Australia's Broadband Evolution to 2007

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Abstract: The *Journal* revisits an historic paper, written by Peter Darling in 2007, which details Australia's evolving broadband policy as background to the decisions likely to be made by the incoming new Australian Government in that year. Broadband policy was a critical differentiator between the outgoing Coalition government and the incoming Labor government in the 2007 federal election. The paper is written for a broad readership within the Australian telecommunications industry.

Keywords: History of Australian Telecommunications, Broadband Evolution and Policy, *Telecommunication Journal of Australia*.

Introduction

Peter Darling (1946–2013) was a nationally recognized expert on new public telecommunication networks (Gerrand, 2013). It is notable that he was as highly regarded during the 1990s and 2000s by consumer groups (e.g., ACCAN) and business groups (e.g., ATUG) as he was by his employers in Telstra's network strategy and regulatory groups, for both his integrity and his technical expertise. He was also highly respected across the industry for the number of excellent tutorial papers he wrote for this journal's predecessor, the *Telecommunication Journal of Australia*, and this journal on a wide range of new network technologies and developments.

The revisiting of this historic paper (Darling, 2007) is timely, given the contested implementation of broadband policy in Australia since that time. The design of the National Broadband Network became the defining issue in resolving the 2010 federal election (Gerrand, 2010) and an ongoing source of policy differentiation between Australia's major parties in federal government until at least 2022.

Darling's paper describes the political consensus in the 1990s on the need to provide infrastructure competition to the former incumbent carrier, Telecom Australia (evolving into

Telstra by 1991), while diverging on the need for privatization of Telstra. The paper reflects on the policy debate during the election campaign period – when the paper was written.

The paper provides an overview of the network technologies that were candidates for delivering broadband services in 2007 — most of which are still used in the Australian public network. This overview is followed by a comparison of the two major competing industry proposals to the federal government. The first was the Telstra 2005 proposal, using optical fibre to the premises (FTTP) in greenfield areas, and ADSL2+ over existing copper access networks — and the reasons given by the government for rejecting this. The second was the G9 proposal (by the 'group of nine' competitors to Telstra) for deploying Fibre to the Node (FTTN) over existing copper access networks.

The paper draws attention to the trade-offs which the Howard government agreed to, in terms of the $1.1 billion in rural subsidies (the 'Connect Australia' project) needed to gain National Party support for the final tranche ('T3') of the sale of Telstra in 2005, which delivered a huge windfall to the federal Treasury. To meet further needs for rural areas, this was followed by an additional $600 million for a 'Broadband Connect Infrastructure Program'.

Darling points out that, in the two federal elections before 2007, the ALP's policy on broadband had been largely focussed on opposing the privatisation of Telstra, with only statements of general intent on the need for faster broadband. This changed dramatically on 21 March 2007 when the ALP's new federal leader, Kevin Rudd, announced his new national broadband network policy.

Darling concludes his paper with a detailed comparison of the Coalition and Labor policies on broadband leading into that year's federal election campaign.

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The Historic Paper

◯ TOWARDS A BROADBAND POLICY

Peter Darling, Pondarosa Communications Pty Ltd

Under the Australian Constitution, matters relating to communications are a national responsibility. However, until recently, there had been a broad consensus across the political parties about most communications policies, with the major exception of the privatisation of the former incumbent, Telstra.

This consensus no longer holds. One of the issues raised by all sides in the recent election period was 'broadband', and there is no doubt that, now the election results are clear, Australia may actually be on the way to developing a broadband policy.

This article reviews the background to the recent policy debate, and provides some comment on the issues that have been raised in the Election Campaign.

INTRODUCTION

For many years, commentators have compared (unfavourably) Australia's laissez-faire approach to 'broadband' to that in many other countries.

Australians voted in a national election on Saturday 24th November, 2007 for all the positions in the House of Representatives (the 'lower' House) and half the Senate (the 'upper' House). The outcome of this election has resulted in a change of Government – the Australian Labor Party will form the Government for the next three years.

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This consensus no longer holds. One of the issues being raised by all sides in the election period was 'broadband', and there is no doubt that now the election results are clear, Australia may actually be on the way to developing a broadband policy.

This article reviews the background to the recent policy debate, and provides some comment on the issues that were raised in the recent Election Campaign.

AUSTRALIAN TELECOMMUNICATIONS NETWORKS

In common with many countries, Australia had government-owned monopoly networks until the early 1990s – *Telecom Australia* for domestic traffic, and *OTC (A)* for international traffic. In 1991, the Government of the day combined these two carriers into a single company, *Telstra*, and introduced limited network competition. The Government sold its domestic satellite operations to form a new carrier, *Optus*, able to offer both fixed and mobile domestic service as well as international carriage. A third mobile licence (and associated GSM spectrum) was sold to *Vodafone*.

These 1991 changes were the first step to full network competition, to apply from 1 July 1997. The *Australian Labor Party* (ALP) formed the government at the time of the 1991 changes, and through much of the preparation for the 1997 changes. Despite a change of government to the *Liberal* & *National Party Coalition* (LNP) in 1996, the same broad policy continued, and full network competition was introduced as planned in 1997.

Over two hundred carrier licences have been issued,[1] with many small carriers (including ISPs) as well as the major carriers established in 1991. Telstra is still the largest (and most profitable) service provider.

THE PUBLIC SWITCHED TELEPHONE NETWORK (PSTN)

The telephone network provides service to almost all locations in Australia, and forms part of the global network. The PSTN is formed from interconnected, co-operating networks from a number of service providers. The network is optimised to carry a 4 kHz voice signal, but has also been used for other services working within this channel.

As was described in a previous TJA article (Darling 2005), the PSTN can be divided into

- The Core Network, made up of shared switched and transmission facilities, and
- The Customer Access Network or CAN that provides the connection from each user (customer or subscriber) to and from the core network.
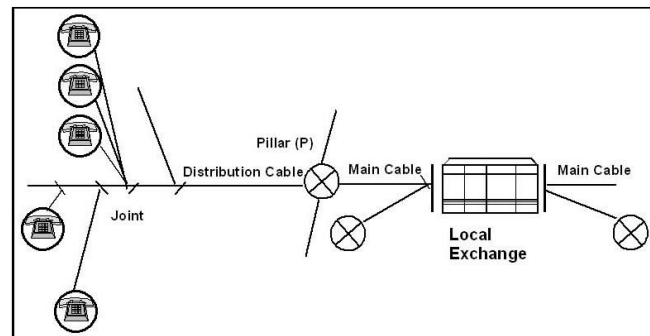

Figure 1 The customer access network

There has been continuous technical development of the core network, but very little change in the Customer Access Network for 'fixed' users. For almost all these users, the connection to the network is by a pair of copper wires, twisted to minimise interference to other wires, and incorporated into large cables that terminate at the local exchange, using a structure similar to that shown in Figure 1.

More recently, radio-based cellular techniques have been developed to support mobile telephony, providing telephony and other services to 'mobile' users, and there are now more mobile users than fixed users.

