PEDESTRIAN CROSSINGS AND SUPERHIGHWAY ROBBERY: SOURCES OF MARKET POWER IN BROADBAND

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ABSTRACT

In a world where ubiquitous and affordable broadband availability is the key to unlocking the benefits of the information society, obstacles remain to the deployment of appropriate access networks. Traditionally, an analysis of the potential problems from a regulatory perspective would involve consideration of whether any players control bottlenecks or have significant market power in the market for carriage services. Such an approach is likely to prompt the forms of regulatory intervention which have been successful in the past or which have been applied overseas.

This paper suggests that the analysis, at least from a technical perspective, of the benefits of ubiquitous broadband should have as its primary aim the creation of a vibrant market for applications and services. As a result of the nature of the next generation network (**NGN**), the focus of regulatory intervention should be on access to services (and not physical network elements) in the NGN access network. In the nascent market for the delivery of broadband services that can support a rich media experience, the current concern need not be about market power. The real issue is how to regulate the delivery of the applications and the services that ubiquitous and affordable broadband can provide. Any regulatory intervention associated with the deployment of a national broadband network should focus, as it has in Europe, on workable competition in the NGN access network.

INTRODUCTION

This paper takes a technology-oriented view of the next generation network (**NGN**) broadband world and of the issues involved in the delivery of a near-ubiquitous broadband network in Australia. This network has been labelled the "National Broadband Network" and is the subject of a Request For Proposals process administered by the Department of Broadband Communications and the Digital Economy. The paper suggests that speed is the vital aspect of the delivery of services and that Australian consumers are already aware of this. Further, the applications and services delivered by the NGN are independent of the carriage service provided in the access network. Over-zealous regulatory intervention in the access network is likely to result in the question of market power in broadband becoming moot. Unless there is regulatory certainty on this point, there will not be the multi-billion dollar investment that is required to deliver the broadband access network in the first place. As a result, the regulatory focus needs to change so as to recognise that the deployment of the NGN represents a paradigm shift for operators and should represent the same for regulators.

The paper begins by examining the importance of broadband as an enabler of the benefits of the information society – even if a country does not aspire towards this social vision. The paper then considers the form of

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competition that the network will create in an upstream market for services and applications before considering the importance of capital to the construction of an NGN access network. The next step is to assess whether wireline and wireless delivery of broadband are substitutes. The paper then moves on to argue that the regulatory approach which applies to the legacy, copper-based, circuit-switched world is not applicable in the NGN environment – suggesting that attempting to map the old regulatory world onto the new technology is an inappropriate response. The paper argues that the upstream market for applications and services can thrive as long as there is workable competition in the NGN access network and that it is at this level where a regulatory intervention is appropriate, if intervention is required at all. We then summarise and draw some conclusions.

THE IMPORTANCE OF BROADBAND AS AN ENABLER

Australia has not embraced the idea of the "information society" in the way that the members of the European Union have. That is, other than the National Broadband Network policy, Australia does not have a set of policies which recognise that information and communications technologies deployment will deliver growth and assist social policies related to inclusion. This contrasts with European Union member states where the benefits of information enablement are considered a key element of growth strategies (European Commission 2005). By adopting the information-enabled society as a concept, we make it easier to focus on the requirements of the optimal telecommunications infrastructure. The minimal requirement of a successful information society is access to low-cost and ubiquitous broadband. The Organisation for Economic Cooperation and Development has already recognised that broadband is a utility rather than a luxury - although state intervention is often required in order to ensure its ubiquity (Falch 2008).

The technological developments associated with the NGN are likely to radically change the way that society functions. There has already been a widespread adoption of mobile technology in Australia whereby the number of mobile lines in service exceeds the country's population. A crucial part of the mobile experience is the delivery of services on an immediate basis. Indeed, the concept of a world without short message service (**SMS**) and email is hard to grasp. This world is likely to be expanded into one where rich media will be delivered on a personalised basis to individuals in ways independent of location and time. We are finally moving into the era of convergence about which a number of authors (including this one) have written for the last decade and a half. Associated with the delivery of rich media content are two parameters which were identified by the European Union (European Commission 2005). These are interoperability and speed.

