

# Alcatel-LucentBroadband 2020

- Alcatel-Lucent's perspective for broadband in the coming decade

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## 1. Executive Summary

The Australian government has foreshadowed a need for policy, legislative and regulatory reform to support the National Broadband Network (NBN) project. The changes will likely stand for years to come so it is critical to get them right first time. Anticipating Australia's broadband needs in 2020 is an important part in this process.

In this paper, Alcatel-Lucent uses its best endeavours to identify important broadband issues and applications. When looking to the future, these potentially offer the best insight as to how people and businesses could be using the NBN in 2020.

The paper attempts to enumerate the benefits that could flow for the community and the economy which, in turn, might help in understanding how to specify, engineer and build a robust and flexible NBN.

If we as a nation get broadband right, by 2020 Australia will have significantly addressed many of the important issues facing society today:

- **Combating climate change** - according to Treasury the single most important challenge facing Australia in the next ten to fifteen years;
- Increasing demand on the **health care system** as the **population ages**;
- The need to continually **improve productivity for international competitiveness** and to **fight inflation**;
- The desire of many Australians for **improved work-life balance**;
- **Child and aged care cost and availability**;
- **Road and air congestion**;
- The need for infrastructure to support ongoing **skills development and education**;
- Reliable communications during times of **national disaster and emergency**;
- **Improved government services** delivery and accessibility;
- **Reducing socio-economic inequality** by removing the 'digital divide';

This future, however, should not be taken for granted.

In 2020, Australians are likely to look back with disbelief at the idea - still common in 2008 - that 'Broadband' simply means 'the Internet on steroids'. The social, economic and environmental benefits that could flow from broadband suggest an unprecedented opportunity for transformation of Australian society and our economy. This realisation should establish the backdrop against which NBN discussion and planning take place.

The government needs to offer appropriate incentives to encourage NBN deployments that are capable of delivering these enhanced outcomes, whilst avoiding the delay and expense of reengineering the NBN in the future. An appropriate regulatory environment should be established to simultaneously encourage long term investment and healthy and sustainable competition for all participants.

Consequently the recommendations in this paper focus on critical points of intersect between government and industry:

- Flexible regulation to accommodate and embrace inevitable ongoing technology advances in a timely way,
- An industry structure and regulatory framework to drive competition that benefits all of the community, not just the highest value sectors,

- A network built to accommodate expected exponential increases in volume and variety of broadband use in future.

Alcatel-Lucent welcomes comments and ideas stimulated by this paper.

## About Alcatel-Lucent

Alcatel-Lucent (Euronext Paris and NYSE: ALU) provides solutions that enable service providers, enterprises and governments worldwide, to deliver voice, data and video communication services to consumers.

It is proud to supply equipment and services to Australia's leading telecommunications incumbents and competitors. It has supplied the infrastructure for a significant portion of Australia's residential DSL community, making it a leader in helping Australians access the advantages of a digital lifestyle. Its solutions achieve advances in DSL, fibre optics, wireless and satellite access that help companies and individuals get maximum benefit from fast Internet services.

Alcatel-Lucent's commitment to Australia is not new. It has been part of the Australian telecommunications fabric since 1895.

Its leadership in the development of Australia's communications infrastructure has included the country's first undersea cable network, the introduction of broadband Internet, the country's first 3G mobile network (m-Net) and the world's longest optical link, between Adelaide and Darwin.

As a leader in fixed, mobile and converged broadband networking, IP technologies, applications, and services, Alcatel-Lucent offers the end-to-end solutions that enable compelling communications services for people at home, at work and on the move. With operations in more than 130 countries, Alcatel-Lucent is a local partner with global reach. The company has the most experienced global services team in the industry, and one of the largest research, technology and innovation organizations in the telecommunications industry. Alcatel-Lucent achieved revenues of Euro 17.8 billion in 2007 and is incorporated in France, with executive offices located in Paris.

Alcatel-Lucent wishes to continue to play a leading role in improving Australia's economic outlook and standard of living by ensuring that the community has access to a rich variety of broadband services, wherever they live.

For more information, visit Alcatel-Lucent on the Internet: <http://www.alcatel-lucent.com.au>

## 2. Ubiquitous Broadband - Australia from a 2020 perspective

In the year 2020, what used to be called the ‘telecommunications industry’ now provides services which are barely recognisable from the ordinary tools of day to day life. The devices people use to access what were once called “broadband services” actually hide the technology from the people who use it. The “network” is such an integral part of peoples’ lives that it’s taken for granted - almost invisible to people in their everyday lives.

### *Combating climate change*

Using remote monitoring and management tools and automated devices connected to the NBN, Australians in 2020 are informed and understand their energy consumption habits. They use energy only when they need to and are more careful than ever before to use it wisely.<sup>1</sup>

Remote-access capabilities are commonplace in appliances, tools and machinery. Devices can be accessed, monitored and operated using all manner of personal, fixed or mobile devices. Whether it’s from your mobile phone or your laptop, you can check on the TV at home, your air conditioner, your answering machine or the car and you can skip from one device to the other without missing a beat at work. From household and office appliances to industrial blast furnaces and power station load and demand management, broadband is playing a key role in making information instantaneously available, anywhere.

In 2020, broadband has enabled a reduction in Australia’s carbon emissions to levels well below what were, in 2008, considered aggressive targets - and Australia is on track to exceed its 2050 targets for stabilising the global climate.<sup>2</sup>

### *Improved health outcomes*

In 2020, everyone’s health records are securely and instantly available - to the right health professional at the right time - no matter where you or they are in Australia. Diagnosis is faster and more accurate. The best specialists’ skills are available wherever and whenever they are required.

Patients leave hospital much sooner than they did in 2008 because routine observation and monitoring is with you wherever you go - whether through your mobile phone, your wrist watch, your handbag or your “i-Pod”.

In 2020, modern networked medical appliances are taking advantage of broadband access to reduce the length of hospital stays through improved outpatient supervision and monitoring. This reduces the overall cost of delivering better health outcomes across the nation.