THE (PUBLIC) INTERNET

The network now known as 'the Internet' is formed from a set of interconnected networks based on the 'Internet Protocols' (IP) developed to interconnect different data networks. The Internet is defined by (transport) protocols rather than by its architecture or by the main service carried. Unlike the PSTN, where additional facilities and services are provided by network equipment (an 'intelligent network') the Internet only provides for the carriage of information (a 'dumb' network). Services are supported by applications running on the equipment at the network edge.

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The Internet Protocols were designed to support data carriage over a wide range of transmission media, with a wide range of transmission speeds.

CABLE TV NETWORKS

There has only been limited development of cable TV networks in Australia. In contrast to most other countries, the existing networks, using HFC (hybrid fibre-coaxial) technology are owned by the major PSTN operators. Optus started installing HFC networks in the major cities of Sydney and Melbourne in the mid-1990s, and this was matched by Telstra. The Optus network was used to support telephony as well as pay TV.

Changes in strategy by Optus stopped the extension of their HFC network, resulting in only a limited geographic coverage by their network and the matching Telstra networks. The major method of delivery of entertainment TV services is now by satellite rather than terrestrial cable.

OTHER NETWORKS

There have been other specialist networks, primarily intended for business users, with limited geographic carriage. These have included the telex network, an X.25 data network, a frame relay network as well as specialist point-to-point transmission networks.

AUSTRALIAN TELECOMMUNICATIONS POLICIES

Current communication polices in Australia have been developed to support the wide-spread availability of the telephone service, and allow for the introduction of competition in the provision of customer equipment, services and network facilities when in '*the long term interests of end users of carriage services or of services provided by means of carriage services*' (Trade Practices Act 1974).

UNIVERSAL SERVICE

Prior to 1990, the government-owned Telecom Australia was set the goal of extending telephone service across all geographic areas in Australia. When network competition was introduced, this was set as a direct policy to ensure that competition did not result in services only being provided in profitable areas. The current telecommunication legislation has the major Object '*... to ensure that standard telephone services, payphones and other carriage services of social importance are reasonably accessible to all people in Australia on an equitable basis, wherever they reside or carry on business...*' (Telecommunications Act 1997).

The mechanism for funding the provision of this universal service, the Universal Service Obligation (USO), has been a subject of continuing dispute since the introduction of network competition (and indeed is again being reviewed in late 2007). The services covered by the USO have been limited to telephony and equivalent services, for example TTY access for people not able to use the telephony service. Despite a number of proposals, there has been no agreement to extend the USO to cover other services[2] (such as broadband Internet), and it seems to this observer this would require a complete new basis for funding instead of the current PSTN-based system.

NETWORK COMPETITION

Before the introduction of network competition in 1991, the incumbent carrier (Telstra) provided all services, and policies had to be developed to allow new entrants to interconnect with Telstra's services and facilities.

Whilst it was possible for a new carrier to provide competitive facilities in some areas, the new entrant generally had to use infrastructure and services already in place. This was achieved by a policy that allowed for services to be 'declared', either by industry agreement or by the competition regulator, the ACCC (Australian Competition and Consumer Commission). For these declared services, if commercial agreement could not be reached between the Access Provider (generally Telstra) and the Access Seeker, the ACCC was able to set access conditions, including a wholesale price.

The telephony Customer Access Network appears to have many of the characteristics of a natural monopoly. The high cost of infrastructure provision combined with the relatively low return from the capital invested means that there has been limited competitive provision of access infrastructure for the fixed telephone network, except in a small number of geographic areas with high business demand. This seems to be a situation where one firm can produce a given level of output at a lower total cost than can any combination of multiple firms – a natural monopoly. As a consequence, the fixed telephony access network has been regulated in Australia (as in many other countries) to ensure competitive suppliers of telephone service can use the CAN without having to pay the CAN provider excessive amounts.

TELSTRA PRIVATISATION

One of the major areas of difference between the two main political parties in Australia has been the ownership of the major carrier, Telstra. The ALP government established Telstra as a Corporation in 1991, but retained full Government ownership. The opposing political parties, which gained government in 1996, supported moving to full privatisation of the company.

Telstra was privatised in three stages. At each stage, there was political opposition to the sale of Telstra, and policy decisions were made to help overcome this opposition and assist passage of the enabling legislation through the Senate, in which the Government of the day often did not have a majority.

- The Bill for the sale of the first tranche of Telstra, T1, passed the Senate in December 1996, with a public share offering of one third of Telstra taking place from September 1997. Independent Senators from Tasmania and Queensland supported the sale, in return for specific benefits flowing to their States;
- After the success of the first float, the Liberal Party announced in March 1998 plans to sell the remaining parts of Telstra;
- A Bill to privatise the remaining portion of Telstra was defeated in the Senate in July 1998, with concern about the future availability of Telstra services, particularly in rural areas;
- In July 1998, the Government announced a staged approach:

  - Legislation for new customer service safeguards (to apply irrespective of any further changes in Telstra's ownership);

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- Further sale in stages, with the next stage (T2) leaving 51 per cent, and majority control, in Government hands; and
- An independent inquiry to assess Telstra's service levels to customers in each of metropolitan, rural and remote areas against prescribed standards before any further sale.

- After the LNP coalition won the October 1998 election, a Bill allowing for the next stage of the sale, and the creation of the Independent Inquiry was submitted and passed by the Senate in June 1999.
- The T2 share offering took place from September 1999
- The Independent Inquiry was established in March 2000, reporting to the Minister in September 2000. The Regional Telecommunications Inquiry (2002) found that users in metropolitan and regional centres enjoy good telecommunication services and are generally satisfied with them. They also found that a significant proportion of those who live and work in rural and remote Australia have concerns regarding key aspects of services.[3] These included lack of reliable access to the Internet and data speeds generally.
- The LNP was elected for a third term in November 2001, but it did not appear that there would be majority support in the Senate for further Telstra privatisation. At the start of the first Parliamentary session, the Government indicated that it would not proceed with any further sale of Telstra until it is satisfied that arrangements are in place to deliver adequate services to all Australians.
- An Inquiry into regional telecommunications services was established in August 2002, reporting in November 2002. While the Inquiry report was generally positive about rural services, it noted general availability of dial-up Internet access, but concerns about access speeds (Regional Telecommunications Inquiry 2002).
- The LNP Government was returned in the election of October 2004, and for the first time had a majority in both Houses of Parliament. A revised Telstra (Transition to Full Private Ownership) was introduced into Parliament in September 2005.
- There was concern in the junior member of the coalition, the National Party, about the impact of the full sale of Telstra on users in rural areas. The Government agreed to use the proceeds of the Telstra sale to establish a $2 billion Communications Fund, which would be accompanied by a $1.1 billion Connect Australia package to extend access to, and improve the affordability of broadband.
- With these assurances, the legislation was passed by the Senate. The final tranche of the sale of Telstra (T3) proceeded, and the shares were listed on the Australian Stock Exchange from November 2006. (Some Telstra shares remained in Government ownership, via the Future Fund established by the Government to support public sector superannuation.)

Telstra was (finally) fully privatised as a single company, and the ability of the government to use its role as majority shareholder to encourage the company's decisions removed. A large amount of current policy has come from the political decisions necessary to enable the sale. Other options, such as the structural separation of the company, did not seem to find any favour during these political processes.

