ALCATEL



**Ross Fowler**
Chief Executive Officer

23rd May 2002

The Secretary
House of Representatives Communications,
Information Technology & the Arts Committee
Suite R1, 116
Parliament House
**CANBERRA ACT 2600**

Dear Mr McMahon,

Attached please find the original copy of Alcatel's Submission on the "Current and Potential Use of Wireless Technologies".

We will be pleased to have discussions on any of the issues raised.

Yours Sincerely,

pp. Ross Fowler
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**Alcatel Australia**

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## Overview

All the wireless technologies described in this paper have a role to play. This does not mean that they compete, rather that they complement each other. The section headed "Wireless Broadband Technology Inter-relationships" on page 12 highlights how each of the technologies are positioned.

We have described the status of wireless technologies and covered global trends as well as Australian status.

We have raised a number of regulatory issues and indicated the need for continued vigilance to ensure that converging technologies do not outpace the need for appropriate regulatory reform.

The relatively high cost of wireless broadband compared with fixed broadband access results in the fact that applications for broadband will be developed on the fixed environment and applications for mobile and location based services will be developed in the mobile environment. Some valuable combinations will emerge.

## Wireless Broadband Rollout

The current rollout status of wireless broadband technologies in Australia and overseas are described below along with forecasts for future growth. They are grouped and described as follows:-

1. Wireless LAN (using the 802.11 standard), bluetooth
2. 3G (UMTS, W-CDMA)
3. LMDS, MMDS
4. Wireless local loop (WLL)
5. Satellite

### Wireless LAN (using the 802.11 standard)

Originally Wireless LANs were designed for use within corporate premises, however new applications are emerging for the residential market. One example of this is the introduction of a range of ADSL routers with WLAN capabilities. Applications leveraging WLANs in the public environment are becoming more common. These include:

- Local ISPs, mostly in the US, offering WLAN access to the Internet in small communities
- Community services (e.g. Seattle Wireless, NYC Wireless, Consume and others) offering WLAN access to the members of a community. These services are directly managed by the members of the community
- Commercial services (e.g., Wayport, HomeRun, and others) proposing nationwide WLAN access in major airports and hotel chains. This service is perceived to be competing with the mobile operators' offering.

Note that different pricing schemes are employed by various operators of these commercial public WLAN, from one-off charge (either per month, per day, or per minute) to packages that include bundled time or download volume. Examples are:-

- Wayport (available mostly in USA) charges a prepaid fee from US$ 4.95 (in airports) to US$ 7.95 (in hotels) per day and per location with connection costs. For individual professional mobile Wayport offer a US$ 29.95/month plan with unlimited connectivity based on a yearly agreement at any hotel or all-wireless airport locations. For less frequent users, a prepaid card of US$ 49.95 with discounted rate for connections at any hotel or all-wireless airport locations (30% off the regular retail connection price).
- Telia HomeRun offers similar services in Sweden and Norway but charges slightly higher fees. HomeRun was launched in October 2001 with a deployment up today of 300 WLAN networks in hotels, train stations and airports and SAS plans in-flight services. Telia charge 170 Euros per month for a flat rate subscription or 22,69 Euros for a 24-hour calling card.

- Sonera launched wGate in June 01 with 70 hotspot such as airports and 200 planed by end 2001. Sonera charges 3,36 Euros per month and 0,33 Euros per minute.
- Telenor launched a trial in March 2001 with19 locations and a plan for end 2001of 50 zones, most hotels & conference establishments. Telenor charges by volume (3.2 Euros/MB up to 20MB, no subscription fee), per 24-hour subscription (leasing a WLAN card at the hotel for unlimited usage). Besides airports and hotels other WLAN sites will be transport hubs and corporations. Full commercial launch is depending on trial results.
- Metronet with 66 hotspots in Austria today in places such as hotels, coffee, restaurants, rail station, airport and other busy places. Metronet offer a prepaid plan of 19.98Euros/60m. For regular user they provide a plan of 34.80 Euros subscription with 19.98 Euros/month limited to 0.60/MB or 34.80 Euros subscription with 34.80 Euros/month and limited to 0.30/MB.
- iobox, (Telefonica) has set up a WLAN network at the Four Seasons hotel in Munich. Telefonica is willing to accept some cannibalization of its future UMTS service revenues by WLAN since the thinking is that if Telefonica does not offer such services itself prior to the introduction of ULMTS, competitors will.
- Century CyberWorks Ltd. (former Hong Kong Cable and Wireless) began offering wireless LAN service in Hong Kong's airport commercially in April, and said it plans to set up reciprocal agreements with other international airports to add to business travelers' convenience.
- Nanjing Telecom, (China Telecom) for the Nanjing International Exhibition Center will offer Internet access at up to 11Mbps in hotspots such as hotels, transport hubs, airports and corporate enterprises.
- Chiang Kia Shek International Airport, free WLAN services trial from 16 January 2002 for 3 months, at a restricted place.

### *Market Trends*

IDC is currently predicting that the worldwide market for Wireless LAN networks will grow at 20% a year between now and 2006 to reach US$3.7 billion by 2006. Total worldwide WLAN equipment revenue will increase from US $1.45 billion in 2001 to over US$3.72 billion in 2006. Wireless LAN shipments will grow to 36.2 million units in 2006, up from approximately 8 million in 2001.

