Telstra

Inquiry into Wireless Broadband Technologies

Submission to the House of Representatives Standing Committee on Communications, Information Technology and the Arts

Telstra Corporation Limited

July 2002

Telstra

1 Executive summary

Telstra Corporation Limited ("**Telstra**") welcomes the opportunity to make this submission to the House of Representatives' Standing Committee on Communications, Information Technology and the Arts ("**Committee**") Inquiry into Wireless Broadband Technologies ("**Inquiry**").

Until recently, demand for broadband in Australia has generally been slow – a lack of compelling content and general consumer satisfaction with low-priced dial-up services are two key reasons for this. However recent promotion by Telstra and the introduction of initiatives such as an entry level plan and service level guarantees, have led to a significant increase in demand in 2002.

Telstra predicts that, in line with overseas trends, the increase in broadband take-up will continue and that this trend will be reinforced by the introduction of attractive new wireless based applications in the near future.

As overall demand for broadband increases, Telstra believes wireless services have enormous potential in the following areas:

- as an alternative technology upon which new, targeted services and applications can be developed for particular market segments (such as for fixed wireless 'hot spot' applications)

- as a way of providing broadband services to consumers and businesses where fixed lines are not available, including through the use of satellite based services in regional and rural Australia; and

- as a means of providing effective competition for existing local access networks in urbanised areas.

In Australia, there is already a large and diverse range of providers offering innovative wireless broadband solutions. These providers vary from international satellite operators backed by large multi-national corporations such as Microsoft to small regional players backed by local councils and community organisations. There are numerous services on offer and a number of business models employed.

Yet, any emerging business will face obstacles and risks, with large capital outlays and competitive pricing making short payback periods difficult to achieve. It is still too early to assess which companies, business models and solutions will prove to be the most successful.

The problems faced by these early wireless broadband investors are not unique to Australia. For example, early wireless broadband investors overseas have faced difficulties establishing sustainable business models. In the United States of America - where wireless broadband investment has possibly been strongest - high start up costs, strict regulatory controls on the market structure and sluggish demand and slow take up of new services have seen some operators face bankruptcy.

Similarly, technology-related shortcomings of wireless broadband are also well documented overseas, including the following:

- the presence of a wide range of competing, unproven technologies;
- the fact that most current wireless (not satellite) systems have only a very limited coverage range (in the case of fixed wireless, or WIFI, this is up to only about 150 metres in normal urban applications); and
- the fact wireless broadband technology is often susceptible to interference from other electrical goods and household appliances, which further restricts their use, especially for more rigorous data applications.

These issues and the growth of the industry overall are further exacerbated by a lack of international standards for wireless broadband, particularly in relation to spectrum. Overall, given the number of uncertainties surrounding these technologies and future market conditions, the industry is only in its early stages of evolution and can be considered to be in a state of flux.

It is therefore prudent for Australian decision-makers to move cautiously when considering policy directions for wireless broadband services.

Telstra understands the commercial and operational difficulties in delivering new technology products and the special challenges in serving regional and remote communities. Its innovation in providing two-way satellite Internet services to remote Extended Zone customers in response to the Government's Untimed Local Call tender demonstrates how Government tenders can act as a catalyst to telecommunications companies in the development of new technologies – ahead of time, without the need for regulatory interference. The two-way satellite is now available throughout Australia as a commercial offering.

Telstra believes that there are significant remaining opportunities for governments, industry and community groups to work together to develop pilot programs to help in the understanding of demand drivers and to stimulate the development of new, targeted applications.

Telstra also strongly supports a more open and flexible approach to regulation of these new market segments, including appropriate management of the radio spectrum, to encourage innovation and investment and the development of sustainable, market-driven solutions and business models.

Indeed, if the necessary conditions are present for a vibrant broadband wireless sector to develop, including free and open competition backed by regulatory certainty and a framework to encourage efficient investment, then Telstra believes that Australia can play an increasingly important role in developing new business and consumer related applications and services, which in turn will support the sustainability of these technologies into the future.

The remainder of this submission is set out as follows:

- section 2 offers a definition of ‘wireless broadband’;
- section 3 looks at the prospects for wireless broadband, identifying the key benefits of take-up and the current and potential players in the sector;
- section 4 identifies current and emerging technologies and considers their associated investment risks;
- section 5 assesses the impact that access regulation would have in terms of wireless broadband and the associated incentives to invest in that technology or related services; and
- section 6 briefly summarises the submission.

2 What is wireless broadband?

At present, a universally accepted, clear and concise definition of ‘wireless broadband’ does not exist.

The Organisation for Economic Co-operation and Development (“**OECD**”) defines ‘broadband’ merely as “shorthand for high speed Internet access”,[1] while the Australian Competition and Consumer Commission (“**ACCC**”) and the Federal Communications Commission (“**FCC**”) define it in terms of information transmission speed. The ACCC considers that broadband is defined as “any high speed connection greater than 200kbits/sec over a mix of media”; and notes that this definition excludes PSTN and ISDN dial up connections operating at 56, 64 or 128kbits/sec.[2] The FCC also uses a speed of 200 kilobits

---

1 Paltridge, S, OECD, ”The Development of Broadband Access in OECD Countries”, 29 October 2001, page 6.

2 ACCC Snapshot of Broadband Deployment as at 31st March 2002.

per second ("**kbps"**) as the broadband threshold because, in its view, this speed is enough to provide the most popular forms of broadband service – namely, changing web pages as fast as one can flip through the pages of a book and transmitting full-motion video.[3]

Like the OECD, Telstra considers that a qualitative definition of 'broadband' is more appropriate and lasting than one framed by reference to a precise speed. As such, a technology can be considered to be broadband if:

- it supports each of the major corporate and consumer multimedia applications (including e-mail, banking, web browsing, digital photo transmission, audio and video streaming);
- users perceive it to be fast or at least perceive no significant delays in delivery; and
- it allows a user to remain connected ('always on') and be charged according to the volume of data transmitted, rather than according to the time connected.

Wireless broadband technologies are those that use terrestrial radio signals between user devices and the service provider. This definition generally excludes point–to-point microwave systems that are used to carry trunk traffic and connect different standalone sites. Wireless broadband technologies are utilised in the "last mile" access in a point-to-multipoint or multipoint-to-multipoint communications system.[4]

3 Wireless broadband: opportunities

This section identifies the key benefits of wireless broadband take-up and looks at some of the services and business models of the current and emerging wireless broadband service providers.

3.1 Key benefits of wireless broadband take-up

The successful development of wireless broadband services can provide an important and diverse range of benefits for Australians. Wireless broadband is both a cost effective way of providing broadband services to regional and rural Australia and a means of providing

---

3 Quoted by OECD (2001) *ibid* page 6.

4 Given the criteria applied in this section, current cellular mobile technologies, such as GSM/GPRS, do not qualify as "broadband". However, this submission includes discussion of these technologies, where appropriate, for the sake of completeness.

effective competition for existing access networks in more urbanised areas. Wireless technologies reduce the time it takes to provision services compared to fixed-line networks. Instead of installing time consuming and higher cost cable infrastructure, many operators are counting on wireless broadband technology to gain time-to-market and to derive lower cost advantages, which can be crucial to the success of a product in a dynamic environment.[5]

The additional functionality, most importantly in improved data capacity, that mobile broadband technology (described further in section 4.1 below) offers can create significant productivity benefits for business. For example, improved wireless connectivity could increase the effectiveness of mobile mortgage lenders, allowing them to access all the on-line services they would utilise in a branch environment while in the field visiting clients. It also enhances opportunities for remote workers, as it will allow them more flexible working patterns.