SUPPORT FOR USERS IN RURAL AND REMOTE AREAS

As can be seen from the long tale of Telstra privatisation, the need to provide 'adequate' services to users in rural and remote areas has been a continuing concern.

With a government-owned monopoly, government direction may be sufficient. In a competitive market place, there is no certainty of service provision across all areas. As described above, the introduction of network competition required other policy mechanisms – for example, the Universal Service Levy.

During the process of Telstra privatisation, three further policy approaches were adopted:

- The requirement for special action by Telstra, often as a condition of Telstra's Licence or by specific legislation. Examples include the requirement for untimed local calls, and the availability of a digital data service.
- The expenditure of Government money (often from the proceeds of Telstra privatisation) to meet a particular need, for example the extension of mobile coverage in particular areas to the subsidy of services provided by an ISP in a remote or rural area. These approaches are often linked together in some form of programme – for example, *Networking the Nation* or *HiBis*. However, to many observers, they lack cohesion and seem subject to the political advantage of the allocating party.
- The adoption of broader policy frameworks to support specific goals. In the view of this observer, this approach has yet to be fully realised. The recently established **Communications Fund** is intended to '… *provide an income stream to fund the Government's response to reviews of the adequacy of telecommunications services in regional, rural and remote parts of Australia prepared by the Regional Telecommunications Independent Review Committee*' (Commonwealth Numbered Regulations 2005). This should provide the possibility of a more wholistic approach, to meet the stated goal of future-proofing rural communications, but would not prevent election-driven fund allocation. Similarly, the **Connect Australia** programme should provide the possibility of longer-term, goal driven allocation of funds.

THE MOVE TO BROADBAND

WHAT IS (OR ISN'T) BROADBAND?

What is the 'broadband' that is now being quoted in political speeches and discussions?

The term is very general, with no accepted definition. In general, when people are talking about 'broadband', they seem to mean 'broadband internet access'. As I will argue later, this is a rather limited definition.

To the OECD, in their oft quoted broadband rankings, the OECD Broadband Statistics, broadband download speeds are 256 kbit/s or higher (OECD 2007).

For the FCC, download speeds of 200 kbit/s or more are broadband.

For the ITU, broadband describes data at rates greater than the ISDN Primary Rate (1.54 Mbit/s or 2.048 Mbit/s).

It often seems that, to a **marketer**, broadband is any speed faster than dial-up!

To this **writer**, who lives in a rural area without ADSL, the more general definition could be 'an access speed at least twice the speed currently available'!

Figure 2 Dialup is not broadband

BROADBAND TECHNOLOGIES

An article in the recent special Broadband Edition of this journal summarised the technologies that are in use or planned to provide broadband (Darling 2006a).
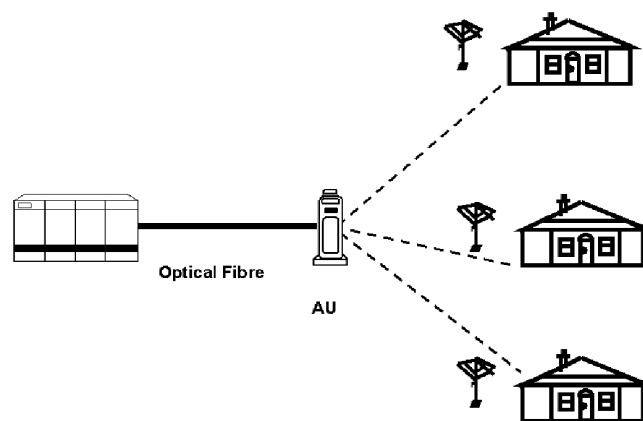

Figure 3 Broadband CAN

Optical Fibre is the preferred technology in the Core Network, supporting data speeds up to and including Tbit/s rates. Traffic from a number of users can be combined over the Core Network, but at as shown in Figure 3, at some point close to the user there has to be a unique connection established for each user.

This 'Access Unit' could be, for example:

- The subscriber stage of a telephone exchange;
- A remote node (RIM or CMUX) in the telephone network;
- A mobile base station;
- A wireless data access point, or
- An Internet router/server/access point.

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As described in the previous article, possible technologies to provide a broadband access link include:

- Coaxial cable: for example, over a cable TV network;
- Copper: using the current telephony copper access network, using DSL (Digital Subscriber Line) technology;
- Terrestrial Radio: including the next generation broadband systems;
- Satellite and Tethered Stations: radio access from geostationary satellites, position keeping platforms or by constellation of satellites in other orbits;
- Distribution by Powerline: over the mains power line, with high frequency signals superimposed over the 50 Hz (or 60 Hz) power distribution; and
- Optical Fibre: using techniques such as Passive Optical Networks to reduce infrastructure cost.

With some technologies, the connection to a user may be over a single transmission medium dedicated to that user, for example over a copper pair in the telephone network, or a dedicated optical fibre. With other technologies, a shared transmission medium may be used, for example a radio-link from a base station or a power-line distribution system.

As a general rule, the closer the Access Unit (and optical fibre termination point) to the user, the higher the speed that is possible. When a shared transmission medium is used (for example a radio-based system) the available speed will depend on the number of users at any time, and the nature of their use. For example, users with constant speed applications such as video streaming are restricted to a simple division of the total bandwidth available, but users with varying 'bursty' traffic typical of Web browsing will have much higher peak speeds.

SERVICE REQUIREMENTS

There is no ideal broadband speed – the required speed is determined by the required applications:

- For **email**, and **very simple web browsing**, **dial-up access** is sufficient
- For **voice** and (low resolution) **video telephony**, for low resolution video conferencing, and more complex web browsing, **medium speed broadband access** (up to 750 kbit/s) is needed. (eg ADSL)
- For **image rich web applications**, **medium to high speed broadband access** is needed (e.g. fast ADSL or ADSL2+)
- For a **single broadcast-quality TV channel**, **medium to high speed broadband access** is needed (e.g. fast ADSL or ADSL2+)
- For a **single broadcast-quality high definition channel**, **high speed broadband access** is needed (e.g. ADSL2+).
- For **multiple TV channels**, and **personal video recorder** functions, **very high speed broadband access** is needed (e.g. ADSL2+ or Optical Fibre).

The consultant *broadbandtends.com*, looking at the developing US broadband market, suggests:

- For a 'basic triple play' of 2 SDTV, Internet, telephony, a speed of 6 Mbit/s or greater was necessary; but
- To move to HDTV, video on demand and personal video recording, the user would need 20 Mbit/s initially, 100 Mbit/s later.

These higher speeds are suggested for a service provider combining the functions of entertainment provision (Pay TV), Internet service provision and telephony service provider, with multiple applications in use in a household.

To this observer, the key questions must be what do users/customers want, and how much are they willing to pay? Will there be other applications (not yet defined) that will be valued by users and justify the cost of very high speed broadband access? Would other technologies (e.g. satellite distribution) be more cost-effective?

BROADBAND IMPLEMENTATION IN AUSTRALIA

Services at broadband speeds (for example 2 Mbit/s) have been available to business users for some time, but residential broadband has only been widely available in this decade.

