White Papers from Intercai Mondiale

Why WiMAX?

“The future is here. It's just not widely distributed yet”
– William Gibson

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Summary

Over the last year, there has been a significant amount of media interest in WiMAX and its potential to threaten current fixed and mobile operators. In order to properly assess this threat, it is important to understand what WiMAX is, to place it accurately against competing, and complementary technologies and to have a clear view of what the likely future development paths will be.

This paper explains WiMAX and compares its capabilities with the other leading communication technologies. We assess the suitability of WiMAX in several contexts – for fixed wireless access, for mobile wireless access and for provision of basic connectivity.

The concerted view that emerges is that WiMAX might not take the world of mobile wireless access by storm but will be a significant technology. The basic reason for this conclusion is that alternatives with strong backing (notably High Speed Downlink Packet Access, HSDPA) will be available making it an uphill struggle for Mobile WiMAX (802.16e) to become the dominant technology. By the time WiMAX has matured, the market may well be served by established HSDPA networks, potentially enhanced with HSUPA too, and associated cheap hardware. With HSPDA a fully conformant mobile technology (i.e. one that supports roaming, one that can be managed as an integral part of an established mobile network) the scope for WiMAX is constrained.

Nonetheless, it is likely that WiMAX will have a very significant role and a key factor is Intel's support. If, as seems likely, they provide a low-cost hybrid Wi-Fi/WiMAX chipset as part of a future Centrino specification they will provide impetus to the uptake of WiMAX. It will still be a struggle though, as this will not guarantee that the networks will be deployed. Mobile broadband is as much about coverage as it is about cost, and the cellular network operators have had close on twenty years to build up wide-reaching base station networks.

With strong competition in the mobile market, it may be that WiMAX will be more successful in fixed wireless access. It certainly is an area for which it has potential and the main issue is the size of the market. There appears to be a significant Broadband Wireless Access (BWA) market in the developing world in which fixed WiMAX can provide broadband connectivity where fixed infrastructure (and therefore DSL) isn't available. There have been more than 40 deployments of this type so far, with more under way and there is little denying the rapid growth of WiMAX in this sector.

In summary, there are two distinct markets in which WiMAX can compete with (and possibly provide a complement to) other technologies. As a fixed access mechanism it will likely be squeezed by lower-cost (and higher-speed) wired technologies such as DSL but it does provide a way of extending the reach of broadband service with minimal installation time and cost. As a mobile wireless solution, it competes with established mobile network in general and with HSPA in particular.

It may not prove to be the universal wireless solution that some hype suggests it might be but WiMAX is likely to be a technology that has a place in the communications network of the future.

Introduction

When it comes to deciding whether WiMAX will be a success or not, the only test that really matters is whether the companies deploying the technology can find an appropriate business model and so make a reasonable return from deploying it. If it does cost in as a viable way of delivering telecom services, the technology will be a success, if not it will fail.

It is also important to consider WiMAX in the context of the overarching change in the supply of communications services and content to customers. These are becoming increasingly decoupled from the networks over which they are supplied; services based on a common communications protocol (notably IP) may be delivered over a variety of different network technologies and can therefore take advantage of the best and most appropriate route to the customer, as defined by the specific requirements of service, content, speed and location. Further developments are to be expected in combined control systems which may, in time, enable customers to seamlessly change between network types on a dynamic basis.

At the very simplest level, it appears that WiMAX could sit neatly in between short-range technologies such as Bluetooth and the various technologies used by wide area network operators.

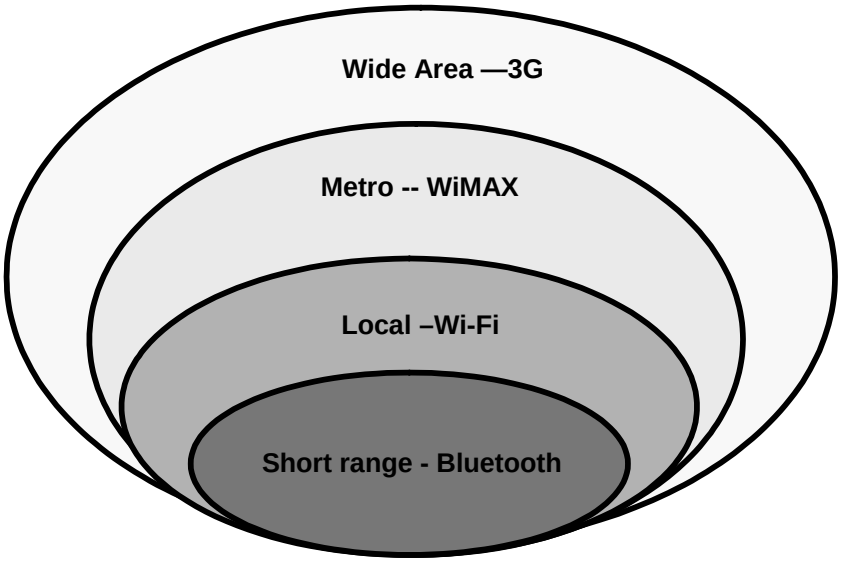

Figure 1: Technology Ranges

However, this is something of an idealised picture. In truth, the technologies used in the wide area can be used elsewhere. How effective they are, and the extent to which any one technology has its niche, is a matter of detail. And so the remainder of this paper considers the necessary detail to properly evaluate the prospects for WiMAX in the marketplace.