These broadband-enabled services started to emerge in 2008, with early broadband enabling a wide range of innovations and initiatives supporting the vision for improved health services and efficiency in the sector and across the board. Improved broadband to all

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<sup>1</sup> Dennis, M., Jones, H. M. 2007, *Broadband communication enables sustainable energy services*, Telecommunications Journal of Australia 57 (2 and 3): pp. 25.1 to 25.16. Provides a comprehensive discussion of the roll broadband can play in assisting the energy sector to meet essential cost and performance targets for a sustainable national electricity supply network.

<sup>2</sup> Mallon, K., Johnstone, G., et al, 2007, *Towards a High Bandwidth, Low Carbon Future. Telecommunications-based Opportunities to Reduce Greenhouse Gas Emissions*. Climate Risk Pty Ltd. Provides a comprehensive, quantified overview of the carbon savings and economic benefits arising from the use of telecommunications networks - including Broadband.

Australians greatly improves the ability to deliver these benefits. The following case studies, presented from a 2020 perspective, provide some examples.

### *The Mayo Clinic*

Information and communications technology were a critical piece of our country's effort to provide affordable and accessible healthcare for all of our citizens.

Dr. William Mayo of "Mayo Clinic" fame described medicine as a "cooperative science" where the clinician, the specialist, and the laboratory workers unite for the good of the patient.

In 2020, broadband technologies have brought Dr Mayo's vision of cooperation to practical reality. Broadband technologies deliver the right information to the care team at the point of care. Care givers are scattered over broad geographic regions in metropolitan hospitals and in regional centres. A patient suffering from a serious head injury in a regional Intensive Care Unit can be treated by a neurosurgeon based hundreds or even thousands of kilometres away. Capable broadband networks have taken e-health well beyond efficient distribution of records and on-line personal medical histories to enable the kind of collaboration between caregivers to reach patients no matter where they are.

Creating more time for patient care was about helping health carers plan and use information and communications technology as strategic tools to improve clinical workflow. This meant moving and sharing information such as voice, image, video or data, when and where needed to devices, both wired and wireless, both inside and outside the hospital.

Some of the key features of e-health in 2020 include:

- Providing care givers access to the patient's home for remote monitoring
- Expanding the range of health services available at regional hospitals and reducing the need to move patients in an acute condition by using the network to introduce specialist skills wherever they are needed at the time those skills are called upon
- Creating collaboration tools that are easy to use and can be accessed from fixed and mobile devices in any location, reducing the delay of accessing on-call health care professionals
- Providing security at all levels for information and people

### Montedomini Healthcare Centre

Health care solutions modelled upon the early and successful Montedomini Healthcare Centre in Florence, Italy, have revolutionised aged care.

The Montedomini project enabled seniors to connect with the facility's video call centre from their homes over Telecom Italia's broadband service. Sensors monitored everything from their heart rate to household gas consumption and electricity and helped the aging population continue to lead 'normal' lives with the confidence that they were being well looked after and that help, if necessary, was always close at hand.

In its initial 500 patient pilot, Montedomini showed that the benefits of networked patient supervision included a:

- Decrease in outpatient medical consultations and fewer trips to the doctor or clinic
- Decrease or postponement in hospital admissions
- Reduction in the overall costs of providing healthcare

In the years that followed, Montedomini introduced other monitoring features such as glucose levels, weight scales, blood pressure, heart function and respiration.

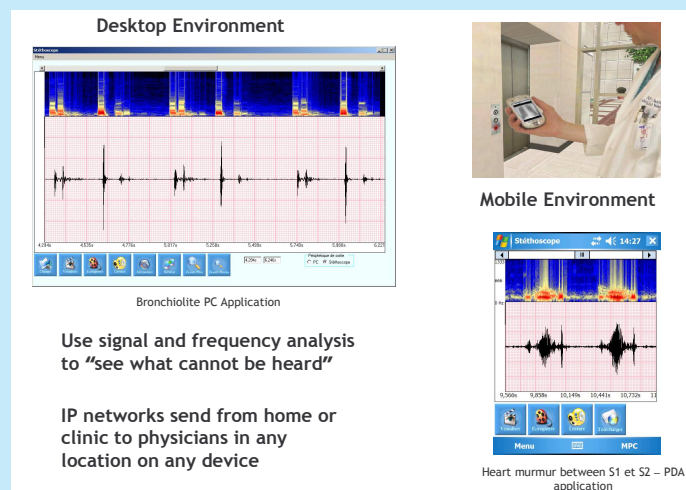


Figure 1 Continuing research to enable more time for patient care

On the left side of the figure above, the patient is showing symptoms of wheezing and a murmur. The images were captured using a digital stethoscope and the data was transferred wirelessly onto the home network using contemporary 'Bluetooth' wireless technology.

### Better skills and education

Better access to information resources for every student at every stage of their education is one of the keys to Australia's education system in 2020.

Australian workers, with their growing dependence upon a knowledge based economy, have also felt the increasing need to maintain the currency of their skills. Knowledge turnover in many professions continues to accelerate<sup>3</sup> and as technologies and techniques in all sectors continue to evolve at an ever-increasing pace, people need to refresh their training far more than previous generations.

Broadband was the key to making this happen. What used to be called “distance learning” is now commonplace regardless of where people live.

Back in 2008, when broadband access transformations started to take place in many different parts of the world, the Australian government recognised the emerging opportunity for Australian universities to offer additional full-fee paying positions to distance-learners living overseas. Similarly, with the roll out of Australia’s NBN, foreign universities with specialist capabilities started to target Australian students and compete with Australian institutions.

By implementing a policy which foresaw and supported an expanded export role for Australian knowledge, the government was able to provide Australian educational institutions with an early lead in the international distance-learning market, establishing firm ground upon which to secure its position in 2020.

## *Telecommuting is a way of life*

A significant proportion of Australia’s workforce - even some of those in service industries - have realised the benefits and potential of working outside what in 2008 was considered to be “the workplace”.

Twelve years ago, we expected that only certain types of workers could realistically work from home. White collar professionals, consultants and knowledge workers like engineers, project managers, accountants or logistics suppliers - the workers who’s roles depend upon “information and communications technologies” (ICT) - were expected to benefit most from telecommuting.

But in 2020, telecommuting has extended into a much broader range of industries. The mining industry is a case in point.

