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We at TJA are grateful to Allan Horsley for his role as Guest Editor for the major theme of telecommunications policy gaps in this issue, in helping us to structure and source the eleven valuable papers we are publishing on this important theme. Allan of course brings to bear his past experience in helping influence Australian telecommunications policy, as Managing Director of the Australian Telecommunications Users Group (from 1996 to 2001), as a Commissioner of the Australian Communications Authority (2001-5), and more recently as an Honorary Life Member of the industry group Communications Alliance. The Guest Editorial, which follows, brings out the more recent historical background to this theme, and summarises many of the important policy gaps identified by our eleven contributors: all of which focus on the National Broadband Network.

TJA is also grateful to Telstra for sponsoring this year’s Christopher Newell Prize competition, which encourages authors to contribute original papers on how telecommunications can be used to assist people with disabilities. The independent Judging Panel (comprising Professor Gerard Goggin, Dr Mark Bagshaw, Dr Milosh Ivanovich, Alex Jones and the Managing Editor of TJA, as chair) received five strong papers, with a diverse range of ideas. All five papers are published in this issue.

The three prize winners will be announced at an Awards Ceremony to be held in Melbourne on Tuesday 10 May. We are very pleased to announce that Telstra, who acted as sponsor for the Christopher Newell Prize in both 2010 and 2011, has volunteered to sponsor the Prize competition again in 2012 – underlining its long-term commitment to assisting people with disabilities.

Finally, this issue benefits from a timely paper by Warwick Davis, from Frontier Economics, on telecommunications economic regulation. This paper draws attention to the implications of the Australian economic regulator, the ACCC, finally stepping away from the use of hypothetical, and ultimately futile, cost models in setting access prices for Telstra’s fixed line network. His paper brings out the implications for the new national broadband company NBN Co, whose broadband access infrastructure will progressively replace Telstra’s copper access network.
This article introduces eleven papers published in TJA’s May 2011 issue (Vol 61 No 2) on the theme of policy gaps in Australian telecommunications. It provides a historical context for recent telecommunications policy development, and then provides a framework in which the individual papers’ identification of policy gaps can be usefully placed.

The Australian government's sole current review relevant to telecommunications is the Convergence Review, announced on 21 April 2011, and due to report by March 2012. Its prime purpose is 'to review the operation of media and communications regulation in Australia and assess its effectiveness in achieving appropriate policy objectives for the convergent era'.

This review is timely – it would have been timely even in 1997 – but with its emphasis on media and communications regulation for convergent digital media, it runs the risk of not giving much – if any – emphasis to several important policy gaps arising in the implementation of the National Broadband Network. These concern the design of the national public network infrastructure, the ongoing provision of traditional services, and the necessary education of end users.

When we put out feelers in February to a wide range of expert industry commentators and industry lobby groups, we found an enthusiasm to contribute short articles on a wide range of perceived policy gaps in Australian telecommunications, and this issue of TJA shows the results: eleven thoughtful policy papers.

The purpose of this introductory paper is to provide a framework in which the individual policy recommendations can be best understood in a holistic manner.

BACKGROUND: TELECOMS POLICY DEVELOPMENT SINCE 1981

Development of the Australian telecommunications sector over the past three decades, both economically and in regulatory aspects, has been based upon a consistent pattern of public consultation on new policies before proceeding to legislation.

In each of the three major steps, during 1988/89, 1990/91 and 1996/97, the Government published a 'White Paper' setting out its policy objectives and goals and sought community input. An 'Exposure Draft' of the implementing legislation was then published, again seeking public comment. Finally the legislation was presented to the Parliament and passed, largely with bipartisan political support.

The result was that the community and the industry had a reasonable understanding of what the intended outcomes were and how they would be achieved.
It was of course not all beer and skittles, especially after the overturn in 1997 of the industry-specific regulator Austel – which over eight years had learned a lot, the hard way, about the industry and was getting good at exercising its powers of arbitration – in favour of an economic regulator, the ACCC, which took several years to ‘climb the learning curve' concerning the tricks played by technically sophisticated telecommunications operators.

In that period, many parties sought to exploit gaps in the legislation and regulations to avoid complying with the intent of the legislation. The ultimate disaster was around the turn of the century, when twenty plus disputes were sitting with the ACCC at the one time. The ‘undertakings' element of the Trade Practices Act extensions, provided in 1997 to enable parties to develop practical and industry-based solutions, was deliberately not being used, as a means by some to game the system and delay outcomes that were not to their advantage.

Further, good quality customer service and a high level of end user satisfaction were not natural outcomes, and as a consequence heavy regulatory impositions were sometimes incurred.

This whole process since 1989 was, amongst other things, meant to bring an end to a huge monopoly by an enormous Government Business Enterprise, and to promote both infrastructure and service competition, all intended to be in the long term interests of end users.

**CURRENT POLICY GAPS**

Given the historical precedents, and the ongoing desire of the community and the industry to be consulted on changes in policy, it is surprising the development of the National Broadband Network was not preceded by any public policy White Paper.

In contrast, the community has had to largely rely on media releases to gain its understanding of Government objectives for the NBN.

The key elements of the NBN policy are currently:

1. 100 Mbps access for 93% of Australian premises by optical Fibre to the Home (FTTH) technology, and a minimum of 12 Mbps to the remaining 7% premises, using fixed radio, terrestrial (4%) and satellite (3%) to be implemented by 2018;

2. A Government Business Enterprise, NBN Co, to build the broadband access network ‘tails', to operate as a wholesale carrier only, and to be connected via Points of Interconnect (POIs) to private sector broadband carriers;

3. NBN Co to be potentially sold off (although this will be resisted by the Australian Greens) after it completes the national rollout of the NBN;

4. Telstra to be structurally separated into Retail and Wholesale arms, to solve the 20-year competition problem of a dominant, integrated wholesale and retail carrier;

5. The competition regulator, the ACCC, to decide the number and location of the POIs;

6. The wholesale pricing of the NBN to be uniform across Australia. (The Minister's declared aim of uniform retail pricing has been undermined by the ACCC's POI decision, as we will see below.)

Realistically the Policy Gap considerations fit into four baskets,

- infrastructure, involving matters relating to the design, construction and operation of the transport platform and the competition rules (including access and pricing principles) that should apply;
- service provision and service delivery operational policy;
- end user issues, including customer service and take-up, which impact on every member of the community;
- trans-sector policy for the digital economy, to ensure that the NBN delivers benefits across the entire economy.
ON INFRASTRUCTURE

Ros Eason points out that there is now confusion as to which body is expected to carry out technical regulation of the NBN: the ACMA or the Minister's Department – neither of which have taken an active public role to date – or the ACCC (which is meant to be the economic regulator of competition law).

By giving the ACCC sole responsibility for the POI decision, the Government has caused the ACCC, in its December 2010 decision on POIs, to make implicit engineering decisions on the future design of the NBN, for which the ACCC has arguably no engineering competence. Its December decision, in increasing the number of POIs from 14 to 121, drastically reduces the footprint and interconnectedness of the NBN, as well as undermining the NBN's original pricing policy goal of permitting uniform national retail pricing of basic access.

The numerous city-based Retail Service Providers without national broadband networks of their own will now need to use third-party wholesale infrastructure backbone carriers (such as Telstra) to connect them to regional POIs if they wish to provide national coverage. The wholesale charges set by the third party wholesalers will then undermine the ability of Retail Service Providers to provide uniform broadband access services across Australia.

Furthermore, as raised by Mike Rocke and Kit Wignall, NBN Co will no longer have any de facto role as a national transmission network planner for end-to-end Quality of Service (QoS) performance across multiple carrier networks – a role traditionally discharged by Telstra, which is vacating that role. There is no public agency or private company that has been designated by the Government to carry out this important function, vital to ensure that the national broadband network – on which our entire national economy will soon depend – will satisfy basic engineering requirements for end-to-end network reliability, redundancy and resilience.

Rocke and Wignall raise other serious network or transport layer issues which appear to have been ignored or at least not communicated to date. Failing to address how relevant international standards recommendations will be accommodated seems to be a big policy GAP.

Paul Budde also makes the point that a Strategic Framework for rollout is needed, which would no doubt address the performance and QoS issues.

Parts of the David Lee and Wayne Hawkins papers raise the equity of access and service issues, which need to be addressed in the infrastructure design and the related pricing principles to ensure all Australians share the benefit.

Ros Eason notes the marginalisation of ACMA at critical times in the development of the NBN. Rocke and Wignall also share the concern, making the point that there is a great opportunity for ACMA to lead.

ON SERVICE DELIVERY

Simon Hackett highlights the need for equality amongst all Retail Service Providers in the way they are offered NBN services by NBN Co and how they interoperate in a fair and reasonable way.

Using the examples of local number portability (LNP) and peering, he makes it clear that new arrangements are needed for these two matters (and we imagine many others), if effective and fair competition and good service is to result.
ON END-USER NEEDS

There are many contributions in this area. Peter Darling makes the point that Australia has detailed policy and regulations addressing telephony services, which have yet to be translated into NBN policy. The most important issue is what will replace the Standard Telephone Service when virtually all public telephone calls are carried out using Voice over Internet Protocol (VoIP) technology via the NBN?

He lists several examples of standards and regulations which have been put in place to protect the rights of end users. How many remain relevant in an IP world is a good question: the Untimed Local Call and distance based charging are hardly a contemporary need, but LNP and QoS in the form of the Customer Service Guarantee remain an ongoing need.

What principles should apply to the further development of the National Numbering Plan, which has in the past promoted geographic numbers as a means of understanding call cost?

The concept of the Universal Service Obligation, and the composition of the USO package, are promoted by David Lee (of the NSW Farmers Federation) and Rosemary Sinclair (ATUG) as worthy of review.

Not surprisingly John Stanton (Communications Alliance) reasonably advocates that the opportunity should not be lost to reduce the regulatory burden carried by the supply side, and to only take forward absolutely essential regulatory arrangements. This is a very sensible proposition, but he uses a very unfortunate example of wanting to reduce Consumer Protection controls at a time when consumer satisfaction is at an all time low – as evidenced by the fact that consumer complaints with the Telecommunications Industry Ombudsman have recently been at an all time high.

What seems to be forgotten is that the community takes many of these historical benefits for granted. If they just disappear without consideration and appropriate notice, there will be an uproar and a political backlash. This is a potential danger zone for the Government and it will make the backlash during the phase out of analogue mobile phones pale into insignificance if not properly treated.

The matter of consumer confidence and trust being of crucial importance is made by Rosemary Sinclair and is a telling point. Without it the whole concept of e-commerce and innovative applications will fail.

The recent experience of some banking customers highlights the effort that must be put into ensuring services are safe and secure.

Wayne Hawkins addresses the important issue of equity policy, seeking to ensure people with disabilities don't miss out on the opportunities offered to the general community.

While the concept of universal design is a catch cry for the disability sector, in reality they have been badly let down it the past. For example, the loss of portable TTY’s, when AMPS mobiles were replaced with GSM, is still a very sore point. They don't wish to see that sort of disadvantage repeated.

CONTEMPORARY APPLICATIONS TO EDUCATION AND HEALTH

The papers by Mandy Salomon (on new education applications) and Andrew Pesce (on new e-health and medical applications) are terrific. They address the real benefits that can be achieved on the NBN with innovative thinking.

The Government, on behalf of the general community, needs to invest in stimulating the practical development of a great range of such beneficial high-speed broadband applications. The active addressing of 'human factors' or 'user design factors' in the development of new applications is crucial.
Andrew Pesce calls upon governments to 'build the overarching infrastructure that is necessary to connect patient information across the health care sector', ie to invest sufficiently to make a secure shared electronic medical record system universally feasible, and one where the medical records can be personally controlled by their owners.

Mandy Salomon's paper points out that 'well over 100 Australian education institutions' are now trialling multi-user virtual environments (MUVEs), and argues for the pedagogical value of MUVEs as virtual classrooms, citing case studies. MUVEs are a learning innovation that require the fast access speeds and ubiquity of the NBN, and can thus be used to demonstrate the NBN's value in enhancing Australian education. She notes that while there are some signs of exploratory interest, the federal government's Digital Education Revolution is slow to support trials and implementations of MUVE technology.

ON TRANS-SECTOR BROADBAND POLICY FOR THE DIGITAL ECONOMY

Paul Budde points out the need for a strategic trans-sector policy framework in order to reap the maximum social and economic benefits from the NBN. Current policy to a large degree seems to stop at building the NBN infrastructure.

Several of our authors (e.g. Dave Lee and Rosemary Sinclair) point out the need to promote community engagement, including 'awareness raising' initiatives as well as tailored training sessions, to motivate the community to wholeheartedly 'opt in' for the NBN and to then use it beneficially. Without a high take-up of the NBN across Australia, many community benefits, including extended government services, will not be delivered most cost-effectively, i.e. online.

Paul Budde also points out that to achieve the long-sought benefits of the Digital Economy, we need a coherent national trans-sector policy for the Digital Economy. These benefits include the cost-effective delivery of remotely delivered health and educational services, the support of a national electricity grid and other environmental management systems, and the support of teleworkers in rural areas. It will not be possible or appropriate to leave these broader policy initiatives to NBN Co, especially as NBN Co has deliberately and quite reasonably restricted its role to that of a wholesale broadband data stream provider, in order to maximise market opportunities for the private telecommunications service providers.

CONCLUSIONS

The eleven authors in this special issue of TJA have identified many policy gaps concerning the implementation of the NBN, perhaps because the NBN project has been carried out quickly without much thought being given to transition from current telecommunications arrangements. This is rather typical of an incoming management team that seeks to clear the decks to avoid being constrained too much by past history.

Yet both the telecommunications industry and the community have rich experiences of telecommunications use and longstanding expectations, and these are deserving of consideration. If not adequately addressed, the very worthy NBN concept could founder or at the very least be significantly delayed in providing its expected community benefits.

The policy gaps identified in the Infrastructure area need to be addressed to ensure that the combination of the NBN and its numerous Retail Service providers have the end-to-end capability to deliver the outcomes expected.

The policy gaps in the Service Provision area must be addressed if the innovation and ingenuity latent in this sector is to bloom and not be handicapped by inequitable cost distributions.

The policy gaps in the End User segment must be resolved to ensure community members have the confidence, technical awareness, user skills and trust to take up the innovative services that will be offered.
And there is a compelling need for trans-sector broadband policy development to ensure that its estimated cost of $43 billion, including $27 billion of taxpayer funds, really pays off in terms of boosting all relevant industry sectors and hence the national economy.

Lastly, the government and its relevant department (DBCDE) needs to recognise that the low profile task of national network planning, so important to the security, reliability and quality of our national telecommunications, is now carried out by no organisation. This task was carried out by the incumbent monopoly Telecom Australia prior to 1991, and carried out de facto from 1991 to 2005 by the largest network infrastructure owner, Telstra, in collaboration with the technical regulators Austel and ACA. The job always had a low public profile precisely because it was carried out effectively; its purpose was to ensure that end-to-end user requirements of technical Quality of Service (including reliability, resilience, safety and quality of transmission of voice, data and images) would be met across a multi-carrier environment, using the most relevant technical standards developed internationally.

Given that Telstra will soon be quitting the market for fixed access residential networks, and handing that function over to the NBN and its thousands of retail service provider customers, a policy vacuum exists. Some of us thought that NBN Co itself would carry out that essential function, but the ACCC decision in December 2010 on POIs has changed the NBN network from a nationally interconnected set of broadband access networks to 140 separated 'island' networks with little in the way of transit network functions. It thus becomes far less appropriate for NBN Co to voluntarily take on the national network transmission planning role.

But some competent and independent engineering organisation needs to be given this national role. Otherwise we will have created a patchwork of networks whose only duty of care is to their own customers, within the limits of services carried entirely within their own networks. The high standards of end-to-end communication expected by the Australian community since the 1960s will in future be only available to those affording premium services, if this most important policy gap is not filled.
While Australia is leading the world with its National Broadband Network project, there still is a lack of a strategic trans-sector policy framework in order to reap the maximum social and economic benefits from the NBN.

AUSTRALIA IS LEADING THE WORLD

The extraordinary progress Australia has made in relation to the transformation of its telecoms industry has received a great deal of attention from the international community. Under the leadership of Minister Conroy the all-important regulatory and NBN Co legislation was finally passed in March 2011.

Many countries, including the USA, are following the example of Australia and are looking at national broadband plans as nation-building policies that would generate significant social and economic benefits. However without strong political leadership it is impossible to undertake such fundamental cultural changes.

In Australia, as elsewhere, there remains a long-term policy gap, which involves aligning the NBN business plan with the national purpose for which we are building this infrastructure. The lack of such a plan is already apparent in areas such as e-health and smart grids, where separate infrastructure plans have been developed because of the lack of an overarching trans-sector-based strategic framework. However, with the NBN legislation now in place the Minister will introduce new policy initiatives in relation to the digital economy at the end of May.

ARE WE ON THE RIGHT TRACK?

There is an increasing call from a few but very vocal people, to stop, review or abandon the ambitious broadband plans in Australia.

The situation now is as follows: …

Most people agree that Australia has the right vision for its national broadband plans, based on Fibre to the Home (FtH), the social and economic benefits linked to a trans-sector approach, and the structural separation of the incumbent. It has been a battle to reach this point, since initially the incumbents vigorously opposed these plans. But now, three years later, we are finally getting somewhere. In some ways it is a compromise, but the overall plan remain largely the same; and it is pretty good.

However new people are now jumping onto the bandwagon – academics, politicians, engineers and other experts, and they are all claiming that different things need to be done to make it work (better).
The proposed variations are all different from each other, as most of the individual alternatives are based on diverse fields of expertise, political views, vested interests, etc. There is no – or very little – uniformity in these comments.

First of all, let me say that no country in the world – and no single expert in the world – has the ideal solution. Nor do I believe anyone ever will have. Even when the experts in charge of these projects are putting their best solution in place, the reality is that in real world compromises will need to be made in order to make at least some headway. So, while we might have identified what the best possible solution should be, we will inevitably end up with a practical compromise.

This creates the following dilemma. As we have discussed before elsewhere, there are many ways to skin this particular cat and a range of issues play a role: politics, environment, investments, geography and so on.

Some of the suggestions made for improvement by the experts are good – there is no doubt about that. But what should we do? Start again and look at all these different new options?

This would, without a doubt, result in significant delays (as in 3-5 years) and the most likely outcome would be that no agreement would be reached on any of these (excellent) new options and the whole project would collapse.

Or do we stick to the original plan, even in the knowledge that it is not perfect?

I am in favour of the latter course. I think getting underway within the context of the plans that have now been developed in Australia – which I think are, in principle, pretty good – is more important than delaying in the hope of finding a better solution. I believe that projects like this offer a once-in-a-lifetime opportunity.

If it isn’t pushed through now it will simply collapse. At this point my company BuddeComm is holding discussions with key parties about building in sufficient flexibility to allow for the integration of good ideas and different solutions, without derailing the project.

And, in general, this is what is happening. However, the political reality is that flexibility affords the sceptics and those opposing the project (mostly based on strong political libertarian convictions) an unlimited opportunity to criticise – they will use any change, any correction, any discussion to declare that this is evidence that the whole project is flawed.

THE LONG-TERM POLICY GAP – LACK OF A STRATEGIC TRANS-SECTOR POLICY FRAMEWORK

HARNESSING THE SOCIAL AND ECONOMIC BENEFITS

While the above creates a few short-term problems, a more serious long-term issue is the policy gap that exists between the infrastructure policies and the trans-sector policies.

Exhibit 1 - Economic effects of trans-sector broadband
(Source: BuddeComm: Australia – National Broadband Network – Trans-sector model)

<table>
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<tr>
<th>Research Company</th>
<th>Conclusion</th>
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<tbody>
<tr>
<td>World Bank</td>
<td>10% increase in penetration of broadband services increases economic growth by 1.3%.</td>
</tr>
<tr>
<td>McKinsey &amp; Company</td>
<td>10% increase in broadband household penetration produces 0.1% to 1.4% rise in GDP growth.</td>
</tr>
<tr>
<td>Allen Consulting Group</td>
<td>Broadband will add 0.6% to Australia’s GDP growth per year.</td>
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</table>
The reason we are building the NBN is not simply to provide high-speed access to the Internet. The aim is also to achieve the social and economic benefits it will deliver to the nation. These benefits fall largely outside the balance sheets of the telcos and it is therefore essential for the government to become involved in this infrastructure building process.

Broadband infrastructure will stimulate the digital economy, creative innovation and export opportunities, as well as e-health, tele-education, smart grids, e-government and digital media. It will become the foundation for smart buildings and cities – indeed, a smart country.

**POLICIES NEEDED TO DIRECT GOVERNMENT ORGANISATIONS TOWARDS THE NBN**

While a great deal of lip service has been paid to these benefits, comparatively few hard policies have been put in place that will force important government departments such as Health, Education, Energy and Climate Change to use the NBN for the delivery, and improvement, of their services.

There is widespread acknowledgment that many of the serious problems we are facing as a society cannot be solved via the linear processes that were developed 50 or more years ago. Innovative government solutions are required to address problems such as an ageing population, increases in chronic illnesses, climate change and energy shortage – and to promote an environment of first-class education and international competitiveness in the wake of the growth of countries such as China and India.

**REALLOCATION OF GOVERNMENT BUDGETS ARE NEEDED**

In order to address these issues in new, innovative and far more cost-effective ways a trans-sector policy is required – one that will involve significant budget reallocation in order to change the way services are delivered, from the traditional analogue processes to the new digital processes that will supply these services to people’s homes and businesses via the NBN.

**ALL-INCLUSIVE TRANS-SECTOR POLICIES TO ENCOURAGE UNIVERSAL COVERAGE**

Once clear political and budgetary commitments for such policies are in place, a range of supporting policies will be developed. These new services require universal coverage and that necessitates an all-inclusive policy, aimed at also actively engaging the 20% of the population not currently online.

This is not just an infrastructure connectivity issue. It is one of education and information, and it will require the first-line-of-response people involved in healthcare, community services, education, etc, to become actively engaged with the wider population to ensure that all Australians can participate in these new services. Probably the 20% of people who are not currently online will be the ones who will benefit most from many of the all-inclusive services.

This is an enormous challenge and requires much more than infrastructure policies.
Exhibit 2 - Key developments in FttH and Trans-sector strategies
(Source: BuddeComm: Global – Fast Broadband and Trans-sector Policies)

- E-health, e-education, digital media and sustainability are the key reasons why developed nations need Next Generation Networks.
- Smart communities cannot be built from the current silo structure that dominates our thinking and require a holistic approach.
- In terms of FttH connections, Japan continues to lead the world with around 14 million homes and businesses connected.
- In terms of actual FttH penetration, South Korea leads with around 44%.
- Improvements in international fibre and other infrastructure in Africa are leading to a growing number of FttH initiatives. However, mobile broadband will be driving Trans-sector developments here.
- There has been substantial recent investment in next generation infrastructure in the richer countries of the Middle East. Some projects have been completed and others are moving forward rapidly.
- Russia accounts for over half of all Eastern European FTTx subscriptions.
- Reforms in New Zealand will create a number of Local Fibre Companies (LFCs) which will operate FttH access network infrastructure in specific geographic areas.

COMMUNITY ENGAGEMENT

Current developments in social networking indicate the importance of community engagement. An extensive network across all the states and territories, and indeed across all cities and other communities, should be developed to engage the broader population. Some good ad hoc initiatives have been taken by the government, but the process needs to be formalised and structured, with staff available across the country to work with the local communities, government organisations and volunteers on how to maximise the benefits that they can achieve themselves.

There are already examples of broadband leading to a repopulation of regional and rural areas. Communities, towns and cities can use broadband to promote their skills, businesses and activities to create opportunities. New businesses can be developed leading to employment opportunities, often generated by the people themselves.

COST BENEFIT ANALYSIS WOULD HAVE POINTED TO SUCH POLICIES

The negative effect of not having a cost benefit assessment done is not the actual figures that this would produce but the realisation that sound policies will need to be in place if we want to reap the other benefits. These benefits do not emerge automatically. It will be necessary for ivory towers and silos to be broken down if we are to embrace the new digital environment and a cost benefit analysis would have pointed out that budgets would need to be allocated to guide and implement that process.

Of course this can be achieved without a cost benefit analysis, but that requires the political will to take responsibility for developing the essential strategic framework.

DIGITAL PRODUCTIVITY – A STEP IN THE RIGHT DIRECTION

The addition of the responsibility for ‘Digital Productivity’ to Minister’s Conroy’s portfolio is a step in the right direction and the first results of this appear promising. Several targeted
conferences (eg on healthcare and retail) have been organised; the e-health record legislation has been passed; and a subsequent e-health fund of $467 million has been announced.

**INDEPENDENT STRATEGIC FRAMEWORK**

However digital productivity needs to be discussed and analysed within an independent, well-structured strategic policy framework, which needs to be properly funded and resourced so as to bring the infrastructure rollout in line with what the Americans call the ‘national purpose’.

At the moment the industry enjoys the full support and commitment of the Minister, and he has been delivering the goods. However we cannot rely on one person to move this enormously complex project forward on their own. The Minister’s activities and responsibilities need to be expanded into a full-blown strategic operation.

The best outcome of the ‘Digital Productivity’ policy would be for it to provide a policy framework that ensures that the vision, ideas and strategies that have been developed over the last few years are given a secure future. It should also make sure that the NBN is implemented for the purpose for which it was developed – to provide Australia with a range of social and economic benefits that will allow its people to better address some of the challenges the country is facing. And, finally, it should operate as a tool to improve our lifestyle and make us international leaders in the digital economy, thus delivering major national social and economic benefits, including export opportunities.

TELEPHONY AND THE NBN

Peter Darling
Pondarosa Communications

Most of the discussion about Australia’s National Broadband Network (NBN) has been about the costs, the benefits and the implementation of “super-fast broadband”. This article looks at another important use that will be made of the optical fibre to the user provided by the NBN – the provision of telephony service as a continuation of the current standard telephone service available across Australia.

The article looks at the extensive range of current policies that will have to be considered and quite possibly modified with the implementation of the NBN. Work has begun on only a few, but many more policy areas will have to be resolved to enable a smooth transition to the new network and identify the ubiquitous services that the NBN will provide.

INTRODUCTION

The National Broadband Network or NBN represents a major change in Australian communications. For the large majority of Australian users it will result in a change from the current copper-based fixed network to a new network based on optical fibre, moving from current networks to next generation networks (NGNs).

There has been considerable discussion about all aspects of the NBN, including (but certainly not limited to) the following areas.

Political – the NBN represents one of the major differences between the Government and the Opposition, and indeed has been credited with gaining the support of the Independent Members to allow the current Government to function.

Economic – with varying views on the merit of the estimated 43 Billion Dollar expenditure required for the NBN, and the need for a rigorous cost benefit analysis

Technical – the best means of providing 100 Mbit/s or more to the majority of users, and the relative roles of optical fibre and radio technologies.

Implementation – rolling out a fibre-based network to 93% of users in less than eight years, together with radio-based networks to serve the other 7%.

What has often seemed to have been forgotten is that we already have in place a national public switched telephone network that provides voice telephony across Australia, working with mobile telephony networks that serve the centres of population. The bandwidth required for telephony seems small by comparison with many of the services talked about for the NBN, but the requirements for a real-time, two-way service such as telephony are not trivial.

Telephony is a “socially important” service – the majority of telecommunications policy and regulation to date has been directed to telephony, which historically has been regarded as too important to leave to the market. This paper looks at telephony and similar services in the NBN, and the transition from the current environment to the NBN.
HISTORY

Telecom Australia was formed in 1975 to take over the provision of national telephone service in Australia, previously the responsibility of the Postmaster-General’s Department or PMG. It was a fully-owned Government Business Enterprise with a monopoly on network provision. As a fully Government-owned organisation, Telecom Australia was guided by the Government of the day with limited direct formal Government direction. Telecom’s main task was to provide Universal Service – a telephone that worked and, ideally, a telephone that worked all of the time, to be available to all premises. In almost all cases Telecom’s engineers used the technology of the day – twisted copper pairs to each residence, connected to analogue local exchanges and trunk (or toll) exchanges.

Telecom Australia was merged with the Government-owned Overseas Telecommunication Corporation in 1992 to form what we now know as Telstra. Network competition to Telstra was introduced in two stages, with two additional mobile and one additional fixed operators from 1991 and full network competition from July 1997.

As technology developed, the core of the network was replaced with digital equipment, but the Customer Access Network (CAN) remained largely analogue.

The extent of (potential) competition varied for different services:

- **Trunk services** (long-distance national and international) were very competitive, with preselection prescribed by regulation to encourage customers to use competitors’ transit networks beyond the Telstra local network.
- **Local (fixed) services** were not very competitive, with most carriers using Telstra’s network to provide retail services based upon Telstra’s (regulated) wholesale rates; whereas
- **Mobile services** were competitive, initially amongst the new mobile network operators who purchased the right to use the necessary radio spectrum, and later with virtual mobile network operators who used the wholesale services of another mobile provider.
- **The (public) Internet** was also open to full competition from 1991 (in practice from 1992), with Internet Service Providers (ISPs) using the carriage services of other providers. As Digital Subscriber Line technology developed, ISPs began to use this technology, primarily as ADSL, over Telstra copper lines, which they were able to access at regulated rates. More recently, Internet access has been available as part of the range of services offered over 3G mobile networks.

PRIVATEISATION OF TELSTRA

In 1997 the Government of the day moved to sell one third of Telstra in conjunction with the introduction of full network competition, and sold the remainder in two subsequent tranches in 1999 and 2006.

Telstra remained as a single integrated entity, with ownership of:

- The Customer Access Network;
- An inter-exchange network, including substantial long-distance and local transmission;
- The largest mobile network;
- A hybrid fibre-coaxial cable pay TV network; and
- The largest ISP, among other assets.

The Government’s policy resulted in a direct conflict between the duties of the Directors, responsible to shareholders for the best return on their assets, and the responsibility of
Parliament to the nation as a whole to provide telecommunications services (and to the political parties that did their best to please voters).

The solution adopted was to give substantial powers to the economic regulator, the Australian Competition and Consumer Commission (ACCC). The ACCC could “declare” a service, and require a service provider (generally Telstra) to provide this service to others at regulated prices. This resulted in considerable gaming by both Telstra and access-seekers, and the development of (to this non-economist) increasingly esoteric models to determine the regulated price.

THE STANDARD TELEPHONE SERVICE (STS) AND THE USO

Each tranche of Telstra privatisation was accompanied by legislation to ensure that Telstra met continuing obligations to society as well as to Telstra shareholders. These obligations were generally expressed in terms of delivery of the “standard telephone service”, a basic voice telephony service which enables a telephone user to call any other user of a standard telephone service, whether or not the users are connected to the same network.

The Government ensured that Telstra has the role of Primary Universal Service Provider, with a universal service obligation (USO) to ensure that Standard Telephone Services are reasonably accessible to all people in Australia on an equitable basis, wherever they reside or carry on business. This means that consumers can generally expect to be able to receive a voice telephony service on request from Telstra (as the Primary Universal Service Provider) wherever they work or live.

The provision of a standard telephone service is regulated by a complex set of legislative arrangements with various features and service standards, such as enabling access to emergency call services. Telstra has also been required to provide additional services when supplying a standard telephone service in fulfilment of the Universal Service Obligation. A list of regulated features and standards for a standard telephone service is set out in Appendix A (from the Department of Broadband, Communications and the Digital Economy Discussion Paper “Implementation of Universal Service Policy for the transition to the National Broadband Network environment”).

THE NBN APPROACH

As is now well known, the current Australian Government plans a “National Broadband Network” or NBN, using fibre to the user’s premises for 93% of users, and a mixture of radio-based techniques for the other 7% of users (who will be distributed over by far the largest part of Australia). This network will provide a “fixed” wholesale broadband transmission service to user’s premises, and together with mobile networks (3G and 4G) will provide support for both current and next-generation services.

This NBN will be realised using a new Customer Access Network to be implemented by a government-owned company, the NBN Co Limited. This company will have responsibility for providing the optical fibre CAN for 93% of users, and the radio-based access (fixed wireless and satellite) for the other 7% of users. The NBN Co will provide a wholesale bitstream service to Retail Service Providers, who will deal direct with users and provide the other facilities necessary to support the services they offer.

I believe that much of the discussion in the industry and within the NBN Co has been based on the assumption that the NBN will be the extension of the current public Internet. The NBN will support the public Internet, and be able to use the Internet protocols (amongst others), but the view that the NBN is just the Internet sells the NBN short. It should be the basis for the future network, supporting current services such as telephony and the Internet as well as new services.
THE NEW CUSTOMER ACCESS NETWORK

A previous article in the *Telecommunications Journal of Australia* by this author (Darling 2010) described the techniques the NBN Co will use to provide an optical fibre CAN. The NBN Co is to provide an Optical Network Termination Unit (NTU) at each user’s premises, and will provide a Layer 2, bit-stream connection from that point to a Point of Interconnection (PoI). Each end-user will obtain their services from one or more Retail Service Providers who will manage the relationship with the end-user, accessing the end-user via the nearest PoI.

NBN Co will have no direct commercial relationship with end-users, but will provide connectivity from an end-user’s premises to the nearest PoI. To use a railway analogy, the NBN Co will provide the tracks, but not the trains that run over the tracks, which may be freight trains, commuting trains or even private trains – end-users will have a relationship with the train operators and through that relationship will contribute commercially to track operations and maintenance.

POINTS OF INTERCONNECTION

The NBN Co originally suggested there would be two types of PoI. The first would be provided in each large Fibre Serving Area (FSA) (mainly in cities) and the second (mainly in rural areas) would cover several Fibre Serving Areas.

The draft Business Case produced by the NBN Co suggested that they had been influenced by the current Internet industry and the Government’s wish for uniform wholesale pricing. Their draft Business Case proposed a limited number of PoIs, located at each State capital city. This was not greeted warmly by existing suppliers of long-distance transmission, as it would bypass their existing infrastructure and thus potentially reduce competition in this area.

As discussed below, it would also make it difficult to use the NBN for local services such as telephony (if the current arrangements for untimed local calls continue) and utilities which may be based on regional rather than State boundaries.

The Government referred the NBN proposal to the ACCC, which developed a new set of criteria for the location of PoIs, proposing they should be established on a “semi-distributed” basis where it is technically and operationally feasible to allow interconnection and there are (or are planned to be) a least two competing long distance providers.

There is now a list of 121 PoIs agreed between the ACCC and the NBN Co. This is a little closer to current telephony interconnection arrangements than the initial NBN Co proposal but will still make it difficult to provide a local telephony service in all rural areas, as FSAs and telephony exchange charging areas do not necessarily coincide.

WHAT ABOUT TELEPHONY?

The first presentations by NBN Co said that the Optical Network Termination Unit might contain one or more Analogue Telephony Adapters, based on using SIP, an extension of the HTML protocol used in the Web. This represented a departure from the basic concept of services to be provided by the NBN Co, as the telephony adapters would use an Internet, Layer 3 protocol, not the Layer 2 that would otherwise be supplied by the NBN Co. The underlying Layer 2 would be configured to support the high quality, low loss and low latency connection needed for telephony.

Telephony did not get a high profile in the initial technical discussions, despite its current social importance. Current technology used in telephone exchanges provides a central battery, independent of the commercial electricity supply. When the need for battery backup to replicate the current arrangements was raised in the Communications Alliance Working Group looking at customer equipment, this was given a low priority by the industry.
The Minister, Senator Conroy, had a different perspective, perhaps based on the importance of telephone service availability in recent fires and floods when domestic power is (often deliberately) not available. He indicated that he expects the NBN Co to provide battery back-up to all premises in the fibre footprint to ensure a standard telephone will continue to provide voice services during blackouts, until the Government completes consultation with stakeholders, including emergency services, on the appropriate way of ensuring access to battery back-up services for those who need them.

THE TELSTRA/NBN AGREEMENT

There was general recognition that the NBN is much more likely to be successful if Telstra agrees to use the NBN Co facilities for both broadband and telephony, and makes the Telstra cables, ducts, buildings and other facilities available for NBN Co use. If agreement could not be reached, Telstra could provide strong competition for many NBN services.

Protracted negotiations on the financial consequences of such a deal continued during the first half of 2010. On 20 June 2010 Telstra announced a “non-binding Financial Heads of Agreement with NBN Co to participate in the rollout of the National Broadband Network (NBN)”. The 2010 Federal election, in which the NBN was a significant issue, delayed the detailed discussions, but the Telstra CEO announced at the company’s Half Yearly meeting on 10 February 2011 that commercial terms have been agreed. The final deal will have to be endorsed by the shareholders of both companies as well as (in some form) by the competition regulator, the ACCC.

Under the agreement, the NBN Co will be able to use Telstra’s existing ducts and pipes under a 30 year lease arrangement (which would be presumably leave Telstra with responsibility for their maintenance), making it much easier for NBN Co to implement its Optical Fibre rollout.

The NBN Co would also be able to use other Telstra infrastructure; for example exchange buildings could be used for the equipment required in each Fibre Serving Area.

Telstra has agreed to migrate both its telephony customers and its broadband customers (on both its copper and Hybrid Fibre-Coaxial [HFC] networks) to the NBN facilities, and to decommission both the copper network and the cable broadband network.

As the Telstra statement to the ASX said, “the transaction would see Telstra progressively migrate its voice and broadband traffic from its copper and cable networks to NBN Co’s network as the latter is rolled out. Telstra will continue to use its cable network to meet its pay TV contract with FOXTEL.” There would be a payment from the NBN Co to Telstra as each customer is migrated.

TELEPHONY IN THE NBN

This agreement, if finalised, makes the NBN implementation a transition from the current Telstra copper CAN to the NBN Co optical fibre CAN. It means that, in future, people will have to use the NBN optical fibre if they want a fixed telephone service, or rely on mobile telephone service where available.

It is likely that users will have their current household telephone wiring moved from Telstra’s copper pair NTU to the Analogue Telephone Adaptor on the NBN Co’s Optical NTU (ONTU). A telephony service provider with a “softswitch” situated beyond the Pol would be able to provide service. It would also be possible for a Retail Service Provider to offer telephony from other customer equipment which it provides beyond the network termination unit.

The extent to which current telephony obligations would apply (as detailed in Annex A), to either NBN Co or the Retail Service Provider, needs to be resolved.

The Government has agreed to remove Telstra’s current universal service obligations with the establishment of a new USB Co. It has issued a Discussion Paper “Implementation of
Universal Service Policy for the transition to the National Broadband Network environment” (DBCDE 2010) that highlights the policy issues to be resolved, particularly in relation to the telephone service.

**NUMBERING AND ADDRESSING**

The current telephony system uses a national numbering system administered by the technical regulator, the Australian Communications and Media Authority (ACMA), consistent with the international system specified by the ITU. The Plan is service based, with unique numbering ranges for each service.

Numbering for mobile services is based on number blocks allocated to service providers with the possibility of number portability when a user changes service provider.

Numbering for fixed services (geographic numbering) is much more inefficient. Each service provider is given a number range for each area in which they operate (or may operate), with the possibility of number portability when a user changes service provider. Under the current Numbering Plan there are over 2000 such areas, and the move to the NBN is likely to result in a significant increase in telephony service providers active in each area.

One of the main reasons for such a complex arrangement has been the policy requirement that providers of a standard telephone service must provide the option of an untimed local call (see Appendix A). The concept of a local call is based historically on analogue technology, but there has been a strong political requirement for it to continue. The Numbering Plan has been configured, and numbers are allocated, so that it is possible for a service provider to analyse if a call is “local” or “long distance” from the dialled number.

The Internet uses a very different approach. Connection points on the network are allocated an IP address (either dynamically or statically). These addresses are allocated on a (supranational) regional basis rather than a national basis, with each IP address coming from a pool allocated to the chosen Internet Service Provider (or directly to large organisations). For most applications, this IP address is not accessed directly by an end-user but obtained by accessing the Domain Name System with a unique URL (Universal Record Locator) that is then translated into an IP address.

Telephony services on the NBN will probably have both an IP address and a telephone number, and may also be accessed by a URL.

There are a number of policy issues to be resolved:

- The continuing need for many of the current STS requirements, in particular for local and long-distance service distinctions and untimed local calls;
- Changes to the Australian telephony numbering scheme to reflect the NBN requirements, and the fact that the NBN is likely to accelerate the trend to new services (such as “near telephony” or Internet telephony/VoIP). The ACMA is consulting on possible changes at present.
- The relationship between IP and telephony numbering and addressing; and
- The current systems and facilities that use telephone numbers rather than IP addresses (for example, emergency services, legal interception and the IPND).

**SERVICES IN THE NBN**

In an NGN environment, service could be provided at a number of “layers”. A service provider could provide:

- Transport (at Layers 2 and 3 of the OSI model), both for access from a user and in the core network;
- Applications (at higher layers of the OSI model)
• These applications could be real-time “communicative services” such as telephony, two-way video or multi-person gaming; or
• Other applications that often do not require real-time, two way communication such as web browsing and video streaming;
• Content, associated with the provision of an application or applications.

The current policy division into Carriage Service Providers and Content Service Providers does not seem adequate in this environment. There needs to be a further division into new categories of service provider, splitting Carriage Service Provider into:

• **Transport Service Provider (TSP):** Providing transport of data (a transport service);
• **Application Service Provider (ASP):** Providing applications for an end user (or multiple end-users). (Some applications could be further classified as “communicative services”).

(The NBN Co will be a specialised form of Transport Service Provider, providing Layer 2 transport to other (retail) Service Providers, from the end-users premises to the PoI.)