What is WiMAX?

WiMAX stands for Worldwide Interoperability for Microwave Access. It is developed to standards implemented by the Institute of Electrical and Electronics Engineers (IEEE), the source of the Ethernet family of specifications.

The general application of WiMAX is illustrated in Figure 2 below. It has been designed to allow line of sight, and non-line of sight connections to be established, the latter over a lower frequency range. In effect, this means that WiMAX offers both fixed and mobile capability.

With this flexibility, potential data rates of tens of Megabits/sec and a transmit range of miles rather than metres, the prospect is for WiMAX to be the basis of high capacity mobile networks that can support applications such as Internet access, voice and video.

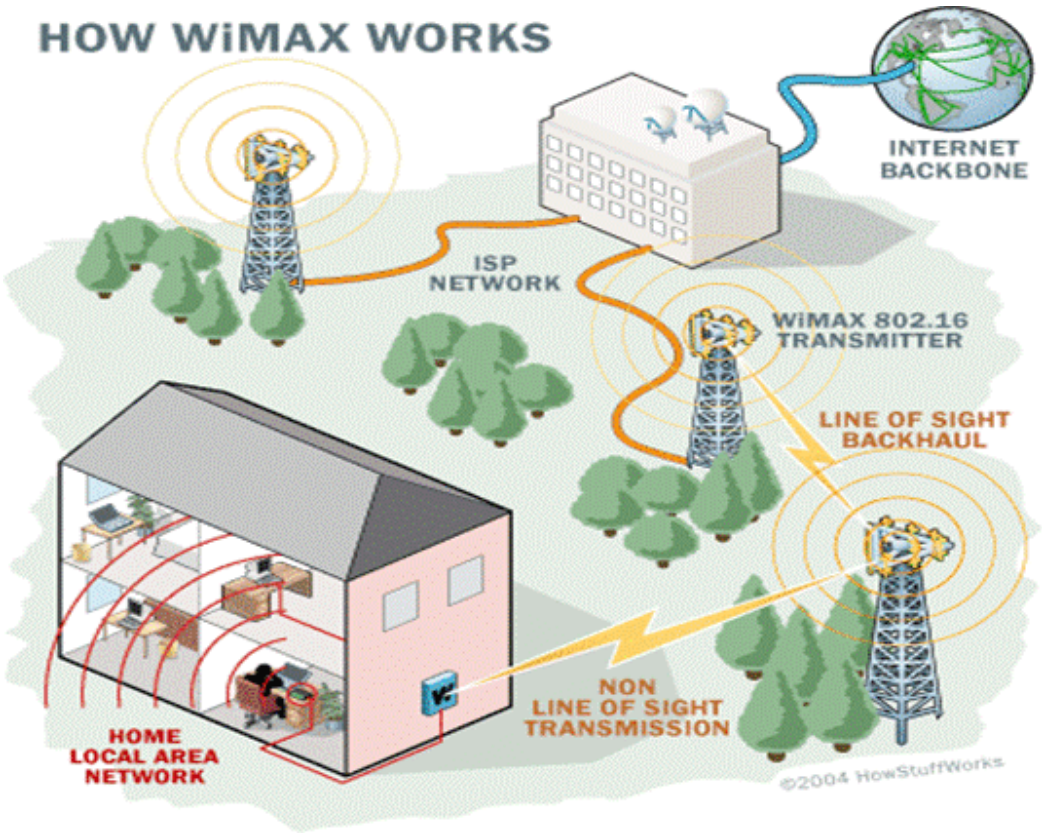

Figure 2: Application of WiMAX

The two most important standards for WiMAX are 802.16-2004, which deals with fixed wireless access, and 802.16e (aka 802.16e-2005), which deals with mobile / nomadic wireless access. The former was, as its name suggests, standardised in 2004 while the latter was largely complete by the end of 2005. Equipment conforming to the 802.16-

2004 standard has been commercially available for a little over a year and the 802.16e standard is now firm enough to allow suppliers to start delivering equipment.

The key differences between the two WiMAX standards are summarised in the tables below:

Technology – WiMAX 802.16-2004 (Fixed WiMAX)

Positives	Negatives
• Fast deployment • Simple service interface	• CPE costs and their recovery leading to sustainable pricing concerns. • Limited resources – licensed or unlicensed spectrum and availability. • No worldwide standard frequency band requires equipment to be multi-band for universal use.