*Worldwide Wireless LAN Equipment End-User Revenue by Region 2000-2006*

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2001-2006 CAGR (%) |
|---|---|---|---|---|---|---|---|---|
| United States | 525.7 | 613.3 | 715.5 | 934.0 | 1,218.2 | 1,587.9 | 1,900.1 | 17.6 |
| Growth (%) | NA | 16.8 | 16.7 | 30.5 | 30.4 | 30.3 | 19.7 | |
| Share (%) | 48.9 | 40.2 | 39.1 | 38.0 | 37.4 | 37.6 | 37.1 | |
| Asia/Pacific (excluding Japan) | 285.8 | 421.0 | 567.5 | 728.7 | 965.3 | 1,008.7 | 1,137.7 | 22.0 |
| Growth (%) | NA | 38.5 | 34.8 | 28.4 | 28.5 | 19.7 | 12.7 | |
| Share (%) | 26.6 | 27.6 | 30.9 | 29.6 | 29.6 | 23.9 | 22.2 | |
| Western Europe | 225.1 | 335.2 | 459.9 | 612.1 | 727.2 | 815.2 | 986.9 | 21.5 |
| Growth (%) | NA | 47.0 | 37.2 | 33.1 | 18.8 | 12.1 | 9.8 | |
| Share (%) | 21.0 | 22.1 | 25.0 | 24.9 | 24.8 | 24.0 | 23.8 | |
| ROW | 65.8 | 94.7 | 134.6 | 182.5 | 236.7 | 273.4 | 315.5 | 30.1 |
| Growth (%) | NA | 43.9 | 42.0 | 35.6 | 29.6 | 15.5 | 15.4 | |
| Share (%) | 6.1 | 6.3 | 7.3 | 7.4 | 7.2 | 8.2 | 8.5 | |
| Worldwide | 1,101.4 | 1,454.2 | 1,877.5 | 2,456.3 | 3,011.4 | 3,387.2 | 3,720.2 | 20.7 |
| Growth (%) | NA | 34.2 | 29.1 | 30.8 | 22.6 | 14.1 | 11.1 | |

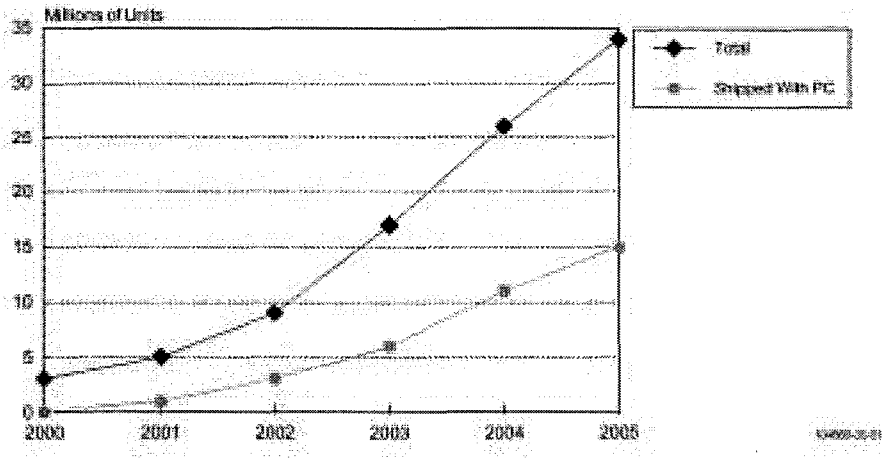
Source: IDC 2002

According to Gartner Group during 2001 end-user spending on Wireless LAN equipment grew by 40% year over year to US$1.5 billion worldwide. Gartner expects the worldwide market to grow at a CAGR of 22% reaching US$3.4billion by 2005. IDC too, predicts that WLAN equipment market in Europe will grow at 21% per year to total around US$ 328 M in 2004.

In the Asia Pacific region (excluding Japan) IDC predicts that the market for WLAN networks will grow at 51% per year between now and 2005.

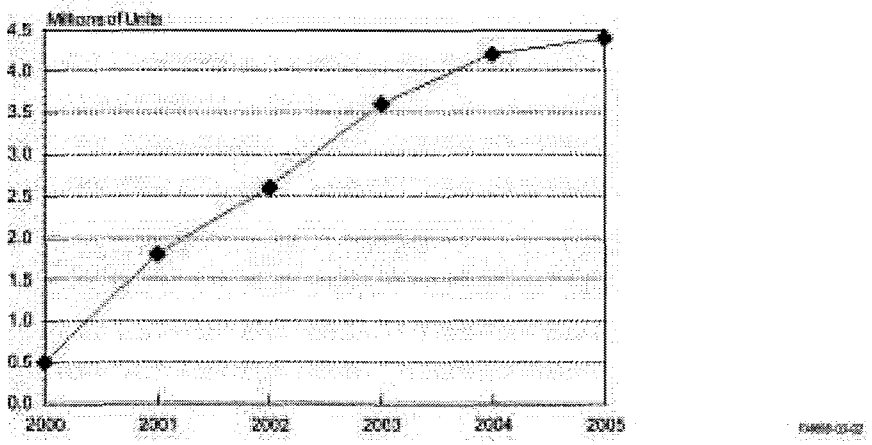
The key driver for the growth in the Wireless LAN market is demand for bandwidth to enable portable PC's to have access to email, web content and other corporate applications. Gartner is forecasting that the United States will represent 55% of the Wireless LAN market by 2005, followed by Europe, the Middle East and Africa with 22% and Japan with 20%.

*Wireless LAN Adapter Shipments Worldwide 2000-2005*




Source : Gartner Dataquest 2002

*Wireless LAN Access Point Shipments Worldwide 2000-2005*




Source: Gartner Dataquest 2002

## Bluetooth Market

Gartner is currently forecasting that Bluetooth-enabled product shipments will approach 40 million units in 2002 and grow to more than 125 million units in 2003. By 2006, Bluetooth revenue is expected to exceed US$2billion.

## 3G (UMTS, W-CDMA)

The most popular true 3G networks on offer today conform to 3GPP's UMTS standard. The 3GPP-2 version of 3G mobile network is still being considered by some operators such as SK Telecom in Korea.

SK Telecom claims to be the first operator offering 3G services via Cdma2000 1x technology. They are correct in the sense that ITU agreed with Cdma2000 1x to be a 3G technology, but from a capability perspective it is more like 2.5G (GPRS). A true 3G version of the Cdma2000 is still being standardised.

Some 3G (UMTS) networks are already in commercial operation. The first example is the NTT DoCoMo service described as FOMA. The FOMA service network has been operational since October 2001. At the end of March 2002, they supported approximately 95,000 users. The availability of handsets has limited growth.

In Europe, a UMTS network is operational on the Isle of Man. This network is being operated by mm02 (previously BT Cellnet).