Even as far back as January 2008, Rio Tinto’s chief executive unveiled the company’s operational vision for the Australian mining industry of the future. In 2020, remotely controlled robotic technologies are operating in the Pilbara allowing mining operations to be centralised where it is most convenient for the company.

Equipping mines with driverless trains and trucks and operator less drilling equipment has enabled skilled mining specialists to work 1300 km away at a new centre in Perth. The company can now apply skills as and where they are needed, lowering production costs and reducing extraction and processing times.

Occupational health and safety has also been dramatically improved in the mining and other heavy industrial industries. For the workers, broadband technologies mean more job opportunities, less time away from their families and a healthier work environment.

These same workers and many of their fellow Australians are also able to market their capabilities throughout the world, building on their experience and skills as they work.

Whether they know it or not, each and every one of these workers owes the improvements in their lifestyles to the decisions we made back in 2008 when we built a broadband network capable of much more than simply supporting “the internet”.

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<sup>3</sup> Cetron, M.J and Davies, O. 2005, *Trends Now Shaping the Future*. The Futurist; pg. 37.

The benefits for company bottom lines have also been immense. Back in 2008 British Telecom, in addition to boosting overall productivity for the company, saved £6,000 for every full time teleworker employee per annum. Today the teleworker is a built-in feature of Australia's lean, competitive, productive economy.

That means more job opportunities within an organisation and a larger overall 'pool' of employment choice in the market. Organisations operate across unlimited territory because working families are no longer constrained to living within easy commuting distance of "the workplace".

Being at home to take delivery of a package or waiting for a tradesperson to fix the washing machine no longer affects peoples' productivity or availability. Visiting a local doctor used to mean taking a day off work. Today it need only mean half an hour away from the virtual office.

Australia in 2020 is an increasingly integrated part of the global economy because tasks can be accomplished outside traditional office hours, making it easier to collaborate beyond the local time zone. As Trade Minister in 2008, Simon Crean articulated a dream of enhancing the service sector's proportion of Australian export revenue. In 2020, that dream has been fully realised - and then some - with Australian workers and businesses able to provide their services from wherever they choose to wherever they can find a market.

### *The social benefits of telecommuting*

The social benefits of telecommuting in 2020 are immense. What was in 2008 an emerging crisis over caring for aging relatives without 'going part time', has now been resolved. Today working families are able to manage the demands of caring for dependents while still 'having a life'.

Through telecommuting for at least some of the time, fewer Australian parents now require full-time long-day-care services for their children. Instead they use more flexible part-time placements. The government's role over more than a decade - encouraging a gradual shift towards more flexible child care placement - was important in supporting the shift towards part-time telecommuting.

As a result, the demand on full time childcare placements - from parents for whom telecommuting is not an option - is much lower than had been anticipated a decade earlier.

The 'digital divide' that denied world class broadband to remote Australians is a thing of the past. Socio-economic inequality created by Australia's 'tyranny of distance' has largely disappeared. Kids in remote parts of the country have just as much chance of competing for educational opportunities, jobs, income and business opportunities as do their peers in the cities and towns.

Transport and other costs once borne by business and the community alike are now a thing of the past. Pollution, traffic congestion and time spent in transit better spent kicking a footy with the kids have been dramatically reduced.

### *Environmental benefits of telecommuting*

Almost 20 years ago in 2002, transportation activities in Victoria generated 16.5% of the state's overall greenhouse emissions, proportionally up by more than 17% since 1990 and

expected to rise a further 16.4% by today<sup>4</sup>. A 2007 Australian study<sup>5</sup> suggested that a 5% reduction in daily trips would reduce Sydney's greenhouse emissions by 17% and by 2011, would lead to savings of more than 10% in road maintenance, accidents, motorists' time and fuel costs. Expressed per household, the annual savings were expected to be \$3300.

From around the turn of the century, the US state of California required all large employers to make provision for a proportion of the total of hours worked per week to be conducted away from the traditional office. The state's primary motivation was to address the increasing problem of road congestion in its major cities that had been previously spiralling out of control, diminishing quality of life for Californian residents and exacerbating its already major air pollution problems. The programme was first introduced when the earliest high speed Internet connections became available. During the next decade of the programme's operation, the initiative has proven itself through measurable reduction in congestion.

Australia learnt from the Californian experience. We built the right broadband network to support telecommuting. And government encouraged employers to change the way they did business to make telecommuting work.

Initially, only a small proportion of the Australian workforce found it feasible to work from home permanently. However a much larger number discovered working from home one day per week increased productivity because routine workplace disruptions could be avoided and they could focus on the task at hand. They also realised that by avoiding the commute (which seemed to be taking more time year after year), they could simultaneously 'spend more time at work' but still 'have more time at leisure'.

The benefits of even moderate levels of telecommuting also accrue for those who continue to commute. Lower congestion levels naturally reduce queuing and improve traffic flow. Getting cars off the road reduces travel time just as it happens during school holidays.

In 2020, through better use of video and other communications enabled by modern broadband services, the amount of air travel has also been reduced. Every meeting conducted on-line significantly reduces business costs and travel.

## ***National disasters and emergencies***

Even before climate change, the Australian continent was a harsh and unforgiving environment. In 2020, just as in the past, unpredictable emergencies occur regularly. Fires, floods and cyclones seem to be monthly occurrences somewhere across our vast nation. When an emergency or disaster strikes, dealing with these situations requires reliable and dependable communications.

Fortunately, the broadband network deployment that commenced in 2008 was engineered to accommodate unprecedented levels of traffic - such as occurs when families and friends attempt to contact each other to provide assurance they are safe during an emergency. Higher traffic volumes are sustained even when major network routes have been damaged in the disasters. Continuous power sources were engineered so that equipment continues to function until emergency maintenance crews arrive at the scene. Facilities were constructed to withstand floodwaters and heat, earthquake and attack.

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<sup>4</sup> Commissioner for Environment Sustainability, Victoria, *Commuter Transport - Mode efficiency, mode choice and environmental impact in Victoria*, 2006, The Office of the Commissioner for Environmental Sustainability

<sup>5</sup> Nairn, R J., 2007, *Broadband telecommunications and urban travel*, Telecommunications Journal of Australia 57 (2 and 3): pp. 26.1 to 26.9.

