3 Enabling a new generation of services

SUMMARY

- In the early years, the focus of the NBN will be on replacing copper infrastructure with fibre to serve current fixed-line demand for voice, Internet, and other broadband applications, over a faster and more open delivery platform.
- The initial NBN service set should be limited to Layer 2 wholesale services in the fibre access network, and should ensure that these services are specified in a way that enables other service providers to deliver sophisticated Layer 3 services such as IPTV. The NBN service set may also evolve to include passive fibre services.
- Longer term, the NBN will transform the end-user experience by enabling faster and richer services and supporting innovative applications and devices. To facilitate this, NBN Co should upgrade its Layer 2 active equipment over time, with reference to international benchmarks and industry standards.
- In the non-fibre footprint, wholesale services should be delivered at Layer 3, given the limitations of the access technologies deployed.
- Video delivery should be enabled primarily through bitstream services. RF services should only be offered where they support a multiple-operator platform but are not expected to be commercially attractive to NBN Co.
- The NBN will also provide a platform to support the delivery of new e-government applications and other public services such as smart infrastructure over broadband—although is only one element of an e-government capability

The NBN will need to serve and enable an evolving set of market needs. Today, fixed-line networks mainly deliver Internet connectivity, voice, and broadcast RF television. The NBN will initially serve these same needs, only better—with faster Internet, interactive on-demand IPTV and VoIP. Over time, the superior platform offered by the fibre access network will unlock new value-creating services and business models—for example, through direct delivery of applications, premium classes of service, and other innovations. It will also provide a platform for government e-services.

This chapter explores the expected needs of the market, and how the NBN can meet these needs through a portfolio of wholesale services. It is organised in four sections:

3.1 Meeting end users' evolving needs

3.2 Delivering wholesale services to meet end-user needs

3.3 Delivering video services over the NBN

3.4 Enabling future e-government capabilities.

3.1 Meeting end users' evolving needs

Communications services are rapidly evolving, with increasing demand for speed and performance. The NBN will serve existing market demand, while enabling a new generation of superfast services. This section outlines how the NBN will best meet these demands:

3.1.1 Serving current market demand

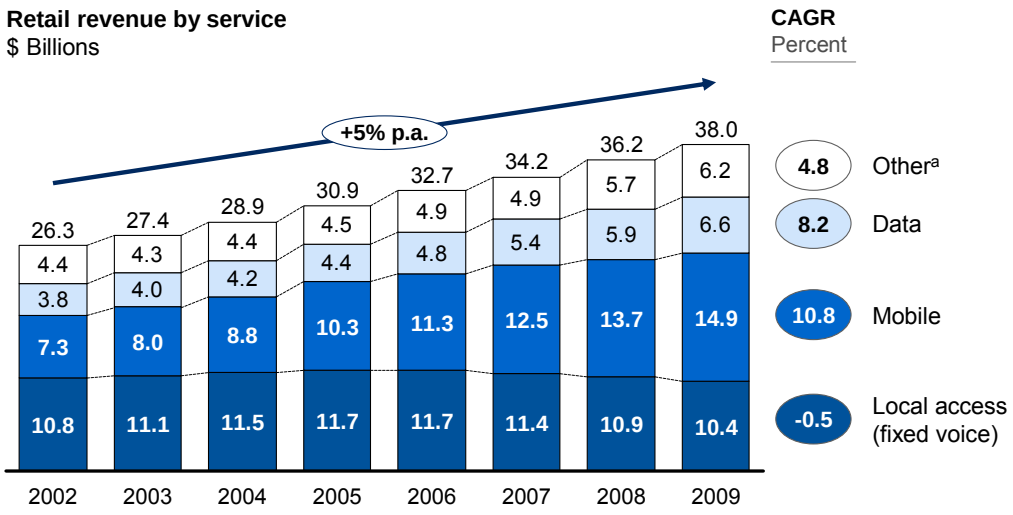
3.1.2 Facilitating a superfast broadband future.

3.1.1 SERVING CURRENT MARKET DEMAND

In the short term, the NBN will primarily serve current market demand. Despite offering a step-change in industry structure and network performance, the nature of this demand is unlikely to transform immediately. Demand for fixed-line services is driven by fixed-voice and broadband Internet (Exhibit 3–1). This section assesses the market requirements that the NBN will serve, now and in the future.

Exhibit 3–1 shows recent growth in retail revenues has been driven by mobile and fixed-broadband services. While fixed-voice revenues have declined, they still comprise approximately one-quarter of the revenue pool.

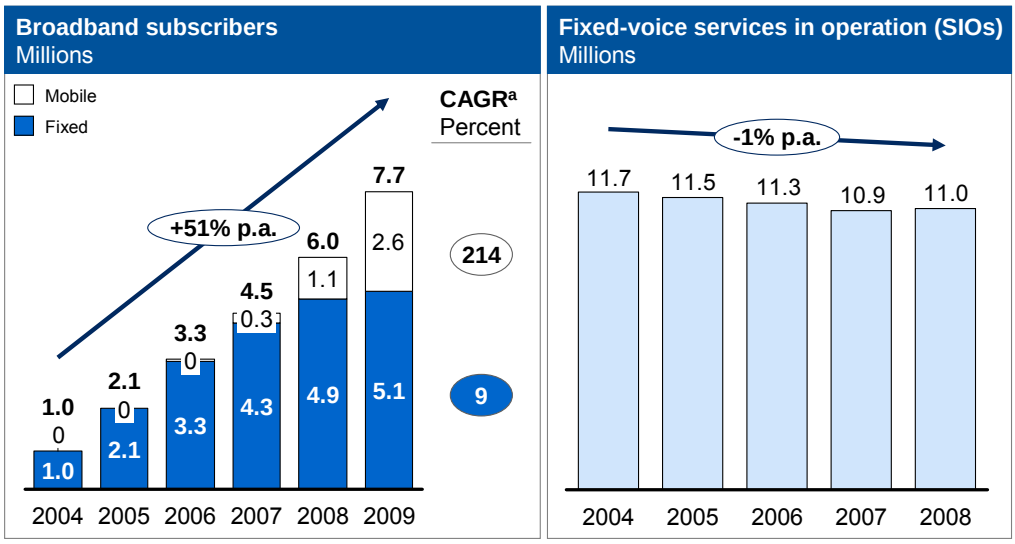
Exhibit 3–1. Retail telecommunications revenue by service



a. Includes: specialised data and IP access, business services and applications, online advertising and directories, pay TV, overseas activities and other minor items

SOURCE: Buddecom

Exhibit 3–2. Retail broadband and voice subscribers



a. 2007–09
SOURCE: J.P. Morgan 2009, *Australian Telecom Sector in FY09*; DBCDE 2009, *Statistical snapshot*

Increased broadband revenue has been driven by rapid growth in the number of broadband subscribers (Exhibit 3–2). Approximately 62 percent of households have a fixed broadband service.[41] This is still lower than many OECD countries, for example the Netherlands (83 percent), France (74 percent) and the UK (68 percent).[42] However, mobile broadband subscriptions have grown rapidly in the last three years, so actual broadband penetration is higher than fixed-only statistics.

Driving continued growth of fixed-line broadband Internet access

Once the NBN fibre network is widely deployed, it will establish fixed broadband as an essential service for households. From an end-user perspective, the NBN will address two factors currently limiting broadband in Australia: slow fixed-line data rates, and high costs for data usage.

The average broadband data rate in Australia is slow relative to other OECD countries. In a 2008 Information Technology and Innovation Foundation survey, Australia ranked 27th out of 30 countries for speed, with an average download data rate of 2 Mbps.[43] This is low compared to the US at 5 Mbps, the Netherlands at 9 Mbps and Japan at 64 Mbps.

41 Goldman Sachs JB Were 2009, *Telecommunications services: Revisions to industry forecasts to reflect shift to wireless*

42 J.P. Morgan 2009, *Australian telecom sector in FY09*

43 Information Technology and Innovation Foundation 2009, *2008 ITIF Broadband Rankings*

Exhibit 3–3. Fixed-line access technologies in Australia

Access medium	Active layer technology	Data rates, Mbps	Coverage, households	Contention of access medium	Data-rate variability
Copper	ADSL2+	< 20	92%	No	Significant—users 5 km from exchange may only receive 1 Mbps
HFC	DOCSIS 1.1	< 20	20%	Yes	Not significant
	DOCSIS 3.0	< 100	5%	Yes	Not significant
FTTP	GPON	100	1%	Yes, but with managed allocation	No

Source: ACMA 2009, *Communications Report 2008–09*; press reports

Fixed broadband in Australia (Exhibit 3–3) is delivered mostly by ADSL technology or over HFC cable. The combined coverage of superfast broadband, including Telstra's Melbourne DOCSIS 3.0 cable network and pockets of FTTP or FTTN, is only around 6 percent of premises.[44] This compares with markets in Europe and North America, where platforms delivering 50 Mbps or more—including FTTP, DOCSIS 3.0 cable and VDSL networks—are being deployed extensively. The fibre access network will offer a step change in data rates, without the variation or unmanaged contention of ADSL and cable. These increased data rates will be noticeable even for casual web users, and certainly for gamers and other high-bandwidth users.