The potential for economic benefit and enhanced service delivery is likely to be greatest in the areas of health, education, small-to-medium enterprises and community networking. For example, broadband applications in the health field can enable people in regional or remote areas to receive more timely access to specialist services. Distance and online education is both a significant export market and an exciting means to provide enhanced education opportunities for Australia's geographically dispersed population. Broadband connections to schools and universities can increase the efficiency of online research and enable videoconferencing to improve learning opportunities.

Telstra considers that mass take-up of wireless broadband will be application-driven. In other words, before users will embrace wireless broadband technology, there must be compelling applications that are delivered to affordable user devices. As such, Telstra is actively engaged in explorative trials and discussions with innovative service developers to identify compelling broadband service content and applications.

3.2 Wireless broadband services

There is a large and diverse collection of service and infrastructure providers active in the Australian wireless broadband sector today. These service providers vary from international satellite operators backed by Microsoft to small regional players backed by local councils. They offer a range of services and employ a variety of business models including: displacing existing infrastructure providers; meeting the needs of rural communities; and offering

5 Wireless technology will not be appropriate in all situations as there are limitations in distances served and service efficacy can be impacted by geography.

enhanced mobile functionality for teleworkers. A number of players have secured spectrum to enable them to roll out wireless broadband services. As Table 1 shows, not all wireless broadband services require licensed spectrum:

Table 1: Wireless broadband spectrum secured *(note previous discussion)*

Wireless Application	Band	Current Licensees
*Cellular 2G GPRS	825~845/870~890 MHz	Telstra, AAPT, Hutchison
	890~915/925~950 MHz	Telstra, Optus, Vodafone
	1710~1785/1800 MHz	Telstra, Optus, Vodafone, Hutchison, One.Tel
Cellular 3G	1900~1980/2100 MHz	Telstra, Optus, Vodafone, Hutchison, CKW, 3G Investments
*CDMA WLL	825~845/870~890 MHz	Telstra, AAPT, Hutchison
FRA/BWA	3425~3575 MHz	AKAL/Unwired, Telstra
DECT	1890~1900 MHz	Class licensing requirements only (public access)
Bluetooth	2400 MHz	No licensing requirements
WLAN 802.11b	2400 MHz	No licensing requirements
WLAN 802.11a	5100 MHz	No licensing requirements
MMDS	2300 MHz	Austar & many small localised operators
LMDS	27 GHz	Agility (Optus subsidiary)
	28/31 GHz	AAPT
Satellite	L, C, Ku, Ka bands	Optus, AsiaSat, PanAmSat, Iridium, GlobalStar, IndoSat, ShinSat, and many others

*These are not strictly broadband technologies, but are included for the sake of completeness.

Telstra offers both one-way and two-way satellite access to the Internet. Its one-way service uses either a PSTN or ISDN return path (upload); however its two-way service downloads and uploads information via satellite. The service is targeted at customers in rural areas and offers download speeds of up to 512kbps and the option for varying upload speeds of up to 128kbps.

Telstra also offers a suite of innovative mobile services that will likely expand as data speeds improve. Telstra's Wireless IP Solution provides access to LAN-based data and applications within Telstra's mobile GSM (albeit at comparatively low speed) coverage area using GSM

Packet Radio Service (“**GPRS**”) technology. It is targeted at mobile workers such as sales, technical and repair staff and transport and courier operators.

Telstra also utilises GPRS technology to deliver a host of Wireless Application Protocol (“**WAP**”) services. WAP is a technology that allows specially-written Internet pages to be viewed on the screen of WAP-enabled mobile phones. Telstra also runs an Application Partner Program that is designed to help companies commercialise WAP and SMS content. The program allows companies to learn from Telstra’s WAP experience and Telstra provides advice on business models and channels to market. Also of interest is the introduction of the Blackberry wireless solution as a business tool for corporate customers, using Telstra’s GPRS technology.

Further, Telstra is undertaking research into innovative broadband solutions and content. It operates a business-to-business online community for wireless data development. Telstra’s “Wireless Data Development Zone” provides a forum for members of the wireless data community to become more broadly known and to swap ideas, so that solutions are developed to meet companies’ evolving needs. Telstra also runs a Broadband eLab, a jointly funded project with the Federal Government, based in Launceston, which is assessing the commercial viability of a number of emerging broadband products, including wireless broadband solutions. Telstra is also a member of the m.Net consortium in Adelaide which is developing the use of advanced wireless technologies and supporting services for application in Australia.

4 Wireless broadband technologies

Despite being driven by applications, mass broadband wireless take-up will not be achieved without appropriate infrastructure being in place. Once key applications have been developed, a variety of factors will influence their take-up. Of these factors, the two most important are likely to be reliability of delivery and affordability. Adequate reliability and affordability cannot be achieved without the efficient deployment and operation of technology. Telstra’s view is that efficient deployment is best achieved by competition between operators and technology platforms.

This section describes the different types of wireless broadband technologies and then looks at some of the risks associated with the substantial investments required to deploy such technologies.

4.1 Types of wireless broadband technologies

In addition to ***wireline*** broadband technologies such as fibre optic cable, HFC modems and Digital Subscriber Line (“**xDSL”**), there is an array of current and emerging ***wireless*** broadband technologies.

In general, broadband wireless technologies can be categorised according to the communications environment they support. That is, broadband wireless technologies can be categorised into three types of services:

- **fixed** technology which supports services only in one place;
- **portable** technology which supports services anywhere within the service area but cannot be used if the receiving device is moving faster than pedestrian pace; and
- **mobile** technology which can be used anywhere in the service area and can be used while travelling at speed.

Table 2 sets out a selection of current and emerging wireless broadband technologies that support the three main types of services described above. The emerging technologies in most cases offer significant improvement in speeds, allowing the effective delivery of a broader range of services. The annexure to this submission contains further information on these and additional technologies.

Table 2: Wireless broadband technologies

Service type	Available technologies	Max Range	Maximum downstream data speed	Emerging technologies	Max Range	Maximum downstream data speed
Mobile	GSM Packet Radio Service (“GPRS”)	30 to 35km	40-80 kbps	3G (wideband CDMA)	~10km	384 kbps to 2 Mbps
	1xRTT	9 to 30km	~153.6kbps	3G (1xDO)	9 to 30 km	~2.4Mbps
Portable	Wireless Local Area Network	50 to 100m	~5 Mbps	802.11a	30 to 50m	50 Mbps to 72 Mbps
	Bluetooth	20 to 50m	~700 kbps	HiperLAN 802.15	30 to 50m	~20 Mbps
Fixed	Multichannel Multipoint Distribution System	~ 10km	~10 Mbps	802.16b	5 to 10km	~10 Mbps

	("MMDS"), Broadband Wireless Local Loop					
	Local Multipoint Distribution System ("LMDS")	3 to 5km	2Mbps to 27 Mbps	802.16	3 to 5km	Up to 155 Mbps
	Fixed Satellite	Nation -wide	Up to 8Mbps			

Although there is a wide array of broadband technologies that are or will be available within a two-to-four year time frame, there is significant uncertainty about which will be the most successful, given both:

- the uncertainty surrounding the performance of newer technologies in mass deployment conditions; and
- the fact that the precise services that will be offered over those newer technologies are unknown.