Technology – WiMAX 802.16e (Mobile WiMAX)

Positives	Negatives
• Mobility • Faster than 3G (theoretically but not yet proven) • Greater range than 3G (theoretically but not yet proven) • Simple service interface	• Limited resources – licensed or unlicensed spectrum and availability. • Competing against established mobile. • No requirement in standard for roaming (considered higher level, but may be developed by operators independently.) • May require licensed spectrum for successful national deployment (local interference may present problems if unlicensed is used.) • No worldwide standard frequency band requires equipment to be multi-band for universal use.

Of course, it is not very useful (and somewhat difficult) to think of WiMAX in a vacuum isolated from other technologies. To appreciate the realities of WIMAX, it must be considered in the context of broadband service, consumer requirements and technology development. We have therefore split our analysis into two. The first deals with WiMAX as a potential technology for fixed wireless transmission. In this case the key question is how it fares against established and emerging methods of wired access such as DSL. The second part of our consideration of WiMAX is what part it might play in the world of nomadic and mobile communications – notably, how it stacks up against 3G.

Fixed Access - Wireless vs. Wired

The main competition for WiMAX 802.16-2004 is in high capacity links over existing telephone wires (using various flavours of Digital Subscriber Loop, DSL), over hybrid fibre/coaxial cable networks and over optical fibre. The position of WiMAX with respect to each of these is summarised in the tables below:

Technology – xDSL

Positives	Negatives
• Existing infrastructure • Clear upgrade path • Proven technology • Technical improvements develop faster speeds – up to 24Mbps in some cases.	• Distance from exchange and line quality define speed • Cost of laying additional fixed infrastructure requires large initial investment • Often asymmetric

Technology – Cable

Positives	Negatives
• Existing infrastructure • Generally fast speeds.	• Availability restricted to built-out areas. • Aging technology in some places

Technology – Fibre

Positives	Negatives
• High bandwidth	• Installation difficult to justify in the context of existing infrastructure and current bandwidth requirements. • CPE not yet available at low cost

The clear advantage of WiMAX against any of the wired solutions is that it requires (virtually) no infrastructure to be installed. Of course, any wireless network comes with the inherent issues of bandwidth availability due to use of radio spectrum, a scarce resource. This, coupled with the requirements for additional wireless Customer Premises Equipment (CPE), create certain cost disadvantages for wireless relative to a fixed solution. In mitigation, wireless solutions, do allow an operator high levels of initial coverage and incremental capital expenditure profiles that keep the cost of entry low.

In terms of performance, wireless will generally not support the same data rates as a fixed infrastructure solution (assuming that one exists). This is due simply to the fact that the latter provides a dedicated line from the user to the switch/router on the core network

and this provides uncontended bandwidth. Even when aggregation does occur, backhaul bandwidths are capable of handling significant volumes of data with blocking and queuing restrictions usually not significant.

Wireless, on the other hand, shares a limited amount of spectrum amongst users and therefore must be planned effectively around contention for that limited resource. The design of the wireless network must ensure that sufficient speed can be maintained even during peak demand and this places restrictions on the cost effectiveness of the network. In order to correctly dimension a WiMAX network it may be the case that the maximum service range is reduced in a more densely populated area, and if required, extra wireless channels are added to provide more bandwidth. Flexibility to cope with a range of deployment cases is provided through the number of ways in which a base station can be configured: the number of channels can be adjusted to cater for high demand in a specific location without interference between radio channels.

In planning a WiMAX access network, there must be sufficient subscribers to ensure that the business model works, but not too large a density of subscribers to make the business model uneconomical against a wired solution. Mesh networks will, to a certain extent, help with this problem, but in order to avoid physical relocations of base stations, step changes in capacity provision will be evident. This will lead to some over provisioning of base stations and inefficient use of capital. Hence, the planning of a WiMAX solution is vital to its successful deployment.

Wired networks involve significant up-front capital expenditure and relatively small incremental expenditure based on customer additions. Wireless infrastructure employs smaller initial capital expenditure, but with higher subscriber incremental expenditures. Where wired infrastructure of sufficient quality is not available, the key factors that determine the most effective option are:

- Customer demand
- Fixed build costs
- Wireless CPE costs
- Wireless network costs

There are a number of ways of configuring a WiMAX solution and there are significant cost implications for each option. Some of the practical approaches that have been used by Intercai in WiMAX deployments are shown in Figure 3 below.

Of particular importance is the option of using WiMAX as an access carrier to serve a community (e.g. in an apartment block). Such sharing mechanisms can significantly affect the breakeven point on a WiMAX business plan.