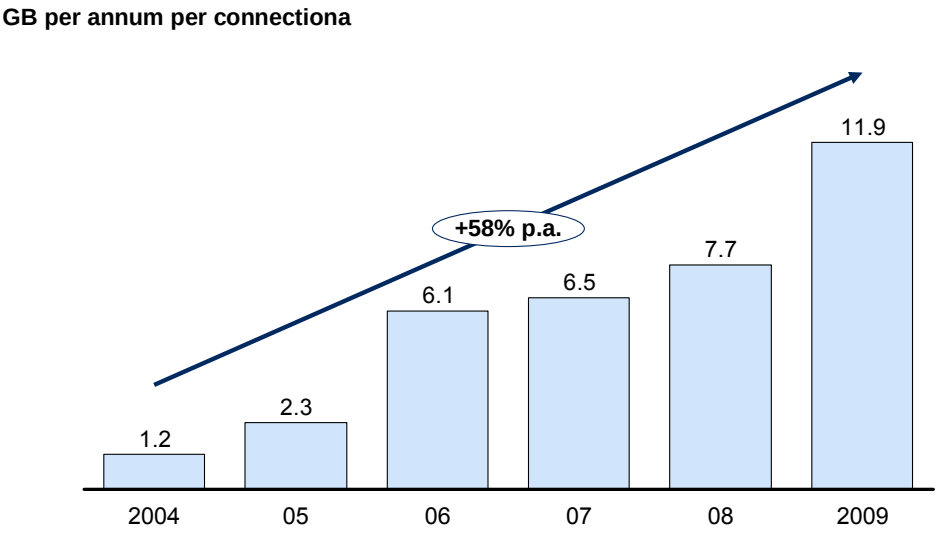
In areas without ADSL, users experience lower data rates and variable performance. Despite access to world-class mobile networks, such as Telstra's NextG HSPA service, there are gaps in coverage, limited choice of service providers, and variations in service performance.

Current access technologies will struggle to support continued growth in bandwidth requirements. The trend from 2004 to 2009 is 58 percent compound annual growth (Exhibit 3–4), however there is evidence that is accelerating—the ABS estimates that Australians downloaded 80 percent more data in the June quarter of 2009 compared to the same period in 2008.[45] Over-the-top (OTT) video services, for example YouTube, are one cause of the recent increase in broadband usage. ADSL can deliver these services in standard definition; however the user experience is often inconsistent. Some current

[44] Telstra's DOCSIS 3.0 network in Melbourne currently covers 1 million homes (Telstra 2009, *Telstra unveils superfast cable broadband*)

[45] Australian Bureau of Statistics 2009, *Internet activity, Australia, June 2009*, cat. no. 8153.0, Canberra

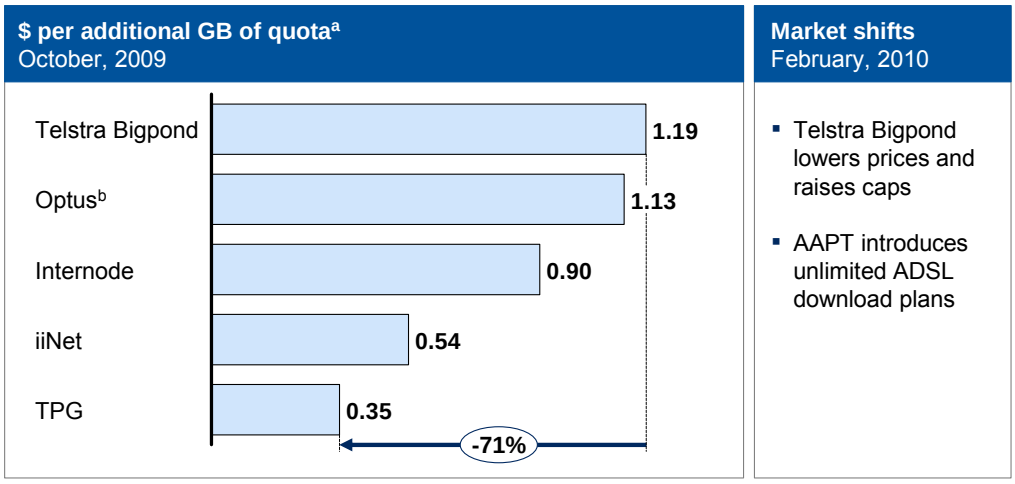
Exhibit 3–4. Growth in Internet usage per connection, Australia, 2004–09



a. Estimated from data downloaded and number of subscribers
SOURCE: ABS, *Internet Activity, Australia*, various releases 2004–09

wireless and satellite technologies are poorly suited to deliver video content at scale—due to limitations on the speed and capacity of data downloads over wireless and contention between users accessing wireless transmitters or satellite transponders simultaneously. The NBN will address the growth in bandwidth requirements through much higher data rates, and the implementation of efficient distribution functionality such as multicast.

Exhibit 3–5. Average marginal retail price of downloads



a. ADSL, ADSL2+, Naked ADSL2+ services (excludes Cable and Fibre). Marginal price calculated as price difference between adjacent download quotas within a service of the same specifications e.g. the retail price difference between Naked DSL 30GB and 50GB packages for iiNet
b. Naked ADSL prices only—other ADSL prices are affected by bundling with fixed line and/or mobile
SOURCE: Whirlpool 2009; Implementation Study

In addition to lacking superfast networks, broadband in Australia is also constrained by usage-based pricing. Broadband plans in Australia generally come with a monthly download cap. If users exceed their cap, they must either pay charges for additional data or have their download speed constrained or 'throttled'. Download caps are less common in other countries.[47] In Australia, many local providers face genuine costs for IP traffic—national backhaul, peering and international transit are all more expensive than in many other OECD markets. However, the range in usage pricing of different ISPs suggest that the prices charged by many providers are well above the level that would be explained by the cost of providing data downloads. (Exhibit 3–5).

SP Telemedia may introduce uncapped broadband offers if it acquires Pipe Networks

Telemedia Executive Chairman[46]

Market shifts in early 2010 confirm this view with ISPs such as Telstra, TPG and iiNet reducing download prices. Nevertheless, usage-based pricing continues to impact Australian content providers and end users. Demand for 'heavy' services is growing—usage per connection has increased significantly in recent years (Exhibit 3–4). Two factors drive this. First, standard Internet websites are becoming increasingly rich in content. For example, many websites are now embedded with videos or other interactive features. Second, users are consuming increasing quantities of data-rich services, such as video and music downloads.

The NBN will loosen usage constraints in several ways. Although ISPs will still face the cost of international capacity, the NBN's provision of transit services at affordable prices would directly reduce the cost of national backhaul. With respect to peering, increased retail competition can be expected to support development of exchange points and shared fabrics at a lower cost to service providers.

Highlight. Current usage caps for fixed-line broadband packages in Australia are among the most restrictive in the world. Retail usage caps are likely to become less restrictive on the NBN due to increased backhaul affordability and greater retail competition.

Addressing the fixed-voice market

Despite sustained growth in fixed-line broadband, fixed-voice services are still an important revenue pool in telecommunications. In 2009, Australians spent just over $10 billion on fixed-voice services—equivalent to one-quarter of the industry revenue.[48]

46 White, D 2009, 'Unlimited downloads in pipeline', *Australian Financial Review*, 18 November

47 Organisation for Economic Co-operation and Development 2008, *OECD Broadband Portal*, viewed 16 February 2010 <http://www.oecd.org/sti/ict/broadband>

48 Buddecomm 2009, *Australia: Internet, broadband and convergence statistics*

The fixed-voice market has declined in recent years, but will remain a substantial source of revenue and profit for the telecommunications industry. Penetration in Australia has declined nearly 3 percent per year since 2005 (Section 4.4). This decline has been driven by fixed-to-mobile substitution and the increasing use of VoIP at the expense of PSTN technology. Section 4.4 discusses both of these trends. Analysts differ in their expectations about the rate of continued decline in the fixed-voice revenue pool, but under any scenario, it will remain significant for some time.