For example, some technologies are more appropriate for dealing with large data downloads but smaller uploads. This may be ideal where information flows are asymmetric (such as web browsing), but other technologies would be more appropriate where information flows are symmetric (such as software development and exchange). It is most likely that a variety of wireless broadband technologies will be required to adequately deliver a variety of services in a range of geographies.

Mobile data broadband services are currently delivered through GPRS and through satellite. There is a number of emerging mobile technologies that will offer an improvement in data rates, including third generation ("**3G**") technology.

Portable data technologies are generally based on the wireless LAN standard. This standard operates in what is known as the industrial, scientific and medical ("**ISM**") band. This band is unlicensed, allowing anyone to use it for any purpose (subject to adhering to the radiation limits of the band as defined by the Australian Communications Authority ("**ACA**")). There has also been much media interest in Bluetooth, a short-range wireless connection standard. Its aim is to link computers, electronics and telecommunications devices using a low-power, two-way radio link which is built into a microchip.

The development of fixed wireless systems for delivery of high-speed data is proceeding at a fast pace and all these systems use packet data transmission. The technologies utilised include multichannel multipoint distribution system ("**MMDS**") and local multichannel distribution system (“**LMDS”**). LMDS enables point-to-multipoint connectivity and is currently used, most notably by AAPT, to increase network coverage by providing a wireless broadband connection between the carrier’s network and its customers - essentially offering service providers and internet service providers last mile connectivity between their fixed networks and customer sites.

4.2 Risks of wireless broadband investment

Given the number and variety of companies active in the sector, the availability of useable spectrum and the range of companies undertaking research into new applications, all conditions are present for a vibrant broadband wireless sector to develop.

The companies active in the sector employ an array of business models. These include providing:

- fast access to the internet in rural areas (for example Ruralnet);
- alternative fixed broadband connectivity in CBD and metropolitan areas (for example AAPT, AirNet);
- localised portable connectivity (Megalink); and
- new mobile broadband functionality (for example Telstra and Optus).

However, the risks and uncertainties, especially for investment in a particular technology, are substantial, including the following:

- the technologies being utilised are new and unproven under mass rollout conditions. Technological constraints (for example, the technology only being able to work in very confined geographic conditions) may subsequently make deployment uneconomic;
- although there is much promise, it is unclear what, if any applications, will drive mass take-up;
- significant research and development investment is being ploughed into wireless broadband technologies. As a result, new and innovative solutions are being developed all the time. There is a real possibility that if an investment is made in a particular wireless broadband technology, its functionality could be superseded in a short space of time; and
- regulatory risk, where constraints imposed by Government or regulators may undermine the economic deployment of technologies. This is the subject of the next section.

The significant risks inherent in deploying wireless broadband technologies are amply illustrated by experience in the United States of America. Currently, only 2 per cent of the

9.6 million high-speed subscriptions in the United States of America are delivered via wireless broadband or satellite.[6] In 2001, the wireless broadband sector contracted dramatically, with:

- the two biggest service providers in the United States of America - WorldCom and Sprint - both halting their MMDS rollout plans;
- the urban LMDS sector losing its three biggest service providers - Radio Telecom, Teligent and Winstar - either to bankruptcy or acquisition;
- equipment manufacturers going out of business including Adaptive Broadband and Spike broadband;
- AT&T choosing to exit the wireless sector, incurring approximately US$1.3bn in exit costs alone;[7]
- the failure in the United States of America, of Metricom and Mobilestar in providing Wireless LAN based services.

Indeed, investment in wireless broadband is inherently risky. As the next section shows, inappropriate regulation can undermine investment incentives and, given the already risky nature of investment in wireless broadband technologies, this may deter investment in these often unproven technologies.

---

6 http://ftp.fcc.gov/Bureaus/Common_Carrier/News_Releases/2002/nrcc0201.html

7 Athena Platis, "*Broadband Wireless Limitations and Opportunities*", April 2002: www.ntca.org/bus_tech/epapers/.

5 Effect of regulatory regime on wireless broadband investment

As has already been demonstrated, there is considerable commercial risk associated with any investment in wireless broadband technology. Associated with this risk, there is uncertainty about the regulatory environment. These risks have been thoroughly documented by the Productivity Commission in the course of its recently-concluded inquiry into the operation of the telecommunications-specific competition law provisions of the *Trade Practices Act* 1974 (Cth) ("**Act**"). Principally, the Productivity Commission was concerned about, and made recommendations to correct:

- the extent of regulatory over-reach by the Australian Competition and Consumer Commission ("**ACCC**") and the impact of regulation on stifling investment in telecommunications technologies;
- the absence of mechanisms to protect new investment from regulation; and
- the potential for the deployment of new and innovative technologies to be stalled or delayed because of uncertainty about the application of the regulatory regime to costly investment.

Based on these findings, the Productivity Commission recommended, *inter alia*, that a safe-harbour mechanism be introduced into the Act in order to protect investment from unwarranted or overly-intrusive regulation. Telstra supports the Productivity Commission's recommendations.

Separately, in an inquiry also conducted by the Productivity Commission, the Productivity Commission identified problematic aspects of the system relating to the granting of, and tenure of, spectrum licences. As a result, in its Draft Report, the Productivity Commission recommended the abolition of the spectrum bidding limits and the introduction of measures to enhance spectrum owners' certainty in relation to the tenure of spectrum licenses. Telstra echoes these concerns and, with some qualifications, supports the Productivity Commission's Draft Recommendations. Telstra also asks the Committee to note that the Productivity Commission's Final Report is due to be completed in July of this year.

5.1 Risks under the present regulatory regime

As has been shown, there are considerable risks and uncertainties associated with the development and deployment of wireless broadband technologies. Making investment decisions in an environment characterised by dynamic change, uncertainty and substantial stakes is inherently risky. Substantial (potentially sunk) costs are involved, with uncertain returns and uncertain success.

Side-by-side with that investment environment sits the regulated access regime found in Part XIC of the Act. Briefly, that Part allows the ACCC to “declare” a service to be the subject of regulated access if declaration would promote the long-term interests of end-users. Once a service is declared, providers of that service become subject to certain ‘standard access obligations’ in respect of that service, with the terms and conditions for access being, in the first instance, the subject of commercial agreement between the access provider and the access seeker(s). If the parties cannot agree on the terms and conditions for access, there is a process in the regime for the ACCC to arbitrate those terms and conditions.

One of the key issues that has arisen in relation to the operation of the access regime found in Part XIC of the Act is the uncertainty the regime creates for investors in infrastructure as to:

- whether services provided over the infrastructure in which they seek to invest will be made the subject of the mandated access regime (that is, whether the services will be ‘declared’ by the ACCC); and

- if services provided over the infrastructure in which they seek to invest are ‘declared’, what the terms and conditions for access to those services will be.

As to the former, when the relevant legislation was originally passed, it was clearly the Parliament’s intention that regulated access would not be imposed where existing market conditions already provide for the competitive supply of services.[8] In practice, however, the vague standards for declaration of a service have meant that a number of services have been declared under conditions that did not meet Parliament’s original intention (that is, existing market conditions already provided for the competitive supply of the services).