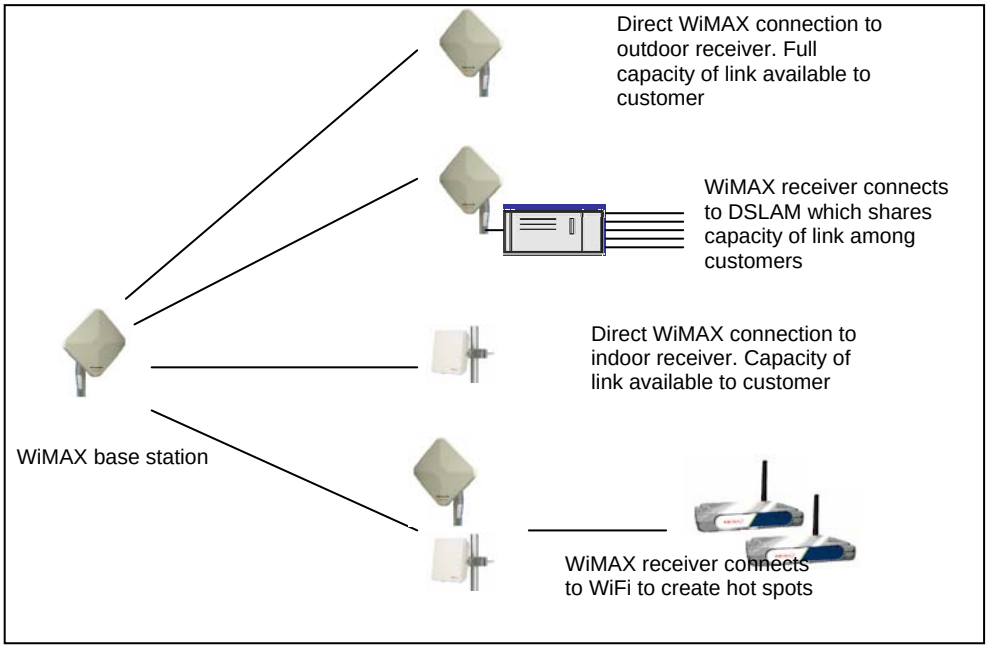

Figure 3: WiMAX Connectivity

There is little doubt that, where sufficient demand is forecast, and geography is acceptable, wired infrastructure will generally be the favourable option. This will often be the case for new build opportunities but there are many cases where the installation of a wired solution is not feasible or attractive.

It is also worth noting that existing, poor quality, fixed infrastructure may actually inhibit the upgrade path for fixed networks. Where customers are receiving basic telephony services and only low-speed broadband (sub 0.5Mbps) is available, but are still paying of the order of £10 per month rental for the line, the financial model for replacing this infrastructure is probably not viable. We believe that infrastructure replacement will only be encouraged once consumers are unwilling or refuse to pay £10 (or anything like this amount) for a low speed service, thus forcing the infrastructure owner to act, but this is probably several years away. It seems, therefore, that there is a window of opportunity for fixed wireless infrastructure offering higher bandwidth to a small number of customers requiring higher bandwidth services within an area of poor fixed infrastructure.

In summary, we believe that fixed wireless WiMAX is likely to be most successfully implemented in areas which exhibit the following characteristics:

- Sufficient demand to generate financial return on investment.
- Not too much demand to make a wired solution more attractive.
- Geographic issues which inhibit or prohibit (financially or technically) wired networks but which favour a radio-based solution.

- Lack of existing infrastructure, or infrastructure of sufficient quality for DSL services.
- Alternative non-telco (e.g. Google) wishing to attract telco traditional revenues

And this degree of limitation on market opportunity probably leaves WiMAX as a complementary option to DSL, a specialist adjunct in a large market that, with careful planning, can be used to provide a fast and effective solution for fixed access. And the size of the overall market is significant in assessing the extent to which fixed WiMAX will be used - there are now many examples of its deployments in the developing world, some of which are shown in the Figure 4 below.