Provision of service to a user requires an underlying Transport Service with an application running over that service. The same entity may be both TSP and ASP, but it should be possible for a user to select an ASP separately from the TSP. Alternately, an ASP may purchase a wholesale transport service from a TSP to offer a complete “carriage service” to a user.

**SOCIALLY IMPORTANT SERVICES**

There should be an end-to-end transport facility able to support the full range of applications/services for all users. The NBN Co will not provide this, as they will be restricted to providing Layer 2 services between the edge of a users premises (the ONTU) and the PoI. There is at present no certainty that one or more retail service providers will be available to offer this service in areas that are not commercially viable.

This raises the question as to whether the future USO should be based on an underlying requirement for a Layer 3 service, probably based on the Internet Protocols.

Conceptually, from a regulatory perspective, higher-layer communications applications (or services) in an NGN environment could be divided into two distinct categories:

• Communications services of social importance (this category generally encompasses communications services which meet a defined, minimum standard and which are available on an ubiquitous (or near-ubiquitous) basis), as an extension of the current USO concept; and
• All other communications services and applications.

**THE FUTURE STANDARD TELECOMMUNICATIONS SERVICE**

There will be a continuing community need for a service (or services) to support social communication requirements. This provides a policy challenge – not whether an STS (or similar service) ought to be mandated, but rather how this should be done. I believe the underlying policy need for an STS will not change, but many policy details have to be agreed. Policy issues to be resolved include:

• Whether the current Standard Telephone Service ought to be expanded to include other services or purposes; and
• Whether the list of regulatory requirements, outlined in Appendix A, which currently attach to the STS ought to be contracted (or expanded).
In the NGN environment, there are likely to be other services that are similar to the main telephone service, but have other features. Current VoIP / Internet telephony services provide a good example of this – they appear to be telephony, but do not have all the features of the STS. This is the basis of current regulatory work which is trying to accommodate VoIP within the STS framework.

**A WAY FORWARD**

One policy option may be to specify a new **Basic Communication Service** (BCS) which is to be made generally available and would be integral to any universal service obligation.

The features of this “basic communications service” would desirably include:

- Ubiquitous coverage;
- Ubiquitous availability;
- Ubiquitous interoperability;
- Satisfactory Quality of Experience\(^5\) (QoE);
- Emergency calling;
- Support for people with disabilities: physical, hearing, sight;
- Naming/numbering/addressing which is adapted to an NGN; and
- Conformity with international standards.

This BCS may comprise a bundle of services, for example interactive voice (telephony); Interactive text; and Interactive video, alone or in combination. Whatever is decided, there is no doubt telephony will be part of the future NBN and most of the community will continue to depend on it.

**CONCLUSION**

This issue of the *Telecommunications Journal* is looking at policy gaps. We know that current Policy is to provide develop the NBN (with 93% of users of the NBN served by optical fibre). We know that, if the agreement between NBN Co, Telstra and the Government is confirmed (as now seems likely), existing copper will no longer be used for all fixed services, including telephony.

Much of the current discussion about the NBN is about the techniques (and economics) of high speed broadband, particularly in the access network. As this paper has indicated, the transition from the current, highly regulated telephony-based network to the network of the future requires the resolution of many policy issues. Some of these (for example the provision of universal service) are at least being recognised, but are a long way from resolution. Many others, both during the time of transition to the new network and when the NBN is the major network, still need to be identified and appropriate policy developed.

The timescale for the NBN means a large number of users must be connected each year – by June 2012 the NBN Co Business Plan suggests that over 250,000 users will be served by optical fibre, ramping up to almost 1 million by June 2013. Not all of these users will choose to use the active services provided over the NBN, but the large majority are at present, and are likely to remain, telephony customers.

Much work needs to be done in the next few months!
APPENDIX A:
FEATURES OF A STANDARD TELEPHONE SERVICE

From the Discussion Paper “Implementation of Universal Service Policy for the transition to the National Broadband Network environment”, DBCDE October 2010

Table 1.1 - Features of a standard telephone service that apply regardless of provider

<table>
<thead>
<tr>
<th>Feature</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must provide option of untimed local calls (mobile telephone services are exempt from this requirement)</td>
<td>Part 4 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
<tr>
<td>Service connection and repair, and meeting timeframes</td>
<td>Part 5 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em> and the Customer Service Guarantee Standard 2000 (No 2)</td>
</tr>
<tr>
<td>Telecommunications Industry Ombudsman membership scheme</td>
<td>Part 6 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
<tr>
<td>Access to emergency call services</td>
<td>Part 8 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
<tr>
<td>Operator assisted services (including for dealing with faults and service difficulties)</td>
<td>Part 2 of Schedule 2 to the <em>Telecommunications Act 1997</em></td>
</tr>
<tr>
<td>Directory assistance</td>
<td>Part 3 of Schedule 2 to the <em>Telecommunications Act 1997</em></td>
</tr>
<tr>
<td>Itemised billing</td>
<td>Part 5 of Schedule 2 to the <em>Telecommunications Act 1997</em></td>
</tr>
<tr>
<td>Call interception capability by law enforcement agencies</td>
<td>Part 15 of the <em>Telecommunications Act 1997</em> and the <em>Telecommunications (Interception) Act 1979</em></td>
</tr>
<tr>
<td>Pre-selection (i.e. ability to select an alternative carriage service provider for national and international calls)</td>
<td>Part 17 of the <em>Telecommunications Act 1997</em></td>
</tr>
<tr>
<td>Calling line identification</td>
<td>Part 18 of the <em>Telecommunications Act 1997</em></td>
</tr>
<tr>
<td>Number portability</td>
<td>Part 22 of the <em>Telecommunications Act 1997</em> and the <em>Telecommunications Numbering Plan 1997</em></td>
</tr>
</tbody>
</table>
Table 1.2 - Features specific to a standard telephone service supplied in fulfilment of the USO

<table>
<thead>
<tr>
<th>Feature</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must offer customer equipment (the requirement to offer standard telephone service equivalent for people with a disability is explicit)</td>
<td>Sections 6, 9 and 9E of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
<tr>
<td>Must provide option of untimed local calls (including for mobile telephone services)</td>
<td>Part 4 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
</tbody>
</table>

Table 1.3 - Features that apply only to a standard telephone service provided by Telstra

<table>
<thead>
<tr>
<th>Feature</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail price regulation</td>
<td>Part 9 of the <em>Telecommunications (Consumer Protection and Service Standards) Act 1999</em></td>
</tr>
<tr>
<td>Priority Assistance arrangements for people with life threatening illnesses</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
<tr>
<td>Network Reliability Framework</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
<tr>
<td>Access to Directory Assistance and operator services</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
<tr>
<td>Low income support measures</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
<tr>
<td>Differential charging for standard telephone service with and without handsets</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
<tr>
<td>Internet Assistance Program – speed of dial-up Internet access via a standard telephone service provided in fulfilment of the USO</td>
<td>Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997</td>
</tr>
</tbody>
</table>
REFERENCES


ENDNOTES

1. For example, IP addresses for Australian ISPs are allocated by the Asia-Pacific Network Information Centre (APNIC)

2. The Integrated Public Number Database or IPND is an industry-wide database containing all listed and unlisted public telephone numbers and associated information (including physical address). It is used as a source of information for emergency and law enforcement purposes.

3. The Open Systems Interconnection Model or OSI Model was developed starting in 1978 by the International Organization for Standardization [ISO]. The model has seven layers each providing data transmission functionality to the layer above or below. Each layer contains a set of systems, standards or protocols that communicate with corresponding entities in higher layers. As each successive layer depends on the one below, data cannot jump or skip layers. Currently, the Internet uses the more lax TCP/IP protocols that have absorbed some of the OSI model. See, for example, [www.osimodel.org](http://www.osimodel.org)

4. This approach appears to be the long-term basis of the USA National Broadband Plan, and the recent Notice of Proposed Rule-Making (on their future USO) by the FCC. See [www.broadband.gov](http://www.broadband.gov)

5. This would include technical parameters to measure Quality of Service, but would also include measures based on the users of the service. (The ITU defines QoE as the overall acceptability of an application or service, as perceived subjectively by the end users.)

The future success of telecommunications service providers will depend critically on achieving end-to-end performance that meets the reasonable expectations of customers for services carried over IP-based packet switched, multi-services, multi-carrier networks.

In the Australian context the NBN will be a fundamental part of the IP based next generation networks. Agreed end-to-end performance standards for IP based networks have been established by both international and Australian regulatory and standards organisations. However standards for the allocation of the ‘QoS budget’ between segments provided by different carriers for the various parameters comprising those performance standards have yet to be adequately developed. While the importance of such standards is recognised, progress in this regard is very slow. The need for action by the appropriate authorities both in Australia and internationally is rapidly becoming critical to enable network suppliers, including but not limited to NBN Co, to build complying networks in a timely fashion.

BACKGROUND

The business of successful telecommunications service providers is to deliver telecommunications services that meet the expectations of their customers. The concept of quality of service (QoS) is universally accepted as providing an objective framework for defining and measuring the performance of telecommunications network services and their various components. From a customer’s perspective, however, what matters most is end-to-end QoS for the services he/she uses.

In the pre-Internet world telecommunications networks were initially designed for telephony, with data and other services relying on a range of techniques to exploit the voice bandwidth to deliver those services. National network monopolies were the norm, with connections between national networks to provide for international telephone (and data) calls. The design of national and international networks followed a strict routing hierarchy. The key components of end-to-end quality of service in this environment were defined for telephony in terms of loudness loss (or transmission loss), noise, delay and echo. Maximum end-to-end ‘budgets’ were defined, with components of these budgets allocated to national networks and the international connection. This allocation was managed through the International Telecommunication Union processes and frameworks, with international and national standards clearly spelled out. For Australia those standards are now contained in the Australian Communications Industry Forum’s (ACIF) Australian Network Performance Plan: ACIF G502; 1998 (Version 1.0) Published: February 1998, which contains references to many other national and international standards documents.
The modern telecommunications environment is considerably more complex in terms of the range of services catered for, but less hierarchical in nature. A much wider range of telecommunications services is now available, with the current best practice being for all services to be carried over a single integrated network platform based on Internet Protocol (IP) packet switching. National networks are less likely to be run by a single monopoly provider, and are typically operated by multiple network infrastructure providers and multiple service providers offering wholesale and/or retail services, and requiring interconnection between networks to provide end-to-end services to customers. Further, the strict routing hierarchy of analogue telephony no longer applies, with traffic being routed dynamically according to the best available path and often according to a prioritisation of service type.

Figure 1 below from ITU-T Recommendation Y-1542 (06/2010) shows an end-to-end network with three network suppliers and five separate networks. In the future, with the introduction of the Australian National Broadband Network (NBN), the access networks (or network segments) will be provided by NBN Co and the transit networks A1 and C1 could be provided by two different suppliers i.e. there could be four different suppliers of the five different networks.

Network suppliers will be responsible for establishing and meeting the performance standards for their own networks. They will also be responsible for the performance standards of the full range of services carried across their networks. Further, they will be responsible for delivering the traffic for those services to the interfaces to other networks in a form suitable to enable them to be carried at an appropriate level of performance across those other networks.

Quality of service management is consequently much more complex. For all services in digital networks QoS can be characterised by the same set of measurable primary parameters of delay, packet loss and jitter; however depending on the service type some characteristics are more important than others. Comparing voice and data services for example, telephone calls are more sensitive to jitter (or variation in packet delay) than packet loss, whereas data file transfer is critically sensitive to packet loss.

This new environment presents major challenges in the allocation of the end-to-end budget across different components of the end-to-end network for each of the key QoS parameters in a modern, IP-based, packet switched, multi-services, multi-operator network. In this regard the community is entitled to expect standards that clearly specify the performance required from each network in a multiple-operator service connection, and which will collectively meet the end-to-end performance standard required by customers for all services carried.
INDUSTRY STANDARDS

The International Telecommunication Union (ITU) is the United Nations telecommunications industry agency. Within the ITU the Telecommunication Standardization Sector (ITU-T) is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardising telecommunications on a worldwide basis. Individual countries have national regulatory authorities and voluntary standardisation bodies responsible for determining their own national standards, and almost universally those national standards are consistent with ITU-T standards.

In addition to the ITU-T there are a number of other international organisations with responsibility for related technical standards that apply to telecommunications networks or components of those networks. These organisations include, but are not necessarily restricted to, the:

- Broadband Forum (BBF)
- Metro Ethernet Forum (MEF)
- Institute of Electronic and Electrical Engineers (IEEE)
- Internet Engineering Task Force (IETF)
- 3rd Generation Partnership Project (3GPP and 3GPP2)
- International Organisation for Standardization (ISO)

Each of these organisations has a key role to play in their areas of interest and expertise, and provides guidelines, recommendations and specifications as appropriate in those areas. The ITU-T recognises their roles and where appropriate references their publications, both in relation to the application of IP-based packet switching techniques in telecommunications networks and more generally in relation to the telecommunications industry.

Within Australia the two major organisations responsible for voluntary and mandatory telecommunications standards are the Communications Alliance (CA) and the Australian Communications and Media Authority (ACMA).

INTERNATIONAL TELECOMMUNICATION UNION (ITU)

The ITU Telecommunication Standardization Sector (ITU-T) is “responsible for studying technical Questions and issuing Recommendations on them with a view to standardising telecommunications on a worldwide basis.”

The ITU-T’s “Series Y: Global Information Infrastructure, Internet Protocol Aspects and Next Generation Networks” Recommendations provide, among other things, coverage of QoS parameters and standards relevant to this paper. ITU-T Recommendation Y.1541 (02/2006) contains recommendations on end-to-end network performance objectives for IP-based services, while excluding consideration of contributions to full end-to-end performance made by, for example, “home networks, LANs, application gateways, terminals, hosts and other customer devices”. With reference to figure below from Y.1542 (which is a simpler version of a similar figure in Y.1541), the end-to-end performance covered in this paper is between the two User Network Interfaces (UNI).
Y.1541 recommends clear QoS performance standards under the direct control of public network infrastructure providers, while stating that “further study is required to determine how to achieve those performance objectives when multiple network providers are involved”.

The ITU-T has provided further consideration of various approaches to achieving end-to-end performance objectives involving multiple providers in Recommendation Y-1542 (06/2010). This document is primarily a discussion paper, outlining the major challenges in achieving the end-to-end performance objectives recommended in Y.1541. Those challenges “are present when:

- multiple network suppliers are necessary to complete the path;
- the number of networks in the path will vary request by request;
- distances between users is generally unknown;
- the impairment level of any given network segment is highly variable;
- it is desirable to estimate the actual performance levels achieved on a path;
- the operator must be able to say if the requested performance can be met or not; and
- the process must eventually be automated.

A number of different solutions are examined, with the advantages and disadvantages of each also evaluated. The document acknowledges that each solution presents further challenges in the standards development process. It also summarises the various aspects of the development and agreement that will be required for the new tools and capabilities to establish recommended standards.

Y.1542 addresses IP networks in general. Its Appendix IV addresses further considerations applicable for Next Generation Networks (NGN), with particular attention to the carriage of IP telephony as a fundamental public network service. In this regard Australia’s proposed National Broadband Network (NBN) will be the access network component of an end-to-end national (and international) NGN, with the IP telephony service carried over the NBN (and national NGN) ultimately replacing the current public switched telephone service (PSTS).

In both documents the ITU document indicates that, for similar reasons, with interconnected NGNs the appropriate method of guaranteeing end-to-end QoS is not clear. It advances two major approaches, both of which are considered in the body of Y.1542, noting that they are not mutually exclusive and can be used in combination. At this stage, no clear solution or recommendation is provided.
The Communications Alliance (CA) produces guidelines, codes and standards for the Australian telecommunications industry through industry consultation. Those guidelines, codes and standards are generally developed to be consistent with ITU-T Recommendations, adapted if and as necessary to meet Australian conditions.

Responsibility for regulation in the telecommunications industry is shared between the Australian Competition and Consumer Commission (ACCC) and the ACMA. Technical regulation is one of the responsibilities of the ACMA.

The ACMA may register industry codes and standards that meet certain criteria laid down in legislation. Compliance with a code is generally voluntary, although the ACMA has the authority to direct individual industry participants to comply with a code. Compliance with a registered standard is mandatory.

As a general rule the ACMA’s preferred approach is to rely on industry self-regulation through the registration of codes developed by relevant industry bodies and associations, with the CA being foremost in this regard. Only if it is clear that this approach is not working satisfactorily will it consider an industry standard; however in the absence of a relevant code it must be directed by the Minister or the ACCC to establish a standard. At the time of writing the only standard registered by the ACMA is in relation to the Do Not Call Register.

The only documents published by the Communications Alliance addressing QoS parameters for IP networks and services are guidelines. The two guidelines relevant to this discussion are G632:2007: Quality of Service parameters for networks using the Internet Protocol and G634:2007: Quality of Service parameters for Voice over Internet Protocol (VoIP) services. Neither is registered as either an industry code or industry standard by the ACMA.

The QoS parameters and end-to-end standards in G632 are fully consistent with those in ITU-T.1541. G632 also includes consideration of the methods for allocating QoS budgets between network segments. In the absence of a preferred approach promulgated by ITU-T it states that it is inappropriate for G632 to be prescriptive about how the budgets might be allocated. It further states that there “is also insufficient experience at present to support a recommendation of particular values for the performance targets to be met by individual networks.” However it does describe a methodology for budget allocation across multiple networks based on one of the two major approaches canvassed in ITU-T Recommendation Y.1542. An example of the application of that methodology is also provided for a hypothetical network path over two provider networks connected by a single interconnection link.

G634 canvasses the allocation of end-to-end QoS budgets for voice calls using IP networks in more detail, and considers the involvement of up to three carrier networks. It is similarly non-prescriptive in allocating specific budget allowances to each network, while also providing a methodology for doing so.

CURRENT AND PLANNED WORK ON STANDARDS

In the documentation referred to in this paper, both the ITU-T and the CA indicate that further work is required to provide a comprehensive framework for the allocation of end-to-end network QoS standards between different IP-based packet switched networks involving multiple network providers.

ITU-T

ITU-T Study Group 12 has coverage of Recommendations Y.1541 and Y.1542 (among others). Study Group 12’s Work Programme for 2009-12, as shown on the ITU-T website, indicates that Question 11/12 – Transmission planning, interworking and traffic management
for networks supporting voice, data and multimedia services and Question 17/12 - Performance of packet-based networks and other networking technologies list, among a wide range of issues for attention, the achievement of end-to-end QoS objectives where more than one packet-based network participates in provision of telecommunications services. Review of Recommendation Y.1541 under Question 17/12 is listed as under study commencing in October 2011, with review of Recommendation Y.1542 under study in 2012. No further details on the status or activity on these studies are listed on the website, with further enquiries indicating that there appears to be no other significant activity in this regard.

COMMUNICATIONS ALLIANCE

The “Future Work” sections of both G632 and G634 refer to work proceeding in international forums on achievement of performance objectives when multiple network operators are involved. In this regard they specifically refer to work on “dynamic” QoS negotiation on a session-by-session basis (one of the major approaches canvassed in ITU-T Recommendation Y.1542). The CA Works Programme 2011 does not list either G632 or G634 for review, and this status was confirmed by further enquiries.

In this regard it should be noted that the CA guidelines do closely follow the relevant ITU-T Recommendations. With ITU-T activity on those recommendations listed for activity in late 2011 and in 2012 it is arguable that at least a prima facie case exists for the CA to wait until the outcomes (or likely outcomes) of the ITU-T are known before determining what future activities it might undertake.

ISSUES FOR AUSTRALIAN NETWORKS

End-to-end delivery of services incorporating use of the NBN will be IP based and will involve multiple networks and multiple service providers in most, if not all, cases. At the wholesale service level it will involve, at a minimum, an access network at each end of the network connection and a backhaul network link. In a typical end-to-end network connection NBN Co will provide at least one of those access network segments, the backhaul link provided by a separate backhaul network infrastructure provider and the other access network provided by either NBN Co or another infrastructure provider. Other more complex multi-network configurations are also likely to occur.

As things currently stand, for packet-based multi-service networks QoS performance standards for each segment are determined by individual network infrastructure providers. While CA Guideline G632 provides a methodology for (and simple example of) how end-to-end QoS performance standards might be allocated statically to individual networks in a multiple network environment, that approach requires agreement between those providers but without a clear and consistent framework for doing so. G634 similarly canvasses up to three different networks for provision of IP voice services.

At this stage the ACMA does not appear to be taking an active role to lead and facilitate industry-wide agreement on the issue of end-to-end QoS allocation. NBN Co is consulting widely with the industry on a wide range of issues, including the issue of end-to-end QoS objectives of retail service providers (RSP). In a response to submissions received to a consultation paper it issued in December 2009, NBN Co noted that different RSPs had “a different number and definition of QoS levels through to their end users”. In response, NBN Co proposed to “provide RSPs with maximum flexibility in the operation of their end-to-end QoS capability”.

In December 2010 NBN Co released an updated version of its NBN Co Fibre Access Service Product Technical Specification Version 2.0, which dealt with a number of QoS-related issues. However the specification is silent on QoS performance standards, either for its proposed wholesale product offerings or on an end-to-end network basis.

Key concerns arising from these circumstances are that:
• In the move of existing telecommunications services (such as telephony) to an Australian NGN (of which NBN Co’s network will be a fundamental part) there is a risk that the current consistency of high quality end-to-end service quality of (fixed) telephony services may be unacceptably reduced. As a consequence there is significant potential for the quality of telephone calls to vary significantly and to fall outside the current high standard enjoyed by customers. Conversely, a deliberate design tolerance to different levels of QoS would be a positive response to the need for flexible and competitive pricing.

• The offering of new services that have a high dependency on QoS (such as widely available desk top video conferencing) may not be commercially successful due to the risk that the consistency of end to end service quality of these services is not well managed, and therefore does not meet reasonable customer expectations. Again, conversely, a variation to this would be an intended variable quality to suit different levels of price and acceptability in the market place.

These concerns are particularly an issue in Australia with the move to the NBN. The NBN will be the access network for great majority of fixed services, including existing services such as telephony, and is intended to be a modern best practice digital IP based access system. NBN Co, the industry and the regulators need to decide on the allocation of QoS component to NBN Co access network so that appropriate amounts are remaining for other network suppliers/service providers for end-to-end national and international services. It also represents a major opportunity for Australia to take an active role in influencing the ITU approach to allocation of end-to-end QoS. Flexibility and adequacy for the user application and actual market needs should guide QoS allocations. Unilateral allocation of QoS for end-to-end connection segments by individual carriers and service is not a recipe for success.

For Australian network suppliers the allocation of performance budgets would provide a sound basis for back-to-back Service Level Agreements between network suppliers, in turn providing greater certainty for the design, construction and operation of their respective networks.

In our view achieving appropriate end-to-end performance for all services that are connected via the NBN is essential to the success of the NBN. Failure to act swiftly on performance standards for individual networks delivering multiple services across a multi-network service connection carries a high risk of poor service delivery to customers and subsequent customer discontent. Loss of confidence in the NBN is likely to significantly impact on community support for it.

THE WAY FORWARD

The process of determining national and international standards for the telecommunications industry is a long one. In an environment where the NBN Co will shortly commence a commercial rollout a stable, agreed process for allocation of end-to-end QoS performance standards across multiple networks (including international networks) is rapidly becoming critical. Otherwise reasonable customer expectations will not be met for services that will become IP based and at least in part be carried on the NBN.

The issue is much wider than what NBN Co can address on its own. While Australia’s NBN will be an important component of an end-to-end service, it will be only one component. This is thus a national issue, which is also reflected in global networks.

The ITU-T Recommendations and CA Guidelines (among others) provide a sound framework of end-to-end QoS standards. What is required (and is currently lacking) is a framework for allocation of the end-to-end QoS budget, both within Australia and internationally, that takes due account of the needs and expectations of NBN Co and other network infrastructure and network service providers, and most importantly of end customers.

In this latter regard, particularly given the planned transition of many existing services to the NBN, a sound case also exists for data collection and reporting of customer perception of
service quality for at least fixed and mobile services (both voice and data) that are susceptible to QoS issues. It is acknowledged that this is a complex matter with a number of challenges. For example, it is difficult for customers to recognise QoS related performance issues in a structured way. Generally the service quality has to be very poor and occur often before customers are frustrated enough to report this as a concern. By that stage the overall technical status of end-to-end services may be very poor and possibly be very difficult to redeem.

Given the complexities of an IP-based multi-services environment involving multiple network providers a systematic process of information collection, sampling and measurement may be required.

The good work done to date by the CA and the ITU-T provides a solid foundation for future activity. A framework for that future activity should address, at a minimum, the:

- Processes;
- Mechanisms (voluntary codes or mandatory standards); and
- Key issues.

PROCESSES

The current processes for establishing national and international standards, codes, guidelines, recommendations etc. are well established and have proven to be successful in obtaining widespread agreement and compliance. Those processes are, however, time-consuming and require extensive contribution of resources from the telecommunications community.

As indicated earlier, there is currently a low level of activity in both international and Australian forums in determining the allocation of network performance standards across multiple networks in a multi-service IP-packet based environment. There is a consequent high risk of unsatisfactory performance for end-to-end services using those networks. Given the rollout timetable of the NBN and the planned transfer of Telstra services to the NBN a strong, if not compelling, case exists for Australia to establish the required standards in advance of international standards from the ITU-T.

In this regard, well-established processes for establishing national standards already exist through the ACMA and recognised national bodies such as the CA. However the ACMA currently uses a “light touch” approach, preferring to largely rely on the CA to manage those processes under ACMA supervision. Given the current low level of activity, the risks to achieving satisfactory end-to-end performance and the complex processes involved, the time has come for the ACMA to use its authority to initiate and actively manage those processes to ensure a timely outcome on these critical standards. If the ACMA requires additional powers and resources to do so they should be made available as a matter of priority.

AUSTRALIAN MECHANISMS

The major key mechanisms in use under Australian legislation are registered voluntary codes and mandatory standards.

A key advantage of registered codes is that they are developed with extensive industry consultation and therefore are likely to have a high level of ownership of, and compliance by, industry participants. A disadvantage is the exposure to network suppliers who take voluntary to be discretionary and only comply where it suits. While the ACMA has the authority to direct a participant to comply, the delay can be lengthy, and any remediation of the network also potentially lengthy. The impact could be an extended period of poor performance for network connections involving such a supplier.

On the other hand mandatory standards provide much greater authority to the ACMA in managing compliance in a timely way (assuming appropriate means of enforcing compliance accompany that authority). A further advantage is that, if established in a timely fashion, network suppliers are better positioned to design and build complying networks. A disadvantage is the potential for less ownership of the standards by suppliers.
Given the critical importance of realising end-to-end performance standards across multiple IP networks, combined with a more active role by the ACMA the mandatory standards approach is likely to achieve a satisfactory outcome within a shorter timeframe than would otherwise occur. This in turn would provide network suppliers with a greater opportunity to build complying networks in a timely fashion.

KEY ISSUES

Principles for allocations and budgeting of performance should consider the different service types and solutions for these types, taking into account at least the following:

- A requirement for equitable allocation at each end for the access component;
- Notwithstanding the above, an asymmetric and dynamically flexible accommodation of satellite, wireless (e.g. WiMax), and mobile (e.g. LTE) access methods may be necessary, and an appropriate budget and QoS assumption and degradation tolerable for this type of access;
- For the remaining networks, the number of network suppliers for any one connection is variable;
- Traffic can be routed dynamically according to the best available path and often according to a prioritisation of service type;
- An agreed allocation for carriage between access points (e.g. PoIs); and
- A budget allowance for terminal devices (e.g. video devices) and access configurations (e.g. LANs).

NETWORK RELIABILITY

The focus of this paper to this point has been on the performance of an IP-based packet NGN involving multiple carriers once an end-to-end service connection has been established. Arguably of equal importance is the capacity to establish and maintain that end-to-end connection for the time it is required. This performance characteristic is variously known as network reliability, availability and/or resilience. Causes of failure can be due to faults within one or more of the supplier networks or through an external denial-of-service (DoS) attack.

While not discussed further here, the issues and status of performance standards for establishing and maintaining that end-to-end connection for IP-based packet NGNs involving multiple supplier networks is similar. That is, there is a lack of any clear framework for determining how end-to-end network reliability is established and managed across multiple supplier networks. There also appears to be a similar lack of action among international and national standards forums to address this fundamental issue.

CONCLUSION

The performance of both way interactive real time services such as telephony and video-conferencing (to name just two) is fundamental to the successful operation of telecommunications networks and the support of the social and economic functioning of nations. Meeting the end-to-end QoS and network reliability standards is essential in meeting customer expectations of the performance of all telecommunications services. Failure to do so carries a high risk of poor quality services, high levels of customer dissatisfaction and, in the case of Australia impact on community support for NBN.

The ACMA and the CA have an inherited national responsibility to lead a process for allocation of end to end QoS, along with allocation of network reliability responsibilities, in NGN connections involving multiple supplier networks, both within Australia and internationally that takes due account of the needs and expectations of NBN Co and other
network infrastructure and network service providers and, most importantly, of end customers.

Given the long lead times typically involved in establishing national and international standards the timing is of this activity becoming critical. It is imperative that the industry, industry regulators and the Federal Government recognise the importance of having a sound basis for network suppliers to design, build and operate networks that will be used as part of end-to-end network connections delivering multiple services to customers. If necessary this should be done in anticipation of the work of the ITU-T. The responsible organisations (most notably the ACMA) need both the resources and the full authority to effectively initiate and execute these tasks.

REFERENCES


Communications Alliance Ltd. 2007a. G634:2007: Quality of Service parameters for Voice over Internet Protocol (VoIP) services

Communications Alliance Ltd. 2007b. G632. Quality of Service parameters for networks using the Internet Protocol


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Deploying a ‘superfast’ national tail circuit network (i.e. the National Broadband Network) will highlight other bottlenecks in information flow that currently exist between voice and data service providers in Australia, unless those bottlenecks are also addressed. This paper highlights the need for appropriately symmetrical peering arrangements to be enforced, for both voice and data services, between all NBN Service Provider networks.

INTRODUCTION

The National Broadband Network (NBN) represents a huge intervention in the telecommunications realm in Australia. It is intended to replace the dominance of Telstra with a new 'good' monopoly that should be limited to operating in the wholesale realm alone.

While such a tail circuit network will address a critical part of the future communications needs of Australians, there are other bottlenecks that exist between consumers and the information sources they wish to access. Raising the tail circuit speed may simply highlight those other bottlenecks to information flow unless they are also addressed.

I will note two specific bottleneck points that seem to have escaped consideration thus far, and explain why some attention to these details within NBN policy would be of benefit to consumers.

PEERING BETWEEN NBN SERVICE PROVIDER NETWORKS

A consistent issue in Australian telecommunications has been around the notion of ‘peering’. In the telecommunications context, this refers to a scenario where two or more industry members support the smooth and efficient passage of information between their respective networks without adding artificial cost constraints; in other words, without one party imposing an asymmetric cost upon the other party in order for information to be exchanged between those parties.

The generally accepted charging model for such interactions is ‘sender keeps all’ (SKA) peering – in other words, each party to such a peering connection pays its own costs to the point of interconnect and retains all income related to the flow of information across the link(s) concerned.

There are two key 'peering gaps' in Australia today, with one related to voice and the other related to Internet data.
VOICE NETWORK PEERING

In the voice realm, Telstra (as the dominant fixed line voice carrier) has long imposed onerous, outdated, and expensive constraints (both technical and financial) upon other carriers wishing to achieve financially and technically efficient bilateral 'local number portability' (LNP) and the bilateral exchange of phone calls with the Telstra voice network.

The importance of this ‘voice peering’ in the context of the NBN is that the NBN will physically remove the existing distance based costs related to originating and terminating voice calls, and will replace that with the carriage of all calls to NBN customers via Voice over IP. Whether the customer end is implemented through the ATA (analog voice) port on the customers optical termination unit, or the call is delivered via the customers Ethernet port to VoIP equipment in their home, the marginal cost to deliver the call from the NBN Point of Interconnect to the customer falls to zero in this environment.

As such, it is logical to expect the replacement of the existing CCS7, distance based, circuit switched PSTN mechanisms (call origination, call termination, and local number portability) with the simple peering of each service provider voice network using Voice over IP.

This makes the use of SKA peering an obvious and appropriate mechanism in the voice realm for NBN based providers.

To date, industry requests to engage in this form of VoIP based, SKA voice peering and to implement LNP over the same framework with Telstra (as the dominant voice platform provider today) have been rejected, and it is therefore clear that some form of policy requirement for such voice interaction is necessary when the NBN is deployed.

INTERNET DATA NETWORK PEERING

In the data realm, Telstra and others have historically formed the ‘Gang of Four’, a subset of Internet Service Providers who have refused to offer SKA IP network peering on a neutral basis and instead have imposed asymmetric costs on the connection and exchange of IP data between Telstra and parties not within the 'gang'.

In particular, while other IP backbone providers in Australia peer extensively (via both bilateral and multilateral peering points around the county), the members of the “Gang of Four” (and most critically, Telstra and Optus) require other providers to purchase connectivity to and from their networks at commercial (transit) IP carriage rates.

These connections are expensive, and as such they are frequently not provisioned with sufficient ‘burst’ capacity to accommodate transient high demand for data flow. By contrast, SKA based peering links are generally provisioned with high capacity (and proactively upgraded) as there is no reason to do otherwise.

These peering links encourage efficient transfer of data between IP backbones, and ensure there is no artificial bottleneck created in the flow of Internet data between a customer on one network within the Gang of Four and a server attached to another network not inside the Gang of Four (or vice versa).

It is important to note that for some time now, the paid transit links between the Internode national IP backbone and the Telstra and Optus networks is such that we deliver more data to those backbones than we import. In effect we are paying to deliver data to those networks that is then on-sold to its customers.

Historically, the ACCC recognised this problem in 1998 and took enforcement action to require peering between IP networks. However, the determination made at the time was fatally flawed. The ACCC decided (incorrectly) at the time that the (then) dominant four players had to peer – but no requirement was placed upon those four to peer with anyone else, ever. All subsequent requests and attempts to peer with Telstra and Optus since then have been rejected by those network providers.
In 2011, only two of those players (Telstra and Optus) remain in a market dominant position, and both steadfastly refuse to engage in sender-keeps-all neutral IP network peering, despite the entire rest of the industry having engaged in extensive bilateral and multilateral peering arrangements for many years. This situation leads to higher costs and reduced network efficiency for consumers.

WHY THIS MATTERS

In the ultra high speed NBN environment it will become vital that both issues are resolved and that peering of voice and data occurs efficiently between all providers offering customer services across the National Broadband Network.

At 100 megabit customer port rates, a lack of sufficient peering capacity (and a lack of economically rational paths through which to expand that capacity in accordance with technical requirements) will rapidly impede commerce and consumer utility for high bandwidth applications.

Similar issues will exist with respect to fixed line voice services unless action is taken to ensure that voice networks are peered and that efficient number portability is made available to consumers ‘on demand’ across the NBN.

Indeed the mobile number portability regime in Australia only exists today due to such an intervention to force it to happen. A similar intervention is clearly necessary in the NBN voice services realm. It will not happen by itself.

ADDRESSING THESE POLICY GAPS

Having indicated the existence of these problems, the question becomes one of how to ensure that efficient neutral peering in both voice and data do occur between all retail service providers that operate on the NBN. Where could a policy be defined and made to operate, in order to achieve this outcome?

A number of points exist at which such a policy could be defined and required of NBN service providers. These include:

- Amendments to the laws applicable to the NBN to require technically efficient SKA peering of voice, voice local number portability and SKA peering of data service networks between NBN service providers.
- Appropriate contractual requirements within the NBN Co wholesale access contract that all NBN service providers must sign
- ACCC intervention, potentially via requirements for the approval of the forthcoming NBN Co Special Access Undertaking (SAU) for the network
- A requirement for peering being included within the Telstra/NBNCo ‘side deal’ under which Telstra will be paid to shut down the copper network as the NBN fibre network is commissioned

However it is achieved, it is clear that technically and financially neutral peering of NBN service provider networks (voice and data, including local number portability) are essential parts of ensuring that the NBN delivers the full benefits to Australians that we all expect of it.

THE POLICY GAPS: NBN INFRASTRUCTURE AND REGULATION

TOO MANY COOKS
HAVE WE GOT OUR REGULATORY STRUCTURES RIGHT?

Ros Eason
Communications, Electrical and Plumbing Union (CEPU)

The liberalisation of Australian telecommunications in 1997 was accompanied by changes which saw responsibility for competition policy, and especially access issues, transferred from the industry specific regulator to the ACCC. Ros Eason considers how well the current dispersal of regulatory responsibilities and energies has served the industry and asks whether it is time for a re-think of our institutional arrangements.

SOME QUESTIONS

The decision by the Australian Competition and Consumer Commission (ACCC) last year to recommend rejection of the National Broadband Network Company’s preferred network design was a critical moment in telecommunications policy making in this country. Not only did it throw the hugely expensive and time-sensitive NBN project significantly off-schedule but it also highlighted the peculiarity of Australia’s current regulatory arrangements.

Where else in the world does the competition regulator – one which self-confessedly has minimal internal expertise in matters of telecommunications network engineering – effectively determine the topology of complex and critical national communications infrastructure?

How is it that, given its unparalleled role in this area, the ACCC’s views were not signalled to NBN Co at an earlier point in the design process? What coordination, if any, on this question was there between the competition regulator, the company charged with delivering the government’s programme and the Department responsible for overseeing the project and advising the Minister?

And where, in the formal process, was the technical regulator, ACMA, whose views on the practical ramifications of the proposed network architecture for the delivery of multiple services, some more latency-sensitive than others, may have been worth hearing?

SOME OBSERVATIONS

No doubt the ACCC decision reflected not only problems of coordination between the different bodies responsible for our national telecommunications policy but also ambiguities at the heart of the NBN project itself. Uncertainties as to the scope of the NBN “mission”– themselves related to the requirements that the network further both competition and social policy goals while generating sufficient returns to keep its costs off budget –have bedevilled the project from its inception.

The highly centralised network model proposed by NBN Co, which allowed for only 14 Points of Interconnection (POIs), would have maximised the company’s revenues (especially in the absence of volume discounts) while lowering unit costs, thus best positioning it to fund
the substantial internal cross subsidies which the government’s uniform pricing policy implied. (No alternative funding mechanism was proposed by government.)

At the same time, however, it would have stranded a large portion of existing fibre assets and effectively foreclosed all but inter-capital city markets to new competitive entry by fixed network operators. Such a scenario was acceptable neither to major industry players nor to the ACCC, given its understanding of its pro-competitive charter.

The final model endorsed by the Commission now provides for 121 points of interconnection (POIs), but it is not clear how long this number will withstand the conflicting claims of industry participants and the demands of policy. Indeed, at the time of writing, proposed government amendments to the *Telecommunications Legislation Amendment (National Broadband Network Measures- Access Arrangements) Bill 2011* would appear to allow the winding back of this number if such arrangements proved incompatible with NBN Co’s uniform pricing mandate.

At the same time, to put the matter beyond doubt – and to hobble the economically orthodox – the amendments specifically authorise cross-subsidisation as a means of achieving such pricing outcomes, effectively prioritising this goal over the provision of multiple access points.

The amendments thus deal head-on with one of the key areas of conflict – access arrangements and their relation to social policy – that has so vitiated telecommunications policy in Australia in recent years. Unfortunately, however, they do not essentially disturb the division of regulatory labour which has institutionalised these conflicts since 1997.

At the time of the introduction of the *Telecommunications Act 1997*, support for the transfer of some regulatory functions from the then AUSTEL to the ACCC was largely based on the expectation that the move would lead to a more industry-neutral and hence less intrusive approach to telecommunications competition regulation. These hopes proved profoundly mistaken.

Far from being confined within the general provisions of the then *Trade Practices Act 1974*, the ACCC was armed with two new telecommunications-specific sections which were used to justify and implement an increasingly assertive pro-competitive approach to access and access pricing issues. Such interventionism thrived in the policy vacuum created by the Coalition Government’s single-minded pursuit of Telstra privatisation as its overarching policy goal. Increasingly, however, it produced outcomes which were at odds with other “legacy” elements of policy, notably uniform retail tariffing and the related issue of universal service delivery.

Regulatory anomalies flourished: averaged retail line rental prices and de-averaged access seeker charges; divergence between pricing methodologies used by the ACCC for access pricing and ACMA for USO calculations; conflicting and apparently arbitrary pricing approaches to access services which might reasonably be regarded as substitutes.

In recent times any attempt at policy coherence appears to have been abandoned in favour of an unabashed pragmatism. How else can the ACCC’s most recent ULLS decision, which in anticipation of the NBN – but contrary to the Commission’s historic cost-based stance – introduces averaged access price for Bands 1-3 (but not 4!), be understood?

Such policy zig-zags have undermined confidence in the Commission amongst some of its most ardent supporters even as it has sought to extend its regulatory reach into questions of industry structure and, most recently, network design.

Meanwhile, ACMA, where technical expertise relevant to much of the ACCC’s activity resides (e.g. for the sub-loop unbundling inquiry, determination of non-price terms and conditions for declared services) has been largely marginalised from the central regulatory and policy debates. Its function as assessor of USO costs was dealt a death blow by Communications Minister Alston in 1999 with the pre-emptive capping of the 1997-98 USO at the politically acceptable level of $253 million. (The then ACA’s subsequent estimate was $548 million, while Telstra put the figure at $1.8 billion.) Since that time the authority’s...
telecommunications functions, at least in relation to wireline services, have been confined largely to the endorsement and monitoring of technical standards, themselves developed by industry under the auspices of the Communications Alliance.