Prior to this, residential access to the Internet was via a dial-up connection over the PSTN to an Internet Service Provider (ISP). When the core of the PSTN was updated with digital technology, and as modem technology improved, speeds up to 56 kbit/s became possible, but this was the limit of the technology (and could rarely be achieved in practice).

The first residential broadband Internet access was provided over the Optus and Telstra HFC networks installed for Pay TV, at first using proprietary technology with cable modems provided by the carriers, and later using the internationally standardised DOCSIS (Data Over Cable Service Interface Specifications).

While the HFC networks are still used for broadband access, the major broadband technology in current use is DSL (Digital Subscriber Line), in particular asymmetric DSL (ADSL) with a faster download speed (from the network) than the upload speed. This technology makes use of existing copper pairs, provided for telephony service, with frequencies above telephony providing broadband access.

The first set of ADSL standards provided for download speeds of up to about 5 Mbit/s for users close to the exchange – the speed available drops rapidly with distance from the exchange, or less than perfect cable condition. Later standards increased this speed – the ADSL2+ standard allows download speeds over 10 Mbit/s at distances of up to 2 km from the exchange, while the VDSL+ standards allows speeds of over 100 Mbit/s over short distances.

The competition regulator, the ACCC, declared the 'Unbundled Local Loop' or ULL service in October 2000. This allowed another service provider to install their own DSL and telephony equipment at a Telstra exchange, and use an existing Telstra copper pair to provide service to their customer. The ACCC further declared the 'Line Sharing Service' in December 2004, allowing another service provider access to the higher frequencies on an existing copper pair while Telstra continued to provide telephony service over the line.

Initially, the DSLAM equipment required in exchanges was large and complex and was mainly provided by Telstra. Other service providers bought the Telstra service at a wholesale price. As DSL technology evolved, DSLAMs became smaller and much less expensive. This has resulted

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in a number of service providers installing their own DSLAMs in Telstra exchanges, and rapid growth in services in use.

According to the figures from an Australian Bureau of Statistics Survey in June 2006, at that stage over half the Internet services were provided by broadband access, and this proportion would have increased with the continuing rapid growth in Broadband Internet since that survey (ABS 2006). The survey also indicated that broadband Internet connections were much more common in metropolitan areas (34% of all households) than in non-metropolitan areas (19% of all households).

BROADBAND 'LEAGUE TABLES'

While there was rapid growth in the number of broadband access services in use of Australia, many commentators noted that we were well below the penetration rates of comparable countries, especially those such as South Korea which had a central policy promoting the availability of broadband access and the services that could be used over broadband.

Information such as that summarised in Figure 4 from the OECD Broadband Statistics entered into the public debate on communications policy – why were we so low in the rankings, and did it matter.

(To be fair, the latest OECD figures show that, at December 2006, Australia was now ranked as no. 16, having passed Austria and Germany, and just behind the USA [OECD 2007]. However, our average speed lagged behind many other countries, including these. If and when the OECD raises its minimum standard from 256 kbit/s, we may drop to almost the bottom of the rankings.)
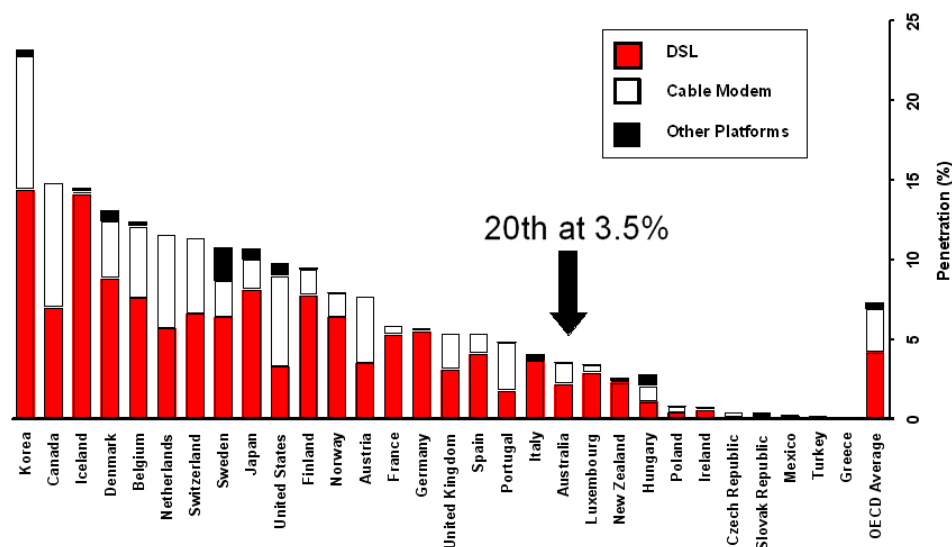

Figure 4 OECD rankings
Source: OECD

INDUSTRY PROPOSALS FOR BETTER BROADBAND ACCESS

Over the last two years there have been two competing proposals from the industry to provide widespread 'next generation' broadband access.

TELSTRA'S BROADBAND PROPOSALS – NOVEMBER 2005

Telstra conducted a series of public Strategy Meetings in November 2005 outlining proposals for major changes to their networks, as summarised in a previous TJA article (Darling 2006b).
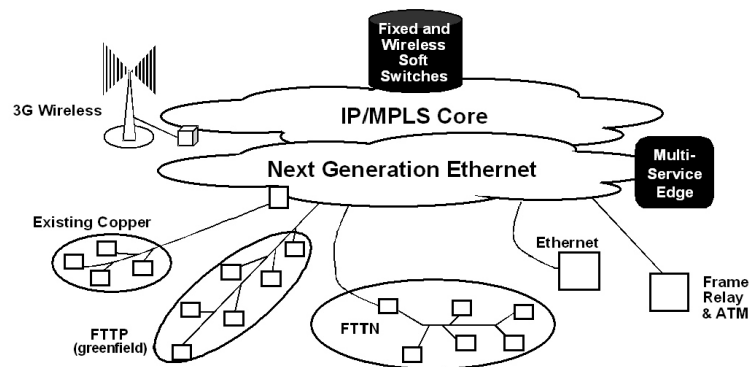

Figure 5 Telstra's Proposed Network

Telstra announced plans to replace their core network with Internet Protocol based technology, and to provide medium to high speed broadband access for users in major cities and towns.

For 'Greenfield' areas they indicated they planned to use optical fibre to the user's premises (FTTP). For areas with existing copper, they would use ADSL2+ over copper.
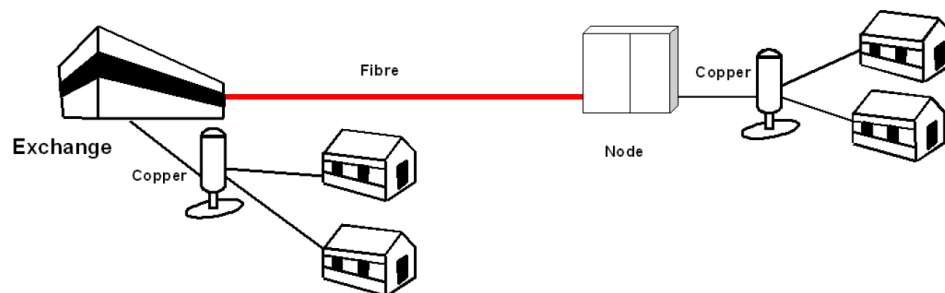

Figure 6 Fibre to the Node

For one third of users, this would come from equipment at the current exchange site. For the remaining two thirds, the ADSL equipment would be installed in road-side cabinets or 'nodes' which would be served by fibre from the core (hence fibre to the node or FTTN). This approach was claimed to be able to provide download access at 12 Mbit/s or greater.

