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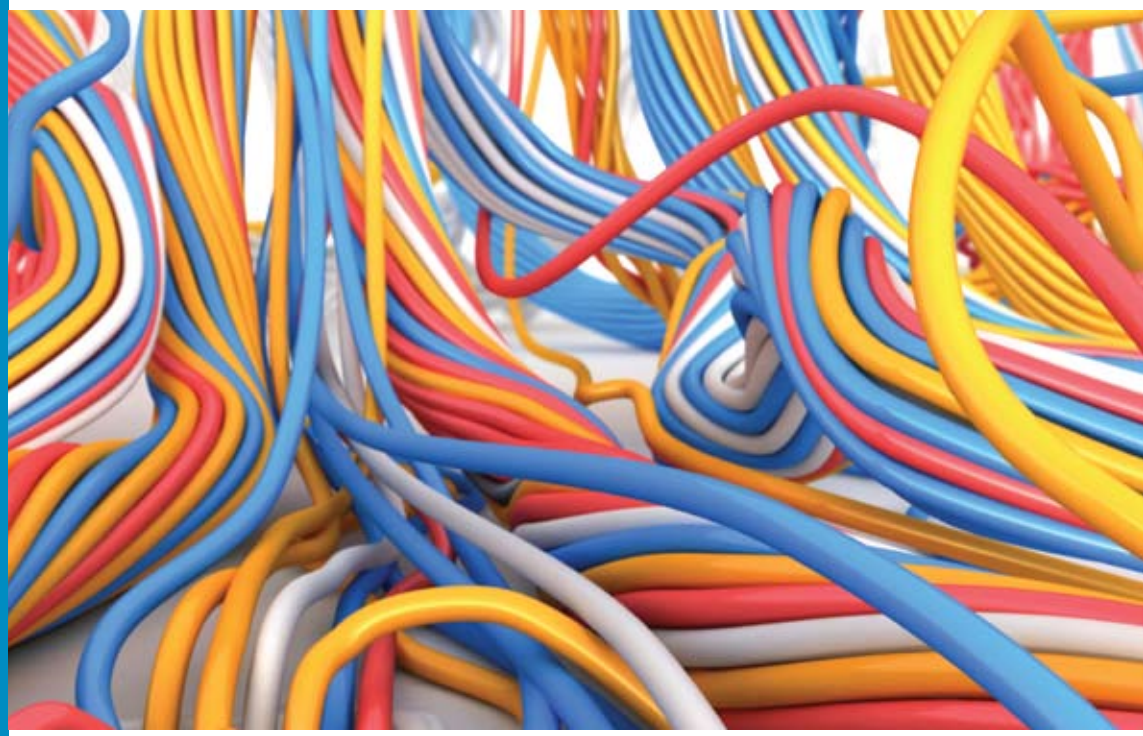
GROWTH

Australia's Broadband Future:

Four doors to greater competition



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committee for economic development of australia

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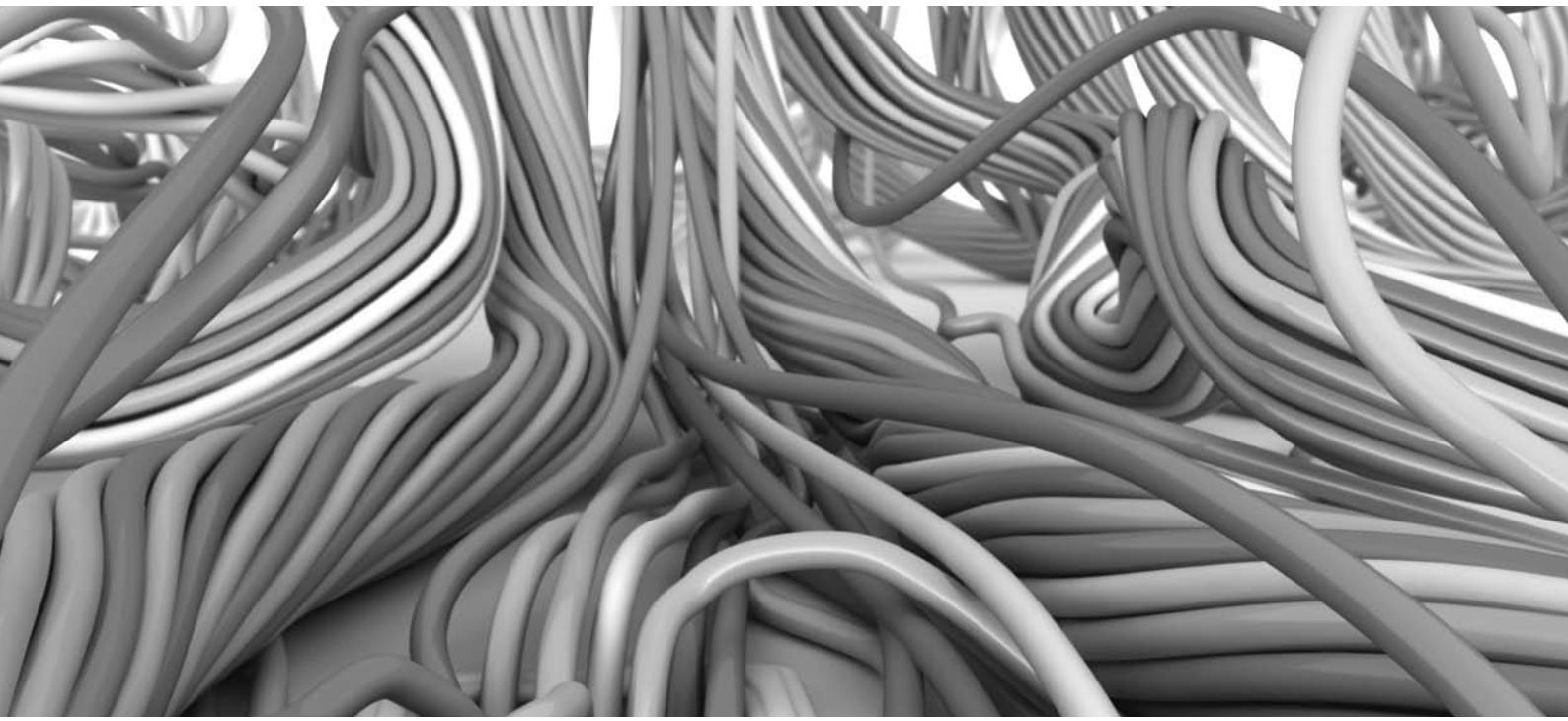

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About CEDA
For nearly 50 years, CEDA has informed, influenced and raised the standard of discussion about the issues shaping Australia's economic and social development.

We do this by:
- publishing independent research
- providing a forum for debate and discussion
- offering a membership network to people and organisations that value knowledge, insights and ideas in Australia's best interests.

CEDA is an independent not-for-profit organisation. Our funding comes from membership fees, events, research grants and sponsorship.

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Foreword

For almost 50 years CEDA has been at the forefront of ideas and action on Australia's economy – informing, influencing and raising the standard of discussion about the issues shaping our economic and social development.

In recent years Australians have begun to realise the contribution that telecommunications and competitive media can make to the development of a prosperous and socially viable nation. With that realisation, broadband has moved to the centre of the policy agenda. The potential to undertake large and complex information processing tasks facilitated through networked information technology offers the promise of a transformed economy. This is particularly so in the services sector where there is obvious potential to generate new efficiencies in the way that health, education, and government services are developed and delivered.

Australia's Broadband Future: Four doors to greater competition focuses on the current Australian broadband debate. While as a nation we may currently be fixated on the rollout of a national optical fibre network, we need to remind ourselves of the real question at stake: How do we deliver the best information services to customers in differing situations across the country?

This report reflects alternative views, from Australian and international experts, on what is required to achieve this. We greatly appreciate their contributions. While their precise arguments may be different, there is broad agreement across the chapters on the virtue of promoting infrastructure-based competition and diverse solutions rather than a single national solution.

For CEDA's part, we believe that broadband policy cannot be separated from the wider digital information policy agenda. Information services can be delivered at speed and volume through each of the 'Four Digital Doors' of telecommunications infrastructure – copper telephone lines, wireless, coaxial cable and fibre. Technology is advancing in ways that cannot be predicted. Regulation cannot keep pace. High levels of investment and innovation are required. The task is to promote real broadband competition across the four infrastructure 'doors', allowing rivals to differentiate their services and compete more vigorously along their supply chains. If there is to be public subsidy associated with a fibre network rollout, it may be better targeted at the delivery of education, health and other services through the network rather than at the establishment of the network.

We thank IBISWorld for its support for this collection, and its support for advancing policy ideas on broadband and digital information policy. Thanks also to Minh Bui Jones who edited this volume and secured the contributors.

Many facets of this issue remain unexplored by this volume. CEDA intends to keep broadband and digital information policy at the centre of our research and policy agenda for some time to come – facilitating serious discussion of policy options and advancing further ideas of our own.

David Byers
Chief Executive, CEDA

A word from the sponsor

When Australia's New Age began in 1965, information technology and telecommunications became the new utility for industry and households – just as electricity, gas and water became the new utility for the Industrial Age a century earlier.

Forty years ago we could not have imagined the extent to which this new utility would impact on businesses and our lives, and perhaps most people still have difficulty in guessing what it can do for us in the decades ahead. But to see the take-up of mobiles and the connectivity to the internet by students, workers, researchers, homebodies and the retired is to see a new world opening in front of us.

When motor cars arrived on the scene over 100 years ago they were few in number, slow and cumbersome; made worse by roads designed for the horse and cart. The parallel with today's ICT sector is stark. Our hardware, software and information explosion are way, way ahead of the channels for their use: the 'roads' are inadequate. We have the equivalent of unsealed roads when the demand is growing for freeways and tollways that can carry vastly more traffic at higher speeds.

So, CEDA's continuing research into Australia's broadband future is to be commended. This study is timely given the intended rollout of broadband in 2009 and beyond. Telecommunications is a $40 billion revenue business in 2009 – almost 30 per cent of the giant ICT industry – with revenue of $135 billion, nearly double the revenue of pre-existing electricity, gas and water utilities.

IBISWorld is delighted to sponsor this valuable research effort. As an online information company operating worldwide, we have a vested interest in seeing far greater capacity and speed available to our clients, suppliers and employees in Australia and elsewhere. We suspect once householders are exposed to truly high-capacity, high-speed broadband – in excess of 100 Mbps – it will open up another chapter in their lives in terms of education, health, entertainment and visual telecommunications; perhaps acting as surrogate transport in many instances and thereby helping to ameliorate the global warming dilemma.

We commend *Australia's Broadband Future: Four doors to greater competition* to all concerned: it puts things in perspective, outlines options and progresses the debate.

Phil Ruthven
Chairman, IBISWorld

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1 The 'Four Digital Doors' – a CEDA Research perspective on digital competition

1.1 Introduction

Given the new technological and financial situation facing Australia at the end of 2008, Australia's information policy must be modified to achieve real competition across the 'Four Digital Doors' of telecommunications infrastructure. Broadband competition should come from and within:

1. Copper telephone lines (ADSL and VDSL)
2. Wireless systems (mobiles, WiMax, satellite)
3. Hybrid fibre-coaxial (HFC) cable
4. Fibre systems, including the fibre-to-the-node (FTTN) network, subject to tender.

Each of these digital doors will in the future produce fast broadband and the services that go with it, such as voice, video, TV, including internet-based TV (IPTV), data and text on a range of platforms. Media and general business competition is highly dependent on the speed and volume of data obtained through these potentially competitive but differing infrastructure doors.

The current policy debate should be about much more than the FTTN rollout, since existing cable and evolving mobile platforms also present fast and competitive platforms, as the Australian Competition and Consumer Commission (ACCC) and most independent parties have confirmed. Yet we seem bogged in a technologically exclusive debate about a 98 per cent rollout of FTTN, rather than on how to deliver the best information services to customers in differing situations. While there are issues where joint use of these technologies requires coordination, and where other technologies can blend in (for example, using electricity wires and railway lines), these synergies do not require the dominant role of one party as at present. Australia needs competition across infrastructures, keeping Telstra as a key but competitive leading edge in telecommunications.

This chapter argues in favour of a broad approach to 'infrastructure' competition in telecommunications. It argues against the application of a restrictive access regime to apply to the winning FTTN network that emerges from the current Federal government

CEDA has resolved that on a small number of key policy issues affecting the economic development of Australia, CEDA Research will assemble articles and a policy perspective. There may also be preferred policy directions in the attached documents. While CEDA continues to be a neutral and broad facilitator of dialogue and opinion on a wide range of topics related to economic development, on this limited set of key issues CEDA Research may go beyond the facilitation role to suggest directions and options worthy of government actions. Broadband and digital information policy is such an area.

This CEDA volume reflects alternative views regarding the current situation facing Australian broadband, telecommunications and, as a result, associated media policies. The papers also draw on lessons from international experience with the structuring and regulation of broadband and competition issues in telecommunications. CEDA Research has noted that in the case of telecommunications, regulation, or implementation of regulatory advice, has had a habit of being out of sync with technology in the sense that regulation today is based on perceptions of competition that typically understated the competitive forces emerging in the marketplace.

tender process. It argues against structural separation of Telstra on the grounds that there are distinct coordination and other vertical synergies from owning a network and retail telecommunications business. However, in order to achieve horizontal competition in telecommunications and particularly broadband, it argues in favour of the successful bidder for the fibre tender being required to divest all shares in its coaxial cable systems. Cable can and should be a much more competitive source of broadband as well as cable TV (Telstra HFC cable passes 2.5 million homes; Optus 2 million).

The arguments related to forced access to private infrastructure to benefit separate firms and their customers has recently been the subject to lively debate and rulings in the Pilbara, regarding third party access to freight railways built by iron ore producers. Just as in the Pilbara, there seems an excessive focus in telecommunications policy on access to the facilities of producers who are already in competitive product markets and whose investment decisions will be frustrated by the scheduling complications of sharing. The common view is that it makes sense for owners of railways (or wires or networks) to share costs with external companies who would like to pay to use a line. Why not force a deal and save wasteful capital expenditure on duplicate infrastructure and allow further downstream competition through access rights? These are difficult issues in the case of the Pilbara, where adjacent railway lines may not make sense despite the powerful economic arguments. But in the case of fibre, copper, coaxial, cable and wireless mobiles, Australia has these multiple infrastructure systems in place, with one about to expand by tender (FTTN). In these circumstances it is much easier to argue a nevertheless powerful case against enforced access in the case of telecommunications, precisely because there are going to be at least four doors of infrastructure competition.

Decisions of the previous government in 2004, against ACCC advice, made cable the 'lost opportunity' in broadband competition, a situation that can fortunately be reversed as part of the FTTN decision. Broadband can be a source of competition for television; for example, through IPTV (multi-channels via the internet) – a reality that presents for 2009. By allowing Telstra to retain the vertically integrated copper-based telecommunications, and potentially to win the fibre FTTN rollout, the government will facilitate a state-of-the-art vertically integrated telecommunications company, both in copper ADSL and fibre optic systems. To add a fibre-based system to the current owner of a controlling share in Foxtel cable would, however, facilitate an un-necessary domination of communications media in Australia. Should the Terria consortium win the FTTN tender, it will need to coordinate closely with Telstra, given the interdependencies between the copper and fibre systems, particularly in transition. Thus the parties with controlling interest in the fibre and copper 'last mile' systems should, as part of the contractual conditions, cease to own shares in the HFC cables, and the Foxtel and other cable systems. Instead, access to cable should present real broadband competition, potentially around Data Over Cable Service Interface Specification (DOCSIS) 3.0, and allow much faster speeds than ADSL2+ and many other systems.

Similarly, in the future wireless (mobiles), ADSL/VDSL and fibre will offer digital TV and data in competition with cable TV. The need is to create maximum competition between these broadband infrastructure systems, rather than to haggle over access regimes and the structural separation of Telstra services on the copper system. While there is a vital role for ACCC in regulating access to copper and fibre networks, and particularly for backhaul of mobile and other systems, the dilemmas are much more easily dealt with under infrastructure competition across all 'four digital doors' and notably with cable rejoining the competitive fold.

Prices for broadband access, mobile phone plans, cable TV charges and internet usage charges will all come down, and download volume restrictions relaxed, when the doors that deliver the digital services are all in real competition. After all, what is being delivered through all the doors is simply packets of 0s and 1s which then get unpacked and converted into useful interactive information through an expanding variety of platforms.

Divesture of HFC cable and Foxtel shares by the new winners of the FTTN tender, in modified bids, would remove a perceived conflict of interest that has prevented cable from providing the sort of competition for copper and fibre in more competitive systems overseas – in countries where there is not common ownership of HFC cable and copper ADSL systems; Canada, US and in Europe, for example.

In the context of the personal losses in the current financial crisis, a subsidised FTTN rollout is considered wasteful and unnecessary. Fast broadband is already available in other ways, at lower cost and with many more tailored regional services now emerging, notably for quite remote towns. The tender should be amended to involve no automatic subsidy of the network; rather, the government could 'backfill' where customers may miss out. Additionally, telemedicine, education and other services may properly be the focus of direct subsidies, along with those in remote locations.

1.2 Towards infrastructure competition in telecommunications

Whereas for water, electricity, gas and transport there have been significant technological advances over recent decades, these have been relatively small and more predictable in comparison with telecommunications, and have not changed the natural monopoly status of the key network services which may still need strong but pro-competitive regulation. In the case of telecommunications technology the changes continue to be more dramatic, and they have spawned a range of new products and challenged existing ways of doing business and using information. The consequences of restricting or regulating telecommunications services have rarely been fully understood in advance, as new products and flow-on technologies have jumped forward faster than any of us could expect.

Most of the technologies that combine to create modern telecommunications have experienced revolutionary changes over the last few decades: the microprocessor, fibre optics, the internet, wireless systems and graphic displays are a few examples. Thus it is not surprising that governments seeking to act on behalf of customers appear, in retrospect, to have misjudged the potential for both competition and transitory monopoly powers of a technology that is dominant, if only for a short time. However, we are at a point now where there are enough differing technologies and platforms using these technologies, for a less intrusive form of regulation within telecommunications infrastructure systems. This is because each system in the different classes of systems – copper (ADSL, VDSL), fibre (FTTN, FTTP), HFC cable and wireless/mobile systems (3G, 4G) can now compete among and within themselves – in what is called 'infrastructure competition'. There are also complementary dimensions to competition, and economies of scope with other technologies – electricity and rail communications for example.

Infrastructure systems that may compete can be vertically integrated in many or all dimensions; what is important is that the systems can compete at the wholesale, retail or platform level. While there remain interesting transitional challenges, there is less need for regulation of any one door if all four doors are competing. The trick is to facilitate real competition across platforms – something that is not sufficiently in place in Australia but is proceeding better elsewhere.

In 2008–09, during the most extreme financial crisis of most people's lifetime, it may be unsound to subsidise a rollout of technology that is already capable of evolving via private sector investment. There is a real prospect of current and future players delivering best practice for the vast bulk of customers, based on fibre-optic systems. The new systems will evolve from the copper network, but supplemented for more remote communities by very broad access via 3G and 4G mobile systems, wireless systems such as Wimax and the new wave of satellite phones for those off the 'last mile' or out of copper and urban fibre range. This access and speed situation is in evolution and is in sharp contrast to the dial-up mode many used at the time the FTTN policies were first rolled out by both political parties.

The situation now is one where both the copper ADSL systems and the mobile phone 3G (NextG) platforms are delivering speeds and access that are far better than predicted. While Australia is lagging in rollout of fibre-optic technologies relative to many countries, the spending of $4.7 billion subsidy does not seem in order given the potential of the mobile and satellite systems and the chance to blend and extend existing fibre cables with wired and wireless systems in the bush.

Ergas and Ralph (see chapter 4) argue Australia is lagging because of regulatory uncertainty making for a climate that discourages investment, and they also note the competitive potential from other telecommunications infrastructures. Joshua Gans argued in a 2006 CEDA information paper (Gans 2006), and

again in this volume (see chapter 3), for a far more localised approach to delivery of broadband – not a one-size-fits-all model.

In summary, a new policy and regulatory mix is capable of delivering an outstanding range of services, with modest residual needs for subsidies to those in remote Australia. The key to the change is genuine competition between the cable, copper, fibre and wireless systems.

1.3 US example of infrastructure competition

As Jeffrey Eisenach argues (see chapter 5), there is a general recognition that the evolution of regulation and competition policy in the US has been less than ideal. Yet today the imperfectly conceived (initially from horizontally unbundling AT&T, for example), vertically integrated structures in the US are delivering real competition across the system, as cable, ADSL, mobiles and fibre deliver competitive outcomes. In Australia the debate has been very much about sharing access on the copper 'last mile' and the potential for sharing in a much faster fibre-optic system through the rollout of a FTTN system.

As Eisenach notes:

> The debate over broadband policy is at once dizzyingly complex and utterly simple. At its simplest, it boils down to this question: will consumers best be served by forcing incumbent owners of communications networks to resell access to their networks to competitors ('unbundle') at mandated prices; or, alternatively, should competitors be required to build their own networks, thereby encouraging investment in competing infrastructures? At least part of the answer lies in incentives: If forced to resell their networks to competitors, incumbents will be less inclined to invest; and competitors, given risk-free access to the networks of incumbents, will have weaker incentives to build new networks.

Henry Ergas and Eric Ralph (see chapter 4) highlight that the regulation regime in Australia makes it very unattractive to invest in new infrastructure, since the access regime imposed is uncertain and has a tendency to force access charges below a level required for investing in new networks. The incumbent argues expropriation, and other users of the network, who are paying fees to the network owner, find it cheaper to use the existing assets rather than invest in new infrastructure. This appears strongly to be the case; one example being a resulting gross underutilisation of the two HFC cable systems owned by both Telstra (passing about 2.5 million homes) and Optus (passing 2 million homes).

Jim Holmes (see chapter 6) also addresses regulatory issues, focusing on scope within a technology for using regulation to achieve efficient outcomes within a competitive environment across separate infrastructures so as to get better outcomes. Holmes states that, in particular:

> There are two broad choices for regulatory frameworks to promote competition in this situation. Regulators can rely on inter-modal competition – that is, competition between different technologies, to generate appropriate incentives for cost and price reduction, innovation and quality. Or they can rely on intra-modal competition sustained by an access regulatory regime.

In terms of intra-modal competition the choices come down to separation of three kinds: accounting, functional and structural. Holmes goes on to argue there is "no completed example of regulated structural separation, and therefore no established arrangement that can shed light on how the benefits and problems claimed might work out in practice".

1.4 The proposed Fibre-to-the-Node network

The context of this CEDA report is the current tender for the proposed rollout of the FTTN network. To quote from the tender document:

> As a key element of its plan for the future, the Australian Government has committed to provide up to $4.7 billion and to consider necessary regulatory changes to facilitate the roll-out of a new open access, high-speed, fibre-based broadband network, providing downlink speeds of at least 12 megabits per second to 98 per cent of Australian homes and businesses.
>
> On 11 April 2008, the Minister for Broadband, Communications and the Digital Economy, Senator Stephen Conroy, announced the release of a Request for Proposals to roll out and operate a new, open access, high-speed, fibre-based broadband network. The network will represent the single largest investment in broadband infrastructure in Australia's history.
>
> The party to build the National Broadband Network will be selected through a competitive assessment process to maximise outcomes for the community. This process will be transparent and accountable. (DBCDE 2008)

The tender requires both open access and uniform

pricing, which Ergas and Ralph argue in chapter 4 are likely to grossly distort economic efficiency and which discourage "facility-based competition". The imposition of heavy regulatory and uniformity constraints is the opposite of what is required since, as Gans is keen to point out in his contribution (chapter 3), conditions vary markedly across Australia as does the preferred means of serving customers. Ergas and Ralph argue for regulatory delay on the grounds that "regulation once established, cannot be easily unwound, since a range of parties come to rely on it and on the rents it invariably creates".

As noted at the outset, the current and proposed delivery of broadband in Australia is via the following four channels or 'four doors'.

1. Copper telephone lines (ADSL and VDSL)
2. Wireless systems (mobiles, WiMax, satellite)
3. Hybrid fibre-coaxial (HFC) cable
4. Fibre systems, including the fibre-to-the-node (FTTN) network, subject to tender.

The minimum that should be achieved in terms of digital and information sector outcomes is real competition between all 'four doors', something that is not achieved at present. For example, at present HFC cable is not really competing with ADSL in the broadband space since Telstra also offers ADSL. Optus, while owning an HFC cable network passing 2 million homes, uses the Telstra copper network at the regulated access charges. And while Optus still has some 200,000 pay television subscribers, they are in effect subscribers to Foxtel so that Foxtel has no competition on cable but competition through free-to-air broadcasting and potentially IPTV over broadband.

What the experience in Australia and overseas suggests is that cable television systems based around HFC cable can, using systems such as the Data Over Cable Service Interface Specification (DOCSIS), achieve higher broadband speeds than currently available on ADSL2+, yet these systems have been barely marketed in Australia in light of the lack of inter-modal competition. What is suggested by many technical experts is that Australia would benefit from genuine broadband competition between the coaxial HFC cable systems (which would upgrade) and the copper systems, ADSL2+ shortly with the new VDSL range.

The tender of the fibre system is an opportunity to make a condition of winning the tender for the FTTN rollout that the winning party divest all shares in HFC cable and business systems, so that a coherent business in cable will be able to compete with both the fibre and ADSL/VDSL systems as well as wireless and mobile systems.

Furthermore, the competitive structure of mobiles is changing rapidly following deployment of 3G and NextG. WiMax is also an unfolding technology with potential in new areas.[1] Within each 'door' there is also scope for competition; for example, across mobile phones, via wholesale access on copper wires, fibre and cables, and via satellites. In wireless and mobiles, the competition is already intense; based around separate and shared infrastructure, with newer technologies raising speeds and allowing areas of high speed broadband at local levels and at affordable costs.[2] There is also scope for interlinking different systems such as cable to towns, wireless to homes, or using electricity wires to homes from fibre nodes.

1.5 Media platforms

Flowing from all the potential competition in transmission of digital signals – the packages of 0s and 1s – is a new level of competition in the processor-based platforms that use signals, voice, radio, television and print media via platforms such as telephones, PDAs, computers and the overlapping devices based around differing combinations of digital technologies. The gap between Australia and better practice was evident at the time of the Beijing Olympics, when broadband customers in countries such as Canada could watch up to seven events at a time on the internet, while customers were rationed access to a single event in Australia. While this chapter does not argue against subsidy of disadvantaged or remote customers, or of production of creative content from Australia, quite the contrary, the priority now is facilitating the power of competition across all platforms before such fibre rollout subsidy decisions are implemented. The gaps need to be clear before the backfilling starts!

For the proposed FTTN network, the terms and conditions of the tender need to be tuned to achieve the best outcomes for consumers of digital information and the products that flow from it, with care to preserve or even enhance competitive technologies that will deliver competition despite the advent of a new dominant model. Any subsidy element should be for community groups and technologies with substantial external benefits – remote communities, education and telemedicine – where there is a convincing case for subsidy from the government's announced fund.