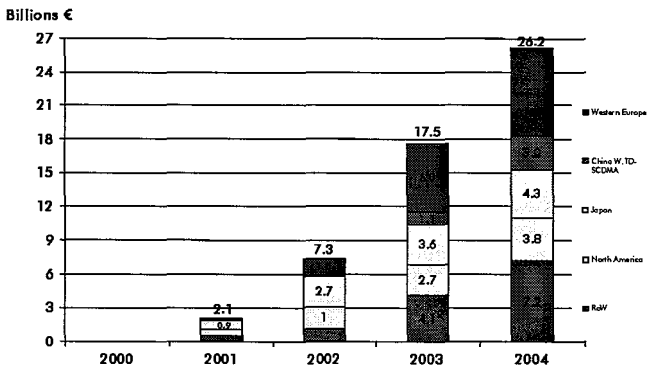
For the rest of Europe, the message is mixed. Regulators in some countries have agreed to delay the commercial roll out of a 3G network at the request of their operators. Belgium for example has a nominated date to deploy a commercial 3G service as part of the spectrum licensing agreement. This date was set to be September 2002 however; the Belgium regulator has agrees to shift the start date forward by 1 year. The operators' reason for the delay was due to the unavailability of terminals in large quantities. In additional, they also argued that network equipment was not ready for commercial deployment.

A large number of 3G trials are operating around the world today. One in Australia using Alcatel's technology is the m.Net trial in Adelaide.

### *Market Status*

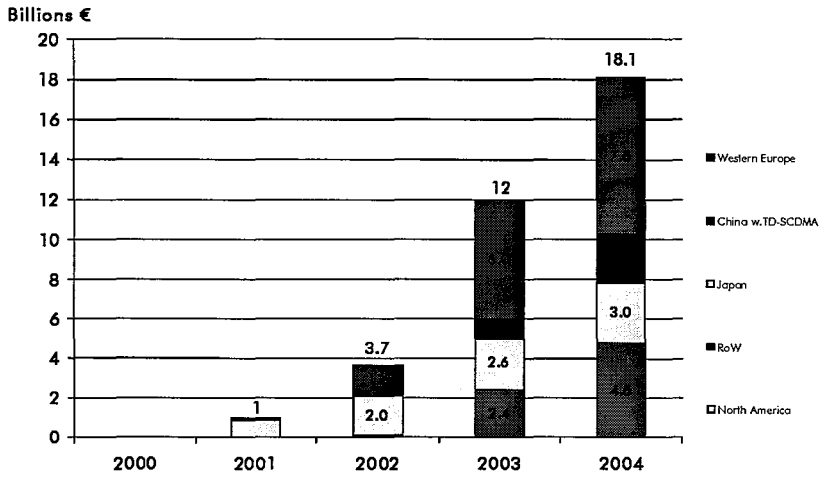
3G Investment is primarily being driven from Japan and Western Europe.

*Worldwide 3G Infrastructure Investment 2000-2004*



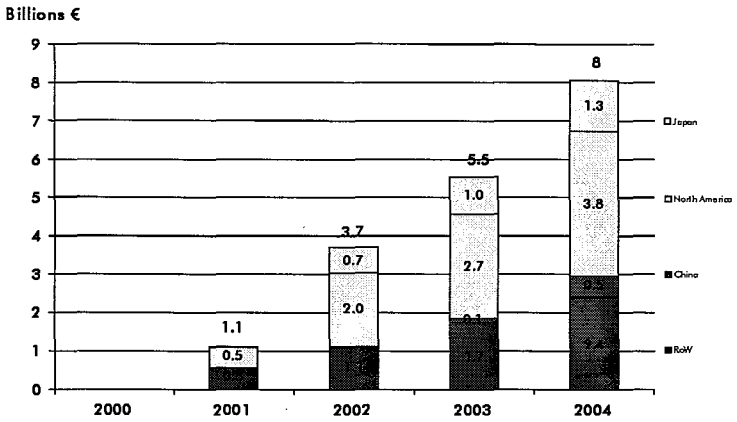

Source: Alcatel 2001

*Worldwide UMTS Infrastructure Investment 2000-2004*




Source: Alcatel 2001

*Worldwide CDMA2000 Infrastructure Investment 2000-2004*




Source: Alcatel 2001

*Australian 3G Mobile Market Projection*

In Australia we expect 3G Infrastructure investment to grow from Euro 27.9 million in 2002 to Euro 139.8 million in 2003 with the major impetus in investment not anticipated until 2004/2005.

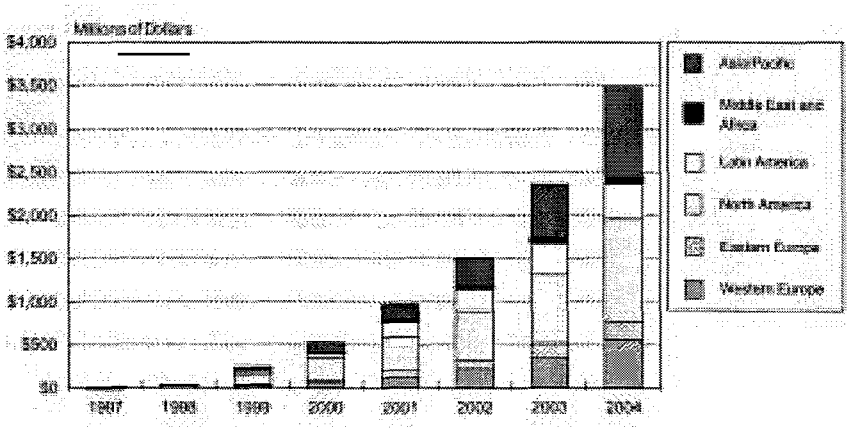
| Year | Mobile subscribers (millions) | 3rd Generation subscribers | Mobile revenue (US$ million) | 3rd Generation revenue |
|---|---|---|---|---|
| 1999 | 7.0 | 0% | 5,480 | 0% |
| 2000 | 8.0 | 0% | 5,950 | 0% |
| 2001 | 8.9 | 0% | 6,276 | 0% |
| 2002 | 9.8 | 0% | 6,715 | 0% |
| 2003 | 10.6 | 0% | 6,895 | 0% |
| 2004 | 11.1 | 2% | 7,045 | 2% |
| 2005 | 11.8 | 4% | 7,312 | 5% |
| 2010 | 15.0 | 75% | 9,459 | 70% |

Source: Ovum 2001

## LMDS

Gartner estimates that the worldwide LMDS market will grow from US$0.5 billion in 2000 to $3.5 billion by 2004. Gartner are currently forecasting that the US LMDS market will remain flat over the next two years due to the current downturn in the US economy, the recent bankruptcy filings of LMDS service providers (eg: Winstar and Teligent) and the relatively high upfront expenditure required. The largest potential growth region for LMDS will be the Asia Pacific, due to the lower penetration of fixed networks. The key driver of future LMDS growth will most likely be mobile wireless backhaul applications.