It is not clear what role, if any, it will play in the implementation of the new USO arrangements, including the reassessment of costs, that the NBN project will require. What is clear, however, is that when government needed an assessment of the scale of Telstra’s current funding obligations for the purposes of the Heads of Agreement with NBN Co, neither ACMA nor the Department of Broadband Communications and the Digital Economy (DBCDE) was evidently deemed to have the internal expertise necessary for the task. The work was contracted out to McKinsey. Here is another straw in the wind that is blowing through Australia’s increasingly bleak telecommunications policy landscape.

CONCLUSION

It is time for a thoroughgoing assessment of our public policy making capacities and related institutional arrangements. The fragmentation of responsibilities introduced by the *Telecommunications Act 1997* has acted against the development of coherent and technically informed solutions to the challenges that such a dynamic industry poses.

It has instead encouraged political fixes (the 1999 USO decision is an egregious example) which diminish the authority of our institutions without providing long-term policy answers. And it has involved a dispersal of policy expertise – and a related thinning of institutional memory – which a country as small as Australia can ill afford, especially as we move into the unchartered territory the NBN project represents.
This article examines the issue of policy gaps in the Australian telecommunications framework from the prospective and reflective viewpoints.

Looking forward, the article examines the pressing need for an Australian ‘master plan’ for the development of the Digital Economy and related industry sectors. It also argues for a more comprehensive approach to ensuring that Australian consumers are equipped to make a smooth transition to fibre-based telecommunications services and to make informed decisions that will optimise their communications experience in an NBN world.

The article stresses that it is equally important for Government and regulators to review and possibly remove the raft of existing provisions that were designed and implemented for an earlier telecommunications era. It argues that many of these instruments presently serve little purpose other than to impose costs and obligations on industry players which outweigh any attendant benefit and reduce the industry’s competitiveness and flexibility.

When addressing policy gaps in the Australian telecommunications landscape it’s practically impossible to provide a comprehensive view. Given the pace of change and game-changing events such as the rollout of the National Broadband Network (NBN), there are bound to be many gaps that industry has not yet recognised, and many more that no-one has yet identified.

For the purposes of this article, I have adopted a somewhat liberal definition of “policy gaps”.

The first series of “gaps” I attempt to describe are provisions that exist in the telecommunications legislative and regulatory framework today, but which I contend should be considered for phase-out or termination. So the “gap” is perhaps a weakness in the regulatory review process which has allowed out-dated elements to survive.

REGULATORY PROVISIONS FOR REVIEW OR REMOVAL

There is little doubt that it is easier to legislate and regulate than to deregulate. I concede that Gillard Government Ministers will argue, with some justification, that legislating in a minority Government is no cakewalk, but the general point stands up to scrutiny.

Bureaucrats in DBCDE and related Departments have borne a heavy load over the past 18 months, drafting a host of Bills needed to create the basis for the NBN, along with numerous other pieces of telecommunications legislation.

The legislative focus has been squarely on the NBN, and particularly on the critical interconnect and access issues that underpin competitive activity and commercial possibility. It is not surprising, then, that relatively little attention has apparently been paid to the fact that the statute books contain a raft of legacy and residual regulation – much of which was framed to address an environment in which Telecom or Telstra was the dominant and vertically integrated incumbent.
With the advent of the NBN as a universal non-discriminatory access provider, the environment changes fundamentally, and much of the existing regulation becomes less relevant, less effective or anachronistic.

The Federal Government should – with industry’s help – take on the hard, parallel task of seeking a “clean slate” approach by removing as much of the out-dated regulation as possible and building up new provisions based on cost/benefit and emerging requirements.

In particular, we need a forward-looking approach to consumer protection regulation. Many well-intentioned existing instruments are either barely effective in the current environment and/or impose substantial costs on industry that tend to outweigh the benefits.

The Government’s 2011 Convergence Review is unlikely to achieve a great deal on this front, as its terms of reference appear to focus away from telco regulation and toward content and convergence issues.

Following are just a few examples of existing regulation that is approaching its use-by date, or might already have slid beyond that point.

**UNTIMED LOCAL CALLS**

Many customer service plans today treat local telephone calls as a piece of ‘included value’ in a product bundle. Many plans include local calls as a ‘free’ component. Increasing use of Voice over IP (VoIP) services dispenses with the concept of a local call altogether. These trends – combined with ongoing fixed-to-mobile substitution – will continue until, soon, telephony is just another application on the information super highway – and a relatively low-value application at that. It is reasonable to ask, then – why do we continue to enshrine and impose on industry the cost and complexity of maintaining an untimed local call billing and charging structure that is derived from Telstra’s network structure and design of the 1960s?

The peculiar maintenance of untimed local calls in Australia has its roots in the federal by-election in the seat of Adelaide in February 1988. The Hawke Government lost the seat to the Liberal Party via an adverse swing of more than 8%. Public anger against the plans of the then Telecom Australia to introduce timed local calls appeared to play a decisive part in the election result. A political taboo emerged overnight around the timed local calls issue.

In early 1988, Telecom had undertaken a wide-ranging public consultation process in an attempt to convince the populace that the move made sense (which it probably did). The then Minister for Transport and Communications, Senator Gareth Evans, summed up the situation in the wake of the by-election when he told the Senate: ‘I readily acknowledge that that was not one of the more successful community consultation processes of all time, unless one adopts as one’s measuring stick the achievement of an early decisive result.’

So decisive a result, in fact, that 23 years later, untimed local calls are still a mandatory feature of the Australian telecommunications landscape – long after technologies, products, customer usage and preferences have all moved on.

**CUSTOMER SERVICE GUARANTEE (CSG)**

The Customer Service Guarantee Standard was created in the year 2000, but already looks like an anachronistic instrument. It applies only to standard telephone services (in an era where mobile services outsell fixed services by a ratio of 2 to 1 and Internet/data services are driving overall growth). The Standard has been based around Telstra’s historical network topography and connection capabilities, yet it also applies to all Carriage Service Providers. How does the CSG play in an NBN world, where infrastructure delivery times are primarily the responsibility of NBN Co? The risk is that there will be a temptation to further expand the CSG, when the sensible course would be to phase it out.
STANDARD TELEPHONE SERVICE

The Australian regulatory regime continues to be based around regulating a “standard telephone service”. In many instances it assumes a one-to-one relationship between infrastructure and service delivery. This is a thing of the past. A new nexus needs to be identified.

PRE-SELECTION

Pre-selection dates back to the introduction of fixed-service competition in the early 1990’s. It allows customers with a standard telephone service to choose a different service provider to supply their national long-distance calls, international calls and calls to mobile numbers. It was designed to overcome the bottleneck control of Telstra over local access and to give a ‘leg-up’ to new entrants.

In future, NBN Co will be responsible for providing network access on a non-discriminatory basis, thus removing at a stroke the main rationale for pre-selection. Furthermore, consumers connected to the NBN will have the luxury of multiple ethernet ports on their network termination unit (NTU) in-home to connect to numerous service providers if they so choose. In these circumstances it seems pointless and inefficient to mandate continued pre-selection capability.

MANDATED CUSTOMER INFORMATION

A regulatory spring-clean is well overdue in the area of mandated customer information. Carriers and CSPs carry obligations to inform customers of many things that may have been important 15 years ago, but which should by now have faded away.

Quite apart from regular items such as the Standard Form of Agreement, premium services information and information about special assistance complaint handling customer service guarantees, emergency services etc, there are additional and separate information requirements arising from at least five pieces of legislation, five regulatory determinations and fifteen industry Codes.

This load is soon to be increased by new information requirements in the Communications Alliance Telecommunications Consumer Protections (TCP) Code (the present revision of the Code is expected to be complete by mid-2011). Finally, the migration of customers onto NBN-based services will bring with it a raft of extra customer information tasks for the industry.

A related potential policy gap is the lack of a national approach to disseminating the relevant information to customers. In an increasingly on-line world, the tendency is to say ‘it is on our web site’, but policy makers – and service providers – need to address accessibility issues in a more structured and considered manner, which should in turn generate improved discipline about what information is actually required.

OTHER EXAMPLES

There are other elements of the telecommunications framework that are worthy in principle and made sense in the past, but which are rapidly being overtaken by advances in technology and changes in usage patterns. The National Relay Service (NRS), for example, is an expensive network, supported by levies on industry, which enshrines the old technology of teletype. IP-based communications technologies for customers with special needs will soon overtake the usefulness of the NRS. The question is, how quickly will Australia respond to this and make the shift to a better tool?

Another example is the National Numbering Plan, which should be a flexible technical document focused on network addressing and call routing. Industry manages small pieces of
the Plan, e.g. the INMS and associated freephone and local rate numbers, and this arrangement seems to work well. The rest of the Plan is administered by the ACMA and the process for change is lengthy, complex and relatively inflexible.

**NEED FOR A DIGITAL ECONOMY MASTER PLAN**

Minister Conroy has foreshadowed his intention to address one of the more obvious policy gaps relevant to the telecommunications industry. This is the creation of a national Digital Economy Strategy.

Details are scarce to date, but if it is to be effective, the strategy should bear at least some of the characteristics of the information technology ‘master plans’ that have been used so effectively in countries such as Singapore and the Republic of Korea to coordinate policy settings across all arms of government and drive national initiatives to bring the benefits of high-speed connectivity and applications to business and consumers alike.

Australia’s strategy must be calibrated to foster an environment in which applications development can thrive and e-government services can become pervasive and deliver productivities and efficiencies to help make our nation globally competitive.

One element that Australia needs badly is a national initiative to accelerate the digitisation of Australian content. Korea began a concerted campaign back in 1987 – yes, 1987! – to digitise all Government documents. Rapid achievement of this task laid the foundation for the Korean e-government revolution, which is a key contributor to that nation’s economic rise over the past decade. More than 80% of Korean tax returns are completed online and more than 1500 Government services are available via digital platforms.

The Executive Chairman of Open Text Corporation, Tom Jenkins, visited Australia in March 2011 and recounted how the lack of digitised Canadian content had generated unintended consequences after Canada had upgraded its national broadband capability. The advent of ‘fast pipes’ for consumers meant that the youth of Canada were flooded by digitised American content, with the result that Jenkins believed that young Canadians had effectively ceased to exist – they were now young Americans.

Jenkins warned that the NBN rollout could have similar effects in Australia unless we move quickly to digitise more of our local content. At present, he claimed, only about 3% of Australian content had been digitised.

I had first-hand exposure to the problem recently, when peripherally involved in a Federal Government initiative to create a personal identification platform for a particular service, widely used in Australia, around which there are some valid security and law enforcement concerns (confidentiality requirements prevent me describing it more precisely). The use of Passports for identification purposes was a logical option, but could not be used because Australia has not yet completed the digitisation of passport data.

**CONSUMER EDUCATION AND THE NBN**

Communications Alliance has been active since early 2010 on the issues surrounding the need to ensure that consumers get access to the information they will need to make sensible and informed decisions when the time comes to migrate their services to the NBN.

Consumers will be confronted with a myriad of new possibilities and questions around such issues as:

- the merits of competing service plans;
- whether existing customer-premises equipment will still work or needs to be modified or replaced;
- whether to use existing wiring, wireless devices or new cabling to distribute services in-premises;
• whether existing services can all be replicated exactly on a fibre-based platform;
• how to deal with multiple ethernet ports and multiple service providers; and
• how to manage faults.

Once migrated, consumers – including businesses – will face new challenges to optimise their telecommunications experience in a fibre-based world, including which of the vast array of IP-based applications they should use and how to manage their video services as triple-play options become prevalent and intelligent IPTV offers totally new video opportunities.

The consequences of widespread consumer confusion and/or poor initial decision-making by consumers can be readily imagined. This could generate a public-relations ‘perfect storm’, prove damaging to the health of the industry, and impede the delivery to consumers of the many benefits that fibre-based services and applications can offer.

The Government has mandated that NBN Co undertake a wide-ranging Public Information Campaign, including on service issues that lie beyond the NBN Co network boundary. Communications Alliance has established an industry Working Group to assist NBN Co in this task.

It is doubtful whether these arrangements will be sufficient for the task. The Government allocated funds in the region of $60 million to publicise and provide consumer information around the television Digital Switchover campaign – in which consumers need to make comparatively simple decisions about how to be ready for the switch from analogue to digital transmissions.

The lack to date of a similar commitment to ensuring Australians have the information they need to take full advantage of the nation’s significant investment in the NBN stands out as a potentially dangerous policy gap.

CONCLUSIONS

Today’s telecommunications legislators face the unenviable task of trying to make a traditional and unwieldy law-making and regulatory process keep pace with accelerating advances in technology, product development and consumer usage patterns.

Policy gaps will inevitably occur, either through a combination of procedural time-lags and unforeseen events, or because regulation is made too prescriptive to cope with changing circumstances.

To a degree we must accept this as a symptom of rapid progress – provided there is an ongoing commitment to repair those gaps that do appear.

Equally, however, we must ensure that the out-dated elements of regulation - the provisions that once made sense but have now become less useful and/or simply act to impose unnecessary obligations and costs – are cleaned away to promote efficiency and the ability to meet new challenges.

With the implementation of the National Broadband Network, Australians within a few years will be provided with arguably the best broadband infrastructure in the world. The challenge is to ensure that the end users reap the benefits of that infrastructure in the context of a broadly based digital economy. Several important questions are posed that require further policy elaboration, in order to meet the long-term best interests of end users.

INTRODUCTION

The Australian Telecommunications Users Group (ATUG) is pleased to contribute to TJA's issue on 'Addressing Policy Gaps'. In 2011, ATUG celebrates 30 years of working to improve communications services and prices on behalf of end users who rely on communications to efficiently deliver their services, to effectively connect with customers and to innovate for growth and productivity.

The recent communications sector policy debate in Australia has been focused on fundamental reform of a framework that has not delivered on its 1997 promise of open and effective competition in the fixed local access market.

A change of Government in 2007 led to renewed focus on telco sector outcomes and broadband was the case in point – slow speeds, high prices, under served regional markets, switching processes that discouraged customer choice, a patchy platform that did not support innovation.

THE 2009 POLICY FRAMEWORK

In April 2009 the Government outlined a comprehensive and complex framework for the communications sector. It stated it would:

- Commence an implementation study to determine the operating arrangements, detailed network design, ways to attract private sector investment
- Fast-track negotiations with the Tasmanian Government, to build on its NBN proposal to begin rollout of FTTP network and next generation wireless.
- Address 'black spots' through the timely rollout of fibre optic transmission links connecting cities, major regional centres and rural towns.
- Progress legislative changes that will govern the national broadband network company.
- Facilitate the rollout of fibre networks, including requiring greenfields developments to use FTTP technology.
• Make an initial investment in the network of $4.7 billion. (In the December 2010 Statement of Expectations, the Government committed to an equity agreement with NBN Co based on $27.5 billion funding requirement, to be reviewed annually.)

• Commence a consultative process on necessary changes to the existing telecommunications regulatory regime.

Much of this policy agenda is well underway and yet there are gaps – many of which emerge more clearly during implementation.

For instance, at the time of writing, the NBN Companies Bill and (ATUG's shorthand) the NBN Access Bill have both passed the House of Representatives and are currently in Senate Committee with hearings scheduled in early March. The governance structure and accountability framework for the NBN Co will be properly in place only with the passage of these Bills through the Senate. ATUG was pleased to see the 'long-term interests of end users' remain as the key objective for NBN Company and for this to be reinforced by NBN Company's access arrangements being part of the Competition and Consumer Act (Trade Practices Act) access provisions.

POINTS OF INTERCONNECT

An important issue which was until recently a 'gap' was the difference in view between NBN Co and others including ATUG on the number of Points of Interconnection. This problem was solved using time-tested processes of public consultation and discussion, with the outcomes being a larger number of Points of Interconnection, which preserved competition in backhaul markets. The decision leaves further questions for end users in regard to delivering on the Prime Minister's undertaking about a Uniform National Wholesale Price so that 'regional areas can pay the same price as people in the city'. For industry there are still questions on the criteria that will only be agreed between the ACCC and NBN Co after NBN Co lodges its Special Access Undertaking. And Telstra has advised that some of the identified POIs are not yet suitable for use and would require additional investment and extensive work to refit or expand so they would be suitable. The same issue may arise for other parts of Telstra infrastructure that will be part of the $9 billion access arrangement between NBN Co and Telstra.

COMPETITION IN THE WHOLESALE BROADBAND MARKET

In general, the objective of preserving infrastructure competition where possible in an NBN policy world raises a series of questions about the new emerging wholesale markets – both NBN Co markets and backhaul markets. The legislation preserves an opportunity for others to build local access fibre provided it meets NBN technical and access standards. Questions will which arise which will need policy responses if commercial market outcomes are not satisfactory.

For ATUG this is an area of 'wait and see' as the outcome depends on service providers at Layer 3 developing an effective wholesale market while they still have retail market interests. What visibility is needed for this market? How can users be sure prices are competitive? Who will respond if barriers to entry emerge such as balance sheet strength, customer numbers or technical parameters? Again ATUG is pleased that a risk mitigation strategy is part and parcel of the legislation – if the market doesn't develop, the Minister and/or the ACCC can respond.

END USER CONCERNS

Assuming these new markets develop effectively there are a series of practical questions end users have about quality of service, end to end performance quality through network assets owned by a number of companies, fault handling processes and billing processes. All of which require significant intra-industry work to achieve what end users enjoy now – any to any connectivity and end-to-end service performance. In this context, the first and second
release sites are not just 'construction trials' for the NBN Co; they are competition and consumer trial sites for the NBN Policy Framework.

The NBN policy promise is not only about speed it is also about much improved competition – multiple services from multiple service providers over the NBN Co local access link with a consistent customer experience from one end of the NBN to the other end. In this new world, the focus for end users will be on practical outcomes – How much will services cost? When will they be available? How much disruption will there be? Who do I call if something goes wrong? But these outcomes will depend on good policy responses to emerging issues.

Part of the risk mitigation is the Joint House NBN Committee, which has been agreed to. This will provide a six-monthly review by both Houses of progress with the NBN, including importantly network rollout performance including service levels and faults and NBN Co’s strategy for engaging with consumers and handling complaints. The wide-ranging terms of reference for this Committee provide an important protection for end users and an important protection against unforeseen policy gaps.

DECIDING THE NEW USO

Universal Service Obligation is a very significant policy area where there are still many questions. A new model has been proposed as part of the Telstra/NBN/Government arrangement needed to support the cost effective deployment of the NBN (with consequent benefits for end users in terms of prices). The new model leads to a new organisation, USO Co, and new processes where Telstra becomes a sub-contractor to USO Co with NBN taking responsibility for infrastructure in fibre-served areas but being required to maintain copper services in non-fibre served areas. The objectives of the updated USO arrangements are to ensure that a basic voice service remains available across Australia, to provide clarity and certainty to consumers and industry, and to ensure consumer safeguard regulations are effective. A series of Ministerial Determinations will be needed to give effect to these objectives and until these are clear, an important policy gap remains.

THE NEED FOR BUSINESS GRADE BROADBAND RETAIL SERVICE OFFERINGS

So far in the policy development the focus has been on residential market outcomes – perhaps because revenue volumes are here, perhaps because of a belief that businesses will benefit from competitive infrastructure. Business grade offerings from NBN Co will be important in driving residential take-up because it will be business applications (including entertainment) and government services that will drive take-up of consumer connections. Encouraging new 'business-focused' entrants to the communications market will be an important KPI for the government's NBN Policy. These new entrants need to be supported with pro-competition implementation plans because they will drive innovation outcomes for the NBN.

BEYOND THE NBN BUILD – POLICIES FOR THE DIGITAL ECONOMY

Beyond the NBN build and connect phase issues, ATUG sees policy work emerging in the transition to a Digital Economy – the benefits side of the NBN project.

ATUG has been discussing the shift to a Digital Economy and a number of questions have emerged in these discussions:

- **Innovation and Applications** – How can we encourage the new businesses? How can we support the transformation of existing business and government service delivery models? How can we encourage and support new ways of working such as teleworking? How can we use Cloud Computing services?
• **Integrity and Assurance** – How do we deal with community concerns about privacy? How do we improve digital confidence? How do we empower consumers with e-security strategies? How do we improve community skills to encourage wide participation in the Digital Economy?

**STRATEGY STARTS AT THE TOP**

There are a series of seemingly independent initiatives that need to be brought together in a comprehensive Strategy for Australia’s Transition to a Digital Economy. COAG is the vehicle to coordinate Federal and State Government efforts. Industry should be an equal partner given the commitment to investment, training and change that is going to be needed.

**INNOVATION MUST BE FOSTERED**

• Ubiquitous, affordable, high-speed broadband connectivity will enable much higher levels of participation and interactive engagement – much more user-generated content.

• Innovation needs more than speed. Open Source working and a Creative Commons approach will be innovation drivers in a Digital Economy. What is the role for Copyright? What do Digital Economy Business Models look like? How will price structures change? Might applications charges include access charges?

• Business innovations will depend on Digital Confidence as much as Digital Connectivity – telecommuting; manufacturing on demand; shopping online with telepresence; business intelligence services; financial services 'Gone Green'; Software as a Service – the role of Cloud Services. Business software providers will embed collaboration tools to add 'Social Networking' community power to business processes.

**SERVICES WILL DRIVE SUCCESS**

• Visual Services are seen to be a key use of the new networks. Whether it is visual interaction in the delivery of Education or Health services over distance, video conferencing services as an alternative to long distance travel, or television services, (free to air or subscription) the opportunity offered for High Definition visual services is substantial. The implication is Symmetric Service Capability.

• There may be many 'new' Service Providers. The concept of a 'government port' on the termination unit had strong support in ATUG's discussions as many people considered that the delivery of government services via the new broadband networks has the potential for better service to the community and reduced costs of delivery. Such a concept may require the establishment of a 'Government ISP' to bring together the online services of government in a coordinated and user-friendly style.

**SECURITY IS THE SCAFFOLDING FOR A FAST GROWING DIGITAL ECONOMY**

• End User Trust and Confidence in the Digital Economy and in the services delivered over the new broadband networks is a key 'Success Factor'. Community concern about the perceived absence of adequate security of online payment arrangements has slowed the take up of electronic commerce

• Service Availability and Service Integrity are critical for all users in a fully Digital Economy

• Business needs education on better methods of verification/authentication. 'Bandwidth is not enough in dealing with security issues.' Governance tools are just as
important as technology tools. What is 'Best Practice' for online transactions in a Digital Economy?

SKILLS NEED UPDATING FOR A DIGITAL ECONOMY

- Developing skills to enable small and medium businesses and consumers to effectively participate in the e-commerce world is just as important as the development of professional and practitioner skills through University, TAFE and private provider courses.
- Consumers need education on 'best practice' for information online – being confident about how personal information will be accessed and used, and how it will be protected. The EU's eYouGuide to consumer rights in a Digital Economy substitutes concrete rights for 'best endeavours' but there are no absolute cures, only control measures to reduce risk and increase confidence.
- Digital Media Literacy is important to ensure the benefits of a Digital Economy are available to all; to give end users the confidence, knowledge and understanding needed to participate in digital media and communications environments.

STRUCTURES NEED UPDATING FOR A DIGITAL ECONOMY

- The introduction of an open access, wholesale only NBN is a key underpinning of the move to a Digital Economy. It is essential that 100% of premises have access to NBN standard services as quickly as possible.
- Regulatory structures need to be reviewed in light of the move to a Digital Economy. This work has started in the Telco Sector with the emergence of the NBN but it needs to go further by looking at Consumer Policies in an NBN based Digital Economy and the issues flowing from the service innovation and convergence enabled by a Digital Economy. The 2011-2012 Convergence Review is an important step.
- Issues are different in different sectors - Australia's Retail Sector has no tradition of catalogue shopping and so has not developed the logistics systems needed to support retail distribution in a Digital Economy. In the Health Sector a key issue is who owns the Health Record? How best to secure and store the record? How to protect personal information?

CONCLUSIONS AND RECOMMENDATIONS

Australia's National Broadband Network policy is an important policy framework that delivers an upgrade of the copper network on a national basis to fibre to 93% of Australian premises. NBN Co is charged with building the network by 2021 and operating it on an open-access, wholesale only basis with uniform national wholesale prices and an architecture which promotes competition. The next decade will see the implementation of a policy designed to deliver much better outcomes for end users.

This phase will need continued attention by policy makers, end users and NBN Co to outcomes that are in practice in the 'long-term interests of end users.' This paper contains several recommendations to enable Australia to make a satisfactory transition to a Digital Economy that meets the needs of end users.

Where is the Australian Government’s procurement policy for accessible information and communications technology? This paper investigates the current Australian Government procurement policy, the policies being introduced to dismantle barriers that Australians living with disability encounter and the international procurement policy environment for accessible information and communications technology (ICT). The paper argues that in order for Australians with disability to be able to have more access to employment, public services and a greater market of accessible ICT products and services Australia will need to adopt a comprehensive whole-of-government procurement policy for accessible ICT.

INTRODUCTION

In recent years Australia has introduced a range of progressive public policies to address the participation barriers faced by its citizens who live with disability. The Government has become a signatory to the United Nations Convention on the Rights of Persons with Disabilities, implemented a raft of reviews, inquiries and public consultations on how best to dismantle the barriers that Australian citizens with disability encounter every day in all areas of economic, social and cultural participation. However, despite this progress in disability public policy and a growing awareness and discourse on how societal barriers create disability, the question remains: where is the Australian Government’s public procurement commitment to accessible information and communications technology?

This paper highlights the need for an accessible information and communications (ICT) Australian Government public procurement policy by investigating the current Australian model of access and inclusion in public policy as it relates to the ICT environment; the policy changes that have been implemented in this sector to disassemble some of the barriers that people living with disability encounter in accessing our growing digital economy; and through comparisons with the international accessibility public policy landscape.

WHAT IS PUBLIC PROCUREMENT?

Public procurement is the process that governments follow when purchasing goods and services from the private sector. In Australia all levels of government – Federal, State and Territory as well as local – have procurement policies in place to monitor and prescribe the way in which goods and services are purchased. The Commonwealth, for example, has adopted the Commonwealth Procurement Policy Framework to guide departments and agencies in the acquisition of goods and services. The Framework ensures that the following principles are encompassed as part of any government procurement: “value for money; efficient, effective and ethical use of resources; and accountability” (AGIMO 2009).
Public procurement policies are not unique to the area of ICT and are used widely by national, state and local governments to promote and protect a raft of initiatives.

As Cynthia Waddell asserts, these initiatives include such policy goals as:

- to stimulate national economic activity;
- to protect against foreign competition;
- to improve competition in certain economic sectors;
- to drive innovation in a particular area of technology;
- to remedy regional disparities; and
- to achieve specific social policy goals. (Waddell 2009, McCrudden 2007)

An accessible ICT public procurement policy is a whole-of-government commitment to the purchase, lease and funding of information and communications technology products and services which include built-in Universal Design or access-for-all functionality.

All public procurement policy is dependent on procedures and criteria in order to be effective. An Australian accessible ICT procurement policy will require specific procedures and steps in order that it achieves the following strategic goals:

- improving accessibility in the public service workplace;
- increasing accessibility to all public services delivered via ICT platforms, and most importantly; and
- fostering Universal Design in the mainstreaming of ICT products and services for the entire Australian ICT marketplace.

Public procurement in the context of this paper relates to the expenditure of government funds in the purchase of all ICT products, services and contracts across all levels of government, and public expenditure limited to the purchase, lease and development of hardware, software, and the development of public services. It does not include any public expenditure associated with human resources in the operation of these ICT products and services.

According to the most recently reported data on Government ICT expenditure collected by the Australian Bureau of Statistics, the total Australian Government expenditure on ICT in 2003 was over $5 billion (ABS 2004). With an annual ICT budget of this magnitude, the Government has the power to drive the marketplace for ICT products and services. It is in the public interest that the Government use this market influence to encourage innovation, growth and availability of accessible computer equipment, software, telecommunications and public services. There is a strong argument supporting the link that demand creates innovation. Therefore, it follows that market demand created through public procurement policy can have the power to both foster and grow innovation in accessible ICT products and services. When increased competition is created through the desire to feed public procurement demand for ICT products and services – products and services which incorporate access-for-all functionality – the cost of equipment for people with disability across the marketplace should decrease.

It is not only people with disability who benefit from the principles of access-to-all functionality in an ICT marketplace. The development of electronic reading devices for the blind or vision-impaired have been co-opted as the preferred model for reading by many fully sighted people and consequently a bourgeoning market for e-books is threatening traditional publishing models.

Having a competitive marketplace of available, accessible and affordable ICT will be fundamental if the Government’s Social Inclusion agenda is to include people with disability in Australia’s growing digital economy.
INTERNATIONAL PROCUREMENT POLICIES

Several of the world’s leading economic markets have already adopted access-for-all ICT public procurement policies. Perhaps the most influential of these in leveraging increased e-access and e-inclusion is Section 508 of the United States’ Rehabilitation Act of 1973, (FCC 2008), which stipulates that all Federal Government departments or agencies must purchase, develop, maintain or use information and communications technology that is accessible to people living with disability. For all U.S. Government employees or consumers living with disability who use government services, all information must be accessible. In order for government agencies to purchase ICT products and services, these products and services need to be Section 508 compliant.

The market driver that Section 508 wields in the United States ICT economy ensures that developers and manufacturers of ICT goods and services address accessibility in order to sell to the U.S. Government. The roll-on effect of this is that the wider ICT marketplace has more ICT products with access-for-all functionality built in, removing the barriers of availability and affordability of accessible products for many of the U.S.’s approximately 60 million citizens living with disability (U.S Census 2010). In support of the Federal Government’s commitment to Section 508, the Federal Communications Commission Access Board adopted a standard for procurement developed by the Telecommunications and Electronic and Information Technology Advisory Committee in 2008 (TEITAC 2008). Additionally, the General Services Administration provides federal agencies with Section 508 procurement guidance and information. (GSA 2011)

The European Union has adopted an access-for-all ICT public procurement policy, Mandate 376 (M-376) (EC 2005). The main objectives of the M-376 mandate are to harmonise and facilitate the public procurement of accessible ICT products and services and to provide a mechanism through which public procurers have access to an electronic toolkit that enables them to make use of harmonised requirements in the procurement process (G3 ICT 2007). There is a range of EU States’ initiatives developed under the auspice of Mandate 376, which provide national and harmonised intra-EU States access-for-all ICT public procurement recommendations.

Both national and international studies of e-access and e-inclusion have highlighted a digital divide between people with disability and their non-disabled family members, friends and colleagues when participating in the growing digital economy. Addressing this digital divide needs to be one of the Government’s top priorities as Australia’s digital society increasingly transforms all aspects of economic, social and cultural life. The power of the public purse can leverage the wider ICT market to adopt the access-for-all principles of universal design, principles that can help bridge this digital divide and provide greater participation for all Australians in our rapidly advancing digital society.

These international procurement policies, such as the European Union’s Mandate M-376, include consultation with people with disability, experts in ICT development, standards bodies and manufacturers to ensure that the steps for procurement realise the goals of the policy. These stakeholders are included in the:

1. request for tender assessment of vendors & tenders;
2. product development or customisation;
3. implementation and evaluation; and
4. ongoing maintenance.

The inclusion and consultation of people living with disability in the development of public policy is essential if these policies are to be effective. In the case of an accessible ICT procurement policy where people with disability are the end-users, there needs to be a thorough understanding of the barriers in access to ICT products and services.
This range of international public procurement policies developed to ensure that accessible ICT products and services are available for government markets can provide best-practice guidelines for the development of an Australian accessible ICT public procurement policy.

**AUSTRALIAN POLICY**

Unlike comparable first-world countries, Australia has yet to adopt an ICT procurement policy which includes promotion of access-to-all and universal design protections for our already disadvantaged citizens living with disability. While the Federal Government has adopted ICT procurement guidelines, guidelines informed by the *Review of the Australian Government’s Use of Information and Communications Technology* Report 2008, these guidelines do not include any reference to the need to address e-access or e-inclusion for people living with disability. (AGIMO 2011)

Given the rapidly changing digital environment which has been embraced and championed by the current Government, the lack of a comprehensive ICT procurement policy that drives innovation, economic growth and social participation will only continue to disenfranchise and exclude the very people that a new digital society is hailed as benefitting.

This blind spot in Australian public policy can only be interpreted as the proverbial elephant in our public square, particularly given that in recent years the Australian public awareness of the disadvantage that many of our family, friends and neighbours living with disability face as they engage with the wider world has increased. Leading this growing awareness is a paradigm shift in the way we view disability. Increasingly policy makers and civil society are adopting the social model of disability – that is, disability as a result of societal barriers and attitudes – rather than the outdated medical/welfare model of disability which viewed disability as intrinsically being an individual’s deficit. Over the past three years the Australian Federal Government has developed a number of policies designed to help ameliorate the barriers that inadvertently create many of the access issues that people living with disability face in everyday life. Most significant is the 2008 ratification of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) (UN 2006). Underpinning the presupposition of this paper are several of the Articles of the UNCRPD which explicitly address the need of states parties to improve accessibility in the areas of information and communications technologies while also calling on signatory states to improve access to those technologies which allow full participation in the digital economy.

*Article 4
General obligations

1. States Parties undertake to ensure and promote the full realization of all human rights and fundamental freedoms for all persons with disabilities without discrimination of any kind on the basis of disability. To this end, States Parties undertake:

   (g) To undertake or promote research and development of, and to promote the availability and use of new technologies, including information and communications technologies, mobility aids, devices and assistive technologies, suitable for persons with disabilities, giving priority to technologies at an affordable cost;

Australia has reinforced its commitment to the UNCRPD by ratifying the Optional Protocol which enables disability discrimination complaints to be taken to the United Nations if they have failed to be resolved using all domestic remedies within the States Parties.

Another of the recent public policies developed by the Government is its Social Inclusion agenda, which has been adopted as a whole-of-government commitment to ensure that all Australians “have the opportunity to participate fully in the life of our society”. This Social Inclusion agenda is based on the core principle that “the needs of individuals must be at the
centre of policy development and service delivery”, and as such public services must be accessible for people living with disability (ASIB 2009).

Ironically, in stark illustration of how inadvertent barriers prevent people living with disability from social participation, the Government’s Social Inclusion website registration process was initially developed with an inaccessible authentication captcha box that had no audio alternative, thereby disabling participation, or social inclusion, for people who were blind or vision-impaired. Had there been a whole of government ICT procurement policy in place, the development of an inaccessible government website would have been addressed before it went live.

This social inclusion agenda aligns with the Government’s guiding policy initiative for addressing disability; the National Disability Strategy (NDS). The overarching NDS is intended to implement remedies to participation barriers that have been identified by people with disability, disability service organisations, peak disability bodies and government departments and agencies that interact with people living with disability (COAG 2010). The NDS has recently been adopted with a range of high-level ideals and very little in prescriptive solutions to the many barriers that prevent people living with disability from being able to fully and equitably participate in the Australian way of life. While the NDS does address accessible websites, the lack of inclusion of a whole-of-government procurement policy requiring built-in access-for-all ICT is the major shortfall of the NDS as it stands. As a national initiative to be implemented under the auspice of the Council of Australian Governments (COAG), the NDS would have considerably more relevancy and currency with the inclusion of an accessible ICT procurement policy.

While the Government has not yet undertaken to address this significant gap in public policy, there have been some recent government initiatives designed to improve access, specifically in the area of ICT, for people living with disability.

These new policy initiatives include the December 2010 release of the Access to Electronic Media for the Hearing and Vision Impaired Report which made 22 recommendations to improve access to broadcast services such as television for those Australians who are Deaf, hearing-impaired, blind or vision-impaired (DBCDE 2010). The report recommends that closed captioning on free-to-air television be increased from its current 6pm to 10:30pm primary channel requirement to 6am to midnight on all free-to-air broadcasters’ primary channels and all news and current affairs programming. Another of the report’s recommendations is for the Government to conduct a trial of Audio Description (AD) on the ABC television network for a period of 13 weeks. Audio Description is a verbal commentary of the visual content of video that is not available to viewers who are blind or vision-impaired. In order to provide a closed AD trial, one that can have the audio description content turned on or off depending on a viewer’s need. As the trial will need to be run on one of the ABC’s digital multi channels, this will require that the digital television or digital set-top box has audio-enabled on-screen menu navigation functionality.

Unfortunately, for Australian television viewers who are blind or vision-impaired, there are currently no audio-enabled set-top boxes available in the Australian marketplace – boxes which provide an alternative to visual navigation of the on-screen menu. Without an accessible set-top box, a closed trial of audio description will exclude the very people it is intended to assist.

Highlighting how public procurement can influence and drive the market, the Government’s Digital Television Switchover Taskforce is currently running a trial of fully accessible set-top boxes for its Household Assistance Scheme (HAS). Prior to the Taskforce’s announcement of the trial, consumer and blindness organisations lobbied government and manufacturers to promote the development of an audio-enabled digital set-top box for the Australian marketplace. In the meetings these groups held with industry the discussions ultimately focused on the market size for disability specific products and the return on investment for manufacturers producing these products. Discussions on the benefits of Universal Design and the economies of scale that could be achieved from an access-for-all market approach were
not fully appreciated by manufacturers and consequently they would not commit to developing fully accessible set-top boxes.

However, in order to secure contracts through future HAS Requests for Tender which will most likely require full accessibility features in set-top boxes; the manufacturers have since developed audio-enabled boxes and will soon produce these fully accessible boxes for the wider Australian market. These set-top boxes will not only enable blind consumers to navigate digital television but will provide assistance to the growing numbers of aging Australians with vision loss, consumers with low English-literacy skills and consumers with cognitive impairments. Through the power of the public purse, accessible set-top boxes in the Australian marketplace will ensure that the increased choice and participation that digital television offers as our most ubiquitous medium for entertainment will be available for all consumers.

Similarly, the Government’s policy to adopt the World Wide Web Consortium’s (W3C) Web Content Accessibility Guidelines (WCAG 2.0) will be significant in increasing e-access and e-inclusion for all Australians, not only those with disability. This policy commits all government websites to be “A” rated by 2012 and “AA” compliant by 2014 (AGIMO 2010). This will make access to online government information and services that are delivered via the web accessible and easier to use for many people living with disability. Unfortunately it will have limited impact on the under-representation of people living with disability in public sector employment and even less impact on the wider ICT marketplace.

ACCESS FOR ALL

If Australia is fair dinkum about including all citizens in the increasingly ubiquitous digital society, the lead needs to come through government commitment and policy. An accessible ICT public procurement policy will:

• promote the principles enshrined in the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) in which Articles 4, 9, 21 and 30 specifically address access to ICT and the role that access plays in encouraging economic and social participation;

• create greater employment opportunities for people with disability; and

• increase access to the growing number of government services being promoted through online platforms for people living with disability.

Adoption of a policy requiring accessible ICT equipment and software in all government departments, and public-funded organisations would largely increase the opportunities of employment for many Australians living with disability. The roll-on effect of this increased employment would produce a range of benefits for the whole community. With more people with disability in public service employment, the cost of providing financial assistance will decrease. With more people with disability in public service employment society’s attitudes will change seeing people with disability as fully participating members of the community. With more people living with disability in public sector employment there will be greater awareness and employment opportunities within the private sector for people living with disability.

As of June 2010 the percentage of people living with disability employed by the Australian Public Service was a low 3.2 percent (APS 2010), while at the same time the ABS was reporting that more than 19 percent of the Australian population identified as living with a disability (ABS 2010). While we do not know all the reasons that the number of people with disability is so underrepresented in the public sector, it is likely that with an accessible ICT public procurement policy in place, the employment opportunities in the public sector for people with disability would increase. The ABS reports that while Australia is facing a labour shortage there has been no increase in the percentage of employment of people with disability over the last financial year, yet the number of Australians in receipt of the Disability Support Pension has risen.
Current statistics on the numbers of Australians living with disability who are employed are very disheartening. Vision Australia’s 2007 Employment Report showed that 63 percent of Australians who are blind or vision-impaired are either unemployed or under-employed, and of those who are employed, only 30 percent have a weekly salary over $1000. (VA 2007)

CONCLUSION

As the term implies, access-for-all provides usability and functionality of products and services to the greatest number of people. Through the adoption of a robust and relevant whole of government accessible ICT public procurement policy, all Australian public service workplaces and ICT public services could become accessible to people living with disability.

While Australian Commonwealth departments and agencies are required by the Disability Discrimination Act 1992 to ensure that online information and services are accessible by people with disabilities, there remain many strong arguments as to why Australia needs to adopt a comprehensive accessible ICT public procurement policy, ranging from the rights-based principle that all Australian citizens need to have full and equitable access to government services; the power of the public procurement economy in influencing the broader marketplace; and to ensure that Australia does not become the dumping ground for inaccessible ICT goods that are unsellable overseas where policies protect markets from inaccessible products and services, in particular the larger economies of the United States and the European Union.

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Accessed 14 February 2011, available from:


An e-health system that connects patient information across health care settings – and to which treating doctors and other health workers have access, and to which they can contribute – will improve the safety and quality of medical care in Australia.

A well-designed e-health system makes the best use of existing health care services and avoids errors, duplication and waste. Although Australia has made significant progress in developing technical specifications and standards for e-health systems, the time has come to build the overarching infrastructure to make e-health a reality.

In June last year, the AMA looked forward to an acceleration of e-health programs in Australia after the passing of the Healthcare Identifiers Act by the Federal Parliament.

Healthcare identifiers are an important building block for electronic health records. They will facilitate the timely and accurate sharing of electronic patient information.

However, a Department of Health spokeswoman recently conceded that the Healthcare Identifiers Act does not provide for a system of shared electronic records. Instead, the National E-Health Transition Authority has selected IBM to design and build the National Authentication Service for Health to improve the security of electronic health communications.