The NBN should therefore consider voice functionality and pricing carefully in the development of its wholesale services. Failure to address this revenue pool could lead to significant leakage of industry value at both wholesale and retail levels. It would also alter consumer willingness to pay in a way that permanently affects the commerciality of NBN Co and its customers.

The typical approach for ensuring continuity of voice services and revenues in many international markets, as well as in Australian greenfield fibre deployments, is PSTN emulation at the ONT. This allows users to keep their existing phones and home wiring, significantly reducing barriers to migration to the NBN from legacy networks. However, retailers currently operating pure PSTN calling networks will need to develop new IP platforms to interconnect with these services. A broader issue exists regarding the future of interconnect between carriers in an all-IP world, but this primarily concerns core network operators and is therefore beyond the NBN's ambit.

Advice. That the NBN Co Board recognise the value of fixed-voice revenue for sustainable retail models in the way it develops and prices its services and manages migration onto the network, for example by providing PSTN emulation on the ONT.

Enterprise-grade fibre services

It is critical that fit for purpose access and other wholesale products are available to support the specific needs of enterprise customers. Business customers typically require enhanced product offerings when compared to the needs of consumers.

COLT Telecommunications, UK[49]

In the corporate and carrier market, fibre point-to-point services are well established. Specific revenues from these services are difficult to track, however, as Section 2.5 outlines, overall fixed-line revenues for large enterprises and public institutions are estimated at $6 billion. Telstra is the largest provider in this market, with limited competition for multi-site and non-CBD customers. The NBN will offer more affordable services, grow the market, enable innovative retail service offerings, and allow all service providers to compete for national accounts.

[49] COLT 2009, *Response to Ofcom's consultation document: Next generation networks*

Access network operators—including mobile, DSL and cable providers—also require enterprise-grade connections. Many of these operators, particularly mobile networks, are currently constrained by a lack of affordable connections due to high prices on many backhaul routes (Chapter 6). Enterprise-grade services on the NBN will address these bottlenecks to allow these operators to deliver improved levels of service to end users.

3.1.2 FACILITATING A SUPERFAST BROADBAND FUTURE

As discussed above, the NBN will improve today's services. However, the platform also creates the potential for a new generation of applications, services and user devices. This Section discusses some of the types of services and models that rely on a superfast, open-access NBN platform.

Enabling richer applications

Beyond faster access to current services, the increased speed and performance that NBN offers will enable a new generation of richer, premium applications. The step change in customer experience will be similar to the change experienced in the move from narrowband to broadband, which enabled a new generation of Internet services—for example, iTunes, YouTube.

Predicting exactly which services will emerge or will succeed is difficult. The Implementation Study has considered a wide range of service types that represent the types of demand that will be made of a next-generation network. Exhibit 3–6 outlines a selection of potential services.

Exhibit 3–6. Potential NBN-supported services

Type of service	Examples
Super-rich content delivery	■ 3DTV ■ Interactive TV—for example, selection of multiple camera views in real time
Lifelike human interaction	■ High-definition video-conferencing ■ Simulated touch experience
Video gaming	■ Virtual reality video gaming, including motion-sensing and feedback ■ Low-latency peer-to-peer virtual LAN games
Monitoring and response	■ Tracking diagnostic indicators of chronically ill patients ■ Video surveillance
Machine-to-machine systems	■ Remote power management (feature of some 'smart grid' solutions) ■ Supply chain management for small businesses

Source: Implementation Study

Exhibit 3–7. Example devices that exploit superfast capabilities

Type of device	Examples
Bigger and smarter screens	■ Widespread implementation of software on large screens, allowing viewers to access content previously limited to small computer displays (e.g. YouTube) ■ 3D screens, approaching mass-market price points ■ Large touch-screen displays—e.g. Microsoft Surface
Next-generation human interfaces	■ High-definition video conferencing, with supporting 'environmental' enablers such as superimposed backgrounds and surround sound ■ Feedback touch interfaces—e.g. gloves that simulate feeling a virtual object ■ Remote presence, including 'virtual workers' (Exhibit 3–8)
Seamless mobile devices	■ Voice handsets that hand-off between macro networks and home base stations ■ Smart network selection on mobile web devices—phones that automatically select highest quality / lowest cost network ■ In-car navigation systems which download map and point-of-interest updates when garaged
Source: Implementation Study	

Supporting new and innovative devices

The evolution of new services will rely on the concurrent development of devices. The NBN is also likely to facilitate the emergence of new and innovative devices that transform the way users experience the services that emerge.

Exhibit 3–7 outlines a range of potential devices that could emerge as NBN services become ubiquitous. Exhibit 3–8 provides an example of the types of devices that can take advantage of superfast broadband connectivity.

17 percent of respondents that upgraded to FTTH now work from home more

Ovum[50]

[50] FTTH Council Asia-Pacific 2009, *Submission to the New Zealand Government Broadband Investment Initiative*

Exhibit 3–8. Case study: Advances in devices transforming life at work

Telepresence in the workplace: the IvanAnywhere robot	
Situation	A worker in Canada found that his remote working regime was proving difficult. However, his alternative was a 1,350 km commute. Given these constraints, he devised a means for being 'virtually present' in the office—a robot avatar, remotely controlled via broadband.
Innovation	Dubbed IvanAnywhere, this robot was a highly specified and functional device. It was equipped with a full set of inputs and outputs: ■ Microphone to hear office goings-on and conversations ■ Video camera to allow navigation and view faces of colleagues ■ Monitor to display face of Ivan ■ Speakers to project voice of Ivan ■ Fully-mobile chassis with battery pack, electric motor
Outcome	The tool proved highly effective at enabling remote productivity for Ivan. For example, he could now: ■ Interact face-to-face with colleagues ■ Attend meetings ■ Make presentations
Implications for NBN	Although seemingly futuristic, ubiquitous fast broadband will make innovations such as this one more common—potentially leading to improvements in productivity, and interactivity.
Source: Walcoff, M 2007, 'Meet IvanAnywhere', *Record*, 1 September	

Acknowledging the difficulty of predicting business models and value creation for the NBN

Given the wide array of innovative and valuable services that may emerge, NBN Co could reasonably expect to capture value beyond today's broadband services. However, it is difficult to predict which business models will prevail, and the quantum of value that NBN Co may capture.

First, new services may be delivered in a variety of ways.

- **Over-the-top, via the Internet.** Although there are advantages to managed IP connections, many services will continue to function adequately over the Internet.
- **Through a specified bitstream, in conjunction with a retail provider.** Retail providers are likely to have a primary billing relationship with each activated premises, based on a core service such as broadband, voice, or TV.
- **Standalone, using a wholesale bitstream service**. In this scenario, an application provider—say, a healthcare monitoring service—would offer services directly to the end user, without an interaction with a traditional telecommunications service provider. The user would access the service through an identified ONT port and pay the application provider directly.

As new and innovative services emerge on the NBN, value will be created for industry, users and the wider economy. However, NBN Co, as a wholesale-only network provider, is unlikely to capture significant proportions of this value as direct revenue. This challenge is recognised when modelling revenue for the NBN. Hence, the modelling takes a conservative approach to new sources of revenue that NBN Co can reasonably expect to capture. The approach to revenue modelling for the fibre and non-fibre networks is explained in Chapters 4 and 5 respectively.

3.2 Delivering wholesale services to meet end-user needs

As a wholesale-only provider, the NBN will not directly serve end users. Rather, it should offer services that allow its customers—retail providers and intermediate wholesalers—to meet end users' needs. It is important for NBN Co to design and offer the right services, as they will affect end-user experience, competitive outcomes, and the ability of NBN Co to generate revenue. This section outlines the principles that should guide the NBN service portfolio, now and in the future, to balance these needs:

3.2.1 Defining a set of services to fit the current market

3.2.2 Ensuring NBN services meet future needs.

3.2.1 DEFINING A SET OF SERVICES TO FIT THE CURRENT MARKET

In its broadest sense, NBN's service offering is defined by two considerations: the layer in the network stack in which it will operate; and the geographic extent of its offer. These considerations define the logical and physical boundaries of the network, and the activities that will need to be undertaken by service providers using the NBN to deliver services to end users. Therefore, these considerations influence the degree of innovation and control left open to service providers as well as the nature of their business models and the industry structure that is expected to emerge. Exhibit 3–9 demonstrates how the options for NBN service offerings fit within these considerations.