Telstra's strategy presentation suggested that their proposed access strategy was 'subject to acceptable regulatory conditions'. In answer to analysts' questions, Telstra gave a general indic-

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ation that they planned to restrict competitor's access to ensure that Telstra gained maximum value from their investment.

Under the current policies and regulatory arrangements this seemed very unlikely. The proposed Telstra broadband access network would almost certainly become a 'Declared Service', and Telstra would be required to provide access at rates set by the ACCC, which would certainly result in a lower return on investment than Telstra required.

Telstra lobbied the Government to provide a 'safe harbour' for their investment, allowing regulatory relief from providing access to their competitors under current conditions. Telstra's competitors lobbied the Government against this approach, indicating that not only would their ability to compete be reduced, but also the introduction of Telstra nodes to two thirds of users would mean competitors could no longer use existing and planned exchange-based DSL equipment.

TELSTRA PROPOSAL TO THE PREVIOUS GOVERNMENT

The Telstra internal proposals covered the major metropolitan areas only. They proposed to the Government a broader national approach, the details of which have not been generally released. Based on information provided at a Senate Committee,[4] the Telstra plan was to replace ageing parts of the old copper network and to connect 98 per cent of Australian homes and businesses to fast broadband over five years. Telstra proposed to expend $3.1 billion of its own funds, with Government contribution of $2.6 billion. Part of the Telstra proposal included relaxation of the regulatory rules.

At the same Committee, the Department of Communications, Information Technology and the Arts gave the following reasons for rejecting the Telstra plan:

- significant winding back of the competition regime;
- an effective access holiday for the new network;
- no commitment to pricing;
- effectively locking the Government into Telstra's technology choices;
- risk of further increasing Telstra's dominance;
- funding based on a significant Government contribution; and
- no leveraging of private sector investment.

There were a number of reports in the media of continuing discussions between Telstra and the Government, and between Telstra and the ACCC, but these were not successful. Telstra issued a statement to the Australian Stock Exchange on 7th August 2006 indicating that the fibre-to-the-node talks with the ACCC had been discontinued and that '… *Until Telstra's actual costs are recognised and the ACCC's regulatory practices change, Telstra will not invest in a fibre-to-the-node broadband network.*'

From discussions within industry groups, it appears that Telstra had modified its plans from their original proposals, removing many of the original objections. They had agreed to an open-access network, and proposed more extensive use of VDSL to give higher access speeds.

The financial areas remain unresolved.

G9 PROPOSALS

The G9,[5] a group of nine competitors to Telstra, proposed an alternative plan for broadband access with has technical similarities to Telstra's plan, but with considerable organisational differences.

The group released its proposed Fibre-To-The Node (FTTN) network model,[6] and has lodged a special access undertaking with the ACCC.[7] They propose to create an industry-owned, special purpose company, SpeedReach, to make key decisions about the network, and a new entity created called the Fibre Access Network Operating Company (FANOC), which would manage the network.

The G9 planned to use a FTTN structure similar to that proposed by Telstra, with the majority of users served by DSLAMs at Nodes located beyond the local Telstra exchange. As the G9 has confirmed, this proposal would only work if Telstra uses the G9 network and Telstra grants access to G9 to the Telstra copper mid-span. This would require Telstra's co-operation or regulatory intervention – not surprisingly, Telstra has indicated it would fight what it sees as confiscation of its assets.

A key area of difference was that the network owner FANOC would provide wholesale services only. Under the G9 proposal, no single carrier would be allowed to own FANOC, and FANOC would not be able to provide retail services.

The biggest barrier to the G9's proposal is that a significant portion of the existing copper network will still be required, but this is owned by Telstra. The G9 claims that Telstra would be able to join but Telstra has declined the invitation!

BROADBAND POLICIES – AUSTRALIA'S MAJOR POLITICAL PARTIES

Many of Australia's trading partners in our region have seen the development of a national communications infrastructure as a policy priority, and have invested to achieve this either directly, via Government funding, or indirectly, by using policy tools such as regulation to encourage industry investment.

As a consequence, the OECD listing of broadband penetration showed Australia with a much lower ranking than countries we would consider our peers. This has resulted in pressure on both major parties to develop a coherent broadband policy.

SENATOR ALSTON (THE WORLDS GREATEST LUDDITE?)

Senator Richard Alston,[8] the Minister for Communications in successive LNP governments from March 1996 to October 2003 was often dismissive when asked about the need for an Australian broadband policy. He appeared to doubt the benefits of widespread availability of broadband, and in interviews in 2002 was critical of the South Korean broadband initiative, indicating he believed it was the main reason for the high take-up rate was pornography and gambling!

His view seemed to be that demand was uncertain, and that if it existed, the market would deliver, assisted by the regulatory settings put in place from 1997.

Others were not so certain, and from about 2000 there began to be calls for a new policy framework going beyond the 1997 telephony-oriented policies. In March 2002, Senator Alston announced the formation of the *Broadband Advisory Group*, composed of high-level people from the ICT industry and chaired by the Minister himself.

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The Group reported in January 2003, making 19 Recommendations, emphasising the benefits of broadband and the need for a broadband vision matched by a set of goals, and made specific implementation recommendations.

It may be a little unfair to say that very little happened – perhaps it is true to say that what did happen, happened very slowly. Senator Alston did not seem to have a change of heart.

RURAL AND REGIONAL CONCERNS

A significant proportion of the proceeds of the T1 and T2 sales were used to support programs such as 'Networking the Nation' that assisted basic (dial-up) Internet access, mobile telephony, fixed telephony and related issues in rural and regional Australia.

By the early 2000s, technology to provide broadband started to be offered (e.g. cable modems, ADSL). It was notable that availability was much higher in metropolitan areas, and there was concern from members of the junior party of the LNP Coalition, the National Party, that this digital divide would continue, particularly if and when Telstra was privatised.

The Federal and all State Governments, with the exception of Victoria, agreed to a **National Broadband Strategy** in March 2004, which was designed to '*inform future policy development in broadband and coordinate activities across government. It sets a number of objectives for broadband development in Australia.*' One of the more tangible outcomes from this was **HiBIS** (Higher Bandwidth Incentive Scheme) which subsidised ISPs on a per eligible user basis to offer higher speed broadband access in regional and rural areas. While this did support some provision of faster access, it was only a short term solution, causing problems when the program ended in December 2005. HiBIS was extended by the **Broadband Connect** program, which was in turn extended by the **Australian Broadband Guarant**ee announced in March 2007.