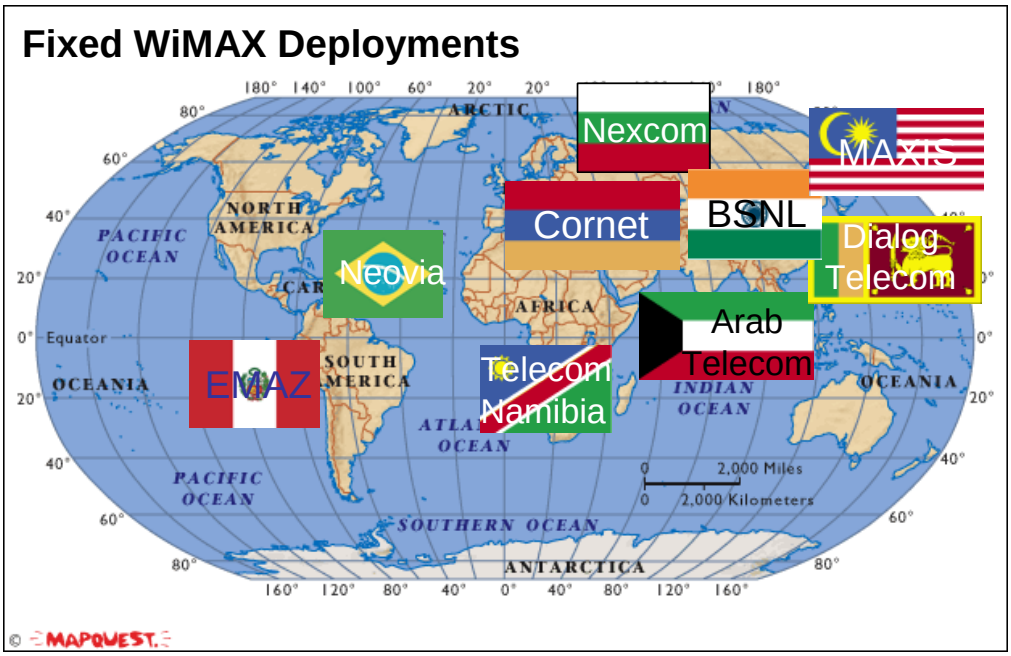

Figure 4: Sample Fixed WiMAX Deployments

Nomadic and Mobile Access - the Key Wireless Technologies

Where customers require mobile or nomadic use, wireless is obviously the only way to go. The decision then comes down to which of the available technologies best satisfies customer needs and there are a number of options, each with its own characteristics in terms of available bandwidth, support for mobility, cost and availability. The figure below illustrates a few of the leading possibilities.

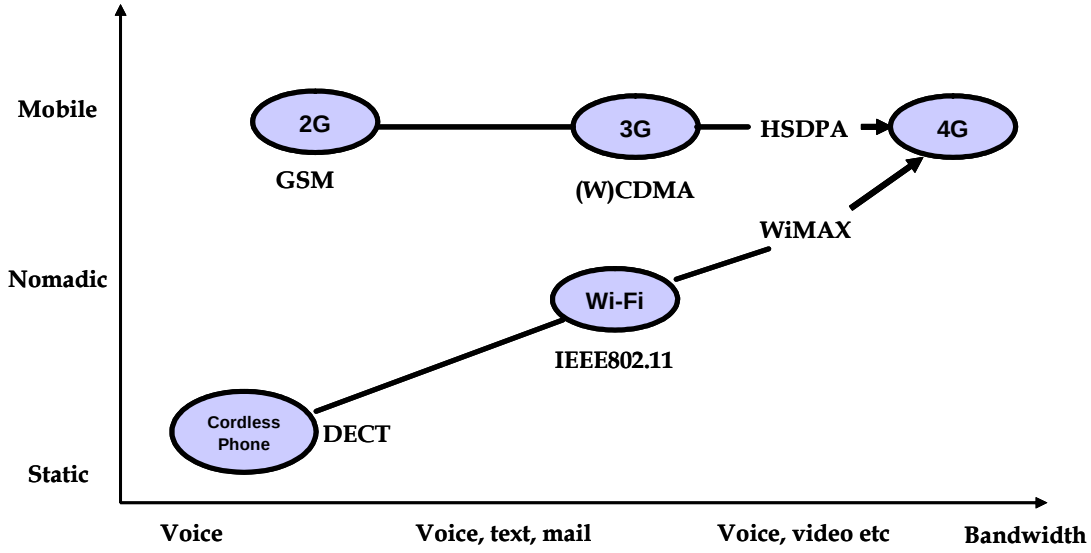

Figure 5: Technologies for Mobility

Additionally, customers value the unique benefits of both mobile and nomadic use and are therefore willing to make the trade-off between the positives and negatives of mobile and nomadic technology.

The mobile standard for WiMAX has been in place since the end of 2005, but a full range of terminal equipment and installed networks are only now starting to appear – Mobile WiMAX networks are currently being installed in locations as diverse as Brazil, Pakistan and the US.

To provide a combined nomadic and mobile capability, Intel, the key backers of WiMAX have demonstrated a chip that merges Wi-Fi and WiMAX, thereby providing both local and wide area connectivity. This combination could have significant positive influence for the future of WiMAX.

A key question on the future of WiMAX involves an assessment of how much of a threat the mobile standard for WiMAX presents to the established mobile operators. In order to address this question we must assess the following:

- What are the key practical differences between WiMAX and the latest mobile technologies?
- What consumer requirements does it address?

- Does it provide any significant benefit?

Some of the main positives and negatives of existing wireless solutions are indicated below for comparative purposes – by no means a rigorous analysis but enough to set the context for an examination of mobile WiMAX.