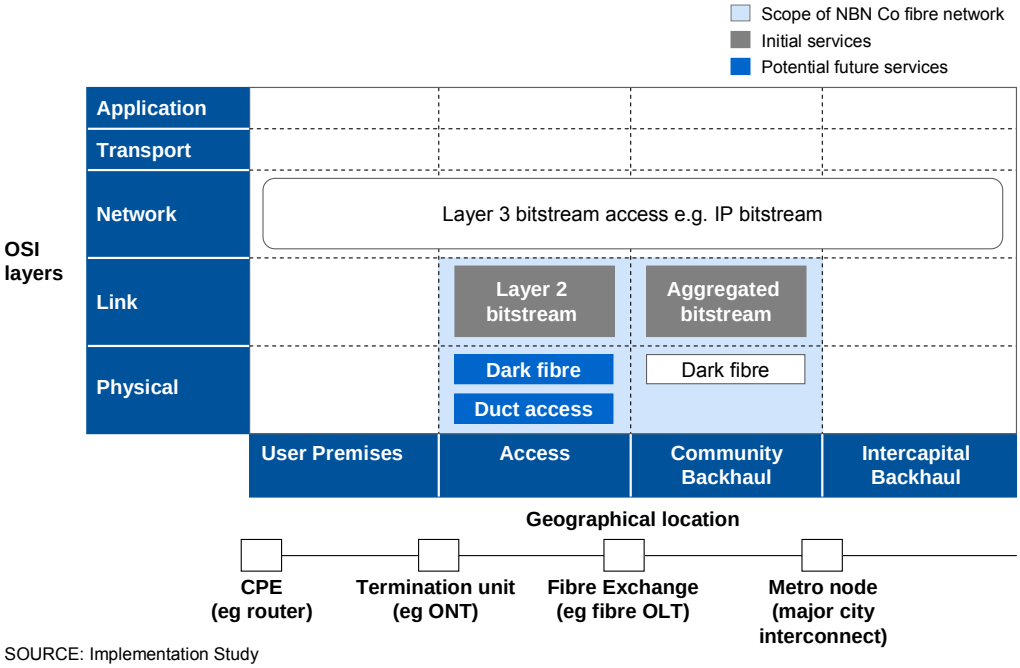
Defining the layer in the network stack

The Open System Interconnection (OSI) network stack is a widely referenced framework for understanding networks. It comprises seven layers, of which the lowest—or most fundamental—three are commonly discussed when constructing telecommunications networks.[51] Exhibit 3–10 shows the OSI stack, and the key terms which will be used in our discussion of the NBN. These layers are not entirely discrete, and there are different interpretations of the appropriate boundaries between them. For ease of comparability, the Implementation Study has aligned the definitions below with those used by NBN Co in its industry consultations.

Service providers have greater control of the network, and therefore more scope to innovate, at lower layers of network access. The NBN is an enabler of innovation, rather than a driver of it. The NBN should therefore offer services at the lowest layer of the

[51] Although there is no official Layer 0, conceptually it exists as the physical link

Exhibit 3–9. Options for NBN service offerings



SOURCE: Implementation Study

network stack that enables vibrant retail competition. We discuss the features and requirements of a healthy retail market in Chapter 9. In this section we focus on the performance implications of services at different layers in the stack.

Exhibit 3–10. OSI network stack model

OSI network 'stack'	Example wholesale service	Function
7 Applications layer 6 Presentation layer 5 Session layer 4 Transport layer	N/A	**Service enablement** ▪ Provides functionality for user services
3 Network (IP) layer	IP stream	**Cross-network communication** ▪ Controls routing and ensures reliability
2 Link (active) layer	Ethernet bitstream	**Area networking** ▪ Creates connection and transfers data
1 Physical (passive) layer	Dark fibre	**Transmission medium** ▪ Defines mode of transmission and receipt
0 Medium (passive) layer	Duct access	**Physical medium** ▪ Transports physical network medium

SOURCE: NBN Co 2009, *NBN Co consultation paper: Proposed wholesale fibre bitstream services*; Implementation Study

In discussions of the appropriate service offering, it is necessary to address different technology platforms separately. It is possible to offer access at all layers on fibre—including duct access, dark fibre, Ethernet, and IP. However, satellite and wireless wholesale services are typically delivered at Layer 3.

Wholesale access can look different on each technology, and models other than wholesale access may be considered for wireless parts of the network.

Ericsson [52]

Fibre footprint

Within the fibre access network, there are several potential service offerings at different layers. These have natural geographic extents—for example, continuous dark fibre is not typically offered between a metro point of interconnect to premises several hundred kilometres away because of the physical topology of the network. Rather, multiple dark fibre links would be pieced together to enable a connection between those points. Similarly, IP managed bitstream services typically exist between two smart devices so would be offered from a service provider's central facilities to end users' premises.

There are several considerations in determining which layer(s) should be provided to access seekers. The primary trade-off is between enabling greater competition by lowering barriers to entry, which suggests services higher in the stack, and enabling network management and innovation, which requires access lower in the stack. Exhibit 3–11 illustrates these trade-offs.

Access at the passive layer gives service providers the greatest level of control over their service offer. Although the fibre cable itself is standardised across the industry (based most commonly on ITU standard ITU-T G.652), access to the dark fibre allows the provider to control the transmission of signals over it. For a given cable, different methods can be employed to do this using different modulation and optics. Ethernet is emerging as a standard which creates a data link, generally regarded as Layer 2. At Layer 3, IP is a dominant standard for the transmission of data. Although Layers 2 and 3 are mostly standardised, passive access gives service providers opportunities for sophisticated routing and traffic management, including quality of service.

Regulators usually favour passive access as it provides CPs (communications providers) with the greatest level of control over the underlying infrastructure. This, in turn, provides the greatest scope for innovation, allowing CPs to reduce costs and prices, and develop new products, bringing real benefits to consumers

Ofcom[53]

52 Ericsson 2009, *Ericsson submission to the Department of Broadband Communications and the Digital Economy National Broadband Network legislative framework*

53 Ofcom 2009, *Ethernet Active Line Access: Updated Technical Requirements*, viewed 8 February 2010, <http://www.ofcom.org.uk/telecoms/discussnga/eala/eal/>

However, one limitation of access at the passive layer is the level of investment required to enter. Service providers must invest in active equipment in any area they want to serve. In the short term, this would increase barriers to entry and limit competition to large, existing network providers (e.g. Telstra, Optus, AAPT). This situation would not meet the NBN requirement for a level competitive playing field at the retail level. In the long-term however, passive access may be needed to introduce competition at lower layers in the stack. We discuss this in Chapter 9.

Access higher up the network stack at Layer 3 significantly lowers the barriers to entry for service providers. Access to the NBN at this layer would allow many service providers to compete, from limited geographic points of interconnect (e.g. only major cities). However, Layer 3 access would require NBN Co to manage all network routing and end-to-end service specification. This requirement would have two impacts. First, NBN Co would need to offer a large range of services to meet the needs of all access seekers. This would increase the risk of the NBN not meeting the needs of some service providers. Second, it would reduce the level of control and scope for innovation of service providers. This would reduce the potential benefits for end users of the network.

We conclude that active services at Layer 2 provide the best means of levelling the retail playing field in the short term without unduly limiting service provider competition and innovation. Layer 2 bitstream services are already implemented in other separated telecommunications industries around the world (Exhibit 3–12). Regulators like Ofcom, have also examined and endorsed the ability of Layer 2 active services to meet the needs of a range of service providers.[54]

We acknowledge the challenges in predicting the evolution of service specifications at Layer 2 (Chapter 4). For example, enabling IPTV services requires Layer 3 awareness, known as IGMP snooping, to responsively present video streams to end users. The possibilities for ambiguity of definitions based on the OSI stack are significant and ongoing monitoring and adjustment will be required.