In 2005, the Page Research Centre, a policy group associated with the National Party, published a Discussion Paper[9] developed as part of the discussion at that time about the final privatisation of Telstra. This paper described an option for a government-provided optical fibre CAN, replacing the existing copper CAN, to all but 6000 remote users in rural Australia. It quoted an estimate prepared by the construction company Baulderstone Hornibrook that that this would take $7 Billion over five years, but noted that Telstra's costing at that time was closer to $30 Billion over 20 years.

TOWARDS A BROADBAND POLICY

By 2005, with the final sale of the last tranche of Telstra, there was increasing pressure on the LNP government to develop policies covering broadband, particularly for rural areas where the need was seen to be greatest (and the political pressure greatest).

As part of the agreement to ensure passage of the T3 legislation, the Government agreed to establish **Connect Australia**, a $1.1 Billion package for regional access to telecommunications services. As well as continuing the case-by-case approach of HiBIS, the Minister announced the Broadband Connect Infrastructure Program.[10]

BROADBAND CONNECT INFRASTRUCTURE PROGRAM

Programs such as HiBIS showed the need for better underlying infrastructure to provide rural and regional communications, rather than a drip-feed of funds to many different service providers

using different and often incompatible technologies. The *Broadband Connect Infrastructure Program* was designed to support 'a small number of large scale infrastructure projects', and in fact is now planned to cover only one inter-related project by one provider.

The Government announced that $600 million would be allocated to the project, and after public discussion it called for expressions of interest in June 2006. It sought information on possible approaches to provide improved broadband coverage in under-served areas, requiring improved multi-megabit broadband speeds and a technology platform that would be scalable, including the capacity to achieve even higher speeds into the future.

The details of the contract that came from this program are described in following sections.

'THE BROADBAND BLUEPRINT'

The Minister, Senator Coonan, released a document titled **'the Broadband Blueprint'** in December 2006. It was released as part of a joint Australia-Korea-New Zealand Broadband Summit, and according to the Departmental website the document was intended to:

> provide a national framework for the future of broadband in Australia. In order to establish this framework the Blueprint gives an overview of the Australian Broadband Market as at December 2006. It also details the past and present initiatives to encourage broadband implemented by the Australian Government as well as a brief overview of the activities of state, territory and local governments. The Blueprint articulates the essential elements of the broadband market and a forward strategy to encourage their development (Australian Government 2006).

The following extract from the Table of Contents in the Blueprint outlined the 'strategy' that was promised in the website.

FUTURE ACTIONS
- *Continuing collaboration with all tiers of government*
- *Learning from international experience*
- *Guidance for local councils and planning authorities*
- *awareness campaign on use and consumer opportunities*
- *Mapping backhaul*
- *Spectrum*
- *Measuring progress*
- *Reviews*
- *Conclusion*

And what was the planned Strategy? To quote from the final section of the Conclusion:

> For its part, the Australian Government will continue to provide leadership to shape Australia's broadband future and will foster investment confidence through a stable yet responsive regulatory environment and targeted investment to areas of market failure and need.

To this writer and many other observers, this document was embarrassing. It was over-produced, and it considerably under-delivered. This 'strategy' could not stand comparison with the initiatives from South Korea, or even New Zealand.

CURRENT POLICIES AND POLITICAL DEVELOPMENTS

THE SITUATION IN 2007

By the start of 2007, there was much discussion but little action about future broadband:

- Medium speed broadband, primarily ASDL but also DOCSIS over pay TV cable, was available at in most metropolitan area and some larger non-metropolitan towns;
- Some competitors to Telstra had started to install faster ADSL2+ equipment at major exchanges, and to provide service. Telstra was also reported to have installed ADSL2+, but said it would not provide service in the current regulatory environment;
- Telstra had outlined its strategy to provide faster broadband, but had failed to gain agreement with the Government and ACCC for changes to the regulatory environment that Telstra believed were necessary before it could make the necessary multi-billion Dollar investment;
- The G9 had outlined their strategy for a FTTN high-speed broadband system, but it was obvious this could not proceed without Telstra involvement (or Government direction to Telstra);
- The LNP Government was developing arrangements to provide low to medium speed broadband in rural areas, via the Broadband Connect Infrastructure Program;
- Telstra had been privatised, and Telstra management was taking a much more aggressive stance to defend what they saw as their shareholder value. Relations between the company and the government were very different from those that had applied in the past, were a government suggestion became Telstra policy.

Both in Australia and other countries, it was clear that moving to the next stage of broadband, and indeed to the 'Next Generation Network' concept of integrated and converged communications would take major investment. The copper telephone access network was never designed for broadband, and ADSL technology was reaching its limits. Higher speeds and more reliable service would require investment to move the Access Unit closer to the end user. Around the world, service providers were developing new networks, using either fibre to the premises, or fibre to a Node near the premises, often in competition with high speed access over entertainment TV cable.

A NEW ALP POLICY

At the previous two elections, the Australian Labor Party had made general remarks about the need for faster broadband, but their detailed policies were more concerned with opposing the sale of the final tranche of Telstra. In his response to the Budget in May 2006, the then Opposition Leader made reference to a possible national plan for a 6 Mbit/s network, but like most of the previous broadband discussions, this seemed just another general statement of intent.

On the 21st March 2007, this changed.

The new leader of the ALP, Kevin Rudd, announced a new policy '**Building a National Broadband**' (Australian Labor Party 2007). The new policy said that a future ALP Government would '*build a world class national broadband network, providing service for 98 per cent of Australians*', over a five year period.

The ALP said they would invest up to $4.7 billion in this proposal, in a partnership with the private sector. They said the result would be a joint venture, most likely 50% owned by the Government. They indicated that the private sector partner would be chosen by a competitive process with potential partners such as Telstra and the G9 bidding for access to the joint venture.

The network would be 'open access', providing wholesale services to all service providers.

The statement indicated that 'an appropriate regulatory framework' would be part of the discussions during the choice of partner.

The source of the Government contribution of up to $4.7 billion would be the existing communications fund (which would provide $2 billion), with the remainder taken from the Future Fund's 17 per cent share of Telstra.

A NEW LNP COALITION POLICY

The Minister, Senator Coonan, announced a new policy framework '**Australia Connected**' on 18 June 2006,[11] in a move seen by many as a response to the ALP proposals.

She included the previous initiatives announced by the Government, including the regional wholesale network funded by the *Broadband Connect Infrastructure Program* and the 'top-up' scheme *Australian Broadband Guarantee* which provided a broadband subsidy of $2750 per household for the areas most difficult to reach. As described below, she included details of the successful tender for the *Broadband Connect Infrastructure Program* as part of the package of announcements.

Her major new initiative was the announcement of **a new commercial fibre-optic network**. This was designed '*to facilitate a fibre network build in cities and larger regional centres via a competitive bids process and subsequent enabling legislation*'.

She announced the establishment of an **Expert Taskforce.** Unlike the large number of previous taskforces/d committees, this would not just make recommendations to Government (which would often then be ignored) but had a more specific task. The Minister indicated the '*the guidelines for the competitive bids process will be developed by the Expert Taskforce in consultation with industry. The Taskforce will also settle a realistic timetable for the bids to be submitted and assessed.*'

The Minister emphasised that her plans would not involve expenditure from the Communications Fund, the revenue from which would still be available for future rural upgrades.