Interoperability means that devices and platforms will need to be able to "talk to each other" regardless of the form of connectivity. This only works in an environment where broadband is fast enough to permit the delivery of video services and at a price which is affordable to the vast majority.

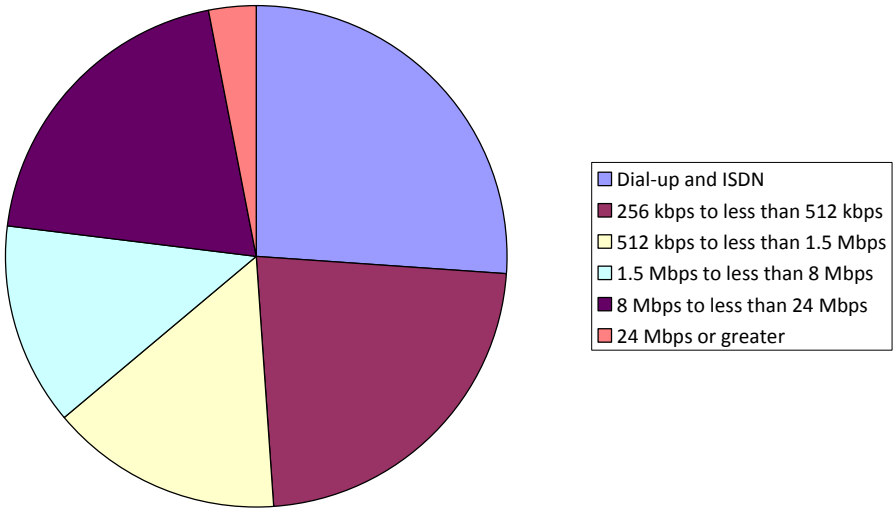

Figure 1 – Internet access speeds in Australia in December 2007, Source: ABS

It is essential that consumers be able to access this rich media content at an appropriate bitrate to the content and applications being served. Whereas this may have been of concern to the European Commission in 2005, in Australia it is clear that consumers already recognise this issue. The Australian Bureau of Statistics published data for the December 2007 quarter which showed that a majority of Australians who have internet access have broadband at a bitrate greater than 512 kbps (Australian Bureau of Statistics 2008) as set out in Figure 1. Indeed, although ADSL2+ has not been deployed for a significant length of time, the take-up of broadband services at those rates (including broadband service over cable) exceeds one quarter of the 7 million internet households in Australia. Given that this number of households is approaching the total of 7.7 million, it is clear that Australian consumers recognise the "need for speed" and are acquiring those services as rapidly as they are becoming available. There is no question of choice between broadband or dial-up, nor is there any ambiguity as to the demand for fast broadband services. Australian consumers are voting with their feet and their pocket books in a way that confirms that there is significant consumer recognition of the need for high-speed broadband access. To some extent, this is recognised in the government's policy in respect of the National Broadband Network. The government's intention of delivering 12 Mbps to 98% of all businesses and households, set out in the request for proposals to deliver the National Broadband Network, is set as a minimum threshold for broadband delivery rather than an aspirational goal.

COMPETITION IN SERVICES AND APPLICATIONS

One of the most significant differences between next generation networks and the legacy PSTN networks that they partially replace, is the complexity of the relationship between applications and services provided over the network and the network itself. In the PSTN world, a voice service is merely a voice service, albeit one that is supported by a number of features in its switching. However, in the NGN world, voice is an application. Certainly, this application could be provided by the owner or the operator of the network, but this is a fairly unlikely outcome. Competition in the provision of voice as an application means that the application provider can choose the mechanism by which the network is used. In a fibre to the node (**FTTN**) network, a voice provider might resell the voice service which uses line cards in the node. On the other hand, a new entrant might choose to offer a software-based voice application, using voice-over-broadband from the home through the NGN to the application provider's hosted application. Further, the hosted application does even not need to be located in the same country as the NGN. Instead, there is likely to be global competition for the provision of services and applications over next generation networks.