## *Better government services*

Twenty years ago, governments first put their toes in the 'e-government' water. Back then, the private sector provided many more and (often) better quality online services. In 2008, *The Economist* magazine's Special report on e-government described government electronic service delivery around the world as "government offline", arguing that "despite heavy spending, progress has been patchy".

Today, in 2020, Australia has caught up with countries like India and China which leapfrogged the first world on government service delivery about ten years ago. Smart thinking, strategic planning and a well-designed broadband network enabled government agencies to restructure what they do and deliver services designed around citizens' needs. In the process government structures, practices and cultures were updated and made more efficient.

Providing online availability of government services was an important way to improve their accessibility. Isolated families living a long way from regional centres can interact without the need to embark upon long round trips to their nearest regional centre. Farmers experiencing heavy workloads during daylight hours can access services when their day's work is done and regular office staff has long since gone home. Busy office workers can perform simple routine tasks such as renewing registration or paying their annual council rates without having to take time off. The alternative - to leave their workplace, travel to an office and to stand in a queue for an extended period of time - is "so ten years ago".

With citizens able to access government services via broadband enabled devices whenever and wherever they choose, government service delivery has become more effective over a broader range of service areas - and at a lower cost.

## *The Media and Content Industry Environments*

In 2020 the Australian media and content industry sector has:

- a smaller number of access / infrastructure players,
- a larger number of applications / service players - dependent upon wholesale 'Bitstream' offerings from the access sector,
- little or no distinction between 'television', 'print', 'radio', 'pay TV', 'movie rental' and 'the Internet',
- only a small role for purely local content provider organisations,
- a large role for national content providers. Locally relevant material is introduced using interactivity to enhance generalised national content.

The greater share of revenues and margins now rests with the application sector rather than the access sector where it once resided.

Those content and application providers that recognise consumers' desire for networking simplicity and convenience are succeeding. New commercial relationships between application providers, content owners and developers mean people are more easily able to use broadband content as part of their everyday lives.

## *Looking back from 2020*

Broadband is ubiquitous. But we didn't get here without good planning and careful implementation. Many things had to be done right from the moment we decided to build a national broadband network.

### 3 What do we need to do today?

In 2020, Australians will take the reliability of the nation's broadband infrastructure for granted, but today's network is the result of the careful specification, design, engineering and evolution the government commenced in 2008, and programmes of ongoing maintenance in the years that followed.

This section of the paper outlines what we need to do - starting today - to get it right, as well as some of the technical risks we must manage to avoid getting it wrong.

Much of the language is out of necessity more technical, as a level of specificity is required to impart the required information. However our recommendations are summarised at the end of the document and Alcatel-Lucent is more than happy to respond to any and all questions that may arise.

#### *Getting it right*

#### *Removing the 'digital divide'*

Today's 'digital divide' can be seen in a number of ways. In one sense, a line separates those who have understood and embraced the new information technologies and those who have not. A different line encompasses the subset of the community that can afford and justify a subscription to a premium broadband service. Yet another differentiates between those who have access to each of the various broadband technology options. Further distinction can be drawn between those who live closer to a telephone exchange than 1.5km and can confidently expect a 12 Mbit/s ADSL2+ service to remain reliable in the long term as take-up grows versus those that cannot. There is yet a further division between urban and regional subscribers and their varying opportunities to access competitive service offerings.

In Alcatel-Lucent's view, the success of the NBN project should be judged on the extent to which it has been able to diminish each one of these types of 'digital divide'. Yet through the deployment of the NBN, it is virtually inevitable that new forms of 'digital divide' will manifest.

DSL and wireless broadband access technologies are both inherently 'adaptive'. When conditions are best (when propagation distance or loop length is shortest and interference minimal) throughputs and reliability are highest. It is a strength therefore of these technologies that they can adapt to sub-optimal conditions and continue to provide service. Yet in comparison with ideal conditions, adapted services at the extremity of practical distance limits require compensation to mask the inevitable transmission errors and are only capable of lower throughput.

From the choice of technology available, an appropriately engineered NBN can certainly deliver reliable 12 Mbit/s services to 98% of Australians. Reliably assuring this minimum to those furthest from network equipment via DSL or wireless implies four or even more times this rate for the very small minority of subscribers fortunate to be experiencing theoretically ideal conditions. Ironically, then, deploying fibre in an FTTN and Wireless broadband context to address the original 'digital divide' - which separated those for whom access to at least 12 Mbit/s was and was not available - would create a new divide at a higher throughput rate will inevitably be acknowledged.

But when deploying fibre, it is likely that a proportion of the NBN footprint will be upgraded using superior Fibre to the Premise (FTTP) technologies. Typical FTTP deployments can

deliver peak throughputs of several gigabits per second and can be dimensioned to indefinitely sustain hundreds of megabits or more to every subscriber.

The capabilities of FTTP substantially exceed the NBN's minimum 12 Mbit/s requirement and promise to serve its communities for the longest investment life of all the technology options. Yet it is clear that NBN communities served by FTTP will establish yet another digital divide compared to those served by less capable wireless or other fixed technology options.

Alcatel-Lucent welcomes the government's initiatives to engage with industry to develop a NBN and commends its willingness to recognise and address the problems of today's 'digital divide'. The issues we have described strongly suggest that it is unlikely to ever be feasible to eliminate all forms of the 'digital divide' and foreshadows the need for the government and industry to continue to work together to evolve the availability of broadband services during the coming decade and indeed beyond.

### ***Ensuring all Australians have competitive access to the lowest cost telecommunications services***

Up until now, deployment of broadband infrastructure in Australia has been ad-hoc and non uniform. There are no national standards or agreements upon architecture, configuration or broadband capability sets (known generically as "Bitstream" standards). There is no national agreement upon the configuration, location or requirements at the customer broadband network boundary, or guidelines to establish common Point Of Interconnection facilities for different access networks serving consumers in the same areas. In other words, access providers to date have independently adopted their own approaches and solutions.

