, (c) from 2006 IEEE Xplore*
- Taaghoul, P., Salkintzis, A. K. & Iyer, J. 2008 'Seamless Integration of Mobile WiMAX in 3GPP Networks', *IEEE Communications Magazine*, Oct. 2008

Wang, F., Ghosh, A., Sankaran, C., Flemming, P. J., Hsieh, F. & Benes, S.J. 2008 'Mobile WiMAX Systems: Performance and Evolution' IEEE Communications Magazine October 2008