To some extent, we have already seen the entry of new players into the "cloud compute" space. In Australia, Bigpond offers "office" functionality software over the internet without the need to install complex applications on the user's machine. Similarly, Google offers the Google Documents Suite which includes a word processor, spreadsheet and presentation software. Both Google and Amazon offer potential providers of applications the opportunity to use their existing and extensive interconnection with the internet to be able to host cloud computing applications. These applications have the benefit of being almost infinitely scalable based on demand, with the cost of hosting linearly related to the number of users taking advantage of the application. In an NGN world, some of these cloud computing applications and services will continue to be delivered over the internet whereas others will be provided using the NGN. The quality of service requirements will dictate whether the application or service should be web based or hosted via an NGN. In either case, the appropriate quality of service for the delivery of the application will be determined by a combination of the user's requirements and the provider's aspirations. What is occurring is the potential for vibrant competition in respect of these applications and services. This competitive position simply requires that high speed broadband, with an appropriate quality of service, be available to each user on a ubiquitous basis.

THE IMPORTANCE OF CAPITAL

Constructing a new broadband NGA with capabilities significantly greater than ADSL2+ services, requires a significant capital investment. The requirements for such capital is not unique to Australia and is significant whether the technology chosen uses fibre all the way to the customer premises or to a node at some small distance away from the customer (typically less than 1 kilometre).

A number of countries are investing in next generation access networks in the region: Australia, with a government contribution of $4.7 billion towards what will likely be a network which costs more than $10 billion; Malaysia, which has entered into a public-private partnership with Telecom Malaysia to deliver access which will enable 50% of Malaysians to have broadband connectivity by 2015 at a Government cost of $US4.7 billion; and Singapore, which has called for tenders for both a core network and a next generation access network.

In purely privately funded rollouts, both Verizon with its FiOS fibre to the premises network and AT&T with its U-verse FTTN network are spending significant amounts of capital in order to deliver broadband services. In Europe, France Telecom and Deutsche Telecom are also making significant investments.

As such, an absence of capital expenditure is a block to the provision of ubiquitous broadband services. It does not, of course, mean that access to capital is itself a source of market power associated with the delivery of broadband services. In the face of her repeated calls for the maintenance of existing regulatory structures, the European Commissioner, Viviane Reding, has recognised the need for regulatory certainty (Reding 2008):

> *we want to encourage investment into next generation access networks by a stable and predictable regulatory environment. We are still discussing the final details of this in the Commission, but I believe that the 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 %.*

CONTENDED ISSUES: WIRELINE AND WIRELESS

For voice applications, the traditional PSTN and mobile wireless services can be considered as either substitutes (Sung and Lee 2002) or complements (Albon 2006). For the purposes of voice calls, there is only a marginal difference between the network design for mobile services and the network design for fixed services. In the case of mobile services, a typical design parameter is to require a "2% grade of service" during peak

busy hour of peak busy day in peak busy month. That is, mobile networks are typically designed to provide a 98% probability of being able to initiate a voice call during the busiest time. Modern fixed line voice services offer a higher quality of service. However, the difference between the two is not noticeable for the majority of consumers most of the time.