This is a welcome move and another step towards implementing personally-controlled electronic health records as part of the Government’s 2010-11 Federal Budget commitment of $466.7 million to develop a system that supports personally-controlled electronic health records.

But this funding falls well short of the $1.1-$1.8 billion that the National Health and Hospitals Reform Commission had estimated was needed to deliver the national core infrastructure, governance standards and the tools to ensure the system will be available to all Australians who choose to participate.

It is clear that significant investment is still needed in e-health.

The push now is for a commercial approach that will rely on private investment and private engagement. However, it is hard to see e-health becoming a reality without a solid commitment from the Government to build the overarching infrastructure that is necessary to connect patient information across the health care sector.

A report by Booz and Co last year into e-health investment found:

- e-health in primary care drives most of the health system benefits, however these benefits are not realised in the primary care setting but flow on to the acute setting;
- the investment must be made at the primary care level, but the financial benefits of that investment accrue elsewhere;
- those who are required to make the significant investments reap only a small proportion of the benefits;
• those with the most to gain incur fewer costs; and
• governments are best positioned to intervene in this distorted market.

Personally-controlled electronic health records can empower and encourage individuals to take responsibility for their own health, but for medical practitioners, their use may be severely limited because of problems with the accuracy and comprehensiveness of the information they contain.

If e-health is to deliver safe and quality patient care, and avoid medication errors and duplication, we must have a shared electronic medical record in addition to any personally-controlled health record.

A shared electronic medical record that links reliable and relevant medical information across health care settings would provide treating doctors with the information required to inform clinical decisions.

The AMA Federal Budget Submission 2011-12 called on the Government to concentrate all its efforts on getting pathology results, diagnostic imaging results, hospital discharge summaries, and medications dispensed information onto an electronic medical record.

This is basic information, yet critical to patient care. It is currently available in electronic format, but it is not easily or instantly accessible to doctors in all situations when they are providing care for patients.

If it were possible for doctors to electronically access this patient information in ‘real time’, while protecting patient privacy, a significant amount of the e-health ambition would be realised.

The Government must fund and implement a shared medical record that:

• is supported by a personally-controlled electronic health record;
• contains reliable and relevant medical information about individuals;
• aligns with clinical workflows and integrates with existing medical practice software;
• has appropriate security measures in place to protect patient privacy;
• is governed by a single national entity; and
• is fully funded by governments and supported by appropriate incentives, education and training.

Of course, there will need to be appropriate safeguards for patient privacy. Every doctor is concerned about the clinical risks if patients are reluctant to share information with them because they thought – somewhere, sometime – that information might be accessed inappropriately. These concerns will need to be dealt with when there is legislation that covers the arrangements for electronic health records.

Making e-health a reality is a complex process that requires a sound and realistic implementation plan. Medical practitioners will play their part in bringing about the benefits of e-health by investing within their own practices. But the Government will need to take strong leadership to invest in and build the overarching infrastructure that is needed to connect patient information and assist doctors to obtain the capability to make e-health a routine part of medical practice.

The AMA Position Statement on shared electronic medical records can be viewed at http://www.ama.com.au/node/5472

THE POLICY GAPS: END USER NEEDS

The impending roll-out of the NBN provides an opportunity to address the inequitable access to high-speed broadband, and to empower citizens to effectively use new technologies as they become available. This paper seeks to briefly highlight the technological inequality in Australia, outline Australian Government policies and programs aimed to address the digital divide, and discuss potential gaps that require attention.

Focus is concentrated on Australian Government facilitated educational and informational policies designed to reduce the digital knowledge divide. Given the massive investment of taxpayer funds in the NBN, it is argued that further educational measures are required to ensure citizens have the ability to make use of available technology, and thus gain the maximum benefit from the NBN.

The NSW Farmers’ Association is the key state representative body for both intensive and extensive industries ranging from broadacre, meat, wool and grain producers, to producers in the horticulture, dairy, poultry meat, egg, pork, oyster and goat industries. Through its commercial, policy and apolitical lobbying activities it provides a powerful and positive link between farmers, the Government and the general public.

The Association’s telecommunications policy has been developed over many years, continually evolving with changes in technology, social policy and regulatory framework. Regardless of change, there have always been two underlying principles: parity of service and parity of price. The Association believes these principles should apply to all telecommunications customers – regardless of their geographic location. This philosophy drives the Association’s objectives in the area of telecommunications, with broadband Internet and the development of the National Broadband Network (NBN) being no exception.

Whilst the Association’s primary policy focus is equality of access and price, the issue of a digital divide exacerbated by the inability to optimally utilise available technology is also of concern to our Members, and requires further action from Government.

INTRODUCTION

The NBN is Australia's largest infrastructure project. It has been widely lauded as a landmark investment that will bring broadband access to all Australians, whilst simultaneously being criticised for not having undergone an independent cost-benefit analysis. As the NBN is rolled out, and better broadband resources become available, investments in empowering citizens to embrace the opportunities it brings are necessary. Furthermore, as expectations rise from business, society and government to participate in the digital world, the coming years are shaping up as a watershed period in addressing the digital divide.
Whilst there are many definitions of the digital divide, it is defined in this paper as 'the gap in access to technology'. Digital divide is caused by a number of factors including income, education, age, location, disability, opinion, gender and culture (ACT Government 2003; Curtin 2001; Curtin 2003; Lloyd & Hellwig 2000). The Australian Government has made a significant investment in the NBN to reduce this gap. A key element of the NBN is the guarantee that all Australians will be able to access high speed broadband of a minimum 12 Megabits per second (Mbps) peak speed. Whilst increased physical access will contribute significantly to reducing the digital divide, it's just one piece of the puzzle.

In one study access was divided into three components: access, ability and affordability (ACT Government 2003). 'Access' is described as technical access from home, community or public access points. 'Ability' is explained as the provision of training and support, including culturally appropriate training, and 'affordability' is referred to as the cost of access to appropriate technologies. In this article, the term 'access' will refer to technical and physical access, not to be confused with ability or affordability.

The purpose of this paper is not to comment on the necessity, price, or technical elements of the NBN. This paper focuses on the policies and programs in place aimed to address the contribution of ability to the digital divide. This is not to say that access and affordability aren't important, or have been resolved. Clearly they haven't, and these issues will be briefly visited to provide context.

**THE DIGITAL DIVIDE**

Gibson (2003) identified eight factors that contribute to a digital divide: income, education, age, location, disability, opinion and gender. Whilst all eight factors can affect the ability to utilise the Internet effectively, this paper focuses on location. This is due to the historical geographic divide in Australia, and the Government's responses aimed to address this issue.

Internet and broadband services have expanded outside of cities as a result of increases in technology, geographical extension of access, and Government assistance targeting underserved citizens and regions. Government programs such as the Higher Bandwidth Scheme, the Broadband Connect and the Australian Broadband Guarantee were somewhat successful in responding to the issue of lower availability of broadband Internet in rural Australia. Their overall success is of less certainty, with a detailed analysis having been provided by the Australian National Audit Office, released on 15 February 2011.

This history of the need for Government intervention to improve access in rural Australia relates to ability in two ways. Firstly, it shows that there is a market failure for telecommunications services in rural Australia, which shows no signs of abating. Secondly, it shows that rural Australians are newer to broadband technology in general, and thus may require further information on how they can benefit from the Government's massive investment in new technology.

Figure 1 below shows the continuing digital divide and constant improvement in the percentage of households with Internet access. It must be stressed that merely having access to the Internet is only one element of digital participation. Quality and affordability are equally important, and both are affected by location.
Government Policy objectives aimed at reducing the digital divide can be divided into two components:

I) those aimed at increasing access and affordability, and

II) those aimed at encouraging efficient use by those who already have access.

These two policy aims are closely linked and often overlapping.

(I) ACCESS AND AFFORDABILITY

The NBN proclaims to provide all Australians with access to a minimum peak speed of 12 Mbps. 93% of Australians will have access to fibre to the home which will allow for speeds of 100 Mbps and more. Of the remaining 7%, 4% will have access to fixed wireless, and 3% to satellite services which will allow peak speeds of up to 12 Mbps (as opposed to minimum peak speeds originally promised by NBN Co), an obvious disadvantage. The millions of Australians who make up this 7% are often forgotten in discussions touting the benefits of fibre. The digital divide remains a significant issue, with no solution proposed.

NBN Co. has indicated that they will charge the same wholesale prices Australia wide. However retail prices are far from certain, and could well vary between geographical locations.

The quality of service provided by satellite and fixed wireless will also be inferior. The Wireless Access Service and the Satellite Access Service will not initially have access to interactive streaming, real-time video or the Transactional Business Virtual Private Network Access service.

(II) ABILITY

As outlined earlier, closing the digital divide depends on ensuring that people have the ability to use services, should they be able to access and afford them. Williams (2011, p54) said:

'Rollout' is necessary but not sufficient without 'roll up'! 'Rollout' suggests that success in implementing a 'national broadband network' is a purely technical matter, with access achieved when inputs are committed. 'Roll up' speaks to the need to understand that success is achieved when the passive notion of 'enabling access' is replaced by an active reaching out to people to actually use this new tool.

As the NBN rolls out, and more advanced technology is available, there is a risk that people will be intimidated, and feel like they have 'missed the boat'. Figure 2 shows that Australians...
would like to have a greater knowledge on how to use the Internet. It is interesting to see how many people in their thirties who want to use the internet, but do not understand how.

Figure 2 - Internet non-users responses to the statement 'I would like to use the Internet but feel intimidated by the complexity of it all', by age.

Note: excludes respondent category 'cannot say'.
(Source: Roy Morgan Single Source Australia Database, Internet non-users aged 14+, Jan 08–Jun 08, (n= 2049).)

CRITIQUING THE CURRENT NBN POLICY GOALS

Government's policy goals and programs designed to address the ability of Australians to maximise the potential benefits that the NBN facilitates are outlined below. The evidence suggests that policy is unclear, and programs are inadequate given the scale of the provision of broadband infrastructure.

POLICY GOALS

When looking at the Government's stated policy goals, it is not clear what role they aim to play in addressing the lack of ability of Australians to participate digitally. Page 3 of *Australia's Digital Economy: Future Directions* defines the key focus in creating a successful digital economy:

- for Government, to:
  - Lay the foundations for the nation's digital infrastructure
  - Facilitate innovation
  - Set conducive regulatory frameworks
- for Industry, to:
  - Demonstrate digital confidence and build digital skills;
  - Adopt smart technology;
  - Develop sustainable online content models
- for Community, to:
  - Enjoy digital confidence and digital media literacy skills;
  - Experience inclusive digital participation; and
  - Benefit through online engagement. (*Commonwealth of Australia 2009*: 3)
This clearly states that the Government does not have a role or responsibility to facilitate digital participation. This is contradicted later in the same document when outlining the Government's digital media literacy policy and program skillset aims:

- The technical ability to engage at a basic level with a computer and the Internet, for example creating documents and emails;
- The ability to understand and critically evaluate digital media and to understand and critically evaluate digital media content; and
- The ability to create content and communications. (Commonwealth of Australia 2009: 44)

Whilst this appears to provide clarity of policy goals, the introductory sentence under 'Government measures' provides further ambiguity:

The Government has a number of initiatives in place that are designed to increase access to online services by all Australians. (Commonwealth of Australia 2009, p.49)

This statement oversimplifies the issue the Government is trying to resolve. Whilst they are stating that they are seeking to 'increase access', the underlying problem they are really trying to address is an increase in ability.

Does the Government have a role in facilitating use, promoting knowledge or educating the public about the benefits their massive investment in the NBN will bring? Surely it should be a key area of focus to ensure communities achieve digital confidence and digital media literacy skills. Promotion and education of benefits will encourage greater participation and uptake, thus providing a greater return for the Government's investment. Further clarity in this area from the Government is required.

Whilst NBN Co has been tasked with the roll-out of the NBN, it is not intended that they educate Australians about the potential benefits it will bring. This is highlighted in the Government's Statement of Expectations with NBN Co; no mention is made of education or encouragement of use. The communication, education and empowerment of citizens to use the NBN is the responsibility of the Department of Broadband, Communications and the Digital Economy. The National Broadband Network: Progress update December 2010 does not specifically mention how it plans to educate and empower citizens to get the most out of the broadband network.

PROGRAMS

Despite the policy confusion outlined above, the Government has put in place programs to promote participation in the digital economy, and inform citizens of the potential benefits the NBN will facilitate, with further programs planned. An outline of key programs is provided below with commentary on their relevance and adequacy.

The digital business website (http://www.digitalbusiness.gov.au/) was set up by the Department of Broadband, Communications and the Digital Economy (DBCDE) to assist small businesses and community organisations to move online. This does not fall under the category of empowerment of basic Internet use, but it is a step in the right direction to assist businesses and groups to move online.

DBCDE commissioned the following research projects to help analyse the benefits of a digital economy:

- Household e-commerce activity and trends in Australia;
- Impacts of teleworking under the NBN;
- Financial and externality impacts of high-speed broadband for telehealth; and
- Telemedecine in the context of the National Broadband Network.
The findings of these reports are very useful in identifying the potential benefits of the NBN, and will no doubt be communicated to citizens. The method by which they are communicated remains a key challenge.

DBCDE is implementing a number of programs to improve online safety and security. These are of great importance, as those who are new or inexperienced at using the Internet need reassurance that they will be safe online. It is important that very simple, clear information is communicated to Australians, through a variety of traditional channels, to alleviate such fears.

The Government has committed $2 billion over five years to the Digital Education Revolution program. This program aims to contribute sustainable and meaningful change to teaching and learning in Australian schools that will prepare students for life in the digital economy. Longer term strategies such as these are important, to ensure that no children are left behind.

The four-year Digital Regions Initiative program co-funds digital enablement projects with state, territory and local governments. It takes a collaborative approach to improve the delivery of education, health and/or emergency services in regional, rural and remote communities. Programs that have received funding include:

- Ambulance Mobile Connect SA;
- North East Victoria Bushfire; and
- South Australian Digital Telehealth Network.

Broadband for Seniors is Government funded program aimed to:

- provide older Australians with access, confidence and skills in new technology;
- address issues of technological isolation; and
- build community participation and social inclusion.

The program provides basic Internet training to seniors, given by volunteers. If this training provision were to be extended, volunteers should be utilised where possible. However, if demand exceeds that which the volunteers can provide, Government will need to step in to provide this service. Quite often those who need the training the most can least afford it, and thus it would not be appropriate to leave this up to the private sector to provide.

The success of Broadband for Seniors is currently being assessed by the Department of Families, Housing, Community Services and Indigenous Affairs. Anecdotal evidence states that this has been extremely successful in teaching older Australians basic computer and internet skills, with participant improvement far exceeding expectations. This provides a fantastic example of a program increasing the ability of a group to participate in the digital economy, effectively addressing a market failure. A similar approach is taken in the Indigenous Communications Program. Delivery of computer training is to be provided over the next four years in up to 120 remote Indigenous communities.

Regional Broadband Coordinators raise awareness of broadband and the opportunities of competitive backhaul services, promote broadband take-up and use and improve community understanding of the opportunities of broadband and engagement in the digital economy. Currently, there are eight broadband coordinators in Australia, covering the priority backbone blackspot regions. This means that there is limited coverage in rural Australia to communicate the importance of engagement in the digital economy.

In late 2010 the Australian Government ran Community Forums to provide information on the benefits of high speed broadband. Information provided by DBCDE stated:

- The number of attendees averaged over 25. The audiences were diverse and included both the general community and business representatives.
- Generally, attendees were very grateful for the forums and the opportunity to ask questions. In all locations in which the forums were held there was a very positive sentiment for the Government's NBN initiative.
• The information provided at the forums centred around the benefits of broadband as well as the specific detail around the initiative and the physical rollout. Representatives from both the Department and NBN Co were in attendance to answer questions.
• There are no notes or minutes of the forums, and no further information can be provided at this point in time.

It is difficult to assess the success of this initiative, given the limited public available information.

As at February 2011, DBCDE was working with a communications agency to develop a four year communication plan aimed at educating all Australians about the benefits of an NBN-enabled digital economy. This information is not yet publicly available.

OTHER INITIATIVES

Whilst the focus of this paper has been on the policies and programs of the Australian Government due to their decision to invest in the NBN, it is important to recognise that all initiatives must be accommodated and incorporated in planning. These include initiatives by State Government, Local Government, Private Companies, Internet Service Providers and Public Libraries.

ADDRESSING THE POLICY GAPS

As the NBN is rolled out it is essential that the issue of 'ability' is addressed in a timely, adequate manner. As discussed above, a detailed communications plan will be implemented by the Government to compliment the technical communication that will be done by NBN Co. This communications plan needs to go beyond advertising roll-out details and raising awareness of the project. It should address the policy gaps that exist in relation to ensuring that all Australians have the basic skills to be able to utilise the NBN.

Programs that educate and empower people who will have access to the technology to use services such as online forms, video conferencing and discussion forums are essential. These programs must be free, offered in physical locations with actual instructors, and be well advertised to maximise participation. It is crucial that education methods range from those that rely on no prior knowledge of computers and the Internet, through to more intermediate courses.

The timing of this information is critical. Citizens need to have had an ability to increase their ability to utilise the NBN before they make the decision to opt in. If this does not occur, too many could decide not to opt in, due to the perception that they would never be able to utilise the technology available. Another key point is that Government must be able to learn lessons as the educational communications strategy is rolled out around Australia. Demand for programs can be gauged, and tailored to make efficient use of Government resources.

CONCLUSION

In reviewing the Australian Government's policies and programs aimed at the ability (meaning competence and confidence) of Australians to use the Internet, it is clear that change is required before the NBN is rolled out. The Government has indicated that a detailed four year communications plan will be released by June 2011. It is essential that it clearly sets out how the Government plans to ensure that all Australians are aware that assistance is available that will allow them to improve their Internet skills.

The current lack of information from Government on addressing the digital knowledge divide, whilst worrying, can be addressed in this communications plan. It is essential that the roll-out of the NBN is not restricted to technical information on infrastructure provision, connection details and pricing strategies. The risk that citizens will not embrace the possibilities of the
NBN, or opt out completely, is very real. This could result in a larger issue if people feel that the NBN facilitated digital world has passed them by. Too much taxpayer money has been invested for the key issue of ability to be neglected.

Whilst this paper has focussed on ability, it is stressed that differences in affordability and quality access will continue to be the primary causes of the geographic digital divide even after the NBN has been rolled out.

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INTRODUCING MULTI-USER ENVIRONMENTS INTO AUSTRALIA’S VIRTUAL CLASSROOMS: A VALUE PROPOSITION FOR AUSTRALIA’S NATIONAL BROADBAND NETWORK

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As debate ensues over the nation’s priority to build ‘a gold-standard Internet network’ as Communications Minister, Senator Stephen Conroy describes it, his government’s broadband initiative, the NBN, has many Australians asking what the business case for a super-fast broadband service might be.

With educationalists alert to the fact that the 21st century classroom leaves the closed, teacher-centric, facts-based model of learning behind, the curriculum is being redesigned, teacher practice is changing, and technology tools that cater for an extensible, customised approach to learning are being developed.

Amongst the most compelling technology services for consideration are multi-user virtual environments (MUVEs); these are emerging technology platforms which can be hosted on servers or sold as software that enable 3D rendering of real or composed scenarios, events, people and places, which may be shared in real time with multiple other users, stream rich media and which can integrate learning management systems, such as ‘moodle’.

The aim of this paper is, firstly, to outline the important role MUVEs could play in our virtual classrooms, and, secondly, to assess whether policy and curriculum development are mindful of the advantages of implementing MUVEs, as there is evidence that MUVEs are being overlooked by ICT strategists and in the setting of Australia’s first national curriculum. This discursive paper shows where the omissions are, and suggests that, as far as the implementation of 3D virtual environments in the education sector goes, there may be a disconnection between those who ‘do’ (the teachers) and those who ‘plan’ (the policy makers).

INTRODUCTION

As debate ensues over the nation’s priority to build ‘a gold-standard Internet network’, as Communications Minister, Senator Stephen Conroy (2010) describes his government’s broadband initiative, the NBN, many Australians are asking what the benefits of a super-fast broadband service might be.

In December 2010, Minister Conroy’s Department released its ‘Progress Update’, flagging the new education services that the NBN would facilitate. The planned new superfast technology infrastructure, promising speeds of up to 100 megabits per second (Mbps) to 93% of all premises, would create ‘virtual classrooms’, ‘addressing the distance and isolation barrier…providing access to the best specialist teachers…and enabling collaborative learning between education institutions, both domestically and internationally’ (DBCDE 2010).

The NBN is of course, a means to an end, not a solution in itself, and, concomitantly the complex job of scoping the ‘virtual classroom’, understanding how to learn and teach within
it, and determining which services need to be developed for achieving the aims must, must also be undertaken.

The conundrum is being energetically discussed in forums across the nation and indeed internationally. Outlining the nature of the shift, at the education and technology conference ‘Questnet’, Nick Cross, Education Outreach Manager at the Australian Academic Research Network (AARNet), surmised:

‘Formal education no longer comprises the majority of our learning. Learning now occurs in a variety of ways – through communities of practice, personal networks, and in the participation of targeted learning’ (Cross 2009).

Similarly, in its ‘Teaching and Learning with Web 2.0 Technologies’ report, the Victorian Department of Education and Early Childhood Development referred to ‘the need for more collaborative learning, with student connections formed with experts, parents and peers’ (DEECD 2010, 5).

With educationalists alert to the advantages of the 21st century classroom over the closed, teacher-centric, facts-based model of learning, the curriculum is being redesigned, teacher practice is changing, and technology tools that cater for an extensible, customised approach to learning are being developed.

Amongst the most compelling technology services for consideration are multi-user virtual environments (MUVEs). These are emerging technology platforms which can be hosted on servers or sold as software that enable 3D rendering of real or composed scenarios, events, people and places, which may be shared in real time with multiple other users, can stream rich media, and can integrate learning management systems (Gardner et al 2008), such as ‘moodle’ (Sloodle 2010).

The aim of this paper is, firstly, to outline the important role MUVEs could play in our virtual classrooms, and, secondly, to assess whether policy and curriculum development are sufficiently cognisant mindful of the advantages of implementing MUVEs, as there is evidence that MUVEs are being overlooked by ICT strategists, and those charged with constructing Australia’s first national curriculum (ACARA 2010).

This discursive paper shows where the omissions are, and suggests that, as far as the implementation of 3D virtual environments in the education sector goes, there may be a disconnect between those who ‘do’ (the teachers) and those who ‘plan’ (the policy makers).

The research entailed:

1. Observing the use of MUVEs at Melbourne Grammar School.
2. An environmental scan of government support and initiatives.
3. Collecting and annotating perceptions about the ‘immersive Internet’. It was then considered whether such perceptions constitute the view amongst policy makers that MUVEs are not yet ready for deployment in classrooms – or indeed if they are sufficiently cognisant with them.

The paper does not delve into the machinations of departmental jurisdictions, in particular, the Department of Education, Enterprise and Workplace Relations (DEEWR) and the many committees across the education sector which report to it. Such detail is beyond the scope of this paper, although following this thread would further illuminate the blockages.

In terms of the promise of the NBN and the educational opportunities envisioned, this enquiry is, hopefully, timely.

MUVEs IN THE VIRTUAL CLASSROOM

Reports about trends in online learning (Allen et al. 2008; Johnstone et al. 2009) indicate that a range of factors constitute today’s virtual classroom, but that the range itself is predicated on a network-enabled computer as the baseline requirement, after which all or some of the following features may become involved:
• web-derived content including rich media
• remote access with limited or no face-to-face contact with teachers and students
• synchronous and asynchronous access to content
• self determined learning pathways and time frames
• online collaboration tools such as wikis and blogs for knowledge acquisition

The relationship between the learning community (including teachers), the curricular, and ICT tools and skills are further components for consideration (U.S. Department of Education 2010, 14-22).

Immersive tools are a part of this new paradigm; they are extensible environments for creating, sharing, and building knowledge. Multiple users gravitate or enter the simulated environments because of a common interest or purpose, such as collaboration, education and training, co-design, entertainment, industry and community events, and social interaction. A graphical representation, an avatar, denotes a user’s presence. Numerous users may share the same digital space; they see the same objects and avatars as one another, and can interact with all. Interaction is via multiple channels (chat, voice, gestures, and movements) and many such platforms enable users to share common content synchronously. A computer keyboard is used to navigate and manipulate viewpoints, although new modalities such as gesture, which Xbox’s Kinect brought to market in 2010, are being introduced. MUVEs’ variable elements include graphics, interaction, media input, documentation and presentation tools, scalability and bandwidth.

In his book, ‘Getting Over The Slump: innovation strategies to promote children’s learning’, James Paul Gee describes how new digital environments assist in problem solving, in that they enable educators to ‘build worlds full of the sorts of content we have associated with books’, allowing ‘young people to enter these worlds and experience directly the connections between words and other symbols and the world.’ (Gee 2008, 16). MUVEs open up an enormous range of imaginary tasks, with content which can mimic a historical setting, but which equally, can simulate real world scenarios that allowing students to role-play and problem solve.

The Northern Beaches Christian School (NBCS) in outer Sydney has made a major commitment to 3D learning environments. Teacher, Steve Collis (2009), reports that NBCS students are practised in their use of 3D interactive tools, and that they have created clothing designs and started a business for selling them using an ‘in-world’ currency. There is a bookstore for student writing, a welcome centre, an auditorium, an art gallery showing monthly exhibitions of student work, and an in world radio station streaming student-made programs. Governance, in NBCS' virtual environment is handled by its ‘land council’ there is a content regulatory body for programmers. Directed learning might take place at the Maths Maze, whilst group work has students beaming up into pods that hover above the terrain. Text chat is part of the assessment and is emailed directly to the teacher. A dance club enables students to socialise with their French counterparts, developing language skills and cultural insights at the same time. Importantly, Collis, who has a language teaching background, believes that the students are learning ‘high order skills’ that ‘would impress any employer’ (video narration in Collis 2009). He also emphasises that implementation of MUVEs in to the curriculum would not have occurred without support at the highest level of the school.

**CASE STUDY: ‘MAKE POVERTY HISTORY’ IN SECOND LIFE, MELBOURNE GRAMMAR SCHOOL**

MUVEs have many properties that lend themselves to remote and distance learning (O’Neill 2010, Salmon 2009) but if they were merely a substitute for a physical classroom, there would be no need to use it when students were co-located. Multi-user virtual environments are being used in situations where students are both in the same room as well as connected to each other in a virtual world. This so-called ‘mixed-reality’ learning (Gardner et al. 2008, 8) involves...
class sessions structured around the integration of virtual worlds and traditional face-to-face group work, building on the ideology that knowledge becomes valuable when it is created and devised through the collaborative processes.6

The following case study, a three-day workshop entitled ‘Make Poverty history in Second Life’ (MGS 2008) which was conducted at Melbourne Grammar School (MGS) in July 2008, demonstrates this. The multi-media project, which used the 3D virtual environment platform Second Life, could not have been achieved using more traditional collaborative tools, such as web conferencing or document sharing.

Facilitated by the school’s director of eLearning, Alberto Rizzo, 22 students decided to build on the theme ‘Make Poverty History’ by creating 3D objects and posters in an exhibition space to draw attention to the poor living conditions for communities in developing countries. The location for the activity was Skoolaborate, a schools site within the ‘Teen Grid’, a region purposed for 13-17 year olds in the virtual world, Second Life.2 The project was ambitious in terms of the short time frame, however a project blog was used to help students navigate, two experienced MUVE facilitators, or ‘para-teachers’, as well as MGS staff were on hand to assist.

The awareness campaign culminated in a mixed-reality concert featuring local bands performing in the school’s hall while simultaneously, a virtual version, consisting of the live audio feed and an avatar band (students were controlling the avatar movements) streamed into the ‘Make Poverty History’ virtual space. At the same time, the in-world version (the simulation), comprising a virtual stage, and avatar representations of the band members and their instruments, was streamed into the school hall on a large screen. Skoolaborate member schools from around the world logged in to the region and were able to view the virtual concert in real time, as well as view the creative content designed by the MGS students. Those for whom conflicting time zones were a problem were able to visit the exhibits after the event and watch the real-world concert as an archived machinima (Rizzo 2008).

Figure 1 - Students from Debney Park Secondary College mentor Melbourne Grammar students In ‘The Make Poverty History in Second Life’ project. July, 2008
PRACTICAL ISSUES

The Second Life component amounted to around $6k, a cost which MGS reasoned would be an investment in terms of future projects such as digital storytelling and machinima production (Rizzo 2008). The funds were allocated to employ technical personnel, including para-teachers with Second Life expertise, extra equipment and bandwidth, (though the school’s existing bandwidth proved to be sufficient).

RESULT

Alberto Rizzo believes the cost was justified, given the steep learning curve for the School and the need for experienced hands on the day. Following the event, a school Second Life group was formed involving MGS staff and students, and weekly workshops. The group continues to collaborate locally with Debney Park Secondary College and further afield with Skoolaborate’s global cohort. Activities include 3D modelling, content creation and storytelling. Some MGS students are proving to be so competent that they are employed as content builders in the wider education and training sector, (informal discussion with facilitator, Dale Linegar, in 2010).

Figure 2 - The project blog; students were given series of activities, rather than a ‘how to’ manual. This activity focuses on creating avatars to represent the real world band members. Prompts to action include ‘using the appearance editing tool’, and ‘take some snapshots’
A deconstruction of the event shows that:

1. Group work occurred simultaneously, in the real and virtual environment (‘mixed reality’).

2. Learning to navigate and build content in the virtual world was a hands-on experience. No textbook was used.

3. Students created and constructed visual metaphors for their ideas about poverty in developing countries using in-world tools; no physical resources were required to do this.

4. Students worked in teams, and designated one another roles.

5. A para-teacher with Second Life skills oversaw the event, as no teacher within the school had sufficient training to handle the event.

6. Students were in a position to demonstrate their newly found skills to their regular teacher – a reversal of the usual paradigm where the teacher provides information for students to consume.

7. The students had a critical time frame in which to achieve their goal, and were working with people from other schools whom they had not met before.

8. The project leveraged the mission, motivation and achievement characteristics of multi-player video games with which many young people are familiar and which is played recreationally, outside of school hours.

**OBSTACLES**

MUVEs are emerging technology, thus users commonly experience bugs such as lag and instability. Muves’ plug-and-play potential can be hindered by schools’ IT policies and configurations. Lack of customer support, setup and registration time were identified as major problems by a Victoria University team who opted to use the Second Life ‘Teen Grid’ for their ‘Avatar Project’ (Schutt et al. 2009).

Virtual worlds can present some perplexing issues around governance, as regulatory elements are largely in the hands of developers. Real-world authorities are always in catch-up mode as virtual world practices evolve, and are uncertain about how to regulate public virtual worlds, especially where money laundering, tax avoidance, scams, harassment, and theft have been known to have occurred. These are some of the reasons why educators might seek to use platforms that sit behind their institutional firewall.

Subscribers have limited rights over the environments in which they have invested, and are subject to end user licence agreements (EULA) over which they have little or no input.

If a virtual world platform should close, users have little to no recompense for their digital assets. However, interoperability and content transfer between platforms is well underway, with the Boston-based Immersive Education Initiative (IEI 2010) able to transfer content across five platforms. This mitigates any losses, as users could transfer their work to an alternative product.

**MUVES AND THE NBN**

MUVEs become bandwidth hungry the higher their levels of ‘immersion’; even lightweight platforms are impacted if user-groups are simultaneously looking at multiple, embedded, rich media, such as streaming video, streaming audio and presentations. In terms of the NBN, other factors with a potential to impact of performance (Given 2010) will be periods of peak demand on the network, and the fact that many users will chose to opt in at the ‘entry level’, delivering a likely 12 Mbps, not the high end 100 mbps, which is applicable to the needs of large-scale-enterprise.
Whilst research for this paper did not uncover a definitive range of bandwidth required for optimum usage - variables include the configuration of the client, the number of plug-ins associated with the platform, its graphical density, the number of simultaneous users, the demands of the project at hand – anecdotally, service providers and developers interviewed all support the idea that increased bandwidth builds new services and extends existing ones, and that, ipso facto, demand by the public for these services will increase. This same view is expressed by Minister Conroy’s Department, which foresees that the NBN will ‘support a new wave of digital innovation that will change and improve the way Australians live their lives, receive services and connect with the world.’ (DBCDE 2010).

It is hardly surprising that exponents of the ‘immersive Internet’ are enthusiastic advocates of the Federal Government’s NBN strategy, if for no other reason than their own creative enterprises stand to benefit. But beyond this, MUVE providers cited (comprising a value chain of content developers, designers, technical staff and para-teachers), share Minister Conroy’s belief that the proposed fibre-to-the-premises infrastructure will ‘drive innovation and opportunity’ (NBN 2010).

**PROJECT FUNDING AND POLICY GAPS**

In spite of current bandwidth constraints, experimentation in MUVEs within the education and training sector is well underway. Institutional advocates include the Department of Education and Training, NSW’s Curriculum and Learning Innovation Centre (CLIC) and the Distance Education Hub (DEhub) which includes a Virtual Worlds Working Group comprising representatives of over 30 higher-education institutions with some three hundred scholarly works attributed to them (DEhub 2011). Over 100 projects have been identified in the higher education sector (Salomon, 2010 pp.12-13), and this is by no means an exhaustive list.

In contrast, there is a notable lack of recognition in the Federal Government’s Digital Education Revolution (DER), which has committed $2.4b over the seven years, 2009-16, to make the most of the ‘opportunities presented by the National Broadband Network’ (Gillard 2010). Of this, $40 m has been allocated to professional development programs for teachers and school leaders. Within this parcel, a $16m ICT Innovation fund has selected four large-scale programs designed to equip teachers with digital readiness (DEEWR 2010b ).

Significantly, none of these programs make any clear reference to virtual worlds or multi-user virtual environments. As an example, in the $5.4m program ‘Anywhere, Anytime Teacher Professional Learning’, designed to update teacher’s ICT skills, a program ideally suited to assisting teachers to become cognisant with MUVE technology. One outcome has been the establishment of ‘Pathways for Learning Anytime Anywhere ; a Network for Educators’ (PLANE) by the NSW government to create ‘a 21st century immersive learning environment- a "digital virtual world" for experiential learning, problem based simulation learning, collaboration and communication’ (PLANE 2011). However the bulk of the program focuses on Adobe Connect and Microsoft Sharepoint (DEEWR 2010a), which are cloud-based services designed for the business and enterprise sector; as such, their design is skewed towards project management rather than ‘experiential learning’, a central tenet identified by the Australian Curriculum Assessment and Reporting Authority (ACARA) in its vision for 21st century schools (ACARA 2010, 5-19).

MUVEs are also omitted from DEEWR’s ‘Virtual Learning Environments’ report (2008, 25), in favour of blogs, wikis, and interactive white boards. A word search for MUVEs on the DER website in February 2011 produced no result other than to suggest it might be a misspelling of ‘MOVES’. The search term ‘virtual world’ produced only one result; it was used by the minister responsible – now the Prime Minister, Julia Gillard. In her 2008 address to the Australian Computers in Education Conference, Gillard used ‘virtual world’ generically, describing it as a place where students ‘spend hours…downloading information, playing games and socialising’ (Gillard 2008). Similarly, the term ‘immersive Internet’ and words associated with it. Such as ‘virtual worlds’ are omitted from the Federal Government’s

That said, the funding and research landscape is abundant. Entities at the forefront of developments include Smart Services CRC industry partners: the NSW Department of Education and Training’s Curriculum and Learning Innovation Centre (DET CLIC) and the Australian Academic Research Network (AARnet). Both are assessing virtual platforms for near-future implementation in the K12 and higher education sectors.

AARnet, as the national provider of high speed broadband to the education and higher education sectors sees the need for a timely and strategic approach, given academic communities’ evolving interest in immersive technologies (Sankar 2010).

The 2008 University of Essex (UK) trials in which Open Wonderland was used as a demonstrator for mixed and simulated reality learning environments (Gardner et al. 2008), have helped to shape DET CLIC’s view that virtual environments do indeed extend learning possibilities, and can be used to create ‘a robust, safe, learning platform where’ ‘natural’ collaboration is possible’ (Wood C 2009). DET CLIC’s plans to integrate immersive technologies into its slate of education products such as the popular interactive online science game ‘Murder Under the Microscope’ and continues to lobby its uptake in education policy circles.

The Australian Learning and Teaching Council (ALTC) has funded a number of virtual worlds research projects driven by UniSA’s Dr Denise Wood, including two disability access projects worth upwards of $500k (Wood D 2009).

The Flexible Learning Network has a national allocation of $2.65m for 2011 innovative -e- learning projects in the TAFE/Vocational training sectors, and it has a track record for funding virtual environment projects (Flexible Learning Network 2010)

The Victorian Health Promotion Foundation (VicHealth) has funded two 3-year projects, being the ‘Avatar Project’ (2009)) and ‘Connected Lives’ (Schutt 2009). The latter involved children with disabilities, including autism, from Melbourne and Gippsland regions. Other funding bodies supporting immersive service development include ARC, the Australian Teachers Learning Council, Centre for Creative Industries (CCI) and NICTA. The Smart Services Cooperative Research Centre has a dedicated Immersive Services stream, with the iSee platform, its cornerstone as well as a QUT team under Dr Ross Brown, researching the way virtual worlds can be used as workflow management systems, and a social research team based at Swinburne University of Technology (SSCRC 2010).

At a state level, government agencies are looking to build broadband enabled services, and the construction of its ICT project funds reflects this. In Victoria, for example, the Institute for a Broadband Enabled Society (IBES) is developing a number of immersive and 3D projects, particularly in the health domain (IBES 2010), and Multimedia Victoria (MMV), is embarking on Round 2 of its ‘Collaborative Internet Innovation Fund’ (cIIIF). Whereas Round 1 was designed to develop Web2.0 enabled projects, Round 2, announced in October 2010, has a broader brief: to assist with the development of projects ‘dependant on characteristics of the National Broadband Network such as its ubiquitous nature and high bandwidth’ (MMV 2010). A sum of $5m has been allocated. Further project funding may be available within the context of the State Government of Victoria’s 2010 $110m dollar ‘ICT Action Plan’.

On the creative side, the Australia Council has funded a number of Second Life digital arts projects, including $20k for ‘Babelswarm’ (Australia Council 2007), 30k for ‘MMuve IT’ (Australia Council 2010) and ongoing support for the Australian Centre of Virtual Art (ACVA) which grew out of the Babelswarm project. The Council has also instituted a ‘Geek in residence’ program, to service the digital component within creative practice. Screen Australia, along with state film agencies jointly funds the Laboratory for Advanced Media Production (LAMP) convened by AFTRS.

Screen Australia and Film Victoria have shown leadership with their joint ‘Serious Games Initiative’ in recognition of the emerging market. This program attracted 53 applicants, a
significantly higher number than expected. Two projects were ultimately selected for development (Financial Review, 2009). Given the interest and potential, the funds allocation of $375k for 2009-10 is small, and suffers in comparison to the investment made by the French Ministry for the Digital Economy program in which EU20m has been earmarked for developing ‘serious games’ (Telecom.gouv.fr 2009).

Looking at the wider services sector, support for the industry is adhoc. Virtual world developers such as Keren Flavell (2009) and Bob Quodling of Simmersion (2008) point out that their projects tend to fall between funding camps. This suggests that if Australia’s home grown innovation is to flourish, there may be a case for recognising the immersive Internet as an enterprise entity in its own right.

**SUMMARY AND OUTLOOK**

This paper is a response to the call by the Australian public, and an eager parliamentary opposition, for a clear indication as to how the bandwidth supplied by the National Broadband Network might be applied. The Government needs strong cases, clearly put. The much-vaunted ‘virtual classroom’ is an ideal case for arguing for super fast connection speeds as taxpayers need little encouragement to approve policies that advantage their own.

MUVEs are contextualised with this broader agenda in mind. As flexible, editable, interactive, shared online tools, they are part of our broadband future in which students will extend their own learning by collaborating within shared networks.

Well over 100 Australian education institutions are now trialling virtual worlds, and among members of education’s innovation circles, such as the Distance Education Hub (DEhub), MUVEs’ attributes are well known. But, whilst individual projects are being supported, the immersive Internet industry (services such as content makers, designers, consultants and marketers) is not recognised as an ICT niche in its own right. This lack of identity may be contributing to the immersive Internet industry’s failure to register on some strategic radars, resulting in piecemeal rather than systematised take up. Further evidence to this case is the apparent low level of government ICT purchases of in this bracket: MUVEs have only very recently been directly mentioned (PLANE 2011) in DER projects, whereas, for example, Microsoft’s and Adobe’s collaborative tools have been procured, and teacher training in their use is underway. Although these tools currently have no interactive 3D component, they may have found favour because of the way they integrate with existing government ICT, and for the attractive procurement and service conditions on offer.

If MUVEs are being overlooked because their marketing and support teams cannot compete with their big-tech counterparts, virtual classrooms run the risk of not reaching their potential; users needs and the technology need to be built together. MUVEs cannot be replaced by other collaborative tools as they contextualise human input into a computer by orientating it within an interactive, editable, and graphically satisfying online 3D environment. Document sharing or video conferencing cannot reproduce this experience. Projects at Melbourne Grammar School and The Northern Beaches Christian College have been described in order to support this.