THE LNP RURAL PROPOSALS – THE OPEL WHOLESALE NETWORK

As part of the LNP broadband package, Senator Coonan and the Prime Minister announced on that a new company, **OPEL**, a joint venture wholesale company between Optus and Elders, was the successful bidder for the Australian Government's $600 million Broadband Connect Infrastructure program. They also announced that the Government would allocate a further $358 million to enable the OPEL network to be extended, resulting in a claimed provision of high speed broadband to 99 per cent of Australians.

The network build would include:

- 15 000 kilometres of fibre optic cable open access backhaul to link rural areas to major cities;
- Enabling 312 exchanges with ADSL2+, with an additional 114 exchanges being enabled by Optus on a commercial basis, providing ADSL service to users in or near major towns;
- The rollout of 1361 new wireless broadband 'WiMax' sites across the country, to serve users beyond the approx 2 km reach of the ADSL2+ services.

The Minister's announcement indicated that the first services were expected come online in September 2007, with the entire network completed by 30 June 2009.

Many commentators expressed major concerns about the WiMax component of this initiative. WiMax is not yet a fully mature standard,[12] and it appeared that OPEL intended to use the earlier 'Fixed WiMax' standard rather than the 'Mobile WiMax' standard which is likely to have greater international use. Also, it seemed that OPEL planned to use unlicensed spectrum in the 5.8 GHz region. This is a very high frequency for rural use, and by comparison (for example) with Telstra's NextG HSPDA service at 850 MHz, coverage in hilly areas would be restricted (as the writer knows from personal experience, living in a hilly rural region beyond ADSL reach with little or no mobile coverage).

The Minister's claim of 12 Mbit/s coverage (not *up to* 12 Mbit/s) for users served by WiMax does not seem realistic, and indeed the more detailed coverage information on the DCITA website has many disclaimers. In the view of this writer, the WiMax service is likely to achieve speeds of much less than 12 Mbit/s for most users, and may leave many areas unserved because of radio propagation problems.

THE EXPERT TASKFORCE

Following its establishment with the Minister's Statement in June 2007, the Expert Taskforce (ETF) issued draft Guidelines for public comment (Expert Taskforce 2007a). These guidelines indicated that the Taskforce was looking for proposals for the roll-out and operation of a privately funded, open access, high speed broadband network infrastructure in Australia's capital cities and major regional centres.

The proposals were expected to indicate the requirements for legislative or other regulatory changes, designed to directly assist the proposal. They were also to indicate proposed arrangements to provide for appropriate compensation to affected parties.

There was substantial public comment, focussing on the tight time-frame, the evaluation procedure and criteria, and the limitations of the network to only serve major centres. The Taskforce made some changes to the timescale, but preserved the broad direction of its approach.

On 20 September 2007, the Taskforce called for proposals for the commercial roll-out of new open access high speed broadband network infrastructure and services, in accordance with its Guidelines for High Speed Broadband Network Infrastructure Proposals (Expert Taskforce 2007b).

The closing date for Proposals set by the Taskforce is 14 February 2008. The proposals will be issued for public comment from 21 February until 17 April.

It is, of course, likely that new government elected on 24 November 2007 will vary these arrangements.

HOW WILL WE USE BROADBAND?

As mentioned earlier in this article, there are two main public communications networks – the Internet, and the PSTN. One of the writer's major concerns is that almost all that has been written about broadband is really about the broadband Internet, and broadband should be much more than that.

While the Internet is of increasing utility, the telephone network remains the most socially important network. This role is not likely to reduce, and indeed has been increasing as mobile access to the PSTN, for voice and text, has become ubiquitous. As the writer outlined in an earlier TJA article, the technology of the two networks is converging, but one is not a direct replacement for the other (Darling 2004). Table 1 gives a brief summary of the characteristics of each network.

	Public Switched Telephone Network	Public Internet
Technology	Designed to carry voice, evolving to carry 64 kbit/s circuit switched digital. Underlying technology moving to Quality of Service enabled packet (IP).	Designed to transport end-to-end data packets across the network.
Reliability and Quality	Designed for high reliability and quality of service, in both component elements and network architecture.	Designed as a 'best endeavours' network, with no guarantee of data delivery. Quality may be enhanced by end-to-end protocols such as TCP, but for real-time interactive traffic such as voice this approach cannot be used.
Flexibility	Relatively inflexible, limited by low bit rate architecture.	Flexible, able to work over a very wide bit-rate and to support new applications and services over standardised interfaces.
Regulation	Strongly regulated at the national level, and by international agreement. The telephone service is regarded as having high social importance in almost all countries, and many of its characteristics are set by national governments	Lightly regulated, with many aspects set by national agreement in technical bodies such as the IETF. Increasing content regulation.

Table 1 Comparison of PSTN and Public Internet

The public Internet, as currently implemented, is not able to support a telephony service that meets current national regulatory requirements. The bit-rate requirements to support telephony are low, but the quality requirements high.

The telecommunications industry has developed the concept of the '**Next Generation Network**' or **NGN**. Such a network would be packet based (almost certainly using the Internet Protocols),

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with necessary extensions to give a level of service equal to or better than current carrier networks, with the flexibility of the current Internet, and providing a full range of data transmission speeds.

The NGN is already developing from the move to packet-based technology in the current PSTN.

As the multi-billion dollar investments are planned, all services, including telephony, must be taken into account. It would be almost unthinkable to develop a broadband access scheme only suitable for broadband Internet, and having to retain a complete duplicate telephony infrastructure.

A CRITICAL LOOK AT THE TWO PROPOSALS

Two points will strongly influence future policy implementation:

- Telstra was privatised as a whole. The company (or more correctly the Telstra shareholders) own both the access network and the core network, as well as the services provided over them;
- The proposals now being considered by both parties, in whole or part, rely on the use of sections of the Telstra copper access network to carry broadband traffic.

As a consequence, any plan that is agreed has to take into account the implications on Telstra's current networks.

COMMON POINTS

The following looks at common points in the two policy proposals.

As described, **they rely on the use of fibre to the node**. This means that the broadband provider would use Telstra copper for the final link to the user, and access the current copper at some point, probably relatively close to the end-user.

This has considerable operational implications. ADSL from the exchange site would not be feasible where a node has been provided, both for technical reasons (the much higher power level needed from the node to gain maximum speed) and for operational reasons (as it may be better to terminate the copper at the node).

If Telstra is the successful tenderer, they would gain considerable operational benefits by fully providing a digital connection to all users, even if a user does not choose broadband. If the system were properly specified and integrated with back-office systems, most upgrades, downgrades and changes could be done without physical intervention, and there could be continuous fault analysis and quick rectification.

If Telstra was not successful, many regulatory changes would be necessary to ensure success. As the G9 has already suggested, Telstra would have to be prevented from overbuilding with its own FTTN. If this was permitted, Telstra would have operational advantages and would legitimately be able to place the interests of maintaining its own assets above that of the other broadband access provider. Telstra is already using nodes (RIMs and CMUX) in its network to provide telephony and ADSL, and the regulatory/legislative problems to be solved would be very substantial. If Telstra did not co-operate, there would have to be the potential for considerable litigation.