While solutions that maximise community benefits from public and private investments are needed, as facilitated by a sound regulatory environment, there are fine judgements involved regarding whether the

environment will remain competitive after one party gains control over the FTTN system. The concern of some is that the technology will be sufficiently dominant (relative to wired, wireless and coaxial competitors), and will replace elements of the current ADSL and VDSL copper technology such that a reduction in competition and increase in cost may be an unintended consequence of the FTTN rollout. The impact for many Australians of new access to fibre in combination with an aggressive separate cable broadband supplier(s) will be highly advantageous, not least because Telstra cables already run past 2.5 million homes and Optus HFC past 2 million homes.

Competition is all about pricing and service quality at the margin, and with the vast majority of Australians having potential access to ADSL/fibre connections as well as cable modems, there is scope for extracting far more competitive outcomes. While fibre may make many copper/ADSL connections obsolete, cable modems armed with new DOCSIS 3.0 and other technology will make for aggressive pricing on fibre, cable, wireless (including mobiles) and copper.

There is no great merit in forcing structural separation of Telstra – the copper network from voice and ADSL services, for example, given vertical synergies and investment coordination advantages. However, in the event of Telstra or Terria winning the FTTN tender, the quid pro quo should be:

1. Divestment of Telstra's interest in the HFC cable and Foxtel systems, and in the event Terria wins a similar divestment by Optus of its interest in HFC cable. There will need to be a careful implementation of separation of the cable system from the owners of the fibre network, so that systems work well through the transition and the incumbent power is managed responsibly. For example, all systems will be dependent on key elements of the Telstra system, such as backhaul for mobile systems,[3] and there is a need for the ACCC to monitor transition as a condition for the winning party gaining control of the FTTN.
2. Retention of and continued wholesale access to the copper network on an ongoing basis as part of competition, at least in transition or where that is technically possible and commercially sound. The complexity of linkages between the copper and fibre networks under a Terria win will be substantial. The competitive benefits of the new system will be greatly facilitated by separation of the HFC cable systems and the increasing capacity, coverage and speed of the new mobile networks (for example, Optus claims its mobile network will cover 98 per cent of Australians by 2009, creating real competition with Telstra's NextG, Vodafone and other systems).

While there should be no permanent obstacle to replacement of copper by fibre, any request to remove copper as part of the rollout of fibre should be a matter for ACCC review in locations where ADSL and VDSL will offer fast service at a lower cost.

The rollout of the fibre network currently under tender needs to be adapted to local situations and options. In some remote and subsidised cases the current access via copper, NextG or satellite phones will make the rollout inefficient and/or redundant. While there may be a case for elements of subsidy for non-fibre services to certain remote customers, the quality of mobile services is rapidly approaching standards and costs that may make subsidies inappropriate.

What is at stake in the 'four doors' competition is far more than the telecommunications processes. It is the set of platforms on which our news media, entertainment, geographical and group information are based – to mention a few examples. At the recent Olympics, unfavourable coverage outcomes were flagged in Australia compared to countries such as Canada and the Netherlands. The failure to have implemented truly fast and competitive broadband meant Australians could not choose between the eight or more Olympic event offerings on the internet elsewhere, but were rationed a limited fixed allocation for a few hours on Yahoo7. With new phones and other digital computer devices providing exciting options, the key is the underlying and multiple sources of bandwidth – something Australians are starting to appreciate as an area where we lag.

While the need for the $4.7 billion subsidy the Rudd Government has proposed for the broadband network is questionable, there is merit in a backfill fund for those in areas that will otherwise miss out on quality participation in the information age. It is most unlikely that these groups would best be connected to the FTTN system, given cheaper and better possibilities. Additionally, these groups should be few given the affordable coverage and quality possible via new mobile (98 per cent) and some cases ultra remote satellite systems (2 per cent). Other elements for subsidy might include telemedicine and educational networks where external benefits are demonstrated to be substantial.

1.6 Conclusion

1. Broadband policy needs to be more pro-competitive via the 'four doors to competition' in information policy – a real competition model, based around alternative telecommunication infrastructures that deliver the digital signals that are repackaged in various devices (land phones, mobile devices, TVs, computers, newspapers). These 'four doors' are:
   i. Copper telephone lines (ADSL and VDSL)
   ii. Wireless systems (mobiles, WiMax, satellite)
   iii. Hybrid fibre-coaxial (HFC) cable
   iv. Fibre systems, including the fibre-to-the-node (FTTN) network.
2. While there are other possibilities – for example, telecommunications conveyed via electricity wires[4] – they have been left aside for the moment as experimental. At present, many participants complain about the market power of Telstra – just as Telstra complains about an excessive and overly discretionary regulatory framework from the ACCC. There is some truth in both positions. In reality the legacy systems mean there is 'no show without Telstra'. The strong natural monopoly element of copper's 'last mile', future fibre cable (to node or premise) and backhaul requirements of sub-networks means there is a case for access pricing and other forms of regulation for at least a few years. But, as Telstra argues, these regulations have to facilitate investment as well as competition – and there has to be greater predictability of pro-competitive regulation if risks are to be lowered and the costs of capital more encouraging of investment.
3. Overall, there is now the basis for real competition across and within the four doors, and the prospect of these doors themselves being able to operate relatively free of regulation within a few years. The reality is that telecommunications regulation has not been able to keep up with technology, and the only certain thing is surprise from new technologies. Extra-ordinary speeds like 100 Mbps are now in process for both mobiles and copper, with much higher from fibre.
4. Regulatory certainty is the key to lowering the cost of capital for all infrastructure, including digital communications, because if investment is to come from various pension and other long-term funds, the capital cost is lower as the income stream to the investor is more certain. But there is a trade-off. Providing regulatory certainty that enables companies to invest more because of a lower capital cost is not worth it if that means customers miss out on competitive and cheaper telecommunications.
5. Telstra's pre-submission on the current fibre tender argues that existing copper connections should be removed as FTTN or FTTP connections are installed. The effect of this could be to prevent ADSL competing with fibre in some areas where many are increasingly happy with ADSL2+, and VDSL in the future with its potential speed capability, within a few kilometres of exchanges. While there are technical issues, independent experts confirm that it is often unwise to destroy a copper network to ease the financing of FTTN.

   Even more important is a requirement that coaxial competition – the 'lost opportunity in Australia' – should be reactivated by requiring the FTTN winner to divest its stake in HFC cables and (Foxtel) systems. Encouraging the cable owners to make full use of cable will reactivate what should have been real broadband competition from FTC cable systems – as European, and North American cable systems exemplify.
6. The tender provides an opportunity to get the market settings right. Telstra's complaints about the ACCC over-regulating and the excessive discretion of the ACCC have real force. There is scope for each door to be a genuine source of digital competition. In combination they can create a digitally rich and more exciting cultural and competitive Australia. Telstra can thrive in real competition across copper, coaxial, wireless and fibre.
7. The virtue of the wireless nature of much new technology is that we are probably converging, in terms of outputs and services, on outcomes that can be delivered anywhere. After all, as noted above, with digital communications it is just 0s and 1s in differing packages which are sent and switched around by dramatic new and cheap computing power, received and then transformed by devices as varied as phones, water pipes, television sets, computers and transport vehicles.
8. It is a new and digital age, but until now with the same old politics. What is new is that the same technology that keeps changing is moving in but one direction – that of providing each individual in the world with access to a near infinity of digital information. This makes education policy and how to use information as central as the telecommunications vehicle itself. What is needed is access to assistance platforms, education and training on how to use and benefit from the digital age, and insurances against the negatives

that arise. This institutional and training access, as much as access to fibre, is a valid use of any available subsidy.

9. Information policy (with policy settings much broader than telecommunications or broadband policy) will need to change as technology changes. Governments need to do as little as possible to get in the way of new opportunities – restricting themselves to facilitating competition in accessing and using information, and preventing abuse of market power.
10. In effect, information 'trains' now go everywhere at near infinite speeds, with messages split up into packets and then re-formed by computers along the way and at the final destination in text, music, images and so forth. Given the nature of the information, and the subtlety and power of some digital concepts, it is no wonder that the much-lobbied governments have been getting it wrong. Information is power, and interest groups that make up our political system all want it first. That this whole digital arena includes the print and TV media highlights the centrality of the digital debate, with its capacity to package and send 0s and 1s anywhere.
11. With the benefit of hindsight, telecommunications have been a source of major policy errors by Australian governments over the last few decades. In part, the problem has been the gap between technical change, policy development and political understanding of a changing field. Wires, wireless, fibre, and satellites have all seen their own major communications revolutions as the microprocessor became a centrepiece of the working of all devices save tin cans linked by string. Receiver systems such as mobile phones and computers, and conduits such as the internet, may have become household words, but the doors to them are often not understood.
12. The challenge before Australia is to undertake serious discussion of options for how the development of Australia as a society can be assisted by the benefits of competition and technology. Policy and the regulatory framework need to be set in a manner that enables us to choose the best options.

Endnotes

1. NOKIA Siemens has announced it would deliver fourth-generation-ready (4G) mobile network hardware to more than 10 major operators by the end of this year, a technology that can be upgraded into what is described as faster Long-Term Evolution (LTE) technology.
2. One such wireless example is Meraki, as implemented for example in Prestonsburg, Kentucky, US. Meraki provides wireless services to an entire city and outlying valliess and can provide connectivity to underserved communities for education and telemedicine applications. Meraki boasts coverage across two linear miles of city and nearby rural areas, in a network with 6,000 regular users and with free WiFi for businesses and households (see http://meraki.com/solutions/cs/prestonsburg)
3. 'Backhaul' relates to the intermediate links between the core network and the small sub-networks at the borders of the fibre or copper network. As an example, mobile phones communicating with a single cell tower are what is called a local sub-network, and the connection between the tower and the external world starts with a backhaul link to the core of the (Telstra) network (via a point of presence).
4. A fifth and more experimental door is broadband via electrical wires, an attractive option given all homes have power lines and that internal wires can act as a network. High-speed connections of up to 3Mbps are touted, but there are concerns regarding interference such that the best label to date is experimental. As with earlier decades, it seems true that telecommunications is always subject to innovation and major change, with the danger that regulation deals with old problems and prevents new solutions.

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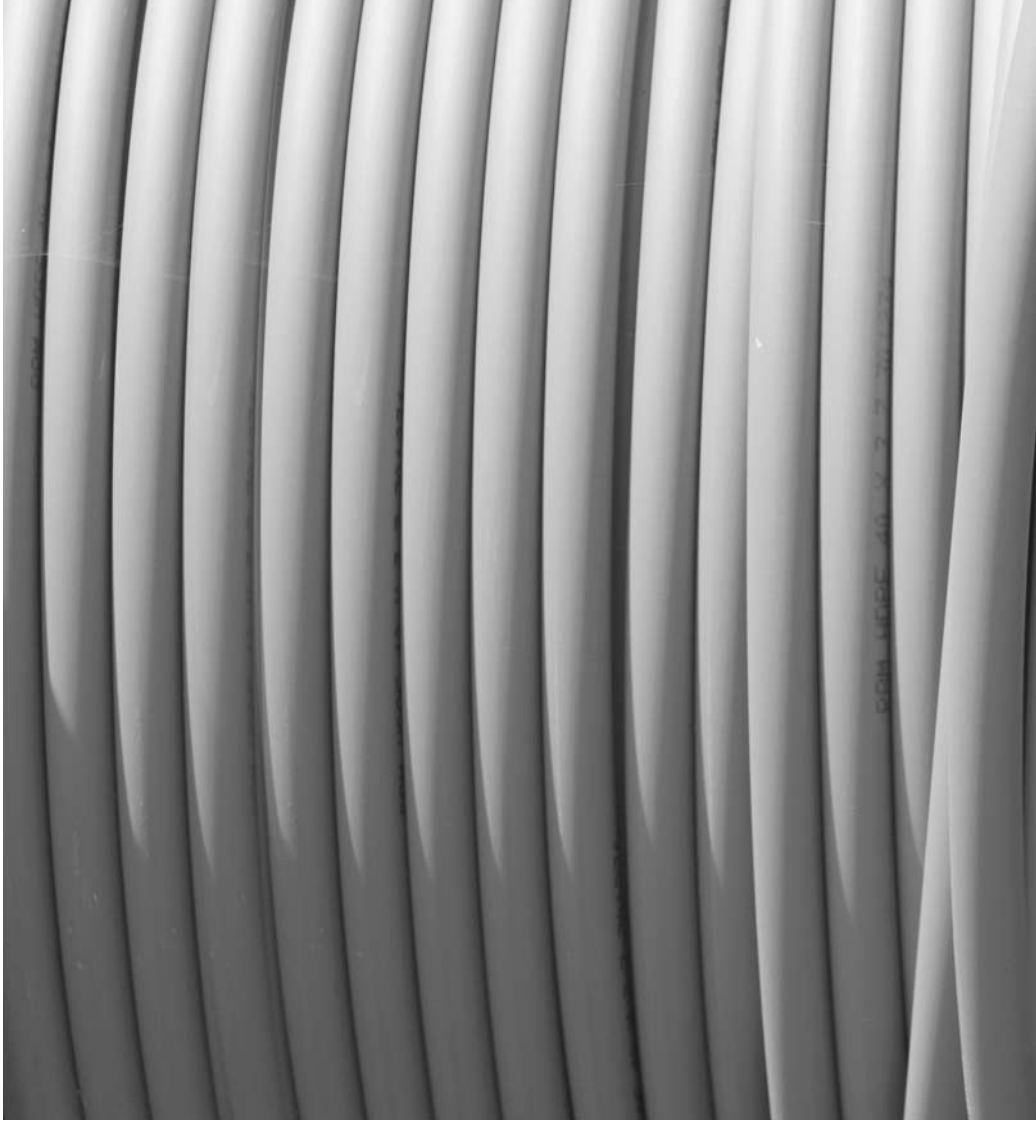


2 Building the broadband network

2.1 Summary

Australia's proposed National Broadband Network (NBN) is an imaginative plan to bring a vital new technology – a next-generation access network or NGA – into use. However, it is important to ensure that it is implemented in the best possible way, and supported by appropriate regulation.

Design of the project should take account of the different competitive endowments of different geographic areas due to population density and commercial opportunity. Such an approach would maximise the competitive potential of existing assets and minimise the threat of re-monopolisation of infrastructure. A three-pronged approach is proposed, differentiating those areas:

- where there is existing infrastructure that could compete with the NBN based on an upgrade of Optus HFC (hybrid fibre-coaxial) network
- where infrastructure is not currently duplicated
- where the NBN is uncommercial and would not be built without public funding.

Where Optus has its own HFC network, incentives should be in place for Optus and Telstra to reproduce the competitive rollout of NGA seen in other countries and regions. This may involve minimal regulation, to sharpen each company's incentives to be the first mover to upgrade the NBN over time or extend their networks, competitively, into new commercial areas. The situation thus differs from areas where there will be only one network, and where the NBN plan has the capacity to accelerate the spread of new services. But regulation must still be designed to ensure that later investments deliver more of the benefits of the new network. Finally, in areas where there is no commercial case for an NGA, public funding will be needed; it should be supplied as part of a competitive technologically neutral process. An approach based on recognising the differences across these three types of areas is likely to bring greater benefits than one which blurs the distinctions.

The issue of whether the NBN should be separated from other telecommunications assets, in terms either of its ownership or operation, has attracted much attention. This paper argues that separation is an unnecessary risk which is unlikely to confer benefits, but likely to impose avoidable costs and delays.

2.2 Regulating next-generation networks

The revolution in telecommunications technology associated with the extension of fibre transmission and the use of IP protocols comes in two broadly distinct forms. At the level of the core – the network linking major exchanges – the transition requires significant investment but is essentially a cost-saving process innovation. But in the case of the access network, which connects millions of homes and business premises, the investment is massive, and capable of transforming the services available. It is a once-in-a-generation change in capability, with the potential to enhance significantly the economies of those countries which get it right.

The Australian government has addressed the problem through a decision to commission the NBN, partly financed by public funds, and capable of providing 98 per cent of the population with a minimum 12 Mbps service within five years. This would be an ambitious project in any country, but is even more so in Australia given its size and its low population densities outside a handful of major cities. It is therefore crucial that this project be designed to maximise the benefit to the economy and to society as a whole. A possible way of thinking through the regulatory problems involved is set out below, based not only on Australia's experience and strategies, but on that of other countries too.

There is a hierarchy of questions concerning the future development of the access markets which has to be considered for each group of geographical markets based on their differing competitive conditions. In particular, where there is already a duplicated access infrastructure, a different approach is required from that used in areas where there is only one network.

Of course, it would be possible to jump over this process and conclude that the outcome will be a fibre monopoly everywhere, augmented by a number of wireless options.[1] If such a policy is adopted, or even if such a forecast is made, it is highly likely that the accompanying regulation will make it self-fulfilling. This reflects the fundamental truth that, just as regulation reacts to market structure, so market structure reacts to regulation. In other words, opening up a network is likely to deter competitive investment. This point has been elaborated in a recent paper which investigates the relationship between access regulation and investment on the basis of data covering a panel of 180 European telecommunications firms over 10 years (Friederiszick, Grajek and Roeller, 2008[2]). It concludes that stronger access regulation has little effect on incumbents' investment but reduces significantly that of entrants. In other words, regulators are controlling a lever which can be used to encourage competitive investments or to discourage it.

The opportunity cost of accepting the inevitability of NGA monopoly is the chance to establish high levels of infrastructure competition, at least in some geographies. How high is this? It is obviously the product of the possibility that competition will emerge, and the value of it, if it emerges. Both of these are hard to establish. However, for the purposes of this analysis it is assumed that both magnitudes are large enough to make the exercise worthwhile, and my own view is that the benefits of infrastructure competition are very large indeed, in both static and dynamic terms.

Accordingly it is useful to distinguish three different geographic areas – which are:

a. potentially competitive
b. probably monopolistic, but where NGA investment can be commercially justified
c. non-commercial.

These will then be linked to three types of regulatory approach:

1. forbearance from access regulation
2. mandatory access to a dominant NGA
3. mandatory access to one or more collectively dominant NGAs in a geographical market.

Each of the geographies is discussed in turn in the following section after first defining an NGA.

2.3 Competitive environments

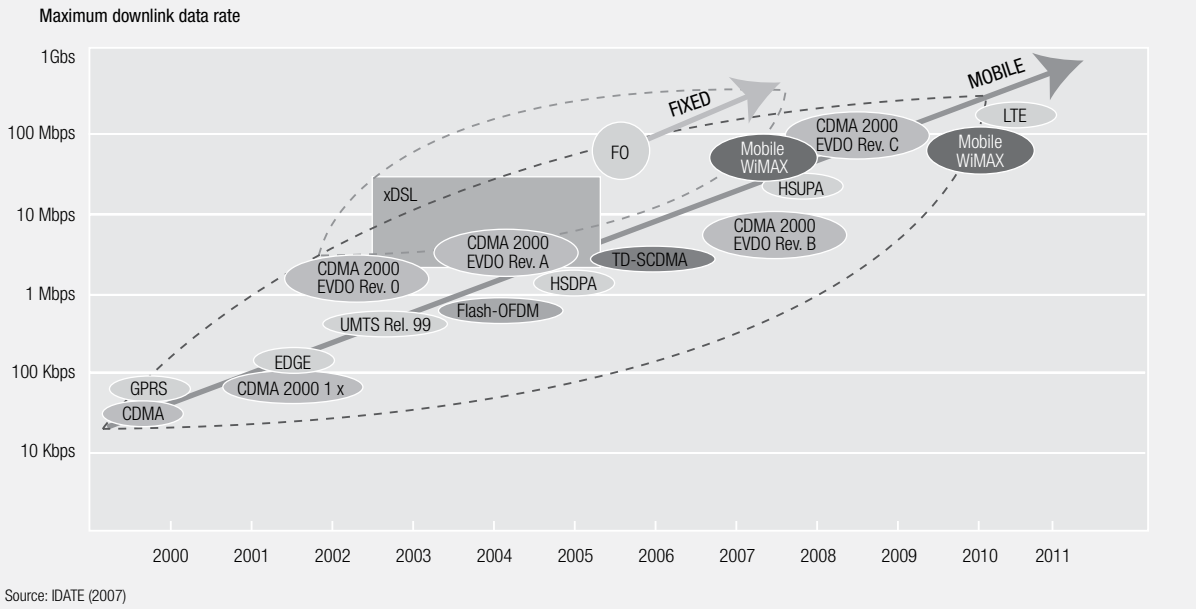
2.3.1 What is an NGA?

For simplicity, NGA is defined as an access technology which can support high-speed broadband, say at 40-50 Mbps download speed. This would have to be an expected speed, or one achieved at least 50 per cent of the time. Including mobile broadband in such comparisons is particularly difficult because the whole network, down to the device, is shared among users and actual speeds can vary considerably.

On this footing, the universe of NGAs might include:

- fibre to the home/premises networks (FTTH/FTTP)
- fibre to the cabin/node networks (FTTC/FTTN)
- upgraded cable networks (for example, using the DOCSIS 3.0 standard)
- fixed wireless networks (using, for example, fixed WiMax)
- mobile wireless networks (for example, 3G, LTE, mobile WiMax).

FIGURE 1:
MAXIMUM DOWNLINK DATA RATES OF VARIOUS TECHNOLOGIES



Source: IDATE (2007)

Figure 1 contains a projection of speeds up to 2011. This projection suggests the following hypotheses:

- fixed networks are on an order of magnitude (up to 10 times) greater than mobile networks
- mobile speeds lag behind fixed speeds by three to four years
- 1 Gbps is quite practicable with a fixed network (eg the Singapore high-speed broadband currently being tendered is based on upgrading all premises to 1 Gbps)
- mobile speeds in excess of 100 Mbps are projected from 2009, when the first LTE networks are projected to come into service.

With a time horizon extending to 2012, it might seem appropriate to treat mobile networks as part of what are currently conceived of as NGAs. We must recognise however, that although wireless technologies will soon achieve the 2008 version of high-speed broadband, they are likely still to lag behind fixed technologies. The entry of higher speed mobile networks will also depend on government spectrum policies, particularly concerning the use of the spectrum to be released by free-to-air analogue broadcasters once the transition to digital transmission is complete (the so-called digital dividend). On this basis it may be preferable to see mobile networks as a competitive constraint on fixed networks, even if they are not formally considered to be in the same market.

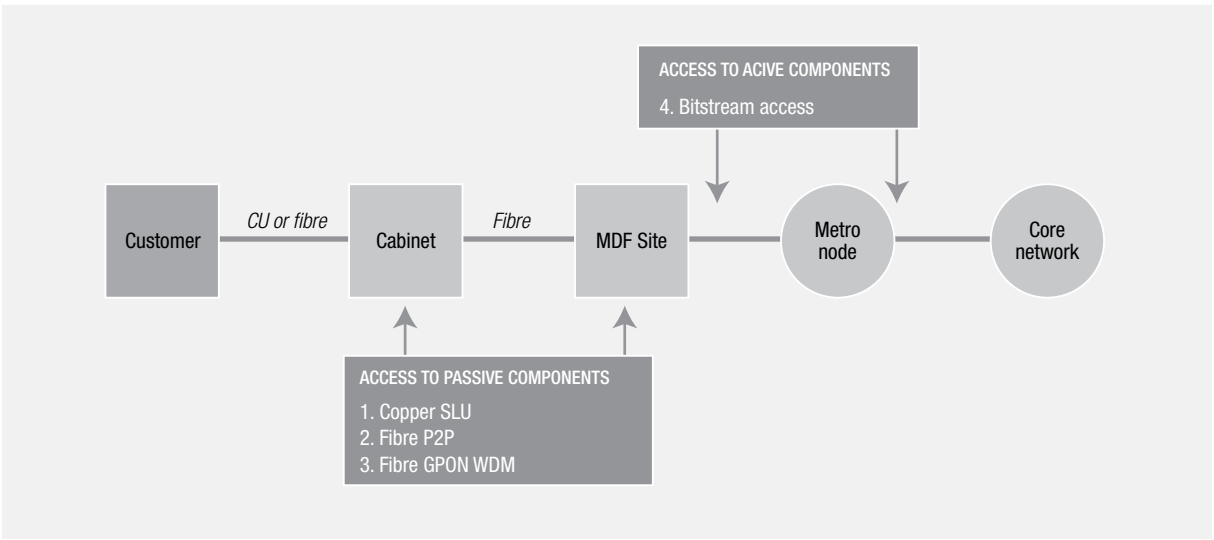
In many countries, a significant proportion of households (amounting in Australia to over 30 per cent) has actual or potential exposure[3] to both upgraded cable-TV and DSL (direct subscriber line) technologies. A very much smaller proportion has access to competing fibre-based suppliers.

As a rough generalisation based on international experience, the competitive dynamics in some areas appear to lead to a race to roll out NGAs. In other areas, including those which lack a cable- or other infrastructure-based competitor using an earlier technology to fibre, rollout is slower or non-existent. If policy and regulation are trying to replicate elsewhere the out-turn in competitive markets – as often they are – this provides some justification for policies to promote investment in NGAs, whether by public subsidy as in Australia, or by regulatory measures, as in much of Europe.

Underlying the need for a different regulatory approach between competitive and monopoly areas is a key difference between them in the application of net present value methods to appraise investments. In a monopoly, replacement of an existing technology is governed by the condition that the total additional costs (fixed and variable) of the new technology must be less than the sum of the variable cost of the old technology and incremental revenues which the new technology brings.[4] If this condition is not fulfilled, the monopolist may well choose to 'sweat' the existing assets. In relation to the replacement of copper by fibre in an access network, this formula can be expressed as:

Annualised costs if fibre < operating cost of copper + incremental revenue from fibre

FIGURE 2:
POINTS OF ACCESS TO NGA NETWORKS



In a competitive market, the right-hand side of this relationship is augmented by two more terms: the sum of revenue gained from competitors as a result of the investment and revenue protected from competitors by the investment.

The change this can make is illustrated by the conduct of KPN, the historic monopolist in the Netherlands. It was losing a significant percentage of subscribers annually to upgraded cable companies, until it became the first incumbent in the European Union (EU) to install an NGA in almost all its territory. In Europe, similar competitive investments can be found in parts of France, in the Nordic countries and in some areas of Eastern Europe. In the United Kingdom (UK), BT has recently announced a modest investment program in NGA. This followed a decision by Virgin Media, the cable company, to market its services on the basis of offering high-speed broadband in almost all its coverage area. This competitive dynamic is lacking in those areas of Australia where Optus has competing cable infrastructure.

2.3.2 Policies for competition

In areas where an investment race is in process or could be stimulated, what regulatory policies are available? The answer to this question is, of course, dependent upon the geographical market definition. A national market definition is far more likely to produce a dominant operator than a geographical market confined to competitive areas.[5] In the latter case, single-firm dominance may or may not be found. If it is not, then regulation is probably not appropriate.

Where competition between infrastructures is present but not effective,[6] the choice of regulatory remedy involves a trade-off between the objectives of service and infrastructure competition, and between short-term and long-term benefits to end-users.