Furthermore, the experience to date has been that, where access disputes have arisen, there has been considerable uncertainty as to the terms and conditions – specifically, the price – the ACCC would determine for access. In large part, this has arisen because of the lack of any legislated guidance as to the pricing principles to be applied by the ACCC in determining access prices. Even where the ACCC has produced guidelines as to the pricing principles it will apply, those guidelines are so vague and indeterminate – and accord the

---

8 Explanatory Memorandum to the Trade Practices Amendment (Telecommunications) Bill 1996 (Cth) re proposed section 152AB, Commonwealth Government Printer, Canberra, 1996, page 41.

ACCC such substantial discretion[9] – that they are of very little value in determining, in advance, the price that might be set for access by the regulator.

In addition to the uncertainty that has been evident in the experience to date of the ACCC's administration of Part XIC of the Act, the problems of risk and uncertainty that are inherent in regulatory environments are well-recognised as a matter of economic theory. Put simply, regulatory regimes – including regulated access regimes such as Part XIC of the Act – carry with them substantial risks of regulatory error.

The main reason for this is because regulators suffer from information asymmetry as compared with market participants (whose knowledge, of course, is also imperfect, though less so). Regulators do not share the same level of intelligence about market conditions, competitive influences, cost structures, market dynamics and so forth, as is harnessed by those competing on a day-to-day basis in a particular sector of a market. The extent and impact of this information asymmetry is exacerbated in circumstances that are highly dynamic (such as wireless broadband). Taking the setting of access prices as an example, a regulator – in order to set the correct and efficient access price (that is, the access price that sends the right signals to the market about whether to invest in building infrastructure or not) – would need to know, among other things:

- the efficient costs of service delivery, including efficient operating and maintenance costs;
- demand conditions both today and in the future; and
- the appropriate return to create incentives for the access provider to continue investing efficiently.

Add to this list the considerable *ex ante* uncertainty that surrounds key parameters determined by regulators - such as the cost of capital and asset lives – and it can readily be

---

9 For example, the ACCC generally employs a Total Service Long Run Incremental Cost ("**TSLRIC**") estimation methodology in setting access prices under Part XIC of the Act. TSLRIC derives costs based on optimised investment. That is, in deriving costs, the most efficient modern technology available is assumed to be employed in the most efficient manner possible. Thus, returns for the investor are set in relation to notional optimised assets rather than the actual asset employed. The result is that the application of TSLRIC demands significant regulatory discretion in the choice of the "notional optimised assets" to be used for the purposes of determining access prices. Rapid improvements in technology, such as those envisaged in the wireless broadband arena, can translate into a value below an asset's reproduction costs, resulting in stranded investments and imposing a capital loss on the asset owner.

seen that the informational requirements for error-free regulation are extremely high and can be even more demanding in a dynamic area such as new telecommunications technologies.

Do such regulatory errors – that, for example, a service is declared for access even though it is supplied under competitive market conditions or a price is set for access that is too low – really matter? Very much so. One reason why is that such errors create considerable scope for incentives for investment to be distorted away from efficient outcomes. In other words, such regulatory errors can result in investments being made in projects or technologies that would not otherwise be invested in (because a higher actual rate of return was available in some alternative investment) or in which investment would occur, but at a different point in time.

In the specific context of access prices that are set too low by a regulator, for example, new entrants into the market may be encouraged to "buy" access from another market player, rather than invest in new technologies that may be more efficient. Similarly, where access prices are set too high by a regulator, new entrants may be encouraged to build or duplicate infrastructure, even though the more efficient course of action would be to "buy" access. Thus, the setting of an inefficiently low access price, or indeed the potential of an inefficiently low access price being set, will deter efficient investment as the investor will not expect an appropriate return on investment and will therefore shift investment to an alternative, but less desirable (from society's point of view), end.

All these types of distortions create substantial inefficiencies and lead to losses in social welfare.

However, these distortions and other costs do not occur only where there is actual regulatory error. They can also occur where there is the prospect of regulatory error or merely uncertainty about likely regulatory outcomes.

It is for these reasons that policy-makers accept that, whilst regulation can improve upon market outcomes under certain conditions, regulation can also hinder investment, particularly in markets experiencing rapid change and technological development. As such, regulation is considered to be warranted only where there is demonstrable market failure.[10]

The problems, risks and costs associated with regulatory uncertainty and errors have recently been re-emphasised at considerable length by the Productivity Commission in its separate reviews of Parts IIIA, XIB and XIC of the Act. For example, the Productivity Commission has commented that:

---

10 An example of demonstrable market failure might be where enduring barriers to entry into the relevant market exist.

> "[r]egulatory interventions are not costless … Apart from their obvious compliance costs, they can also produce their own set of inefficiencies because they involve the use of imperfect instruments by regulators, devised under circumstances of asymmetric information and uncertainty. They impose rules on markets that can 'have chilling effects on entrepreneurship and innovation'."[11]

How, then, can these 'chilling effects' be avoided? One approach that has been widely supported is the introduction of a form of 'safeharbour' mechanism that allows investment to take place under a far more certain regulatory framework than exists at present. The next section briefly addresses the issue of providing safeharbour mechanisms.

5.2 Safeharbour mechanisms

The Productivity Commission – recognising the very problems and issues briefly discussed here – has examined at some length various mechanisms (access holidays, regulatory compacts and other *ex ante* options) by which the problem that regulatory regimes such as Part XIC of the Act can discourage efficient investment incentives might be overcome. In ultimately recommending that the Commonwealth Government should, through the Coalition of Australian Governments ("**COAG**"), initiate a process to refine mechanisms for dealing with the problem,[12] the Productivity Commission commented that:

> "… mandated access still presents formidable regulatory risks to investors. Telecommunications technology and markets are rapidly moving and very risky … If firms consider that regulators are fallible and may have difficulty separating rewards for risk from monopoly returns, then this has adverse consequences for investment. Access pricing that fully recognises regulatory uncertainty and the scope for regulatory error may be a remedy … - but this may be hard to implement and may lack ex ante credibility."[13]

It is for precisely these reasons that Telstra supports the concept of safeharbour mechanisms under the access regime in Part XIC of the Act. Telstra shares the Productivity Commission's

---

11 Productivity Commission, *Telecommunications Competition Regulation*, Inquiry Report, Report No 16, 21 September 2001, page 61.

12 Productivity Commission, *Telecommunications Competition Regulation*, Inquiry Report, Report No 16, 21 September 2001, page 295.

13 Productivity Commission, *Telecommunications Competition Regulation*, Inquiry Report, Report No 16, 21 September 2001, page 294-295.

view that there is a need for some form of safeharbour that would quarantine services provided by specified new infrastructure from declaration or arbitration under Part XIC of the Act, thus encouraging the correct "buy or build" decisions and efficient new investment.

Only by including such provisions will investors gain sufficient certainty to take innovative steps in technology investment secure in the knowledge that the resultant new infrastructure will not be declared for the purposes of the access regime.

These concerns are borne out by Telstra's experience of the operation of the access regime. By way of example, the recent declaration by the ACCC of CDMA mobile services (contrary to the Productivity Commission's recommendation) evidences the ACCC's propensity to declare services provided over new technology platforms when such services are necessarily bound to compete with, and are constrained by, existing and already declared services provided over alternative technology platforms. Such a propensity potentially serves to impede investment and the development of new and better services. New investments that may potentially come 'on line' in coming years, include investments in new technologies such as 3G mobile technology and substantial enhancements of existing facilities such as digitising the various pay TV platforms and upgrading existing 2G mobile networks to a 2.5G platform. However, investors may be unwilling to invest the hundreds of millions of dollars required to get such technologies off the ground until mechanisms for providing greater certainty *ex ante*, as to how these investments will be regulated, are put in place.