By contrast, however, there is a significant difference in this respect between wireless and wireline Internet Protocol-based data services. In the case of wireless services, there is a limitation on the amount of bandwidth that can be provided to each user set in the radio access network. That is, the backhaul from the "node B" is only designed to support a limited number of concurrent data users. In order to be able to provide high speed broadband services to a significantly larger number of concurrent users, the number of nodes B in a 3G network (or indeed any network heading towards Long Term Evolution) would have to be significantly increased. Long Tem Evolution is the next generation of both mobile and WiMAX technologies and, in the US and Europe at least, is the technology which creates the value of spectrum to deliver the "digital dividend" (Reding 2008). This is in contrast to a fixed line network where, in the case of FTTN, the node itself has a Gigabit Ethernet connection and the initial limitation on data rate per customer is dictated by the number of active customers per node. Of course, this is not to suggest that the fixed-line networks are free of other sources of contention. These occur at the point at which the Gigabit Ethernet outputs of a series of nodes are interconnected. This point, an Ethernet Aggregation Point, typically provides contention for those services where contention is permissible. The effect of contention is usually not problematic when all users are engaging in mixed loads (for example, web surfing and email). However, contention becomes problematic when end users are all trying to download concurrently. This effect is witnessed by internet service providers today in the case of peer to peer file sharing. It is also thrown into stark relief in the delivery of Internet protocol television (**IPTV**) services, especially on a video-on-demand basis.

UNLEARNING OF LEGACY REGULATORY LESSONS

There is a significant risk that using existing regulatory models will hamper the development of a market for applications and services which are delivered using broadband. That is, there is a risk of regulatory intervention *before* any market is created in which there may be market power. An example of this is the use, by the European Regulators Group (**ERG**), of Martin Cave's ladder of investment (Nicholls 2008). The concept of the ladder of investment was proposed and described by Professor Cave (Cave and Vogelsang 2003; Cave 2004) and subsequently refined and restated (Cave 2006). The theory posits that regulators can increase the likelihood of infrastructure-based competition by encouraging access to incumbent networks at increasingly higher levels of unbundled access. The encouragement encompasses both carrots (access price low at entry) and sticks (deregulation of access for entrants over time). ERG favours the ladder of investment model (ERG 2005) even if it is not completely applied (Picot and Wernick 2007):

> *European regulators have as yet only established the first part of the concept enabling easy market entry for competitors, while access prices have been characterised by steady decreases throughout Europe.*

Despite the pessimism as to the more robust use of the approach, there have been some decisions by regulators indicating a willingness to remove rungs. In the UK, Ofcom has determined that there is competition in "those geographic areas covered by exchanges where there are 4 or more [competitors] and where the exchange serves 10,000 or more premises" (Ofcom 2007). This eliminates regulation of broadband for 70% of the UK wholesale market (Ofcom 2008). In Australia, the ACCC has proposed to remove access to wholesale line rental and local call resale services in exchange areas where there are either four or more competitors or more than 14,000 lines in service (ACCC 2008).

The ERG argues that, in a next generation network access network (**NGA**), the ladder must consist of at least four rungs. It characterises these as (in ascending order): resale; bitstream; shared or unbundled loops; and

own infrastructure (ERG 2007). However, in stark contrast to Cave's model, one of the differences in the approach employed by the ERG in the 2007 discussion paper is that the ERG sought to find a parallel rung in the NGA world for each and every rung in the legacy broadband over public switched telephone network (**PSTN**) infrastructure world. Cave's work does not suggest that such a parallel rung should be anticipated and the ERG assumed that there would be a direct mapping between the regulation of the PSTN and the regulation of the NGN. It is this type of assumption that represents a significant regulatory risk to there ever being a ubiquitous broadband network.

Recent academic work suggests that vertical integration is beneficial across a number of industries (Lafontaine and Slade 2007) and economic analysis shows that a vertically integrated business tends to be efficient and consequently have a large market share (Buehler and Schmutzler 2005). It is the market share issues and the potential consequences for competition that has led some in Australia, but not elsewhere in the world, to take the view that addressing vertical integration by structural or functional separation (particularly if that term is not defined or ill-defined) is a "magic bullet" which will solve all of the broadband market power issues. The regulatory submissions on the National Broadband Network (DBCDE 2008) certainly, with Telstra a notable exception, reflected this. The proposal of the European Commission, however, that functional separation should be added to the list of potential interventions that are available to national regulatory agencies to regulate the 7 telecommunications markets defined in Europe, has led to considered research in this area. The New Zealand decision on separation and an examination of the UK market with 3 years of hindsight have contributed to the debate.