It is tempting to project the results of Friederiszick *et al* (2008), noted above, to the NGA world. This would involve assuming that to impose rigorous forms of access on the first fibre network to be built is likely to discourage investment.

Moreover, it is well-known that NGAs permit more limited access to the physical network layer than current generation networks, but at the same time, the connectivity services which can be provided on NGAs provide more scope for access-seekers to differentiate their products than is the case with current generation broadband. The options are shown in Figure 2.

Sub-loop unbundling, at the cabinet, is only applicable for FTTC technologies; it may be technically difficult, and unbundlers face the commercial challenge of recovering their costs from a pool of potential customers served by a cabinet, which is much smaller than that available at a local exchange, where local loops are unbundled. The major alternative – bitstream – can be devised to permit a degree of service differentiation which is currently not possible with bitstream services and which can replicate the autonomy over products which access seekers have on unbundled loops.

In my opinion, in actually or potentially competitive areas, the regulator should consider a range of possible regulatory responses, being mindful of the desirability of promoting end-to-end infrastructure competition. In decreasing order of severity, these are:

- no imposition of mandatory access. If applied to all technologies this would cut off from supply at regulated prices those operators currently unbundling

loops in the relevant areas
- restricting mandatory access to fibre to specified wholesale products, for example, those capable of speeds currently available using DSL technologies. This would give the installer of fibre exclusive access to higher speeds, unless it agreed on commercial terms with access-seekers. This is known in the UK as anchor product regulation, and one of its by-products can be to protect customers of existing unbundlers from any inevitable disturbance of their service as fibre replaces copper
- imposing mandatory access obligations, but at prices which are more flexible than those flowing from the long run incremental-cost approach widely applied in current regulation
- incorporating a risk-related element in the cost of capital when settling access prices, the approach apparently favoured by European Commissioner Reding (p7, 2008).[7]

In cases where regulators encounter a situation of potentially effective competition in the NGA-based access market, it is recommended they consider some of the variations at the top of this list.

The argument for doing so becomes stronger where two factors are present: first, there is already a competing fixed network which could be upgraded to provide NGA services, rather than just the prospect of the construction of a new access network; and second, wireless services provide a significant competitive constraint on fixed services. As noted above, Optus has a competing cable network passing approximately 30 per cent of homes in metropolitan areas of Australia, including some of the most attractive potential customers for NGA services. An opportunity is lost if, in the run up to the deployment of NGAs, regulatory settings are not adjusted to maximise the competitive pressures in these areas.

As to wireless, in Australia there is already one network offering wireless broadband at speeds higher than are available almost anywhere else on the planet. This has provoked, or appears to be provoking, a competitive response from Optus, Vodafone and 3. The almost universal availability of competing high-speed wireless broadband networks will place Australia in a highly advantageous position in the provision of high-speed broadband.

2.3.3 Regulating monopolies

It is almost inevitable that, outside the few countries with the historical legacy of ubiquitous cable networks, many parts of most markets will be served by a single-wireline NGA. Their extent may diminish over time, but the level of population served will still be significant. What regulatory regime will promote the replacement of copper with fibre where it is viable?

The problem here is that, in the absence of competitive pressure, operators may choose to delay the installation of fibre even when a fibre network has a positive expected net present value as compared with maintaining the copper network in place. This is because delaying the installation of fibre until uncertainties are removed has an option value to the investor from which it has to be bought out by higher returns.

The access regime has two effects on an access provider's profit – a low access price restricts its revenues directly, and it puts a squeeze on retail prices generally, as competitors buying access products from the incumbent bring down retail prices. On the other hand, the evidence from the study cited above is that in the past in Europe the access regime has not affected incumbents' investment levels.

There is thus an apparent conflict between the *a priori* proposition that a tough (eg a cost-based) approach to pricing mandated access can harm investment and the empirical evidence in Europe. Placing greater emphasis on the latter would encourage regulators to adopt a cost-based approach with fibre. Placing faith in the former would lead them to offer incentives for investment in the form of departures from traditional cost-based access pricing of the kind listed in the previous section.

Whether the evidence of the past response of incumbents to access regulation provides a reliable guide for the future is uncertain given the very different nature of the task incumbents face in building an NGA. Their past investments in the PSTN infrastructure have been significant but incremental to a network which was already largely deployed during monopoly periods before an access regime was instituted. The NGA will involve the construction of a substantial new network to replace the current network.

However, the Australian case partly sidesteps this debate. Under the NBN plan, the Australian government is solving the problem of bringing the initial investment forward by making a co-investment with public funds. However, this will cover only part of the total outlay, since the specification in the proposal – to provide a minimum 12 Mbps service to 98 per cent of the population – only scratches at the surface of the capability of high-speed broadband.[8] This means that substantial further investment will be required, probably from the private sector. Incentives to achieve this in a timely fashion will have to be provided in the regulatory system.

Even in areas where there is unlikely to be a competing fixed NGA, regulators will need to re-evaluate their current approach to access regulation. While effective downstream competition will depend on the availability of NGA products which permit access-seeker

product differentiation, applying current access-pricing approaches, in particular, may adversely affect investment incentives. The UK regulator, Ofcom, is exploring both a shift away from strict cost-based pricing and the provision of upfront commitments on regulated access pricing to reduce uncertainty.

Again, while not providing a close substitute, the competitive constraint of broadband wireless also should be kept in mind. In Australia, Telstra, Optus and Vodafone have, or will shortly achieve, coverage which approximates the 98 per cent coverage required by the government for the NBN.

Finally, the construction of an NGA in a monopoly area – as in a more competitive one – can be encouraged by giving the access provider and potential access seekers the right to construct a risk-sharing contract. This might take the form of co-investment (like the proposal by eight operators in Australia to build a national NGA), but such plans may founder on disagreements. More plausibly, an access-seeker might enter into a long-term contract with an access-provider for a quantity of access services on a 'take-or-pay' basis. Such an access-seeker would expect to benefit from a quantity discount or an adjustment to the price to take account of its assumption of some investment risk. Unregulated arrangements of this kind are fairly commonplace in other sectors. But they impose a challenge for a regulator to establish if they are discriminatory; that is, to verify that the prices and quantities in the contract market and in the spot market do not advantage one or other class of purchasers.

2.3.4 Policies for non-commercial areas

In significant parts of the land area of Australia, inhabited by a much smaller proportion of the population, there is no commercial basis for a single NGA. Reducing costs and increasing demand will shrink this proportion, but it must be well in excess of the 2 per cent outside the coverage target of the NBN.

Australia has a widely praised commitment to ensuring universal service in voice telephony, and the NBN can be seen in some ways as an extension of this to broadband[9] – to be provided at a rate which outstrips the only other national broadband universal service obligation of which I am aware – the obligation on Swisscom to provide a 600 Kbps service.

It is highly desirable that this commitment be fulfilled in a technologically neutral way – both to keep costs down and to use public funding to provide the best service possible. A competitive tendering process can be deployed to produce this outcome. This would involve a reverse auction to provide either a wholesale or a retail service of a specified speed and quality at a geographically uniform price. Alternatively, if it is known in advance that a particular spectrum frequency is best fitted to provide the service, the competition to find the universal service provider can be embedded within a spectrum auction. This would mean that a single licence would carry with it a coverage, service and pricing obligation (Cave & Hatta 2008; Wallsten 2008).

Both of these approaches involve a subsidy to the producer. The other approach is to subsidise end-users, for example by distributing in selected areas vouchers which offer a reduction in the price of high-speed broadband. In principle, such a system can increase demand to a level which makes construction of a network a commercial proposition, while at the same time (assuming that access to the network is mandated) enabling retailers to come into the market to make competing offers. There are, however, considerable difficulties in calibrating the scale of the subsidy, as well as other issues common to the use of vouchers in other circumstances.

2.4 Separation issues

Part of the Australian debate over the NBN concerns whether it should be separated in terms of ownership or operation from other related activities – notably retailing and the operation of the core network. My views on this matter are set out elsewhere (Cave 2008) and the conclusions are summarised below.

As regards the policy context of the NBN in Australia, there is good evidence from other sectors that integration enhances efficiency. Certainly this might be counter-balanced by adverse effects delivered by vertical leveraging of market power, but clear evidence of such effects must be present to overcome the presumption in favour of integration created by the efficiency benefits it appears to bestow. However, there is scant evidence, based on the reports provided to the Australian Competition and Consumer Commission (ACCC), that non-price discrimination, which has been the justification for functional separation in the UK, is a problem in Australia, or that it is a problem in Australia of the same scale as it was in the UK.

Turning to forms of separation and their consequences, it is clear that imposing separation is a strong remedy, and quite distinct from voluntary separation. Moreover, the opportunities for facilities-based competition and technological change in telecommunications (even in areas where the prospects of facilities-based competition are considered low) make

it more difficult to identify enduring bottlenecks for the purposes of boundary drawing in separation models compared to other networked industries. Also, separation creates challenges in the co-ordination of both operational and investment decisions. Because telecommunications networks – whether bottleneck or not – are characterised by the need for continuing re-investment, the investment coordination effects of separation can be more troubling than in other network industries characterised by more stable technology. These are of broadly the same nature and scale whether the separation is operational, functional or structural. On this basis, it would be wrong (based in part on the problems with the UK model of separation) to characterise functional or operational separation as a compromise or fall-back option.

Finally, specifically in relation to the NBN, the scale and progressive nature of the rollout makes the investment coordination problem both acute and persistent. As a result, it is highly unlikely that contractual arrangements between separated entities – whether in common ownership or not – could efficiently achieve the deployment and continuing upgrade of the network. It is also significant that, unlike the legacy copper access network, NGAs can be designed to facilitate the attainment by behavioural means of equivalence between retailers affiliated with and competing with the network operator. And the whole point of the exercise is to achieve equivalence – separation is not an end in itself.

A model incorporating integration and effective behavioural enforcement of equivalence is likely to be the best means of achieving the government's objectives in relation to the NBN. On risk management grounds, this is preferable to experimenting with an untested separation method for a project to deploy a large next-generation network to a highly ambitious timetable.

2.5 Conclusion

The main point is that different areas of a country such as Australia require different approaches to the regulation of the NBN. This is implicitly acknowledged in the request for proposals, where proponents are asked to delineate commercial and non-commercial areas. This is the correct approach in that in competitive areas the competitive process should elicit the necessary investment, and any involvement of public funds will inevitably distort competition. In such areas, however, regulation must be crafted to provide appropriate incentives to invest. A generous access regime is not calculated to meet this objective.

Where there is scope only for one wireline next-generation network, and for as long as wireless technologies do not provide NGA competition, the NBN plan can bring investment forward. It must be recognised that the targets in the plan can only be interim ones, and that substantial further investment will be required to raise speeds and possibly take fibre beyond the node to the premises. Regulation must accordingly ensure that such investment is forthcoming. This may entail re-thinking the current approach to mandating and pricing access. Finally, where a single NGA lacks commercial viability, public funds must be expended to provide the chosen level of access. It is important that this be done in a technologically neutral way, and this is likely to entail heavy involvement of wireless technologies.

Imposing a separation obligation of any kind on the NBN is a risky gamble which is unlikely to bring benefits but will very probably delay the project and make it more costly and less effective.

Endnotes

1. The approach to the NBN advocated by the Terria consortium appears to presuppose a legislative monopoly over fibre deployment to the node.
2. Lars-Hendrik Roeller was formerly chief competition economist at the European Commission.
3. The difference arises because Optus chooses to offer service using its own access network service to only two thirds of potential customers within the footprint of its network, preferring to use Telstra's unbundled local loops to provide service to the remainder.
4. The additional cost of a fibre network is, of course, substantially reduced where an operator inherits physical assets and customers from a pre-existing copper network.
5. Of course, if different operators are dominant in different geographical areas, the number of individual geographical markets grows correspondingly.
6. In other words, one firm is dominant in the relevant access market.
7. The Commissioner personally favours a risk premium around 15 per cent.
8. Thus the Singapore government is commissioning an NGA capable of providing 100 Mbps to every home and business in the country.
9. With the difference that under the NBN, subsidy would come directly from the taxpayer rather than through industry levies, as with the current voice USO.

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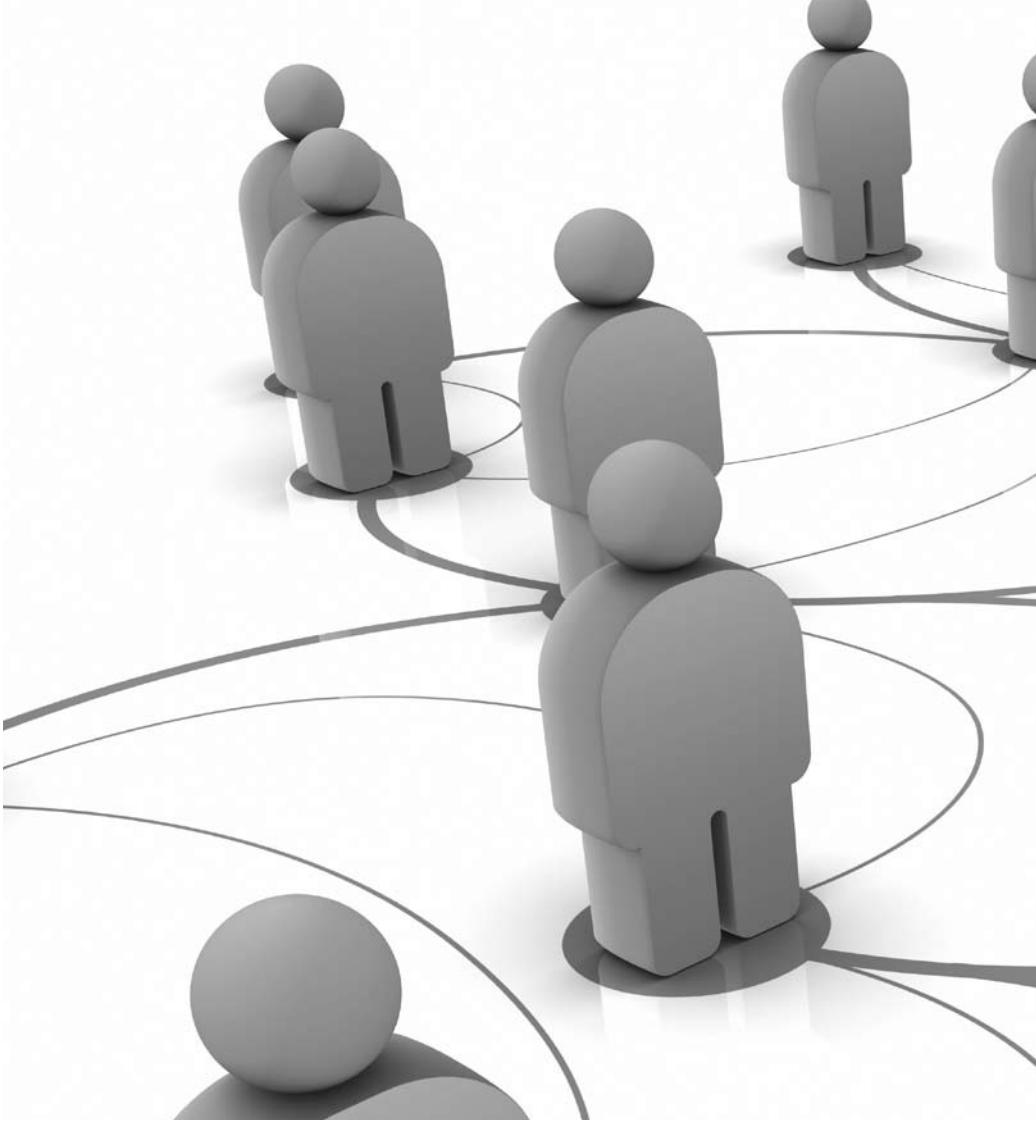
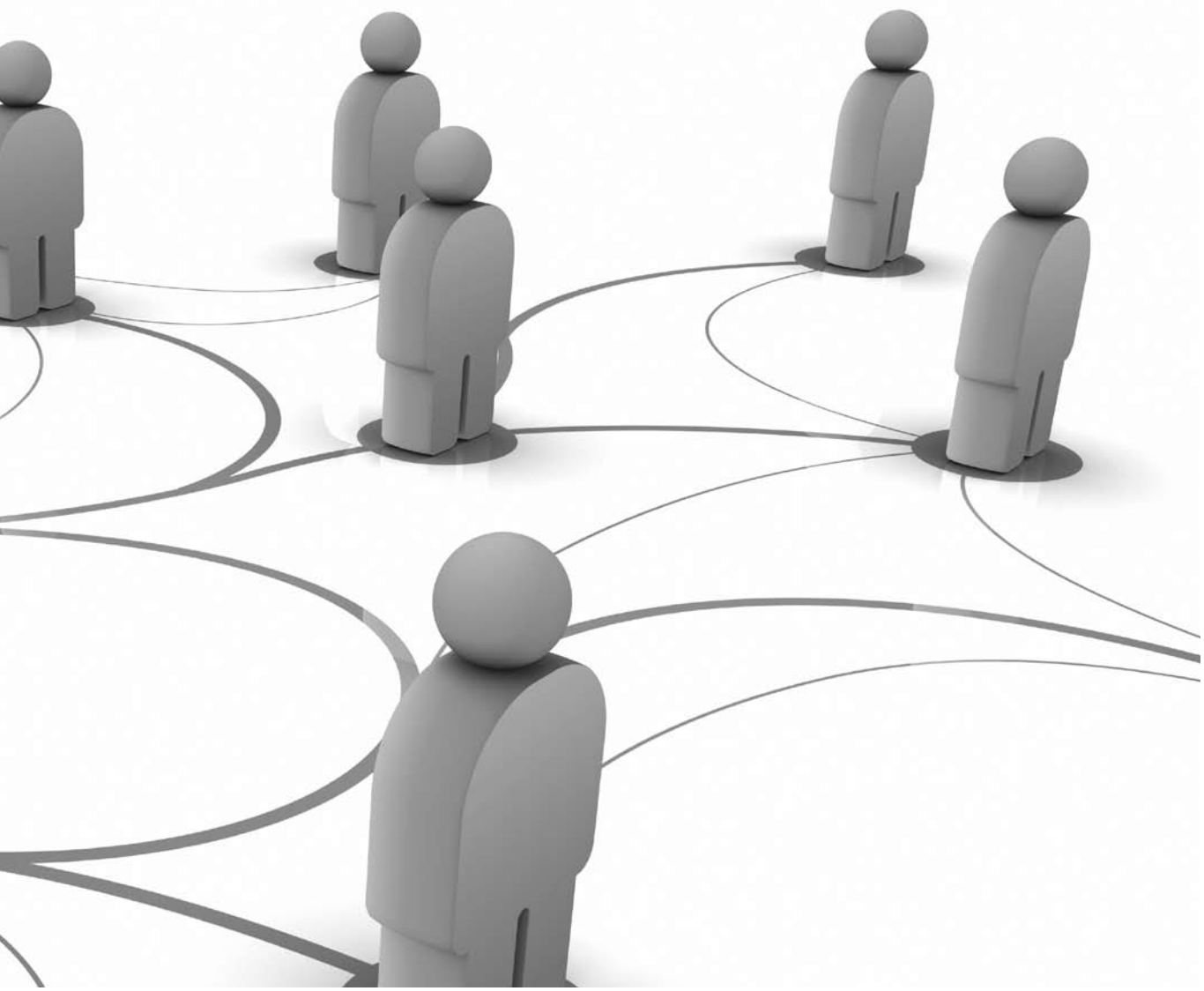


3 Creating an efficient national broadband network



3.1 Introduction

In 2006 CEDA commissioned a study entitled *The Local Broadband Imperative* to examine the issue of the next generation of broadband in Australia, its economics and the best way to encourage investment in it. That report argued that broadband needed many local solutions, not a single national solution. It documented how the technologies, user requirements and the investment costs associated with providing broadband vary considerably across localities. This reality stood in contrast to many proposed solutions based on national strategies far removed from local circumstances.

The analysis led to several conclusions. The first was that then calls for universal service obligations to be imposed on national broadband providers were misplaced and likely to be costly in terms of reduced competition. Instead, what we need are local service obligations and a vesting of responsibility with local bodies to find and adopt solutions for improved broadband.

Second, the report argued that calls for protection of investors from competition are also misplaced and will likely result in higher costs to end-users. Local bodies such as councils could, alternatively, use the power of competitive tendering to drive those costs down or to encourage multiple local providers. In areas with sufficient demand for broadband services, that competition could be sustained.

Finally, where there were areas in Australia not receiving minimally acceptable internet access, the federal government could continue or expand the use of targeted subsidies.

The goal of the policies advocated in the 2006 report was not to compel local councils or other organisations to make broadband investments. Instead, it was to give them the ability to decide whether those investments should be made. The call was for mechanisms to ensure that the efficient path for investment is followed, whether that involves a 'big band' catch-up with other advanced economies, or a gradual rollout of broadband across Australia trading off local needs and local conditions. The issue for Australia is that no such mechanism exists.

Two years later, it continues to be the case – no such mechanism exists. However, we do now have a clear government policy in place that sets out some key investment parameters. The purpose of

this chapter is to examine that policy and to highlight some of the issues the government faces as a result of not choosing a mechanism that would allow for other investment paths to be considered.

The federal government proposes to invest up to $4.7 billion in a new National Broadband Network (NBN), based primarily on fibre (at least to the node and perhaps beyond) being rolled out within five years to at least 98 per cent of the Australian population. The download speed is required to be at least 12 Mbps while upload speeds should be sufficient to allow video-conferencing. The government proposes to engage in a public–private partnership for the delivery of high-speed broadband services and so seeks to earn a return on its investment.

There are several features of this worth commenting on. The first and most obvious given by the 2006 report is that the proposal is for a *single* national solution. It is worthwhile highlighting once again the problems associated with that and how they are affecting the government's implementation of its policy. Second the policy involves a clear technological preference. One issue of concern back in 2006 was that different localities would likely require different technologies to deliver broadband. Once again, this reliance on a single technological solution is creating issues for the government in implementing its policy. Third, as noted in the 2006 report, there are important regulatory issues surrounding broadband. Those issues remain and are currently a major impediment to the implementation of broadband investment. Proposals are offered as to how those regulatory impediments might be overcome in an efficient manner. Finally, broadband is not simply about the basic infrastructure. To provide value to consumers there are other parts that require attention – most notably, broadband applications. This is something highlighted as a key priority in the Cutler Review of the National Innovation System which is a welcome emphasis by the government (Department of Innovation, Industry, Science and Research 2008).

3.2 Do we need a single national solution?

The first assumption in the government's proposal is that the broadband network be national. Importantly, that does not mean that there is a single provider nationally. The tender allows for bids to provide the network in just a single state with other states being covered by one or more providers as the case may be. This is a positive move although it is not clear why a state rather than a local area is the appropriate economic unit. Local areas have particular needs for which tailoring might be desirable. They also have different cost structures in deploying new technologies. All this might warrant a more disaggregated approach and by allowing providers to operate at a local level, more competition both for the market (in the tender) and in the market (later on) might be possible.

However, there is another issue with regard to having a national solution: do we need high-speed broadband everywhere and to every location? On the demand-side, a ubiquitous network can stimulate development of applications that leverage that network. However, much of that already comes from the existence of such networks around the world. It is much harder to identify lost opportunities for Australian-specific applications. If these were identified then surely it would be better to subsidise their development directly and use their success to stimulate the demand for broadband and its investment.

Moreover, to the extent that businesses that rely on high-speed broadband already have location options within Australia, that does not necessarily equate with the notion of providing that capability for every location. From that perspective, a tail is wagging a very large dog.

On the supply-side, while there are issues in overall network management, the nature of the internet allows for interconnectivity and so it does not need to be centralised. Instead, the investment required is kilometre by kilometre, dwelling by dwelling. Thus, there is little in the way of national or state-based scale issues.

Much has been written about the potential economic benefits from broadband and an oft-quoted figure is that it will yield between $12 billion and $30 billion in economic benefits to Australia each year.

BOX 1:
THE SOURCE OF THE ESTIMATE

Peter Martin, then a journalist at *The Canberra Times*, investigated the source of the $30 billion broadband estimate (Martin 2007). He discovered that it was stated originally in a 2003 report of the Howard government's Broadband Advisory Group. That report does not estimate the economic benefit itself but relies upon a 2001 presentation by Accenture which was not available online or elsewhere.

Martin obtained a copy and found that it had to do with basic, not high-speed, broadband and that, in effect, it appeared to be based on scaled-down US estimates.

Box 1 notes that there are doubts as to the validity of those estimates. These estimates have been publicised by Telstra (2008) among others. However, recently, Telstra appeared to have dramatically revised its estimates of the value of broadband. In August 2008, Telstra's CEO stated that delayed broadband investment was costing the Australian economy $200 million a month in lost GDP (about $2.4 billion per year). This is far less than the previous estimates and given the large government investment, and from an economic point of view, it is important to determine whether a proper cost–benefit study has been conducted (either within government or industry). Those benefits could be there, it could just be that they have not been appropriately quantified in a rigorous manner.

The concern is that the government is cutting off options for tailoring and economising based on location. Even in expressing the goal of a national network, it need not do this. As discussed below, building in inter-operability at as many points as possible on the network can allow for local options and solutions, and stimulate competition and entrepreneurship.

3.3 Should we be relying only on fibre?

While the backbone infrastructure of the internet is optic fibre, there are currently four means of taking that data into households. They are:

1. copper
2. cable
3. wireless
4. fibre.

The current plan is to have fibre at least to the node and then to use copper from that point on.

This is too restrictive a prescription. For example, cable can deliver speeds and does deliver speeds up to 40 Mbps without degradation as the cable is further from exchanges. Wireless technologies are improving constantly. Telstra's NextG wireless network is capable of speeds up to 14 Mbps but there are developments that suggest speeds in excess of 100 Mbps are possible on the existing spectrum (Kohler 2008). These technologies may not be technically superior to fibre; however, given the savings in the cost of a new rollout, they can be economically superior to fibre.

Add to this potential changes in how users access the internet, and the 'picking technological winners' issue becomes even more stark. This year Apple has sold more than 10 million iPhones around the world. The iPhone stands out because it has changed the way mobile-phone users access the internet. For straight-out browsing, it is the most popular mobile device despite its relatively low penetration overall. In addition, within homes, users have opted for wireless (through WiFi) access rather than wired solutions. And device designers (for example, for game consoles) are increasingly building only wireless access options into their products. This suggests consumers might have a preference for lower-speed wireless access than higher-speed wired access.

What this means for the National Broadband Network is that interoperability between different technologies should be a key criterion. At various points from the exchange to the home, it should be possible for alternative means of providing that service into the household to be connected. For instance, a WiMax tower could be built on an exchange or a business could interconnect with a node to bring WiFi services to a number of dwellings at once and manage their network for them. To be sure, we do not know whether this is possible or economic everywhere. But we do not know this yet about fibre either. And, by being prescriptive, we deny ourselves the possibility of finding out.

3.4 What sort of regulation do we need?

There is a strong possibility that the proposed National Broadband Network will be the dominant mode of delivery for high-speed and perhaps basic broadband services in Australia. Consequently, as it will not be under competitive pressure to actually generate value for users, its price and other conditions will need to be regulated. The question is: what will the nature of this regulation be?