In order to provide greater certainty and protection from regulation, Telstra believes that that there is a very simple change that can and should be made now in order to deal with this issue. This can be done by involving the ACCC in assessing a pre-investment (or post-investment) undertaking but requiring it to adhere to reasonable time limits in relation to its deliberations. If the ACCC accepts the undertaking, then, consistent with the framework under Part IIIA of the TPA, the service the subject of the undertaking would be immune from any declaration for the duration of the undertaking. Telstra believes that this simple safe-harbour mechanism would do a great deal to ameliorate the present uncertainties investors face in relation to the deployment of new technologies, including wireless broadband.

5.3 Safeharbour for wireless broadband services

Even leaving aside regulatory uncertainty, in the case specifically before the Committee – wireless broadband technologies and services - there is considerable *market* uncertainty associated with investment decisions in this environment. In particular, there are no guarantees about the choices of technology being made (development and roll-out decisions about which must often precede any idea of the possible services that might be created utilising those technologies or, more importantly, any clarity regarding consumer preferences or demand levels). At the same time, the investment sums at stake are substantial.

As sections 2 and 3 of this submission have endeavoured to show, there is the potential for considerable market activity in the area of wireless broadband. Yet, not all investors will succeed. Some technologies will fail, while others will become the technology of choice for a substantial portion of the market (at least until another ‘hot’ technology becomes available). Consumer demand will continue to rapidly grow and change.

There cannot, of course, be any guarantees. Nonetheless, the current wireless broadband market falls considerably short of the demonstrable market failure that, according to economic theory, would justify the imposition of regulation. Wireless broadband is, in short, the very type of market – an inherently risky investment - that the Productivity Commission has recognised could be deterred or dampened by the risks of access regulation and inappropriate access prices being imposed.

Telstra urges the Committee to heed the warnings of the Productivity Commission. If wireless broadband is to be allowed to develop according to the precepts of consumer demand, then it must not be hampered by unnecessary regulation. Wireless broadband technologies and services will only continue to flourish if the incentives to invest in them remain positive. Such incentives are critically dependent upon investors not being exposed to the risks of regulatory uncertainty and error.

Put differently, if there is a risk that wireless broadband infrastructure will be subject to the distortionary effects of access regulation, then wireless broadband solutions may either not be made available or may be made available only on a very limited basis, thus disenfranchising large segments of the Australian community and retarding economic and social development . This outcome would represent a substantial loss for Australia.

In order to avoid these outcomes, Telstra believes that the proposals for legislative change outlined in section 5.2 should be implemented as a matter of urgency. A failure to do so will likely retard the future development of wireless broadband technologies and services.

Accordingly, Telstra would strongly encourage the Committee to endorse the recommendation made by the Productivity Commission that the Commonwealth Government initiate a process to refine mechanisms for ensuring that incentives for undertaking risky and uncertain investments – such as wireless broadband technology and services – are not further undermined by the current regulatory regime found in Part XIC of the Act.

5.4 Spectrum regulation

In a separate inquiry, the Productivity Commission is about to conclude a year-long investigation into the operation of the *Radiocommunications Act* 1992 (Cth) (“**Radcom Act”**) and related legislation. In its draft report, while the Productivity Commission generally considered that the legislation was being administered smoothly, it expressed a number of concerns with respect to the granting and re-issue of spectrum licences. The concerns raised by the Productivity Commission included:

- whether the spectrum bidding limits or prohibitions could be justified;
- whether there should be a mid-term or later review of licences;
- whether licences should be re-allocated by auction at a specified time before the licence expires; and
- the conditions on which spectrum licences would be re-issued to the incumbent licencees.

While Telstra has some reservations about some of the Productivity Commission's draft recommendations, the concerns raised by the Productivity Commission do serve to illustrate the inefficiencies surrounding the limits on spectrum bidding and the lack of commercial certainty currently surrounding re-issue or re-allocation of spectrum licences. The predominant issue is the need to provide far more effective investment certainty for licensees and their financial supporters. Essentially, this requires reform in the following areas:

- reform of the mechanism by which spectrum licence acquisitions are blocked or limited;
- the time at which a decision is made about re-issue or re-allocation of outstanding licences; and
- the process by which such re-issue or re-allocation is to be effected.

Telstra notes, moreover, that its investment in wireless broadband technologies may have been more extensive but for prohibitions on certain spectrum acquisitions, such as 3.4GHz licences in metropolitan areas. Telstra does not, however, intend to comment on these issues in any greater detail, as its position has been put to the Productivity Commission at some length. Moreover, these issues will be canvassed in the Productivity Commission's final report, due to be released in July this year. This notwithstanding, if the Committee would like further information on Telstra's position, then Telstra would be pleased to provide the Committee with that information.

6 Summary

Broadband services can be delivered in a number of ways, of which wireless broadband is one. There are also various options for delivery of wireless broadband services with some technologies likely to compete with fixed cabled services, while others will provide new and unique mobile broadband functionality. Within the range of wireless broadband technologies available, different technologies will be appropriate in different circumstances. Efficient wireless broadband deployment involves consideration of a complex matrix of technological suitability of delivery platforms, cost efficiency of deployment options, and consumer demand driven by application and content. In such a dynamic environment, the operation of the market is most likely to deliver efficient outcomes. Undue regulatory or policy focus on any particular technology or technologies will constrain the ability of the market to develop and adopt new and emerging technologies to meet actual consumer needs most efficiently.

The significant promise that wireless broadband offers can only be delivered with significant investment from a number of parties. However, as shown in section 5, there are significant dangers in implementing inappropriate regulation, particularly in dynamic environments requiring significant infrastructure investment. If companies do not expect to obtain an appropriate return on investment, they will not invest or will delay investments until the uncertainty is removed.

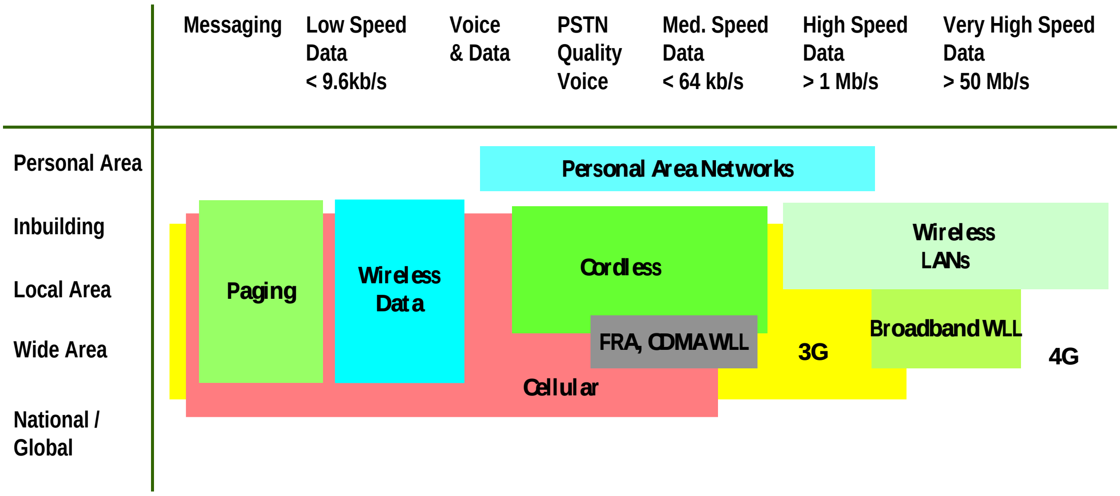
If inappropriate regulation, including the application of current telecommunications access regulation, is applied to broadband wireless services, then there is a real chance that investment incentives will be undermined. This may have negative consequences, as broadband services demanded by users will not be delivered with a resultant loss of welfare. With an underdeveloped wireless broadband sector, Australia will be left at a competitive disadvantage.