[54] Ibid

Exhibit 3–11. Choice of Layer for NBN services in fibre footprint

Core offer in initial stage of network

OSI layers	Example service offer	Ability of access seekers to… Compete with relatively low barriers to entry	Manage network and QoS	Upgrade optical line electronics
3 Network	IP	✓✓	✗	✗
2 Link	Ethernet	✓	✓	✗
1 Physical	Dark fibre	✗	✓✓	✓
0 Medium	Duct	✗	✗	✗

SOURCE: Implementation Study

Exhibit 3–12. Bitstream service examples in other markets

Country (operator)	Type of Service	Stage of development	Support for premium services
New Zealand (Telecom NZ)[a]	Enhanced UBA, over DSL	Offers in market	**Yes.** Voice-ready 40–160 kbps real time bitstreams
UK (BT Wholesale)[b]	Datastream, over DSL	Offers in market	**No.** Best efforts service
UK (BT Openreach)[c]	Generic Ethernet Access, over FTTP	In trials at Ebbsfleet. London launch planned for 2010	**Yes.** CIR, support for Class of Service, multicast, ATA voice
Singapore (Nucleus Connect)[d]	Portfolio of layers and network elements, over FTTP	Launch planned for first half of 2010	**Yes.** Full implementation of carrier Ethernet, wide range of L2 / L3 services, 4 classes of service, multicast.

a. Telecom NZ 2009, Product profile: Enhanced Unbundled Bitstream Access

b. BT, BT to expand footprint for UK's fastest broadband, media release, London, 9 October 2009

c. Infocomm Development Authority of Singapore (IDA) 2009, *Lighthouse series: Active network architecture*, report prepared by Nucleus Connect, Singapore

d. IDA 2009, *About Next Gen NBN OpCo, Nucleus Connect*, viewed 12 December 2009, **http://www.ida.gov.sg/Infrastructure/20090731130844.aspx**

Source: Implementation Study

Recommendation 32. That NBN Co only be permitted to operate at the lowest layer of the network stack that enables sufficient retail competition and diversity of services for end users. Initially, this will translate into Layer 2 bitstream services in the FTTP network, and Layer 3 IP services in the satellite access footprint; that Government request that the ACCC periodically monitor competition, and recommend necessary modifications of the service portfolio to best serve the long term interests of end users; that this include considering the offering of passive services.

Satellite and wireless footprint

For a retailer, interconnection to satellite services at Layer 2 has limited added value because effective management of the access link on modern satellite platforms requires access to Layer 3. This network management is particularly important on satellite given the high latency of the platform, which renders standard transport protocols less effective. The normal model for satellite interconnection is for the satellite operator to perform network management with retailers operating through a Layer 3 (normally IP) connection.

Within the wireless footprint, the successful tenderer(s) for the NBN fixed-wireless service should be required to offer both a wholesale Mobile Virtual Network Operator (MVNO) service as well as a retail offering. Similar to the satellite case, the MVNO service would be provided by default at Layer 3. As part of the tender specification, Government should also consider whether to require the tenderer(s) to offer support for a Layer 2 tunneling protocol (L2TP) to enable Layer 2 data streams to be provided over the network.

Determining the geographic extent of the NBN

As discussed in Chapter 2, NBN Co should focus on non-competitive areas where the market is not delivering outcomes for end users. In practice, this means that the Company should focus on:

- Fibre access to all premises within the coverage objective, except in the few parts of the country where fibre networks of the required specifications exist;
- Satellite where fibre access is not deployed;
- Backhaul where there is no competition.

Delivering services to meet a broad range of needs

Most immediate demand for services will come from carriers, who are focused on voice and best-efforts Internet services, as well as delivering enterprise and mobile services. However, NBN Co should consider the needs of smaller, emerging, or non-traditional providers. These providers will require services which serve specialised needs and are available at a low marginal cost. For example, a smart grid meter may require a low-bandwidth connection, which can be priced very cheaply as it poses no substitution risk

to broadband. Conversely, a remote health consultation provider may require high-grade symmetric services, for which a premium can be paid.

A specific dimension of specialist connectivity is quality of service (QoS). QoS is a means of prioritising packet-switched traffic to create different classes of service to suit different application needs. Currently, wholesale bitstream services are mainly used to deliver Internet services—most notably in the UK and NZ, where ISPs leverage bitstream services on DSL platforms. While creating QoS services across network boundaries at Layer 2 is still relatively unproven for mass-market advanced services such as IPTV, it is well established in carrier network management and should be technically feasible within the fibre footprint. For the satellite service, Layer 3 wholesale services can be created to handle voice, the main QoS service likely to be available on that platform.

NBN Co's role here is to offer the range of services and protocols to service providers that enable end-to-end QoS. It remains the responsibility of the service providers to manage the services across network boundaries.

Advice. That the NBN Co Board ensure the NBN supports service providers in the delivery of next-generation services that are specified to conform to international and industry standards, including emerging standards for Quality of service parameters and classes of service; that reference points include principles and standards published by regulators (such as Ofcom); and technical specifications defined by international forums (such as the Metro Ethernet Forum or Broadband Forum).

3.2.2 ENSURING NBN SERVICES MEET FUTURE NEEDS

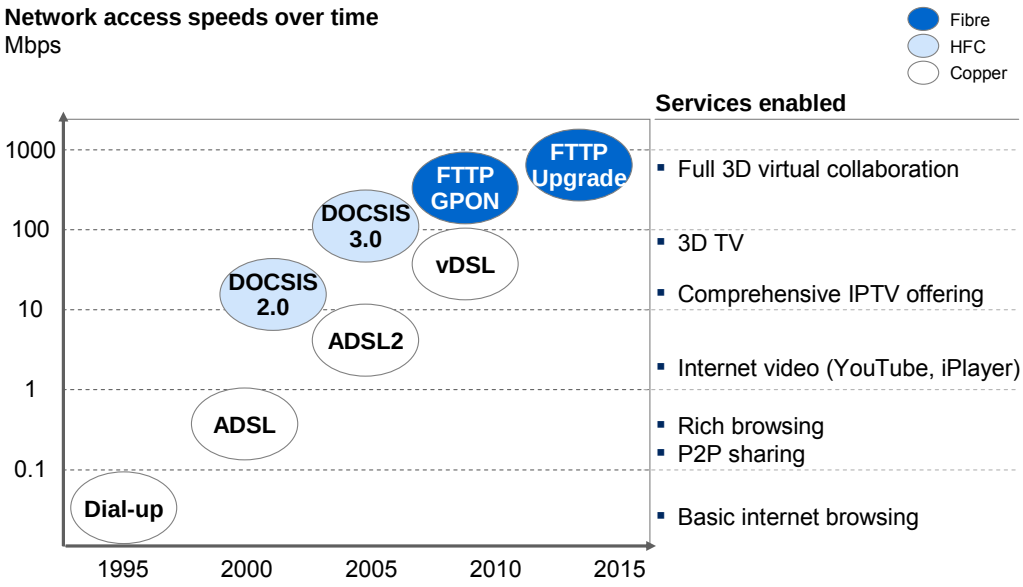
NBN Co's network and service footprint may be required to change over time, as the needs and competitive structure within the industry evolve. These changes could be effected in two ways:

- As upgrades in data rates and performance of the Layer 2 services that form the initial core offering of NBN Co; and/or
- As a shift in NBN Co's service footprint. This shift could be a move up and/or down the network stack (i.e. offering services at Layer 1 or 3); or a geographic shift in where NBN Co offers services.

Ensuring upgrades of active services

As demand for bandwidth and performance continues to grow over time, NBN Co will need to upgrade the specifications of its initial portfolio of active services. Users are likely to demand speeds in excess of current requirements—100 Mbps and 12 Mbps—in the future (Exhibit 3–13). An important question is how to ensure NBN Co, as the only provider of active wholesale services, continues to invest in its network and services to meet such evolving needs.

Exhibit 3–13. Growth in fixed-network access speeds over time



SOURCE: Implementation Study

Referencing international benchmarks prior to active competition

Competition at the active layer of the network provides the most effective way to ensure ongoing innovation and upgrades of services, within the fibre footprint (Chapter 9). However, it may take some time for the market to meet the necessary criteria for the introduction of competition at this layer of the network. NBN Co will therefore need to upgrade its active equipment at some point following the first-generation cycle of 7–10 years.

As its customers demand higher speeds and performance, NBN Co should upgrade its services. These upgrades are likely to require investment in new equipment. In making these upgrades, NBN Co should reference international benchmarks and industry standards, to ensure NBN services continue to offer world-class performance.

> *Although getting fibre deployed into the network is the first and most significant step, we anticipate ongoing reinvestment in equipment [as opposed to the fibre] will be required at least every decade, if not more frequently*
>
> FTTH Council Asia-Pacific[55]

Government will want to ensure that NBN services continue to stay at the forefront of international performance. It is challenging to prescribe an exact mechanism given the dynamic nature of innovation in telecommunications technology. Regulation is one

55 FTTH Council Asia-Pacific 2009, *Submission to the New Zealand Government Broadband Investment Initiative*

option, but does not guarantee optimal outcomes. We believe competition at the active layer will deliver the best outcomes, as discussed in Chapter 9.