If this were a purely greenfields investment, the regulation could consist of a price to consumers ($x per month) for a service with a minimum broadband speed. That price would drive the rate of return of the investment (both to the private provider and to the government).

However, we are not starting afresh here. In particular, any provider proposing a fibre to the node network will also need access to the copper tails of Telstra. Moreover, this type of provider, as well as those proposing a fibre to the home network, will need access to backhaul services from the exchange. Clearly, this is less of an issue for existing providers and, in particular, for Telstra for whom no access

arrangement need be negotiated. In addition, if an access arrangement did have to be negotiated and regulated, experience from other sectors (eg airports) shows that this can take up to seven years to resolve itself through the legal system. There is a risk of major delay to a rollout from this.

In this regard, possibly the key bottleneck will be to ensure open access to the conduits which house the fibre along our streets. These need to be placed under public control to ensure any provider can access them for infrastructure and maintenance. To do otherwise is to invite regulatory delay and cost.

The federal government should favour proposals that allow for a competitive approach to regulating prices and product quality rather than ongoing regulation. In this respect, access regulation should be transparent and simple. The government should view itself as designing a market rather than a regulatory bureaucracy and process.

The key to this is to allow competition to occur as much as possible. As a first step, any regulatory structure should ensure that the existing basic broadband and ADSL services can still be supplied by their current providers. That is, back-stop competition must be possible. While this might mean that this is done in full or in part with new infrastructure, this should be a basis for ongoing competition with the new high-speed network and provide some constraint on prices for a given period of time (eg five to seven years).

Of course, if the provider is an incumbent with a dominant share of market, some additional regulation might be needed to ensure back-stop competition from existing services. In the UK, the notion of 'anchor product regulation' has been argued to provide this purpose (de Ridder 2008). Under this form of regulation, the basic broadband products of the provider (eg up to 2 Mbps and 3 GB per month downloads) are regulated at a fixed monthly fee. However, that is the only product regulated. This gives consumers the choice of a standard option but also freedom to price on other options, including those at higher speeds. It is a simple means of regulation that can be ongoing and allow the rest of the market to flourish.

As a second step, interoperability should be built in. This would allow other providers – especially as technologies emerge – to connect into the NBN and compete with it on an infrastructure basis. This interoperability should exist at the exchange, node and street. Moreover, the basis for pricing to the remaining parts of the network should be the efficient components pricing rule that compensates the provider for ongoing costs of accessing the network and lost profits from customers it will no longer supply. While this rule can be abused in unregulated settings, so long as there is sufficient back-stop competition from existing services or anchor product regulation of those services, it can be appropriately applied and utilised.

Finally, there are concerns that whoever provides the NBN may have their returns challenged as a result of competitors building alternative networks that compete with them. While it is true that infrastructure returns may be affected negatively by competition, the competitors themselves will have to earn a return on their investments in order to compete. Consequently, over-build is only a real concern if it is profitable for competitors, and if it is profitable for competitors it should be profitable for a provider who is at least as efficient in the market. While over-build might require some flexibility in pricing across different localities and regions, it is preferable to allow this than to restrict over-build directly. Multiple competing networks should be seen as a positive outcome in this process.

In summary, it is possible to regulate the NBN so as to allow the option for competition to flourish in the future. To achieve this government must:

- mandate open access to the conduits
- ensure back-stop competition or anchor product regulation of basic broadband services
- build in interoperability so that connections by alternative providers are possible at the exchange, node and street
- resist restrictions on competition under the name of preventing over-build.

3.5 What other investments should be made?

The NBN provides for the infrastructure for high-speed internet connections. However, that does not necessarily create demand for such connections. Indeed, evidence from Japan and South Korea, where fast internet connections are available, suggests that where there is demand it is mainly for video downloads and gaming.

The recent National Innovation review recognised that there was a gap between the government's broadband investment and applications to utilise it effectively:

> With the National Broadband Network, Australia needs to ensure that the relevant applications – specific to local needs – are developed to leverage that infrastructure for the purpose of

> government policy. This includes applications in open democracy, database and privacy standards for health information, tools to facilitate educational use of broadband, traffic systems and standards, and national collections of information and knowledge. (Department of Innovation, Industry, Science and Research 2008)

This is a welcome call for the federal government to complement its infrastructure investment on two fronts. First, it needs to encourage applications that leverage the network. These could be in e-health, e-education or video-conferencing (that might save on commuting costs). In each of these, active reviews of government legislation, information assets and policies need to be taken to ensure there are no governmental bottlenecks to the development of such applications (eg medical liability laws preventing off-site health diagnosis and treatment).

To explore this further, consider e-health. Usually, what is envisaged is a surgeon in Sydney operating on a critically injured patient at some outback station. However, it is far more likely that e-health will be most critical for the routine and mundane medical issues rather than the most specialised and exceptional. Consider the following scenario: your child has a sore ear at 6pm. Panadol and other pain treatments have not been doing much good. Without broadband, you would have to take the child (and perhaps other children as well if there is not another adult around) and go to the doctor. That time is out of hours and the waiting time is much longer. If lucky, you are back home by 8pm with some antibiotics (if the ear is infected) or perhaps some reassurance (if it is not too bad).

With broadband, you might do something different. You login and email your complaint to a GP online. They then ask you to take the child's temperature and also to send them a picture of the inside of the ear using a device. The GP then diagnoses the illness and emails a prescription to the pharmacist. Then you leave the house for 15 minutes to pick up antibiotics or you can have another adult do it. All done by 6.30pm with minimal disruption to you and the GP. And what is more, at no time in this story did we need high-speed broadband to get all of this.

Why isn't this service being offered? The technologies exist to transmit the relevant information to doctors at a low cost. The problem is that the liability laws and health regulations (including Medicare reimbursement) do not envisage this situation and stand in their way. Clearly, this is a low-cost way for the government to stimulate innovation in this regard.

The second complementary investment involves computers themselves. The government needs to investigate the price of computing equipment that households need to access the new network. Computer equipment in Australia is priced substantially higher than in the US and Asia, for example. It has persistently been this way. However, if this pricing is not competitive, the acquisition of a computer will prove a constraint for many lower-income households in utilising the broadband network. And if this occurs, they will be paying for the network through their taxes but not gaining any of the benefit.

3.6 Conclusion

Clear constraints are emerging in the implementation of the government's proposed National Broadband Network. By respecting fundamental facts about the nature of broadband demand and supply, the government's policy can be adjusted and those impediments removed to a large degree. There is opportunity to allow for multiple providers, to improve interoperability requirements so as to avoid picking technological winners, and there is ample room to design a regulatory framework that substitutes for a lack of competition and otherwise does not stand in the way of competition emerging in the future. Finally, regardless of implementation, the government needs to focus on efforts to provide applications and hardware so that users can utilise the new broadband infrastructure efficiently. Only by addressing these issues head on can Australia move ahead on broadband.

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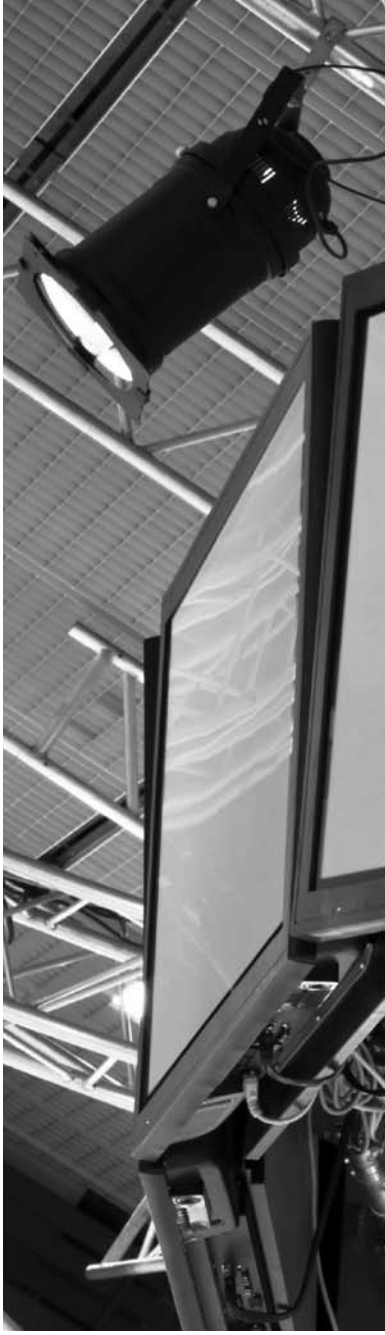
Dr Eric Kodjo Ralph began working as a professional economist in the early 1980s. In 1985 he joined the Finance Directorate of the then Telecom Australia as one of three economists. He played a key role in developing the Directorate's involvement in economic and regulatory strategy. In 1988, he became a Research Fellow and founding member of MONICT, an information and communication technology think-tank at Monash University. He began consulting at this time and has since worked in a range of industries, most notably electronic communications, but also electricity, natural gas, broadcasting, insurance, airline services, harbour towage and railways. In 1990 he undertook a PhD in economics at Duke University, and in 1995 began teaching in the Graduate Telecommunications Program at George Washington University. In 1998, he joined the Network Economics Consulting Group (NECG), also serving on its executive board over 2000–01. Since 2001, he has formally been associated with his own company, EKonomics LLC, but has continued to work extensively with NECG and its successors, CRA and now Concept Economics.



4 A policy framework for a new broadband network

Note: Henry Ergas and Eric Ralph have both worked, through Concept Economics, for Telstra Australia. The views expressed here are not intended to represent those of anyone except the authors.

4.1 Summary

While there are at least seven full facility-based broadband competitors in Australia, competitive facility-based *fixed* line investments appear to be declining in favour of the use of Telstra's network. It also appears that no carrier is presently willing to make significant fixed broadband investments without substantial regulatory commitments and protections relative to those currently available.

Because of its frustration with the present lack of broadband development, the Australian government has announced it is willing to spend as much as $4.7 billion to facilitate deployment of a National Broadband Network (NBN) with open wholesale access at a uniform price to reach 98 per cent of Australia's population (Conroy 2008). This chapter reviews the government's tender in the context of how regulatory policy can obtain efficient rollout of, and ongoing development and use of, next-generation (broadband) networks (NGNs).

Section 4.2 examines the factors that may be driving carriers' current unwillingness to invest. It finds that a commitment to fixed broadband networks, which requires substantial sunk investments but promises highly uncertain returns, is unlikely when regulatory discretion is broad and expected to be widely exercised. Instead, if efficient investment in NGNs is to be forthcoming, a strong and credible commitment to minimal regulation – including regulation of access – is called for. The general characteristics of NGN supply reinforce this conclusion (section 4.3). In short, anything more than minimal regulation of NGNs will materially harm efficient service development and network use.

If minimal regulation is necessary to ensure efficient incentives to invest in an NBN, this raises concerns about whether an NBN provider (or providers) might engage in efficiency-distorting monopoly practices. Section 4.4 finds that if regulation must be imposed to address that harm, then wholesale price caps have some merit. That said, the uniform pricing conditions of the government's tender, when coupled with anchor pricing, will also effectively constrain monopoly pricing. In that light, we propose an approach to anchor pricing that addresses the issue of changes over time in the relevant anchor service. Section 4.6 considers the risks of vertical discrimination, but also finds that these are too easily overstated, as are the net benefits of imposing operational or vertical separation.

Section 4.7 concludes that none of this implies the government's tender is a sensible idea. It might well be better to simply fix the regulatory regime and then let investment decisions flow (including the decision about whether to deploy fibre-to-the-node [FTTN]). Any concerns about universal service could then be dealt with by transparent means, such as a transferable voucher scheme. In contrast, the government's approach unnecessarily runs all the risks of 'picking winners'.

4.2 Robust commitments not to expropriate

The chief contention of this section is that a robust commitment to light-handed regulation of NGNs is critical to the development and use of NGNs, and hence the deployment of an NBN. The fundamental reason for this is that NGN deployment requires substantial long-term sunk investments, and this leaves investors vulnerable to regulatory holdup – a problem the present regulatory regime makes especially acute.

Section 4.2.1 outlines the problem that, despite broad entry, investment – both in the current fixed network and most especially in fixed NGNs – has been weak, primarily because investors do not expect to earn a return that would justify the costs and risks of NGN deployment. Of particular importance are the substantial risks that arise because NGN investments require costly upfront commitments that, once made, cannot be escaped (section 4.2.2). Such risks create opportunities for holdup, and it is the potential for regulatory holdup that makes regulatory commitments not to expropriate sunk investments vital to NGN deployment (section 4.2.3).

4.2.1 Investment lags despite widespread competition

The range and diversity of active broadband suppliers in Australia (ACCC & ACMA 2007, pp9, 11; Ergas & Ralph 2008, p2) suggest a highly competitive industry. Despite the breadth of broadband competition, when it comes to sunk investments – especially in fixed networks – there are signs of serious problems. Three stand out. First, Telstra appears to be the sole source of growth in fixed-line investments, while competitive fixed-line carriers seem to prefer regulatory access to Telstra's network (Ergas 2008b, especially chapter 3 and section 10.1.3; Cave 2007). Second, a significant part of Telstra's investments may not be market driven, but rather may be forced by stringent service quality requirements and accompanying penalties. However, coercion cannot efficiently induce investment in new networks. Thus, observed investment in all likelihood overstates future investments. Third, and perhaps most importantly, Australian carriers have demonstrated an unwillingness to follow their overseas counterparts in making any significant investment in NGNs without substantial regulatory precommitments (for example, see Burgess 2006; FANOC 2007, notably at p15).

4.2.2 Sunk costs and uncertain returns

At a basic level, this reticence to invest arises because high sunk costs and uncertain future income streams characterise NGNs. Specifically, NGN rollout requires sunk investments in:

- the initial deployment of an next-generation access network (NGAN)[1], as once a new access loop is placed those loops have little other value except to provide electronic communications
- the cost of bringing on new services, including:
  - the transition costs
  - development of customer premise and service provider equipment/software/content
  - future NGAN upgrade costs – for example, from FTTN to a fibre-to-the-premise (FTTP) network
  - market development costs, including the risk of substantial losses before penetration reaches sustainable levels.

While the network provider will largely incur the initial deployment sunk costs, retail suppliers (including the network provider's retail operations) could incur a substantial proportion of the sunk costs of service development.

At the same time, NGN investors face uncertainty about the development of both technology and demand, creating the risk that the large sunk costs of

an NGN will not be recovered. There are three components to this risk:

- Technological developments – for example, in wireless – could lead to low-cost competition that would render some part of fibre investments unrecoverable.
- Realised demand may not turn out to be capable of recovering unsalvageable costs. Future demand is, in large part, unknowable, as it involves services not yet developed and perhaps not yet thought of. This is all the more so as cost recovery is likely to depend on demand for very high-speed services (at 50 Mbps and above), for which there are currently very few applications.
- Once assets are sunk, third parties that have power to hold the project up can expropriate revenues necessary for the investor to recover its costs (Ergas & Ralph 2008, p4).

These technological and demand risks are mutually reinforcing. Thus, the expected returns on underlying and largely sunk network will be influenced heavily by the strength of downstream demand, which in turn will depend on both how investments are sunk to create that demand, closing the circle on the underlying network investments. Moreover, these interdependencies are of critical importance in designing an efficient regulatory regime (see section 4.3).

4.2.3 Sunk costs, regulatory holdup and commitment

The prospect of holdup is highly relevant to regulation of the NBN. The subject of this section is regulatory holdup – that is, opportunistic behaviour on the part of the regulator to force the regulated firm, having sunk its assets, to pass quasi-rents on to third parties such as consumers or entrants (Ergas & Ralph 2008; Gómes-Ibañez 2003, pp2, 3).[2] In particular, the regulator may seek to set prices so low that the firm cannot recover its sunk costs, but still has incentives to continue to operate.

Regulators may be tempted to undertake such expropriation because:

- once the NGN is built, such policies can be claimed to not distort, and even to improve, short-run allocative efficiency, because they bring prices closer to short-run marginal costs (in practice, short-run distortions are likely as inappropriately administered rent transfers induce inefficient entry and consumption)
- cutting prices, at least in the short run, may be politically attractive over the period during which the regulator is likely to bear responsibility for such actions. Voters typically notice and appreciate lower prices, while the costs of resulting short- and long-run distortions will be less well understood. As a result, regulatory under-pricing appears common (on the United States, see Hausman & Sidak 2005, especially the second paragraph of section IV(B) and Crandall *et al* 2004; on Europe, see Gruber 2007; and on Australia, subsection 2.3.1).

The risks of such regulatory expropriation are made all the greater by the inherent uncertainties involved in regulatory cost determination. Especially, though not only, when regulators rely on complex cost models to determine access charges, there is scope for a regulator to claim that conduct that is in fact expropriation merely involves a difference of views as to the appropriate level of recoverable costs. This makes it difficult to write a non-expropriation contract that is verifiable, and hence enforceable.

Actual or even merely potential expropriation of quasi-rents has substantial negative consequences. In particular, any firm that potentially may be similarly regulated (not just the expropriated firm) will hesitate to make new efficient sunk investments. Consequently, to ensure efficient investment incentives, the regulator must credibly commit to not expropriate the firm once an investment is largely sunk.

The risk of regulatory expropriation is particularly high when firms are considering rolling out new fixed-line infrastructure, for two reasons:

1. The more a potentially regulated firm's costs are sunk, the greater the potential losses of regulatory holdup, and fixed-line networks require very substantial commitments to sunk costs.
2. Because telecommunications is such a fundamental part of the economy and everyday life, political capital can be gained by reducing short-run prices.

4.2.4 The risk of regulatory holdup appears high in Australia

As noted, the present Australian regulatory environment provides unfortunate evidence of holdup in Australian carriers' unwillingness to make substantial NBN investments without *ex ante* regulatory commitments. This is not surprising, as presently in Australia the regulator can exercise substantial regulatory discretion, actively exercises that discretion, and does so in a manner that commonly leads to under-pricing. Ergas (2008b, chapter 6) notes the following:

- The ACCC's choice of what to regulate (or 'declare') is essentially unchecked.
- Once it declares a service, it faces few constraints beyond a vague list of statutory objectives on how the regulated terms and conditions of access to that service are set.
- Its arbitration determinations on terms and conditions are not subject to any merits review.

As a result, the ACCC can set access charges

without regard to clear principles, criteria or rules. In this environment, it has chosen an access-pricing methodology (forward-looking long-run incremental-cost modelling) that relies on myriad, essentially untestable judgements that have produced access charges which do not sum to total costs, distort relative prices for closely substitutable inputs, and are not time-consistent. It is not surprising that such a pricing methodology has serious efficiency problems (Vogelsang 2002, pp20–23; Ergas 2008b, section 7.2).

Moreover, the ACCC has approached access regulation with great energy. An extensive and growing range of telecommunications services have been subjected to mandatory third-party access. Ten services are now declared (Ergas & Ralph 2008, p7), and no declarations have been withdrawn outside of narrow geographic areas or because they were or became redundant (ACCC 2008b).[3]

At the same time, the ACCC's cost estimates are subject to a downward ratchet (Ergas 2008b, section 8.4; Ergas 2008c), and prices appear to be set without accounting for either the option value of providing spot-market access (cf Pindyck 2004; Guthrie 2006) or the likelihood of regulatory error (Ergas 2008a, pp6–8; Productivity Commission 2001, pp398–99). This, coupled with aggressive declaration of services that are close substitutes (eg the unbundled local loops [ULLs] service and the line-sharing service [LSS] [Ergas & Ralph 2008, note 15]) make regulatory underpricing highly probable, even if it is unintentional (Ergas 2008a, p119ff). Indeed, the regulatory underpricing of access to Telstra's network may be part of the explanation for the failure of full-facility carriers in Australia, such as iBurst.

The result discourages regulated carriers from maintaining existing investments and prevents commitments to new investments that could be regulated on one hand, and on the other cuts investment in competitive infrastructure by carriers that are unlikely to be regulated, but that may gain access to regulated assets.

4.2.5 Policy implications

The conclusion is that in an environment such as that which presently characterises Australia, where both the regulator's capacity and its temptation to engage in regulation are high, efficient investment incentives call for strong commitments against expropriating behaviour.

Regulatory commitments, broadly speaking, can take many forms. The US Federal Communications Commission (FCC) provides a specific example in choosing not to regulate NGNs. A less restrictive commitment would be to not regulate the NBN for a guaranteed period of time, potentially subject to a review with specified terms of reference at that point.

It is also the case that regulatory commitments can be difficult to maintain, which strengthens the need for maximal commitment. Regulatory commitment requires identifying terms and conditions that will remain appropriate over an extended period. As a result, if outcomes are realised under past commitments that are difficult to sustain economically or politically, then they are unlikely to be allowed to persist. This has benefits (it allows adjustment in the face of substantial change) and costs (the inevitable blunting of regulatory incentives), but the point here is that unwavering commitments are hard to make, and this opens the door to regulatory opportunism.

While making regulatory commitments as rigid as possible, so as to make reversals only likely in exceptional circumstances, may seem to be costly, it in fact yields net benefits. At best, it reduces the expectation of inefficient regulatory reversal, thereby allowing investment that generates substantial social surplus, but it also allows regulatory change when it is vitally necessary. At worst, such commitments have little effect, and hence are not likely to prevent changes when they are necessary, but equally will not prevent regulatory opportunism, with consequent harm to efficient investment incentives.

Regulatory holdup can also be made less likely if commitments are bolstered by *ex ante* legislation and contractual protection, and to the extent there is a broad awareness of the harms holdup imposes. Political constituencies, such as the readers of this document, and relevant institutions, such as the courts, the public service, parliaments and regulatory bodies, can facilitate such awareness. As an example, consider the widely accepted view that the Reserve Bank should not undertake policy that might provide short-term stimulus, but create long-term inflationary harm. Together with commitments from the government (including through the Statement on the Conduct of Monetary Policy), this creates a culture that reduces regulatory opportunism.

Finally, the risk of regulatory opportunism is reduced if regulatory regimes have relatively broad coverage, rather than being specific to particular industries. One of the factors that facilitated the ACCC's conduct is the highly bespoke nature of the telecommunications regime (Ergas 2008). This reduces the extent to which other current or potentially regulated industries monitor the ACCC's conduct and exercise political pressure for the discretion vested in the ACCC to be curbed or better controlled. One very important way of increasing the credibility of those commitments is

therefore to rely on arrangements that are economy-wide and hence mobilise powerful constituencies against opportunism, so that a move in this direction should be a priority.

4.3 The tender and regulation

It has been argued that a regulatory commitment to avoid expropriation is necessary to ensure efficient incentives to invest in broadband technologies. Yet, putting these investment incentives aside, the case for anything more than the most minimal regulation of NGNs is weak.

4.3.1 Regulating a dynamic new market is highly costly

Because it carries high costs (Carlton & Perloff 2005, pp682–85; Noll 1989; Hahn 1998), regulation should not be imposed unless there is a strong case that no action would lead to substantively greater harm (Kahn 1988, pp11–12; Farrell 1997; Neuchterlein & Weiser 2007, pp428–29; *Re Duke Eastern Gas Pipeline Pty Ltd* [2001] ACompT 2 [4 May 2001]; ACCC 2008a). This is particularly so for new investments (see section 4.2) and new services (Romer 1994; Hausman 1997; Schwartz 2008, pp430–31), as the resulting losses in social surplus are especially great (Guthrie 2006; Powell 1999; ACCC 2005, pp18–19; Ofcom 2007, Annex 5). Of course, new investments and new services characterise the NBN.

Access regulation also provides a mechanism by which firms with short time horizons can postpone more efficient, but more radical, change (Belletini & Ottaviano 2005). Firms with short time horizons are less likely to sink investments when cost recovery can only be expected over the long term. They would prefer to eke out additional productivity gains from exploiting already sunk investments (especially if made by someone else). Yet it is exactly long-term investments that are necessary for full-facility competition, which may bring both more effective competition than that based on access regulation (ACCC 2007, ppiii, 21; Nuechterlein & Weiser 2007, pp428–29) and obviate the need for regulation, ultimately delivering more efficient long-run outcomes than perpetual access regulation.

Despite this, central to the federal government's tender is the requirement that the winning bidder supply wholesale broadband access to the NBN at a nationally uniform price to all comers. Yet both open access, which has been rejected by the FCC (2004, paragraph 9, paragraph 14), and uniform pricing (see section 4.5.1) are likely to distort economic efficiency. Indeed, Schwartz (2008) and Nuechterlein and Weiser (2007) have grave doubts about the value of future access regulation in telecommunications. Further, access regulation – which is intended to promote efficient competition – seems particularly unnecessary given existing and developing (Vodafone 2008, p11) facility-based broadband competition, and the protections of Part IV of the *Trade Practices Act* 1974 (TPA).

If regulating access is likely to be costly, postponing regulation is relatively cheap, because it preserves substantial option value as compared with early regulation. Postponement avoids distorting initial investments and market developments, which may include competition from unexpected quarters (Kennard 1999). Moreover, regulation can be introduced later should market outcomes demand it, though to minimise regulatory risk, the process and point in time for regulatory review should be specified in advance and high hurdles set. This maintains the option to regulate, but provides an opportunity for market-based solutions (Schwartz 2008, p442; Nuechterlein & Weiser 2007, p428). In contrast, once established, regulation cannot be easily unwound, since various parties come to rely on it and on the rents it invariably creates (in telecommunications see Farrell, 1997; more broadly see Irwin 1996; Bhagwati 2005, p27; Schattschneider 1935, 1974, p288).

Further, current evidence both suggests access regulation postpones NGN deployment (see section 4.2.3), and forbearance encourages it. Thus, because (or despite) US regulatory forbearance, 2.5 million US customers have access to fibre overbuild against established cable companies (AT&T 2008; Verizon 2008). Similarly, wireless investment, which is relatively unregulated, continues apace (Foo 2008; Vodafone 2008; Nuechterlein & Weiser 2007, p29).

In summary, facility-based competition is presently broad, but distorted by regulation and expectations of more of the same. At the same time, no market failure has yet been identified in the context of Australian NGN deployment. These two facts suggest NGN regulation is not merely unnecessary, but will harm economic efficiency. Indeed, substantial inefficiencies are the most likely outcome of regulating new investments in new technologies *before they have been rolled out*, unless this is the only way of reducing the risk of even greater regulatory harm later. Rather, in dynamic markets, there is wisdom in allowing market forces to work, including by inciting 'investment races' for first mover advantages (the basis for patent protection).

4.4 Vertical supply chains and access regulation

The tender process requires bidders to provide open access to the NBN at uniform prices. This is intended to facilitate downstream entry and, though such measures are distorting, it is presumably the government's belief that the resulting competition can bring greater benefits than these costs. Some regulatory costs of an access regime were outlined in the preceding sections. This section focuses on costs that arise when sunk investments must be made up-and downstream, up- and downstream operations are highly interdependent, and it is difficult to identify whether up- or downstream operations have effectively been carried out. In such complex environments, it is unlikely that the regulatory environment can be appropriately attuned to the interaction of firms at different layers of the resulting vertical supply chain. Worse, access regulation creates fundamental uncertainty as to investors' property rights, and this greatly increases the difficulty of writing efficient contracts (Coase 1960). Consequently, the regulation of NBN delivery is again likely to be inefficient.