Annexure A: Wireless broadband technologies

Figure 1 is a snapshot of the current and emerging wireless technologies, the environments in which they operate and the typical range of data rates they are capable of supporting.

The suitability of these technologies as broadband will depend on a number of factors including the environment in which these systems need to operate (that is, mobile or fixed or both) and the specific applications needed to be supported. They are discussed in turn.

Figure 1: Current and emerging wireless technologies



Mobile data technologies

Overview

There are currently two generations of cellular mobile technologies for delivery of data services. These are described by the so-called 2.5G and 3G system standards.

Within the 2.5G framework there are two paths available, one based on the GSM standard (originating from Europe) and one based on the cdmaOne or IS-95 standard (originating from the United States).

3G also has two main standards that are considered evolutions of GSM and cdmaOne.

The evolution paths for cellular technologies from 2.5G to 3G are shown below in Figure 2. The key attributes for each are provided in Table 2. Note that the time line is only.

Figure 2: Evolution of cellular technologies

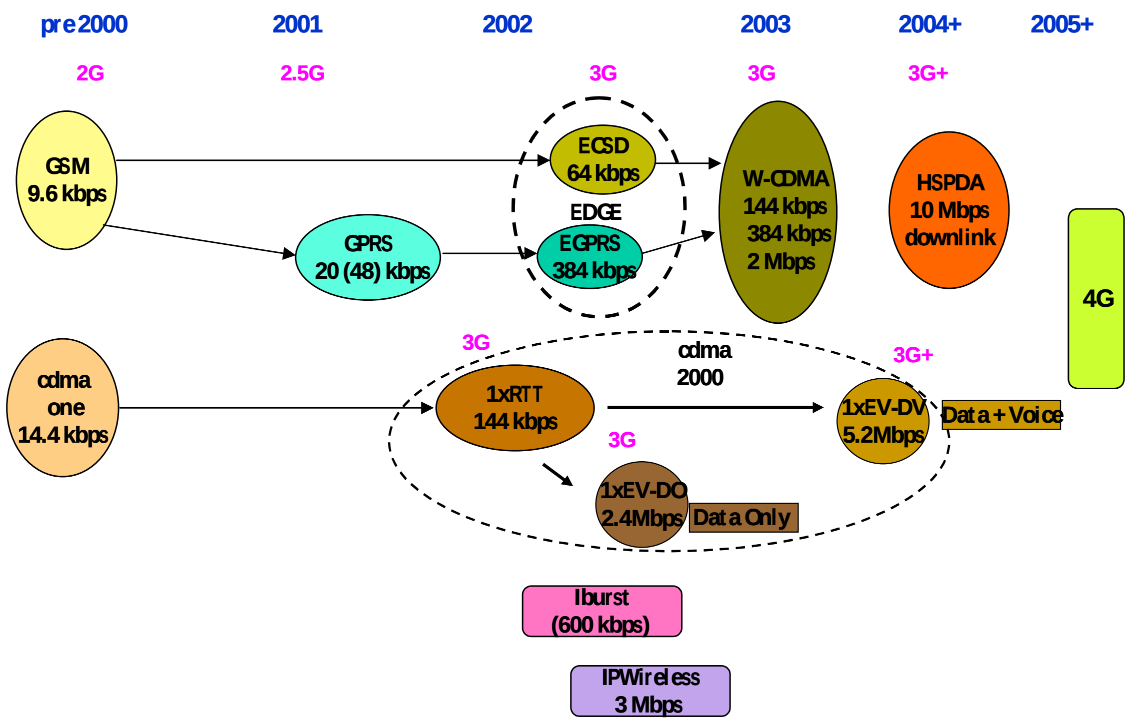


Table 2: Key attributes of mobile technologies

Technology	Downstream peak rate (shared)	Upstream peak rate	Range at peak rate	Frequency band
GSM	9.6 kbps	9.6 kbps	5- 35 Km	900 MHz, 1800 MHz
GPRS	48-96 kbps	12 kbps		Licensed
CDMA	14.4 kbps	14.4 kbps	9-60 Km	800 MHz
1xRTT	153.6 kbps	19.2-153.6 kbps	9-30 Km	Licensed
EDGE	384 kbps	10-384 kbps	2- 10 Km	900 MHz, 1800 MHz

Technology	Downstream peak rate (shared)	Upstream peak rate	Range at peak rate	Frequency band
				Licensed
UMTS	384 kbps	64-384 kbps	2- 10 Km	2 GHz
	2 Mbps (small cell)			Licensed
1xDO	2.4 Mbps	19.2-153.6 kbps	9-30 Km	800 MHz
1xDV	5.2 Mbps	19.2-307.6 kbps		Licensed
HSPDA	10 Mbps	64-384 kbps	-	2 GHz
				Licensed
Ipwireless	3 Mbps	32 kbps	1.5-9 Km	2GHz
Iburst	595 kbps (ded.)	216 kbps	1.5-10 Km	Licensed

GSM and its evolution path

The GSM system that currently provides voice services can also provide circuit switched data services in much the same way as a dial-up modem is used in the fixed telephone network.

The first major step in GSM's evolution to broadband is GPRS (GSM Packet Radio Services), which provides packet data connection for mobile users. Packet data means that the user need only consume network resources when transmitting or receiving data. Packet data also gives the service an "always on" capability. This contrasts with circuit switched data where the user consumes network resources while the call is active, regardless of whether data is being sent (or received) or not. In summary, the 2.5G systems of GSM and GPRS offer fairly low data rates. The next step in evolution for GPRS is to EGPRS or enhanced GPRS through a technology known as EDGE. EGPRS (EDGE) offers a higher data rate.

All of these systems suffer from a range limit imposed by the GSM standard of 35 km. While there are ways of getting around this limit for speech services, it may not be applicable for data. The 3G technology of WCDMA (Wideband CDMA) offers higher data rates, however because it is initially designed to operate in the 2 GHz band, it will have an inferior range compared with systems operating in a lower frequency band.

Note that while GPRS only provides for data transmission, it works together with GSM to deliver voice and data services. WCDMA is capable of supporting both voice and data services.

cdmaOne and its evolution path

The cdmaOne system that currently provides voice services can also provide circuit switched data services in much the same way as a dial-up modem is used in the fixed telephone network. cdmaOne is currently available in two forms, IS-95A – which is the system that Telstra has deployed - and IS-95B, which has been deployed in Australia by another operator. IS-95B has the potential for higher data rates than IS-95A depending on how much of that technology standard is deployed.

The next step from either IS-95A or IS-95B is to the cdma2000 family of standards. The cdma2000 standards are classified as 3G standards by the International Telecommunications Union (ITU). They cover technologies known as 1xRTT, 1xEV and 3xRTT.