Technology – Wi-Fi 802.11

Positives	Negatives
• Mature technology • Large installed base • In-built to many new laptops • Many public network locations • Agreements for aggregation among operators • Use of unlicensed spectrum allows unrestricted growth and resultant scale economies • Often free of charge	• Very short range • Shared bandwidth • Often Unmanaged • Unlicensed spectrum may result in interference – although experience suggests that this is not a practical problem • Perception that it should be free creates resistance to the use of public Wi-Fi services like hot spots

Technology – 3G (evolving to 4G)

Positives	Negatives
• Existing infrastructure • Near ubiquitous coverage • Link to 2G for out of area coverage. • Existing roaming agreements, • quality of service and billing control • Licensed spectrum – country specific • Upgrade path to HSDPA – 1.8Mbps and maybe 14.4Mbps – already being exploited • Strong customer relationship drives up selling opportunities and use of value added services	• Relatively low bandwidth • Mobile operators are likely to attempt to prevent the erosion of revenues by restricting the access to content and maintaining control of the payment mechanisms. (But an open question over whether they will restrict the customer too much?) • High prices, particularly for data (but falling). • Weak content (but improving).

Where WiMAX and the established mobile operators come together is in the mobile and nomadic data segment, where, significantly, voice (particularly packetised voice) can be considered as simply another form of data. The low latency of WiMAX makes it well suited to the carriage of packet voice.

Despite its prominence, the rather limited range of Wi-Fi (tens of metres) does not make it an effective competitor to true mobile operations. It may be a ubiquitous access option

(as is the case in Singapore, for instance) but, in practice, its use is largely limited to cordless access to a fixed router or phone.

To qualify the role of WiMAX, we now need to investigate the relative benefits of the different technologies against the following questions:

- Relative advantages of WiMAX over 3G.
- Existing coverage of 3G.
- Costs of CPE for WiMAX.
- Ubiquity for WiMAX.
- Time to market for equipment
- How restrictive will the 3G operators be with content?
- How well will mobile specific services and applications be developed?
- Could WiMAX become the open infrastructure that 3G is not?

There are a number of obvious differences between 3G and WiMAX. 3G networks are extensively deployed (and have handover to 2G when outside this network), have fully embedded network management, including control of service quality and come with roaming agreements allowing international travel.

WiMAX on the other hand is only just beginning. It has none of the large scale engineering features that come as standard with the major mobile networks. However, it does have the potential to offer significantly greater speeds, both for uplink (UL) and downlink (DL), as illustrated in Figure 6 below.

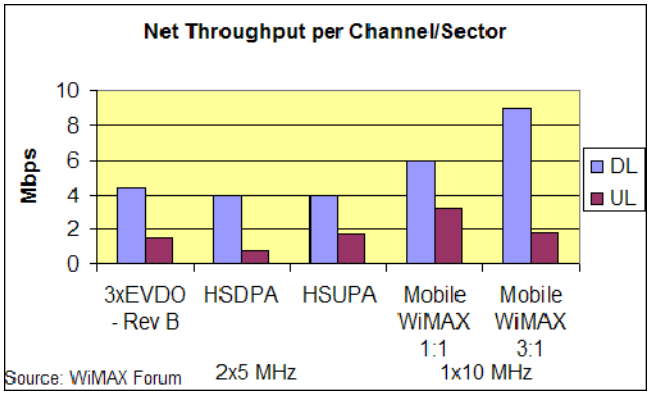

Figure 6: Technology Throughput

In addition, WiMAX has, in theory, the advantage of being subscriber independent1, based on an access package that allows it to be more cheaply deployed and operated. This would provide advantages to the WiMAX operators as voice is continually

[1] 3G and 2G mobile networks are based on subscription models (both pre paid and post paid) where network access is controlled through a SIM card.

commoditised – few high value, mobile specific content and applications are being developed.

However, as the market evolves, it is likely that Mobile WiMAX deployments (e.g. Sprint in the US) will require customer ownership in the same manner as cellular. The drive for this will be that commercial deployments will use licensed spectrum to allow the higher transmit powers needed to achieve the required cell range (unlicensed spectrum use is power limited and therefore coverage is limited to a hundred metres or so). Therefore there will be the spectrum costs to recover, making customer ownership as much an issue for WiMAX as it is for Cellular.

Where WiMAX does hold promise in deployment terms is in the number of base stations that are required to provide a particular level of coverage.

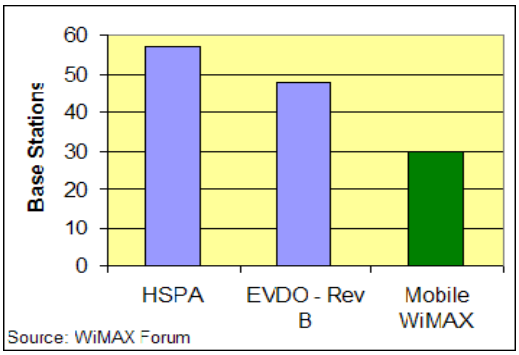

Figure 7: Base Station No. Comparison

Figure 7 shows for two varieties of 3G and WiMAX how many base stations would need to be installed to cover an area of 129 km2 with an available data density of 215 kbyte per second per square kilometre. In this respect, WiMAX has a clear advantage over the other leading mobile technologies.