For example, greenfield telecommunications deployments have, in recent years, been increasingly selected on the basis of a competitive tendering process. In those areas, it is common to find different fixed infrastructure providers serving adjacent suburbs, with non uniform access configuration. Alternately, competitive exchange based DSLAM<sup>6</sup> deployments have proliferated into hundreds of communities. Quality of Service (QoS) and other key Bitstream parameters have been independently chosen and implemented by the respective DSLAM investors.

To compound the situation, it is possible there will be a variety of technology solutions which combine to meet the NBN's requirement of reaching 98% of the population. More than one access provider organisation could be involved in the overall NBN solution.

### ***Keeping the 'rail gauge' consistent***

The outcome would be a little like having different rail gauges in different parts of the country, but at the local community level rather than per state. It's important to consider the potential consequences.

The NBN is important for Australia because ubiquitous and capable broadband encourages innovative development of new and beneficial applications. It is to be expected that application providers will focus their primary attention upon consumers served by the majority (or most uniform) access implementations.

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<sup>6</sup> The acronym DSLAM stands for Digital Subscriber Loop Access Multiplexer and is the equipment, typically installed in a telephone exchange or a node-based cabinet, which provides broadband access services.

The possibility of additional deployment, interconnection or support costs results in a commercial disincentive for an application provider to offer services to consumers dependent upon minority infrastructure. Those consumers face the real possibility of reduced choice.

In the coming decade, as more capable broadband infrastructure is deployed throughout Australia, it is imperative that the consequences of non uniform implementation are recognised and avoided. With regard to the NBN, the government is yet to issue guidelines establishing minimum expectations with regard to service quality and the support of applications beyond High Speed Internet.

Alcatel-Lucent encourages the government to recognise the importance of achieving Bitstream uniformity in order to assure consumers of the best choice and lowest cost availability of world class broadband applications which will include but not be limited to entertainment, information and communications. Getting Australia's broadband rollout right for 2020 involves taking definitive action now to assure all stakeholders work together with common understanding of the longer term goals.

We believe the federal government will incorporate clear guidelines about the need for a Bitstream standard into the design specifications for the NBN. This is encouraging and must be accompanied by careful planning and discussion, agreement and collaboration with industry.

## Building for future demand

It is important for Australians to remember that today's NBN investment decision is not static and it will not last forever.

Since the 1980s, we have all experienced just how quickly information technologies evolve and become obsolete. Although 56 kbit/s Internet access was considered to be 'fast' in 1998, it requires 24 Mbit/s speeds (that's 24,000 kbit/s) to qualify as 'fast' today. Although the question may be uncomfortable, we need to seriously ask ourselves 'how long will the NBN investment last before we will need to consider its replacement?'

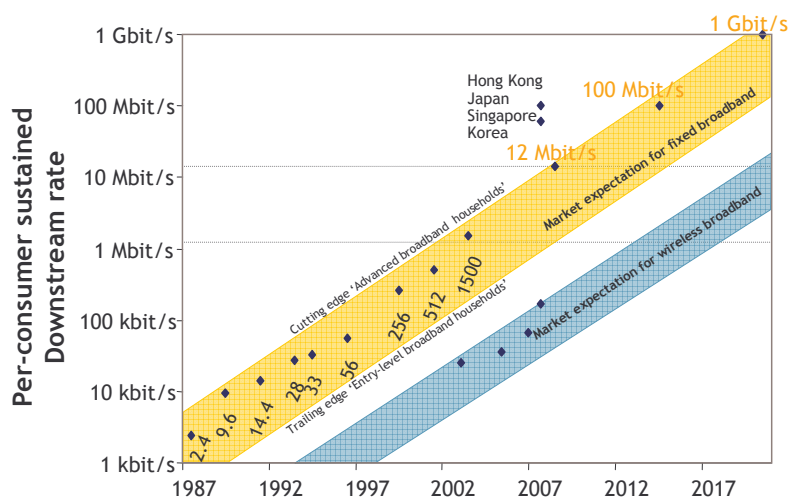


Figure 2 Broadband - relentless evolution demands greater capacity each year

Figure 2 illustrates that by 2020 early adopters and advanced broadband households will be expecting around 1 Gbit/s access to broadband. Importantly, the advanced applications offered by the 2020 broadband industry will have even driven lower-end broadband households to require of the order of 100 Mbit/s access. The NBN design needs to competitively meet the requirements of both lower-end and higher-end consumers even though each of these groups require markedly different features and capabilities.

Most commentators would agree that the ultimate access deployment would involve rolling out fibre all the way to every Australian's premises. Setting aside the cost of such an exercise, the complexity of the logistics and public works for such an undertaking would take much longer than a more modest Fibre to the Node (FTTN) undertaking. Appropriately engineered FTTN access capabilities will certainly satisfy Australia's medium term broadband requirements and can be deployed to a much larger proportion of the community in an expedient timeframe.

There can be no question that different access technologies provide different technical capabilities. Less capable technology options and less capably engineered proposals might satisfy short term NBN requirements, but will inevitably require expansion, reinvestment or outright replacement in an earlier timeframe than more capable proposals. Proposals aimed at barely satisfying minimal requirements will satisfy the nation's immediate broadband needs, but will inevitably fall short of the nation's requirements before the year 2020.

In choosing the successful NBN tenderer or tenderers, the government must unavoidably make the trade off between more expedient short-term investment and more capable longer-term investment. Technology options exist now to satisfy either approach, and the choice will ultimately fall to the government.

Practically, the NBN is therefore likely to comprise a combination of wireless, FTTN and FTTP technologies. The government's challenge will be to apportion these to maximise the benefits and defer the inevitable future need to revisit broadband access issues for as long as practical.

## *The competitive environment*

Industry and consumer groups have been increasingly vocal in calling for reforms to competition and regulatory approaches. The crescendo of discontent highlights dysfunctionality and the need for a circuit breaker. Australia's new government has flagged its intention to review the telecommunications industry model in order to support its NBN initiatives.

During the past few years, considerable attention has been directed towards exploring alternative forms of separation between infrastructure and services. The world's broadband markets provide many examples including, but not limited to, forms of separation. Alcatel-Lucent wishes to be clear that it neither criticises nor endorses any particular approach but notes that enforced operational separation of incumbents distracts effort and investment into process and governance re-engineering rather than network investment.