In summary, the 2G systems of IS-95A and IS-95B offer fairly low data rates, except when the multi-code option of IS-95B is implemented. 1xRTT, which is somewhere between a 2.5G and 3G technology, has the potential to offer a substantial data rate. For wireless local loop applications, this is enhanced by its operation in the 800 MHz band as this offers superior range compared to operating in a higher frequency band. There are limitations in the range of cdmaOne systems and their derivatives. Telstra, in partnership with its cdmaOne vendor, have overcome these limits for voice (extended cell concept). However, at this stage it is not clear if these techniques are applicable to data.

Note that, while 1xEV DO only provides for data transmission, it is designed to work with either IS-95A/B or 1xRTT to deliver voice and data services. This is an expensive solution because it requires the use of separate carriers for voice and data. 1xEV DV can support both voice and high-speed data services on the same carrier. Currently these standards are still being developed and the information given is based on the best data currently available.

Emerging technology

Smart antenna systems use multiple antennae to provide more accurate directional targeting and additional improvements in efficiency. Base-stations work out a position from the relative signal strengths at multiple antannae before directing transmissions. With these systems, it is possible to support either more users, or the same number of users at a higher data rate, or to reduce the number of base-stations needed to provide a particular level of service. Theoretically, the capacity enhancement is proportional to the number of antennae, but in practice it is currently only possible to achieve about 75% of this improvement. ArrayComm's I-Burst base-stations are equipped with smart antennae and colocated within the base stations of a 2G network. They can provide a throughput of 1Mbps at about onethirtieth of the cost of building a 3G network for the same area. Thus, I-Burst plugs the gap between 3G networks (long-range, but capable of 384kbps) and the Wi-Fi wireless-network standard used to connect laptops to the Internet (shortrange, and capable of 11 Mbps). ArrayComm envisages that I-Burst will provide fast mobile data access as well as a wireless solution to the “last mile”. [14]

Multimedia service capability of mobile data technologies

With the exception of video streaming, most 3G technologies and EGPRS can support all other multimedia services. In particular, these services can be provided on the move and in vehicles that are well suited for m-commerce. Given spectrum limitations however, it is expected that bandwidth-hungry services involving picture and rich graphics cannot be implemented on a wide scale.

Roll-out of mobile data technologies

The three main operators have rolled out mobile data technologies such as GPRS in Australia with Telstra’s network having full nationwide GSM coverage and gradually improving data speeds. The Government has already auctioned the 3G spectrum to several successful bidders, with one operator announcing deployment at the end of this year. Overseas, early commercial implementation of WCDMA occurred in Japan late last year with Europe expected to follow this year. 1xRTT has been deployed in South Korea, with the United States and China to follow soon.

Mobile data technologies issues

The main issues concerning mobile data technology for broadband are:

- peak data rates are not as high as fixed wireless, copper or cable technologies;
- high bandwidth services have limited capacity;
- peak rates cannot be guaranteed - they depend much on propagation conditions and distance: in general, the further away the user is from the base station, the more likely he / she will get a lower bit rate; and
- unlike copper, the data rates are generally shared between many users.

---

[14] Information sourced from “Watch this Airspace”, economist.com, 20.6.02.

Portable wireless technologies

Overview

Of late, several portable wireless technologies have become available and are being increasingly used to provide broadband data communications between user devices and the network.

Portable data technologies are generally based on the wireless LAN (Local Area Network) standard.

This standard operates in what is known as the industrial, scientific and medical (ISM) band. This band is unlicensed, so that anyone can use it for any purpose subject to adhering to the radiation limits of the band as defined by the ACA.

The most prominent current technology is IEEE802.11 b, which provides peak data rates of 11 Mbps. This system is evolving into IEEE802.11 or the European HiperLAN system that provide much higher peak data rates of around 55 Mbps. However, these data rates are shared between several users and there are protocol overheads associated with sharing, as well as with making the signal robust in a radio environment. These reduce the user throughput to several hundred kbps in IEEE802.11ab and few Mbps in IEEE802.11b or HiperLAN. WLAN systems are generally short-range supporting link ranges of 20-100 m. Additionally, only pedestrian speeds are supported.

Unlike mobile technology, these provide only the “last mile” access. To provide complete networking, transport and backend systems such as routing, authentication, security, billing and so forth are needed. Some implementations of WLANs include high gain antennas to increase their range of operation to 5-10 km.

Table 3 summarises the key attributes (data speed, range, availability and frequency) of these portable technologies.

Table 3: Key attributes of portable technologies

Technology	Availability	Frequency	Data speed	Range	Voice channels supported
Bluetooth	1Q 01	2.4 GHz	700 kbps	10-50m	3 simultaneous

Technology	Availability	Frequency	Data speed	Range	Voice channels supported
DECT/PHS packet access	now	1.9 GHz; 2.4 GHz;	384 kbps now evolving to 2 Mbps	50 m indoor 300 m outdoor	yes; separate carrier
IEEE 802.11b	now	2.4 GHz	up to 11 Mbps	25 m indoor ~ up to 100 m outdoor	only VoIP
HiperLANII /IEEE 802.11a	4Q 01- 02	5.1-5.3 GHz	up to 55 Mbps	20 m indoors ~50 m outdoor	only VoIP
IEEE 802.15	04-05	not finalised	20 Mbps	10-20 m	only VoIP
Ultra wideband	04-05	Covers several bands; FCC: 3.1-10.6 GHz	100-500 Mbps	5-10 m	

Multimedia service capability of portable wireless technologies

Because of their generally high-speed capabilities, portable technologies are well suited to most multimedia applications including video streaming. However some services would need quality of service (QOS) guaranteed which is not present at the moment in WLANs-based technologies.

Roll-out of portable wireless technologies

WLANs are increasingly being deployed around the world, including in Australia. Australian implementations include coverage in hotels, airports and fixed uses of the technology in various rural shires. Several operators, such as DoCOMo and British Telecom, have announced plans to start wireless LAN services, while Nordic operators such as Telia and Telenor have already implemented these.

Portable wireless technologies issues

The main issues concerning portable wireless technologies are:

- the use of the unregulated ISM band imposes limitations on the use of this technology. In particular, WLANs systems are prone to interference from other WLANs, Bluetooth devices, cordless phones, microwave ovens and medical equipment operating in the band;
- use of high gain antennas to increase the range of WLANs can potentially result in violation of the ISM band radiated power limits. This can potentially cause interference with other applications of the technology such as portable nomadic communications, which is becoming gradually widespread;
- a backbone network is needed to complete communication; and
- only hot spot coverage is economically feasible, and roaming to other networks is needed for wider area coverage.

In addition to WLANs, there are other portable technologies such as the well-known DECT and PHS systems. These systems, originally designed for cordless telephony, have now evolved into packet data systems supporting speeds up to 384 kbps and later evolving into 2 Mbps.

There is also considerable development in what is known as personal area networks (PAN). Examples of these are Bluetooth (700 kbps) and IEEE802.15 (20-30 Mbps) systems which are meant to connect devices in a short range of 10 – 50 metres. Applications for these include high-speed connectivity between mobile phones and laptops, headphones and mobile phones, and printers and PCs.