One of the most marked differences between WiMAX and 3G is that the latter operates within a well defined frequency range whereas the former can use a wide range of the spectrum; the WiMAX standards do not specify particular frequencies to be used. This means that implementations are likely to vary from one country to another and even from one network to another. This may limit the possibility of scale economies, although, in practice, only a few bands (such as 3.5GHz and 2.5GHz) are likely to be widely used and chipsets will be multi-band. The lack of standardisation may, however, limit roaming. The WiMAX community may adopt specific frequency bands as a de facto standard, to give some degree of uniformity, but due to the legacy situation of spectrum usage in different parts of the world this has yet to happen.

Alternatively, WiMAX may continue to be used to link Wi-Fi base stations as happens now. This architecture has very significant advantages over a pure WiMAX architecture and a pure Wi-Fi architecture. It allows areas to be flooded with Wi-Fi easily using the WiMAX ability to develop and maintain a meshed network. It gives access to the large and increasing installed base of Wi-Fi enabled PCs and PDAs. It will support Wi-Fi phones as they are developed. There will be no confusion in the market about frequency bands and roaming will be technically possible even on an international scale.

However, historical evidence would suggest that even if a new technology is equivalent or even superior to an established product or technology, inertia plays a significant role in maintaining the dominance of the existing technology. Conversely, it can also be argued that even an inferior product can be effectively sold into a market where it has strong and focussed sponsors.

We see the development of content and applications as a critical driver of mobile communications. From the perspective of Mobile operators this should help support subscription based packages; from the perspective of WiMAX network operators, this should help support the development of WiMAX enabled PDA's and other mobile communications devices in addition to the more traditional PC data and internet access services.

Mobile operators have tended to restrict access to external content in an attempt to maximise the share of revenue they receive associated with services available through their networks. This may cause customers to become dissatisfied by the level of control being demonstrated. They may prefer a non-restrictive data access, similar to current fixed internet access, for their mobile / nomadic purposes. This may encourage customers to switch to a more uncontrolled network environment with individually selected services and content. This would make new technologies, such as WiMAX, attractive to customers and could harm the long-term prospects of 3G mobile operators. Nevertheless, unless the issues associated with ubiquitous coverage in common frequency bands and scale economies in terminal devices are overcome, it seems that WiMAX will struggle to compete directly with 3G in the mobile environment.

We believe, however, that the development of content for mobile operators will improve significantly over the next 5 years. This is due to three factors:

- In the 3G market, if one operator opens up their network they should gain market share advantage, forcing the other operators to follow suit. However, their margins may not be as good because they stand to lose a greater proportion of high value services, so there is a trade off in the business model. An operator that has already explored this path is Hutchison, operators of the 3 network, who have already considered offering a wireless broadband pipe for a monthly subscription, similar to a DSL strategy. 3G operators with a legacy 2G network are probably more concerned with ensuring an ongoing return from their 2G investment so they are motivated to maintain their walled gardens and bar the use of VoIP to try and stem the migration to pure data use over the 3G network alone.
- The decision (in Spain) to mandate Mobile Virtual Network Operators2 (MVNO). These operators are more likely to create an open service than an existing player since they have no revenue base to protect. They want market share. If MVNO's are mandated or more easily created, it is likely that any control restrictions imposed by 3G operators will be removed quickly. MVNO's are likely to want to drive content sales because they will not get returns on capital employed in the network. Their business is marginal – they will compete on call tariffs and will therefore have to have other revenue streams – so they will deploy content.

[2] European Commission endorsed the Spanish national telecom regulator 'Comisión del Mercado de las telecomunicaciones' (CMT)'s plan that operators must offer reasonable prices and conditions to any company that intends to launch an MVNO business in Spain.

- Development and growth in installed base of 3G devices with form factors suitable for displaying data.

What the 3G companies do with control, access to external content and to pricing will be the key.

Is the current environment the best way to promote the development of applications for mobile and nomadic use? A similar argument, although further developed, is evident with fixed internet access.

For a truly mobile environment, widespread coverage and handover between cells are both necessary. While nomadic services may not require handover functionality, for the mobile environment this is absolutely essential. Until this facility is fully available for WiMAX, it will only realistically compete as a nomadic service. This may happen sooner rather than later as a standard for handover is well advanced but 'bolt-on' solutions, such as Mobile IP, are unlikely to provide the functionality demanded by consumers, so don't provide a temporary fix.

In reality, even in the 3G environment, an increase in the user's physical speed causes a reduction in bandwidth. How much of an impact this lack of handover really will have on the use of broadband services is debateable. However, it is often the users' perceived requirement for such functionality rather than an actual need which dictates customer choice.