As discussed, both up and downstream undertakings involve substantial sunk investments. At the same time, the expected profitability of an NBN, both up- and downstream, is dependent on:

- the wholesale or upstream provider's effectiveness in providing bandwidth, reliability, coverage and data streams with specific qualities of service
- the extent to which retail firms develop downstream demand, notably by developing and promoting new services.[4]

Such interdependencies, coupled with the risks and uncertainties associated with broadband deployment, especially when large investments must be sunk both up- and downstream, may create difficulties in writing and enforcing contracts between up- and downstream firms. However, if it is difficult for such firms to obtain optimal outcomes over the vertical supply chain, then it is even more difficult to identify efficient access regulation. In addition, access regulation worsens the problem by reducing firms' ability to define vertical relationships, notably by muddying existing property rights.[5] Several difficulties stand out:

Firms have an incentive to get another party to make an investment that will benefit them – that is, to free ride. This creates contractual complexities that can harm efficiency.

The benefits of any particular investment in the NBN and market development generally accrue up- and downstream. If the parties that benefit are separately owned, then each has an incentive to try to reduce the amount it pays for the investment, hoping that other parties will meet the difference.

With only a few relatively large and known parties, the desire to free ride may be overcome through negotiations (Coase 1960, but see below). However, the incentive to free ride rises with the number of potential benefiting access seekers.

Smaller players' incentives to free ride are strengthened to the extent that there is a single player that may be willing to unilaterally undertake (though typically not to the optimal extent) the desired investment. A single firm is more likely to undertake unilateral investment if it is large and/or vertically integrated (such as Telstra, vertically integrated with BigPond). This is so respectively because fewer benefits are external to the larger firm, and vertical integration facilitates up- and downstream co-ordination. However, as discussed above, an access regime undermines the already inefficient incentives facing a large investor.

To be efficient, access regulation must account for these factors. For example, the network provider's vulnerability to regulatory expropriation can be reduced (but not eliminated) to the extent that binding regulatory commitments provide appropriate expected returns. But the key point here is that access regulation does not merely provide a means for chiselling, but raises the transaction costs of negotiation by creating deep uncertainty about the network provider's property rights: to the extent that access seekers can influence wholesale prices, *they can change property rights*, and they may be able to do so after the NBN investments have been sunk. When existing property rights are uncertain, negotiating to avoid free riding becomes considerably more difficult, and will lead to inefficient outcomes compared with a case where property rights are well defined (Coase 1960).

Up- and/or downstream sunk investments make contracting difficult, and can have important negative efficiency consequences when these investments are only useful to the upstream network provider and a particular, but separately owned, downstream retailer. Such 'relationship-specific' investments create the possibility that one firm can hold the other up (Williamson 1979): once one party sinks a relationship-specific investment, it becomes vulnerable to the other party seeking to renegotiate the arrangements between them so as to claim the quasi-rents necessary to fund that investment. Some incremental sunk investments (as distinguished from the initial NBN investment) are likely to be relationship specific as the NBN allows for substantial downstream differentiation (Ergas & Ralph 2008, p14).[6]

Vertical relationships between firms with relation-

ship specific assets would be probable even if access were not forced. This is because the network provider would be unlikely to achieve efficient levels of product differentiation on its own, and would seek downstream partners to maximise network usage. However, access regulation makes efficient negotiations less likely because, as before, it creates uncertainty as how the network provider can use its property – for instance, under what circumstances is a network provider able to reject a request from a (downstream) access seeker that wishes to supply a differentiated retail service *that requires specific investments upstream*?

Coordination costs that arise between the network provider and access seekers are likely to be high when the required investments are for new, relatively unknown, services and/or if long-term commitments are required (as in NGN supply).

Writing contracts that are appropriate for all relevant, and sometimes unknown, contingencies is again difficult, and in many cases leads to vertical integration as a means of avoiding these problems (Joskow 1985). As previously noted, NBN supply without access regulation would likely still result in contracts between vertically separated firms, as well as some vertical integration. However, access regulation – again because it muddies the property rights of the network provider – makes it more difficult to write such contracts (Ergas & Ralph 2008, p15).

In summary, regulating access involves writing contracts where, in some cases, private parties fear to tread, thus making it harder for those parties that wish to write their own contracts.

4.5 Protection from the taking of monopoly profits

The previous two sections raise the question of whether an NBN provider, if it were to face very light-handed regulation, would have substantial market power that would be used to harm consumers and/or economic efficiency. This section accepts that some regulation should be imposed to reduce distortions associated with pricing to claim monopoly rents, and considers what regulation would achieve that objective at the lowest economic cost.

4.5.1 A uniform pricing rule is misplaced

The debate about access pricing is sometimes characterised as a choice between short-run allocative and long-run dynamic efficiency. On one hand, it is said that regulating access to existing sunk assets ensures efficient short-run use of those assets, but distorts long-run investment decisions and hence dynamic efficiency. On the other hand, avoiding regulation allows for dynamic efficiency, but may in the short run harm consumers and allocative efficiency.

This section puts aside whether access regulation would harm investment incentives, taking it as given that investment in the NBN is undertaken. In that context, the section makes the point that the imposition of a uniform pricing requirement on wholesale NGN services is unlikely to involve a trade off between allocative and dynamic efficiency, but rather may sacrifice both.[7]

This possibility emerges from the patent literature where a similar debate about allocative versus dynamic efficiency occurs: patents are said to create short-run allocative harm because they lead to monopoly pricing, but provide effective incentives for long-run innovation, bringing much valued dynamic efficiency. However, Hausman and Mackie-Mason (1988) show that this tradeoff need not apply when price discrimination is possible (Schwartz 2008, p423 on telecommunications). This is especially so where price discrimination allows new services to emerge that otherwise would not be provided, and in any case is generally so if marginal costs are falling, which almost certainly characterises new retail broadband services. Similarly, it would allow efficient risk sharing between firms with different appetites for risk, rather than forcing a one-size-fits-all solution.

Efficiency benefits from price discrimination are especially likely if price discrimination allows new service development that otherwise would not occur, since this leads to first order efficiency gains that would be lost under uniform pricing. Moreover, NGN rollout is virtually certain to lead to the development of many new retail services. As a result, the likelihood that some services' viability would depend on price discrimination is higher than if fewer new services were probable.

If marginal costs are declining, then even when price discrimination is not necessary to bring a new service to market, price discrimination is also likely to increase economic efficiency. Declining marginal costs can be expected for services that are reliant on an NGN for two reasons:

- There are likely to be substantial economies of scale in retail broadband services, and most especially in the early days of rollout, when initial volumes are small.
- When new products are rolled out, substantial cost reductions are typically gained from learning by doing. The result is that, even ignoring scale effects,

marginal costs decline over time.

In summary, forcing uniform wholesale prices on NBN services is inappropriate given that many of the derived retail services will be new. Rather, the NBN provider faces good incentives to efficiently price discriminate (see also section 4.6.1).

Of course, the extent to which this issue arises in the NBN will depend on the exact form of any uniform pricing obligation and its interpretation. This is an issue that greatly vexed regulation under the *Telecommunications Act* 1991 (the predecessor to the current regime), which had a range of restrictions on price discrimination. To the extent to which government wishes to see some degree of uniformity, probably the 'least harm' approach involves merely requiring that there be a uniform price on offer, that uniform offer then coexists with offers that involve greater or lesser price discrimination. However, difficulties can arise if the uniform offer must be 'reasonably attractive' or 'reasonably available', in which case it can act as a *de facto* constraint on the scope for potentially efficient price discrimination.

4.5.2 *Ex ante* regulation

Some readers may remain unconvinced that an NBN provider should not face some form of regulation on its capacity to set monopoly prices. This section argues that if regulation is to be implemented, then a wholesale pricing cap will tend to minimise regulatory harm.

Recognising the harmful effects of regulation, the modern view is that regulation should:

- be as light-handed as possible (Farrell 1997), which in part can be achieved by shifting regulation to the wholesale layer (Kennet & Ralph 2007; Vogelsang 2002, pp23–24), thereby narrowing the regulatory footprint and allowing risk-bearing contracts that would be difficult to impose on small end-users, while simultaneously protecting end-users through the provision of competition
- encourage competition so that regulation eventually may be withdrawn (Farrell 1997; Vogelsang 2002).

In this light, wholesale price caps are attractive. In contrast to rate-of-return regulation, price caps:

- provide efficient incentives to innovate so as to reduce costs (Gasmi *et al* 2002, pp59–60, 124; Vogelsang 2002, pp8, 10)
- allow the basket of services covered to be rolled back readily as competition develops (Vogelsang 2002, pp23–24)
- provide appropriate flexibility when a firm is regulated in some sectors and faces competition in others (Gasmi *et al* 2002, chapter 9)
- where applied to a basket of services, provide the network owner with the flexibility to respond to demand – that is, to rebalance (Vogelsang 2002, p8); to price allowing for technological change and competitive developments (Vogelsang 2002, pp14, 16); and to demand interdependencies (because wholesale services typically substitute one for another).

This flexibility is arguably particularly important in the case of the NBN, where demand interdependencies, and technological and competitive changes are closely linked, and can be rapid and extensive.

In contrast to capping a service basket, the ACCC's approach has been to set individual caps so that, at least putatively, the price of each declared input is expected to recover the ACCC's estimate of its incremental costs. Such individual caps can provide good incentives for reducing costs (Vogelsang 2002, pp8–9), but it is unlikely that a regulator could identify the efficient set of relative prices such an approach requires. This is important, given that:

- most wholesale services are substitutes for another
- in any case, they have cross-price effects
- estimating incremental costs of individual services is not only considerably harder than estimating costs for the aggregation of regulated services, but also raises difficult issues about the recovery of shared costs.

In contrast, price capped baskets allow the firm to set individual prices to maximise revenues subject to the cap, which ensures that monopoly profits are constrained.

While price caps have many attractions, they also have shortcomings – for instance, to ensure fully effective incentives for cost reduction, it must be credible that the price cap will be maintained for a substantial period of time. Thus the cap's rules, set *ex ante*, must be sufficiently keyed to exogenous changes that over the regulatory period the firm is unlikely to incur losses or gain substantial profits unjustified by risks. Otherwise the cap may be reneged (Vogelsang 2002, p8). Caps often have to be generous to assure the ongoing viability of the firm, and the more uncertain the regulator is as to cost recovery, the greater the expected profits properly and efficiently granted by the optimal cap (Gasmi *et al* 2002, pp5, 52, 59–62; table 7.11).[8] To the extent to which regulators prove reluctant to grant those profits, exactly the same issues of regulatory opportunism and *de facto* expropriation can occur under a price cap as have characterised the Australian regulatory arrangements to date.

Caps can also require quality monitoring, since profit may be increased by reducing quality as well as costs. That being said, two reinforcing factors likely offset incentives to reduce quality: competition (Vogelsang 2002, p11) and the need to develop broad

network use so as to recover the substantial fixed costs of the NBN. As discussed in the next section, a requirement that wholesale and retail prices be geographically averaged creates strong pressures to maintain both wholesale and retail quality. In low-cost areas, full-facility competition can readily undercut a service with a geographically averaged but otherwise efficiently quality-adjusted price. Any inefficient deterioration in service quality would only increase the extent of facility competition, and reduce the prospects of recovering the NBN's substantial investment. Moreover, the commercial imperative to migrate customers to higher speed services, and to encourage the growth of applications that make good use of the NGAN's distinctive capabilities, further reduces incentives for the network owner to degrade quality.

4.5.3 The constraints of uniform and anchor pricing

The government's tender imposes a uniform pricing requirement. In addition, Telstra has suggested the application of anchor prices, where the prices of a set of existing wholesale services are capped at present rates (a CPI-CPI cap). Each of these constraints, whether ultimately economically efficient or not, is likely to largely prevent the NBN provider from claiming material monopoly rents, assuming it would otherwise be able to do this.

Geographic averaging means that, in retail markets, the NBN provider will face effective competition from facility-based suppliers. This is because, to recover costs, the NBN provider must set wholesale prices that, in low-cost areas, exceed not merely average short-run marginal costs, but average long-run costs. Moreover, it must do so over the long term. Such positive margins in low-cost areas are likely to encourage expansion of existing competitive networks and new network construction. Consequently, to maintain its share in low-cost areas, the NBN provider will have strong incentives to:

- keep network costs as low as possible, while offering service quality and extending service breadth
- offer long-term and other tailored contracts that signal efficient costs, thereby avoiding inefficient bypass (which destroys surplus that could be shared between the NBN provider and potential facility-based entrants).

As for anchor pricing, it involves committing to fixing price levels for legacy services, or at least for key services among those. It is similar to the 'reference service' concept used in Australian gas transmission regulation, which requires regulated entities to define the price of a service – the 'reference service' – for which there is broad demand. Once that price is set, the regulated entities have flexibility in the setting of prices for other, generally substitutable, services, since the price for the reference service acts as a constraint on how prices for those other services are set. In the case of the NBN, the anchor price would be set for the reference services in the legacy network – that is, the core public switched telephone network (PSTN) services and the legacy broadband access services.

Anchor pricing leads to competition from the installed customer base that will force the NBN provider to competitively price newer services so as to ensure maximal network use. If the NBN provider is to recoup its costs, then it must price new services so they are competitive with anchor services (Ergas 2008a, 2008c), otherwise access seekers would thwart service expansion by simply continuing to supply legacy services at low prices.

Anchor pricing also guarantees that migration to an NGN does not make existing access seekers and the installed base of retail customers worse off, since customers retain the options they currently have; as a result, for new services to be viable, they must increase the surplus consumers obtain. In that sense, anchor prices ensure welfare improvement: the incremental costs associated with providing the new services will only be incurred if they are exceeded by incremental benefits, with consumer surplus being no smaller than in the status quo.

Moreover, anchor prices provide a benchmark against which Pareto-improving commercial contracts can be negotiated (Graham & Vernon 1991). If more complex contracts are efficient – that is, those which allow gains from trade that exceed negotiation costs – then these are likely to be realised without further regulatory (and likely distorting) intervention. For instance, the NBN provider would have incentives to offer access seekers commercial contracts with discounts for long-term volume commitments. Such prices would make it easier to allocate the costs of long-lived assets across their lives and shared infrastructure, thereby avoiding arbitrary cost allocations to different time periods or services (Kennet & Ralph 2007, pp137–40). This both ensures a greater likelihood of efficient cost recovery on the part of the network provider, and likely provides access seekers with more efficient build/buy and network usage signals (since their marginal costs are more likely to emulate network marginal, rather than average, costs).

The network provider's incentives to offer competitive commercial contracts are similarly sharpened by the NBN's high fixed and low marginal costs. Under such a cost structure, the network provider's profits are maximised by substantial network use, which is more likely to be obtained if prices signal the marginal

costs of supply rather than, for example, long-run incremental costs averaged over both time and volumes. Thus the network provider has good incentives to seek out more efficient access prices than those that can be expressed in spot prices.

Anchor pricing has a further advantage of being relatively simple to implement – the regulatory review, at its simplest, could accept existing spot prices, given these were previously determined by regulation.

A potential concern is that the anchor may be of fading efficacy over time. Thus the legacy broadband access services (offered at speeds of up to, say, 8 Mbps) would certainly be an effective constraint in the near term over broadband pricing for new NBN access services, but might no longer be so should speeds in excess of 12 to 15 Mbps become the prerequisites for access to a broad range of applications. However, it seems reasonable to suggest that such a situation corresponds precisely to the 'upside' that could justify commercial investment in an NBN, and that to regulate pricing in that 'upside' merely removes or blunts the incentive required to motivate the investment in the first place – especially as there is no corresponding floor to the losses the network owner would incur in the 'downside'.

However, it may be that the government requires a higher degree of protection from too-high pricing than could be given by a once-and-for-all anchor, given concerns about the likely declining effectiveness of such an anchor over time. To that extent, it may be worth considering some form of 'floating anchor', in which the anchor service, and its obligations, move in line with changes in the composition of market demand. Such a 'floating anchor' might be based on the concept of a 'reference service' used in Australian gas pipeline regulation. A possible approach is as follows:

- As under the Gas Code, a network operator must nominate at least one reference service.
- A reference service must account for a substantial share of demand.
- The price cap for a reference service is deemed to be set at CPI-CPI, unless an application is made to the regulator and accepted for it to be set on another basis.
- The initial reference services are the core legacy services (PSTN fixed-network access, 1.5~2 Mbps WDSL).
- Once a service accounts for 40 per cent of demand by volume, it is deemed to be a reference service, unless the operator nominates an alternative service (see below) and that nomination is accepted.
- If the network operator nominates a reference service, the regulator must accept that nomination unless it would be unreasonable to do so, where unreasonable means that the nomination would result in a situation where the interests of end-users would be harmed as a consequence of price increases. If the regulator is offered an undertaking that prevents such price increases, the regulator must accept it unless the undertaking would more likely than not be ineffective.
- Once the regulator has accepted a nomination for an anchor service, prior nominations become void and no other services are anchor services during the period of the nomination.
- The network operator must offer long-term contracts for all anchor services it offers, and must negotiate over the terms and conditions of those long-term contracts in good faith.

In short, as was stressed in Ergas (2004), transition to an NBN offers scope for far-reaching simplification of the regulatory arrangements, shrinking the set of regulated wholesale services to at most a very few services that provide transparent IP transport from customer premises to points of interconnection. Anchor pricing provides an equally simple way of controlling the charges that a network operator can set for those services, with the anchor prices:

- ensuring consumers are no worse off, and potentially significantly better off, from the move to an NBN (assuming service quality levels are also no worse than in the *status quo*)
- creating scope for efficiency-enhancing contracts that yield gains from trade relative to the anchor prices
- constraining the network builder's pricing discretion, without removing the ability for it to secure higher prices should consumer demand for new services prove to be strong.

4.6 Non-discriminatory access

Vertical discrimination is typically thought of as arising when a vertically integrated carrier supplies a poorer wholesale service to its downstream rivals than the service it supplies to itself. As a result, vertical integration is widely perceived as opening the door to vertical discrimination. However, incentives to vertically discriminate exist even when the upstream firm has no downstream operations. There is little to prevent up- and downstream firms from collaborating, perhaps even only implicitly, to effect profitable vertical discrimination (as has been found to be the case – *Virgin Blue Airlines Pty Limited* [2005] ACompT 5).

That said, there are many circumstances where vertical discrimination is not profitable (Mandy & Sappington 2007) so protection against it is unnecessary. Since the presumption is that commercially chosen vertical integration is beneficial (Lafontaine & Slade 2007; Yarrow 2008, section 9; Cave 2008, section 1), *imposing* separation threatens substantial benefits for uncertain gain. For example, imposed separation results in inefficiently low upstream quality when downstream prices are marked up above costs (as will be the case on NGNs) and efficient nonlinear access prices cannot be determined (as is again the case, since access prices are typically linear and the regulator is unlikely to set efficient nonlinear prices) (Buehler *et al* 2004; Ergas 2007). Finally, competition law rather than *ex ante* regulation is probably the most effective means of dealing with such behaviour.

This section focuses on two main propositions:

- in supplying an NBN, a vertically integrated network provider's incentives to discriminate against its downstream rivals are muted as compared with a traditional copper network[9]
- a more generous price cap will reduce incentives for non-price discrimination.

4.6.1 Incentives to discriminate

An NBN is different from traditional networks in two ways that reduce the NBN provider's incentive to vertically discriminate: the ratio of shared to marginal costs and retail product differentiation are likely to be higher. These factors reduce and may eliminate the profitability of vertical discrimination.

The profitability of vertical discrimination

The profitability of vertical discrimination rises with the ratio of wholesale to retail margins; and given an act of vertical discrimination, the ratio of the retail revenues the network provider gains to the retail revenues that its downstream rivals lose (Biglaiser & DeGraba 2001), here called the *diversion ratio* (after Werden 1996).

In the extreme case 'where the ratio of wholesale to retail margins is negative so access prices fail to recover short-run costs and all cost recovery occurs in retailing', a vertically integrated network provider has strong incentives to both minimise what it wholesales 'since every failed sale is a loss avoided', and maximise what it retails 'since this the only way it can recover its costs'. As a result, the network provider has strong incentives to vertically discriminate.

If access prices make a contribution towards sunk costs, then a given act of vertical discrimination – assuming it has an effect – reduces wholesale demand, causing a loss of contributions towards sunk costs. This is attractive to the vertically integrated network provider if retail margins more than replace lost contributions on access sales. The degree to which this can happen depends on two things:

- the size of the retail margin gained relative to the wholesale margin lost,
- the fraction of customers who switch to the vertically integrated network provider relative to those who simply stop consuming (essentially the diversion ratio).

When retail supply is differentiated, the diversion ratio of a given form of vertical discrimination is generally less than one – that is, some customers stop consuming altogether, rather than switching to the vertically integrated network provider. For example, if vertical discrimination leads ten customers to quit downstream rivals, fewer than ten customers – say, eight – switch to the network provider. Thus, for vertical discrimination to be profitable, the retail margin must exceed the wholesale margin. Continuing with the example, if the margin lost on wholesaling is $1 per customer, the vertically integrated network provider loses $10 in wholesale contributions, but gains a retail margin from eight customers. That gained retail margin must exceed $1.12 (rounding to whole cents) if the vertical discrimination is to be profitable.

The result is that the higher the ratio of the wholesale to the retail margin, and the lower the diversion ratio, the less attractive vertical discrimination becomes.

NGNs reduce the profitability of vertical discrimination

With the factors that drive incentives to vertically discriminate explained, why vertical discrimination is less likely on an NGN is now discussed. In particular, relative to a traditional network, the ratio of wholesale to retail margins will be higher, while the diversion ratio will be lower, reducing or eliminating the gains from vertical discrimination.

NGNs are thought to have lower operations and maintenance costs upstream as compared with traditional copper networks. These lower costs are in part obtained by incurring relatively high upfront costs, including by pre-provisioning high-capacity fibre-optic connections to nodes and high speed line cards at nodes. Further shifts in the ratio of marginal to fixed costs are obtained through deployment of all-IP soft switches, which typically have far greater scale economies and handle far greater numbers of lines than conventional circuit-switched systems.

A consequence of a relatively high ratio of marginal to fixed costs is that if access prices are to recover upstream costs, then the difference between those prices and short-run marginal costs (upstream contribution margins) will have to be higher than they are now.

High access price margins reduce the prospect that access prices will not cover short-run costs, and avoid a situation in which vertical discrimination is virtually guaranteed. More generally, higher margins – holding retail margins constant (but see below) – increase the ratio of wholesale to retail margins relative to those on a traditional network, reducing the attraction of vertical discrimination.

An NBN also allows greater downstream service differentiation. When Optus resells a Telstra service on the existing network, minor differences in price structure and possibly retail service (such as billing) aside, the final product is pretty much the same. Matters are more complex for ULLs, but FTTN is more capable than ULLs, with more scope to alter service quality and features. This is further so as NBN service providers compete not only in terms of network or service level attributes (such as contention ratios), but also in terms of the range of applications they offer.

Increased service differentiation has two interrelated impacts:

- It tends to increase downstream margins. This is because, with product differentiation, consumers choose the service that suits them most, and switching requires choosing something with less attractive attributes; as a result, firms have somewhat more localised market power than when services are more similar.
- It lowers the diversion ratio, again because it makes purchasers less willing to transfer their custom to another firm.

The upshot of higher upstream margins and lower diversion ratios is that the attractiveness to a vertically integrated infrastructure provider of stealing downstream custom is less on an NBN than on a copper network. While greater downstream differentiation is likely to increase downstream margins, downstream differentiation lowers the diversion ratio so these margins are less available to the vertically integrated firm. The result is that the opportunity cost to the vertically integrated firm of selling to downstream rivals is lower, strengthening its incentives to sell access services.[10]

4.6.2 Non-price discrimination

On wholesale contributions and the incentive to engage in vertical sabotage

Whether vertical discrimination is profitable depends on the specifics of any circumstances, though in telecommunications the likelihood that demand-reducing vertical discrimination is profitable is small (Mandy & Sappington 2007). Moreover, as discussed, the vertically integrated firm's revenue losses from engaging in vertical discrimination increase with the difference between the wholesale price and short-run incremental cost.

This, however, is only part of the story. In the present context, the regulator wishes, among other things, to:

- regulate access prices to provide appropriate investment incentives without granting the firm unnecessary profits
- prevent (to the extent that this is an issue) non-price vertical discrimination.

It is likely that efforts spent on preventing excess profits and non-price vertical discrimination both have positive, diminishing marginal benefits, and at least constant – if not increasing – marginal costs. At the same time, the actions the regulator can take are partial substitutes – for instance, a larger gap between access price and cost reduces the profit gained by discriminating against downstream rivals, so reduces discrimination. In this circumstance, the efficient regulatory response is to reduce the harshness of monopoly price policing so as to obtain optimal incentives to avoid vertical discrimination (Holmstrom & Milgrom 1991).

Such an easing of price regulation is reinforced by two further factors. First, the need to ensure appropriate investment incentives complements the regulator's desire to reduce vertical discrimination through more generous access-price regulation. Second, many efficient actions may well appear discriminatory (for example, it is difficult to determine whether the vertically integrated firm faces lower costs because vertical integration is efficient, or because it discriminates against other firms). As a result, there are costs, including those as a result of error, associated with enforcing non-discriminatory regulations, or because vertically separated firms inefficiently emerge (which may still discriminate through contracts and understandings). As with price squeezes, these costs are likely to be greater if the regulation is applied *ex ante*, rather than as part of the competition law regime.

It follows that the optimal stance of policy is to err on the side of allowing relatively high access prices (or equivalently, to accept relatively lax access price regulation), as such a stance:

- is a cost-effective approach to reducing the risk of discrimination while preserving efficiencies of vertical integration
- is consistent with the need (discussed at length above) to provide credible incentives for investment and avoid or mitigate the risk of *ex post* expropriation.

4.7 Conclusion

The federal government is seeking tenders to deploy a NBN that will reach 98 per cent of Australia's population (Conroy 2008). The central tender conditions are that the bidders can seek up to $4.7 billion of government funding, and that the winning bidder will be required to supply wholesale broadband access to the NBN at a nationally uniform price to all comers. Beyond this, the tender conditions are extremely open, allowing bidders to specify the regulatory framework within which the NBN would be built and supplied.

This chapter examines what regulatory framework might be appropriate. It notes that efficient investment will not be forthcoming if there is a risk that sunk investments could be expropriated. Credible commitments to reducing this risk are therefore required, though it cannot be eliminated. To this end, and bearing in mind that the current process is being run as a competitive tender (meaning there will be some degree of rent dissipation), there is not a convincing case for price regulation. Strengthening the conclusion in this respect is the fact that the network operator, given its cost structure, will have strong incentives to promote use of the new network, and can use price discrimination to do so.