*LMDS Market by Region 1997-2004 US$*




Source: Gartner Dataquest 2001

## MMDS

The MMDS has also been hampered by a downturn in the US economy, financial difficulties facing MMDS service providers such as Worldcom, as well as technology problems, eg Line of Site, Cell Size issues etc. Gartner are currently forecasting that US MMDS subscribers will grow from 390,000 users in 2001 to 1.5 million users in 2004, driven by the demand for two-way broadband services for residential and

small office/home office users. RHK are currently predicting that MMDS service revenue in the US will reach between US$122-$177 million in 2002.

## Wireless local loop (WLL)

To date the deployment of Wireless local loop has fallen well short of industry forecasts initially predicting installation of upwards of 500 million lines worldwide. Today analysts estimate that there are between 5-10 million lines worldwide of WLL installed (Intelecon Research 2001). A number of factors have hindered the deployment of WLL including regulatory licensing allocations, competition from alternative access technologies, technical limitations eg line of sight issues and the general slowdown in the telecommunications market. Future growth potential for WLL is primarily in developing countries with low tele-density due to its cost advantage in that environment. Alcatel sees limited deployment opportunities with this technology in Australia. There will be niche geographical areas that benefit from WLL when DSL and Cable are not cost effective and WLL is lower cost to deploy compared with Satellite.

## Satellite

Terrestrial network solutions are currently well positioned in the broadband market and have defined very aggressive business models in term of cost of services and cost of equipment. However the economics of terrestrial broadband network deployment suggest that a percentage of the population and business in many countries will not be served for many years. Satellite-based systems have therefore a clear opportunity to complement such network solutions:

- In low population density areas where broadband terrestrial solutions will not be deployed,
- In areas where the terrestrial infrastructure is not ready to support xDSL service due to the poor quality of the phone line and where no cable TV system is currently deployed.

Satellite solutions are now tailored to target the following broadband markets:

- Small/Medium Enterprise (SME) market
- Small Office/Home Office (SOHO) market
- Internet Access Providers for Consumers or Corporations

Maximizing the use of satellite bandwidth is a key to a cost effective model as is the need to minimize the cost of the terminal. Today, antenna size (0.96m or 1.2m) and HPA power (1 or 2 Watts) has been kept as low as possible and installation must also be simple and low cost. Forward links from 2 to 45M bits/s and return rates from 144k bits/s to 2M bits/s are practical today.

### *Satellite based mobile systems*

Mobile Satellite communication systems (Inmarsat, Globalstar, Iridium, Thuraya, Aces) are presently serving specific niche markets. Similarly to terrestrial mobile networks, these satellite systems provide point-to-point communications.

The satellite best "killer application" is broadcasting. Success of TV satellite broadcasting and now satellite radio broadcasting to portable radio (WorldSpace) or car radio (XM satellite Radio, and Sirius Satellite Radio in the US) demonstrates that the satellite is efficient for point to multipoint applications. In the future such a concept may also be implemented within mobile systems.

### *Point to point mobile satellite systems*

Mobile Satellite Systems (MSS) are composed of either Low Earth Orbit (LEO) satellite constellation or geosynchronous (GEO) satellites. Existing examples of this technology are Inmarsat, Thuraya for GEO and Iridium and Globalstar for LEO systems.

Compared to terrestrial systems, these systems have some limitations:

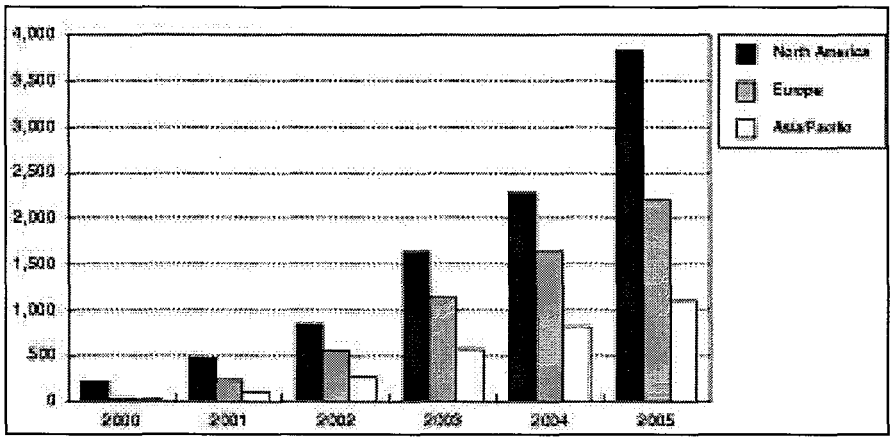
- Low capacity in term of simultaneous circuits and data rate,
- Long propagation delay (latency),
- Low penetration inside buildings,
- High power terminal,
- A range of standards, not all fully T-UMTS compatible, leading to dual mode terminals

Constellation of satellites with new technologies, such as very large antennas and onboard digital processing, could mitigate some of these limitations. However, the system would still face dual mode terminal and indoor penetration. In regards of the initial investment, only global service coverage and association between all operators could make these satellite-based systems viable.

### *Satellite Market*

Growth in the broadband satellite services market is expected to be driven by demand for broadband access to the Internet, coupled with deregulation and technological advances in space and ground infrastructure. Gartner is currently forecasting that the total revenue for satellite broadband access market will grow from $538.8 million in 2000 to $10.5 billion by 2005. The total number of satellite terminals will increase from an installed base of 293,500 at end of 2000 to 7.15 million at the end of 2005.

*Satellite Terminals by Region (000's)*




Source: Gartner Dataquest 2001

## Wireless Broadband Technology Inter-relationships

In general the various wireless broadband technologies all provide un-tethered access. The use of untethered access fits into one of three broad categories:

- Wireless or Cordless Access in the home or office
- Fixed Wireless Access to the network
- Mobile Access

Each of these categories as well as their interaction is discussed in detail below.

### Cordless Access

Cordless Access refers to the use of radio technologies as a convenient alternative to the use of cables around the home or the office. Typically these technologies provide freedom to move around a small geographic location and remain connected. The geographic range can be quite small (a few meters) such as around a single room or office and extend up to 100metres such as a house or a typical open office environment.