An important lesson to be learned, however, is that the ideology of separation or any other approach cannot on its own guarantee a specific outcome, particularly with regard to ongoing investment and transformation. Indeed, different approaches could emerge that will ultimately be considered preferable to those on the table today. Ultimately, the Australian government will be responsible for evaluating and choosing amongst all the alternatives or for adopting a uniquely Australian approach.

The NBN as currently proposed is set to impose 'open access' requirements upon its investors. These requirements will establish a form of industry separation that promotes an 'access' sector (concerned with deploying and maintaining physical NBN infrastructure) and an 'applications' sector (that will wholesale bitstream connections from the access sector to deliver consumer services).

If the NBN proceeds as such, Australia's future legislative and regulatory environments need to assure each of these sectors will be independently viable. Assuring application providers the ability to successfully innovate to deliver Australians new and compelling broadband services will secure the longer term success of our fledgling knowledge economy.

Similarly the proceeds from access need to provide an adequate return on the investment and to cover its ongoing maintenance.

Given that Australia's journey towards what may ultimately become ubiquitous 'FTTP' deployment is only just beginning and that there will likely be several intermediate stages along the way, further access investments will be required through the coming decade and beyond 2020. The timing and level of future investments can only be estimated within a framework of a specific governmental vision for Australia's long-term broadband requirements.

The government has already indicated that each NBN project respondent will be invited to outline specific legislative and regulatory requirements upon which their project proposals are founded.

If these ongoing investments are to be funded by the access industry itself, it is imperative that the forthcoming legislative and regulatory reviews assure access sector participants certainty. Access returns should provide for (a) the costs of achieving a return on the initial investment, (b) the additional cost of maintaining the NBN and most importantly, and (c) a cash flow from which ongoing investment and transformation can continue viably in to the long term future.

### *Bringing fixed and wireless together*

Although we currently perceive a difference between mobile and fixed telephony services (indeed we are encouraged to do so because they are marketed as independent services) we will increasingly come to consider wireless and fixed broadband together as a single 'broadband access' product. Consumers will become more intolerant of applications and application providers which support one access technology but not the other.

The market will likewise become increasingly intolerant of devices that are locked to a wireless or a fixed access network and which cannot seamlessly reconnect to the best available connection as we move about at home, at work or in between. In the event that Australian broadband services continue to be constrained by monthly download caps, consumers will prefer plans that establish aggregate wireless plus fixed caps rather than plans which continue to treat these independently.

Unified wireless and fixed broadband could be achieved in either of two ways: application providers could establish independent relationships with individual wireless and fixed access providers or wireless and fixed providers could work directly with each other to achieve the same ends. The latter will be technically more efficient. The former is more likely in the current industry environment.

Up until now, the government has encouraged a competitive model in which wireless broadband access providers compete head-to-head with fixed broadband access providers. During earlier times, when broadband services were very new, this mode of competition made greater sense. Looking towards the future, we will increasingly question the rationality of setting wireless and fixed access modes in direct competition with each other.

The tremendous advantage of wireless access is that there are no wires or cables. With ubiquitous coverage, subscribers can connect to the network wherever they are, whenever they want. Wireless access is convenient and imperative in today's highly mobile society. However, because wireless radio spectrum is an inherently shared medium and because natural obstructions can significantly impair performance and range, wireless access cannot assure us of consistent reliability and throughput. Additionally, because wireless spectrum is shared across the entire community, its ability to simultaneously support the broadband demands of thousands of households and commuters is limited.

The converse advantage of fixed access is its wires and cables. Compared with wireless, many fixed technologies dedicate a separate wire or cable to a single or only a small number of end users. Appropriately engineered, today's leading fixed technologies can reliably sustain tens of thousands of times the information flow to a community of tens of thousands of subscribers when compared with typical deployments of today's wireless technologies. The practical capabilities of contemporary fixed technologies are foreseen to remain significantly greater than the capabilities of contemporary wireless technologies. But you'll never be able to drive down the street or go for a run and enjoy the enhanced capabilities that fixed broadband connections can offer.

Today, we are starting to see the earliest emergence of consumer products that are capable of leveraging a combination of fixed and wireless access. As consumers, we are sometimes on the move and we are sometimes stationary. We already require both fixed and mobile connectivity and will continue to do so in the future. However, today's competitive model has delivered fixed and wireless solutions that are inherently independent. Whilst we can 'roam' from base station to base station, there is no straightforward solution that allows us to 'roam' from wireless to our fixed service at home.

In 2020, most consumers will prefer devices that connect seamlessly and effortlessly to either fixed or wireless networks without their direct intervention. Competition and industry policy will have a significant bearing upon establishing an environment that delivers this outcome sooner rather than later.

Competition policy which aims to set wireless providers directly against fixed is incompatible with increasing consumer desire to seamlessly integrate broadband applications. Today's policy approach assumes that wireless and fixed providers will always remain direct competitors. Given that Australia is on the verge of reviewing its broadband technology and industry options, now is the right time to consider policies which encourage and reward collaborative industry approaches between wireless and fixed operators, rather than driving the wedge between them deeper than it is already.

## *Regulation and the Government*

In 2020, broadband services will be considered to be a universal right, even if they have no direct legislative or regulatory recognition as such.

The last major review of telecommunications legislation occurred in the 1990s. In the relatively short period since then, the world has seen the emergence of the narrowband Internet, broadband Internet and now wireless Internet.

Australia is on the cusp of a national broadband project and a review of telecommunications legislation is arguably long overdue. Many in the industry are looking forward to contributing to a broad review of telecommunications legislation and regulation coincident with the start of the NBN project.

As the project proceeds, Australians will more clearly recognise the importance of the social and industrial changes that precipitate during deployment and ongoing development of the NBN ecosystem. Ongoing technological advancement and emergence of new applications and devices will continue to challenge the competitive landscape and relationships between industry participants. It is likely that more frequent regulatory and legislative reviews will be required than we have seen in the past.

Assuming economics will dictate that the present NBN project will be a mix of FTTN and FTTP technologies, it is likely that an industry, legislative and regulatory review will be required towards the middle of the next decade with which to plan the next step. Thus, by the year 2020, the nation will be looking towards its fourth generation of modern telecommunications and competition legislation.