That said, to the extent to which prices are to be regulated, a light-handed approach is recommended based on anchor pricing – that is, on locking in a price for a reference service that acts as a constraint on the prices of other services. A 'floating anchor' is one option to address the concern that any initial anchor price may become less of a constraint over time, as the composition of demand shifts from legacy services to ever-higher speed and service quality levels.

Concerns about vertical discrimination in an NBN are greatly overstated, and we have demonstrated why that is so by analysing the incentives to discriminate. Despite many emotive statements to the contrary, it is unconvincing that, beyond existing competition law protections, additional specific measures are needed to deal with vertical discrimination – and all the more so as any such measures are likely to have high economic costs. Given those costs, the most efficient way of dealing with vertical discrimination concerns, beyond relying on TPA remedies, is to adopt a light-handed approach to access-price regulation, as higher upstream margins (needed in any event for efficient regulation) will reduce the incentives for the network operator to discriminate downstream.

Overall, the policy framework set out above would accommodate the objectives the government has set. This does not mean, however, that the current NBN process is economically justified. Rather, it might well be preferable to address the deficiencies of the current regulatory arrangements (which, along with possible remedies, are discussed at length in Ergas 2008) and then allow commercial investment decisions to guide the deployment of new networks. Such an approach would avoid the need for government to 'pick winners', and preserve the option value inherent in allowing technologies to be adopted when, and only when, market circumstances create a compelling case for that to occur.

Endnotes

1. The NGAN is the part of the larger NGN over which access is supplied.
2. A quasi-rent is income that can be lost without affecting an agent's short-run behaviour, but which is necessary to recover the costs of any assets sunk in that short run.
3. In CBDs, LCS was withdrawn and WLR not required; inter-capital transmission has been withdrawn. OA, LCS and WLR may be withdrawn in specific areas.
4. A fully vertically integrated NBN provider would also be very likely to engage in retail demand development, but this may also be true of an NBN provider that only wholesales, as is common for many manufacturing products.
5. Imposing an access regime exchanges a property for a liability rule (Ergas & Ralph 2008, note 27, citing Calabresi & Melamed 1972).
6. Davis and Williams (2008, p5) suggest local loops and other network assets cannot 'be considered relationship specific', since 'in many cases they could readily be supplied to other firms [and t]hat should significantly reduce the possibility of investment holdup'. Yet, as noted, asset specificity is likely at the margins of coverage, and especially quality and product expansion. Moreover, these margins are critical for efficient network deployment and use. At the same time, the free-rider problem, outlined in the preceding dot point, arises for the substantial proportion of the basic network that will likely be used by many access seekers. Davis and Williams also seem to assume (contrary to the literature) that physical specificity is the only form asset specificity takes, which is incorrect. Asset specificity arises from the ability of two parties to secure greater joint returns from using a common set of sunk assets than would be obtained in the next best alternative. That gives rise to a quasi-rent that can be shared between the parties and which each party would lose without access to the other. While physical constraints on profitable redeployment are one reason that may be so, they are far from being the sole reason. For example, if Telstra invests in fibre loops in the expectation of sharing in the revenues that will be generated by the unique applications owned by a third party, and would be unable to recover its costs once they were sunk, should it not have access to that application, then it is vulnerable to holdup by that party, even though there are no physical features of the loop that prevent its redeployment to less valuable alternative applications.
7. The NBN tender requires uniform geographic prices with no variation between access seekers. It is not clear whether price variation across applications would be allowed, and the tender may allow prices to vary with purchased volumes. The analysis in this section applies to any restriction the tender imposes on the NBN provider's capacity to engage price discrimination.
8. In the context of oligopolists that face varying demand, price caps that exceed long-run marginal cost can still bind and so increase output, and hence economic efficiency and investment relative to no regulation (Buehler *et al* 2008).
9. Ergas and Ralph (2008, pp26–28) point out that while *ex ante* imputation tests can be applied to prevent price squeezes, these have significant efficiency costs, and much more so in the case of broadband, as compared with traditional telephony services.
10. In this respect Davis and Williams (2008, pp8, 11) are wrong to claim (in contrast to the literature) that 'vertical integration concerns will *only* be lessened with NGNs if the NGN investment is accompanied by much less stringent price regulation'.

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5 Broadband in the US – myths and facts

5.1 Summary

The United States (US) approach to broadband policy has been much maligned, both at home and abroad.[1] Critics base their case on its low rankings in the Organisation for Economic Co-operation and Development (OECD) statistics on broadband penetration, on the relative paucity of resale-based competition, and on comparisons to countries like Japan and South Korea, which moved more quickly than the US to deploy fibre infrastructures. Broadband in the US, they argue, is less advanced, less competitive, and less widely utilised than in other advanced countries, a clear indication that its relatively deregulatory policy approach has failed.

The case against the US broadband policy is widely accepted. In some circles, it may even represent a consensus. But there is a problem: the brief against US broadband policy is, at its core, fundamentally incorrect. This paper compares US and (briefly) Canadian broadband policies and outcomes, with the policies and outcomes in other advanced nations. The results show that the relatively deregulatory American approach to broadband policy has produced highly desirable results, including high levels of investment and innovation, nearly ubiquitous broadband availability, high and increasing levels of penetration, falling prices, and high levels of consumer satisfaction. Indeed, the US model is producing better overall results than in countries which continue to pursue mandatory unbundling and other highly regulatory approaches. Moreover, the advantages of the American model are likely to grow more pronounced over time. To avoid being left behind, other nations should abandon policies based on mandatory resale of incumbent networks and adopt the American approach.

5.2 The American way

The debate over broadband policy is at once dizzyingly complex and utterly simple. At its simplest it boils down to this question: will consumers best be served by forcing incumbent owners of communications networks to resell access to their networks to competitors (unbundle) at mandated prices; or, alternatively, should competitors be required to build their own networks, thereby encouraging investment in competing infrastructures? At least part of the answer lies in incentives: if forced to resell their networks to competitors, incumbents will be less inclined to invest; and competitors, given risk-free access to the networks of incumbents, will have weaker incentives to build new networks. On the other hand, if entry barriers are so high, or economies of scale so significant that competitors cannot viably build their own networks, infrastructure competition will never develop, so resale competition is the only viable option. One widely adopted thesis is that regulators can give competitors a boost up the so-called 'ladder of investment' by mandating access to incumbents' networks until they reach critical mass, and then gradually weaning them off the regulatory teat (Cave 2006; Eisenach & Singer 2007).

In the US, regulators have by and large answered these questions in favour of infrastructure competition. Cable modem service was never subjected to mandatory unbundling, and the broadband services provided by telephone companies using DSL and fibre were effectively exempted in 2003–05. Canada has followed a somewhat different path, but ultimately reached a very similar result.

5.2.1 US broadband policy

US communications policy is governed by the Telecommunications Act of 1996 (Telecom Act or Act). At the time the Act was passed, however, the internet had only just taken off (the first graphical user interface, the Netscape browser, was released in early 1994), and as a result the legislation was almost entirely silent on the topic of broadband.[2] As a result, broadband policy was left largely to the Federal Communications Commission (FCC) and the courts.

The FCC's initial implementation of the Telecom Act focused on mandating forced sharing of the traditional telecommunications network, including digital subscriber line (DSL) services as well as voice services. However, the FCC's approach was quickly found wanting by the courts, which ruled in several important cases that the FCC had gone beyond its statutory authority, most notably in failing to limit mandated unbundling only to those facilities which were 'necessary' for competition and without which competition would be 'impaired'. As a result, the FCC was forced to reconsider its initial course, and, beginning in 2003, scaled back unbundling significantly for all traditional telephone services. Most importantly for our purposes, the FCC determined in 2003 that fibre-based services would not be subject to unbundling, and that telephone companies would no longer be required to provide line-splitting (ie allowing competitors to lease only the frequencies used for broadband services) (FCC 2003); and, in 2005 it ruled that DSL facilities would no longer be subject to unbundling (FCC 2005). Thus, by late 2005, broadband services provided by traditional telephone services, regardless of the technology used, were for all practical purposes exempt from mandatory unbundling requirements.

It is worth noting that the FCC's decisions were not based on the existence of competition, but rather on the Commission's *expectation* that competition would develop:

> We find that an emerging market, like the one for broadband internet access, is more appropriately analyzed in view of larger trends in the marketplace, rather than exclusively through the snapshot data that may quickly and predictably be rendered obsolete as this market continues to evolve… While we recognize that broadband Internet access service is *not ubiquitously available* today, this market is rapidly changing and growing. (FCC 2005, emphasis added)

For cable companies, policy developed along a somewhat different path. While the unbundling provisions of the 1996 Act did not apply explicitly to cable, a case could be (and was) made that the Commission nevertheless had the *authority* to mandate unbundling of cable-modem services. Indeed, during the late 1990s, America Online, then the world's largest ISP, engaged in a major lobbying campaign designed to force cable companies to provide 'open access' to their lines. The issue came to a head in 1999, when AT&T purchased the largest US cable company at that time, TCI, a transaction which required FCC approval. The ISPs, joined by so-called public interest groups, urged the FCC to impose mandated unbundling or bitstream access as a condition of the merger. The FCC, under the leadership of then Chairman William Kennard, refused to do so, arguing that the broadband marketplace was "still in its infancy" and that regulation would thus be premature (TechLawJournal 1999). Furthermore, Kennard explained in a 1999 speech, any effort to impose such requirements on cable firms would be fraught with difficulties:

> It is easy to say that government should write a regulation, to say that as a broad statement of principle that a cable operator shall

> not discriminate against unaffiliated internet service providers on the cable platform. It is quite another thing to write that rule, to make it real and then to enforce it… So, if we have the hope of facilitating a market-based solution here, we should do it, because the alternative is to go to the telephone world, a world that we are trying to deregulate and just pick up this whole morass of regulation and dump it wholesale on the cable pipe… when I look at the cost of regulation versus the benefits, when I look at the prospect that we can have a robust, competitive broadband marketplace, I conclude that we have to resist the urge to regulate and let it play out for just a while longer. (Kennard 1999)

While the issue of cable unbundling was not formally and finally resolved until 2002 (FCC 2002), as a practical matter, the idea died with Kennard's 1999 speech.

The third primary leg of the broadband stool, wireless, has taken an even more convoluted course, and it is well beyond the scope of this article to recount the entire history. Briefly, however, the US has pursued a relatively market-oriented approach in the wireless arena as well, most notably by refusing to impose a single technology standard for digital mobile wireless services, by auctioning permissive spectrum licences that allowed carriers to deploy the services of their choice, and by allowing carriers to lease and trade spectrum licences among themselves (Hazlett 2001).

In sum, US broadband policy followed a long and winding path to today's relatively market-oriented posture. While it was apparent from at least 1999 on that cable modem service would not be subjected to mandated unbundling, relief for the incumbent telephone companies did not arrive until six years later, in September 2005. With respect to wireless, the US market, while far from perfect, has been competitive and largely unregulated throughout the broadband era.

5.2.2 Canada's broadband policy

While Canada followed the US down the path of unbundling last-mile infrastructure, it did not mandate line-sharing (Crandall 2007a), and its unbundling regime has – for a variety of reasons perhaps unique to Canada – not led to high levels of resale-based competition. Moreover, in 2006, a government-appointed advisory board recommended substantial deregulation of broadband (and other telecommunications services) (Telecommunications Policy Review Panel 2006), which is now being implemented (Canadian Radio–Television Commission 2006). Under the new policy, the regulator is required to forbear from retail-rate regulation in any area where competing services are available to 75 per cent of customers from two competing infrastructures, of which one may be wireless (Canadian Governor in Council 2007). Thus, while Canada has not completely forsworn mandated unbundling of broadband, the net result of its policies has been a high degree of infrastructure competition and relatively little resale-based competition (Atkinson *et al* 2008).

5.3 The case against the US model

The brief against the US model takes two basic forms, the first theoretical and the second empirical. On the theoretical side, critics allege that broadband infrastructure is either a natural monopoly (at least in the 'last mile'), or that whatever competition (eg between cable companies and telephone companies) that does emerge will be insufficient to generate economically efficient outcomes. On the empirical side, critics point to results in other nations, such as Japan, and to the US' relatively low ranking in the OECD's broadband penetration rankings, as evidence that the US model has failed. These two sets of arguments are summarised below.

5.3.1 Infrastructure competition theory

The theoretical case against the US model rests on one of two assumptions. Some, such as former FCC Chairman Reed Hundt and Google Chief Technology Officer Vint Cerf, have suggested that the last-mile infrastructure is a natural monopoly; that is, that duplication of last mile facilities is economically inefficient. For example, in a February 2008 interview, Hundt opined as follows:

> [W]e need to get over the idea that having cable and telephone companies each do an okay job is somehow better than one firm doing a great job... If the network is truly open and if the goal is to maximize the bandwidth and that's what you have as your business and regulatory paradigm, then it's not very important that you always pit cable against telephone. It's more important that you have at least one universal provider. (Gubbins 2008)

Hundt's comment, of course, is a popularised version of what is ultimately a highly technical economic argument relating to the importance of economies of scale and scope in next-generation networks (NGN). Sceptics of the viability of last-mile competition argue, as the European Regulators Group concluded in 2007, that the characteristics of NGNs "are likely to reinforce the importance of scale and scope economies, thereby reducing the degree

of replicability, potentially leading to an enduring economic bottleneck," and thus "may lead to a natural monopoly in certain areas of the electronic communications value chain" (ERG 2007).

Even where infrastructure-based competition does occur, some critics argue it is insufficient. For example, in June 2008, Google's Vint Cerf attracted attention when he suggested that the Internet infrastructure should be nationalised (Shonfeld 2008). He subsequently explained his comments, arguing that

> … the internet is in some ways more like the road system than telephone or cable. These are essentially single purpose networks, each built for a particular application... I think the incentives now in place for broadband service provision *have not produced significant facilities-based competition*. (Cerf 2008, emphasis added)

Underlying Cerf's argument that facilities-based competition is not significant is the notion that the wireline infrastructures deployed by cable and telephone companies constitute a duopoly which does not produce economically efficient results. As one prominent US Congressman put it, "broadband service to residential consumers in the United States is dominated by a 'digital duopoly' of two technologies – cable modem and telephone company DSL services" (Markey 2006). Similar arguments have been advanced in more formal terms in various regulatory forums, with economists and others urging regulators to conclude that the competition between cable and telephone companies "does not provide effective competition" and "fails to protect consumers" (Baldwin 2007), and ultimately that "the United States' dismal position in the world is a result of the FCC's failure to foster competition in broadband markets now dominated by a telephone–cable duopoly" (Schwartzman *et al* 2007).

5.3.2 The empirical case

This brings us to the second primary argument against the US model: that the US is 'losing the race' to deploy next-generation broadband networks. As one analyst put it recently, "It is hard to follow broadband telecommunications policy without hearing almost weekly that the United States ranks 15th out of 30 [OECD] nations in broadband deployment" (Atkinson *et al* 2008). The critique goes beyond penetration, arguing that US pricing and quality are also below par. As one liberal US group explained it in a 2008 policy briefing:

> [W]e are falling behind the rest of the world. In 2001, America stood near the top of global rankings of broadband adoption; a few short years later, we have been leapfrogged by our European and Asian competitors.
>
> Broadband adoption isn't the only statistic that matters. Maybe more important is whether high-speed internet services are of high quality and value. Unfortunately, we are doing even worse when it comes to price and speed. The average broadband offering in Japan is 10 times faster than the average service available to US consumers – at half of the cost. (One Nation Online 2008)

Such arguments have been advanced in support of various alternative policies, from net-neutrality regulation (Lessig 2006) to increased subsidies for rural broadband deployment (Hundt 2008). However, as explained immediately below, the empirical case against the US broadband model is unsupportable.

5.4 Why the critics are wrong

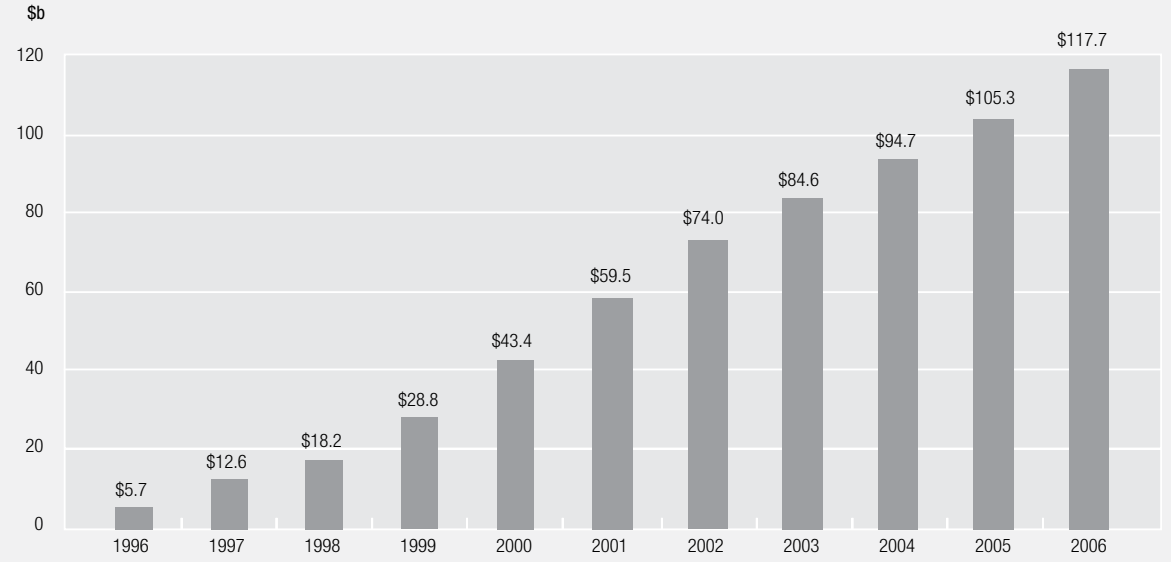
The case for or against the US model ultimately boils down to results. Are the critics right in arguing economies of scale and scope make last-mile infrastructure competition uneconomical? Does the data support the claim that US consumers are receiving sub-standard services at high prices and that US competitiveness is suffering as a result? As demonstrated below, the answer to both questions is, in a word, no. Last-mile infrastructure competition is flourishing, and consumers and the economy are benefiting as a result.

5.4.1 Last-mile infrastructure competition

The economic viability of last-mile infrastructure competition is demonstrated by the simple facts that it exists and is growing. In both Canada and the US, telephone companies and cable companies have deployed nearly ubiquitous competing wireline infrastructures, and significant last-mile competition exists in many other nations as well. Moreover, in many areas of the US, cable overbuilders have deployed a third wireline infrastructure (Eisenach 2008). In significant portions of the US, and in many other nations, advanced wireless broadband infrastructures have also been deployed, and such deployments are expanding rapidly.

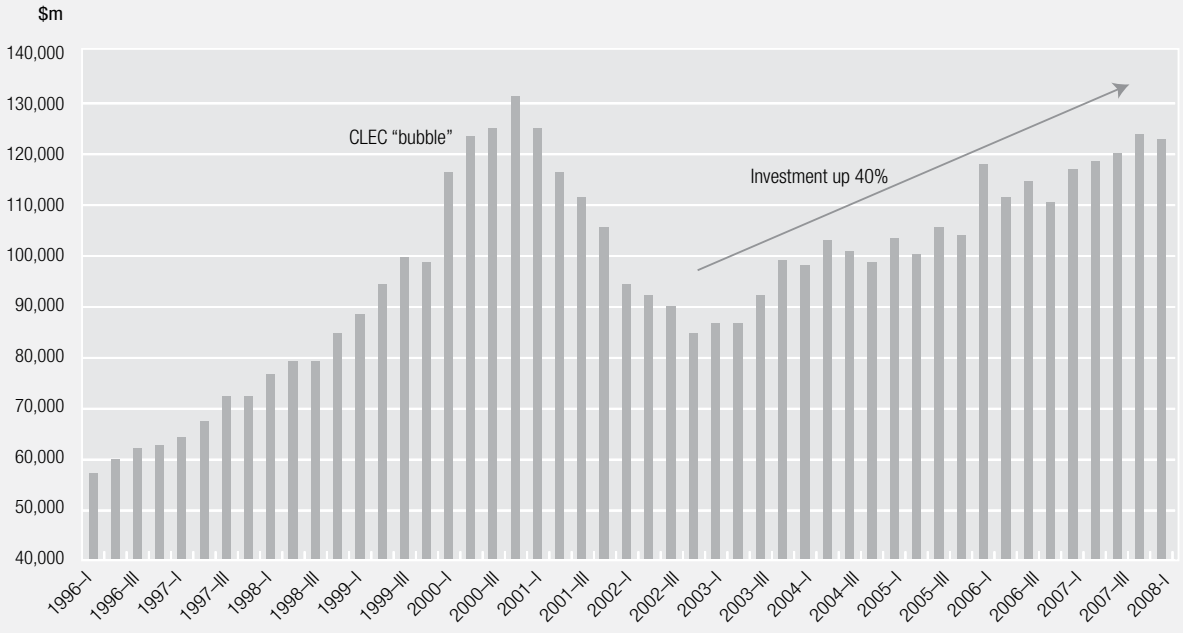
Virtually 100 per cent of US households have access to wireline telephone service from an incumbent telephone company; of these, approximately 82 per cent have access to DSL services (FCC 2008). At least 85 per cent of households are passed by wireline cable providers (FCC 2006); of these, 96 per cent have access to cable modem service, and nearly all of these have access to cable telephony services (Wlodarczak 2008). Further, 82 per cent of US households have access to mobile wireless

FIGURE 1:
CUMULATIVE INFRASTRUCTURE EXPENDITURES BY CABLE OPERATORS 1996–2006 ($ BILLIONS)



Source: National Cable Television Association.

FIGURE 2:
REAL INVESTMENT IN COMMUNICATIONS EQUIPMENT, BY QUARTER, 1996–2008 ($ MILLIONS)



Source: United States Department of Commerce, Bureau of Economic Analysis

broadband services from one or more provider (FCC 2008). Thus, the vast majority of US consumers can choose from at least three infrastructure-based broadband providers – and, as discussed below, more are on the way.

5.4.2 Effects on investment and innovation

There is little dispute that infrastructure competition results in increased investment and drives more rapid innovation. A recent OECD report, for example, finds as follows:

> In the United States, where cable modem use is more prevalent than DSL lines, *competition is leading to network upgrades*. Nationwide fixed-line telecommunication operators such as AT&T and Verizon are actively deploying optical fibre networks to compete with cable TV operators' multiple play services. (OECD 2008, emphasis added)

As telephone companies improve their networks, cable companies are forced to respond with better technology and still faster networks. As a recent report concluded:

> The chief reason why some cable operators are embracing DOCSIS 3.0 so tightly and others are not is the state of telco competition. Comcast is facing strong challenges from Verizon Communications Inc.'s growing fibre-to-the-home (FTTH) network, FiOS. Verizon, which tangles with Comcast up and down the East Coast, has now signed up more than 1 million FiOS TV customers and more than 1.5 million FiOS internet users. (Breznick 2008)

In other words, more intensive infrastructure competition leads directly to more rapid innovation. In the US today, Verizon's FiOS fibre-to-the-home infrastructure is offering 50 Mbps broadband service to over 12 million US homes, while Comcast is beginning to deploy DOCSIS 3.0, capable of speeds up to 160 Mbps. Verizon's response: It recently announced trial deployments of new passive optical networking equipment capable of peak speeds of up to *400 Mbps* (Rearden 2008).

Innovation is also accelerating in the wireless sector, where European leaders now readily concede the US mobile data market has taken the lead (Reding, May 2008; see also Nielsen Mobile 2008, Kraemer 2008). The next phase: deployment of 4G networks, including WiMax. For example, Craig McCaw's Clearwire already offers high-speed wireless broadband (along with VoIP service) in 39 US cities. Now that the company has merged with Sprint-Nextel's Xohm project, and collected more than $3 billion in backing from Google, Intel and the major cable companies, it is building out its 4G network to cover 120–140 million people by 2010 (Sharma & Kumar 2008).

To make these improvements, the cable, telephone and wireless companies are investing literally hundreds of billions of dollars. As shown in Figure 1, for example, US cable operators – which, as noted above, were never saddled with unbundling restrictions – invested more than $115 billion to upgrade their networks between 1996 and 2006. It is noteworthy that investment accelerated significantly in 2000, immediately after Chairman Kennard made it clear unbundling would not apply.

US infrastructure investment has not been limited to cable companies. Since the FCC began exempting broadband infrastructures from unbundling requirements, overall investment in communications equipment in the US has risen by more than 40 per cent, as shown in Figure 2. And, unlike the prior investment bubble, much of which consisted of literally hundreds of billions 'invested' by now bankrupt CLECs in advertising and overheads (Darby *et al* 2002), the bulk of the investment in the last five years has gone into network upgrades that have yielded a faster, more robust broadband infrastructure.

Perhaps most importantly, investment under the US model has outpaced investment in nations which have aggressively pursued mandatory unbundling. For example, as shown in Figure 3, investment per line by incumbent telcos in the US and Canada has exceeded that in the European Union.

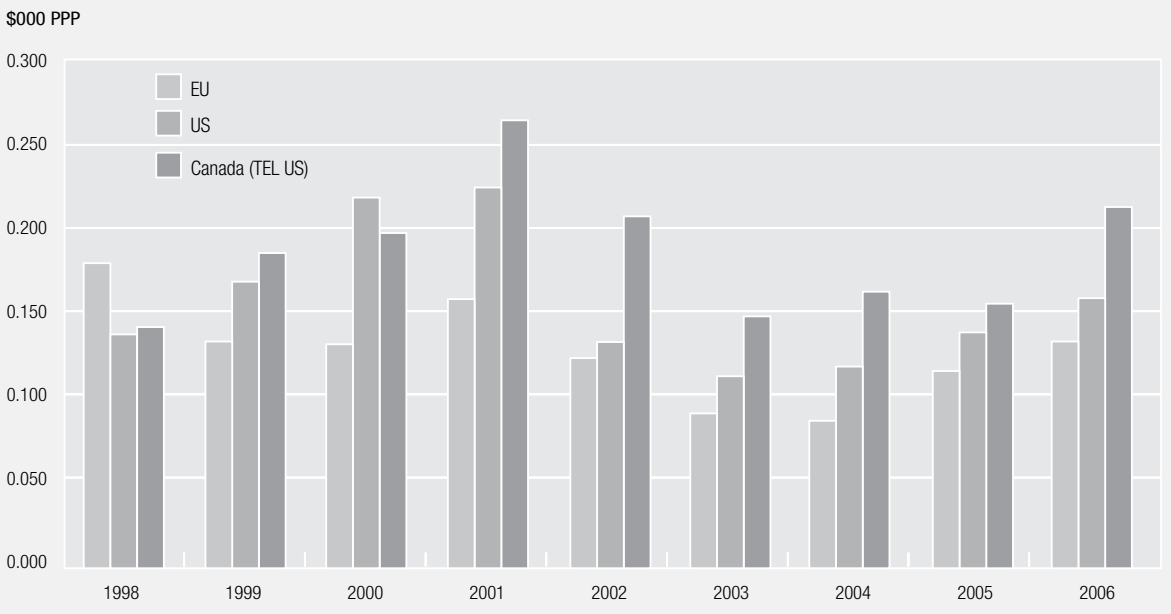
For those such as former FCC Chairman Hundt and Google's Vint Cerf, who have suggested the US government should fund and operate the next-generation internet, these figures should be cause for reflection. In 2007, the US Federal government invested a total of about $57 billion in all US transportation infrastructure, including roads, bridges, ports, airports and railroads. During the same period the *Wall Street Journal* reports US telecom firms invested $70 billion in the telecom infrastructure alone (White 2008).