If negative perceptions are indeed an issue, then the fact that MUVE technology is still in its early stages of development is the likely deterrent; stability, useability, security, integration into existing IT, and the need to set standards continue to challenge the rate of take-up. However, barriers to adoption such as maintenance and upgrades are being averted as services transition to being browser-based and hosted in the data cloud. Already a next wave is discernable, and whilst SecondLife is the lead platform in the education community, Open Source platforms such as OpenSim, Open Wonderland and the Australian product VastPark are well positioned for integrating third party applications, as well as for use behind a schools’ firewall.

Developments in interoperability and content transfer between platforms are moving well (IED 2010), as are moves towards an industry standard, known as X3D. This is welcome
news to developers and consumers as it means more flexible arrangements between institutions, and the ability to share, migrate and re-purpose content.

There are many projects under the auspices of the Digital Education Revolution that could assist the progress of MUVE product development and usage. the aforementioned PLANE project appears to be in the early planning and development stage, and is unable to capitalise onDER’s National Secondary School Computer Fund plans, in which children in upper secondary levels (years 9-12) are to receive their own laptop computer by the end of 2011 (DEEWR 2010b). These are fitted with video cards and inbuilt web cameras, meaning that these computers are capable of hosting most lightweight virtual world platforms. Students have the immersive tools at their fingertips but DEEWR is not optimally using them. This is a lost opportunity. Even if educators are reticent to experiment, their students are not, for they are already familiar with the play structure and protocols of MUVEs, due to MUVEs’ shared attributes with online video games and entertainment virtual worlds, places where young people like to be.

So, the hardware is there, the pedagogy getting there, (it is being constructed by innovative teachers who are conducting their own trials and experiments). What seems to be missing is an understanding of the immersive Internet at the higher branches of the education tree. Could it be that, like many of their fellow Australians, education’s decision makers need high capacity broadband up and running before they will really understand the value in this new service? MUVEs can run with existing ADSL 2 or cable broadband speeds, but where large numbers are involved, or the MUVE platforms carry extra services such as rich media streaming or high resolution video and graphics, bandwidth is quickly filled, and the experience becomes unsatisfactory. This is a pity, because were MUVEs more widely used, strategists within ACARA (Australia’s national curriculum project), and the offices of the Digital Education Revolution (even the Prime Minister herself, who stridently engineered both the DER and the NBN agenda in her previous portfolio) would be assured of some timely insights, which could then be relayed to a nation looking for arguments in the NBN debate that extend beyond the bottom line.

MUVEs are a good news story, but even better, is that unlike schoolbooks, it is the communities of users, not the tools themselves, that give online virtual environments their purpose and definition. The more virtual worlds are used, the quicker progress is made, resulting in more robust platforms, an invigorated pedagogy, an industry of third party services and applications, and a ‘real’ sense of the ‘virtual’ classroom.

REFERENCES


Smart Services Cooperative Research Centre (SSCRC), last viewed February 2011 <http://www.smartservicescrc.com.au/>


ENDNOTES

1. National Broadband Network (NBN)

2. The Department of Broadband, Communications and the Digital Economy (DBCDE)
3. A core feature of the Australian Government’s Digital Education Revolution, being developed by an independent authority, the Australian Curriculum, Assessment and Reporting Authority (ACARA) <http://www.acara.edu.au/default.asp>

4. The ‘Immersive Internet’ is a generic term for a range of computer-generated environments, including virtual worlds and immersive learning and collaboration platforms and virtual event platforms. The term was popularised by technology consultancy firm ‘Thinkbalm (2008-2010)’ <http://www.thinkbalm.com/2009/05/26/thinkbalm-publishes-business-value-study/#high_1>

5. ‘In-world’ is a location term used to differentiate or clarify that a designated place is not the physical one, but the virtual one.


7. Most virtual environments have a range of unique features. In the case of the social online world Second Life, ‘regions’ are connected to each other, giving the impression that land parcels adjoin one another. The user therefore senses that his or her avatar is travelling, (by flying or ‘teleporting’) to other locations and communities. Some locations are locked down and are not publicly accessible; the Teen Grid, is one of these, and is subject to high-level security protocols so that unidentified visitors cannot intrude.

8. Machinima is the term used to describe a video made of activities within the virtual environment. It might be a constructed narrative that is ‘filmed’ using avatars as actors, a recording of a live event, such as a conference hosted in a virtual environment, or a training exercise. Many examples of machinima can be found on the video sharing website YouTube, <http://www.youtube.com/).

9. The IEI’s ‘Platform Eco-system’ comprises Open Wonderland, Open Cobalt, Open Simulator (OpenSim) and realXtend and Sirikata, the latter being developed at Stanford University.

10. The degree of ‘immersion’ in respect to simulated online environments, equates the number of services within the platform which heighten the sense of engagement, for example a spatial audio program, high end graphics program, coupled with the seamless transition and integration of scenes, situations and users’ input.

11. Bruce Joy CEO of VastPark reports that the company’s basic platform, without any add-ons, has ’a footprint smaller than Skype’, (interview with the author, February 10, 2011).

12. As an example, Sprout Labs (2009), an e-learning platform developer based in Tasmania, writes, ‘Our experience with the alcohol training simulation was pivotal in discovering a limitation of the technology over a broadband connection. We originally planned to create a video-based simulation of a conversation with a drunken patron in which the learner had to pick up on non-verbal cues to decide how intoxicated someone is. Video is the perfect medium for this. As the project developed it became clear that working with video was just not possible with the current bandwidth available to most learners. The learning experience had to be reduced to text, which affected the richness of the learner’s experience’.

13. In a number of discussions with the author, conducted 2007-2010, Bruce Joy, CEO of the virtual collaboration platform VastPark, envisages holographic experiences for
users <http://www.vastpark.com/>; Keren Flavell, former program director with virtual worlds video capture company Treet TV, sees collaboratively-generated entertainment programs on the horizon <http://www.vastpark.com/>; Gary Hayes, principal of MUVE design, a company which builds virtual environment content, scopes a future of augmented reality embedded into social networking applications <http://www.muvedesign/>.

14. For example, the ‘Broadband and Beyond’ conference, held in February, 2011, did not refer to the immersive technology tools. <http://www.broadbandandbeyond.com/>

15. The laptops issued by NSW DET, the Lenovo IdeaPad S10e and the ThinkPad Mini 10 use the Intel Graphics Media Accelerator 950 and the Intel NM10 Express Chipset 200MHz graphics respectively (TALE 2010).


17. In inner city Melbourne, cable broadband connection speeds regularly clock in at 6.9 Mbps

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The Royal Institute for Deaf and Blind Children

The Royal Institute for Deaf and Blind Children (RIDBC) provides specialist support to children with a sensory disability, e.g., a vision or hearing impairment. Recent developments in telecommunications technologies have enabled RIDBC to expand their services to better support families and children living in regional and remote areas of Australia. This paper outlines the challenges of accessing support in regional and remote areas, the innovative uses of telecommunications technologies, the specific technologies that have been trialled, the model of service delivery and the technologies currently in use.

INTRODUCTION

The Royal Institute for Deaf and Blind Children (RIDBC) has been assisting children with a sensory disability, e.g., a hearing or vision impairment, for over 150 years. Since it was founded in 1861, RIDBC has been at the forefront of sensory disability, constantly striving to find new and innovative ways of supporting children and their families. Hearing loss and vision loss are both considered to be ‘low-incidence’ disabilities, however, these disabilities are not restricted to densely populated areas. Hearing and vision loss affect the Australian population indiscriminately, regardless of location. However, additional social and environmental factors can lead some regional and remote areas such as indigenous communities to be even more frequently affected by sensory disability (Senate Community Affairs References Committee 2010).

Prior to the development of modern telecommunication technologies, families in rural and remote areas of Australia had limited or no access to specialist support for their children with a sensory disability. Families were often obliged to make long journeys to major metropolitan centres to attend appointments with their children. The introduction of high speed broadband and cellular networks has brought the city to the bush. Modern telecommunication technologies have removed the burden of long journeys and provided families with greater access to regular, intensive support with experts in the field of sensory disability. Not only have new technologies provided access to these services locally, but many families now utilise videoconferencing technology in their homes and access specialist support without having to leave their lounge rooms.

RATIONALE FOR RIDBC TELESCHOOL

Three major factors prompted the development of the RIDBC Teleschool program: the importance of early intervention, the lack of expertise in regional and remote areas and the vastness of Australia. It has been well documented that children with a sensory disability require specialised early intervention support (Sass-Lehrer 2002). Research has also shown that early diagnosis and intervention in children with hearing loss leads to more natural language development (Yoshinaga-Itano et al 1998). For children with vision impairment or
blindness, early specialised intervention is needed in all areas of development and must offer the child experiences and opportunities for independent and active learning (White and Telec 1998). Given the importance of early intervention for children with a sensory disability, there is an urgent need for families to have access to early and intensive support. Due to the low incidence of sensory disability, however, many families in regional and remote areas of Australia do not have access to this kind of specialised support.

Recruitment, retention and ongoing professional development are additional issues that raise significant challenges in regional and remote areas. These challenges exist across most sectors; however, the impact is felt even more greatly in the area of sensory disability. Given the highly specialised nature of sensory impairment, professionals require a specific and unique skill set for supporting children with a sensory impairment. There are a limited number of programs aimed at training professionals in the area of sensory impairment, and consequently the number of professionals who are specifically trained to work in the field is low. This limited supply of qualified professionals cannot meet the demand, which results in many positions remaining vacant. Retention is also a challenge as professionals in regional and remote areas are often expected to cover vast geographical distances and support caseloads that are broad-ranging and encompass wide age ranges and varying levels of complexity. In addition, specialists have difficulty accessing opportunities for professional development, material and technical resources, and informational resources on recommended or proven practices (Rude et al 2005). Professionals in these positions are often the only professional in the area, and frequently experience a greater sense of isolation and lack of support. The combination of these factors results in higher staff turnover in regional and remote areas (Ludlow 2005).

The third key factor in the decision to create RIDBC Teleschool is related to distance. The ‘tyranny of distance’ is a well-known phenomenon in the Australian context. In area, Australia is the world’s sixth largest nation but in population, Australia is home to just 21 million people (Department of Foreign Affairs and Trade 2008). Two-thirds of the population live in major cities as defined by the Australian Bureau of Statistics, while the remaining one-third of the population live in regional and remote areas. For this segment of the population, access to specialist services is severely limited. A Parliamentary Report released by the Federal Government in 2002 highlighted the limited expertise available in regional and remote areas of Australia, particularly in the area of sensory disability (Employment, Workplace Relations and Education Committee 2002). In order to access professionals in the area of sensory impairment, families have generally been obliged to travel great distances to attend appointments at specialist centres in the nearest major city. In some cases, families have even relocated to major cities to avoid the costs and time involved in such frequent travel.

These three factors – importance of early intervention, lack of expertise and distance – combined to highlight a significant gap in services for regionally and remotely located families whose children were diagnosed with a sensory impairment.

ORIGINS OF RIDBC TELESCHOOL

Historically, families living in regional and remote areas of Australia received limited, if any, support for their child’s sensory disability. Support was generally provided through correspondence courses, infrequent outreach visits by specialists or by undertaking long journeys to major cities. RIDBC sought to improve the equity of access to disability services through the use of emerging telecommunications technologies. By the late 1990’s, advances in mainstream telecommunications technologies provided the means to connect families with professionals using real-time two-way audio and video transmission. RIDBC initially developed a program which relied on existing Integrated Services Digital Network (ISDN) connections to link families in the country with professionals in the city. These ISDN connections were often found in hospitals and community health centres. Families reported satisfaction with the support they received via videoconference but reported challenges with
the locations and scheduling. Consequently, RIDBC sought alternatives to the ISDN lines and explored the use of broadband to provide videoconferencing directly into family homes.

Technologically speaking, videoconferencing is a very demanding task and requires fast upload and download speeds at both the sending and receiving ends of the connection. For best results, videoconferencing also requires the upload and download speeds to be equal to each other. In 2004, Symmetric Digital Subscriber Lines (SDSL) met these requirements and RIDBC began trialling the use of SDSL in family homes. The SDSL connection was coupled with dedicated videoconferencing equipment which included a camera, a codec and a microphone. This equipment was then connected to the family television. The use of SDSL was successful in terms of speed and quality, but the technology also raised new challenges. In most cases, it was necessary to install an additional phone line that could be dedicated to videoconferencing. Installation in rural and remote areas often took three to six months with a further one to three month waiting period for an Internet service to be assigned to this dedicated phone line. Once the telecommunications technology was in place, a staff member from RIDBC would travel to the family home and install the dedicated videoconferencing equipment. This process was time consuming and costly and meant that families were not getting immediate access to the support they needed. After trialling this approach with ten families, RIDBC decided to investigate other options.

In 2007, RIDBC began evaluating the possible use of the Telstra 3G network to transmit videoconferencing sessions. The introduction of the 3G network in regional and remote areas offered new potential for RIDBC to connect to families and a small pilot project with three families was undertaken. Installation times were dramatically decreased as families did not need to wait for a second phone line to be installed nor did they need to wait for the subsequent installation of an Internet connection. Instead, a specially-designed modem/router and a Telstra SIM card were connected directly to the videoconferencing equipment and an aerial was used to boost the signal. Again, the videoconferencing equipment was connected to the family television. The availability of 3G connectivity in most regional and remote locations eliminated the need for an additional phone line, which had been the major barrier to the immediate installation of in-home videoconferencing equipment. The biggest limitation of the 3G solution became the availability of equipment and the associated delivery times. However, even taking this into account, families could now be connected to a specialist in sensory disability in a matter of weeks instead of months. From the success of this project, the new RIDBC Teleschool was born and the number of families using in-home videoconferencing grew exponentially.

<table>
<thead>
<tr>
<th>Year</th>
<th>Connection type</th>
<th>Location</th>
<th>Equipment</th>
<th>Installation time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>ISDN</td>
<td>studios at hospitals or community health centres</td>
<td>Dedicated videoconference equipment</td>
<td>N/A (sites already established)</td>
</tr>
<tr>
<td>2004</td>
<td>SDSL</td>
<td>in the family home</td>
<td>Second phone line, Internet connection, dedicated videoconference equipment</td>
<td>four to nine months</td>
</tr>
<tr>
<td>2007</td>
<td>3G</td>
<td>in the family home</td>
<td>Router/modem, 3G SIM card, aerial, dedicated videoconference equipment</td>
<td>four to nine weeks</td>
</tr>
</tbody>
</table>

Table 1 - Telecommunications technologies trialled by RIDBC Teleschool between 2002 - 2007
CURRENT MODEL OF SERVICE DELIVERY

The staff at RIDBC Teleschool is composed of highly qualified and experienced professionals. They encompass a wide range of expertise, including numerous subspecialty areas related to sensory disability. These professionals are based in Sydney and connect with each family via videoconference on a weekly basis to provide one hour of regular, intensive, specialist support. Families are provided with lesson plans and materials via the post or email depending on the needs of the child. Weekly videoconferencing sessions are supplemented with phone and email contact. Local professionals are often involved in weekly sessions. Benefits for local professionals include an increase in their understanding of sensory disability, access to professional development, information about recommended practice in sensory disability and a decreased sense of isolation. Families also benefit from the participation of local professionals, as this provides a more cohesive and coordinated approach to supporting the child and family. RIDBC Teleschool is currently supporting 165 families in all states and territories of Australia and videoconferences are now delivered through three distinct transmission methods: ISDN, 3G/NextG and broadband.

Our early trials with videoconferencing demonstrated that ISDN videoconferencing provides a reliable connection. ISDN lines are generally located in an existing studio, which means that families can begin accessing services almost immediately. Additionally, existing sites typically employ a technical support person who can assist the family and alleviate any concerns about operating the technology. ISDN is currently the preferred transmission method for newly enrolled families at RIDBC Teleschool as it is reliable, accessible and supported by local technical staff. However, ISDN videoconferencing does have some limitations. As we discovered in our early trials, the existing studios are frequently configured in a boardroom setting designed to facilitate meetings by videoconference. This is not an ideal configuration for working with young children and families can feel constrained by the setting. Scheduling can also be complicated depending on how frequently the site is used. For example, in some locations the videoconferencing equipment is located in a multi-purpose room that is also used for meetings and events, thereby limiting the availability of the videoconferencing equipment. Finally, most sites charge an hourly fee for the use of equipment and room hire. While fees vary from site to site, the use of ISDN lines is generally the most expensive transmission method used by RIDBC Teleschool.

The 3G pilot project provided a proof of concept for further implementation. Videoconferencing equipment, a modem/router, an aerial and set-up instructions are sent via courier to the family. The equipment is set up by a local installer who contacts RIDBC Teleschool to confirm the installation. The ease of installation facilitates the rate of implementation. Once installation is complete, the family can commence weekly videoconferencing sessions to access the specialist support needed for their child’s sensory disability. Data is transmitted at a rate of 384 Kilobits per second (Kbps). Although higher speeds are possible, this rate is sufficient for videoconferencing and often provides a more stable connection than higher speeds. Families who have had experience with ISDN videoconferencing quickly develop basic technical skills in operating and troubleshooting the in-home 3G equipment. More advanced technical issues can often be resolved remotely by RIDBC staff. This can be achieved by providing phone support to the family or by remotely accessing the settings on the family’s equipment. Families value the opportunity to work in their home environment and this is evident in family participation and child engagement. While the up front costs for equipment and installation can be significant, the equipment can be re-allocated as families leave the program.

The introduction of high speed broadband has led RIDBC Teleschool to explore yet another transmission method. Broadband technology is being used in two distinct ways: with computer-based conferencing and with dedicated videoconferencing systems. Computer-based videoconferencing takes place using programs such as Skype or Sightspeed. Families use their own Internet connection to download one of these programs onto their computer. If necessary, RIDBC Teleschool will provide families with a webcam. The effectiveness of this method relies on the speed of the family’s Internet connection. As with 3G/NextG...
technology, the preferred rate of transmission is a symmetric speed of at least 384Kbps. Since many home Internet services have asymmetric upload and download speeds, it can be difficult for families in regional and remote areas to attain the necessary speeds. Also, home Internet plans can be limited by the amount of data that can be downloaded. As videoconferencing transmits large amounts of data, families can find they quickly reach their monthly download quotas.

Alternatively, some families may use a dedicated videoconferencing system with their own broadband connection. In this setup, the camera is connected to the family’s Internet rather than a 3G modem/router. The family enters a specified IP address into the camera’s address book and can then connect directly with RIDBC Teleschool. Although using a dedicated videoconferencing system with broadband can result in similar issues to computer-based videoconferencing, there are also some distinct advantages. The picture quality of the dedicated camera is superior to a webcam. The dedicated camera also has a greater range of pan/tilt/zoom features, which enhance the videoconference. Furthermore, RIDBC staff can control the dedicated camera remotely. This functionality alleviates the technical concerns of many families. Broadband transmission is by far the least expensive option currently available to RIDBC Teleschool. Unfortunately, broadband access is currently limited in most regional and remote areas. The implementation of the National Broadband Network will hopefully result in greater availability of broadband service in these areas and ultimately, an increase in the use of this transmission method for videoconferencing.

<table>
<thead>
<tr>
<th>Year</th>
<th>Transmission method</th>
<th>Location</th>
<th>Equipment</th>
<th>Installation time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>ISDN</td>
<td>existing studios at hospitals or community health centres</td>
<td>Dedicated videoconferencing equipment</td>
<td>N/A (sites already established)</td>
</tr>
<tr>
<td>2010</td>
<td>3G/NextG</td>
<td>in the family home</td>
<td>Router/modem, 3G SIM card, aerial, dedicated videoconferencing equipment</td>
<td>four to nine weeks</td>
</tr>
<tr>
<td>2010</td>
<td>Broadband with computer based videoconferencing, e.g., Skype</td>
<td>in the family home</td>
<td>Home Internet connection, computer, webcam and videoconferencing program</td>
<td>immediate</td>
</tr>
<tr>
<td>2010</td>
<td>Broadband with dedicated videoconferencing system</td>
<td>in the family home</td>
<td>Home Internet connection, dedicated videoconferencing equipment</td>
<td>one to four weeks</td>
</tr>
</tbody>
</table>

Table 2 - Telecommunications technologies currently in use at RIDBC Teleschool

OUTCOMES

Since 2002, RIDBC Teleschool has used telecommunications technology to connect more than 250 families to much-needed support for their child’s sensory disability. Over 100 of these families have benefited from in-home videoconferencing. Family satisfaction is evaluated annually through an anonymous survey. In a recent survey, 97 surveys were sent out to families enrolled in RIDBC Teleschool. 52 of these surveys were returned, with all
families indicating that RIDBC Teleschool has made a difference in their lives and they would recommend the program to others.

As a direct result of engagement in this program, families demonstrated greater confidence concerning their child’s sensory impairment, improved their knowledge and understanding of sensory impairment, developed a sense of empowerment in supporting their child's needs and strengthened family and child competence through increased communication. 100% of the families responding expressed the benefit of accessing a service that offers expert knowledge and specialised resources while reducing the burden of travel on the family.

These families also indicated that RIDBC Teleschool provided guidance, and ongoing, regular support for their child’s sensory disability, which made them feel less isolated in their regional and remote communities. Families appreciated the immediacy of feedback resulting from the real-time transmission of audio and video of both the child and the professional. The staff at RIDBC Teleschool also value this two-way communication as they are able to make more timely and responsive therapy recommendations based on their own observations rather than relying on the reports of others.

The range of benefits reported by families could not have been achieved without the increased accessibility provided by telecommunication technology. In fact, families have indicated that their experience with videoconferencing has been so positive that they would value the use of the telecommunications technology to access specialists in other disciplines.

CONCLUSION

RIDBC Teleschool has pioneered innovative uses of telecommunications technologies in an effort to overcome the barriers of distance, geographic isolation and inequity of access. By reflecting on the challenges that exist for families in regional and remote areas and exploring possible solutions, RIDBC Teleschool has developed a model of service delivery that provides regular, intensive specialist support for children with sensory disabilities. The success of RIDBC Teleschool clearly demonstrates the tangible benefits that telecommunications technologies can bring to those living in regional and remote areas.

Prior to the mainstream acceptance of telecommunications technologies, families living in regional and remote areas of Australia were at a distinct disadvantage with regard to accessing support for their child’s sensory disability. The challenges typically faced by professionals in remote communities, e.g., vast distances, large caseloads and diverse client needs, made it difficult for those communities to provide the range and quality of services needed by children with sensory impairment. In addition, staff in regional and remote areas often felt isolated and lacked opportunities for ongoing professional development resulting in higher staff turnover in those areas (Ludlow 2008). These circumstances meant that families frequently had to access support in alternative ways, such as correspondence courses or travelling great distances to the nearest major city.

The availability of telecommunications technologies means that families can now access experts in the field of sensory disability regardless of their location. Families are able to receive greater continuity and consistency of services as staff based in metropolitan areas have lower rates of turnover than regional and remote communities (Ludlow 2008). Families no longer face restricted choices for supporting their child’s sensory impairment. Families can now access professionals who have the experience, specialist qualifications and knowledge of specific subspecialty areas that were not previously available to them.

RIDBC Teleschool is constantly striving to find new and innovative ways of supporting children with sensory disability and their families. For the last ten years, RIDBC has focused on the innovative use of telecommunications technologies to address the needs of families in regional and remote locations. Investigation and evaluation of various transmission methods has led to quicker and easier installations for families as well as more reliable connections. With further advancements in telecommunications technology, such as high-definition capability and the National Broadband Network, an increasing number of families in regional
and remote areas will be able to access specialist disability support without leaving their homes. In the future, a model similar to that of RIDBC Teleschool could be applied to many other areas of disability, health care and education thereby eliminating the barriers of distance and inequity so frequently faced by families living in regional and remote locations.

REFERENCES:


ONE DOWN, TWO TO GO:
PUBLIC POLICY IN SERVICE OF AN AVAILABLE, AFFORDABLE AND ACCESSIBLE NATIONAL BROADBAND NETWORK FOR PEOPLE WITH DISABILITY

Robert Morsillo
Swinburne University of Technology and Telstra Corporation Limited

“What may be gained from thinking about disability and technology differently is potentially a great deal more than commonly thought” (Goggin & Newell 2004, 419). Almost all the policy and politics surrounding the NBN to date have been concerned with supply-side issues pertinent to building the network to ensure the universal availability of broadband services. However, there has not been any specific affordability or accessibility policy considerations to address the needs of people with disability as a particularly interested user group. People with disability can showcase and lead consumer demand for the high capacity broadband capabilities of the NBN given their desire and need for immersive multi-media based communications. This paper suggests some options to address these issues utilising current policy levers available to the Australian Government, including the Universal Service Obligation and the National Disability Strategy.

INTRODUCTION

…what has yet to be addressed is the economics of denying or constraining accessibility for people with disabilities, or, the converse, of designing technology for a wide diversity of users – and what this means for national policy (Goggin & Newell 2004, p. 418).

The National Broadband Network (NBN) is a new Australia-wide high capacity broadband infrastructure project initiated by the Rudd Labor Government in 2009, which is intended to bring 100Mbps capable fibre-to-the-premise (FTTP) connectivity to nearly all Australian households, small businesses and schools. Those not receiving fibre connections (about 7%, mainly in regional and remote areas) will be served by 12Mbps terrestrial wireless or satellite connections (Conroy 2009).

There has been considerable contention about the project, including about its cost, its benefits, whether Australians need such a “gold-plated” solution, the new regulated industry structure that comes with the NBN, and the role of the incumbent telecommunications service provider, Telstra Corporation Limited (Telstra).

There has also been a great deal of discussion about the wisdom of mandating a particular type of delivery technology at this time. For example, the rising popularity of wireless broadband and smart-phones, and the potential of 4G wireless technologies such as LTE (Long Term Evolution) to offer high capacity data connections, provide much fuel to heat the debates (see for example Given 2010b).

This paper does not intend to enter into these supply-side economic and technology debates about whether the NBN is a good idea or not. Rather, its starting point is the very likely and
imminent implementation of the proposed FTTP technology, despite some significant hurdles still to be overcome (cf. Telstra Corporation Ltd 2010b).

Back in 2005 Goggin and Milne claimed:

…there is little consideration of consumer or social issues in the formal evaluation of telecommunications policy, especially in relation to structural adjustment. There is a need for greater research and analysis of these issues, particularly using social science and public policy approaches (Goggin & Milne 2005, 29).

There is no doubt that the NBN is a major “structural adjustment”. In fact, “It’s a total rejig of a nation’s communications infrastructure, top to bottom” (Kohler 2010). There is, therefore, a need to consider and evaluate issues for people with disability as expected consumers of NBN delivered services, and to then decide whether telecommunications policy needs to be adjusted accordingly. In the current context, this is a positive undertaking, since it seeks to understand the key factors that will help make the NBN technology successful, including for people with disability.

While previous discussions in the *Telecommunications Journal of Australia* (TJA) about broadband services and people with disability point to the considerable opportunities that high capacity connections can bring (see in particular Slater et al 2010; Wood 2010), in recognition of Christopher Newell we cannot allow disability and the NBN to be “conceptualised as a specialised, technical issue” (Newell 2005). This paper, then, examines key factors that may hinder the success of the NBN for people with disability and proposes some enablers through incremental improvements to current public policy considerations, in particular the Universal Service Obligation (USO) and the proposed National Disability Insurance Scheme (NDIS).

A summary of the paper and its argument is as follows:

- **Telecommunications networks** create significant social and economic externalities, which may justify government supply-side infrastructure investments. However, these benefits can only be realised if there is significant take-up of the technology, the network effect, which could also justify government demand-side social inclusion investments.

- **People with disability** are significantly under-represented in the access to and use of the Internet, and there is a lack of government policy discussion on affordability and accessibility that particularly impacts this group. However, people with disability can showcase and lead consumer demand for the high capacity broadband capabilities of the NBN given their desire and need for immersive multi-media based communications.

- **USO policy** and the role of USO Co needs to be incrementally bolstered and the NDIS needs to be fully utilised to enable people with disability to gain access to the benefits of NBN connectivity.

**GAINING EFFECT FOR THE NEW NATIONAL BROADBAND NETWORK**

A distinguishing characteristic of telecommunications technology is the presence of significant network externalities. For this reason, investment in telecommunications infrastructure might be expected to yield relatively high social returns. This also provides the case for government investment (Williams 2010, 176).

The recent return of government proposals to invest heavily in new telecommunications networks has already been described in some detail (Given 2010a). This changing political-economic context results in “complex forms of ‘public private interplay’” that demonstrate three trends:

First, they represent shifts away from the liberalisation and privatisation policy consensus that dominated the last two decades. Second, they show a shared conviction about the anticipated size of fast broadband’s economic and social
benefits … Third, they reveal the unlikely impact of the global financial and economic crisis in stimulating investment in particular infrastructures seen as critical to the national economies that will emerge from it (Given 2010a, p. 541 emphasis added).

It is not the intention of this paper to further argue this general consensus on the economic and social surplus produced by telecommunications networks (cf. Birke 2009; Endres 2010). However, it is important to note that such benefits only arise when the network is fully extended in a number of ways. For example, Williams goes on to note in regard to economic growth, “high rates of return occurred only when there was close to universal coverage” (Williams 2010, 176). While the NBN will eventually achieve universal availability, this does not guarantee the required levels of take-up and usage by consumers to realise its benefits.

Allen’s analysis of “new telecommunications services” seems particularly pertinent here, “… when network ‘newness’ is fullblown and network externalities and critical mass play their largest role. Full motion videoconferencing is a case in point; so would be an interactive broadband service to the home” (Allen 1988, 258). At issue is the “perceived value” of the new network by consumers, when it is small and/or has very few people connected. Allen notes that such externalities place the emphasis on supplier incentives, such as introductory pricing, to ensure success in reaching critical mass. As we shall see, affordability is a critical issue for people with disability.

Early indications of interest from the NBN pilot sites give a mixed picture, even at the initial physical connection stage. In Tasmania, the low rate of connection requests (“only half”) prompted the State Government there to consider switching to an “opt-in” default for properties passed by the new optical fibre infrastructure (Neales 2010). Initial results from Brunswick, Victoria, are similar (compared, however, to an average of 70% across five pilot sites). This may be due to the high incidence of renters in such an inner-city area (Gannon 2011). Initial evidence from overseas shows lower than hoped for take-up rates for fibre-based broadband networks, though with only “phase 1” type services available (KPN 2009, 20; Morgan 2010, 3).

In some cases it may not be the overall network size that matters but take-up within a person’s local and/or social network that may be more important. This is relevant to people with disability, such as the (capital D) Deaf community who use Auslan (Australian Sign Language) as a preferred mode of communications. Overall critical mass for a network can be achieved through aggregating a number of specific networks of users that are successful in reaching their own suitable usage thresholds. There is then an argument for the “targeting of specific niches as a viable marketing strategy to overcome the disadvantage of smaller network size” (Birke 2009, 788).

Finally, there is the important role of complementary devices, applications and services, and markets that will utilise the NBN technology in specific user environments, such as health and education. “It is impossible to precisely measure the costs and benefits of the NBN. Many of the benefits will depend on complementary investments by the government or private companies” (Gans & King 2010, 183).

In conclusion, while the NBN will eventually provide universal availability of high capacity broadband, there remains the challenge of gaining the critical mass of users that will generate the network effects that maximise the economic and social benefits of this new technology. As we shall see, people with disability who have strong local and/or social networks, and who value rich multi-media modes of communications and engagement, may be able to play an important leading role in giving effect to the new network, especially since “One-in-five Australians report a disability” (Australian Bureau of Statistics 2003).
NBN OPPORTUNITIES FROM AND FOR PEOPLE WITH DISABILITY

The NBN has the potential to greatly improve the communications options available to people with disability and on that basis to greatly improve life-style choices relating to family and community engagement, employment, education, health care and entertainment. For example, evidence provided to the Federal Communications Commission in the USA cites opportunities for telecommuting, running a business from home, telerhabilitation, online education and digital books, Video Relay Services (VRS) and even “the development of an independent autistic community and culture” (Lyle 2010, 4-5). Goggin also notes the potential for innovation in “expression and communication” by people with disability using the Internet.

Indeed, the new media has meant that many groups who found it difficult to find the means, and cultural backing, to express their ideas, have found innovative ways using the Internet especially to do so. There is a great tradition, for instance, of Blind people devising their own media forms, from Braille to Radio for the Print Handicapped. Or Deaf people developing a rich cultural tradition based on visual communication and sign language. The multimedia potential of the Internet extends the potential for new, far-reaching forms of expression and communication (Goggin 2010).

More specifically, innovative communications solutions such as audio-description, signing, sub-titling, spoken sub-titles, vide-calling and relay services could be made possible with the convergence of high capacity broadband and the television set (Slater et al. 2010). There is the potential (if accessibility is addressed) for people with disability to participate in an immersive way in online communities of interest, such as Second Life, with their own preferred representations of themselves (Wood 2010).

People with disability often represent distinct user environments with distinctive communications needs and opportunities. The Deaf may particularly utilise text but also seek video-based services that allow communication in Auslan. The Blind may particularly utilise voice and audio-based services, such as downloading talking books, and listening to (Internet) radio stations such as Radio for the Print Handicapped (RPH). People with hearing loss may seek a combination of text, or captioning, together with audio for their media and communications. People with disability who are isolated for long periods of time at home, and their carers, may choose online communities of support, including immersive experiences through video and/or 3D facilities such as Second Life.

It is these types of rich, interactive, multi-media, instantly on services that showcase the benefits of high capacity broadband. It is these types of needs and opportunities that can drive demand for the NBN, particularly in its early stages. However, it appears these benefits are not easily achieved for people with disability given the results with first generation broadband.

INTERNET TAKE-UP AMONG PEOPLE WITH DISABILITY

[I like] to have the Internet and a mobile phone and a house phone, that's a big bill right there. I pay about $90 a fortnight just to keep my computer and the phones running (Merrett 2010, 128).

Information about broadband Internet take-up by people with disability in Australia is limited. For example, 2003 is the most recent Australian Bureau of Statistics (ABS) survey of Household Use of Information Technologies, which reported that 39% of people aged 15 years or over with a disability had accessed the internet (Australian Bureau of Statistics 2004). This compares to 58% of the general population at that time (National Office for the Information Economy 2003, 4).
Benchmark research undertaken at the end of 2002 for Telstra’s Low Income Measures Assessment Committee (LIMAC) found that 23% of people with disability had internet access at home compared to 37% for the general population, with cost being cited as the major factor (Telstra Corporation Ltd 2002).

By the beginning of 2006 the LIMAC research found that take-up of the Internet at home by people with disability had increased only marginally to 27% compared to 67% for the general population (see Chart 1). Cost was still seen as the main barrier: “Disabled respondents [sic] experienced the lowest ratings on Internet affordability” and “Perceived affordability of Internet is lowest of all services” (fixed, mobile, Internet). Significantly, this was in contrast to other low income groups such as older people, people who are unemployed and low income families, where take-up of the internet had increased much more significantly (Telstra Corporation Ltd 2006).

Chart 1 - Differential increases in home Internet take-up 2002-2006 for Australians on a low income

This Australian data is consistent with more recent findings from Britain, obtained as part of the World Internet Project:

Disability, such as a health-related problem, remained a key source of digital exclusion. The use of the internet by people with a health problem or disability increased, but only marginally, between 2007 and 2009 (Dutton et al 2009, 17).

While not conclusive, this take-up data suggests that people with disability access the internet at significantly lower rates than the general population and that usage over time has been increasing at a much lower rate than for the general population and even for other low-income groups. This may indicate that price-income-affordability is not the only significant barrier to take-up for this group.

Of course, some people with disability have been early adopters of technology. In the USA, surveys have found that “Seventy-two per cent of people with disabilities are likely to upgrade to a product’s latest model” (Hannah 2008). This might even be glimpsed in the take-up statistics that we do have in Australia, where “The majority of Disability Respondents who have access to the Internet are connected to a broadband service” (Telstra Corporation Ltd 2006).
PUBLIC POLICY REGARDING THE NBN AND PEOPLE WITH DISABILITY

“While the NBN’s fibre, wireless and satellite networks may provide universal availability of broadband in a technological sense, this does not automatically mean universal affordability and accessibility of a service” (Australian Communications Consumer Action Network 2010a, 4).

Almost all the policy work surrounding the NBN to date has been concerned with supply-side issues pertinent to building the network. While this will ensure the universal availability of a basic entry-level broadband service, there has not been any specific affordability or accessibility policy considerations that might address the needs of people with disability as a particularly interested user group. What is at stake is a repeat of the situation that dogged the previous universal network, the copper based Public Switched Telephone Network (PSTN), where accessibility policies didn’t come till the mid-1990s and affordability policies until 2002, many decades after telephones had become widespread in Australian homes.

AFFORDABILITY

Affordability has featured from the very beginning in the Australian Government’s general announcements about the NBN: “…every house, school and business in Australia will get access to affordable fast broadband (Conroy 2009, emphasis added); and most recently, the NBN will “deliver significant improvements in broadband services for all Australians at affordable prices” (Australian Government 2010, emphasis added).

The NBN Implementation Study specifically commented on the relationship between affordability and take-up, recommending that “Wholesale prices for NBN services should be set to meet the goals of affordability and take-up” (McKinsey & Company & KPMG 2010, 32). The suggestion was that this could be achieved through the provision of an entry-level plan. The recent Government Statement of Expectations for the NBN explicitly mentions the need for “maintaining affordability to drive take-up rates” (Wong & Conroy 2010, 10) and, indeed, the NBN Co Business Plan makes provision for a basic 12Mbps/1Mbps “entry-level” service across all delivery platforms (fibre, terrestrial wireless and satellite).

However, the actual retail price of this entry-level plan, as offered by a Retail Service Provider (RSP), will depend on a range of factors. NBN Co modelling indicates that $56 per month is a median benchmark figure (NBN Co Limited 2010, 105). The significant issue for people with disability (and other people on a low income) is that this may significantly raise the bar on the minimum price of any service delivered over the NBN, even just a Plain Old Telephone Service (POTS).

Current market offerings for entry-level broadband plans begin at $9.95 per month (albeit in conjunction with other bundled services) and the majority of subscribers are on low-end, cheaper, plans (Australian Bureau of Statistics 2010). The current entry-level telephone service (Telstra’s HomeLine™ Budget) is priced at $20.95 per month. The major reason for the availability of these lower entry-level prices is the greater potential for marginal cost pricing on the established networks because they are a sunk (depreciated) investment and are relatively fully utilised. This will not be the case for the NBN for many years.

Once the NBN is constructed, marginal cost pricing will maximise economic benefits. However, as the NBN is likely to have average costs well above marginal costs, at least until it reaches capacity, marginal cost pricing for wholesale access to the NBN will not cover capital costs or lead to a commercial return (Gans & King 2010, 182).

Also, affordability has a number of dimensions, not just the monthly price. There is the cost of acquiring and maintaining relevant access equipment such as a desktop computer, or a Wi-Fi router with a laptop or tablet device (such as an Apple iPad). Then there is the cost of acquiring and maintaining the required software applications that may provide useful...
accessibility features for people with disability, such as screen-reading software (e.g., JAWS 1989) or specialised Augmentative and Alternative Communication (AAC) software based on visual symbols (e.g., Proloquo2go 2009).

Further, even NBN based entry-level plans for broadband may not be adequate for the reasonable requirements of people with disability, for example, who participate daily in immersive online communities such as Second Life, which might require 50GB or more per month. This raises the question of when do the perceived costs of disability become an issue of discrimination, rather than of affordability.

ACCESSIBILITY

Australia was one of the initial signatories to the United Nations Convention on the rights of persons with disabilities (the Convention) on 30 March 2007. Article 9 Accessibility includes specific obligations:

(g) To promote access for persons with disabilities to new information and communications technologies and systems, including the Internet;

(h) To promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost.

Given the significance of the NBN and associated ICTs to all Australians, the applicability of the Convention is very clear. Yet there is little indication that public policy will seriously address the accessibility issues of this new technology for people with disability. For example, the only reference to “disability” at www.nbnco.com.au relates to the accessibility of their website.

The one exception (which proves the rule?) arises in transitioning the USO to the NBN framework. Specifically, reference is made to the disability requirements of the Standard Telephone Service (STS) where a voice service is not practical for a particular end-user with a disability; to Telstra’s Disability Equipment Program (DEP) that supplies the equipment to fulfil that requirement; and to the Disability Discrimination Act 1992 that places responsibilities on service providers in general (Department of Broadband Communications and the Digital Economy 2010).

At the very least, there is an opportunity to make explicit these accessibility requirements for telephone services supplied over the NBN by any RSP, not just Telstra as the USO provider. This issue arises because of a current loophole whereby service providers who are not the USO provider can refuse supply to a person with a disability and take their chances under the DDA, which places a significant onus and liability on the customer to fight their case (cf. Newell 2003).

SOME PUBLIC POLICY OPTIONS

UNIVERSAL SERVICE OBLIGATION

If it is worth considering integrated and comprehensive national responses to technology, such efforts must genuinely incorporate people with disabilities, their needs, desires, and expectations. Incorporation of disability into universal service policy is an obvious place to start ... disability can be fruitfully inserted into national policy on innovation systems, technology, and economy (Goggin & Newell 2004, 419).

The NBN will, in and of itself, provide universal availability, in a geographic sense, of a basic broadband data service: “Access to fast broadband ... will put distant towns on an equal footing with people in major cities” (Gillard 2010). This will, in effect, extend the current
USO to such a data service, which is a higher level of capability than currently provided under USO or Digital Data Service Obligation (DDSO) requirements.

Of course, the geographical equity focus of USO policy has been documented as far back as 1993 (Consumers' Telecommunications Network 1993) and so the perceived divide between the city and the bush continues to impress itself on Australian telecommunications policy. Has the NBN, then, effectively subsumed the USO? Given argues that the NBN heralds the “eclipse” of USO policy in Australia.