Professor Pierre Larouche from Tilberg University examines the need for infrastructure investment intervention and argues that it is clouded by distinctions between *ex ante* and *ex post* regulation (based on the premise that what, in reality, is *ex post* regulation can be described on an *ex ante* basis in order to provide the regulatory certainty required by the regulated). He describes the problem (Larouche 2008):

> *Separation has two important consequences for our discussion here: the loss of control over operational decisions of firms (which leads to a "mission paradox") and the risk that the cost of regulation for private firms are not fully taken into account in regulatory decisions (thereby creating a sort of "regulatory externality").*

He then explores the mission paradox and summarises by finding:

> *lawmakers and regulators must let go of the industry, and in particular that they must reckon with the inherent uncertainty surrounding the evolution of this sector. It would be neither appropriate nor in line with the principles of the electronic communications regulatory framework as set out in EC law for public authorities to want to superimpose a holistic vision (typically a layer model) on the sector and exert significant influence over its evolution.*

In respect of the regulatory externality, Larouche finds that:

> *If public authorities want to exert an influence on investment in infrastructure, therefore, they must take the costs imposed on private firms into account. So either the intervention takes place in such a way as not to distort investment incentives, or if it is more intrusive, then public authorities must correct the externality by disbursing public money to compensate private firms. Public authorities cannot have their cake and eat it, by shifting the burden of infrastructure investment onto private firms in the wake of liberalization and then expecting these firms to pursue public policy objectives in the same way as former State-owned monopolists could.*

He concludes (Larouche 2008):

> *structural solutions – essentially separation of vertically-integrated companies – are put forward, but they are perhaps too drastic and they evidence a deep involvement of regulatory authorities with the operation of firms.*

Olsen, Henten and Falch compared the successful liberalisation of telecommunications in Denmark with the less successful results in electricity. Having seen the effects of separation in both sectors, their conclusions set out the paradox arising from the proposed European Union approach to add separation to the regulators' intervention toolkit (Olsen, Henten et al. 2008, p18):

> *Taking these differences in the success rates into consideration, it would seem paradoxical that telecommunications (with some success in terms of competition, innovation and prices) seems to be developing in direction of functional and even structural separation as in the electricity area (where the success rate is lower). The question could be asked whether this difference in success rates is due to the different models of regulation applied. The answer to this question is no. The differences in the success rates of the two industries have much less to do with the differences in regulatory models than the differences in the basic techno- economic realities of these industries. It is difficult to conclude that one mode of regulation in general will be more successful than the other.*

Peter Humphreys from the University of Manchester argues that there are opponents within the European Union to the use of functional separation as a regulatory remedy, and that the rationale behind this is that vertical integration provides incentives to invest and innovate. Professor Humphreys notes (Humphreys 2008, p16):

> *The UK is reportedly in favour of the Commission's proposal to make functional separation an NRA remedy of last resort so long as it is done in cooperation with companies. However, other large member states – including France, Germany and Spain - are opposed. A number of member states and their former incumbents have warned that functional separation could reduce the incentives to undertake risky investment in new access networks. A report published in November 2007 by the incumbents lobby ETNO argued that 'vertical integration of access and services [was] a key driver behind the decision to invest in next-generation networks'. Mandatory separation 'may lead to losses in efficiency and the ability to co-ordinate complex investment decisions'. … French Socialist MEP Catherine Trautmann, who sits on the European Parliament's Committee on Industry, Research and Energy, which is responsible for telecoms, and is the Parliament's rapporteur on the telecoms framework directive, is currently preparing a report which according to a recently circulated paper seeks to 'sidestep' the proposal on functional separation and to 'refocus' the debate onto investment in next-generation networks. Prior to the publication of the current draft legislative proposals, Information Society and Media Commissioner Reding had even faced criticism within the Commission from officials in DG Competition under Commissioner Neelie Kroes, who had argued that 'functional separation risk[ed] harming investments in a sector which [wa]s crucial to the EU's competitiveness'.*