Even if Telstra volunteered or was forced to use the new broadband provider, it would still have to provide a copper CAN for its customers. The new broadband provider would not have the operational advantages mentioned above, and the provision of broadband for an individual user would require co-ordinated manual action by both Telstra and the broadband provider.

If Telstra was not the chosen broadband provider, the selected provider may well find the use of some other technology more appropriate, for example fibre to the premises, or a final link from the access unit to the user by radio, or an electricity powerline.

THE LNP PROPOSALS

RURAL AND REGIONAL

The LNP proposal has already commenced implementation, with the OPEL contract signed on 10th September. As outlined previously, the provision of service to areas outside towns is likely to be less robust than the ALP coverage, with possible gaps in coverage due to terrain and radio propagation problems. Users served by ADSL2+ may be able to be upgraded to NGN, but there is no indication this has been contemplated in the work so far.

MAJOR CENTRES

As indicated above, the work being carried out by the Expert Taskforce should be broadly compatible with the ALP proposal, with the common problems also being outlined above.

As there will be no payment to successful bidders, the only benefit they would receive would be the easing of regulatory restrictions.

It has been reported that the G9 had said they would bid, that Telstra was considering its options and the Deutsche Telekom Asia, with Babcock and Brown, may bid.[13]

If the LNP Coalition had been returned, there would have still been many legislative, regulatory and legal issues to be resolved, particularly if the contract was to be awarded to someone other than Telstra.

THE ALP PROPOSAL

Following the election of an ALP Government, this proposal will form the basis of future broadband development. Unfortunately, little detailed information was made available about the ALP proposal prior to the election. Their approach seems to be based on the proposal put by Telstra to the previous Government in late 2005/ early 2006. As described earlier, that Telstra plan was to replace ageing parts of the old copper network and to connect 98 per cent of Australian homes and businesses to fast broadband, using FTTN technology, over five years. Telstra had proposed to expend $3.1 billion of its own funds, with Government contribution of $2.6 billion (total of $6.7 billion).

The ALP proposal was also for a similar 98% coverage, with a Government contribution of up to $4.7 billion, matched by a similar amount from the private sector (total of up to $9.4 billion).

In media discussions during the election campaign, the ALP indicated that it would not be releasing any coverage maps. The ALP spokesman Senator Conroy was reported as saying 'The network configuration is drawn from commercial in-confidence information that Telstra, understandably, will not allow us to publish' (Sainsbury and Hart 2007)

The proposal is based on use of a FTTN structure in rural areas. This would be more robust than a wireless solution, and better placed to be part of an NGN, but the higher cost of FTTN in areas with lower population density would probably mean the use of equipment to the more robust ADSL2 standard, resulting in service over a greater distance but at lower maximum speeds than obtainable from ADSL2+.

Now the ALP has won Government, it has two basic questions to resolve:

- How does the current contract with OPEL impact its plans? In particular, should the WiMax component be replaced by FTTN? Users receiving WiMax broadband will have to retain their Telstra copper-based services, as WiMax would not be appropriate to provide reliable telephony service. **This is incompatible with the NGN Concept, and would restrict these users from access to future NGN services.**
- How compatible will the work already done by the Expert Taskforce be with the ALP approach? (To this observer, there would seem to be considerable overlap, but significant areas of detailed difference, such as the planned coverage).

CONCLUSION

There is no doubt that Australia is now on the path to a policy supporting a next generation broadband network, but now that the election result is known, much implementation work needs to be done

The policies of the two major parties had many similarities, particularly for major cities and towns, but also the significant differences outlined above. The new Government will have to draw on the various projects initiated by the previous Government to achieve broadband coverage in a reasonable time.

Because of previous policy decisions, in particular the privatisation of Telstra as a single entity, the ALP Government will have many areas of policy and legislation to resolve before such a network is implemented.

But at least we have started thinking (and talking) about it!

ENDNOTES

[1] The website of the ACMA (Australian Communications and Media Authority) shows that Licence No. 240 was issued on 9 Oct 2007 – see www.acma.gov.au/WEB/STANDARD/pc=PC_310408.

[2] In the later revisions to the Telecommunications Act 1997, made in association with the *Telecommunications (Consumer Protection and Service Standards) Act 1999*, there has been a requirement placed on Telstra to make available '… a carriage service that provides digital data capability comparable to an ISDN channel' if required, but this is a separate obligation rather than covered by the USO funding scheme.

[3] The Inquiry said these concerns relate primarily to: the timely installation, repair and reliability of basic telephone services; mobile phone coverage at affordable prices; and, reliable access to the Internet and data speeds generally.

[4] The Senate Environment, Communications, Information Technology and the Arts Committee 2005.

[5] The members of the G9 are AAPT, Internode, iiNet, Macquarie Telecom, Optus, Powertel, Primus, Soul and TransACT.

[6]   The G9 Model is detailed in a paper by Dr Jerome Fahrer (2006) of the Allens Consulting Group.

[7]   ACCC, '*G9/FANOC FTTN special access undertaking (May 2007)*' available at www.accc.gov.au/content/index.phtml/itemId/788471.

[8]   The title 'worlds greatest luddite' was 'awarded' to Senator Alston in 2001 by the respected UK IT Newspaper, *The Register.* Available from: www.theregister.co.uk/2001/03/28/this_man_must/.

[9]   Page Research Centre Ltd, March 2005 '*Future Proofing Telecommunications in Non-Metropolitan Australia*' available at www.page.org.au.

[10]   Government announcement of 17 August 2005. Available from: www.dcita.gov.au/communications_for_consumers/internet/broadband_for_consumers/australian_government_broadband_initiatives.

[11]   Senator Coonan, Media Release 18 June 2007 'Australia Connected: Fast affordable broadband for all Australians'. Available from: www.minister.dcita.gov.au/media/media_releases/australia_connected_fast_affordable_broadband_for_all_australians.

[12]   WiMax is being standardised by the IEEE. The earlier standard, 802.16d or *Fixed WiMax* has been largely replaced by 802.16e or *Mobile WiMax* , as the latter standard is able to provide service to both fixed and mobile users.

[13]   Recent unconfirmed reports have said that Deutsche Telekom Asia may no longer be interested in involvement.

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Peter was the founding Chair of the Australian Communication Industry Forum Network Reference Panel, developing standards for the interconnection of networks in a multi-network environment. Until his retirement from Telstra in May 2000 he led Telstra's work on technical regulation. Since that time he has worked as Principal of Pondarosa Communications Pty Ltd, on projects for clients including the ACA /ACMA, the ACCC, ACIF, Multimedia Victoria, DCITA and the Productivity Commission. He is a member of the TJA Board of Editors, and works as a Senior Researcher with the Network Insight Institute. He has served as an Adjunct Professor at RMIT University.

Peter Darling managed ACIF's Next Generation Network Project, and was the Leader of the NGN Expert Group at ASTAP, the Asia-Pacific Standardisation Programme. He is a member of ACIF's Convergence Group, looking at the transition to NGN.

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