As the political imperative shifted beyond voice telephony and basic digital data capability to higher speed broadband, it was impossible merely to tweak the architecture of universal service and asymmetric obligations on the former monopolist. The cost was simply too large (Given 2008, 98).

However, Given does not consider the adjunct and related issues of universal service accessibility for people with disability and affordability for people on a low income.

Accessibility was addressed after the 1995 disability discrimination complaint ("Geoffrey Scott v Telstra Corporation Limited" 1995) by uplifting the requirements of the DDA into the Telecommunications (Consumer Protection and Service Standards) Act 1999 to ensure that the USO-STS (Universal Service Obligation for the Standard Telephone Service) was an accessible service. This included the funding, by way of an industry levy (similar to the USO levy), of the National Relay Service to provide relay services between voice and text communications users (National Relay Service 1999).

Affordability of the USO-STS was addressed in part by the introduction of the Telstra Carrier Charges–Price Control Arrangements, from 1995, and more specifically by a Carrier Licence Condition (Telstra Corporation Limited), clause 22 Low-income measures, from 2002. Telstra's Access for Everyone package incudes such programs as a pensioner discount, which is applicable to many people with disability, and safety-net services for people experiencing financial hardship.

The USO therefore was extended, if in a piecemeal way, to cover aspects of accessibility and affordability of the STS. Since Telstra was the only nominated USO-STS provider, it has borne most of the regulated responsibility.

With the advent of a new universally available minimum standard broadband service, courtesy of the NBN, history would indicate that much better consideration should be given to the role of USO policy in maximising take-up through affordability and accessibility initiatives. While current USO discourse is dominated by cost calculations and therefore restricted to residual availability issues, there is an opportunity to reframe it as supporting critical take-up thresholds to ensure the success of the NBN, which presumes a different discourse about affordability and accessibility, and so economic and social benefits.

In regard to affordability, discussions need to take place regarding safety-net services that allow people to remain connected in a basic way when the NBN entry-level service is simply seen as unaffordable. USO Co could consider whether some form of InContact® (a Telstra basic phone service) is required, for example, in situations of financial hardship, and whether this could be extended to a basic Internet service that still allows access to government services such as job seeking.

In regard to accessibility, discussions need to take place to ensure that standard telephone services supplied over the NBN, by any RSP, have suitable accessibility options. Required equipment to meet this requirement could be delivered by an Independent Disability Equipment Program, something that has already been the subject of a feasibility study (Department of Broadband Communications and the Digital Economy 2009). Further, now with a new and different entry-level service (a broadband service) supplied everywhere over the NBN, accessibility of end-user equipment might also be usefully considered in this same context. This could include suitable access software and applications.
NATIONAL DISABILITY INSURANCE SCHEME

This second policy lever available to the Australian Government falls under its National Disability Strategy. It is a far-reaching social policy initiative intended to better address the long-term care and support needs of people with disability. In short, it is based on an insurance model that would provide early intervention and resources to improve quality of life and increase social and economic participation to people with disability (Sherry 2010). The Productivity Commission is currently inquiring into the feasibility and form of such a scheme and is due to report to the Government by 30 June 2011 (Productivity Commission 2010). A small number of submissions to the inquiry have mentioned the importance of including communications services in any such scheme, including:

I think there will be a lot of improvements through the Internet and the national broadband network will open up other opportunities, including, for example, interpreting and real-time captioning over the Internet (Lawder 2010, 353).

…access to information, including information and communication technologies, is an essential part of a scheme that giving those – an eligibility regime must take this into account (Salthouse 2010, 359).

A national scheme must provide equipment that will allow all consumers with disability access to voice, voice-equivalent or text-to-speech telephony services, the internet and any future broadband network (Australian Communications Consumer Action Network 2010b, 6).

Such a scheme should enable a comprehensive response to issues of availability, accessibility and affordability of essential services, including communications services (Telstra Corporation Ltd 2010a, 3).

There are two distinct advantages to using a NDIS type scheme to address affordability and accessibility issues surrounding the NBN. Firstly, it could provide a comprehensive solution to these issues combined with the flexibility of addressing individual needs. Secondly, as a driver of demand for suitable ICTs, it can support innovation and the entry of new products and services into the market.

INCOMES POLICY

The Australian Government currently provides a Government Telephone Allowance to a range of eligible pension recipients and others, including those who receive the Disability Support Pension. Telstra also provides a Pensioner Discount under its own Access for Everyone package. Given the new wholesale pricing threshold set by the NBN, consideration needs to be given as to whether the current Government Telephone Allowance is adequate to ensure basic affordability of entry-level services at the retail level, for both information and communications access.

CONCLUSION

We as a society must believe … [for people with disability] that having access to broadband is a big deal. We must embrace the cause… (Lyle 2010, 19)

There is a sound economic case, based on the considerable positive externalities of a new communications network, for Government to invest in extending that network in a range of ways. To date, with the NBN, the locus of that investment is restricted almost exclusively to the availability of the infrastructure itself and to allow geographically averaged (wholesale) pricing.

While some small demonstration projects involving specific applications and user environments have been announced (Conroy 2010), there is another important locus required
for such complementary investments to ensure the rapid take-up of NBN connections and services so that the network effects are realised as soon as possible.

This will involve adjustments to the USO policy and incomes policy to ensure a reasonable safety-net of accessibility for all Australians, as well as committing to including communications access and equity in the implementation of a National Disability Insurance Scheme for people with disability. This will stimulate innovation and showcase new and interesting applications made possible by the NBN. Such public investment in the affordability and accessibility of NBN based services will bring forward the beneficial take-up and use of this important infrastructure, given the many high-bandwidth services that will be particularly useful for people with disability.

Five years ago, Gerard Goggin and Christopher Newell sought to imagine “Disability in 2010”, where and when it was hoped that instead of being viewed as deficit and cost it is viewed as contributory and valuable (Goggin & Newell 2005, p. 70). As a technology, a network infrastructure, an institution, with particular public policies surrounding it, we do not want the NBN to be “shaping, creating and perpetuating disability” (Newell 2005). Rather, with the right attendant policies of affordability and accessibility, people with disability can offer “contributory and valuable” support to the success of the NBN as a new network, and in turn allow people with disability to take up the new opportunities that this technology affords, thus making for true universal service.

While Christopher Newell made great use of communications technologies in support of his research and advocacy on behalf of people with disability, and was highly involved in the telecommunications industry with all the right contacts, it was rather ironic that he was unable to obtain a fixed broadband service at his home for “technology” reasons. And yet, he depended on these technologies. At one point, when in hospital for an extended period of time and subject to intensive medical care, he confided to the author that it was his Internet connection – which allowed him to remain connected to his work, his colleagues and family, right from his hospital bed – that had “saved his life”. The need to resolve NBN affordability and accessibility issues for people with disability doesn’t get any more poignant than that.

DISCLAIMER

The views expressed by the author in this research paper are not necessarily those of Telstra Corporation Limited.

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The enhanced captioning system was developed using a participatory design methodology to improve speaker identification using avatars. These avatars consisted of the speaker's name and image surrounded by a coloured border matching their clothing. An evaluation was conducted using eye-tracking with viewers who are deaf and hard-or-hearing. The major findings indicate that using an avatar image as a method for identifying who is speaking is not only feasible but may require the least attention from viewers to process. Further, differences between hard-of-hearing and deaf participants are reported.

INTRODUCTION

Since being commercially available in the late 1930s, broadcasted television (TV) has quickly become an 'everyday' medium for consuming content (CRTC, 2009). As such, film and TV have played a significant role in the cultural development and distribution of many modern societies. However, people who are deaf (D) or hard-of-hearing (HOH) are unable to fully access and benefit from this experience, due to their condition. A majority of these individuals rely on captioning as the primarily method for consuming and participating in this cultural activity. Captioning is a text-based transcription of sound, using text descriptions and symbols for representing dialogue and non-speech information (NSI) such as speech prosody, emotion, speaker identification, sound effects, and music.

The most popular form of captioning is found on TV and is called closed captioning (CC) in North America, or subtitles (for the hard of hearing) in Europe and other parts of the world. When either captioning system is enabled, a captioning 'window' may be displayed on-screen that contains textual information regarding the current content. These windows may appear in various shapes (multi-line) or sizes, either consecutively or simultaneously, and possibility at different locations on-screen. The information contained in each window may be printed using different styles: typewriter (word-by-word), vertical scrolling (line-by-line), or pop-on captioning (block of words). Despite these similar features, both captioning systems were developed separately using different technologies and are not technically compatible with one another.

Although practical and beneficial, a common misconception is that captioning is complete and no further development is required. The ideal goal has been to provide an experience that is equivalent (or as close) to consuming content as intended, with access to the audio. This ability to effectively convey sound information is crucial for obtaining a complete and accurate 'picture' of the content. This is especially the case with viewers who are D or HOH, as this sound information would otherwise be inaccessible to them. This ideal goal has yet to be met by the existing captioning systems (e.g. CC and subtitles), which were developed in the early 1970s. In fact, these captioning systems pushed the limits of technology at the time,
even though they are text-based. The lettering for captioning was initially all-uppercase due to
difficulties of early decoders in rendering lowercase letters that had descenders (e.g., \( \text{g, j, p, and q} \)). As a result, the use of all-uppercase lettering was the de facto standard initially and
still is for some captioning practices (CAB 2008). However, technology has advanced so
much over the past 30 years, that this is no longer a limiting factor, and that new opportunities
for better solutions are now possible.

In particular, the use of text descriptions and symbols is not adequate for conveying NSI
effectively to these viewers who may be D or HOH. This inability to represent NSI is a
critical issue of captioning because important information and content is either missing or
incomplete which may affect their comprehension. Not only will users be missing out or
perhaps misinterpreting the content, but will also be less able to enjoy or participate in this
cultural activity. As such, providing an equivalent experience as envisioned by accessibility
pundits and enshrined legislative mandates has not been realised and further developed for
captioning is, and in fact, necessary.

In this paper, a solution to this issue of speaker identification is presented, which uses text and
graphical-based identifiers as a potential for being more effective. The results of evaluating
this EC system with participants who are D or HOH are also presented.

BACKGROUND

HISTORY AND BROADCASTING

Captioning did not appear on TV until the early 1970s, nearly 30 years after TV was
commercially available. The term 'closed' as in CC, but also applies to subtitles, is used to
indicate that the captioning may be turned on/off by the user. Otherwise, if the captioning is
embedded or 'burned' in the video, it is considered as being 'open' since it cannot be removed
and is always visible. This 'open' captioning is commonly used for translating languages
which may be different from the remaining content, or entirely as in foreign films. However,
'closed' captioning is commonly used for broadcasted TV as it allows viewers the choice of
displaying them as required.

The process of providing 'closed' captioning for broadcasted TV has more or less remained
the same in the past 40 years. The captioning data is encoded into the video signal for
transmission and is decoded before being displayed on-screen. This data is encoded on Line
21 of the Vertical Blanking Interval (CEA-608) of analogue TV and in the picture user data
of the MPEG-2 stream (CEA-708) for DTV. For subtitles, this data is transmitted using an
information retrieval service called teletext, and on a particular page which varies depending
on the country (e.g., Page 888 using Ceefax in the UK). Finally, if the user has enabled this
feature, the captioning data is decoded and shown on-screen.

TECHNICAL STANDARDS

The current standards for CC are the CEA-608 (CEA 2008) for NTSC (analogue) and CEA-
708 (CEA 2008) for ATSC (digital) broadcasted TV. These standards were originally
developed in 1994 and 1997, by the Consumer Electronics Association (CEA) - which was
known as the Electronic Industries Alliance (EIA) before 1999.

The current standards for teletext, which is used for transmitting and displaying subtitles, are
the 'Enhanced Teletext specification' (ETSI 2003a) for analogue broadcasting and the
'Specification for conveying ITU-R System B Teletext in DVB bitstreams' (ETSI 2003b) for
Digital Video Broadcasting (DVB). These standards were originally developed in 1994 and
1996, respectively by the European Telecommunications Standards Institute (ETSI). Another
standard is the 'Teletext Subtitles and VBI Data for HD Television' (SMPTE 2008) by the
Society of Motion Picture and Television Engineers (SMPTE).
The first standard for teletext is called 'World System Teletext' (WST 1989), which is the successor to CEPT1 (1981) created by the European Conference of Postal and Telecommunications Administrations (CEPT), and earlier the 'Broadcast Teletext Specification' (IBA 1976), which was originally created in 1974 jointly by the Independent Broadcasting Authority (IBA), British Broadcasting Corporation (BBC), and British Radio Equipment Manufacturers' Association.

**LAW AND REGULATIONS**

In response to the significance of broadcasted TV, laws and regulations have been passed to ensure that accessing this content is more accessible to everyone, especially those with disabilities (e.g. deaf and hard-of-hearing). These laws and regulations are mandated by governmental organisations, such as the Australian Communications and Media Authority (ACMA) in Australia, the Federal Communication Commission (FCC) in the United States (US), the Office of Communications (Ofcom) in the United Kingdom (UK), and the Canadian Radio-television and Telecommunications Commission (CRTC) in Canada.

The first of these regulations was the Television Decoder Circuitry Act of 1990 which was passed in the US. Effective July 1993, this act required decoder circuitry which is used for displaying closed captioning to be built into TV sets that were 13 inches or larger. As a result, users were able to access this captioning service without the need for purchasing a separate or external decoding device.

In addition, other regulations have been passed to reflect this essential service, specifically to increase the quantity (availability) and quality of captioned content. Such examples of these regulations are the Broadcast Services Act 1992 in Australia, the Telecommunications Act of 1996 in the US, the Audiovisual Media Services Directive 2009 in Europe, and the Broadcasting and Telecom Regulatory Policy CRTC 2009-430 in Canada. The latest of these regulations which was passed is the Twenty-First Century Communications and Video Accessibility Act of 2010 in the US.

There is also the Convention of the Rights of Persons with Disabilities (2006) of the United Nations (UN), which is an international treaty and the standard for most regulations of countries today.

**PROTOCOLS AND GUIDELINES**

Over the years, protocols and guidelines for captioning have been developed by organisations all over the world. For example, the Canadian Association of Broadcasters (CAB) in Canada, National Center for Accessible Media (NCAM) @ WGBH in the US, the Office of Communications (Ofcom) in the UK, and Media Access Australia (MAA) in Australia. Although these are different organisations, there are few differences in their recommendations. The only noteworthy difference in these standards is how they represent NSI. In general, NSI is represented using only text descriptions and symbols for CC, while different colours for speaker identification and indicating sound effects for subtitles.

**Speaker Identification**

The current method for identifying a speaker is one of the limitations of a text-based captioning system for representing NSI and is the focus of this paper. Currently, the placement of the captioning near the character is the foremost indicator for identifying the speaker. However, this is often ambiguous or insufficient, as there may be multiple characters or off-screen speakers. In these cases, text descriptions and/or symbols (e.g., ANNE: Good evening everyone. The chevrons are used to visually indicate a change in the speaker,
while a colon : separates the speaker's name with the dialogue. However, the problem with using text-based identifiers is that viewers (including those who may be D or HOH) are required and assumed to be able to associate either the name or description of the speaker to the correct character.

Furthermore, this practice of using the speaker's name is often omitted due to the additional character space that is required. Instead, only chevrons >> are used whenever possible (not ambiguous). The practice of using different colours (e.g., white, yellow, cyan, and green) is used in subtitles for speaker identification. However, this only indicates a different speaker, and not necessarily who is speaking at that given time. As such, the use of different colours or a text-based identifier (e.g. name) is not sufficient for speaker identification. This is especially the case with viewers who are D and HOH.

SYSTEM DEVELOPMENT

The enhanced captioning (EC) system was developed using a participatory design (PD) methodology to include people who are deaf and hard-of-hearing – intended users (Vy & Fels 2009). This was to help ensure that the EC system would be more usable by involving users throughout the entire design and meeting their needs by including them in the decision-making process. The researcher together with some users (participants) were involved in a mapping technique (Bødker 2004) in which to better understand their needs and explore technological options that are available. This also enabled a mutual learning (Beguin 2003) process between both parties, which further promoted this co-operative design for creating a more effective system. The mapping technique was chosen as it best suited this situation and is one of many tools from the MUST method - a Danish acronym for theories of and methods for design activities (Kensing 1998).

The needs of users were investigated using an activity and interview to obtain their opinion on watching TV with closed captioning (CC) – the current system. This information was then analysed using the mapping technique to establish an overview and understanding of the situations that were problematic (Bødker 2004). From these discussions with participants, a diagnostic mapping was created to analyse the problematic situations that were identified, while a virtual mapping was created to evaluate ideas for their solutions. As expected, the investigation indicated that in some situations, captioning is either inadequate or ineffective for addressing the needs of users. The specific issues that were identified by participants related to non-verbatim captioning, speaker identification, non-speech information, sound and music, and other technical issues.

The solution that was developed to address these problems and needs was using a captioning panel and avatars for speaker identification (Vy & Fels 2009). In particular, there are three identifying components for indicating a speaker:

1. Image. Ideally, this is a screenshot of the character when they are facing the camera (head shot or portrait). This image should be updated throughout each scene to match changes in the lighting, clothing, etc.

2. Coloured Border. This border surrounds the image and the colour usually matches the character's wardrobe. Another purpose for using colour was suggested for displaying their emotion.

3. Label. This is usually the name of the speaker, or if that is unknown their role (e.g. mail carrier) or at the very least a description of their voice (e.g., gender).
METHODOLOGY

RESEARCH QUESTIONS

The following research questions will be explored in this paper:

- What is the impact of closed captioning and enhanced captioning on user’s stated preferences and eye gaze activity of closed captioning and enhanced captioning?
- What are the differences in user’s preferences and eye gaze activity between closed captioning and enhanced captioning?

STUDY PARTICIPANTS

There were a total of 19 participants (twelve deaf and seven hard-of-hearing) who were recruited and conducted this user study. The participants were between the ages of 20 and 89 years old (M = 40.68, SD = 17.54) and watched an average of 9.55 hours of television per week (SD = 4.61). While watching television, sixteen of these participants always used captioning, while the remaining three (HOH) participants have never used captioning.

Deaf Group

The Deaf group consisted of nine females and three males. Their age ranged between 20 and 59 years old (M = 34.92, SD = 10.70). The highest levels of education completed in this group consisted of: two people who completed high schools, seven who completed college, and three who completed graduate school. This group watched an average of 9.33 hours of television per week (SD = 5.19).

Hard-of-Hearing Group

The HOH group consisted of three females and four males. Their age ranged between 20 and 89 years old (M = 50.57, SD = 21.99). The highest levels of education completed in this group consisted of: one person who completed high school, one who completed college, three who completed university and two completed graduate school. This group watched an average of 9.93 hours of television per week (SD = 3.33).

STUDY PROCEDURE

Participants watched a total of 16 video clips, which consisted of a combination of four captioning styles and four video clips taken from a film (Transformers 2007). The different captioning styles consisted of the existing CC and three different configurations of EC: the speaker's name (SN), the avatar (AV), and both components together (AV+SN) (see Table 1). The video clips were selected so that there was a variety of settings, number of speakers, and words per minute (WPM) of the dialogues as outlined in Table 2. The viewing order of each video clip and captioning style was randomised for each participant, minimising any potential learning effects that may be encountered.

<table>
<thead>
<tr>
<th>Captioning Style</th>
<th>Dialogue</th>
<th>Speaker's Name</th>
<th>Avatar</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>Yes</td>
<td>Sometimes</td>
<td>N/A</td>
</tr>
<tr>
<td>EC (SN)</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>EC (AV)</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>EC (AV+SN)</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - Captioning Styles and Components
### Table 2 - Properties of Video Clips

<table>
<thead>
<tr>
<th>Video</th>
<th>Setting</th>
<th>Duration</th>
<th>Number of Speakers</th>
<th>Rate of Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Narration</td>
<td>1m 13s</td>
<td>1</td>
<td>104 WPM</td>
</tr>
<tr>
<td>B</td>
<td>Aircraft</td>
<td>51s</td>
<td>4</td>
<td>173 WPM</td>
</tr>
<tr>
<td>C</td>
<td>Dealership</td>
<td>1m 36s</td>
<td>3</td>
<td>184 WPM</td>
</tr>
<tr>
<td>D</td>
<td>Transformers</td>
<td>1m 24s</td>
<td>7</td>
<td>124 WPM</td>
</tr>
</tbody>
</table>

### DATA COLLECTION

For this study, qualitative and quantitative data were collected from study participants, using questionnaires and an eye-tracking device (Tobii x50). The questionnaire data has been presented in a previously published manuscript (Vy & Fels 2010).

### Gaze Fixation and Scan Path for Eye Tracking Data

The basic information that can be obtained from most eye-tracking devices is gaze fixation and scan path.

A gaze fixation is determined by a pre-defined size and duration of a gaze point – the x-y coordinates of where the participant is currently looking on the screen. The scan path is the movement between these determined fixations.

A fixation filter of a 30 pixels Velocity Threshold (or radius size) and a 100ms Duration Threshold was used for analysis. This is the recommended setting for using a stimulus which contains both images (e.g., video and avatars) and text (speaker's name and dialogue) as indicated by the analysis software, ClearView 2.7.1 (Tobii 2006).

### Areas of Interest

*Areas of Interest* (AOIs) are defined regions on the screen that are outlined by points and lines (polygons) which are used for analysis of eye-tracking data.

There were three categories (or types) of AOIs that were defined:

- Video: the region containing the video
- Captioning: regions where captioning may appear
- SID: speaker identification component (avatar) of EC

### Closed Captioning

The following describes the difference of the AOIs for CC (see Figure 1a):

There is a total of two Captioning AOIs: CC.Lower and CC.Upper

There is no AOI defined for SID as the speaker's name is not reliable and does not always appear.

### Enhanced Captioning

The following describes the difference of the AOIs for EC (see Figure 1b):

There are a total of four Captioning AOIs: two levels (.Upper and .Lower) for each speaker (.Left and .Right).
The two SID components for EC (SN) are: Name.Left and Name.Right
The two SID components for EC (AV) and EC (AV+SN) are: Avatar.Left and Avatar.Right

Figure 1 – Areas of Interests (AOIs) as defined for CC (left) and EC (AV+SN) (right)

ANALYSIS OF DATA

Because of the large quantity of information collected from eye-tracking, only a subset of this data was analysed. As such, the data that were analysed was of captioning styles: CC and EC (AV+SN) for Video D only. Video D was the most ideal choice, because it had the greatest variety of different situations. For example, Video D had instances of dialogue between different groups of characters, off-screen speakers, and a rate of speech of 124 WPM which slightly lowered that of the average of all video clips (146.25 WPM).

As there is a difference in the number of participants in each group, the percentage of these fixations will be used in a frequency analysis. This will be used for determining a frequency count within Areas of Interest (AOIs) which is normalised and can be used for comparing both groups.

RESULTS

FIXATION COUNT

A frequency analysis of the fixations of the AOI was carried out to compare any differences between both groups (see Tables 3 and 4).

The results indicated that HOH group viewed the video more and the captioning less than the Deaf group. Although the SID component was viewed the least for both groups, HOH participants viewed the Avatar more, but less of Name than deaf participants.
Similarly, the same trend for CC with the Video and Captioning AOIs appears as for EC. The HOH group viewed the Video more and captioning less than the Deaf group.

Table 3 - Fixation Count and Percentages of AOIs for EC

Table 4 - Fixation Count and Percentages of AOIs for CC

DURATION OF FIXATIONS

A repeated measures ANOVA (Analysis of Variance) was carried out for fixation duration using between-subjects factors: AOI_Type (Video, Captioning, SID), Captioning_Style [EC (SN), EC (AV), EC (AV+SN), CC], and Hearing_Status (deaf or hard-of-hearing).

There was a significant interaction effect for fixation duration between AOI_Type and Captioning_Style, $F(5, 12620) = 3.73, p < 0.05$, and between Captioning_Style and Hearing_Status, $F(3, 12622) = 5.58, p < 0.05$. There was significant main effects for fixation duration between AOI_Type, $F(2, 12623) = 10.19, p < 0.05$, between Captioning_Style, $F(3, 12622) = 23.44, p < 0.05$, and between Hearing_Status, $F(1, 12624) = 49.10, p < 0.05$. Post-hoc analysis using the Tukey’s HSD test showed significant differences ($p < 0.05$) between CC and EC captioning styles (see Table 5).

Table 5 - Mean and Standard Deviation for Fixation Duration

Figure 2 shows a comparison of Mean Fixation Duration times between the two groups. In general, the Deaf group spent more time watching each video for all the captioning styles than the HOH group. For both groups, the shortest amount of time was spent with CC. The Deaf group spent a similar amount of time for the different EC captioning styles, but longer than with CC. However, the HOH group spent the longest time with EC (AV+SN), and shorter times with EC (AV), EC (AV+SN), and CC.
Figure 2 - Average Fixation Duration by HOH and Deaf Groups

AVERAGE FIXATION DURATION

The following shows the Estimated Marginal Means for fixation duration for the different AOI categories: Video, Captioning, and SID components (see Figure 1 for AOI definitions).

Figure 3a shows that both groups spent less time with the Video with CC than with most of the EC. In general, the Deaf group spent more time looking at all AOIs than the HOH group. For the EC (SN) and EC (AV) captioning styles, the HOH group spent less time looking at the Video for CC.

Figure 3b shows that both groups spent less time looking at the conventional closed captioned videos (CC) compared with all of the ECs. Within EC, the Deaf group spent the most time looking at Captioning of EC (AV) style, while the HOH group spent the least amount of time. The HOH group spent the most time looking at Captioning with the EC (AV+SN) style, while the Deaf group spent the least amount of time.
Figure 3b - Average Fixation Duration for AOI Type: Captioning

Figure 3c shows that, in general, the Deaf group spent more time looking at the SID components than the HOH. The Deaf group spent the most time looking at the speaker’s name of EC (SN) style, while the HOH group spent the most time with EC (AV+SN) style. Both groups spent the least amount of time looking at the Avatar in the EC (AV) style.

Figure 3c - Average Fixation Duration for AOI Type: SID

For the captioning styles of EC, deaf participants spent more time looking at the SID components than HOH participants. When compared to the other EC styles, deaf participants spent the most time on looking at the speaker’s name with EC (SN), while HOH participants spent the most time with EC (AV+SN). Both groups spent the least amount of time looking at the avatar in EC (AV), when compared to the remaining EC styles.

DISCUSSION

IMPACT OF DIFFERENT CAPTIONING STYLES ON PREFERENCES AND EYE GAZE ACTIVITY

The data show that there are significant differences in the eye tracking data between the conventional closed captioning style and all of the enhanced captioning styles. There were significant interactions and main effects for fixation duration for Captioning Style. In general, the fixation duration increased for all of the enhanced captioning styles compared with CC. This was an expected finding because most of the participants were accustomed to the CC style of captioning, as it has been the convention for the past 40 years. The enhanced
captioning styles were new and probably required more attention to process them, for all individuals. Longer term exposure to enhanced captioning styles may reduce this novelty effect. To determine whether eye gaze behaviour would change with practice, longitudinal studies with different types of content will need to be carried out.

Examining the Area of Interest (AOI) data for the enhanced captioning conditions only provides more details regarding the differences between the Captioning Style allowing inclusion of the EC (AV) captioning style condition as well. As seen from Figure 3, the video component was watched most for the EC (AV+SN) video condition by both participant groups and least in the EC (SN) or EC (AV) video conditions for both groups. The enhanced captioning SID components (either speaker name or the avatar) were looked at most in the EC (SV+AV) video condition for the HOH participants while the deaf participants watched the SID components most for the EC (SN) video condition. Finally, HOH and deaf participants spent the least amount of time looking at the enhanced captions in the EC (AV) video condition.

It seemed that for both groups, it was not necessary to look at the avatar images (SID) for a long duration to discover who was speaking; there was no reading involved and the visual association between speaker identification indicator (avatar) and who is speaking may be simpler. Cognitively, reading may require more time for processing than image processing in the visual cortex so it is not surprising that both participant groups spent the least amount of time watching the avatars when their eyes were focused in that AOI. However, the HOH group spent the most time looking at the avatar and speaker name when they appeared together but the Deaf group spent the most time in that AOI looking at the text of the videos (in the SN Captioning Styles condition). It appears that the cognitive load may be increased more for HOH participants when text and images appear together, while for deaf people, text processing by itself may require more cognitive effort than when there is redundancy between the text and the image. It may also be true that the avatar image was of least interest and was disregarded immediately when it appeared. A further examination of the cognitive effort being expended by participant groups for the various enhanced captioning conditions is required in order to better understand the effects.

DIFFERENCES BETWEEN DEAF AND HOH GROUPS

Examining the fixation duration for all of the AOIs showed that deaf participants spent more time in all of the AOIs than did HOH participants. This indicated that deaf participant’s eyes were fixated on all aspects of the videos, regardless of style or video type, for a longer time. Because the playing time for each video was constant, it would then seem that the eyes of HOH participants were looking elsewhere (non-AOIs) for more time than the eyes of deaf participants or that they were more concentrated on the AOIs. This could indicate that deaf participants had to spend more perceptual and cognitive effort to process the captioning information regardless of style, thus requiring additional attention; or that deaf participants found the video clips (video and captioning) more interesting and worthy of their attention. Ikehara and Crosby (2005) found that eye tracking can provide evidence of levels of cognitive workload, in that increased fixation and duration indicated increased cognitive workload for computer tasks. Whether this can be translated into measuring cognitive workload while reading captions has yet to be determined. Further research examining cognitive workload using fMRI or EEG measures or subjective workload techniques such as the NASA TLX may provide additional insight into these possibilities.

Deaf participants looked at the captioning text more often than the video content or the avatar, and the converse occurred for HOH participants. This would seem to indicate that deaf participants relied more on information from the captioning than the video, compared with HOH participants. This was expected since deaf participants have much less access than the HOH participants to the auditory information that would have been provided by the soundtrack and they therefore relied on the captioning more than the HOH participants did. However, it was surprising that deaf participants looked at the speaker’s name more, and less at the avatar and video, compared with HOH participants. This could indicate that the avatar...
and video were less interesting or useful than for the HOH participants or that it did not require as much attention to cognitively process. Again, further study using cognitive workload measures may provide more detailed insight.

The use of a person’s name for speaker identification, as found in most guidelines and standards for captioning (CAB 2008) incorrectly assumes that using text descriptions is adequate and satisfies the needs of both groups. However, deaf people typically identify others by their physical appearance or personality (e.g., body size/height, hair, job/position, etc.) rather than by their name. The speaker’s name information may have required more cognitive effort and time to process resulting in the increased fixation duration found in this study. The fixation duration for deaf participants also shows a slightly lower time for the avatar captioning style compared with either of the enhanced captioning styles containing the speaker’s name. In contrast, a name is a written speech identifier, which is a more familiar convention for HOH individuals, and would likely take less time to cognitively process as a result. The extra written text information provided by the speaker’s name may have required additional effort and time which in turn could have caused deaf participants to find it less useful.

These differences between deaf and HOH users provide some initial evidence to support changing existing captioning practices, guidelines and tool design. Given that all of the enhanced caption options are feasible for either digital television or online video content, a 'one-size-fits-all' approach used in conventional television can be replaced with an approach that allows for user customisation options. Deaf users may prefer to use avatar or visual indicators for speaker identification rather than text names, while HOH users may prefer text versions.

CONCLUSION

The study reported in this paper provided some evidence from eye-tracking data that using images to represent who is speaking is a feasible alternative to text-based speaker identification, particularly for deaf users. Using real-time eye tracking data of fixation duration and area-of-interest seem to provide useful data for analysing user viewing behaviour and differences between hard of hearing and deaf users. Designing captioning systems that allow for different captioning styles could provide customisable accessibility options for deaf or hard-of-hearing users that better meet their needs. Designing intelligent software that could automatically create avatar images based on face recognition and lip movement in the video could reduce the manual work required to generate these images. Finally, broadband telecommunications networks are more than capable of distributing image and text data with video data in real-time.

The study reported in this paper is the first in a series of studies designed to examine enhancements to captioning to provide better access to non-speech audio information. Future work on speaker identification could include studies examining longitudinal effects as well as system improvements. In addition, the captioning of other non-speech information such as music and sound effects must be considered. Regardless, it is important to recognise that there is considerable research and innovation that remains to be done to improve captioning, that the captioning system for analogue television is no longer valid and must be changed, and that high-speed telecommunication systems, rather than television, can facilitate those changes.

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Like web 2.0, a participatory culture is central to university life. Several theorists have recognized the importance of digital technologies in including students with disability. Mainstream accessibility measures are beneficial to both students with disabilities and those without. Data for this paper is entirely crowd sourced from web 2.0 platforms and explores the ways students with disabilities are using mainstream accessible web 2.0 technologies – file sharing, Facebook, FourSquare and blogs – to foster inclusion. By utilizing the knowledge of the crowd this paper seeks to empower the disability narrative. People with disabilities are not just assisted by web 2.0, they are innovators of it.

It wasn’t until I reached university that I realised that my disability was a problem. Prior to university, I didn’t have many problems in terms of my disability – I had supportive teachers who went out of their way to ensure that I was not excluded by virtue of my hearing impairment... I tried to change the learning environment to ensure that students with disability had the same access to the learning environment as their non-disabled counterparts, but did not have much success. Sometimes, I considered dropping out of uni, but I persevered. However, I left uni with a dearth of self-confidence. (Saab 2011)

INTRODUCTION

Up until the latter part of the twentieth century, those who were designated as disabled were mostly denied access to a mainstream education. With increasing numbers throughout the 1990s, moving into the second decade of the 21st century, university students with disability are an established and growing minority. In the United States they make up about 6% of the student population while in Australia they number 4% (DEST 2007). From a charitable ethos of “helpful” or kind staff “helping out” students with disability, an environment has emerged whereby these students can expect and demand support through dedicated disability offices. However, as the above student’s experience demonstrates, this is not always the case because inflexible practices and people continue to inhabit academia.

Several theorists have recognised the importance of the Internet to students with disability. While Li and Hammel (2003) suggest it can offer innovative ways to bypass the effects of impairment that can prevent a student from participating, Mullen et al. (2007) believe participation on the web can allow a neutrality of identification to allow the student with disability to blend in as though not disabled. Finally, Alltree and Guard (2007) argue that adjustments introduced to assist students with disability have far reaching benefits for the non-disabled population also and Wood (2010) cautions that students with disability would benefit the most from engagement with technologies that provide learning opportunities yet inaccessibility often excludes them. These examinations provide a good starting point for an investigation of the inclusion of students with disabilities in tertiary education; however, in
this paper I wish to expand the theorization to look at more recent web 2.0 technologies now available to students with disability through the mainstreaming of accessibility measures and the ways that these students and their allies are innovating their use to facilitate greater inclusion of people with disabilities in University life.

Extending my previous argument (Ellis 2010) that any investigation of the ways digital technologies assist individuals with disabilities must consider the communicative work people with disabilities are undertaking on the web, this paper utilises the knowledge of the crowd, to empower the disability narrative, to see how students with disabilities are taking technologies designed for perhaps a more mainstream market and using them to their advantage. This situation is only available because accessibility is becoming mainstreamed. Looking at web 2.0 through a disability lens highlights the ways people can work together under this philosophical and technological concept to share ideas, information and creations while working with others for a specific purpose. This review paper foregrounds the social aspects of digital life, a concept particularly important to the inclusion of people with disabilities.

Universities foster innovation, they encourage students to become creative and critical thinkers. Like web 2.0, a participatory culture is central to university life, academically and socially. At university, students are encouraged to connect with others and engage with the community. It is vital that people with disability, already excluded in much of social and community life are not prevented from gaining a university education. While official organizations have emerged to address this, significantly, the participatory culture of an accessible web 2.0 allows people with disabilities the opportunity to innovate modes of inclusion via digital technologies themselves. At the Australian Tertiary Education Network on Disability’s 2006 Pathways Conference, pioneering disability academic Christopher Newell gave a keynote address on accessible design as a way to include people with disability in life long education and training. He envisioned a world where the rhetoric would become a reality:

I long for, I dream of, I desperately desire, a world where learners, academics and administrative staff with disability in higher education and training know that they are embraced, know that we are found to be part of the moral community and where when we speak of the nice, normal and natural we know that those of us with a diverse range of disabilities are included. I dream of a world where the power of narrative and dreaming helps to transform the world. (Newell 2006)

Also an academic with a disability, Newell saw the creation of accessible technologies as a political move in actually embracing the inclusion of students with disabilities. The universal design of technologies so that they can be used by the greatest number of people without need for adaptation was especially important. Recent mainstream accessibility measures such as those introduced by Apple, Facebook, and Google have changed the way web developers and the general public view access for people with disability. No longer is it something extra, unnecessary, special – accessibility is something everyone can benefit from (Ellis and Kent 2011). Mike Calvo, a blogger with vision impairment suggests this is particularly important to students because they are increasingly encouraged to multitask throughout their education. For example, screen readers designed to assist people with vision impairment now included on Apple products such as the iPhone and iPad will become increasingly important to the mainstream population:

if we can find our tunes eyes-free, we are going to want to do many other things eyes-free. And that means a future where blind people like you and me no longer have to struggle for accessibility just moved a whole lot closer (Calvo 2008)

Throughout this paper I acknowledge the chequered history of the web in excluding people with disability but celebrate the current accessibility turn, and examine the ways people with disabilities are using mainstream web 2.0 applications, to reflect on the opportunities this provides for students with disabilities to participate in a tertiary education. Borrowing from Newell’s (2006) argument that the power of narrative transforms the world, data for this paper relies on reflections posted by students with disabilities on a number of web 2.0 platforms.
I begin this paper with a consideration of the increasing importance of collaborative web 2.0 applications to University education. Just as the number of students with disabilities enrolled at University has increased, the general student population is becoming more diverse with students regularly balancing any number of competing demands. Alternative pathways to entry are also increasingly common to attract these groups. Educators are finding that incentives designed to improve access for students with disability actually improve the educational experience for many students negotiating study with competing demands. For example in 1998, Lectopia – the lecture recording and distribution system – was introduced in Australia at the University of Western Australia (UWA) to enable students with disability better access to lecture materials (Ellis & Kent 2008). The system has now been broadly embraced by a diverse student population in many universities. Effective disability policy that provides support and resources for students with disability often has an added benefit for everyone. As the lectopia platform moves into providing transcripts of lectures, people with hearing impairments are able to access the material independently and can now search for key words along with nondisabled people benefitting from the technological advancement.

Legislation such as the Disability Discrimination Act 1992 and the Disability Standards for Education 2005 influence disability service provision at the tertiary level. Most Australian universities mandate disability policies and publications that proceed from the definition of disability discrimination outlined by the Disability Discrimination Act 1992. Under these regulations, the university cannot treat a student with disability less favourably than a student without. Where disadvantage does exist, reasonable adjustments must be adopted to compensate. The second section of this paper therefore moves to consider the importance of providing accommodations for students with disabilities and highlights the role of universal design in whether a student can access the information necessary to complete a university degree.

These accommodations, while vital to the student with disability, are frequently stigmatized and regarded as onerous and unnecessary for the wider student population, thus I seek to demonstrate in the third section of the paper the importance of mainstreaming accessibility. Through a number of case studies I explore the ways students with disabilities, as innovators of web 2.0, are using web 2.0 communications platforms to complete a tertiary education.

WEB 2.0, COMMUNICATION AND INCLUSION IN EDUCATION

According to John Jennings (2007), an “always-on” Internet connection transforms the learning experience and improves inter-institutional collaboration, existing service provision and significantly, enables wider access to an education. With a greater number of people attending university and accessing a wider breadth of information, broadband has become a significant resource in modern education. Instant access to previously unavailable information and databases has and will continue to transform education for all students (Dempsey 2005).

Ongoing research at UWA demonstrates that students expect an increasing use of ICT throughout their degrees, either provided by their lecturers or used during private study or group work. While lectopia, WebCT, and powerpoint were the most used, increasingly students and lecturers are turning towards blogs, discussion boards, and social networking (Cluett & Skene 2009). With the majority of students owning a computer and mobile phone along with the widespread availability of the Internet, students today have advanced skills in ICT and expectations regarding their use in education as well as their own innovations in how to use the technology. Educators likewise seek to exploit this and see new technologies loosely defined as web 2.0 as particularly suited to the educational experience and thus seek to experiment with user generated content.

Web 2.0, or the “read-write” web is taking the use of ICT in education to a more immersive and collaborative level particularly with the availability of an always-on, low-latency network broadband connection. The difficulties with these platforms, experienced by students with disability, demonstrate the potential problems of bringing web 2.0 tools into the academy. When design is disabling some students are unable to navigate these environments, while
others are forced to reveal their impairments. Despite this, the use of web 2.0 in education may be beneficial – the ability to manipulate digital content in ways that suit the user’s learning style is particularly useful to students with disability:

Once a piece of information or content is digitised its form is significantly transformed. Whereas a work written on a page is locked in that format, once a word is a digital file it can be transformed to suit any person trying to access it. It can appear as the written word, it can be automatically translated into another language, it can be interpreted as an image, it can be shown in sign language and it can be displayed on a Braille tablet. Once that file is connected to the internet all these different modes of access can take place simultaneously, all over the world. This information can be requested through a traditional keyboard, by speech, through eye tracking software or by moving any of a number of different mouse devices. Making that content accessible is a choice. Making it inaccessible is also a choice. (Ellis & Kent 2011)

Despite the strong rhetoric that digital information will automatically liberate students with disability, many will struggle with content that is inaccessible by design (Martínez-Cabrera 2010). Universal design (see Newell 2006) to allow access using a number of different methods is paramount to the inclusion of students with disability who often make use of adaptive technology.