Arata Kamino, Executive Director, InfoCom Research, Inc. and his co-author Professor Hidenori Fuke of Komazawa University argue that the "success" of separation in the UK is based on an inappropriate analysis of the unbundled local loop sector (Arata and Fuke 2008, p18):

> *It is true that LLU-based competition had not progressed much in the UK's DSL market, when Ofcom recommended functional separation to BT and accepted BT Undertakings through Telecommunications Strategic Review (TSR). It is also true that taking up of LLU has been accelerated since BT established Openreach. However, Germany and France that had not introduced any kind of functional separation already experienced explosive use of LLU when Ofcom initiated TSR in April 2004. Japanese DSL market started to show a spectacular growth since 2000 when LLU and collocation was formally mandated following the reorganization of NTT in 1999. These facts throw doubt on full support for the assumption that functional separation itself promotes LLU usage.*

They go on to warn that vertical integration may not provide any source of competitive advantage in an environment where the dynamic competition is in the supply of services and applications (Arata and Fuke 2008, p24):

> *it is not clear at present that owning network, in other words, holding vertically integrated organization, always accompanies competitive advantages. In particular, as assumed from net*

> *neutrality discussion, if incumbents are unable to change flat rate structure for broadband access provision, upgrading and maintaining access and combined backhaul, core network would become a burden for incumbents.*

There also seems to be an assumption (at the highest levels) that there is trans-national political support for functional separation in Europe. For example, in reporting the meeting of the Council of EU Telecoms Ministers in Luxembourg on 12 June 2008, Viviane Reding suggested that there would be no European telecommunications regulator by merger with Europe's Network and Information Security Agency (ENISA). Instead, Reding noted that there was a broad majority around the Table of Ministers, and also in the European Parliament, to continue access regulation where there are competition bottlenecks on the telecoms markets. She added that there was also strong opposition in Europe to the idea of "regulatory holidays". Reding also noted on 12 June that most ministers agree with the Commission proposal to include the new remedy of functional separation in the remedies tool box of independent national telecoms regulators.

However, by 25 June, Reding's tone had become much less interventionist and she called for a 15% risk premium for the NGA roll out. The consensus that she declared between the Commission and the Parliament had also disappeared. There is a legislative package before the European Parliament's Committee on Industry, Research and Energy and the rapporteur is Catherine Trautmann. It is important to note that the change here would mean that the ERG and the BERT (the putative Body of European Regulators in Telecoms) may have a majority decision in accepting or rejecting a proposed intervention (ERG members currently have an agreement to stay silent). The other vital comment on separation comes from the Explanatory Statement:

> *Functional separation, due to its far-reaching character, is subject to a special treatment whereby the Commission and BERT have to agree that it is the only effective remedy in order for the concerned NRA to be able to impose it.*

That is, the European Parliament and the Commission appear to be at odds over the general (rather than national) applicability of functional separation.

COMPETITION IN THE NGN ACCESS NETWORK

There has been a significant body of work on the interconnection of NGN, particularly by NGNUK (the industry grouping tasked with consideration of wholesale interaction with BT's NGN known as 21CN). In the main, this work has assumed that there is interconnection at each of the planes of the NGN (NGNUK 2007). These planes are shown in Figure 2.