Bluetooth is an example whereby PCs, PDAs, personal entertainment devices (MP3, games consoles etc), mobile handsets and other peripherals may be "interconnected" using radio techniques rather than standard serial, parallel, ethernet or USB cables. This can be used as a means of synchronising data shared by the various devices, transferring data between devices and for providing access to network based services as provided by one of the peripherals (eg PDA to PC, or laptop to mobile). The range of Bluetooth is typically a few metres, and will be used by devices scattered around a desk or room. Other possible applications include wireless mouthpiece/earpieces for mobile handsets.

Wireless LAN is an example whereby PCs, servers, printers and other network connected devices maybe "interconnected" using radio techniques rather than standard ethernet or USB cables. This can also be used as a means of synchronising data shared by the various devices, transferring data between devices and for providing access to network based services as provided by one of the peripherals (eg Laptop to network terminal). The range of Wireless LANs can be up to 100 metres and can be used by devices scattered around a residential property or office environment.

### Fixed Wireless Access

Fixed Wireless Access refers to the use of radio technologies as an alternative to the use of cables as a means of gaining network access. When used as a means for delivering broadband based services Fixed Wireless Access is an alternative to DSL and fibre based technologies. Typically broadband Fixed Wireless Access is used where either DSL or fibre is either uneconomical or not feasible. Attempts to compete with in place cable based technologies using the "rapid deployment" scenario associated with radio based access have typically failed.

Fixed Wireless Access solutions are either terrestrial or space based. The terrestrial systems (LMDS, MMDS etc) are ideally suited to provide access in outer urban and rural environments where copper cable lengths are too long for DSL technologies (5-10km) but distances are short enough (15-25km) for the inherent line-of-sight radio systems to function at their optimum. The space-based systems are ideally suited to provide access in remote environments where neither cable-based access or terrestrial radio systems are economic. Note that the space-based system can provide access to anywhere within a large geographic footprint, and as such can provide "compete" with either existing terrestrial radio systems or cable based access. Whether such competition is cost competitive and feature competitive will be the issue. It is probable that space based broadband access will not compete with DSL or fibre based access in urban and CBD environments (specific niche applications such as broadband access for one off events do provide an exception). It is however possible that space based broadband access may provide an alternative to terrestrial based radio systems in outer urban and rural environments. For example, if the core space-based infrastructure is subsidised by government to provide service to remote communities, the cost of access for regional and rural communities may be able to be priced at a marginal rate.

## Mobile Access

Mobile Access refers to the use of radio technologies to provide access while on the move and across the wide area. This refers to the use of cellular radio technologies and the use of handover techniques when moving between radio cells to provide a continuous on-the-move (or mobile) coverage. The use of first generation (analogue) and second generation (2G) digital mobile systems (GSM, CDMA) have been deployed primarily as mobile voice networks. The use of "spare" bandwidth in mobile signalling channels as used in the second-generation systems has seen the emergence of simple text messaging (in the form of SMS) as an important "data" communication application. These systems will be supplemented by the third generation (3G) mobile systems that will provide both voice and broadband data access.

## Interaction

These different categories of access interact with each and their fixed network alternatives in a consistent manner. The interaction is illustrated below.

The most significant issue is that the *cordless access* (WLAN, Bluetooth) technologies can be used with any of the *network access* technologies, whether they are fixed wireless, mobile or cable. It is likely that some combinations may find greater market acceptance or implementation (eg 3G mobile with bluetooth or WLAN with fixed cable), but it is probable that all combinations will actually exist.

As already noted above the *fixed wireless access* will provide an alternative to other fixed access technologies, and the *mobile access* will provide a true on-the-move alternative to any of the fixed solutions.

One final point is that the *cordless access* technologies typically take advantage of unlicensed spectrum while the *network access* technologies are typically licensed and regulated. This has particular significance when radio interference issues are considered. It can be expected that all regulated technologies will not significantly

interfere with each other, ie any interference is within acceptable limits or controlled in some way. On the other hand the use of unlicensed spectrum for the *cordless access* technologies leaves them open to causing interference to each other. Anecdotal evidence suggests that neighbours who use WLAN technologies around their own homes can degrade each others throughput as they compete for the limited radio spectrum. Interference by digital cordless telephone systems on WLAN causing actual loss of throughput has also been reported. There is also the reality that if poorly implemented (without adequate security) one neighbour may be able to actually use another neighbour's WLAN network to gain access to the network.

This tends to suggest that the use of any radio technology using unlicensed spectrum for a public based service may be severely limited in its scope. It also highlights that consideration be given to regulating devices that use unlicensed spectrum to prevent interfering with and being interfered by other technologies.

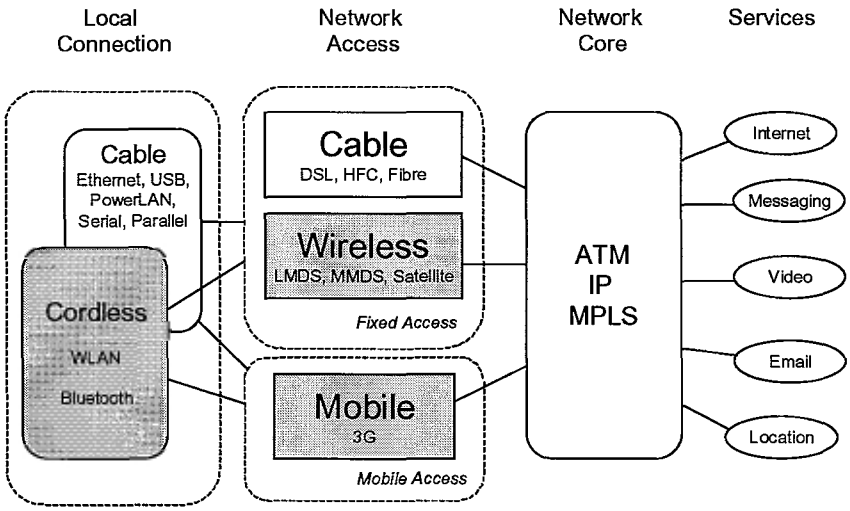



*Figure 1: The Role of various Broadband Radio Technologies and their possible interactions between themselves and with the fixed network*

## Fixed and Wireless Broadband Comparison

The benefits and limitations of wireless broadband technologies compared with cable and copper based broadband delivery platforms are discussed. The potential for wireless broadband technologies to provide a 'last mile' broadband solution, particularly in rural and regional areas are also covered.