The nature of the government's role to participate in the projects, either as a partner, an overseer or a contributor of funding will still likely feature significantly and frequently during public discussions.

Traditionally, the broadcast and telecommunications industries have been subject to their own specific legislation. Amongst the many underlying presumptions is the premise that the print, broadcast and telecommunications media maintain their own independent means of delivery to somewhat independent markets.

In this paper, we have attempted to underscore the importance of considering 'access' and 'applications' independently. Increasingly, the same physical delivery mechanisms will be used for print, broadcast and telecommunications services and the Australian legislative and industry policy approaches should be encouraged to recognise this distinction.

Before 2020, today's cross media ownership laws will have outlived their suitability. The increasing volume of international network-borne content and user-generated content will demand we rethink requirements about issues such as media diversity, editorial independence and content control.

### *Economic considerations - FTTP is preferable*

Ultimately, the aggregate cost of the NBN project will depend upon the chosen mix of access technologies and on specific conditions encountered on a community-by-community basis as the network is deployed. In some regions of Australia for example, the prevalence of rock and gravel throughout a community would mean significantly greater civil costs. Outer metropolitan or regional communities characterised by larger lot sizes and lower living densities will mean fewer households can be reached within a given radius of coverage, and fewer subscribers can be served per kilometre of trench or per access hub. NBN alternatives requiring per-household rewiring will incur up front cost regardless of whether the householders choose the highest tiers of NBN service on day one or not.

The practical effectiveness of any broadband solution will be determined by a combination of many attributes including;

- the guaranteed maximum loop or propagation distance - especially an issue for FTTN or Wireless deployment,
- the technical capability of the proposed technology (e.g. which FTTP, DSL or wireless standard and its revision is proposed for the deployment),
- the effective spectrum available per DSL line or to be shared wirelessly per unit area of the community,
- the capacity of backhaul and the dimensioning ratio which effectively sets the sustainable per-subscriber average throughput.

FTTP promises the longest term investment life and by far the greatest broadband access capabilities. However, for all of the reasons noted above, a 'brownfield' roll-out of FTTP technology would incur the greatest per household cost.

On the contrary, 'greenfield' fixed infrastructure projects are different because trenching and per-home installation is required regardless of the chosen broadband access technology. If the developer needs to dig a trench anyway, they're better off installing forward looking fibre rather than copper access, especially because the unit cost of a fibre cable is similar to that of a copper cable. FTTP proposals are likely to be more attractive than either FTTN or Wireless in greenfields.

FTTN options leverage existing community telephone cabling to minimise the need to perform per household investment. Alternate FTTN proposals need to be carefully compared

on the basis of guaranteed capability and expected adequate service life. For an FTTN provider to guarantee a particular minimum throughput, many FTTN communities might require reconfiguration of local distribution networks to reduce maximum loop length. In order to minimise service disruption at the time of cut-over from today's access to FTTN, effort and planning is required to streamline the cut over to FTTN. To assure the same service reliability as today's exchange based network, the FTTN needs to be appropriately specified and dimensioned.

The capability of alternate wireless proposals ultimately falls to available quantity of spectrum and to the number of households sharing a given spectral allotment. It would be very difficult to mount a successful wireless business case engineered to meet the sustained throughput capability of a contemporary FTTN or FTTP deployment in urban or major regional contexts. For wireless access to achieve similar sustained throughput capability, a substantially greater number of base stations would be required to reduce the number of consumers simultaneously sharing each base station's finite capacity.

Regardless of the chosen access technology, all access options require careful examination of backhaul. There would be little point in deploying a multi-megabit access network if the dimensioned capability of the FTTP, FTTN or wireless backhaul can only sustain kilobits per household. In this sense, 'backhaul' means the capacity of the connection between the access node and the application provider. Of course, backhaul from the application provider to the Internet is a separate consideration and presumably beyond the scope of the NBN.

To effectively compare and evaluate broadband access proposals, prospective investors should be required to provide considerably greater technical disclosure than has been common to date. The NBN will be the first significant project for which full technical disclosure is important, however all future access proposals of a public nature should be subject to greater technical scrutiny than ever in the past so that the community is assured transparency and confidence in understanding the capabilities on offer.

## *Managing technical risks*

Planning the NBN will require a lot of careful consideration and specification if the outcomes described above are to be assured. As Australians plan the NBN, it is equally important that some attention be directed to the potential consequences of deploying an inadequate NBN.

### *Scenario 1: Vulnerability of NBN applications to deliberate attack*

It is the year 2020. A terrorist group launches an Internet worm similar to the 'Slammer' worm which crippled the Internet on January 23<sup>rd</sup>, 2003<sup>7</sup>. Within the space of 15 minutes, 90% of Australia's computers have been 'infected' and data traffic levels have escalated to 100 times their normal volume. The NBN is overwhelmed by traffic and legitimate applications start to fail because connectivity is effectively severed. Both wireless and fixed NBN implementations are impacted.

Without an adequately specified definition of NBN 'Bitstream' that carefully incorporates engineered Quality of Service (QoS) assurances, the NBN remains incapacitated for days, severing effective connectivity to every application delivered through the NBN.

In 2020, the NBN will have virtually replaced all other communications access infrastructure. There are no alternate means to efficiently communicate solutions for the terrorist 'infection'. Telephony and other forms of communication dependent upon an NBN

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<sup>7</sup> Refer to [http://en.wikipedia.org/wiki/SQL\\_slammer\\_\(computer\\_worm\)](http://en.wikipedia.org/wiki/SQL_slammer_(computer_worm))

with inadequately specified 'Bitstream' remain ineffective for many more days. With Australia's civilian communications knocked out like this, the country is brought to its knees.

### ***Scenario 2: Diminishing communications reliability as traditional platforms age***

Now in 2008, for approximately the past decade, there has been minimal development and investment in traditional telephony switching platforms. Carriers, having invested in the digitalisation and upgrading of their telephony networks during the 1990s, have redirected the bulk of investment towards broadband access and backhaul. Telecommunications providers have been carefully monitoring competitors and international trends in voice technologies and deferring further investment in telephony platforms in anticipation of the start of a major shift towards Voice over IP (VoIP) in the access network.