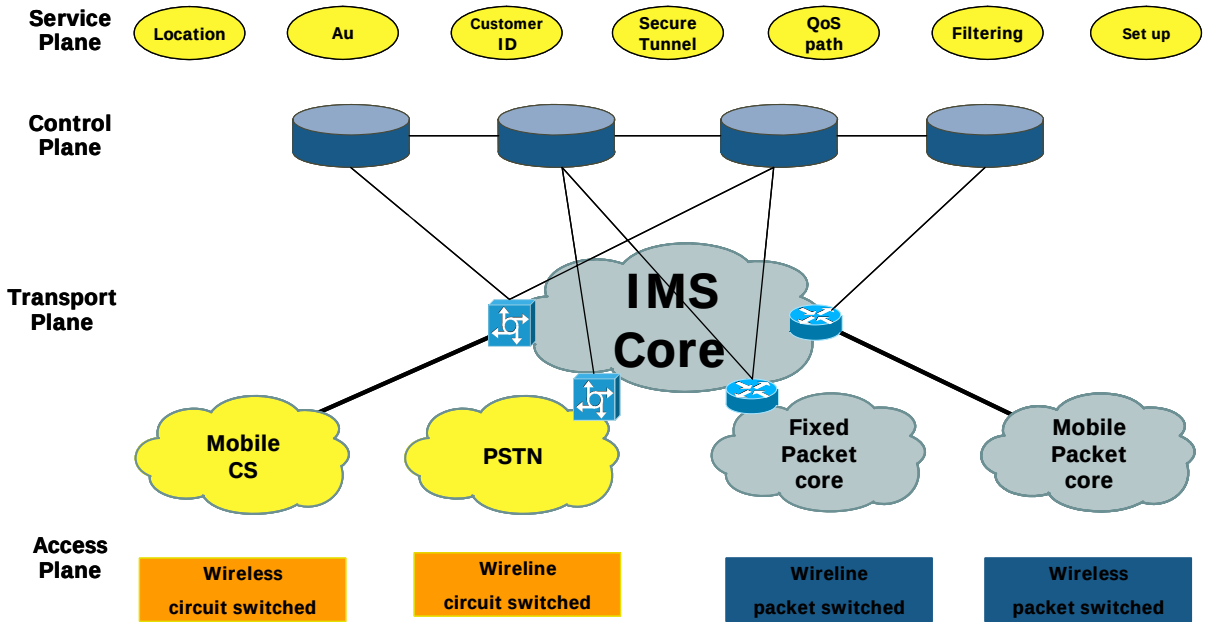

Figure 2 – NGN planes

However, it is not clear that there will always be a requirement for interconnection of NGN even though there is almost always a requirement for interconnection of NGA. The primary issue associated with interconnection of NGN is the establishment of a QoS path for the content of the communication between two NGNs (whether via a transit NGN or otherwise) (Mitchell, Paterson et al. 2007). There have also been reviews of the challenges to both regulators and businesses arising from the deployment of next generation core networks and associated access networks (Amendola and Pupillo 2008; Kirsch and von Hirschhausen 2008; Marcus and Elixmann 2008; Reichl and Ruhle 2008). Given that the construction of the upper planes of an NGN represents a very low investment cost, it may be feasible simply to have NGA interconnection. The principle behind this approach is set out in Figure 3.