The cost of delivering broadband bits over a fixed access network will always be lower than the cost of delivering those same bits over a wireless access network. As such the drivers for the development for broadband application will almost always be from the fixed networks. Applications that leverage mobile or location based characteristics will be driven from the mobile network environment.

Applications developed in one area will find value in the other and it is expected that innovative broadband applications will emerge from the convergence between fixed and mobile as well.

The wireless technologies that directly compete with DSL and Cable for residential broadband access are Satellite and Wireless Local Loop. DSL offers a dedicated fixed bandwidth over most telephony copper pairs and is the lowest cost of all of the broadband access technologies available today. Cable is only slightly higher cost but the access is shared which, over time will limit the attractiveness. Given that almost all of the homes in Australia have copper based telephony and cable only passes about 25% of the homes than DSL will be more pervasive over time.

WLL is relatively expensive and there have been very limited deployments worldwide. The value of this technology is the rapid deployment but this has not been sufficiently profitable to see significant growth.

Satellite is an important technology for broadband access in remote locations. It offers a solution to truly isolated individuals that otherwise would not be serviced using any other means.

Satellite will continue to deliver broadcast content and it will become even more complimentary to DSL as the broadcast services become increasingly interactive. Hybrid solutions combining Satellite broadcast and DSL back channel will offer some real value added interactive video services.

LMDSL has emerged as the technology of choice for fixed mobile base station back-haul if fibre is not available. In this example LMDS is growing in many markets including Australia. Other market segments such as for business access have not been successful as the cost is too high when compared to traditional 2M bit/s copper or fibre solutions.

## Wireless Broadband Content and Applications

Broadband applications will be driven from the fixed broadband environment as the cost of delivering broadband over a fixed access is, and will continue to be considerably lower than for a wireless access. Fixed broadband access is characterised by a single access delivering multiple services and the emergence of video will play an increasing enabling role in applications development. Mobile and location based services will be driven by the mobile access environment. The cross-pollination between the fixed and mobile environments will enable some novel and as yet not considered applications.

Many mobile applications will not be driven by bandwidth per say, but rather the low latency always on model due to the relatively high cost of transporting bits over a mobile access. Some Key application drivers in wireless data for the next 5 years are:-

- Messaging from the business and the personal side will account for 48% of all wireless data revenue in 2005.
- Business users will continue to drive the market and contribute a higher percentage of total revenue than the consumer user until 2005, when personal (consumer revenue) will surpass business revenue.
- Banking and trading, professional services and utility users will lead vertical markets. Other fast growing vertical applications identified include insurance, retail and construction.
- E-mail/calendar/PIM, messaging, field service and sales automation/inventory will lead horizontal business wireless data. Other fast growing horizontal applications include enterprise resource management, digital photography and corporate legacy/file transfer.
- Messaging, information services, location services, entertainment, games and e-mail/calendar/PIM will drive personal wireless data revenue. Other fast-growing personal applications include advertising, m-commerce customer service, digital photography and financial services.

There are very few applications delivered over broadband that cannot be at least to some extent delivered over narrowband today. A key exception to this is video based services. Very little can be done today with video over a narrowband infrastructure. Even with significant and ongoing video compression improvements, narrowband and video are a poor combination.

The cost of delivering video over a wireless broadband network is high and will remain relatively high for a number of years so the idea of delivering high quality on demand content such as movies to a 3G terminal is economically impractical today and into the medium term future.

Video however will play a very important role in the evolution of services delivered over the wireless broadband networks. Taking advantage of MPEG4 compression reasonable quality can be delivered to small screens easily within a 384k bit/s

bandwidth. Note that 3G devices will contain enough memory to store significant amounts of audio and even video so delivery of content non-real time will play a role.

Both still images and video will enhance many of today's applications and we will see an ongoing use of these capabilities as new services emerge. Almost all the services listed below will be enhanced with interesting uses of video, fixed images and audio.

To summarise, a number of application areas are listed as follows:-

**Personal:**
Information
Messaging
E-Mail
Financial Services
Location-Based services
M-Commerce
Image Transmission
Video Transmission
Audio
Home Automation
Entertainment
Games
Customer Service
Advertising
M-couponing

**Vertical business:**
Public safety
Government
Insurance
Healthcare
Banking and trading
Real Estate
Utilities
Manufacturing and construction
Professional services
Retail (point of sale)

**Horizontal business:**
Field Service
Transportation
Sales force Automation
E-mail
ERM
Video
Location-based services

*European perspective note:*

Mobile payment is regarded as a solution considered for 3G in the short term. Many European countries spend large amount of money on 3G spectrum and need to find revenue generation solutions in the short term.

While a long list of applications for long term applications are being reviewed by all of them, the mobile payment solution can potentially address the 3G revenue requirement. In this case, Mobile phones in this case can be used instead of cash or credit to perform both local and remote transactions in place of cash, smart card or credit card.

## Effect of the Telecommunications Regulatory Regime

This section deals with the effect of the telecommunications regulatory regime, including spectrum regulation, on the development and use of wireless broadband technologies, in particular the Radio communications Act (1992) the Telecommunications Act (1997), and Parts XIB and XIC of the Trade Practices Act.

A wide variety of issues impact on the development and use of wireless broadband technologies and the situation is complicated by social, business and regulatory needs and their often opposing positions.

### International Spectrum Planning

A major concern for the adoption of new wireless technologies is spectrum and the way that it is allocated. Australia's move to adopting international spectrum standards has helped greatly with planning and adoption of new technologies where appropriate. This initiative should continue to ensure that conflict is minimised in the future.

### Apparatus Licences

Recently the Productivity Commission reported on the current use issue of apparatus licences and the normal one-year life of such licences. The one-year period allowed spectrum to be vacated at short notice. This was fine for the new user of the spectrum, but left business with the expense of moving to new spectrum. It was suggested that a five-year life be given to apparatus licences to ensure that current users were not disadvantaged by these decisions. The consequences for the adoption of new technologies are obvious. It may take five years to adopt new technologies. Given the life cycle of some new technologies, the benefits maybe lost before they can be adopted.