5.4.3 Prices, quality and penetration

Ultimately, the complaint against the North American model rests on results, and – because Canada has consistently ranked highly in the most frequently cited OECD statistics – primarily on results in the US. As discussed above, critics argue that the US has fallen in the OECD rankings of broadband penetration, and also argue that prices are higher, and service slower, than in other OECD nations.

As a preliminary matter, the OECD rankings, which are (in theory) based on the number of residential internet connections divided by a country's total population, have been demonstrated to produce biased results, for several reasons, including: (a) the OECD statistics do not reliably distinguish business from residential connections (meaning that business connections are likely included in the totals for other nations, but excluded from the totals for the US); and (b) counting connections per capita, as opposed to per household, inherently understates the proportion of connected households in countries, such as the US, with large household sizes (Adkinson *et al* 2008, FCC 2008, Wallsten 2008). Further, the OECD data fails to count most wireless internet connections, an arena where the US (as noted above) is among the leaders, and where more than a third of the population accesses the internet using public WiFi connections (Horrigan 2008).

FIGURE 3:
CAPITAL EXPENDITURES PER LINE ON FIXED-LINE NETWORKS
NORTH AMERICA VS EUROPEAN UNION LOCAL EXCHANGE CARRIERS, 1998–2006



Source: Crandall 2007

Data on household internet penetration paints a very different picture from the OECD data. For example, a recent Ofcom report, based on 2006 data, ranked Canada first and the US fourth in both household penetration and growth of household penetration, ahead of Germany, Italy and France (Ofcom 2007; see also Wallsten 2008, showing the US ranked ninth among 31 advanced nations). The Pew Project on the Internet and American Life reports that household internet penetration in the US increased from 47 per cent in March 2007 to 55 per cent in 2008, and that the annual growth rate increased from 12 per cent to 17 per cent over the previous year.

Furthermore, academic studies leave little doubt that infrastructure competition leads to higher penetration (Distaso *et al* 2005), a fact recognised even by pro-unbundling policymakers. For example, European Union Commissioner Viviane Reding, a staunch advocate of unbundling for next-generation networks, recently conceded that:

> effective infrastructure competition has been one of the main factors contributing to broadband rollout. Countries such as the Netherlands and Denmark, that have the highest broadband penetration levels in the world ahead of Korea and Japan, are those that have a real choice of infrastructures. (Reding January 2008)

The data relating to prices and quality cited by critics are also highly misleading. Typically critics point to a few countries, notably Japan and Korea, where high-speed services are available for relatively low prices, but ignore the fact that such services are not available to most consumers, or are heavily subsidised; or, they cite advertised speeds, ignoring the fact that advertised speeds are rarely delivered (Internet for Everyone 2008; Schwartzman *et al* 2008). Surveys of broadband prices that take these factors into account tend to find the US has among the lowest prices and highest delivered (as opposed to advertised) speeds of major countries (Kende 2006, Ofcom 2008, Wallsten 2008).[3]

Indeed, infrastructure competition in the US has led to lower prices across the board. For example, FCC Chairman Kevin Martin reported in a recent speech that prices for entry-level DSL service dropped from $49.99 to $14.99 between 2002 and 2006; that is, during the period cable companies were aggressively rolling out their cable modem services (Martin 2006), and the Pew Project on the Internet and American Life recently reported that average broadband prices in the US declined by 4 per cent between December 2005 and April 2008 (even as speeds increased) (Horrigan 2008). A recent report by the US Government Accountability Office concluded that markets in which cable

overbuilders had deployed competing infrastructures enjoyed 23 per cent lower pay-TV prices as a result (FCC 2006), while a Bank of America survey found even deeper price cuts, ranging from 29 per cent to 43 per cent, in markets where Verizon had deployed FiOS pay-TV services (Ford 2006). Overall, US telecommunications prices have declined by 6 per cent since 2000, while the consumer price index rose by 18 per cent.

Perhaps the ultimate test is that US consumers appear to be highly satisfied with their broadband services. For example, Ofcom reported that 85 per cent of US consumers reported being satisfied with their download speeds (the highest satisfaction level of the countries surveyed), compared with only 39 per cent of Japanese consumers (Ofcom 2008).

In sum, while it is indisputable that *some* consumers in *some* countries have access to higher broadband speeds at lower prices than consumers in the US, the selective use of this fact to suggest that US broadband policies have failed, or that the US broadband market is failing to deliver the services consumers want at attractive (and constantly falling) prices, is simply not justified by the facts. To the contrary, the evidence suggests the North American broadband market is meeting the needs of the vast majority of its consumers, and that performance will continue to advance as the pro-infrastructure competition policies that constitute the North American model continue to result in higher levels of investment and innovation.

5.5 Can the US model work elsewhere?

Given the facts above, most policymakers, including those who support access regulation of next-generation networks, appear to recognise that infrastructure competition is the most desirable outcome in broadband markets. For example, the European Regulators Group recently concluded that:

> Competition over competing infrastructure has many advantages. The pressure to minimise costs is exerted over the whole value chain, inducing greater scope for innovation in products and processes which creates a downward dynamic for costs. Consumers also benefit from more diversified offerings, which correspond more closely to their individual needs. (ERG 2007)

Similarly, the Australian Consumer and Competition Commission, which has aggressively pursued mandatory unbundling on next-generation networks, admits that "facilities-based competition is more likely to promote the [long-term interests of end-users]. This is because this form of competition allows rivals to differentiate their services and compete more vigorously across greater elements of the supply chain." (ACCC 2007)

5.5.1 Flaws in access regulation

Given the widespread agreement on the desirability of infrastructure competition, why do policymakers continue to advance policies aimed at increasing competition through resale? The most commonly cited reason is that most countries, unlike Canada and the US, do not presently have widely deployed competitive wireline infrastructures (ie cable). As Commissioner Reding explains:

> Only about 20 per cent of Europe's telecom markets have full infrastructure competition in the access networks. The rest have no choice but to connect using the incumbent's local loop, in practice this means that 90per cent of European subscribers are on the incumbent's local access network. That is why access regulation, in particular the process of unbundling access loops, has been so important. (Reding January 2008)

Thus, while regulators generally agree in the *desirability* of infrastructure competition, they argue that it can only be achieved through access regulation, and in particular by applying the so-called ladder of investment model. As Commission Reding puts it:

> The current EU rules are based on the view that, by also giving competitors access to the networks of dominant operators, new market entrants will start generating revenue, thereby climbing up the first step of a 'ladder of investment'. And this will allow them in due course to roll out their own infrastructure and to become less dependent on other player's facilities. This will lead to more infrastructure-based competition over time which is to be welcomed as a more resilient and independent way to compete. (Reding June 2008)

Furthermore, the logic goes, broadband networks are no different from (or, as noted above, perhaps even more prone to natural monopoly than) the traditional telephone networks to which the 'ladder of investment' model was initially applied:

> The move to Next Generation Access Networks does certainly not change the logic when assessing the need for regulation in order to ensure effective competition… In the Commission's view, it would be a fatal mistake to deviate from the pro-competitive approach of the current framework. (Reding June 2008)

Thus, "[u]nless there is a competitive access market, access regulation can be expected to

continue irrespective of the underlying technology" (Reding June 2008).

The problems with this line of reasoning are both numerous and profound.

First, the economics of next-generation networks are, contrary to some regulators' assumptions, profoundly different from the economics of single-purpose telecom and cable networks. Whereas single purpose networks must recoup the entire cost of investment from a single service (telephone, pay TV), next-generation networks allow providers to increase their average revenue per user (ARPU), by selling multiple services over the same network. For example, many US cable companies now have ARPUs at or above $100 per month (Moffett 2007). At the same time, falling input prices and economies of scope have reduced the costs of infrastructure. Regulators in the US and elsewhere have recognised that digital convergence "significantly reduces the amount of capital that is required to build and maintain facilities" (Telecommunications Policy Review Panel Canada 2006; see also FCC 2005). As a result, service territories that might once have been unable to support multiple wireline providers can economically do so – as the experience in the US, Canada and elsewhere has shown.

Second, there is virtually no evidence that the 'ladder of investment' approach to telecoms regulation has worked in practice, in the sense of having encouraged (or even permitted) competitive telecommunications carriers to move from reliance on incumbents' networks to building their own (Eisenach Singer 2007; Hausman Sidak 2005). While theoretically appealing, the model's success depends on the ability of regulators not only to predict the correct prices for unbundled network elements, but to adjust those prices constantly to reflect changing market conditions and, ultimately, to determine when the time has come to cut competitors off from mandated access altogether. These tasks are challenging as a matter of technical economics, but perhaps even more so when competitors argue in the public arena that any increase in access fees, let alone complete termination of mandated access, will harm competition. Even where competitors have deployed fully functional networks (as, for example, in Australia, where competitor Optus has built out a hybrid-fibre-coax network to approximately two million homes, but continues to use unbundled network elements from incumbent Telstra to serve those same homes), regulators are likely to be told that continued mandated access is essential to the competitor's economic survival (Eisenach 2008).

US regulators overcame these fears. Their decisions had profound impact on competitive telecom providers, as well as on ISPs whose business models depended on reselling the broadband services of facilities-based providers. Undoubtedly, the objective of being fair to competitors delayed the move away from mandated access regulation. Yet, the FCC ultimately decided to place the long-run interests of consumers ahead of the short-run interests of competitors.

Third, the existence of competing infrastructures (or the lack thereof) is, as economists would put it, an endogenous variable. For example, in Germany, where only about 5 per cent of broadband services are provided over cable modems, the cable television infrastructure passes approximately 80 per cent of homes. Why has more cable modem service not been deployed? The reasons are complex, and include the facts that the cable system was once owned by incumbent Deutsche Telecom (which had little incentive to upgrade the system to provide cable modem service when it was already providing broadband over DSL), and that the industry is highly fragmented (a situation which is now beginning to change). Going forward, however, there can be little doubt that the incentives of cable operators to spend billions upgrading their systems to provide broadband are affected by their perceptions of the likelihood that Deutsche Telecom will be forced to offer next-generation services to competitors at below-cost rates, thus undercutting the cable companies' ability to earn an economic return on their investments (Atkinson *et al* 2008). Thus, the very decision to mandate access in the face of inadequate infrastructure competition is a recipe for *continued* inadequate infrastructure competition.

Would cable companies in the US have deployed advanced broadband infrastructures, or deployed them as rapidly and wisely as they did, if the FCC had yielded to pressure to impose 'open access' requirements in 1999? Would the telephone companies today be rapidly and widely deploying advanced FTTP and FTTN infrastructures if the FCC had imposed unbundling requirements on those investments? All of the evidence suggests not.

Ultimately the case for mandated unbundling of next-generation networks fails for the simple reason that today's broadband markets are intensely dynamic. Today's next-generation network is – as the US cable companies are finding out in the face of competition from 50 Mbps FiOS service – tomorrow's technological dinosaur. Multi-billion dollar investments must be made on the basis of business judgements about largely unquantifiable risks, in an environment in which analysts and economists are bound to disagree. Many analysts, for example, continue to believe Verizon's FiOS investment will prove to be a loser; and,

it is anyone's guess whether Clearwire's investors will ever see a penny of their money back. Moreover, a delay of a year (a nanosecond in regulatory time, but eternity in the modern broadband marketplace) may be enough to ensure an investment is never made at all. As Chairman Kennard stated so clearly back in 1999, regulations have costs as well as benefits.

5.5.2 Principles for advancing competition

Given the demonstrated viability and acknowledged benefits of infrastructure competition in broadband markets, the only remaining question for policymakers should be how best to advance such competition. Designing the policies will be a complex undertaking, but regulators would do well to begin with four principles in mind.

First, the presumption in broadband markets should be that competition is viable. Thus, in the absence of a clear demonstration of specific market failures, broadband infrastructures should not be subjected to mandated access rules. That is, policymakers should take a cue from the FCC, whose decisions to forbear from access regulation were made largely on the basis of its *expectation* that infrastructure competition would develop in the future.

Second, to the extent regulators have residual doubts about the prospects for infrastructure competition to develop, they should weigh those doubts against the likelihood that regulation is capable of achieving economically efficient outcomes.[4] Simply put, they should weigh the likelihood (and magnitudes) of imperfect marketplace outcomes against the certainty of imperfect regulation.

Third, to the extent infrastructure-based competition is not already occurring, regulators should look to the particular causes, including specifically whether existing policies may be part of the problem. For example, as discussed above, the German cable industry has been extremely slow to deploy cable modem service. In such a circumstance, regulators should ask what policy obstacles may be delaying investment by cable operators, rather than jumping to the conclusion that the broadband market is a natural monopoly.

Fourth, to the extent countries elect to subsidise deployment of broadband networks, particularly in rural areas, they should design such policies to be both competitively and technologically neutral. In this regard, the US is a poor model, as the design of its universal service program has provided billions of dollars in subsidies to one class of incumbent telephone company (the rural local exchange carriers, or RLECs), and billions more to subsidise duplicative wireless voice service, while virtually ignoring rural areas served by other wireline carriers (GAO 2008).

5.6. Conclusion

The North American model for broadband policy has been widely criticised. Upon inspection, however, the criticisms simply do not hold up. Next-generation broadband networks are manifestly not natural monopolies in most places; and, with the exception of a single highly publicised but deeply flawed OECD penetration metric, the performance of North American broadband markets compares well with the performance of markets in other nations. Indeed, by forbearing from application of access regulation to next-generation networks, US policymakers have set the stage for continuing investment and innovation that promises to make North American broadband markets the envy of the world. Regulators elsewhere would do well to take notice, as their continued pursuit of mandated access regulation is likely to result in the perpetuation of infrastructure monopolies and their attendant economic disadvantages.

Endnotes

1. Unless otherwise noted, the words 'broadband policy' refer to economic regulation of broadband services (ie to regulations requiring mandatory unbundling and resale of broadband services by incumbents to competitors). In so doing, I do not intend to diminish the significance of other aspects of broadband policy, such 'network neutrality' regulation and subsidies for deployment in hard-to-serve areas. For a review of such policies, see Atkinson *et al* May 2008.
2. The two exceptions were Title V, the Communications Decency Act, the main portions of which were subsequently overturned by the Supreme Court, and Sec. 706, which permitted the Federal Communications Commission to forbear from regulating advanced services, but has not played a significant role in the Commission's decisions.
3. The data cited in the Ofcom report has to be carefully sifted, as price comparisons are reported for a number of different baskets of services of telecommunications services, many of which include prices for pre-paid mobile (higher in the US, but purchased by very few US consumers relative to other nations), or exclude TV licence fees (which do not exist in the US). Looking solely at the broadband prices reported by Ofcom, US prices generally rank lowest or second lowest.
4. In this regard, consider Commissioner Reding's recent statement that "[T]he best way for encouraging long-term investment is to establish *a priori* a number of principles that national regulators should take into account when regulating access prices with regard to next-generation access networks. In my personal view, these should include a risk premium of around 15 per cent" (Reding June 2008). This proposal is simply ludicrous, for two reasons: First, as discussed above, the ability of analysts and economists to estimate the economically efficient risk premium for any given project is at best doubtful. Second, there is no reason whatsoever to believe the risk premium would be the same across projects. Reding's proposal, if implemented, would thus guarantee the misallocation of billions of dollars of scarce investment capital.

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6 The European experience – regulating broadband services

6.1 Summary

This chapter examines imperatives driving the global initiatives by governments and operators to establish broadband infrastructure and deploy broadband services. It also considers their connection to universal concerns that the provision of broadband services, and access to broadband infrastructure, should be established on a basis that supports fair and sustainable competition. Various approaches are examined, including platform or infrastructure-based competition on the one hand, and a selection of mandated access regimes on the other. The chapter notes there are no cases where a comprehensive structural separation approach has been completely implemented, and that many programs for establishing functional separation arrangements are either in planning or in early implementation stage. This makes it difficult to assess such arrangements, since they are all works in progress. In terms of the European experience to date, the chapter discusses UK, Italy and Sweden as useful case studies on regulating access to infrastructure for the competitive deployment of broadband services. In addition, some countries, such as Hong Kong and the Netherlands, have addressed the related regulatory issues of migrating from copper to fibre infrastructure for broadband service provision. These countries provide a useful context in which to consider the approach being planned by the Australian government.

6.2 Why broadband is important

Most Australians would recognise that information and communications technology (ICT) has the capacity to transform the way in which they live, relate socially and conduct business. They recognise this because of their own experience over the past decade or two. They know that access to the internet has changed their ability to access information in ways that were not possible before. They know that the messaging services to which they are connected give a new immediacy to social and business interaction and transactions. They know that response times and cycle times for many business processes have

reduced significantly. They know that they, and their acquaintances, are more connected and contactable than ever before, through mobile and other wireless forms of communication. And if they forget this, they are reminded as soon as there is a breakdown or non-availability in the systems on which they rely. A day without internet access might be regarded now as 'wasted', given the reliance on ICT systems.

The parameters of the information society are widely understood and the benefits widely accepted. The benefits of broad enabling technologies, such as those categorised as ICT, have been studied in terms of national productivity improvement and at the level of the individual firm. Not only does ICT improve efficiency at these levels, it will also transform both businesses and economies (Ovum 2003).

It is interesting to note that the benefits attributed to broadband are essentially those that relate to ICT generally, although perhaps writ large in recognition of the services and applications that will potentially be developed with greater data capacity and speed. The question remains how to assess the increment of social and economic benefit that will result from the additional, substantial cost of providing ubiquitous broadband access. This is very difficult, in part because broadband comprises a set of general and enabling technologies across the economy. It is a question that is similar to asking about the benefits of universal electricity services. A further question, seeking to clarify the differential in benefits between different broadband access systems (for example, fibre-to-the-node (FTTN) compared to fibre-to-the-premises (FTTP), simply adds another level of complexity.

Unfortunately it does not help to look at the responses to these general questions overseas. The answers there are very similar to those in Australia. For example, Viviane Reding, the European Commission's Commissioner for Information Society and Media said:

> Since the 1990s, the internet has changed our life and has transformed our economy. This process will accelerate as the mobile internet and ultra-fast broadband make it possible to deliver innovative services such as eHealth and eLearning everywhere, even in the poorest and most remote communities.
>
> We all share the view that the internet is a key tool for free speech and contributes to a more people-centred and inclusive society. It is also a tremendous instrument for conducting business, for eCommerce. One of our favourite leisure activities, television, goes increasingly through the internet, as does our mail and our relations to public agencies. (Reding 2008b, p2)

The point of this statement is not how different it might be, but how very much the same it is to the approach in Australia. Although the reference is to the internet, the context was broadband. The benefits are couched in the same terms of increased and innovative opportunities for social interaction, new services and new means of delivering both new and old services.

6.2.1 Broadband goals

Other goals are also being sought through broadband. A key goal is to ensure that national competitive advantage in trade and commerce is maintained. This leads to concerns about slipping behind our major trading partners and generally losing out in the global market place. The debate at this point has moved from specific benefits in terms of service development and delivery, convenience and social amenity, to fears about shifts in comparative national efficiency and productivity. The focus of this discussion is how well we are doing relative to other countries, rather than whether we are reaping the benefits that are inherent in the technology. In practical terms globalisation means that Australian businesses need to be connected with their partners and customers in other countries; and should have equivalent communications facilities.

6.2.2 A new focus

There are difficulties in developing a clear, quantified view of the social and economic benefits of broadband because:

- we recognise the dynamic nature of the technology and of the services that are involved, but the transformational and multiplier effects through many systems over time are not readily understood or amenable to reliable forecasting
- we have no long-term time frame that would give us comfort in this area – we tend to consider that we are at the beginning of a major shift in platforms for transacting, innovating and communicating generally
- the potential impacts will go so deep into the economic and social fabric that current analytical tools appear to be inadequate to fully assess them.

ACIL Tasman noted the difficulty in valuing broadband:

> It is impossible to fully capture and model all of the impacts of broadband on the economy. This is partially due to the limitations of measures such as labour productivity, total factor productivity (TFP) and GDP in describing the 'value' of a technology. But, perhaps more significantly, broadband technology provides certain value that avoids quantitative detection and valuation by even the most complex economic models… A knowledgeable population tends to make more people more informed. More informed people make more rational decisions, and more rational

> decisions tend to be more efficient decisions. And, the argument follows, that more efficient decisions by more people can make us all better off. Hence, it is important to recognise that while there are measurable gains from a technology such as broadband, its impacts on making the population more knowledgeable are not readily quantifiable. (ACIL Tasman 2004, pp3–4)

On the same point, the OECD has noted:

> There is relatively little empirical evidence of the economic impact of broadband, although research is growing. In part this is because the impact on the economy occurs indirectly as it acts on variables that, in turn, are drivers of growth. Broadband is an enabler of changes – it allows an impact on the economy and restructuring when it is combined with other ICTs, such as computer hardware and software, and complementary factors such as skills and organisational change. The study of the economic impact of broadband is complicated by data availability and measurement problems, reminiscent of the early days of the study of the impact of ICTs more generally and Solow's Productivity Paradox (IT is everywhere except in the productivity statistics)... It is also difficult to establish any causality related to broadband as it is very hard to disentangle the effects between infrastructure availability and economic growth (and availability does not necessarily mean efficient use). (OECD 2007a, pp22–23)

Even at the level of the investing firm, the case for broadband access and the deployment of fibre in the access network is not clear, especially when the areas are currently being served by copper technologies. The upgrade in suburban and provincial town locations will typically be in the order of $A1000–2000[1] per household passed, given typical Australian business and residential land-use patterns, and depending on the pre-existing circumstances. The additional revenue needed to make the business case will be dependent on the take-up rate that might be achieved. Uncertainties are manifest at this stage of broadband applications and service development. The level of uncertainty is compounded by policy uncertainty and by higher cost of deployment in markets with smaller demand and greater unit cost.

Under these circumstances it is not surprising that the policy debate has moved from quantifying the benefits to establishing arrangements for maximising the benefits that might exist and the incentives for innovation. Governments need broadband infrastructure so that the national and social goals already mentioned can be pursued. But it is to competition that they turn to provide the driver that will ensure that investment occurs in the right mix of technologies, at the right time, to address social and business demand in the right measure. And the framework for sustainable competition needs to be established.

6.3 The competitive framework

Generally, western economies are seeking sustainable competition at two levels in the provision of broadband:

- at the level of broadband access services, which is often packaged up with a set of services such as internet access and email, and sometimes also with associated telecommunications and/or entertainment services
- at the level of services or applications that are delivered and supported by the broadband platform.

At the first level, Australia has a history of permitting regulated access to those parts of an incumbent carrier's network that are considered to be natural monopolies – that is, those facilities or assets which it would not be economical for a competitor to duplicate. The critical assets that are relevant for the provision of broadband are those associated with the access network connecting subscribers to the operator's public exchanges (or switches). It is generally not economical to duplicate the access network both because of the substantial investment needed and because the existing network has substantial additional capacity. It is only used part of the time by each subscriber and, for residential subscribers, the provision of a single line is both necessary and sufficient.

Broadband is provided over copper lines using various digital subscriber line (DSL) technologies through the sharing of a common line between voice and data applications using splitter systems. However the maximum data capacity is limited to around 2 Mbps using current technologies at a distance of up to three kilometres between the premises and the serving exchange.[2]

The capacity can be increased, and the applications capable of being delivered greatly enhanced, if the copper lengths are shortened to a few hundred metres, and the FTTN method of installing fibre into part of the access network (to a distribution node) is designed to do this. With such a configuration, speeds can be increased up to 12 Mbps, and potentially much higher. Fibre connections running the whole distance from the exchange (or major network node) to the customer's premises (FTTP) will permit even greater speeds, currently in the order of 100 Mbps and potentially much more.[3]

Fibre networks offer even more pronounced natural monopoly characteristics than copper networks. On current usage patterns households will only ever need one connection. By its nature broadband is a multimedia platform, so that different services will be delivered by the same access service, simultaneously if required. Separate service-specific networks will be superseded and displaced.

6.3.1 Inter-modal competition

There are two broad choices for regulatory frameworks to promote competition in this situation. Regulators can rely on inter-modal competition – that is, competition between different technologies, to generate appropriate incentives for cost and price reduction, innovation and quality. Or they can rely on intra-modal competition sustained by an access regulatory regime.

For inter-modal competition, the contest in the market place is between different infrastructures based on different technologies. In the broadband market, one dimension of this contest is between cable technologies (including fibre and copper) on the one hand, and cellular and other wireless technologies on the other. The characteristics of these competing technologies means that they are not complete substitutes, and each has advantages that might suit the requirements of different services, or the same customers in different circumstances. Radio-frequency spectrum and other constraints make bandwidth more expensive on cellular and other wireless systems, such as WiFi and WiMAX, compared to cable. Screening capabilities might also influence the subset of uses that each is best suited to. Mobility or nomadicity is an advantage for some applications.

Although most regulators profess to be striving for a technology-neutral approach to industry regulation, they cannot ignore the characteristics of the services that are typically supported by different technologies. Based on this, industry wisdom at this stage of development is to regard wireless and fixed cable technologies as complementary rather than as in full competition, overlapping service markets notwithstanding. So neither in Australia or elsewhere is the inter-modal competition at this level regarded as sufficient to deliver competitive outcomes for broadband service delivery.

Another inter-modal competitive opportunity exists between telecommunications operator broadband platforms and cable television operator platforms. This is an important source of meaningful competition in countries that are well served with independent cable systems either nationally or in some key regions. The United States is an example of the former, and the United Kingdom of the latter. The pattern of independent cable systems in Europe is quite varied.

In Australia the two cable television networks are in the hands of Telstra and Optus, and not controlled by parties independent of the major telecommunications carriers. The opportunity for inter-modal competition is further reduced by the largely aligned coverage areas of around 2.5 million households in aggregate and the decision by Optus to retire its network and to deliver broadband services using Telstra's mandated unbundled local loops (ULLs) service. Optus' investment remains under-utilised and undeveloped for broadband provision (ACCC 2008).

6.3.2 Intra-modal competition

For most countries, including effectively the whole of Europe and Australia, the choice of regulatory framework boils down to choices about the access afforded to a common broadband infrastructure.