Discussion

Fixed WIMAX that conforms to the 806.16-2004 standard should be considered against the traditional fixed / fixed-wireless argument. We believe that the deployment of fixed wireless devices is suitable as a complement to existing fixed infrastructures. There are well understood advantages of deploying a fixed wireless solution including:

- Speed to market
- Initial large coverage area
- Mitigates certain geographic features which would preclude a fixed solution.

Conversely the system has disadvantages, including:

- Costs and current lack of CPE
- Availability of spectrum
- Lower capacity in the access network that may limit penetration in densely populated areas.

Use of WiMAX as a fixed wireless solution will therefore only make sense for niche projects where the advantages of wireless outweigh the advantages of wireline. Examples of such situations include:

- Limited and/or low quality fixed infrastructure (and probability that a high quality fixed infrastructure will not be cost effectively deployed). Wireless will normally have a cost disadvantage against wired and will therefore be difficult to deploy commercially where a fixed infrastructure exists.
- Geographic features mean that fixed infrastructure is expensive or impossible to deploy.
- Emerging markets where the speed to market allows large initial coverage with the ability to back-fill with fixed infrastructure where appropriate.
- As a supplement to a fixed infrastructure player allowing improved coverage.
- Use as backhaul after cost / benefit assessment vs. alternative technologies. Backhaul options and alternatives have not been explicitly considered in this report, which focuses on the link to the consumer, but our analysis indicates that WiMAX is well suited to this type of use.

Nomadic / Mobile WiMAX on the 802.16e standard should be considered as a complement or supplement to 3G, but there are difficulties as a unique network solution in its own right.

Mobile operators, after initial resistance, have adopted Wi-Fi solutions through installation in key locations, aggregation of Wi-Fi operators and combined mobile / Wi-Fi billing solutions. The same may happen with WiMAX, which solves the problem of Wi-Fi not scaling well when too many hops are needed to make a connection (a set up akin to

local and trunk carriage in a telephony network) This would offer customers the ability of greater download speeds as the circumstance demands and would be focussed on major urban locations.

However, the inescapable fact is that WiMAX faces a significant uphill struggle to be a viable replacement for 3G due to the time advantage the existing 3G operators have, and the current infrastructure, processes, locations and equipment costs. However, we believe that there may be significant demand for WiMAX to improve download speeds for certain applications.

The greatest concern over the existing 3G operators will be the speed at which they develop mobile content which is truly mobile unique and not simply re-porting of fixed / internet content. This is where the true advantages lie. If the 3G operators move slowly, or overly retard development because they want to maintain control over their customers, this may open a window for alternative WiMAX network operators to gain a foothold.

It is very important to note that due to the many variables involved in telecoms, each individual situation requires specific attention. However, in our opinion, it is difficult to foresee WiMAX mounting an overwhelming challenge to the 3G operators as an independent service provider using one access technology. We foresee the future as being a deployment of different access technologies which are selected on the basis of a number of factors including usage profiles, device, content and location. The winners will be the network operators who deploy the most appropriate solution for the relevant, customer and time-specific, situation.

Of course, the strategy of different operators with respect to WiMAX will vary depending on their background and aspirations. An established fixed network operator may see mobile WiMAX as good way of entering the mobile data market. With established operators in this market focussed on maximising their established revenues (e.g. from text messaging), the high bandwidth and rapid deployment of WiMAX is attractive. The table below summarises some of the likely operator strategies and motivations.

Established Operator	Market Entrant
• Provision of Nomadic Services, particularly once WiMAX embedded in PCs • An option for backhaul for WiFi hotspots (giving immediate access to nomadic PC services) • Diversification of investment in technology (e.g. minimising risk in 3G rollout)	• Provision of Fixed services: o Broadband access comparable to DSL (particularly in developing markets) o Voice services (through high quality VoIP) • Provision of mobile service , effectively leapfrogging established mobile operators to deliver 4G service • Rapid deployment as an alternative service provider in newly liberalised markets

This is a no more than partial view but the general ideas do transfer well into practical situations and have been used as the basis of both business cases and licence applications.

On a more general note, the development of IP based networks allows the collapse of different network types into one, allowing service delivery on different technologies. While handoff between different technologies for the mobile environment is still in its infancy, we expect to see this becoming much more prevalent in the coming years3. The ultimate result will be the full interoperability between access technologies depending on specific user requirements. The focus will then be on satisfying current and future consumer demand through a combination of the right technology in the right place at the right time.

WiMAX has undoubted attributes and should continue to demonstrate significant growth. It is unlikely to become the dominant mobile technology in the short to mid term but it has a clear niche and can, if used correctly, provide the basis for sustainable and profitable networks.

[3] NTT DoCoMo are reported to be currently testing Mobile WiMAX and HSDPA handoffs.

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Mark Norris & Chris Angell “The disappearance of telecommunications” Intercai Mondiale White Paper, www.intercai.co.uk

The material contained in this White Paper is based on Intercai’s wide experience of wireless and mobile networks. Training courses tailored to your specific requirements can be provided on request.