So in 2008, the majority of the world's telephony services continue to be delivered using traditional analogue telephony technology, much of it deployed during the 20<sup>th</sup> Century. On the whole, the older platforms are continuing to provide reliable service because the telephone exchanges and access platforms were designed and manufactured with an intended service life of between 20 to 30 years. However, as the platforms continue to age, engineers expect the hardware failure rates to progressively increase. Without further investment, the reliability of telephony access will progressively diminish year on year.

If the NBN is deployed without QoS, telephony services can continue, for the time being, to be delivered using today's traditional analogue means but ultimately, there will be no alternative but to retire the obsolete telephony access and exchange equipment and migrate telephony directly on to the only other ubiquitous access network: the NBN.

Without an adequately engineered NBN 'Bitstream' capability, the quality of telephony cannot be assured. Telephony will be 'just another broadband application' and telephony traffic will be treated equally alongside other forms of NBN traffic. The quality of a voice connection will be subject to the whims of the instantaneous traffic levels for other applications sharing the NBN. At times, telephony calls can be expected to drop out or become unintelligible just as mobile telephony calls today degrade at the fringes of reception areas.

### ***Scenario 3: Susceptibility of life-critical applications to one-off events***

During the next ten years, the health sector is expected to dramatically transform the manner in which outpatient care is administered to remote and homebound patients.

Imagine we have been transported forwards into the weeks of the 2016 Olympic Games. Australian swimmers have qualified for the final of the freestyle relay and the race is underway. In a controversial finish, the team is disqualified. Spectators in the aquatic centre immediately upload footage onto the YouTube web site and onto Peer-to-Peer networks. During the hours that follow, Australia's NBN, which has become the nation's primary telecommunications access platform, is brought to its knees because of the overload as incredulous fans download footage and participate in massive online discussions.

If the NBN has not been engineered to assure reliability and quality for critical applications, important broadband applications such as outpatient monitoring will start to experience deterioration and even connection failure as the NBN overload impairs access. Patients will be left without adequate medical supervision.

### ***Specifying the NBN to avoid these risks***

It is important that the Government carefully considers the *process* of building the NBN in addition to considering the potential outcomes and objectives discussed in this paper.

The process necessary to adequately specify and build the NBN might be more familiar than most people realise. As an illustration, consider the approach that a prospective home owner might adopt when considering building a new home.

After choosing a block of land, prospective home owners need a house plan. They discuss their needs with an architect who draws up detailed plans. The prospective home owners then negotiate with builders before contracting to commence the construction. In order for the prospective home owners to be confident that their new home will meet all their expectations, it is critical that the plans are sufficiently detailed that there can be no doubt about the how the finished home will turn out. It would be unthinkable for a prospective home buyer to contemplate giving a go-ahead on the basis of a rough sketch alone.

The process for selecting the NBN should be similar.

Thus far, the government has established that the NBN must achieve a 12 Mbit/s minimum access rate for at least 98% of the population. These specifications provide important clarity about the NBN but when compared with the kind of detail a house plan is required to contain, 12 Mbit/s to 98% is like confining the specification to a brief note stating 'the home's roof should be 3m above the ground and cover a land area of 150 sq metres'.

- How high should the floor be above ground level? (Unlike today's Internet access, will the NBN offer minimum throughput guarantees?)
- Will all rooms be identical or will the home have a dedicated kitchen, bathroom and bedrooms? (Will the NBN be designed to support one application, or will it be designed to support multi-service, guaranteeing appropriate quality of service for each application?)
- Where should doors and windows be placed and how many of them should there be? (Where will application providers interconnect with the NBN and will the points of interconnect for different access deployments be required to be in the same location for each service area?)
- How much weight should floor bearers be specified to support? (What level of abnormal broadband traffic should the NBN be engineered to tolerate before service degradation becomes evident?)

In the absence of detailed technical specifications, Australians will remain uncertain about the kind of NBN capabilities prospective tenderers are offering. The capabilities of the network will be unclear until the network has been constructed and subscribers have been connected in sufficient volume so as performance can be ascertained. If the NBN turns out to be inadequate, by then it could be too late to set the project on a surer footing.

To be adequately specified, the government must ensure it establishes guidelines about the level of detail tenderers will be expected to provide in their responses. Appropriate technical evaluation will be facilitated by submission of detailed 'Bitstream' specifications as a part of each NBN proposal.

## 4. Recommendations

Government, industry from all sectors of the economy, and community stakeholders must together articulate a clear national vision encompassing:

- A recognition that the NBN, as it is currently proposed, will segregate today's broadband industry into distinct 'access' and 'applications' segments. A definitive set of objectives should be specified for each segment against which responses for the NBN project should be framed.

- A recognition that the NBN will enable important applications beyond High Speed Internet, from outside the traditional telecommunications industry.
- A complementary mix of copper, fibre and wireless services to maximise national availability of capable broadband access.
- Effective and complementary use of fixed and wireless solutions rather than an outdated competitive model between fixed and wireless.
- Recognition that FTTN and wireless access cannot satisfy Australia's broadband needs indefinitely and that ongoing access investment will be required.
- A programme of appropriate regulatory and legislative reform to encourage ongoing investment for the introduction of emerging and improved access technologies
- Better alignment of broadcasting and telecommunications legislation to accommodate a more converged market.
- Other industries that stand to benefit from the NBN and which will help Australians address climate change, health, education, transport and energy.
- A requirement for government agencies to move to an online service delivery models for all Australians.

Alcatel-Lucent encourages the Government to specifically solicit and compare the respondents' own:

- visions for viable competition in both the access and applications industries,
- views about Australia's future broadband requirements, how quickly these will evolve vis a vis other broadband access markets around the world and our placement amongst the OECD rankings,
- visions about the need for ongoing access technology evolution in the Australian marketplace to extend the capabilities of higher NBN performance to more of the Australian population,
- views about the differences between the responsibility of the private sector and government in delivering these visions.

The Government's NBN vision can become the template against which the design and progress of the NBN can be measured and monitored to ensure that it serves Australia's national interest now and in to the future.