**ACCOMMODATION AND ADAPTIVE TECHNOLOGY**

The inclusion of students with disability involves more than providing a space where they don’t need to declare their impairment as many of the disabling problems of the “real world” are reproduced on the Web in the form of inaccessible interfaces. University administrators and academics should ensure digital content can be accessed in many different ways as Ellis and Kent (2011) describe above. Students with disabilities will often make use of adaptive technologies such as dictation software:

One thing that has helped me quite a bit as a blogger, writer, grad student and person with chronic pain subject to flare-ups has been speech-to-text software. The basic idea is fairly self-evident: You install the software, plug in the headset that comes with it, open up the word processing program of your choice, and start talking. (Annaham 2010)

Or screen readers and Braille displays to access ICT:

I have been using braille all my academic life, I write much more quickly and smoothly in braille. Only in braille can I write fast enough to keep up with my thoughts ... I write anything significant, such as essays … in braille first, then transfer them over to my computer (using JAWS) if I need to do so. That said, I have become much more proficient at typing since I started uni, and can almost keep up with my thoughts typing as well. ... I just prefer Braille because I have been doing it for so much longer, and use it more naturally. (Personal communication.)

In order for these students to be included in the online educational experience, the sites and technologies used must be accessible and allow for the use of adaptive technologies. While, for a long time, interfaces and programmes were inaccessible by design, accessibility is now being built into the design of mainstream, popular products such as Apple and Google. Paralleling the increasing visibility of students with disability who rely on adaptive technology (Westin 2005) to compensate for their impairments has been the wide spread uptake of ICT amongst the student population. Mainstream accessibilities measures are beneficial to both students with disabilities and those accessing the web from mobile devices.

Although structural measures are in place to enable the full participation of students with disability in the tertiary arena, many students find that their presence in the University classroom is resented and themselves resent the amount of personal information they must share about themselves to large numbers of academic and administrative staff:
Don't think that we're special people asking for special treatment. If schools were not made to systematically exclude us, we wouldn't have to share so much personal information because we wouldn't need accommodations. Accomodations (sic) are one way that we can change normal schooling so that we can learn and express our knowledge, because we want to learn, but accomodations can't do everything for us. (Dene 2008)

As educational institutions come to increasingly rely on web based resources, mainstreamed accessibility would be truly inclusive and address many of the issues outlined by this student. A course that is planned to be inclusive of all people (including educators who may have a disability) is much more effective than courses that undergo a belated accessibility retrofit:

Students need to be able to concentrate on course material day one – not be trying to figure out how to use the workbook that is inaccessible to a blind student or track down a key needed for a service elevator for a physically impaired student to get to a class. The web designers, administrators and other decision-makers should have to navigate their campus while simulating a variety of disabilities – – they have no idea of the hell they put students through. (tbstoller cited on Parry 2010)

In the realm of online academic engagement, accessible design also offers greater academic insight. For example, alternative (alt.) text, as it describes what an image is attempting to communicate within the context of a site, allows both access by a screen reader and provides other learners with additional course information. Courses should be made accessible from the beginning because most students, regardless of disability, find fully accessible courses easier to understand (Edmonds 2002). While demands for accessible content can and should be made, students with disabilities, like students without, also value making innovative use of existing technologies, in order to effect social change. The next section will consider the innovative ways various web 2.0 platforms are being used by university students to access academic resources, navigate the physical campus, and engage in social connections as well as disability activism.

INNOVATIVE USES OF WEB 2.0 IN HIGHER EDUCATION

ACCESSING INFORMATION – BOOKSHARE

Accessing information can be a problem for students with disabilities, especially when alternative formats are required:

Whereas a sighted student can go to the library, read a book for three hours and put it back, I would have to borrow the book, organise for it to be read onto tape and then listen to the tape. This all took twice as long and at the end of it, the book may not have contained the desired information anyway. (University of Queensland News 1997)

While digital documents on the Internet are celebrated for allowing people with disability access to information, in a way not possible with hard copy books, this can be a complex process as digital documents often need to be converted and corrected by a sighted person before they can be accessed using adaptive technologies (Ellis & Kent 2008). This also happens in isolation, with a number of different Universities converting books for their individual students without sharing that resource. As the conversion process is a lengthy and onerous task, many students with disabilities receive their course readings very late in the semester. Web 2.0 technologies harness everyday experiences and build on current knowledge and foreground the sharing of ideas amongst groups of people. Web 2.0 is communicative, collaborative and documentative (Poore 2008) and has prompted the creation of and connections between a number of databases and reference libraries such as the Gutenberg Project and Bookshare which benefit students with disabilities requiring alternative formats or who use adaptive technology.
Bookshare.org is a free academic resource for US students with disabilities that is revolutionizing education for eligible students. The searchable database offers 90,000 digital books, textbooks, teacher-recommended reading, periodicals and assistive technology tools (Bookshare 2010). Volunteers scan and proofread books and then upload them to the library. This has significantly increased the amount of books available to students with disabilities:

I found out about Bookshare through my assistive technology teacher. My first thought was that it was a gift from God because no longer [would] I have to get … three books that I wanted to read at one time, I could just put them on my Braille note and listen to them, or read them on my Braille note. I call it the blind man’s laptop because everything that you find on a laptop is on this. You can have a place where you type your documents called keywords, you have media player on here, a file manager, a book reader which reads the books you download from Bookshare. We have Internet, emails, where you can check your email. It's very much like a laptop. (Bookshare 2009)

When a single page of text converts to several pages of Braille, a system where text books can be downloaded and read from a computer using whatever the user’s preferred method of output is particularly attractive. Doubly so when there are a number of different types of alternative format required, for example one student may need large print, another audio, and another again, Braille. The database can also be accessed by a large number of students at different academic institutions. The innovation of connection and collaboration as illustrated by the Bookshare platform and database enables the inclusion of students with disabilities. Connection at University however involves more than academics and in the next section I consider the relevance of social networking and Facebook especially in fostering connections for students with disabilities.

SOCIAL CONNECTIONS AND ADVOCACY – FACEBOOK

For Lisa Cluett (2010), social networking sites such as Facebook, provide universities a flexible way to establish a virtual presence and connect with their students, particularly during the orientation process. Cluett who established a Facebook page at UWA in 2009 believes these sites create a university community by connecting students with each other and to staff and support services. This in turn creates a sense of belonging and captures emotional “intangibles”.

Students with disabilities in particular benefit from structured and unstructured transition initiatives like Cluett’s UWA Facebook page. Despite a history of inaccessibility (AbilityNet 2008), Facebook is now considered the most accessible social networking site. Other benefits for people with disability include:

an opportunity to break stereotypes, exchange support and reduce isolation. Facebook also offers a free method of publicizing helpful disability organizations, books, products — and the people behind them. Advocates view it as a powerful tool for social change. Throw in the fact that it's just plain fun, and suddenly you have a lively, integrated community that's been hard to achieve in the physical world. (Dobbs 2009)

There are several Facebook groups specifically dedicated to students with disabilities. Some, such as Glasgow University Disabled Students Society are devoted to specific universities and provide students with information about how to access disability support services. Others, for example Students for Disability Awareness, are broader and seek to foster disability activism and social justice. One of the most well-known disability Facebook groups (see discussions in Ellis & Kent 2011 and Haller 2010) is The Official Petition for a More Accessible Facebook. The group was started by a student and prompted Facebook to address many of its accessibility problems (Ellis & Kent 2011).
WAY-FINDING – FOURSQUARE

Li and Hamel (2003) cite actually navigating the physical University campus as a powerful site of exclusion for students with disabilities and suggest technology as a way to mitigate this by allowing students to work from home. However, if people with disabilities always stay out of sight, disabling physical environments are unlikely to change, further excluding people with disability. Digital technology is now providing a way to enable people with disability greater access. Several iPhone applications (apps) such as the location based social networking app FourSquare have pioneered this phenomenon. Community accessibility (Ellis & Kent 2010) where other users contribute to a database of knowledge regarding the accessibility of certain locations is having an impact on way finding for people with disabilities using FourSquare. FourSquare is reported to enable students with vision impairment a way to navigate around university campuses (Parry 2010). This revolution in way finding is possible because it was made accessible and also invites the participation of the wider community:

Foursquare is a city guide, friend finder, social network, game, and various other things. Essentially with a compatible phone like an iPhone the GPS finds nearby locations and you check in to the location using the app. Checking in just means you are saying that you are at the given location. You can also see where your friends are in your city and around the world though various screens and optional push notifications. For instance, if I saw that [a friend was close by] I could (from the Foursquare app) send him a text message, call him, or communicate via Twitter to …see if he wanted to have lunch or a coffee. Each venue can also have tips which users add. This is an area where foursquare can be used as an accessibility wayfinding tool. For example, I was just at the Coolidge Corner station on Boston’s green line. I added a tip to the venue stating when you get off the train which side of the tracks had even numbers on the street and which side had odd numbers. Thus if another user accessed the stations tips, either while on the go or through the web site, they would see that navigation tip which I added. (Mika cited on Shandrow 2010)

Web 2.0 is characterised by networks that get stronger the more people in and contributing to them. Accessibility on web 2.0 applications gets stronger when the community of users becomes involved (Ellis & Kent 2011). Following this user led revolution; there is now a National Institutes of Health/National Eye Institute funded project in development at the University of Massachusetts Amherst that provides students with vision impairments audio instructions as a navigational aid (Callahan 2010).

INTER-INSTITUTIONAL COLLABORATION – BLOGS

Wikis, blogs and other user generated content are embraced within academia because of the strong rhetoric that the current generation of students are digital natives and that these sites can be easily accessed by anyone with an Internet connection. The use of online social network sites has been shown to be beneficial within the requirements of a university education. Significantly for students with disabilities, these sites reduce social exclusion and increase independent study. However, Foley and Voithofer (2008) argue that the example of students with disability shows that social computing environments are not always easily accessible.

While prolific disability and feminist blogger Chally uses wikis, text message and email to interact with other Sydney uni students or collaborate on projects, her blog Zero at the Bone provides her significant opportunity for inter-institutional interaction to engage in social justice work and participate in online disability activism:

My blog work is very important for connecting with other people with disabilities interested in social justice. I don't interact with disability justice work a lot offline, because I usually don't have the time and energy to get out there and work in
community what with all the pressures of my disability and the rest of my life! With blogs, I can sit at home in my own comfort zone and have amazing discussions. With students in particular, sometimes I'll blog about university accessibility issues, and we connect over that. There are lots of students in disability communities on the Dreamwidth platform, too, for instance. There's a lot of opportunity for discussion! (Personal communication.)

For Chally, avoiding the situation Foley and Voithofer (2008) describe is paramount and she maintains a commitment to accessibility on her blog:

Where accessibility is treated as a hypothetical a lot of the time (we don't need a ramp, we've never had anyone who uses a wheelchair in here!), basic ethics as well as personal friendship means that I couldn't make my blog inaccessible in good conscience. I try to reflect regularly on what I can do to make my blog more accessible, and take into account every suggestion. I've had to stop using the blockquote function as the blockquote colouring in my blog theme is light grey on a white background. I had tried changing this by forcing it through HTML, but that affected the colouring on my RSS feed, which of course many readers would use as their own accessibility tool (you can modify textcolouring, sizing and so forth in your feedreader). It's a pity, because this is the most accessible theme I could find that fitted my purposes on my blogging platform, Wordpress. I transcribe or describe videos, I describe images, I use descriptive text (or include title text) in my links: I do whatever I can think of to make my blog an easy reading experience for all my users. (Personal communication)

Thus there are many different ways to include and exclude people with disabilities on web 2.0.

CONCLUSION

People with disability and educators are often “early adopters” of new technology seeing the potential benefits of these technologies within their lives. This is most true of ICT; the web has been variously described as “opening a new world” for people with disability, a “solution”, and an exciting mode of inclusion (Ellis & Kent 2011). Likewise, the web 2.0 pedagogical benefits for learners and educators are celebrated in terms of opportunities for collaboration, communication and documentation. Technology allows flexibility and is a key driver in trends of flexible learning. Ironically however, with the move to web 2.0, learners with disability who potentially benefit the most from these platforms experience disabling limitations. Educators and policy makers need to be aware of digital disability and approach disability from a social perspective. Students with disability must be included in this potentially revolutionary environment. While my focus in this paper is on students with disabilities as innovators of web 2.0 technologies, integral to this discussion is the mainstreaming of accessible technologies.

Throughout Disability and New Media, a book I recently coauthored with Mike Kent, a number of ways the web is disabling for people with disabilities are identified. As educators, we found the example of students with disabilities particularly illustrative. We recognized that the web was increasingly important within university education and highlighted several platforms including virtual worlds, social networking, ebooks and some learning management systems, as inaccessible for students with a variety of disabilities. However, several high profile companies including Google, Apple and Facebook announced mainstream accessibility measures as we were completing our research, and we ended the book with “more hope than trepidation” (p 146). Many technologies including text-to-speech and dictation software are now released on devices designed for a mass market such as Amazon’s Kindle and Apple’s iPhone and iPad. Reena (2009) claims that these innovative and convenient technologies are available to the mass market only because people with disabilities pushed for innovation and improvement. In this way accessibility does not pertain solely to disability and benefits other groups of people.
This paper is an extension of that hope and recognizes that both mainstream accessibility measures as well as community accessibility is having a positive impact on the inclusion of students with disabilities. By drawing together insights from people with disability across a number of web 2.0 platforms including, blogs, discussion forums, email, Twitter, Facebook and YouTube, I have sought to focus on communication as innovation and foreground the actual lived experience of students with disabilities prompted, by web 2.0, to collaborate and innovate.

REFERENCES


ENDNOTES

1. The University where I work in Western Australia – Murdoch University – offers On Track, a pre University program to facilitate entrance of non traditional applicants or people who have had major disruptions to their life or study, including applicants with a disability. See http://www.murdoch.edu.au/Future-students/Domestic-students/Applying-to-Murdoch/Admission-pathways/Non--school-leavers/

BROADBAND, DISABILITY AND THE ROLE OF STANDARDS

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Australia’s broadband future has the potential to realise tangible benefits for consumers living with disability. This paper discusses the importance of bridging the digital divide between Australia’s disabled and non-disabled consumers, the role that broadband industry standards can play in bridging this divide and the importance of including people with disability in the development and promotion of best practice standards for broadband products and services. The paper argues that through implementation of best practice ‘access-for-all’ standards for broadband products and services, which have been developed in consultation with end-users with disability, the implementation of a ubiquitous broadband network will help bridge this digital divide and provide Australians living with disability increased inclusion and participation in all aspects of Australian society.

BACKGROUND

Through the delivery of high principled, best practice standards that have been developed in close consultation with people living with disability, it will be possible to ensure that the new and emerging products and services that will undoubtedly result from the introduction of a ubiquitous Australian broadband network will provide real and tangible benefits for consumers living with disability; products and services providing levels of access that have previously only been imagined by Australian consumers living with disability.

Including the end user with disability in the development of these best practice standards will not only ensure their relevancy but will also ensure that people with disability will have a greater sense of self-determination and benefit from products and services that make a difference in their lives.

Just as standards have proven to be widely important in other industries, standards for broadband products and services will improve the usability of new broadband applications for the whole community, provide economy of scale savings in manufacturing and marketing and most importantly provide greater access to full economic, social and cultural participation for consumers living with disability.

Disability Standards for Access to Premises, for example, have benefitted the whole community. The provision of access ramps for wheelchair users has also been beneficial for parents with baby strollers, trades people and the elderly who find it easier to use a ramp rather than climb stairs. In the same way, broadband-related standards that provide greater access for people living with disability can also benefit the larger community.

Another example of how standards have assisted in the social inclusion of people with disability in the Australian context is the Interactive Voice Response (IVR) standard for telephone menu navigation. This was initially developed by the banking sector, and has been adopted by the Australian Federal, State and Territory Electoral Commissions in the
Electronically Assisted Voting schemes designed to provide Australian voters who are blind or vision impaired access to fully independent, secret and verifiable ballots.

Standards developed with consultation of people with disability will be essential in helping to provide the benefits of broadband which can bridge the digital divide of economic, social and cultural participation experienced by many Australian consumers living with disability.

While standards alone will not provide full accessibility to broadband services, they can foster access for all design, increase interoperability and encourage the necessary market environment for mass production of affordable and accessible ICT equipment and broadband services.

**INTRODUCTION**

The introduction of Australia’s National Broadband Network (NBN) offers the opportunity to provide unprecedented social and economic value for all Australians. The benefits for our society at large – although the subject of some political debate – are increasingly obvious to many commentators (Clarke 2009; Broughall 2010). However, the same benefits of increased social and economic participation for the growing number of Australians living with disability are very uncertain.

The Australian Bureau of Statistics (ABS) reported that 18.5 percent of the Australian population reported having a disability in 2009. The percentage increased with age, with approximately 6.6 percent of those aged 15 to 24 having a disability, compared to 40 percent of those aged between 65 and 69, and 88 percent of those aged 90 years and over (ABS 2010). With the ageing of the Australian population, it is likely that the numbers of people with disability will rise.

While the discussion of how best to develop and implement high-speed broadband in Australia has been hotly debated and which technology will provide the greatest utility has been a political football (Gerrand 2010) the potential long-term benefits that a national high-speed broadband network will provide to the Australian population in general, and the disabled community specifically, has not been in question.

With the introduction of the World Wide Web in the early 1990s and the increased take-up of Internet connections, we have seen dramatic changes in the way we live, learn, conduct business and connect with our families, friends and community. The Internet has transformed many of the ways in which we manage finances, find employment, and shop for everything from groceries to holidays, and stay informed and in touch.

The NBN will bring broadband data-transfers that offer speeds up to ten times that available to residential users today. It is likely that this widely available, high-speed broadband connectivity, which will be easily accessible by the majority of Australians, will result in an increased number of new services, both public and private.

But many Australians living with disability will be unable to readily benefit from these new services, or even from services available using current broadband speeds.

Consumers who are blind or vision-impaired, for example, need to have access to equipment and services that are audio-enabled. This allows functional usability through spoken navigation, instructions and applications that are not solely graphics-driven but offer alternative text functionality.

Consumers who are Deaf or hearing-impaired need full functionality of products and services via graphics and text utility. Deaf consumers will require operational functionality in broadband products and services via Auslan (Australian Sign Language) or text captions.

Consumers with physical or cognitive disabilities or complex communication needs will only be able to take full advantage of the benefits offered through ubiquitous broadband if their access requirements are incorporated in the design of these new products and services.
The role of standards is to provide guidance for developers and manufacturers in the most efficient and productive way in which to bring new technologies to market. They also serve as an important mechanism in making technology more accessible to the whole of society, not just for those living with disability. Standards that provide the greatest value are those that incorporate consultation and input from the end user of the product or service.

Standards for ICT products and services have several facets including issues of highly technical detail, interoperability, market forces and usability. The development of relevant, robust and appropriate standards involve several key concerns: defining what should be standardised; recruiting a balanced team of contributors; achieving consensus of stakeholders; public consultation; implementation; and educating end users of the relevance of the standard in a product or service. (Gill 2007)

There are a range of different categories of standards from voluntary industry guidelines, national, regional and international best practice standards to national standards that are adopted by government as essential requirements for legislative conformance.

One of the most relevant examples of best practice standards is the World Wide Web Consortium’s (W3C) Web Accessibility Initiative’s development of the Web Content Accessibility Guidelines (WCAG 2.0 2008).

These guidelines provide best practice advice on how to design and author web content in a variety of languages and platforms that provide maximum usability, not only for people with disability but also for all users of web content.

One way in which the WCAG 2.0 guidelines can help both people with disability and the greater population is the recommendation to provide a text equivalent for every non-text element. This enables screen reader software to verbalise the graphics function for computer users who are blind or vision-impaired, while at the same time providing additional information for users who may not immediately recognise the significance of a graphical webpage link.

In the last decade there has been an increased focus, both in Australia and internationally, on inclusive information and communication technology. In 2010 the Australian Government made a commitment to adopt the WCAG 2.0 guidelines for all Government websites (Federal, State and Territory). Consequently all Government websites will be WCAG 2.0 ‘A’ rated by end of year 2012 and ‘AA’ rated by end of year 2014 (Dept. of Finance 2010).

Internationally there has been a growing effort to raise awareness, educate and develop inclusion standards for ICT products and services. For example the European Union has been developing ongoing accessibility awareness campaigns through the European Commission’s eAccessibility initiatives.

The European Commission’s Mandate M-376 incorporates a range of standards that will help ensure interoperability across its member states, avoiding a fractured marketplace and fostering a market for affordable and accessible ICT products that are developed using the principles of access for all.

Similarly, in the mid 2000’s Japan developed a range of ICT accessibility standards, JSI X 8341-3: Guidelines for Older Persons and Persons with Disabilities: Information Communication Equipment, Software and Services. These included five key categories for accessibility:

- Common Guidelines;
- Information Processing Equipment;
- Content;
- Telecommunication Equipment; and,
- Office Equipment.
These guidelines were developed through consultation with all stakeholders, including people with disability. Whilst developed as best practice standards, JSI X 8341-3 has been adopted by manufacturers across Japan.

Japan’s standards body, Japanese Standards Association (JSA), aware that Japanese manufactured products incorporating these standards would only be marketable internationally if these standards were harmonised through International Standards Organisations, submitted JSI X 8431-3 to the International Organisation for Standardisation (ISO) for adoption.

Consumer advocates and disability organisations have lobbied long and hard to have ‘access for all’ incorporated into information and communications technology both in Australia and internationally. These disability organisations have worked with industry, standards bodies and regulators to gain accessibility for people with disability in a range of ICT products and services, from fixed line handsets to audio-enabled set-top boxes.

As a result of consumer consultation and lobbying, for example, Australia’s telecommunications industry has adopted a Standard requiring a raised dot on the "5" button on telephone keypads, for the benefit of consumers who are blind or vision impaired (ACIF 2001). As an example of how standards designed to assist people with disability have been adopted for a wider range of uses, the raised dot has migrated to most other devices that use the standard number keypad, such as banking ATMs, retail checkouts, calculators and most recently, accessible voting kiosks in the Australian Federal elections for voters who are blind or vision impaired.

Often products and services that have been designed for use by people with disability have also proved to be of great value to the wider community. The telephone was initially invented by Bell to assist people with hearing impairments and yet for most of the 20th Century the telephone was our most widely used mode of communication (Goggin and Newell 2004).

More recent examples of ICT products that have been designed to assist people with disability and then adopted for wider use are call vibrating mobile telephones, volume control on handsets and the display of captions on video screens in noisy environments. All three of these widely adopted technologies were initially designed to assist consumers who are Deaf or hearing impaired.

Unfortunately, many advances in access and the wider awareness of access barriers have been driven mainly by the desire to avoid discrimination suits brought by people with disability under the growing number of national and international anti-discrimination legislation mechanisms, including the Australian Disability Discrimination Act 1992 (Cth) (DDA 1992).

One of the key international anti-discrimination mechanisms is the United Nations Convention on the Rights of Persons with Disabilities 2006 which specifically addresses the need to make information and communication technology accessible for people with disability, Articles 4 (f), 9, 21, 30 (UNCRPD 2006).

The landmark Australian Human Rights and Equal Opportunity Commission (now the Australian Human Rights Commission) decision of Scott v Telstra in 1995 provided the first recognition of the right of people with disability to have equal access to information and communication technology. The Commission handed down a ruling that consumers who have a profound hearing loss must be given access to a teletypewriter (TTY) in the same way as other consumers are given access to a fixed line handset (AHRC 1995). In a later, seminal anti-discrimination case, Maguire v SOCOG in 2000, the Human Rights and Equal Opportunity Commission ruled that the Sydney Organising Committee for the Olympic Games (SOCOG) was discriminating by not making its website accessible for consumers who used screen reader software because of blindness or vision impairment (AHRC 2000). These two cases have helped to raise awareness of the barriers that people living with disability face in accessing mainstream technology when such technology does not incorporate the principles of Universal Design and access for all.
With the introduction of legislative and regulatory instruments such as the European Union’s Mandate 376 (EC 2005), the United States Rehabilitation Act Section 508 (USRA 1973) and the introduction of the US Government’s Twenty-First Century Telecommunications and Video Accessibility Bill (H.r. 3301 2010), ICT products and services will need to meet minimum accessibility standards in order to be viable in these major markets.

If Australia is not to become a dumping ground for the inaccessible ICT products that are unmarketable in these overseas markets, it will be necessary for our own development of minimum accessibility standards for all ICT products and services, particularly as new and emerging services become available as a result of a ubiquitous broadband network.

Until now, much of the effort to make products and services accessible for all has been an exercise in catch-up as governments, regulators and industry try to adapt ICT products and services that have been developed with little awareness of the important benefits of including our colleagues, friends and family members with disability.

The introduction of Australia’s NBN offers the opportunity to learn from these past oversights. But essential in the development of these standards is a paradigm shift in the way Australian society views disability. Increasingly disability is seen as the result of social barriers rather than as a shortcoming intrinsic to an individual (Goggin and Newell 2003). With the introduction of the NBN, Australia has, effectively, a clean slate – an opportunity to change our mindset from viewing accessible ICT not as a bolted-on fix, but rather as an ‘access-for-all’ necessity built into all new products and services.

Through development of best practice standards and the promotion of ‘access for all’ principles in both the public and private sectors, we can bridge the digital divide that continues to keep many Australians living with disability unable to fully participate in the technology that underpins the way we participate economically, socially and culturally in the 21st century.

In the same way that the Web Content Accessibility Guidelines (WCAG 2.0 2008) provide best practice standards in developing accessible websites, best practice standards for products and services developed for broadband will provide greater access for people living with disability.

High-principle, technology-neutral standards for user interfaces that include accessible functionality for all will not only make it possible for people with disability to participate, they will make access for all more efficient, decrease the need for specialised, high-cost adaptive equipment and incorporate the principles of inclusion enshrined in the United Nation’s Convention on the Rights of People with Disabilities.

The accessibility standards that have been developed by the W3C can provide guidance on how we can develop standards for broadband products and services that will increase functionality and usability for all members of our society.

If Australia is to bridge the digital divide as we transform our e-infrastructure to the NBN, it is absolutely essential that the development of standards should incorporate both a heightened awareness of the benefits for all of high-principle best-practice guidelines, and consultation with and input from end users with disability.

There is a range of barriers that confront people with disability in accessing broadband: the cost of service and equipment; inaccessible hardware, software, services and web content; and a lack of training and awareness of the opportunities that broadband services can offer.

A number of Standards would need to be developed in order to ameliorate these barriers. For examples, Standards could cover:

- Equipment, to incorporate the principles of Universal Design to ensure broad usability and built-in interoperability with assistive technologies;
- high-quality captions for all video content broadcast via broadband; and
- high-quality audio description for all video content broadcast via broadband and;
• graphical user interfaces for services offered via broadband that have both captioned and text descriptors for all text equivalent operations.

With the roll out of Australia’s ubiquitous broadband network, there has been much talk about a range of new in-home services that will be possible with the always-on high capacity broadband connection - smart homes, smart grids, home security systems etc.

In order for these broadband services (which will increasingly be accessed via touch-screen graphical user interfaces) to be accessible to people with disability it will be essential that they are developed using the access for all principles of Universal Design.

One of the many potential benefits that the NBN offers us is the development of e-health services in the home for people in regional or rural Australia. Ironically the target audience for this type of broadband service will in many cases be people living with disability. However, without accessibility features built into the user interface and operating hardware, and Universal Design features incorporated into the development of an e-health network, the potential benefits this type of broadband application could offer will not be available for consumers with disability. On-screen menus and instructions would need to be verbalised for consumers who are blind or vision impaired; all spoken instructions and communication would need to be provided in text captions for people who are Deaf or hearing impaired; controls would need to be designed for ease of use by consumers with physical or dexterity impairments; and the user interface would need to be compatible with Braille displays for consumers who are deafblind, and augmentative communication for consumers with complex communications needs.

The creation of best practice touch screen standards developed in close consultation with end users with disability will help developers, engineers and manufacturers design systems that benefit all broadband consumers including those living with disability. With such standards guiding uniformity of operation and functionality, touch-screens will enable people with disability to effectively and efficiently interact with and benefit from these broadband services.

Because the incidence of disability increases with age, and as the Australian population ages, the number of consumers who will need to have fully accessible ICT products and services will increase. For example, the current estimate of the number of Australians living with blindness or vision impairment is close to 400,000 and expected to double by 2020 (ABS 2010).

Another life-changing service that broadband is likely to facilitate is accessible e-learning, which, by providing greater educational choice for people with disability, could improve employment options for people with disability, a group which has experienced high levels of unemployment and underemployment. In the Vision Australia 2007 Employment Report, 63 percent of Australians who are blind are either unemployed or under employed and of those who are employed only ten percent have a weekly salary over $1000 (Vision Australia 2007).

Access to broadband services for people with disability has the potential to change this long entrenched inequity of employment opportunities. A recent American study, for example, asserted that broadband is expected to increase the level of tele-employment of people with disability in one organisation by 100 percent (Lyle 2010).

In order for broadband to fulfil the promise of improved opportunities for people with disability, through high-level, best practice standards – developed in close consultation with the end users with disability – must be promoted within government, industry and the disability sector.

National and international organisations are currently working on developing accessibility standards for ICT. In November 2010 the World Standards Cooperation (WSC) convened an international workshop on Accessibility and the Contribution of International Standards. This workshop brought together experts from all stakeholder groups to discuss how to increase development, promotion and adoption of accessible ICT standards. It included representatives
from industry, national and international standards bodies, regulators, government, consumers and people with disability for three days of workshops, presentations and engagement.

The 2010 WSC E-Inclusion and E-Accessibility forum of the workshop recognised the importance of awareness raising in the role standards can play in ameliorating barriers to ICT accessibility. The workshop consequently made the following recommendations to enhance the adoption of standards for accessible ICT products and services:

- Identify major gaps in ICT accessibility standards present and future;
- Develop harmonised definitions and metrics;
- Bring standards into the education process; in particular train people with disabilities (PWDs);
- Prioritise standards development/adoption to achieve maximum benefits as soon as possible, thereby freeing up resources to target more “specialised” standards needs;
- Include PWDs in the development process;
- Make education and curricula for developers accessible and raise funds to train PWDs;
- Include standards in curricula; and
- Create an accessible, open e-learning platform, and use it also for remote participation.

While many Standards organisations are increasingly raising awareness of the value that accessibility Standards in ICT products and services provide, it is essential that people living with disability are included in the Standards development process and that when ICT access Standards have been developed they be adopted into the education of ICT developers and engineers.

Australian researchers, Dr Scott Hollier and Dr Denise Wood, understanding the importance of promoting standards in the education curriculum for developers, have developed an accredited Unit of Study which is to be offered Starting in 2011 through the University of South Australia. This professional unit of study, Professional Certificate in Web Accessibility Compliance, is a collaborative endeavour between the University of South Australia and Media Access Australia. Through its focus on adoption of the WCAG 2.0 guidelines, this accredited Unit will increase awareness and implementation of standards that will make web content more accessible for all Australians not just those with disability.

CONCLUSION

The implementation of a national broadband infrastructure offers the Australian economy and society the possibility of unprecedented opportunities in the way we engage in all aspects of life. The NBN has been hailed by many as a general purpose technology enabler like the steam engine, railways and electricity. Just as the electricity network led to numerous far-reaching social and economic changes, ubiquitous broadband may have ripple effects in our lives over the coming years in ways that cannot yet be imagined.

However, without a concerted move to developing and promoting high level best practice accessibility Standards for ICT equipment, applications and services Australia’s four (4) million citizens living with disability (ABS 2011) will be further excluded and disadvantaged.

Including consultation with people living with disability in the development of these broadband industry standards will ensure that the end user with disability has the greatest opportunity to benefit from the potentially life transforming possibilities that ubiquitous broadband can provide.

With greater adoption of the development of standards for ICT by industry, government and academia, broadband products and services can become the life changing opportunity capable of transforming the lives of many people living with disability in Australia.
REFERENCES


Recent developments in Australia have seen the telecommunications regulator, the Australian Competition and Consumer Commission (ACCC), propose to step away from the use of hypothetical cost models to set access prices for Telstra’s fixed line network, and move towards a ‘utility style’ framework based on the recovery of historically-incurred costs. The ACCC has been bolstered by a recent decision from the review body, the Australian Competition Tribunal, which cast doubt on the adequacy of Telstra’s modelling of hypothetical costs. The implications of the shift are profound for Telstra, but could also be significant for other regulated entities including mobile operators and the new national broadband company NBN Co.

INTRODUCTION

Attention in Australian media and policy circles is very much focused on the National Broadband Network. However, quietly in the background there have been regulatory developments that are likely to have an equally meaningful – but probably more short-term – effect on Telstra, access seekers and end-users. The developments relate to the way that the ACCC sets prices for accessing Telstra’s existing copper network. A combination of new legislation, giving the ACCC new powers under the (renamed) Competition and Consumer Law Act 2010, and a re-evaluation of the principles by which these prices have been set, is likely to result in a comprehensive overhaul of existing regulatory policies.

This paper has three aims. The first is to provide some (post 1997) historical context and narrative to access price setting for fixed line telecommunications in Australia. The second is to explore the underlying reasons that have contributed to the change in access pricing approach. The third is to consider some possible implications of the change; not just for fixed-line services, but for other services that the ACCC regulates, or may in future regulate.

1997 AMBITIONS

To understand why the ACCC is re-visiting its approach to access pricing, it is helpful to step back to 1997. At this time, the ACCC released its first set of pricing principles for telecommunications services (‘1997 Guide’). The 1997 Guide was issued shortly after the introduction of open entry into the telecommunications sector and the commencement of the telecommunications access regime. It laid the foundations for the ACCC’s approach to pricing telecommunications access services.

At the time, there was much optimism about the prospects of ‘full’ facilities-based competition between fixed access networks; that is, duplication of Telstra’s copper network. These expectations had been heightened by Optus’s – ultimately ill-fated – investments in a
hybrid fibre-coaxial network. As will become clear, these expectations were important to the choice of pricing methodology.

THE REGULATORY CHALLENGE AND THE PROMINENT ROLE OF TSLRIC

The Part XIC access regime introduced in 1997 was to apply to ‘declared’ services; essentially, those services which had monopoly or bottleneck characteristics. In the first instance, prices for these services were to be negotiated between access providers and access seekers. When the ACCC was required to intervene – for example, when considering whether to approve an access undertaking by an access provider, or to issue a final determination in an access dispute – it had to take into account certain legislative criteria, including:

The long-term interests of end-users (LTIE), comprising:
- Promotion of competition in markets for relevant services
- Any-to-any connectivity
- Economically efficient use of and investment in infrastructure
- The legitimate business interests of the access provider
- The interests of access seekers
- The direct costs of providing access
- The economically efficient operation of a network, service or facility.

In setting access prices to meet these criteria, the ACCC faced two difficulties. The first is that no one access price can best meet each of the criteria and, therefore, trade-offs between them will be inevitable. A regulator would want to ensure that prices are high enough to provide a return sufficient to maintain and invest in the network, but not so high as to allow returns on imprudent investments.

A second difficulty is that all regulators have imperfect information regarding the factors needed to establish access prices that best meet the objectives and criteria. That is, there will be an information asymmetry between the regulator and regulated firm. The regulated firm will always know more than regulator about its:
- costs and demand for its services; and
- actions, particularly its ability to reduce costs.

A regulated firm commonly has little or no incentive to reveal this information to the regulator. Rather, the firm would like to convince the regulator that it faces high costs and low demand, so that the regulator will then set high prices for the services it provides; thereby increasing the regulated firm’s profits. The conventional regulatory approach to addressing this incentive problem is to break the link between actual costs and prices, and, where possible, to provide firms with incentive to reveal accurate information about its costs (Laffont & Tirole 2000). A regulator can do this by allowing the regulated firm to retain some profits from its cost-reducing efforts: for example, by setting a cost forecast and allowing the regulated firm to keep any profit if costs are less than forecast, the regulator may gain valuable information about the true level of costs when setting prices for the next regulatory period.

In selecting an access pricing approach for fixed line services, the ACCC had to balance these various considerations. The decision it made was that for ‘mature’ services, access prices should be no more than the total-service long-run incremental cost (TSLRIC) of providing the relevant access services (ACCC 1997).2
MAKING THE ACCESS PRICING TRADE-OFFS

TSLRIC is best understood by explaining its three key components:

- The ‘total service’ (TS) refers to the production of an entire service, which includes both the access service supplied to access seekers and the access provider’s equivalent self-supplied service. For example, the total service in the supply of the unbundled local loops supplied to access seekers also includes the local loops that Telstra, as the access provider, uses itself. This enables both parties to benefit equally from any economies of scale or scope in providing that service.

- ‘Long run’ (LR) means that all factors of production (capital cost, labour and materials) are able to be varied and form part of the cost increment (or ‘incremental cost’ as described below).

- ‘Incremental cost’ (IC) is the additional costs to the access provider of producing the total service compared to not producing it at all.

To calculate the unit costs (and price) of supplying the total service, the incremental cost is annualised and divided by the total annual service units that are demanded. This means that TSLRIC leads to prices that are based on the average costs of providing a total service, not marginal costs of supplying additional units of output.

The ACCC also provided some further guidance to on how it proposed to implement TSLRIC in its 1997 Guide.

The first point was that TSLRIC was to be estimated using forward-looking replacement costs. Estimation of TSLRIC-based prices using forward-looking replacement costs assumes that a network is built ‘as new’ at the start of the price-setting period. This meant that, unlike in other utility industries, the depreciated value of Telstra’s network did not have to be estimated, and that there was no clear link between the depreciated value of actual investments and access prices, which were based on the undepreciated TSLRIC-based replacement cost valuation.

The second point was that the costs should be those incurred in providing services using best-in-use commercially available technology and production processes. In other words, some optimisation was to be applied to ensure that TSLRIC would be an estimate of the economically efficient cost of supplying the access service. The qualification is that available efficiencies have been limited to take account of the existing network design, particularly with respect to the location of exchange nodes in the fixed network (ACCC 1997, 36-38). This is referred to as a ‘scorched node’ approach to network optimisation, which contrasts with a ‘scorched earth’ approach where no such constraints on the location or number of nodes is assumed.

A key reason for adopting optimised replacement costs was that the ACCC originally thought that Telstra’s historic costs of building its network may have been inflated above efficient levels, and that setting access prices using these costs could encourage inefficient bypass decisions by access seekers – building when it would be more efficient to buy access. In practice, this assumption has proved incorrect, with modelling of the copper fixed line access network now commonly indicating increasing replacement costs for the network as a whole.

The ACCC has also allowed inclusion of indirect costs (such as corporate overhead costs) that would be incurred by an efficient wholesale firm. This has been designated by the addition of the term ‘+’ to form the acronym TSLRIC+.

We can therefore see how the ACCC, in choosing a TSLRIC methodology with the specific implementation details described, made the necessary trade-offs:

- the TSLRIC approach was to allow for full cost recovery (albeit of a hypothetical efficient network); not just recovery of marginal or incremental costs of a particular service.
by allowing recovery of the optimised replacement costs of the fixed network, and not actual costs, there would be incentives for access providers to produce efficiently; but optimisation would be curtailed to reflect more commercially-feasible efficiencies.

THE INITIAL WAVE OF SUPPORT

The ACCC received support (either directly or by implication) for TSLRIC from a number of sources, including the Australian Competition Tribunal (Tribunal), international regulators and other industry sectors.

The Tribunal has reviewed a number of the ACCC’s decisions where TSLRIC pricing has been as issue. In 2004, the Tribunal strongly endorsed its use, holding that:

…in our view, it would generally not be in the LTIE to depart from TSLRIC pricing where access is regulated. Accordingly, where an access regime requires, or creates an unacceptable risk, of non-TSLRIC pricing, the Tribunal considers that such a regime is unlikely to encourage the efficient use of, and investment in, infrastructure. (Tribunal 2004a)

There was also a considerable degree of support for a long-run incremental costing approach in overseas jurisdictions, including the United States, Europe and New Zealand:

- In the United States, the Federal Communications Commission (FCC) required State utility commissions to price local access services on the basis of total element long run incremental costs (TELRIC). This involved pricing individual network elements (such as switches, transport and loops) rather than access services, so an access seeker could then aggregate them to deliver retail services. Otherwise, the application using forward-looking costs and the existing network nodes was virtually identical to TSLRIC as applied in Australia. The FCC’s TELRIC methodology, first introduced in 1996, was subject to legal challenge by incumbent local exchange carriers. While initially successful at the US Court of Appeals, the challenge to TELRIC was finally rejected by the US Supreme Court in 2002 (Verizon et. al. v FCC 2002). A majority opinion found that the FCC was not acting unreasonably in choosing an optimised, forward looking costing approach.

- The majority of Western European incumbent telecoms operators had their interconnect prices determined on the basis of a long-run incremental cost (LRIC) methodology. This was driven in large part from the European Commission’s 1997 directive on ‘cost orientation’ for operators with significant market power (SMP) and subsequent recommendation on the use of forward looking LRIC. The LRIC methodology with allowance for common costs was in practice close to identical to TSLRIC (European Commission 1998).

- The telecommunications specific access regime in New Zealand, under the Telecommunications Act 2001, specifically set TSLRIC pricing principles for a number of regulated services (Commerce Commission 2009)

TSLRIC also survived relatively unscathed through the Productivity Commission’s 2001 review of Telecommunications Competition Regulation (Productivity Commission 2001). Although extensive submissions were made and an appendix was devoted to exploring the arguments for and against TSLRIC, the Productivity Commission criticised the ACCC for pricing below long-run efficient costs but did not explicitly object to the continued use of TSLRIC (Productivity Commission 2001, 398).