Emerging technology

Ultra wideband (UWB) and ad hoc networks technologies can be, and are thought to have been used together in military applications for some time. UWB transmits very short pulses on wide range frequencies simultaneously at low power. Such pulses pass unnoticed by conventional radio receivers but can be detected by a UWB receiver. Ad hoc networks consist of multiple devices, each acting as a router for the others; it does not require network infrastructure. The quickest way to transmit data from one device to another changes as the devices move around, and other devices join and leave the network. Futurists believe that UWB and ad hoc architectures are a natural fit, since the UWB devices will have to locate each other and start communicating automatically. Looking beyond 3G networks, and the patchwork of WI-FI and cellular networks referred to as 4G, some are referring to infrastructureless, ad hoc UWB networks as 5G. [15]

Fixed wireless technologies

Overview

The development of fixed wireless systems for delivery of high-speed data is proceeding at a fast pace. Some of this is driven by operators who want to deliver high speed Internet access but do not have a cable or copper network and some is driven by development of the new markets in countries lacking communication infrastructure. All these systems use packet data transmission.

There are a number of technologies including broadband wireless local loop (BWLL), multichannel multipoint distribution system (MMDS), local multichannel distribution system (LMDS) and datacasting. Their key attributes and availability are provided in Table 4.

Table 4: Fixed wireless technologies

Technology	Nodal throughput	Availability	Band	Range	Features
Mobile as Fixed	384 Kbps-2 Mbps	2003	1900-2100 MHz	~ 40% of CDMA	Shared bandwidth No LOS requirements World standard
WLAN technology	4-5 Mbps / 20-30 Mbps; shared	Now	2.4 GHz / 5.1 GHz	~ 3-5 Km LOS	Shared bandwidth world std Works in ISM band Prone to interference
BWLL / MMDS (proprietary)	1.5 10 Mbps	Now	ISM, 2.4 GHz MDS 2.2 GHz	Rural ~ 5-10 Km	Shared bandwidth near LOS;

15 Information sourced from "Watch this Airspace", economist.com, 20.6.02.

Technology	Nodal throughput	Availability	Band	Range	Features
			WLL 3.4 GHz		Proprietary
Datacasting via DTTB	2-12 Mbps	03	VHF, UHF TV Bands	matching analogue TV coverage	Shared bandwidth; essentially broadcast, regional standards, convergence of internet and TV
IEEE 802.16.a	2-10 Mbps?	03	Any band in 2-11 GHz	~ 5-10 Km	shared bandwidth non LOS world standard
IEEE 802.16, LMDS	44.8 – 134.4 Mbps LMDS2-27 Mbps	Now	10-60 GHz LMDS : 27, 28 and 38 GHz	3-5 Km LOS	Strictly LOS Large bandwidth applications

Emerging technology

Mesh network systems can blanket a neighbourhood with connectivity without the need to lay any cables. A neighbourhood access point (NAP) is installed – essentially radio base-stations connected to the Internet via a high-speed connection. Homes and offices within range of the NAP install their own antennae, enabling them to access the Internet at high speed. Each of these homes and offices also act as a relay for other homes and offices beyond the range of the original NAP. As the mesh grows, each node communicates only with its neightbours, which pass Internet traffic back and forth from the NAP. It is thus possible to cover a large area quickly and cheaply. The mesh approach is considered superior to traditional point-to-multipoint approach for the following reasons:

- it navigates obstacles by using rooftop antennae rather than tall antennae, offering multiple paths from one node to another, and is consequently extremely efficient in terms of power consumption;
- systems are typically self-configuring to send traffic by the quickest route;
- mesh networks are robust and can be scaled up easily.

In Maitland, Florida, MeshNetworks has developed its own radio hardware and routing software which blanket areas with broadband wireless coverage using “intelligent” NAPs and wireless routers. The network supports mobile devices such as handheld computers and laptops, and those mobile devices in turn also act as routers for other mobile devices, further extending the mesh. Even when two or more devices are beyond the range of a NAP or a wireless router, they spontaneously form their own local network.[16]

Multimedia service capability of fixed wireless technologies

Because of their generally high speed capabilities, fixed wireless technologies are well suited to most multimedia applications including video streaming.

Roll-out of fixed wireless technologies

There have been niche implementations of broadband wireless local loop technology in the United States by competitive local exchange carriers (CLEC) over the past 2-3 years. There have also been some implementations in South America and Canada. In addition there have been niche implementations of public packet data service using wireless access technologies (for example, ricochet services in the United States). However, initial implementations have not been very successful due to lack of sufficient demand and high cost of terminals. LMDS has been implemented in Australia, by AAPT, and in other countries such as Canada, United States and New Zealand.

Fixed radio technologies issues

The main issues with fixed radio technologies are:

- most technologies need clear line of sight ("LOS") to operate and the availability of LOS in typical urban and suburban Australia is very limited; and
- the terminal equipment is still very expensive.

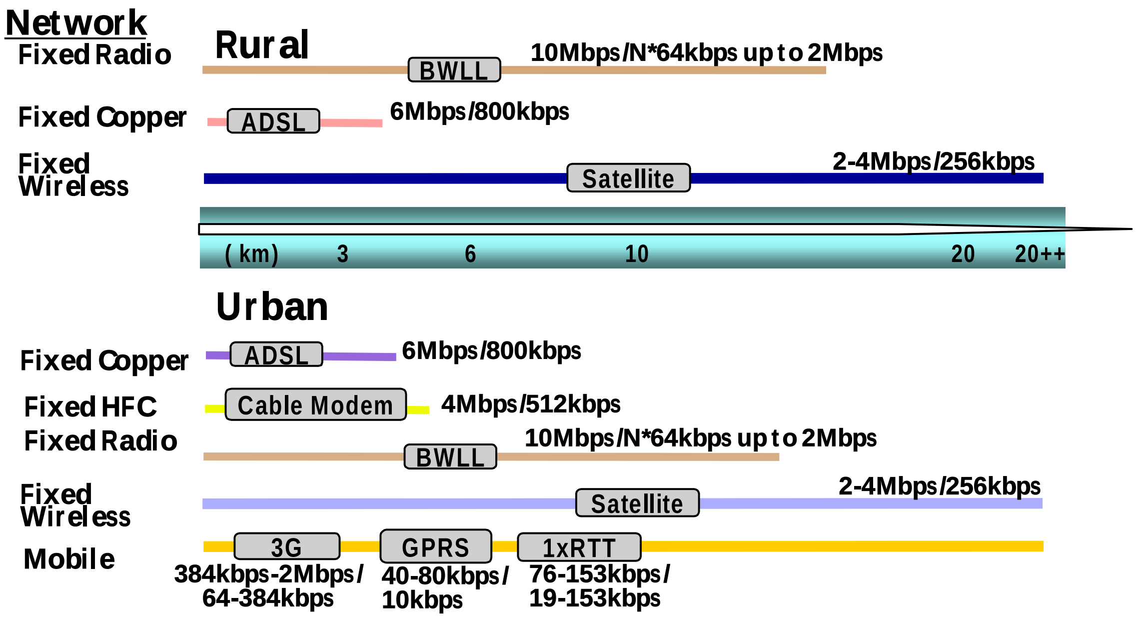
It should be noted that the development of the IEEE 802.16 set of standards is expected to alleviate some of these problems.

---

[16] Information sourced from "Watch this Airspace", economist.com, 20.6.02.

Summary of Internet Access- Urban & Rural Options

No single technology meets coverage, capacity, speed, cost requirements. A mix of access platforms is generally required. Broadband wireless local loop (BWLL) tends to have better rural coverage where there are more open areas. Otherwise, there is little difference between urban and rural coverages of the various technologies.



---

1 DISCLAIMER: Download/upload speeds stated here are based on information and assumptions known to date which are subject to considerable uncertainties at this stage. As such, these are not a representation by Telstra of actual data transmission speeds.