### LMDS / Fibre

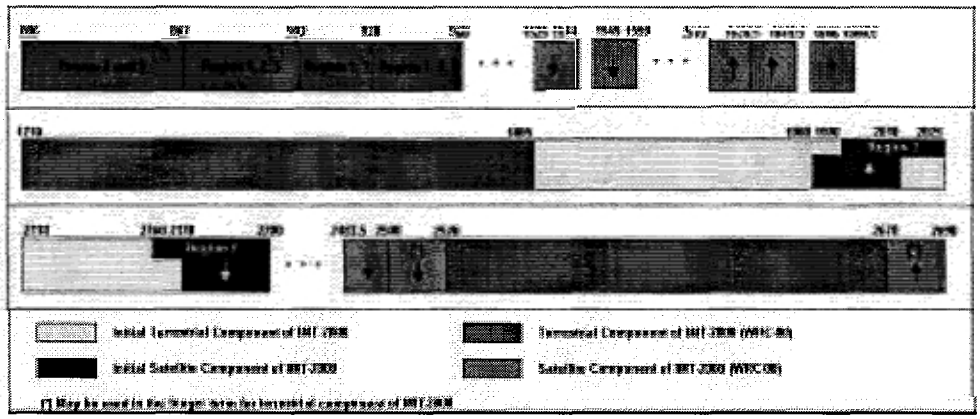
Current and future point-to-point wireless congestion could be alleviated by using technologies such as LMDS (and/or fibre). Further spectrum is available in Australia and meets the International standards. It could be allocated to provide backhaul for high-density areas. Pricing of the spectrum should not be prohibitive to encourage use in this manner. The recent LMDS spectrum auctions resulted in pricing that would be prohibitive for backhaul use.

### 3G Mobile Extension Band

The spectrum used for 3G mobiles is broken up into the "main" band and the "extension" band. The extension band is currently not allocated for 3G mobile use in Australia. Careful and regular assessment of the spectrum needs should be conducted. This will ensure that the extension band can be reallocated in a timely manner should it be required. It should be remembered that this would require a minimum of one year to vacate the band under current arrangements.

Frequency bands identified by WRC-2000 for IMT-2000, as well as bands already identified in 1992, are illustrated in the following figure:-

*Frequency Bands Identified for UMTS-2000*



Future initiatives from manufacturers will see use of satellite technologies delivering 3G multicasts. This will require the use of the edges of the extension band (2.4385 – 2.690GHz). These initiatives will take several years to eventuate, but continued evaluation will be necessary to ensure that Australia can reallocate spectrum in a timely fashion.

4G Mobile Spectrum needs to be assigned in Australia, probably in the 5G band, as soon as internationally assignment is agreed. This will give current users sufficient notice.

## Spectrum Auctions

Prices paid at spectrum auctions worldwide have proven to be too high. Although a good revenue raiser for the government, carriers often cannot afford to roll out their networks following the purchase of the spectrum. One example is the LMDS auction. There has been virtually no roll out of LMDS equipment following the auction. Selling spectrum previously bought at auction often involves writing down the value of the purchase. Companies that do use the spectrum have to recover costs from the customers. This results in higher charges. The spectrum auctions have a good commercial basis, but a method of capping the total price should be implemented to ensure that the customer and Australia can afford to utilise the new technologies.

Auctions should be limited to only spectrum that is known to be required for competitive services. This is the current regime and should be continued.

## Spectrum Allocation

Spectrum assignment should be forward looking and not so much technology dependant. This is the current regime and should be continued.

### Wireless LAN at Home(/SME)

This should be an adjunct to fixed wire LAN services. Some implementations of the technology have been known to interfere with DSL. Home and SME users usually do not understand interference issues and are ill equipped to handle them. Further work needs to be done to ensure that the user can handle the problem. Security issues are magnified with the users' signal being able to be intercepted through the "air". Performance of adjacent networks can be severely degraded. Standards that allow users to control the spectrum used by their equipment, stopping it from overlapping with adjacent users would be welcomed.

### ISM Bands

It is essential that close monitoring to the class licenced ISM band take place to ensure its viability long term. The current levels of interference are tolerable, but increasing in high-density areas. The problem may need a regulatory solution.

## Recommended Changes to the Regulatory Regime

The following are some recommended changes that Government should make to the telecommunications regulatory regime to ensure that Australia extracts the maximum economic and social benefits from the use of wireless broadband technologies

### Broadcast and Telecommunications Act Convergence

The Broadcast Act and the Telecommunications Act are converging at many points. Care must be taken to continually monitor the current issues and those that may rapidly influence the relationship. It may be necessary to create an industry group to suggest ways forward and flag issues that may affect either or both sectors.

### Change to the Regulatory Regime

The current regime appears to be working well and the various watchdogs, including the press are signalling no change at this time. There will always be people calling for change or indicating that various groups are not performing (to their requirements), but this will always be the case. Groups such as ACIF have been criticised recently, but like any professional group, they have responded to the challenge in a positive and relevant way. Close monitoring of the usual indicators for regulatory reform should be an ongoing function of government.

# Future Trends in Wireless Broadband Technology

## The Future of Mobile Technology

The current 2G GSM network can evolve to the 2.5G GPRS and has been deployed and is operational since last 2001. Substantial take-up is not expected until 2003.

3G (UMTS R3) is in trial during 2002, and larger scale commercial operation is expected towards the end of 2003. In the same timeframe, WLAN and mobile inter-working will take place.

The next major step is the introduction of IP multi-media systems expected in 2005.

Increasingly inter-working of different access technologies is a key evolution. This is often referred to as 'beyond 3G' and in this context, the "ABC" concept is often put forward. ABC means Always Best Connected, and refers to the capability to connect to the network in the most efficient and cost-effective way and as much as possible transparent for the end-user. Multi-network terminals are a key to this approach that will result in an increased terminal cost.

4G is a new radio technology for mobile cellular networks offering more than 20M bit/s (compared to a maximum of 2M bit/s for UMTS). Deployment is expected in the 2010 to 2012 time frame.