Regulators have a number of options about how to proceed. The first choice is between *ex ante* and *ex post* remedies for potential anti-competitive behaviour by the sole broadband access network provider. National regulatory authorities worldwide have the task of balancing measures that are *ex ante* (that is, applied in advance as a framework in which competition should develop and operate), with those that are *ex post* (that is, applied in response to anti-competitive behaviour). The problem with telecommunications is that the structural impediments to unregulated competition may well be embedded and unlikely to dissipate rapidly, if at all. *Ex post* solutions, such as prosecuting once evidence of anti-competitive behaviour is found to have occurred, may be difficult to apply because of evidentiary burdens. In any case the victims may well have exited the market or collapsed in the meantime. *Ex ante* remedies, on the other hand, are always intrusive and may inadvertently distort or retard market growth and development. Broadband is considered to be too important to take a wait-and-see *ex post* approach.

So that leaves various forms of direct access control as part of a regulatory framework. The objective is to establish a control regime in advance to ensure that competitors in the provision of broadband services have access to the common infrastructure on a fair and reasonable basis. This includes being subject to terms and conditions that reflect the costs that would apply for access under competitive market conditions, and that are equivalent to the terms that would be applied to the infrastructure controller's own downstream retail operations.

Control is sought through various forms of separation. The three remedies that may be applied are:

(a) Accounting separation

This is a remedy that forces greater transparency in accounts to allow calculation of the real costs involved in the production of regulated services in order to avoid margin squeeze or cross-subsidisation. It is a tool that is already available to Australian and European regulators, and is in fact one of the remedies that they can use where they find significant market power (SMP) in specific markets.

(b) Functional separation

Functional separation requires the creation of separated divisions within the incumbent to comply with regulatory obligations, but does not imply a change of ownership. The separate division that is created is not the operator's total wholesale business – only that part which involves assets that cannot be duplicated economically and to which competitors therefore need access for their own businesses to be viable. It requires operational and management separation to be instituted and, potentially, decisions to be made by the separated division independently of the rest of the company. The most well-known example is that of BT's Openreach, the creation of which was requested by Ofcom as a result of the UK's Telecom Strategic Review (Ofcom 2003).

(c) Structural separation

Structural separation means that the incumbent is forced by the regulator to sell off a division or part of the company or to place those assets at arm's length – joint ownership to comply with regulatory obligations. It is a very strong measure as it implies a change of ownership, but could potentially simplify the regulator's job by removing any incentive for the incumbent to discriminate against alternative providers.

6.3.3 What's wrong with accounting separation?

Accounting separation has serious limitations as a tool for addressing the risks posed by SMP. It is labour intensive and addresses only the accounting aspects of internal transactions. There are many other ways in which infrastructure owners can discriminate in favour of their own downstream retail operations. For example, they can share planning and capacity information, thereby offering timing and rationing advantages plus the element of surprise in the market place to their own operations. Perhaps most importantly, accounting separation involves retrospective assessment of behaviour, and by the time the regulator examines the data and forms a view, irreparable damage to competition may have occurred. In the case of broadband regulation, most regulators have decided that accounting separation is inadequate.[4]

6.3.4 Functional versus structural separation

It has come down to this – which of these remedies is likely to best deliver competitive outcomes in the provision of broadband services, keeping in place effective incentives to invest without distorting or delaying the development of a market that is generally considered to be in a formative stage?

6.3.5 Structural separation for Australia?

In its invitation for applications from organisations seeking to access up to $4.7 billion available from the Commonwealth in equity funding, the government stated its clear preference for some form of structural separation, so that the ownership of the National Broadband Network (NBN) would be held by an entity that was not itself a broadband service provider to retail markets (Conroy 2008).

The general arguments for structural separation are that it involves:

- less intrusive, expensive or continuous regulation
- a clear separation of the interests of the infrastructure services entity (often called NetCo) and the remainder of the dominant carrier's operations (involving competitive infrastructure and service businesses)
- separation of personnel and brand, and no possibility of confusion
- removal of all incentives for the NetCo to discriminate between its customers (all of whom are at the wholesale level)
- a level playing field for all competitors in the market place.

The arguments against are:

- the wholesale NetCo would be less likely to respond appropriately and in a timely manner to the changing needs of dynamic retail markets for broadband
- planning would be less coordinated and effective than in a single organisation
- shareholder value would diminish (in the residual dominant carrier's business)
- NetCo would tend towards a bureaucratic approach to its services
- there would be additional costs and related inefficiencies associated with the separation of IT and other systems that had previously served the total organisation
- most importantly, the possibility of inter-modal facilities-based competition would be extinguished.

A preference for structural separation was understandable given the Australian government's interest in receiving a suitable commercial return on its investment, rather than having the funds treated as a social investment (that is, as a grant). However, the Australian government has left it open to bidders to suggest the organisational arrangements they consider should apply. Telstra has publicised that it is not interested in public–private partnerships for the NBN, or in an outcome that would involve structural separation of any kind. How these positions might be reconciled in an outcome that includes Telstra's bid being accepted remains to be seen.

If Australia is to have a structural separation solution, the details are yet to emerge.

There is no completed example of regulated structural separation, and therefore no established arrangement that can shed light on how the benefits and problems claimed might work out in practice. The nearest example is Singapore, where the government has determined that there will be two levels of structural separation. The Singaporean government is intent on separating the ownership and construction of the broadband network infrastructure from the operation and management organisation. The virtues of this level of separation are not apparent yet and may not be for some time, since the tendering processes are still ongoing.

6.4 The European experience

Notwithstanding the more recent efforts of the European Regulators Group and the EC to develop a common position and framework for determining appropriate regulatory measures to encourage broadband infrastructure investment and the development of a suitably competitive broadband market in each member state, the experience of European countries remains limited. The UK is somewhat in the vanguard, followed by a few other countries applying and adapting similar concepts. In all cases the experience is of functional (or operational) separation, as described below.

6.4.1 European Commission

In November 2007, the EC presented its proposals for the reform of the current telecommunications regulatory framework (EC 2007a). The outcome was influenced by a positive view of the results achieved in the functional separation of the Openreach Division from the remainder of British Telecom (BT) in the UK (more later). As a result the EU Commissioner, Viviane Reding, was enthusiastic to adopt functional separation as a common remedy to be applied by national regulatory authorities (NRAs) across Europe, in appropriate circumstances. This enthusiasm was matched by that of many NRAs.

Moves by the EC to include this remedy in its *Access Directive* have been relatively cautious, as is the case of all *ex ante* remedies. In this case the remedy is intended to be exceptional, and only applied after EC approval, and after persistent failure to achieve non-discriminatory access to non-replicable infrastructure resources, such as broadband (EC 2007b).

The legislation proposed in November 2007 is being considered by the European Council and the European Parliament. The adoption of functional separation as a regulatory tool was agreed at committee level on 23 July 2008, and has come before the plenary session in September 2008. Subject to this and to the finalisation of texts by the end of 2008, the remedy of functional separation, and the whole reform package, will become law in the EU by 2010.

6.4.2 United Kingdom

Openreach was launched in January 2006 as an independent and separate organisational unit in BT concerned with providing equal access (or equivalence of access) to BT's essential network infrastructure. Openreach is responsible for the whole access network and the large majority of BT's regulated wholesale services are under its management.

The initiative to create a functionally separated division along these lines was BT's. It was proposed as an alternative to the structural separation between the access network service division and the rest of BT. That suggestion arose out of Ofcom's Telecom Strategic Review in 2003 (Ofcom 2003).

BT considered that its proposal would deliver the same effective outcomes while preserving ownership by BT. The position of BT shareholders would presumably be maintained.

Openreach performance is reviewed by a specially created Equality of Access Board (EAB) which monitors the implementation of the undertakings given by BT to Ofcom in relation to the provision of wholesale infrastructure access services. The majority of the EAB are independent external members.

The key principle driving the operation of Openreach is the principle of equivalence of access and information to the services it offers, namely ULLs, wholesale line rental (WLR), number portability, wholesale extension services, backhaul extension services and wholesale ethernet services. The manner in which Openreach staff and systems relate with the rest of BT is very important. Equivalence of information requires that the relationship is formal and arm's length, and effectively on the same basis as with Openreach's other industry customers.

One measure of Openreach's performance is the improvement in the delivery of access to infrastructure to BT's competitors. In January 2006 there were only around 200,000 ULLs in service. This number had grown to 4.3 million by March 2008. Openreach is considered to be a success in terms of non-discriminatory access to existing network infrastructure.

The increased investment by the UK industry in ULL technology and the associated multiplexer technologies (DSLAMs) may also be considered to be a potential barrier to the commercial adoption

of, and investment in, fibre delivery systems of the kind required for higher speed broadband. The co-existence of copper and fibre systems represents a fragmentation of the demand for fibre connections and weakens the commercial case for investment in FTTN and FTTP.

The EAB and alternative service providers have expressed overall satisfaction that Openreach has complied with the undertakings relating to its operations and governance, and is delivering wholesale services more quickly and in greater numbers than before.[5] This is a judgement based on equivalence of access and effective delivery principles.

6.4.3 Italy

In April 2007, the Italian Minister of Communications, Paolo Gentiloni, decided to put forward a draft modification of Article 45 of the Italian Code of Communication, which would give the telecommunications regulator, AGCOM, greater powers, particularly in carrying out functional separation of the incumbent provider, Telecom Italia (TI).

In mid-2007 AGCOM undertook a public consultation on issues associated with functional separation. The consultation also explored other issues associated with the direction and intensity of regulation and deregulation in various markets. It concluded in November 2007.

TI has been the subject of takeover speculation in recent years, as a result of one of its major shareholders, Pirelli, seeking to sell its stake in the company. After considerable turmoil and speculation, Telefonica purchased that shareholding via a new holding company. TI seemed to have no control of its destiny at the commercial level or the regulatory level.

In a bid to address both of these issues, TI completed its new investment plans which included an investment in next-generation network and broadband platforms of €6.5 billion in the next decade. This was less than had been previously touted. In order to ward off the prospect of imposed separation in a form devised by the regulator, TI announced a reorganisation in late 2007 of its technology division into four main units, one of which is called Open Access. Open Access is not a functionally separated division and represents a weaker form of separation than alternatives such as the approach in the UK.

AGCOM is reviewing whether the form of separation implemented by TI through Open Access is adequate as a competitive safeguard and for delivery of non-discriminatory outcomes.

6.4.4 Sweden

In April 2007 the Swedish regulator, National Post and Telecom Agency (PTS), was directed by the government to investigate remedies that might ensure non-discriminatory and transparent access by alternative providers to the ULLs of the fixed incumbent provider, TeliaSonera.

PTS concluded that access was impaired and that Sweden was falling behind other nations in broadband service development. PTS also concluded that functional separation would be the most appropriate remedy to rectify the competition problems identified in the market.

The PTS launched public consultation on its proposal and invited comments from the industry. TeliaSonera responded aggressively, announcing that it will establish a new infrastructure company that will cover copper and fibre networks and multiplexing, and will ensure that services are provided on equal terms to TeliaSonera's wholesale customers, as well as to the company's retail arm. TeliaSonera rejected PTS's plans for functional separation as unnecessary in the broadband market. TeliaSonera also raised the issue of potential breach of its property rights guaranteed by the Swedish constitution. (This theme was echoed in Telstra's recent court case against the ACCC's decision on the pricing of ULLs in Australia; ARN 2008).

On 18 March 2008 the Swedish legislature passed the law for the 'Functional separation for better broadband competition', which came into effect from 1 July 2008. This approach is inspired by BT's Openreach, and will ensure TeliaSonera cannot discriminate in providing access to its copper-wire network. It means that functional separation will become a new tool for PTS much earlier than the EU Framework proposal, which is due to come into force by 2010, and in which functional separation is listed as a last-resort remedy. However, practical outcomes are yet to be made manifest.

6.5 Fibre versus copper

An issue that is conceptually distinct from, but which impacts on, various approaches to separation is whether it is necessary to implement a fibre-access network at all, or whether improvements in DSL technology, specifically in ADSL2+ technology, may be capable of providing all the bandwidth that we could possibly require.

ADSL2+[6] extends the capability of ADSL by doubling the number of downstream bits. Theoretically it is capable of a capacity of 24 Mbps and 18 Mbps at one kilometre and two kilometres respectively from the exchange, compared to 8 Mbps for ADSL. In practice, speeds are lower than the theoretical upper bounds, typically between 10 and 20 Mbps and, in 50 per cent of cases, over 15 Mbps.[7]

The issue then is whether the quest for fibre is inappropriate and beyond the needs of most households and businesses. Clearly fibre, whether to the node or the premises, will deliver more, but why do we need more? Broadband is by definition a multimedia platform. For households, the likely major applications for the future will enable high-quality graphics and moving images for entertainment, interaction activation and for file transfer to facilitate remote and home-working. Fuel and transport challenges are likely to increase the number of full-time and part-time home-workers in Australia. Fibre will support high-capacity applications to households and business premises simultaneously. In addition, as capacity becomes more generally available, applications developers will take that into account in producing services and applications that are bandwidth intensive and which rely on greater capacity for increased quality, speed or both.

If ADSL2+ and fibre are technologies that support greater capacity, why can't we have both? The copper is already in place, together with a regulatory access regime, to support ADSL2+, and many service providers including Telstra, Optus, Primus, Internode and others are offering the service in competition. Why is this not enough for now, with fibre access as an overlay? There are two strands to the answer – technical and commercial. If the fibre configuration is FTTN, then both the fibre-based services and the ADSL2+ services will share the copper from the node (pillar or other street distribution point) to the premises – that is, the copper distribution network. It severely limits the downstream speeds that can be delivered if there is a mixture of short and long copper lines all delivering DSL. Hence, much of the benefit of installing the fibre will be lost. In addition, if DSL options are to be retained, and if alternative providers are to remain co-located in legacy exchange premises, then the feeder network copper (from the exchange to the distribution point) needs to be maintained. The result will be a need to maintain multiple networks (fibre and copper) at additional expense. In fact, part of the cost rationalisation that is a benefit of a single broadband infrastructure would be foregone under these conditions.

The commercial issues follow on from the need to retain multiple-access network infrastructures. Demand for services would be fragmented over two networks. The key economic point about access networks is that they are not traffic sensitive and, with broadband, only one is needed to support the delivery of all services to the premises. Both the copper and the fibre networks would pass all of the premises in any service area. In principle such an arrangement would be inefficient. If the business case for broadband is uncertain – and it is, otherwise public funds would not be needed – then it makes no sense to increase that fragility by allowing demand to be leached out via legacy systems.

It therefore makes business sense for an incumbent fixed-network carrier to seek to move all of its traffic onto fibre at the earliest time. Unfortunately, what is sensible also looks very much like anti-competitive conduct. The incumbent's competitors will have established DSL services using the incumbent's ULLs and will have invested in DSLAMs and other equipment to provide their own broadband services to customers. If copper is decommissioned the infrastructure on which the competitors operate will have been withdrawn, and the incumbent will have removed its competition.

6.5.1 The pros and cons

The separation debate – structural versus functional – has become intense in anticipation of the need for new fibre infrastructure, and in anticipation of the grant or investment of public money. However, the debate is generally not on the same terms when it concerns access only to legacy copper. Nobody is proposing structural separation for ULL management alone.

Public policy choices are becoming quite difficult and arriving at optimal solutions is not easy. On the one hand, public policy favours the implementation of fibre infrastructure since that is thought to guarantee the broadband capacity that may be required well into the future. But fibre is expensive, the demand is not yet clear, and public funds may be needed to fill the gap. On the other hand, copper is here and DSL technologies have been proven, including ADSL2+, which will certainly provide sufficient capacity for most people in the short to medium term. ADSL2+ does not need public funding. The niggling reservation is that ADSL2+ may turn out to be a dead end, and not a technology that will serve us well into the future. By relying on it for the medium term we might be risking competitive advantage in terms of overall productivity, leadership in the development and refinement of broadband applications and services, and overall transformation of the economy.

6.5.2 Overseas examples

Is the experience of any other country useful in giving us a steer in the right direction? The answer is probably not. Most developed economies have exactly the same dilemmas as we do, and none have implemented a system which is producing clear outcomes. There are some countries that have, at least, been through the issues associated with the withdrawal of copper access infrastructure, and these can offer us some guidance.[8]

In July 2004 notice was given of the withdrawal of the mandatory access to ULL provided by PCCW in Hong Kong (OFTA 2004). At that time the regulator, Office of the Telecommunications Authority (OFTA), determined that mandatory access would no longer be required, given the fibre capacity that was available in Hong Kong from a number of different carriers. OFTA set the effective date as 30 June 2008 for the change, after which access might be provided on a purely commercial basis. This case provides little guidance for the situation in Australia, because the network circumstances and subscriber densities are quite different. However, the willingness of the regulator to provide a four-year notice period is significant and relevant. Where carriers have been encouraged to invest because of the regulatory arrangements, regulators feel obliged to enable that investment to be written off over a reasonable period if the regulation changes.

A more recent case is the Netherlands. The Netherlands has substantial cable-television infrastructure that will support the provision of broadband services in competition with the incumbent carrier, KPN. In December 2007 the Netherlands had the second-highest penetration of broadband services in Europe at 34 services per 100 population, and of these, nearly 40 per cent were provided by cable operators.

KPN planned to reduce its costs and establish a new competitive business model based on IP platforms. It announced its plan for an 'all IP' network at the end of 2005. The plan involved a combination of fibre to the cabin (FTTC) and fibre to the premise (FTTP), and would provide between 50 and 100 Mbps capacity to the whole country by 2010. This plan involved the provision of fibre in the access network and the removal of traditional exchanges and exchange equipment as the next-generation access network was implemented. Among the exchange equipment to be decommissioned was not only the circuit-switched central offices, but also the related main distribution frames (MDF) on which copper circuits were terminated. Providers of DSL-based broadband services also terminated their links on distribution frames that connected in turn to KPN's. In effect KPN's plans involved the removal of copper and copper connectors and therefore the removal of the service that was critical to its DSL-based competitors continuing their operations.

The regulator, OPTA, responded to the concerns of the alternative DSL providers. OPTA was in a difficult position. It needed to support the rollout of the new all-IP network, but also to protect the position of the alternative DSL-based broadband providers. In the end, OPTA required KPN to arrive at a commercial agreement with the alternative DSL-based broadband providers, and, to avoid regulatory intervention, KPN submitted a migration plan to its competitors in July 2007. Since then it has signed memoranda of understandings (MoUs) with each of them.

The MoUs guarantee the continuation of MDFs in their current locations until 2010, after which there are a number of options. KPN may continue to provide services in some existing locations. If it does not, then alternative providers may migrate to alternative wholesale services, such as mini-MDF services in a number of locations around the country, wholesale broadband access services (unbundled fibre access where the service is FTTP), or access to street cabinets and sub-loop distribution from that point to customer premises (where the service is FTTC). The viability of the last alternative is yet to be tested in practice, and will not be tested under load conditions until closer to 2010.

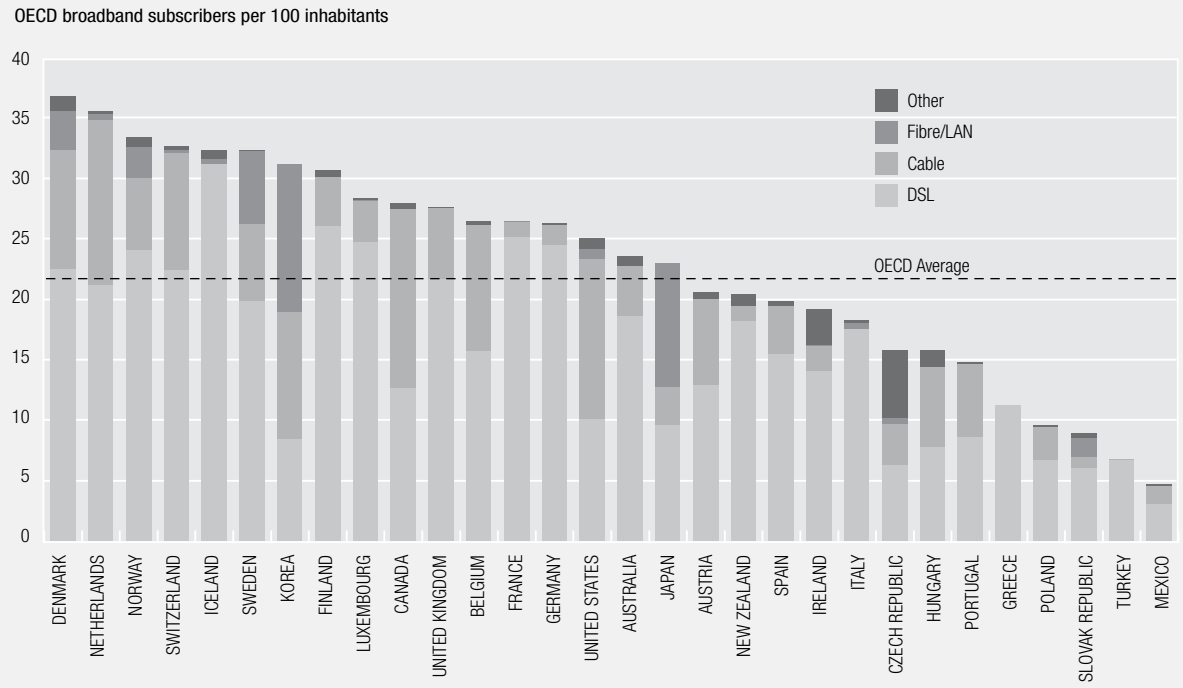
To date, the solution adopted in the Netherlands is not based on functional separation. In this regard OPTA noted that such a remedy would be disproportionate given its analysis of the market, and also one that would be additional and therefore require a ministerial decree.[9] However, the application of a functional separation remedy in the future would be a matter dependent on developments at the European level.

6.6 Conclusion

It is difficult to judge the European initiatives because – with the exception of the UK – they are works in progress, with considerable potential but few practical results. With the exception of the UK, they might be better regarded as European dialogues rather than regulatory framework achievements at this stage.

The impact of these dialogues on investment and investment plans, and the prospect of more rigorous remedies to address potential or actual discrimination and unequal access to essential broadband

FIGURE 1.
OECD BROADBAND SUBSCRIBERS, PER 100 INHABITANTS, BY TECHNOLOGY, JUNE 2008



Source: OECD

infrastructure is unclear. The deferral of previously announced plans by Telecom Italia could be argued to be more of a statement to the financial community about its fiscal conservatism under new ownership than a response to any regulatory uncertainty or anxiety.

On the matter of investment, Commissioner Reding has noted that the EU member states have, in aggregate, invested similar amounts to the North American and Asian zones in new telecommunications infrastructure. This suggests that the European approach, which favours intra-modal competition based on regulated access and the prospect of functional separation, is at least equal in sustaining new industry investment to the inter-modal competition favoured in the US and parts of Asia.[10]

In terms of the take-up of broadband services to date, the available OECD data is less clear than Commissioner Reding on whether intra-model competition based on a mandated access regime produces better outcomes than infrastructure competition. The OECD per-capita-penetration figures for December 2007 show the make-up of broadband services (OECD 2007b). Where countries have a large proportion of services based on DSL, they reflect the mandated access approach of Europe (and Australia). Where services have a large proportion of cable they are more typical of the current arrangements in the US. The results are far from clear and many other factors are at work in driving penetration than the choice of regulatory framework. However, these results do not especially support the European approach.

Overall, Openreach in the UK is considered to have achieved its pro-competitive aims in terms of safeguarding the competitive entitlement of alternative providers to the essential infrastructure needed for broadband (and for other services). To some extent the specific problem cases that have been highlighted and resolved show that the equivalence arrangements are working rather than that there are continuing problems. But larger questions remain unresolved. Equality of Access Board is not concerned with the broader question of whether encouragement by these means of investment in low-capacity broadband that has a limited future may not defer investment in high-capacity access technologies.

It is not clear how BT will be able to make hard decisions about turning off copper in favour of fibre. It has already deferred part of the 21CN programme for its IP-based next-generation network, and extended the deadline by over a year.[11] Regulatory entitlement of existing competitors and longer term national need may yet be on a collision course. However, there was encouragement in BT's recent announcement of £1.5 billion investment to bring fibre-access technology to 10 million households by 2012 (BT 2008).

In most countries, functional separation seems to be preferred to structural separation because of its greater flexibility. Within the EU member states, structural separation has only been discussed seriously in Ireland, and that was essentially to enable the venture capitalist owner of Eircom to reduce the debt burden acquired through its acquisition process. Nowhere in Europe is structural separation still being seriously considered for regulatory purposes.

On the issue of whether fibre investment might be deferred pending greater capacity for copper networks to provide broadband services with enhanced DSL technologies, Europe has voted for fibre. Copper may well provide a continuing source of broadband service competition for the medium term, especially with regulator-mediated commercial agreements as in the case of the Netherlands, but Europe, like Australia, Singapore, Japan, Korea, Malaysia and many other countries, has generally voted for a future without capacity constraints. The issue in that is to manage the migration and allow competitors time to write off current investments and to migrate to alternative arrangements in something that approaches an orderly manner. The lessons from both Hong Kong and the Netherlands are instructive.

Australia may take some cues from the experiences of other countries, but in the main it is as much at the forefront of these issues and developments, and in unchartered industry and competition policy territory, as they are.

Endnotes

1. Author's assessment based on commercial work.
2. With ADSL. Increased downstream capacity can be achieved with enhanced ADSL and other DSL services.
3. "Australia's Gigabit Future needs an end-to-end ecosystem that is scalable, integrated, flexible, device agnostic, secure, widely available and fast. When I say fast I don't mean one, three or even 12 megabits per second. Australia will need 30, 50 or 100 megabits per second in a relatively short period of time." Sol Trujillo, 2008
4. For example, ACCC Commissioner Ed Willett said that, 'It is also noteworthy that the Commission has only relied on the existing accounting separation arrangements to a very limited extent in relation to its imputation testing analysis of specific cases' (ACCC 2004, p4).
5. 'The EAB believes that BT is committed to the delivery of the Undertakings, although the company did not always achieve compliance with every aspect of each requirement' (EAB 2008, p1).
6. ITU Standard G.992.5.
7. http://www.internode.on.net/residential/internet/home_adsl/extreme
8. In Japan, for example, there has been a marked decline in the use of DSL by alternative broadband service providers in favour of direct fibre at 100Mbps. However, the regulatory arrangements behind the migration are not transparent in the author's view and therefore not useful in offering guidance in Australia.
9. http://www.opta.nl/asp/en/publications/document.asp?id=2142. '..in this respect the Commission has adopted the provisional position – based on the findings of the market analyses completed in 2005 – that an obligation which compels KPN to introduce a functional separation appears to be disproportionate for the time being, and it could produce undesirable effects with a view to the primacy of infrastructure competition', OPTA letter of 8 March 2007.
10. 'The European model is empirically proven to promote not just choice, competition and innovation but also investment: in 2006, investment in the EU telecom sector reached another peak of over 47 billion, 5 per cent up on 2005. This was the fourth year on year increase since 2003. By the way, European investment is at least at the same level as other major regions (Asia Pacific: 44.3 billion and North America: 43.7 billion)' (Reding 2008a, p3).
11. "The upgrade, which BT calls its 21st Century Network (21CN) will replace 16 national networks with one single IP network. BT originally said the project would be carried out between 2004 and 2009, but the completion date has since slipped back to 2011. This is the first time the telco has admitted that the programme should have taken 10 years." (BT 2006)

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