> **Advice.** That the NBN Co Board ensure NBN services are upgraded as the needs of customers and users evolve. Where these upgrades require investment in active equipment, that NBN Co reference international benchmarks (e.g. major network deployments) and best practice (e.g. industry standards) to ensure NBN services continue to deliver world-class performance.

Ensuring national upgrades once active competition is introduced

As competition emerges in the active layer, the services offered by new entrants will form a new benchmark of performance and innovation. However, this competition is unlikely to emerge in all geographies, or at the same time, due to differences in the density of demand (e.g. a metro fibre exchange serving 20,000 subscribers would be a more attractive opportunity for an attacker than a regional fibre exchange serving only 5,000 subscribers).

To ensure that similar levels of performance are available across its network, NBN Co should also reference competitive offers when upgrading its equipment and services. Upgrades of NBN services should therefore be available across all geographies within a particular technology footprint, as demanded by end users.

> **Recommendation 33.** That NBN Co be required to offer services with comparable levels of performance in all geographies within a technology footprint, specifically:
>
> 1. While it is the sole provider of active layer NBN services, NBN Co should upgrade services over time and demonstrate that the functionality and performance of its services are in line with international benchmarks; NBN Co's upgrade plans should be submitted for ACMA's approval that they are sufficient to maintain Australia's broadband position internationally;
> 2. As network elements are upgraded over time, NBN Co should ensure all equipment within an access technology platform is on a similar upgrade path. If active-layer competition is in place, NBN Co's offers in competitive areas should be consistent with NBN services in all areas;
> 3. In the satellite footprint, NBN Co should ensure that CPE upgrades continue to be offered via service providers.

Meeting the needs of new business models

NBN Co's services portfolio may also need to evolve to meet the needs of new business models. In Chapter 9 we acknowledge there is considerable uncertainty in the evolution of broadband technology and applications. For example, it is conceivable to envisage a shift from today's carrier-driven model to a future dominated by devices and/or applications. Apple's iPhone and new iPad provide real examples of this shift—these devices form the primary relationship with end users, while the network connection is a secondary consideration.

While Layer 2 active services currently provide the best means of levelling the retail playing field, this may not always be the case. NBN Co should be willing to flex its service offering if stakeholder needs (including those of Government and regulators) demand a shift. In particular, an optimal long-term competitive structure relies on NBN moving down the stack and providing access to passive services—that is, Layer 1. Chapters 9 and 10 discuss this in detail.

It is also possible that market failures at Layer 3 may result in customer demand for a shift up the stack by NBN Co. This is plausible but should be a last resort. A market exists today for these managed-network-type services, mostly provided by the large carriers and networks. However, as with any concentrated market, there is a risk it fails to serve the long-term interests of end users by preventing the emergence of certain services (for example, application service providers offering low-bandwidth applications, with limited ability to pay). We believe the ACCC should play the primary role in monitoring this market, and consider traditional remedies if failures or bottlenecks become apparent. Those remedies should only involve an extension of NBN Co's mandate with specific Ministerial authorisation.

Advice. That the NBN Co Board consider that NBN's service scope may need to evolve as market conditions shift and new business models emerge. This evolution could involve logical (e.g. up or down the network stack) or geographical changes (e.g. more or less involvement in backhaul); that NBN Co ensure decisions made in the design and deployment of the network can incorporate a range of potential changes in scope.

3.3 Delivering video services over the NBN

The NBN will expand the possibilities for service providers to deliver video services to end users. Three types of video distribution technologies are possible over a fibre network and need to be considered for NBN Co: IPTV, radio frequency (RF) and OTT.

In addition to enabling new distribution technologies, NBN Co will derive revenue from offering a wholesale video service. While in the longer term, a wholesale video service could generate significant revenue for NBN Co, it is not expected to initially. Nevertheless, a wholesale video service will ultimately increase competition and take-up by opening access to service providers and by providing consumers with greater choice of providers, content, and video experiences.

The following recommendations address the role of NBN Co in delivering video services, in the following subsections:

3.3.1 Introducing potential video distribution technologies for the NBN

3.3.2 Identifying competition and commerciality challenges with RF

3.3.3 Enabling new innovation and competition over IPTV

3.3.4 Anticipating video-over-Ethernet business models

3.3.5 Acknowledging video market structure and content bottlenecks.

3.3.1 INTRODUCING POTENTIAL VIDEO DISTRIBUTION TECHNOLOGIES FOR THE NBN

Three types of video distribution technology could be enabled by NBN Co:

1. **Internet Protocol Television (IPTV**) is a method for delivering video-over-Ethernet with defined QoS. This allows a service provider to reserve a consistent amount of bandwidth to guarantee that high quality video is available when the user requires it. IPTV, which is growing in international markets, facilitates interactivity and the convergence of different types of applications, content, and services.
2. **Radio-frequency overlay (RF)** provides a television viewing experience similar to terrestrial broadcast. Video-over-RF works by sending video signals through an HFC or fibre optic network on a different wavelength to data transport. Frequently used to distribute cable television, RF is a well understood and reliable technology. Video quality over RF is high, although the platform offers limited scope for innovation.
3. **Over-the-top (OTT).** OTT video is transmitted directly through a broadband connection without dedicated bandwidth. OTT is an efficient method to deliver video over the best-efforts Internet that will not require NBN Co to provide a reserved wholesale video service. Quality and consistency of sound and picture is not

guaranteed and does not match consumer expectations for broadcast linear television. OTT video will likely be generated and delivered in large volumes over NBN. Traditional media companies have already begun delivering content OTT through joint ventures with online services (e.g. Yahoo! Seven, NineMSN) and through new services like ABC's iView platform. No specific wholesale services need to be offered by NBN Co to support OTT delivery of video. Rather, development of the market will be promoted by fast Internet speeds, affordable data plans with large download limits provided by a competitive ISP market. One potential obstacle that will need to be monitored by the ACCC is the incentive for ISPs to throttle speed and discriminate between publishers, either to promote their own content or receive payment for promoting other providers' content.

3.3.2 IDENTIFYING COMPETITION AND COMMERCIALITY CHALLENGES WITH RF

NBN Co should not install an RF overlay unless it caters to multiple operators. A single-player RF overlay will be inexpensive for NBN Co to provide, but will not conform to the open-access principle and may not attract interest from the market. However, it is questionable whether a multiple-player RF overlay would be commercially attractive—it could add up to $1 billion to the cost of network build and will have its revenue constrained by the low-cost alternative of satellite distribution.

RF may also bring a number of technical challenges as the technology has a lower signal/noise ratio than data. RF could reduce the reach of fibre from the exchange by 2–3 km. Further, it is possible that some existing backhaul will not support RF and would need in some instances to be replicated.[56] This may only be of concern in a national network if signals need to be carried between POIs.

Avoiding simple RF implementation due to competition issues

The NBN could be constructed to support one video provider per point of interconnect using fairly simple technology at relatively low cost.

However, a single-provider RF service will conflict with the open-access principle at the heart of Government's NBN policy. The RF port would need to be sold to one provider who would effectively receive exclusive access to the region. No competition would be possible within that POI.

The cost of providing a simple RF overlay is relatively inexpensive for NBN Co as the retailer would provide active equipment within the POI. NBN Co may only have to provide an ONT which reads an RF signal, and that has an additional port for an RF feed.

[56] Industry interviews

It is estimated that this would add approximately $25 to the cost of each ONT, hence adding less than $250m to the cost of build.[57]

Despite the relatively low cost, the commercial rationale for a simple RF service is uncertain. While the cost for NBN Co is low, the cost for the retailer would be high. The retailer would need to provide active equipment at each POI for which they had the exclusive right to deliver video over RF, as well as video content centres at various points in the network (the number would depend on how many POIs they serve). For a service provider with reasonable scale, active equipment would cost approximately $65 per household served, with video content centres likely to cost around $250,000.[58]

More importantly, the RF service would struggle to earn reasonable revenue competing with the low cost of satellite and the existing long-term contracts. Austar and Foxtel are potential customers. Currently, Foxtel delivers to 800,000 customers via satellite and 640,000 over HFC, and Austar delivers to almost all of its 720,000 customers via satellite.[59] Transitioning existing satellite customers onto the NBN would be a costly exercise for Foxtel and Austar. They would need to visit each customer premises to switch customers without an RF-compliant set-top box (STB) to new CPE.