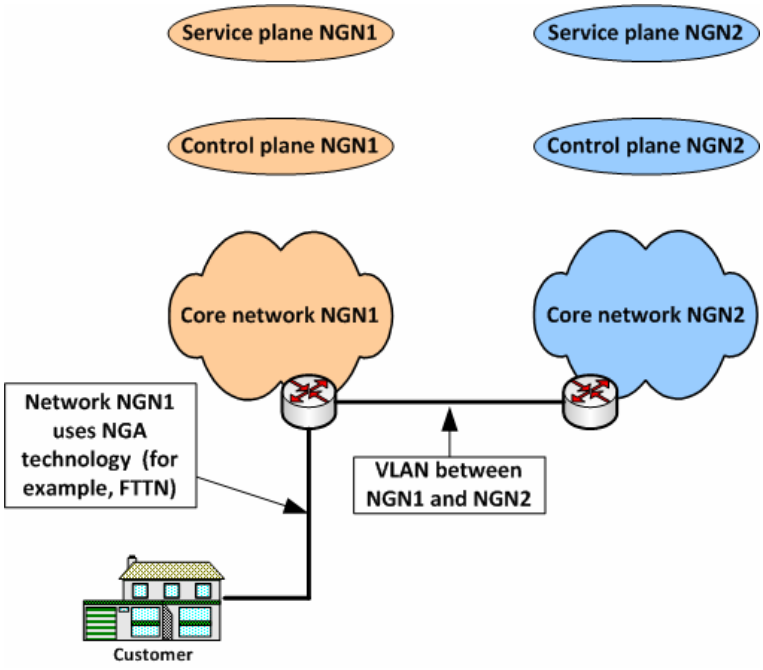

Figure 3 – Interconnection of NGA

If the operator of NGN2 interconnects with the NGA of NGN1, then it is feasible to have managed QoS between both networks and to implement any-to-any connectivity. Further, innovative applications and services can be provided at the applications plane of either NGN1 or NGN2.

The interconnection of NGA requires that QoS parameters associated with the virtual local area network (**VLAN**) between NGN2 and the end user are selected by the operator of NGN2. The operator of NGN2 determines its QoS needs and acquires interconnection services which permit the self provision of changing QoS parameters on an application by application basis.

If NGA interconnection is to be the normal method of interconnecting NGN, then it is important to understand where the access seeker sits in terms of infrastructure-based competition. Clearly, if the creation of an NGN does not require a significant investment, the question arises as to whether that creation represents the level of competition which the regulator needs in order to meet the statutory criteria which guide it. In effect, the answer lies in the delivery of innovative services and applications. If the entrant that is acquiring NGA access is a viable and vigorous competitor in the upstream market for applications and services, then the requirements guiding regulatory intervention may have been met. That is, NGA interconnection could be regarded as facilities-based competition in respect of services other than a retail broadband service. Even the retail broadband service which uses infrastructure provided by the incumbent has the potential for significant innovation simply because the QoS parameters are under the control of the access seeker.

SUMMARY AND SOME CONCLUSIONS

The regulation of next generation access networks will require a significant change in regulatory approach from that which has been adopted in Australia to date. There is no panacea to this in the form of functional separation. Even in countries where functional separation has been adopted (and there are precious few of these), it is not clear that the success or otherwise of broadband penetration is at all related to the introduction of functional separation. Across Europe, even the concept of putting functional separation into the regulator's toolkit has created substantial concern which has been expressed by both the academic community and the industry players. Whereas Viviane Reading may suggest that there is a uniform view between the European Commission and the European Parliament on this issue, there is scant evidence to support this position. As a result, the likely best approach in Australia will arise from the acceptance of some form of undertaking as to access to the next generation access network.

This does not mean a return to the world of monopoly service providers. One of the key characteristics of the NGN world is that there is vibrant competition at the applications and services level. That is, the NGA is simply a "dumb pipe" which delivers the more exciting and interesting services. There is no interrelation between the carriage of services and the content or applications provided using that carriage. The days of a telephone being a service and a technology are on their way out. There is a risk and, indeed, a likelihood, that there will be a single provider of NGA and clearly, that provider will have market power. However, it is unlikely that that market power will have the capability to be abused in a way which is anticompetitive. This, perhaps, is one of the more complex learnings from the next generation access network world.

This means that some regulatory assumptions have to be unlearned. Whereas unconditioned local loop is an important element of access network competition in the legacy circuit-switched world, it is not clear that such unbundling has any application in an NGN world or in the approach to its regulation. All of the assumptions underlying interconnection of networks also need to be revisited in an NGA world where interconnection of NGA may be sufficient to provide effective competition for the innovative services and applications that can be deliverable through the use of NGN technology.

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