### *The Bremen Example*

Bremen in Northern Germany is an interesting example. A UMTS regional working group is established leveraging industry, research and consumers to develop a "mobile community". Work has begun to build a 3G infrastructure for the development of innovative mobile broadband applications. This is about fostering the scientific know-how as well as developing user awareness and dealing with interregional networking issues.

Bremen hopes to become the European centre of excellence for mobile communications and a real test-bed environment for advanced mobile applications.

### *Theft of Mobile Telephones*

A new and growing social issue is theft and increasing violence used to steal mobile handsets. Blocking of phones at the telephone switch by using electronic serial numbers should be supported. Tighter standards in handset design to stop changes to the electronic serial number (by thieves) should be encouraged.

### *Temporary 3G Handset Importations*

Regulation should allow for handsets from other countries to be readily used during brief visits even though those handsets may not be able to be licensed here or may have the potential for some low level interference. The free movement of 3G

telephones is essential if we are to expect our handsets to be freely used in other countries.

## The Future of Wireless LAN

Increasingly Bluetooth will be used to connect devices to the PC and to networks in the home and community areas such as airports, sporting arenas and shopping malls. Personal devices such as PDSs and MP3 players will become network connected using these standards.

This will extend in the home to include almost all appliances. Even washing machines and other white goods will not escape. Examples of network white goods being network connected are emerging. Washing machine Services enabling a pay per wash model exist in trial form in Europe today. The Machine is provided free by the service provider and via an on-line wireless connection records the usage and charges accordingly. Although this type of service does not require much bandwidth, the broadband always on model underpins the approach.

As disk storage costs continue to drop we will see more and more entertainment content stored in the home. This will likely evolve to the use of wireless LAN to a domestic centralised storage device that permits other entertainment devices wireless LAN access to both video and audio content delivery throughout the home. This then will drive home entertainment systems to be wireless LAN connected.

The SME and SOHO business sectors will also benefit from the wireless LAN technologies. The cost of cabling premises for business is high and as business grows or shrinks then premises become unsuitable. Moving the investment is costly and wasteful. Wireless LAN improves this situation significantly.

Standards will continue to evolve that constantly increase the bandwidth of the wireless LAN.

### *802.11 vs 802.11a*

It is apparent that the trend will be for the 802.11 standard to be superseded by developments in 802.11a

### *Wireless LAN Density*

The density of wireless LAN deployment may need regulation to solve interference issues.

## Possible future roles for Satellites with 3G

Satellite systems can provide attractive complementary solutions to the 3G infrastructure. Satellite Digital Multimedia Broadcast system (DMB) is particularly well suited to increase forward delivery capacity of 3G networks. The DMB system

can provide a cost-effective solution to achieve service continuity in rural and low populated areas.

A constellation of advanced satellites could provide reasonable but limited 3G services in rural areas on a worldwide basis, this large investment would probably need to be shared between several operators for service viability.

In the future, the High Altitude Platforms (HAPS) concept could also be contemplated for 3G network deployment. It could offer an interesting alternative to terrestrial systems.

*Point to multipoint mobile satellite systems*

Alcatel Space is currently promoting the DMB (Digital Multimedia Broadcast) satellite architecture, relying on the multicast mode, to provide 3G mobile networks with increased forward traffic capacity. The core idea of this project is to continuously fill the user equipment cache memory with the most appealing content of mobile multimedia services, And thereby relieving 3G networks of the most cumbersome and less profitable traffic. The overall interest of such a "Content Delivery" concept is closely related to the success of consumer multimedia services in 3G. Alcatel Space is currently achieving the technical and business demonstration that this unidirectional transmission might be implemented without impact on User Equipment and in the frame of 3GPP standardisation.

In order to cope with shading in urban areas and indoor penetration, the DMB architecture is designed to take advantage of satellite signal terrestrial repeaters that might be easily integrated on Node B. In rural areas, it is expected that DMB satellites will provide sufficient power to reach outdoor reception, thereby potentially reducing the number of new sites required for 3G rural coverage.

*High Atmospheric Platforms (HAPs)*

An interesting solution to ease 3G deployment would be to move base stations away from populated areas into a high atmosphere stationary platform, closer than satellites in order to provide adequate cell size, capacity, penetration, and low terminal transmit power. Potential candidates to achieve that goal are High Atmospheric Platforms (HAPs). HAPs are stationary platforms (balloon, or glider aircraft) at about 20-km altitude, where winds are relatively lite and constant.

HAPS designers have recently started to plan possible communication systems. The main interest has been identified in the provision of broadband services in the high frequency bands. Third generation services (IMT 2000 and UMTS) and GSM seem also suitable as it was mentioned during the last 2000 World Communication Conference in Istanbul.

To date, few platform designs have proven to be feasible, both technical and financial viability of HAPS systems is still to be assessed. Several companies are working on these types of platforms, including Skystation, StratSat, ARC, and Boeing.

## General issues

### *Mobile Telephone Emissions*

Recent changes to the power levels of 3G telephones have caused debate. Understanding of the scientific reasoning behind the increase will not allay public fear. Spread spectrum devices distribute energy over a wide spectrum at low levels where GSM energy is concentrated in a narrow spectrum. The likely effects are less even with the increases in power. The industry maintains that ongoing medical research is necessary for all sectors. They should be funded and conducted by independent organizations and the results should be publicly available.

### *Mobile Telephone Base Stations*

There are important issues with location, size and visibility. Concern over radiation effects on the human body should be countered by ensuring that the Base Stations are not placed at sites that will create reasonable fear in any sector of the community. They should both blend with the environment and not be large installations. Antenna housings that can combine more than one antenna should be encouraged. Towers and tall poles should be discouraged where possible.

### *Recycling*

Recycling of mobile and other wireless technologies is essential because of the recoverable materials as well the high level of pollutants they contain - especially the batteries. These include persistent toxins that accumulate in the environment, including arsenic, antimony, beryllium, cadmium, copper, lead, nickel and zinc, said the report. These toxins have been associated with cancer and neurological disorders, especially in children. This problem is endemic to wireless technology issue and the issues will continue to grow more rapidly as new technologies are introduced at increasing frequency. Base station equipment should also be recycled.

### *Mobile Telephone Immobilisers*

Blocking systems for mobile phones should not be allowed - already mandatory. Support for systems that communicate with the mobile handset, asking it to go to silent mode (eg: Bluetooth) should be encouraged. Places such as restaurants and theatres will benefit.