As the capex and transition costs will be high, RF would need to provide a significantly more efficient carriage platform for Foxtel and Austar to switch. Foxtel and Austar are estimated to pay a satellite carriage cost of $2–3 per customer per month.[60] Even if every existing Pay TV customer was switched to RF annual revenues would be no more than $50m per year[61] if priced to compete with satellite.

There are two further challenges. First, Austar and Foxtel may not be able to transfer their traffic onto NBN as both companies are locked into long-term satellite contracts.[62] Second, they may prioritise migrating customers to IPTV services, in the expectation that IPTV will become the main platform for future competition in pay TV.

Alongside the existing Pay TV providers, new entrants may be interested in an RF service. Delivering pay TV over RF may be more economic for a new entrant than an established provider. Satellite space has a very high upfront cost, but a very low marginal cost. As a result, satellite is an efficient delivery mechanism only if the provider serves a large number of customers. However, the pricing constraint is still relevant, as a new entrant

57 Industry interviews

58 Ibid

59 Austar 2009, *2008 Annual Report*; Buddecomm 2009, *Pay TV – statistics and subscriber overview*; Industry interviews

60 Austar 2008, *2007 Annual Report*; Industry interviews; press reports

61 Calculated based on 2.16 million Pay TV subscribers and a wholesale charge of $2 per subscriber per month

62 Industry interviews; press reports

would struggle to be viable paying a higher per subscriber access charge than established competitors. Furthermore, IPTV will offer new entrants greater ability to differentiate.

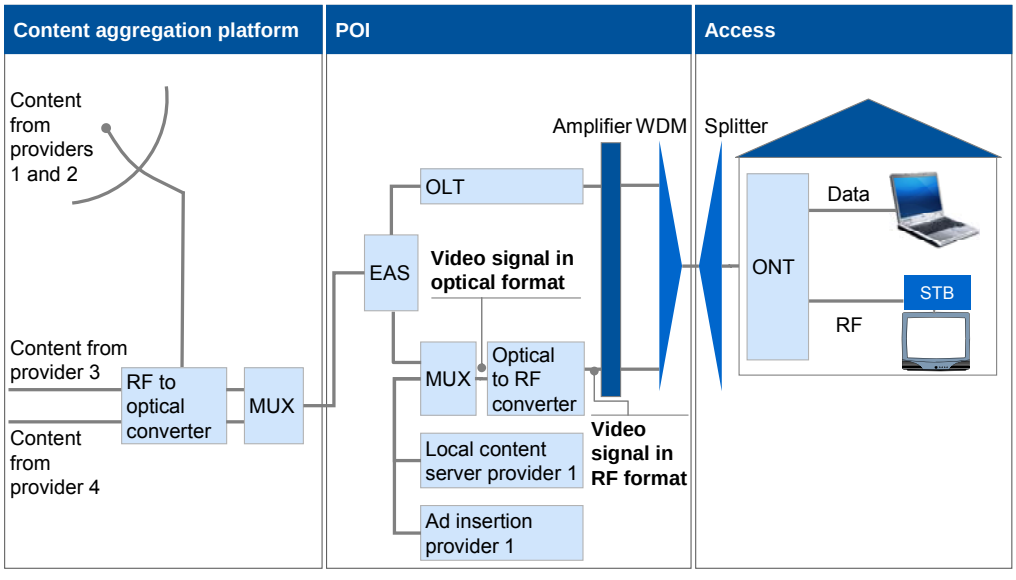
Recognising RF for multiple providers as possible but unlikely

An alternative model for RF would allow for multiple operators. This requires a content aggregator (NBN Co or another intermediary) to operate the RF platform. Retailers would feed their content to the aggregator who would deliver that content to households over the network. Set-top boxes (STBs) would be configured to decode only the signals to which the household subscribes. Exhibit 3–14 illustrates this architecture.

A multiple provider RF overlay allows for competition within the RF service set and would fulfil the open-access principle. However, it is unlikely to be an attractive option because the service lacks innovation potential, duplicates existing technologies and is unlikely to be commercially viable on a standalone basis.

The incremental cost to NBN Co of providing an RF overlay on top of network build is up to $1 billion. Cost is driven by equipment required at three points in the network. First, content aggregation points would need to be constructed. One in each capital city would be required at an approximate cost of $65 per premises covered. Third, NBN Co ONTs will need to have an RF port and a detector capable of reading

Exhibit 3–14. RF architecture for multiple providers



SOURCE: Implementation Study

the varying light intensity of the RF signal. This equipment will cost an additional $25 per premises based on initial cost estimates from equipment vendors.[63]

Revenue potential of RF is low for the same reasons discussed earlier in relation to a simple RF implementation. Even if Pay TV penetration were to double, the total revenue pool would be approximately $100 million, with NBN Co realistically unlikely to gain more than half.

Managing transition from RF in HFC areas

As discussed in Chapter 2, NBN Co's fibre footprint will include areas where HFC is already deployed. Given RF is already being used to deliver video to about 650,000 HFC subscribers,[64] the decision to provide an RF service within that footprint is more complicated. NBN Co will need to assess the commercial and practical issues at the time of transition, but we do not expect that an exception for providing an RF port would be required. If it is, it should be a multi-operator platform.

The commercial attractiveness stems from the fact that the contract between Telstra and Foxtel for carriage of Foxtel's signal provides for a very high carrier charge ($10–12 per month for each user) relative to satellite.[65] The contract is expected to expire in 2020. If NBN Co were to acquire an HFC network as an interim solution (Chapter 2), these high carrier fees are a potential revenue stream if the contract survived a change of ownership. In addition, RF may provide continuity for Foxtel's HFC customers as those customers will not be required to transition to a new platform.

Foxtel would likely prefer to transition customers from HFC to a satellite platform with costs closer to $2–3 per month per user or onto a more functionality-rich IPTV platform. Foxtel would have time to plan for such a transition through the natural cycle of churn and STB upgrade. Alternatively, in an HFC migration agreement, Telstra could transition broadband customers only from its HFC network and continue to deliver Foxtel over HFC.

Recognising practical exception for RF on a user-pays basis in greenfield estates

In addition to providing a premium broadband service to prospective residents, developers install FTTP networks in greenfield estates to deliver free-to-air and pay-TV services. Using RF overlay to deliver television and remove the need for aerials and

63 Industry interviews

64 Screen Digest 2009, *Australia: satellite pay TV operator TV subscribers;* Screen Digest 2009, *Australia: cable operator subscribers*; Screen Digest 2009; *Australia: HDTV subscribers by operator (annual total and forecasts)*

65 Telstra 2009, *Annual Report 2009*; Industry interviews; press reports

satellite dishes is preferred by developers in some estates for aesthetic or planning reasons.

Where greenfield estates demand RFoG as part of their FTTP communications infrastructure, NBN Co should be permitted to enable single-operator RF. This will ensure NBN Co can compete for greenfield FTTP contracts. Over time the demand for RFoG capability from developers is expected to decline as video content providers transition to IP-based platforms.

Recommendation 34. That Government permit NBN Co to offer an RF overlay service on its FTTP network provided it meets these conditions:

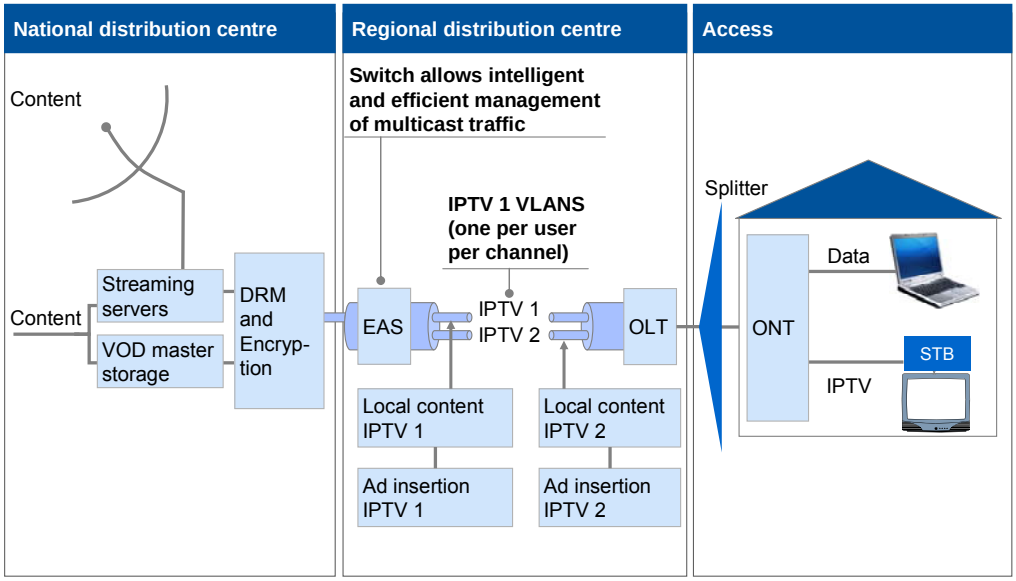
1. Except where necessary to compete for greenfield FTTP contracts, RF overlay supports multiple providers and the RF port on the household ONT is not exclusive to a single provider;
2. The deployment of RF overlay capability is commercially viable for the Company as a standalone service.