Arguably, the ACCC’s approach in telecommunications was also consistent with its approach to the regulation of other industries like electricity and gas transmission networks. In particular, the use of optimised, replacement cost asset valuations (as used in TSLRIC) was endorsed for these industries. In a 1999 statement on the regulation of electricity transmission networks, the ACCC suggested that an optimised replacement cost asset valuation approach had significant advantages on economic efficiency grounds (ACCC 1999).
CRACKS IN THE FAÇADE?

By the middle of the last decade, TSLRIC had received endorsement from a wide range of parties. Nonetheless, some nagging doubts remained about its utility. Conceptually, these doubts included a concern about whether TSLRIC was necessary to encourage efficient ‘build or buy’ decisions by access seekers, and whether, because it implied ongoing optimisation of Telstra’s copper network, it might prove to be a form of regulatory expropriation. However, and perhaps more importantly, doubts were also being expressed because there was little success in actually agreeing a set of modelling principles, and developing a predictable and stable time path of access prices.

In part, the more practical problems were exacerbated by fundamental flaws in the access regime itself. Part XIC at the time provided no formal power for the ACCC to set prices over a defined period across access seekers, as its role was limited to conducting arbitrations and assessing undertakings. The structure of Part XIC also discouraged certainty, and various minor reforms have been ineffective in reducing disputation between Telstra and access seekers (Department of Broadband, Communications and the Digital Economy 2010). Some of these problems may be resolved with a new set of reforms introduced late in 2010, as discussed later in this paper. Having said that, many of key TSLRIC implementation issues have never been satisfactorily resolved, and this has undoubtedly contributed to its demise.

In the following section, we analyse the two purported comparative strengths of forward-looking TSLRIC methods. Then we comment (to the extent they are separable) on the practical problems with implementing it effectively.

‘BUILD OR BUY’ INCENTIVES

The ACCC’s two primary conceptual bases for using TSLRIC to set access prices were that it would:

1. Encourage efficient ‘build or buy’ signals for access seekers.
2. Provide appropriate incentives for access providers to be efficient, but also allow for recovery of efficiently-incurred costs, and would therefore not deter new investment (ACCC 1997).

The ‘build or buy’ motive for using TSLRIC is now recognised as being significantly oversold – if not entirely discredited. The ACCC now accepts that, despite expectations that there was a greater potential for infrastructure-based competition in telecommunications than in other regulated industries, Telstra’s copper customer access network was “more of the character of an enduring bottleneck” (ACCC 2009b, 16).

The original ‘build or buy’ rationale for TSLRIC prices was that inefficient bypass might occur if access seekers compared ‘build’ costs on the basis of efficient, forward-looking costs with ‘buy’ costs based on historic costs (ACCC 1997, 29, fn 36). So, an entrant, when faced with an access price based on historic costs that no longer reflect efficient best practice, might inefficiently bypass the incumbent’s network (build) when it would in fact be more efficient to buy access. For example, if the access price when based on historic cost was 100, but only 80 when based on efficient replacement costs, then the access seeker might inefficiently enter if its costs were below 100 but above 80.

At face value, this logic seems sound. However, the argument intrinsically rests on a ‘contestable market’ standard in which sunk costs (those investments which have no value in an alternative use) do not exist. It therefore ignores the role of cost structure: most of the incumbent’s costs are sunk, while an entrant’s costs only become sunk once the decision is actually made to enter. The entrant will need to consider what will happen if it does enter. Prices will not be determined by sunk costs, but by the incumbent’s marginal costs of producing a service - because it will be more profitable to sell at this price than to let the entrant make a sale. Therefore, the entrant must be confident that it can recover its sunk capital costs even though the incumbent will price down to its marginal costs. Unless the
incumbent is tightly constrained by other regulations, this seems highly implausible. Therefore the likelihood is that prices will have to be a lot higher than 100 (in the example above) to drive entry, so TSLRIC may in fact be no better at promoting efficient build or buy decisions than historic costs.

A FAIR BET?

The second conceptual issue is whether the TSLRIC approach can allow for recovery of costs that are efficiently incurred, or, more colloquially, whether it could provide a ‘fair bet’ for Telstra: that when it makes investments, it can expect to recover the costs of the investments. If that is not the case, then the long-term viability of the approach must be questioned, and other access pricing or costing methods should be preferred. It is difficult to determine whether TSLRIC creates under-investment problems, and, if it does, whether these problems arise from conceptual problems with TSLRIC or just particular implementations of TSLRIC. In highly simplified settings, it is trivial to show that TSLRIC can be consistent with recovery of efficient costs. But, as one moves into the realm of the real world, the treatment of technological progress and asset optimisation creates uncertainty for the access provider about whether even efficient costs can be recovered. Four points can be made in this regard.

First, forward looking pricing concepts such as TSLRIC create uncertainty for both the access provider and access seekers, and, unless the expectations set at the commencement of the preceding regulatory period are exactly realised, then the access provider will be subject to windfall gains or losses.

Second, while, of itself, uncertainty is not a desirable feature of a regulatory regime, economists recognise that it can have an important role to play in encouraging efficient behaviour. Recovery of actual costs, regardless of the prudence with which they are incurred, provides minimal incentives for the access provider to be efficient. Risks introduced by the use of forward-looking costs and optimisation can be used to drive efficiency (King 1996).

Third, if TSLRIC is to promote efficient investment, the risks must be symmetric, giving probability of upside to the access provider as well as downside. Many of the risks that change allowable TSLRIC costs over time do appear to be symmetric, so long as the forecasts used are unbiased and sufficiently account for future network optimisation. For example, unforeseen optimisation, or simply falls in new asset prices, can be accounted for by anticipating these changes in annual capital charges. The risk then borne by the access provider is that the forecast optimisation or decline in prices proves inaccurate. For example, if replacement costs of an asset are forecast to fall by 10% over the next regulatory period, but in fact fall by 20%, then the access provider will not recover the TSLRIC costs specified at the start of the first period. But equally, if replacement costs do not fall at all, then the access provider will over recover (the initially-specified TSLRIC) costs.

Fourth, recent research indicates that there are some reasons to think that forward-looking costing approaches like TSLRIC might not induce efficient investment as well as other costing approaches, as they create costs that are not inherent in other approaches. Evans and Guthrie argue that because TSLRIC approaches shift risk onto the access provider, the access provider will need higher revenue to break even on new investment (so that net present value equals zero, the minimum condition under which a firm will invest). This extra revenue is required to cover the expected cost of asset under-utilisation in the future, as these costs will be optimised out by the regulator, and to deliver the higher returns needed to compensate for the increased risk from capital price and demand uncertainty (Evans & Guthrie 2005).

Further, Guthrie, Wright and Small find that forward-looking cost rules (like TSLRIC) are dominated by backward-looking cost rules (like historic cost) when the objective is to induce investment, regardless of whether forward-looking costs are rising or falling over time. The intuition behind this result is that where forward-looking costs are rising, allowing recovery of
either backward-looking costs or forward-looking costs induces investment, but backward-looking costs will be lower and therefore deliver lower prices. Conversely, when forward-looking costs are falling, backward-looking rules imply higher prices but do much better at encouraging a firm to invest earlier than it would under a forward-looking cost rule. The authors find the gains from encouraging earlier investment are likely to outweigh the losses from the higher prices (Guthrie et al 2006).

These conceptual concerns should make a regulator wary of the use of forward-looking costing methodologies like TSLRIC to set and re-set access prices over long periods. The potentially superior incentive properties of TSLRIC compared to a costing framework using actual or historical costs would need to be substantial to overcome the inherent disadvantages.

A DIGRESSION ON OTHER ACCESS PRICING APPROACHES

At this point, it is also worth briefly considering the conceptual criticisms of cost-based access pricing (including forms like TSLRIC) that have been raised by economists. Perhaps the best known is that developed by Baumol and Willig – the efficient component pricing rule (ECPR) – and extended by Laffont and Tirole – a global price cap, which incorporates both access and retail services (Baumol & Willig 1994a) (Laffont & Tirole 2000).

The Laffont and Tirole critique of cost-based pricing essentially rests on a basic proposition. If the access provider is a monopoly, but is forced to set cost-based prices in that (upstream) market, then it will want to try and capture some monopoly profits by acquiring market power in the market downstream from the monopoly input. Conversely, if access price regulation allows for access sales to be as profitable as retail sales, then the access provider will be happy to sell on a non-discriminatory basis because this will maximise its profits. The tighter is the upstream price regulation, the more the monopoly will lose and the more it will be worth denying access or somehow raising its rivals’ costs.

These are far from theoretical concerns. The Federal Court fined Telstra over $18 million in 2010, on the basis that Telstra had blocked competitors from accessing its local exchanges by telling them that the exchanges were full when they were not (Federal Court 2010).

The ECPR and global price cap access pricing rules address such discrimination concerns by allowing the access provider to make a margin on access sales that is similar to the margins made on retail sales. This reduces or even eliminates the incentive problem inherent in cost-based regulation of access. But each rule creates new problems. The ECPR does not address concerns about excessive returns earned in the (monopoly) supply of access services. A global price cap would allow for normal economic returns overall, but would require regulating both access and retail markets. This does not seem desirable and runs counter to the Hilmer approach of deregulating competitive or potentially competitive market segments (Independent Committee of Inquiry 1993). Neither approach has been seriously contemplated as a universal access pricing solution in telecommunications.

TSLRIC’S INSCRUTABLE IMPLEMENTATION

Estimating TSLRIC requires estimation of a ‘modern equivalent asset’ that would be built to provide service today and into the future. It is an imaginary cost of an imaginary network, and, that being the case, it can be imagined in different ways.

Perhaps symptomatic of the general lack of agreement about how to implement a TSLRIC approach in Australia is the proliferation of models that have been used to estimate TSLRIC prices. The ACCC has commissioned two of these models (the NERA model and the Analysys model, named after the firms that were hired to construct them), while Telstra has developed three (known as PIE I, PIE II and TEA).

In this paper, I cannot hope to exhaustively analyse the disputes about how to correctly implement a TSLRIC model of the fixed network. Rather, it may be helpful to break down the major implementation problems into three sets of issues.
THE APPROPRIATE MODELLING PERSPECTIVE

It is common ground that TSLRIC attempts to measure the efficient forward-looking costs of supply. But whose supply, and what constraints are assumed to apply to it? As we have seen, the ACCC has preferred models of the incumbent’s existing network architecture, rather than that of a new entrant, unconstrained by the incumbent’s past decisions. But how far does this extend? In a recent Tribunal decision (Tribunal 2010), the Tribunal rejected the use of Telstra’s TEA model on the basis that the ‘new entrant’ approach to modelling costs that was implied by the model was undermined by the model’s use of much of Telstra’s existing network architecture.

The Tribunal did not directly address whether this was a difficulty with the scorched node approach itself, or just Telstra’s implementation of it, but is hard to see how it is not an attack on the former:

231. The TSLRIC+ approach seeks to estimate Telstra’s ongoing costs of providing the ULLS. But on the face of it Telstra’s ongoing costs have nothing to do with those of a hypothetical new entrant to the market providing the declared service, especially as the TEA Model is premised on a scorched node approach.14 (Tribunal 2010)

The Tribunal’s position here points to the inconsistency between arguing, on the one hand, that the cost of a new network should be modelled to ensure that an access seeker faces the right build or buy decision, and, on the other, arguing that the incumbent’s network design decisions should be taken into account because that would be fairer to the incumbent. No single approach can achieve both objectives.

As already noted, the ACCC’s position is that what should be modelled is the efficient costs of the incumbent (ACCC 2009c). The trade off made undermines the build/buy incentive for access seekers. If an incumbent does have certain cost advantages deriving from a legacy network, and these are incorporated into the TSLRIC model, then an entrant that is equally-efficient in all other respects will rationally choose to buy access rather than build.

MODEL INPUTS

Disputes about appropriate inputs for costing purposes are, of course, common to all costing approaches. Any approach must make decisions about the way in which capital costs are recovered (asset lives and path of depreciation) and a reasonable rate of return (ordinarily, based on an estimate of an efficient firm’s weighted average cost of capital). Needless to say, these have been areas of great controversy between the ACCC and Telstra.12

When compared with simpler regulatory approaches based on depreciation of actual costs incurred, the additional burden that TSLRIC modelling imposes is the greater degree of foresight required. Such models require long term forecasts of future asset price changes and assumptions about obsolescence of assets. Although this may be easier for civil works, as labour costs are relatively predictable, for other assets these forecasts and assumptions are highly speculative in an era of rapid technological change.

HOW TO UPDATE THE MODELS

Although setting TSLRIC-based prices for the first time has proved contentious, arguably the greater challenge is how to update the costs and prices.

This has been a particular source of concern for Telstra, and for regular Telstra adviser, Henry Ergas. Ergas has repeatedly criticised the ACCC for introducing ‘time inconsistency’ by setting a path for (rising) prices at the outset of the regulatory period (2000/2001) that have turned out to be inconsistent with those actually set in subsequent regulatory periods – because prices have not risen in accordance with the price path set in the first TSLRIC model (Ergas 2008a; 2008b; 2009). The ACCC denies these claims, noting that earlier costing
models were less sophisticated, and by arguing that costs have fallen because earlier models simply estimated costs that were too high (ACCC 2007b, para 423).

The Commerce Commission in New Zealand has encountered a similar problem with TSLRIC. It uses a TSLRIC model to estimate the net costs of the telecommunications service obligations (TSO) imposed on Telecom New Zealand. The Commerce Commission found that continuing to optimise Telecom’s network over time in annual TSO determinations would be inconsistent with the assumptions made about recovery of depreciation in earlier periods and would likely result in cost under-recovery. It elected to solve this problem by essentially ‘locking in’ the TSLRIC values and committed to no longer optimising Telecom New Zealand’s network by assuming an efficient operator would use new technologies (Commerce Commission 2008).

To summarise, the implementation of TSLRIC is far from straightforward, and has led to considerable argument over the past 10 or so years. Key implementation decisions are still not agreed between the ACCC and Telstra, and even the Tribunal has expressed frustration with the current state of affairs. Indeed, the Tribunal, after being such a strong advocate for TSLRIC, has now expressed serious reservations over the TSLRIC approach (Tribunal 2010):

Quite separately, the Tribunal notes that the ACCC proposes to examine TSLRIC+ as part of its review of pricing principles. The Tribunal encourages that review and the consideration by the ACCC of alternative pricing regimes, for example whether pricing on the basis of depreciated optimised replacement cost [DORC] might be appropriate.\(^{16}\)

Alternatively, if TSLRIC+ continues to be preferred, more guidance needs to be given on how it should be implemented\(^{17}\).

THE NATIONAL BROADBAND NETWORK – A TURNING POINT?

By 2009, the ACCC had developed its own cost model capable of setting TSLRIC-based prices (Analysys model), and proposed in a draft report to use the outputs from this model (ACCC 2009b). However, the model was never actually used to set indicative or arbitrated prices.

Quite when the ACCC started to turn away from TSLRIC is unclear. Its Analysys model was commissioned in February 2007, but it seems plausible that, by then, developments surrounding the national broadband network had crystallised reservations that the ACCC had been having about the use of forward-looking cost models to set prices. Later in 2007, a group of nine access seekers (known as the G9) submitted an access undertaking for a fibre-to-the-node (FTTN) network. In a draft decision on the G9’s undertaking (which was withdrawn before a final decision), the ACCC noted that it was not bound to a TSLRIC approach, and that access providers could propose alternative methodologies, perhaps reflecting changing conditions in markets or for pricing new, as opposed to legacy, networks (ACCC 2007b).

The NBN tender process likely provided a further point of reflection for the ACCC. The cost of the new investments needed to build an NBN would need to be recovered. An access provider would want some certainty that its actual costs would be recovered — and not subject to the vagaries of an optimised replacement cost approach. Interestingly, Telstra’s fear did not seem to be that the newly sunk investments would be later found to be imprudent. Rather, its concern seemed to be that the TSLRIC models themselves were already producing cost estimates that incorporated network upgrades (particularly the use of fibre) that would in practice require significant new investments by Telstra. Telstra’s Regulatory Affairs Manager was quoted in 2006 (around the time when negotiations were underway around the building of a FTTN network) as saying:
“…the TSLRIC models [are] actually already optimised, so the cost pool out of which access prices are determined is already in place and in fact is already almost a [FTTN] network. What that means is that we could spend multiple billions of dollars doing a [FTTN] roll-out – multiple billions – and the total cost pool we are allowed to recover from wholesale and retail prices would not go up a jot.” (ACCC 2009a)

So as prices determined by the TSLRIC models would not rise when the substantial new investment was made, there was little incentive for Telstra to actually undertake the upgrade. 18

Although administratively messy, it would have been possible to value new assets required for an FTTN at their actual costs, and maintain the valuation of existing sunk assets that were not to be displaced by FTTN at their optimised replacement cost. However, in its advice to the Government during the first NBN tender process in early 2009 (ACCC 2009a), the ACCC said that in relation to the sunk network, the approach that was now typically used in the electricity and gas sectors, with a ‘locked in’ regulatory asset base, may have some merit because it would remove uncertainty created by continued re-optimisation of the asset base, and would link prices to cost recovery and therefore prevent opportunities for investment cost over-recovery.

By the end of 2009, the ACCC (ACCC 2009b) noted:

For some time the ACCC has recognised that its long held approach to pricing fixed line telecommunications services, a forward looking TSLRIC+ approach with revaluation at every regulatory reset may not be appropriate given the enduring bottleneck nature of fixed services.

A BUILDING BLOCK METHOD

Through the course of 2010, the ACCC consulted publicly on new pricing principles. It proposed, in a draft decision, to switch to a building-block model (BBM) that is more in line with models used in the gas and electricity sectors. In these models, a depreciated regulatory asset base (RAB) is set once, and not re-valued.19 New investments are then rolled into this RAB at their expected cost, which removes the uncertainty caused by re-optimisation and re-valuing of the network assets. An annual revenue requirement is then derived, incorporating operating expenditure, depreciation and a return on capital. This revenue requirement is then allocated to particular services – making it essentially a form of fully distributed cost pricing.

Compared to the TSLRIC approach, a BBM framework involves different trade-offs. Like TSLRIC, it allows for recovery of the efficiently-incurred costs of supplying services. However, the ongoing actual costs of operating the network, rather than hypothetical costs, are estimated. This provides greater certainty of cost recovery for the access provider, but gives the access provider weaker incentives to produce efficiently. Arguably, it might also increase information asymmetry problems, because there is a greater reliance on measuring or forecasting the costs that are (or will be) actually incurred – information that must come from the access provider.

Although the ACCC had made considerable progress in its review of pricing principles by the end of 2010, it was suspended due to important changes to the telecommunications access regime under Part XIC of the Competition and Consumer Act 2010, which became effective on 1 January 2011. The ACCC no longer has the power to make pricing principles. Instead, it has a new power to make ‘Access Determinations’ which can specify price and non-price terms for access seekers not currently subject to an existing commercial agreement with Telstra. The new Access Determinations are expected to formalise the new pricing approach, with prices set for a number of years.
A NEW APPROACH, AND NEW PROBLEMS

The ACCC’s switch of access pricing methodologies raises a number of interesting problems. Some are only transitional in nature; for example, establishing accurate forecasts of operating expenditure. Others seem more elementary: two that are worthy of further consideration are the effect on the NBN, and the potential flow-on effects to other services that the ACCC regulates.

REGULATION OF THE NBN

As we have seen, a TSLRIC pricing approach does not provide strong incentives to upgrade existing network infrastructure, because part of the cost of the upgrade may well be factored into current TSLRIC access prices (if, for example, it was considered an optimised network would use more fibre than the existing network). In contrast, the ACCC’s new preferred approach explicitly accounts for depreciation of existing assets, and allows for actual costs to be rolled into the regulatory asset base on which a return is earned. At face value, this should make the transition to the NBN much more straightforward. Costs incurred now are much more likely to be considered efficient (subject to yet-to-be-determined prudence measures), so that the risk associated with questions of optimisation of the asset base over time should be of less concern.

A problem that may arise from the new methodology is due to the ‘lumpiness’ of investment required for the NBN: much of total capital investment will be required in the early years of the project. It is well known that actual cost approaches can lead to problems with a conventional building-block approach when large, lumpy investments are made because of the rapid increase in the regulatory asset base and, therefore, in prices.

How significant a problem this will turn out to be depends on two factors: how low Telstra’s existing regulatory asset base is valued, and how much flexibility the ACCC is willing to allow NBN Co in recovering its costs. Assigning a low value to Telstra’s regulatory asset base (based on the copper network being heavily depreciated) will cause transitional issues for NBN Co. This will manifest in either end-user unhappiness, as customers will effectively be forced to migrate to NBN Co products that offer inferior value, or in damage to the NBN Co business case. Depending on the views of the ACCC, NBN Co may have some flexibility to address this problem by deferring its recovery of the capital costs of the NBN. That is, by setting prices initially to stimulate demand, but increasing contributions to recovery of sunk network costs over time as the customer base (and, hopefully, consumer willingness-to-pay for new and innovative services) increases. Although not a common regulatory problem, as most regulated firms tend to have much more stable costs and revenues than will NBN Co, there is theoretical support for this kind of pricing in the economic literature (Laffont & Tirole 2000, 68).

REGULATION OF OTHER SERVICES

The ACCC also regulates the price of two other services: domestic transmission capacity, and the mobile termination access service (known as ‘MTAS’). Both services have previously been found to be suitable for the adoption of TSLRIC-based pricing.

There have long been concerns about how to apply the TSLRIC principle to transmission networks, but (perhaps fortunately) the ACCC has never been required to arbitrate or to assess an access undertaking for transmission services. The ACCC has now flagged a move away from TSLRIC-based pricing, but, rather than move towards a BBM as for access network services, it has elected to rely on a combination of benchmarking of competitive routes and other information from service providers (ACCC 2010).

Fixed and mobile network operators must acquire MTAS in order to complete calls to other operators’ mobile networks. The ACCC has regulated this service since 1997, and, since 2007 it has used a TSLRIC model to estimate the forward-looking efficient costs of supplying this...
service to inform its price setting. It therefore seems apposite to ask whether the justification for the use of TSLRIC remain as valid now that the ACCC has stepped away from this approach for fixed lines.

Interestingly, and contrarily to its prominence in relation to fixed line pricing, the ACCC has not used the ‘build or buy’ justification for the use of TSLRIC pricing of MTAS. Rather, the ACCC concluded that TSLRIC was the appropriate price because it:

- reflects the direct cost of supplying the service;
- ensures equally-efficient access seekers in related markets are able to compete on an equal footing with integrated access providers as both will face similar input costs for the declared service;
- takes account of the interests of both access providers and access seekers; and
- encourages the economically efficient use of, and economically efficient investment in, the infrastructure used to provide telecommunications services (ACCC 2004).

Given that build/buy decisions are not an issue, is there a reason to think that the conceptual and practical issues with TSLRIC would be any less for MTAS that for fixed line services? It is difficult to see why, as, if anything, mobile technology evolves even more rapidly than does fixed line technology, and there must be significant uncertainty as to how accurate future asset price trends will turn out to be.

Might the ACCC similarly consider a move to historic costs and a fixed RAB as a basis for setting MTAS prices? As has been recognised by the Tribunal, the costs incurred by mobile operators were relatively recent (compared to fixed line networks) and subject to competitive market pressures due to the presence of between three and four competing network operators (Tribunal 2006). One would therefore expect that the prospects of costs being inefficiently incurred are much less. Of course, adoption of an actual cost approach may also raise some difficult issues. For example, there are three suppliers of MTAS services: Telstra, Optus and Vodafone (having absorbed ‘3’ in 2009). If historic cost is to be used, will each operator be allowed a different MTAS charge? And does comparable historic cost information even exist for the three suppliers? These difficult questions will be subject to review by the ACCC in 2011 as part of a periodic review of the mobile sector.

**CONCLUSION**

It has been a long road, but the ACCC is now close to replacing the (futile) TSLRIC approach with a utility model in setting prices for access to fixed line access networks. This will be positive if it can reduce disputes and encourage investment, and ensure a smooth transition to the NBN, without compromising on end-user interests in low prices. Whether the pricing approach can or will be extended to other services is an issue on which there is sure to be further conjecture.

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ENDNOTES

1. The history with access pricing for telecommunications in Australia does go back further than this. From 1991, under the duopoly model, prices for accessing Telstra’s network were set by the Minister (with advice from Austel) at ‘directly attributable incremental cost’ (Lindsay and Williams 1995).
2. This criterion appears to be the only one specifically directed at restraining access prices. The explanatory memorandum to the legislation introducing the new access regime indicated that the reference to ‘direct’ costs of providing access was “intended to preclude arguments that the provider should be reimbursed by the third party seeking access for consequential costs which the provider may incur as a result of increased competition in an upstream or downstream market.” (Trade Practices Amendment (Telecommunications) Bill 1996 Explanatory Memorandum, 44). This could have potentially prevented the use of an access pricing methodology such as the ‘efficient component pricing rule’ associated with economists Baumol and Willig.

3. As the Tribunal has noted (Tribunal 2006, para 19), these criteria are not particularly limiting in nature, and that there will rarely be one correct or appropriate figure in determining reasonable costs or a reasonable charge.

4. In economics, these are respectively known as problems of ‘hidden information’ and ‘hidden action’ (Armstrong et al1994).

5. This was not applied in all circumstances, even for mature services provided on the fixed network. For wholesale local calls (local carriage service or LCS) for example, the ACCC was concerned that the use of TSLRIC based-pricing with the presence of a retail price cap of 20 cents (excluding GST) could have meant that, the access price plus allowance for efficient retail costs would have exceeded the retail price cap. This would have meant that access seekers would not have been able to compete in with Telstra in the sale of local call to retail customers. To meet the legislative criteria, and particularly the promotion of competition objective, the ACCC therefore set LCS prices using a ‘retail-minus’ methodology which subtracted from the retail-capped price, an estimate of per call efficient retailing costs.

6. Further discussion of this background was provided in ACCC (2009a).

7. See, for example, Application by Telstra Corporation Limited [2010] ACompT 1 (10 May 2010)

8. Hereafter, references to TSLRIC are implicitly references to TSLRIC+.

9. Telstra challenged the access regime in the High Court of Australia on the basis that it was an acquisition of property on unjust terms; in particular, that it did not allow recovery of “the company’s actual costs” (Telstra 2007). The High Court rejected the claim on the basis that there was no acquisition of property because the access regime existed prior to Telstra’s privatisation, and so did not look at the question of particular access terms set by the ACCC.

10. In contestable markets, prices for a multi-product firm are bounded by stand-alone costs and incremental costs of a product (Baumol & Sidak 1994b).

11. An important qualification is that Telstra’s retail share of lines remains around 80% (Telstra 2010), so it is not obvious that under-recovery of costs on access prices would necessarily cause significant under-investment. This will depend on the profitability of serving the remaining 80% of customers and their distribution.

12. An example may help here. Suppose that replacement costs are forecast to decline by 5% over the next two years, but when the model is actually updated two years later, they have actually declined by 25%. It is possible to account for the falling asset prices (through the use of a tilted annuity), meaning that the 5% loss of value is factored into prices. But the remaining 20% is not. When the cost base is reset, the
loss of value will not be accounted for and the access provider will make a windfall loss.

13. Ergas identifies a more extensive list of nine key modelling issues (Ergas 1998), although he does not discuss how the models should be updated, which is the focus of his later work that is discussed below.

14. It is not clear how the Tribunal would reconcile this opinion with its view in East Australian Pipe Line (Tribunal 2004b) in which it did not object to the potential new entrant approach to estimating optimised replacement costs:
   “51. If, as defined and described by the ACCC, DORC is the price at which a potential new entrant making ‘a buy or build’ decision would value an existing asset, it is difficult to see why the ORC used to calculate the DORC of an existing pipeline (such as the MSP) should not include a contingency factor to cover omissions. Clearly, a prudent potential new entrant would allow for contingencies and include them in its calculation of its ORC to arrive at its ‘buy or build' DORC value.”

15. See, for example, the discussion of asset lives in ACCC (2009) or of the cost of capital in the Tribunal (2007).

16. The Tribunal does not further elaborate on how the use of DORC, which would still require estimates of optimised replacement costs to be made, would help matters.

17. With that in mind, the dissenting judgement of Justice Breyer looks prescient (Verizon et. al. v FCC 2002,16):
   “The hypothetical nature of the Commission’s [US Federal Communications Commission’s] system means that experts must estimate how imaginary firms would rebuild their systems from scratch—whether, for example, they (hypothetically) would receive permission to dig up streets, to maintain unsightly telephone poles, or to share their pole costs with other users, say, cable operators—and they must then estimate what would turn out to be most “efficient” in such (hypothetical) future circumstances. The speculative nature of this enterprise, the critics say, will lead to a battle of experts, each asking a commission to favour what can amount to little more than a guess.”

18. This might not hold if the upgrades substantially reduced costs. However, the fibre upgrades did not substantially decrease cost but increased the service potential of the remaining parts of the copper network.

19. It is not always the case that building block models use a fixed regulatory asset base. (ACCC 1999).
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Paul Budde is the managing director of Paul Budde Communication (trading as BuddeComm), a global independent telecommunications research and consultancy company, which includes 45 national and international researchers in 15 countries.

He specialises in the strategic planning of interactive services such as video media, Internet, multimedia and intelligent and value-added networks based on telecommunications, broadband and satellite networks. His particular expertise is on how these new media can be used by organisations to enhance their competitive edge in the market and how to apply and use these new media in mass markets. His Strategic Workshop is a popular consultancy service, conducted throughout the Asia Pacific region.

Since 1978 he has been involved in writing strategic plans and market reports for many of the world's leading companies involved in the new media. He advised organisations and government authorities on the initiation, setting up and implementation of e-commerce and information services. He was involved in Europe's first broadband cable TV services in 1982 and established many public and private online services (now called Internet and Intranet).

In 1983 he came to Australia and since then has provided management consultancy services in the Asia Pacific region. During that period he also established 70 telecommunications business publications and initiated the largest telecommunications research site on the Internet (http://www.budde.com.au/).

In 1996, he initiated the Electronic and Online Services Forum. In 2001, he organised a National Broadband Summit, UtiliTel (telecoms opportunities for utilities) and the Local Council Summit on broadband, putting cities and communities in charge of their own Broadband Agenda. In 2003 this was followed up with ‘mini summits’ in Perth, Armidale, Bendigo, Brisbane and Adelaide, and a range of others are underway. The aim of these undertakings was to create an environment of improved understanding between major players in the industry. Since 2002 Paul has also been organising monthly Roundtables, each one addressing different business issues. So far all event have been sold-out, indicating the interest they receive from the industry.
He is the honorary consultant on telecommunications and broadcasting for the Australian Macquarie Dictionary and is the author of regular telecommunications columns.

At Now 2000 he received the Australian industry award for services to the industry. He was also voted ‘Industry Advocate of the year 2000’ by the readers of Communications Day.

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Peter Darling is the Principal of Pondarosa Communications Pty Ltd, an Australian industry consulting company. Prior to the establishment of Pondarosa, Peter had a long career with Telecom/Telstra as a network planner, finishing as Telstra's General Manager, Industry Regulation. He was an active participant in the national planning of new radiocommunication developments such as GSM, CDMA and 3G mobile, and in the planning of Australia's new numbering plan. He has been active in international standardisation for over twenty years.

Peter has long been interested in new directions in telecommunications. He led the pioneering work in the industry body, ACIF, on NGN, has been active in the international standards bodies IETF, the ITU-T and ETSI, and has served as the Rapporteur for NGN in the Asian standards body, ASTAP. He has undertaken consultancy for the Federal Government and the Victorian Government on related technical and policy issues.

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Ros also has a history of engagement with industry training. She represents the Communications Division on the ICT Sectoral Advisory Committee of the industry’s Skill Council (IBSA) and on the board of training advisor Communications and Information Technology Training (CITT).

In 2009 she was appointed to the Federal Government’s Information Technology Innovation Council.
Ros holds degrees in Arts and Commerce from the Universities of Sydney and Melbourne.

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Peter Gerrand is a company director, academic and independent consultant in ICT strategy and business innovation. He was awarded the Charles Todd Medal by ATUG in 1998 'for outstanding contributions to the telecommunications industry', a Centenary Medal in 2003 'for outstanding service to science and technology particularly to public science policy', and Life Membership by the TSA in 2003.

Amongst career highlights he has been a general manager in Telecom/Telstra, successively leading network research, product development, planning and network strategy (until 1993); and subsequently a professor of telecommunications at two universities (RMIT and Melbourne) and the founding CEO (1996 to 2000) of a publicly listed company (Melbourne IT). From 1993 to 2003 he was Chairman of the Telecommunication Society of Australia Ltd, and since 1994 has chaired the Editorial Board of this Journal (TJA). He holds a PhD from La Trobe University (2008) for his research on Internet linguistics.

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Simon Hackett is managing Director of Internode, Australia's largest privately-owned broadband company. Since 1991, Simon has built Internode into a nationally recognised Internet company that is renowned for its customer-friendly service.

After graduating from computer studies at the University of Adelaide in 1986, Simon was involved in the establishment of AARNet – the Australian Academic and Research Network – a national Internet Protocol-based network that connected universities throughout the country. Simon was also a co-founder of the Internet Society of Australia and founding president of the South Australian Internet Association.

In 1991, Simon founded Internode, a company that since its inception has established itself as a trailblazer in Australia's innovative Internet access sector. As one of the earliest entrants in the Broadband ADSL services market, Internode has recorded strong year-on-year growth since 2000, creating a first-tier, high-capacity international broadband network while preserving the quality service that earns it strong customer retention rates.

Seven years after founding Internode, Simon launched Agile Communications, a privately owned licensed carrier that has pioneered Internet Protocol-based communications in many regional areas of Australia.

In August 2008, Simon received the Australian communication industry's top honour for individual achievement, the 2008 Telecommunications Ambassador award. Presented at the Communications Alliance ACOMMS Awards in Sydney, the award acknowledged Simon Hackett as an outstanding individual who has shown strong leadership and made a significant and visible contribution to the Australian communications industry.

The ACOMMS08 accolade followed Simon's receipt of the 2004 The Bulletin-Microsoft Smart 100 Information Technology & Communications Award, which recognised his role as "a thinker and a doer; a businessman who proudly wears his tech-savvies on his sleeve"

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Wayne Hawkins is a disability advocate who works for the Australian Communications Consumer Action Network (ACCAN). Wayne is legally blind after losing his eyesight in 2005 as an adult due to retinitis pigmentosa. He is dedicated to issues concerning people with disability, especially in relation to accessibility for television, cinema, the internet and other media. Wayne recently returned to Australia after living in New York for 26 years and worked with Blind Citizens Australia before joining ACCAN in 2010. Wayne has a Bachelor of Business Administration from the City University of New York, a Master of Public Policy from the University of Sydney and is starting a Doctor of Arts degree at the University of Sydney in the area of Australian Telecommunications Policy and Disability. Wayne has a dog-guide named Harrison.

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Allan Horsley is a Professional Engineer, a Fellow of the Institution of Engineers and has some 45 years of experience in the Australian telecommunications industry.

He has been responsible for designing, building and operating substantial communications networks, with the State Electricity Commission of Victoria in the 70’s and 80’s, and as Managing Director with Vistel Ltd, the Victorian Governments’ telecommunications provider in the 80’s and 90’s. He led the Australian Telecommunications User Group in the 90’s and was a Member and acting Deputy Chair of the Australian Communications Authority, (ACA) during the period 2001 to 2005.
In recent years he has acted as an advisor to both the Australian Communications and Media Authority, (ACMA) and the Department of Communications, Information Technology and the Arts, (DCITA) on telephony services and facilities for Indigenous communities.

He has provided Telecommunications Regulatory training programs to Governments and Regulators in APEC Economies and to the South Pacific Forum telecommunications Regulators.

DAVE LEE  
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Dave Lee graduated from Curtin University in 2005 with a Bachelor’s Degree in Commerce, majoring in Economics and Finance. This included time studying at the University of Oregon on an international scholarship. To pursue his interest in policy, he undertook a Post-Graduate Diploma in Energy and Environment at Murdoch University.

Whilst completing his final semester in 2007 he accepted a position with the Department of Agriculture, Fisheries and Forestry in Canberra. At the Department he gained agricultural policy experience whilst earning a Diploma of Government. In recognition of his outstanding performance, he received an Australia Day award from Government for his work on the 2008 Drought Review.

In early 2010 Dave commenced as a policy advisor at the NSW Farmers’ Association and is currently responsible for the areas of drought policy, transport and telecommunications.

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Dr Andrew Pesce was elected Federal President of the Australian Medical Association (AMA) in May 2009. The AMA represents the interests of more than 27,000 medical practitioners from all specialties and locations across Australia. He is an Obstetrician and Gynaecologist who works both in private and public practice. He has been Clinical Director of Women’s Health for Sydney West Area Health Service since 2006.

Dr Pesce’s priorities as AMA President include engaging with government to influence national health policy debate for the benefit of patients, the medical profession and the broader community. He is also committed to increasing the AMA’s membership base.

In 2006, he was awarded the AMA President’s Award for his work representing the profession during the medical indemnity crisis. Dr Pesce was chair of the AMA Medical Indemnity Taskforce from 2003 to 2007 and was appointed to the Federal Government’s Medical Indemnity Advisory Panel in 2003 and to the Medical Indemnity Review Panel in 2006.

Dr Pesce was the Obstetricians and Gynaecologists Craft Group representative on AMA Federal Council from 2001 to 2007 and an AMA Executive Councillor from 2005 to 2007. He was Chair of the Ministerial Expert Advisory Committee on Pregnancy Counselling from 2007-2009 and Chair of the National Association of Specialist Obstetricians and Gynaecologists from 2006 to July 2009.

Dr Pesce graduated from The University of NSW in 1983 and became a Fellow of the Australian and New Zealand College of Obstetricians and Gynaecologists in 1990. He was awarded the Chris Hudson Fellowship for 1991-92, which enabled him to train at Whips Cross and St Bartholomew Hospitals in London.

Dr Pesce is married with two teenage daughters.
MIKE ROCKE  
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Mike Rocke is a Senior Associate with Gibson Quai – AAS. He holds a Bachelor of Engineering (Electrical) and an MBA.

Mike has more than 35 years experience in the industry, as both an engineer and senior business manager with Telstra and subsequently as a consultant with Gibson Quai - AAS.

His interest in end-to-end performance standards stems from both his engineering experience in transmission planning and consulting, and as Telstra’s commercial policy manager for the standard telephone service. In this latter role he was responsible for inclusion in Telstra’s Standard Terms and Conditions of the telephone service quality delivered to customers.

MANDY SALOMON  
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Mandy Salomon researches the disruptive properties and opportunities of the immersive Internet. As a member of the Smart Services Cooperative Research Centre, based at Swinburne University of Technology, Mandy is at the nexus of industry and academia, working across a range of service industry domains including health, education and enterprise. Mandy’s personal blog on virtual environments, DigitalDownunder, can be found at [http://www.digitaldownunder.org/](http://www.digitaldownunder.org/)

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Rosemary Sinclair recently resigned from the position of Managing Director of ATUG, an appointment she had held since 1998, to take up a position at the Australian School of Business at the University of New South Wales. Previously she had extensive senior management and strategic planning experience in telecommunications at Telecom Australia, in broadcasting at the Australian Broadcasting Corporation (ABC), and in publishing at Scholastic Australia. She is also a former board member of ATUG and of the Telecommunication Society of Australia.

From 1976 to 1990 Sinclair worked with Telecom Australia in New South Wales. In 1984, she became the first woman in Telecom to occupy the position of District Manager. She then became General Manager, Commercial Operations for NSW, and finally National General Manager, Communications Accounts, in the Corporate Customer Division.

After a brief period as General Manager of the small recruitment company, McKenzie Consulting Service, Sinclair joined the ABC as General Manager of the ABC Radio Division that encompassed Technology, Finance, Human and Industrial Relations, Technical Support, Property and Business Development. She then became Director of Strategic Development with responsibility for the strategic planning and development unit.

While at the ABC, she was a member and chair of the Minister’s Broadcasting Industry Advisory Council Working Group, and an executive member of the International Institute of Communications, Australian Chapter.

From the ABC, Sinclair moved to Scholastic Australia, a unit of Scholastic Inc. the world’s largest publisher and distributor of children’s books, magazines, educational and multimedia materials, as Scholastic Australia’s Director, Education, New Media and Export, before joining ATUG in 1998.
John Stanton is a seasoned communications industry executive with over 18 years of experience.

From 2006-2009 John was Chief Executive Officer of ASX- and NZX-listed telecommunications carrier, People Telecom. Under his leadership, People Telecom became profitable and was recognised as Australia’s Best Regional Service Provider in the Australian Telecom Awards 2007. In early 2009 the Company was sold to M2 Telecommunications.

Prior to that Mr Stanton was an executive with Intelsat, the largest provider of fixed satellite services worldwide. Based in the UK from 2001-2005, he was President and Director of Intelsat Global Sales & Marketing and of the Data, Carrier and Internet Business Unit. Mr Stanton also spent two years in the US with Intelsat as Vice President of Sales and Marketing from 1999-2001.

Mr Stanton joined Telstra in 1992 as a result of the merger with OTC where he was Manager of Public Affairs. From 1992-1999 Mr Stanton held a number of roles with Telstra including Managing Director of Payphones and Card Services. From 1996-1997 he was also Chairman of the Intelsat Board.

In his early career, Mr Stanton worked as a journalist and as a press secretary with the Australian Government.

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