3.3.3 ENABLING NEW INNOVATION AND COMPETITION OVER IPTV

IPTV is a video service that can offer a high quality user experience (e.g. high definition, live linear television). IPTV requires that NBN offer a managed wholesale video service and that retail distributors construct a video distribution platform.

IPTV will be an important platform for innovation. It will be low cost for NBN Co to enable and is consistent with Government's open-access philosophy in permitting multiple types of video retail services to serve different consumer needs. However, we believe that revenue potential is limited in the near term (Section 4.5).

Exhibit 3–15. IPTV architecture for multiple providers



SOURCE: Implementation Study

Favouring IPTV as a platform for innovation

IPTV provides a platform for innovation through interactivity and convergence, though retailers are likely to face technological challenges during the early phase of the market. This contrasts to RF which is a mature legacy technology with similar functionality to terrestrial broadcast and satellite, and limited scope for innovation. A typical IPTV architecture is shown in Exhibit 3–15.

IPTV allows interactivity between the service and the user. In its most advanced form, IPTV permits users to personalise their video interface and control what they are watching by adjusting camera angles, watching multiple programs at once, or watching television and channel surfing at the same time. Data can be embedded in video footage so that viewers can click through to view additional details about the content being broadcast, watch features such as in-depth interviews, purchase a relevant product or play an embedded game. Phone and data services can be connected so that a caller's identity is visible on a television screen, or a television program can be recorded by phone. Internet and television convergence allow a user to query a provider's performance statistics while watching a football game, or chat with friends online while watching the same program. IPTV enables different forms of media to converge, by allowing users to store, access and share photos and music.

IPTV is a natural fit with triple-play, as data, phone and TV services can be interconnected. Based on the development of video markets in international settings, and the current plans of a number of local ISPs, IP-based triple-plays enabled by NBN could

be available to consumers. IPTV would allow an attacker to differentiate through functionality, but creating a competitive content offering would be more difficult given legacy arrangements for sporting and premium movie content.

Bringing IPTV services to market may not occur smoothly in the early stages of NBN, as retailers are likely to need to resolve technological challenges as well as secure compelling content. IPTV services introduced in international markets have experienced initial challenges with deficient installation methods and service faults being relatively common. IPTV services may face similar challenges in the Australian market before they enjoy widespread success.

Enabling open-access IPTV through QoS and multicast

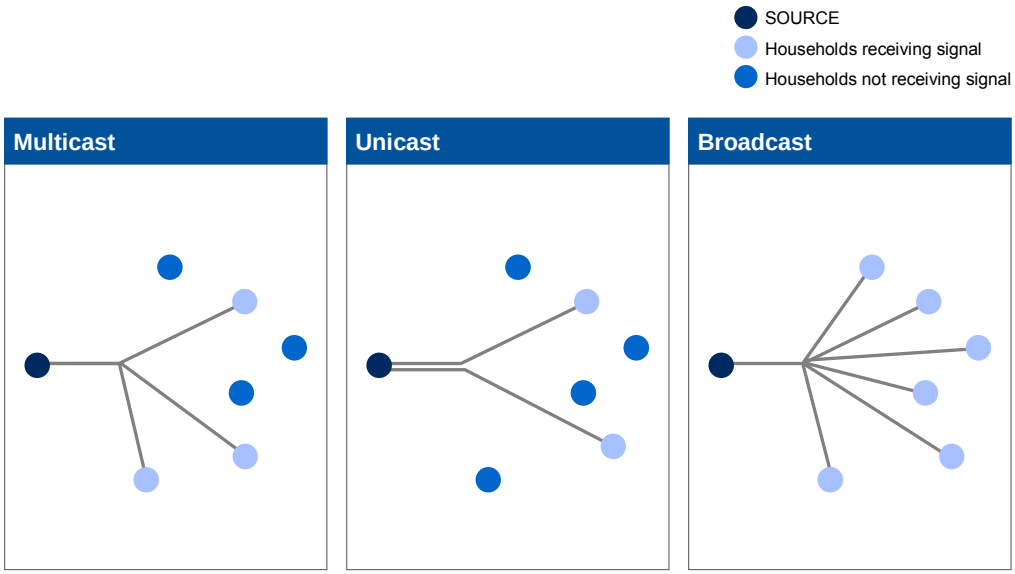
IPTV is relatively inexpensive for the NBN to support. It is unlikely that NBN Co will need to provide any additional equipment, as the equipment required to run an IPTV platform can be provided by the retailer.

However, to ensure the efficient management of IPTV traffic, NBN's standard equipment will need to offer intelligent capabilities. Industry bodies such as the Open IPTV Forum and the Broadband Forum have developed standards to support the necessary technology. The incremental cost to the overall network build will be minimal.

Facilitating IPTV will require the NBN to support IPTV multicast. Multicast is a way of delivering IPTV that minimises data traffic. Data is sent from the source as a single stream which splits and replicates as close as possible to the end users. The result is that when multiple households in a neighbourhood are watching the same channel, the data travels in a single stream over most of the network and may only replicate into multiple streams at the local exchange. This is in contrast to unicast, where one signal is sent to every end user who requests it; and broadcast, where one signal is sent to everyone in the network whether they have requested it or not (Exhibit 3–16).

The NBN may eventually serve millions of users, multiple IPTV operators and thousands of IPTV channels. This could generate complex, high volumes of multicast traffic. Managing that multicast traffic will require additional functionality in the network. While it will probably not entail NBN Co investing in extra equipment, some equipment may require additional processing and memory capabilities to ensure multicast streams are efficiently and effectively managed.

Exhibit 3–16. Methods of video transmission



SOURCE: Implementation Study

IPTV evolved as a telecommunications provider's response to competition from cable. As broadband and telephony began to be offered in addition to video over cable, telecommunications providers developed ways to match the triple-play offering over copper networks, and then over FTTN or FTTP networks. These providers have all been vertically-integrated, often incumbent operators. This has allowed them to manage end-to-end QoS across their own networks. Delivering the necessary QoS across multiple networks is technically possible, but some industry stakeholders are concerned that it will not be straightforward in practice. NBN Co will need to provide the protocols and functionality to enable service providers to deliver QoS across the network boundary to make the sophisticated IPTV functionality possible. This is a specific case example of the broader need for QoS enablement discussed in Section 3.2.2.

Recommendation 35. That NBN Co be required to provide a wholesale Layer 2 bitstream service which enables multi-operator delivery of next-generation video services (e.g. high definition, video-on-demand) that meets industry standards.

Expecting short-term revenues from wholesale IPTV services to be limited

In the short term, IPTV wholesale services may not generate large revenues for NBN Co because IPTV and satellite will compete as video delivery platforms. While satellite has limited potential for future development of services, the functionality of the two technologies will not be dramatically different in the short-term. VoD services can be

provided to satellite customers with a data connection at the STB. A similar model is currently being used by Foxtel, as well as DirecTV and Dish Network in the US.

In the longer term, IPTV may be able to capture additional revenue, allowing NBN Co to charge a premium carriage price. The revenue potential of IPTV is uncertain, however, and should not be assumed in the NBN business case. However, it is possible that IPTV could eventually generate higher ARPU through new services or increased functionality of existing services such as VoD and interactive gaming. Advertising revenues could increase as IPTV will offer new opportunities to embed advertising, target advertising to specific users, and use interactive advertising features.

3.3.4 ANTICIPATING VIDEO-OVER-ETHERNET BUSINESS MODELS

Video-over-Ethernet services exist in the current marketplace and the NBN will likely lead to new models. Telstra is testing a set-top box that permits the carrier's customers to download and watch movies and video-over-Ethernet channels from Telstra sites such as BigPond without incurring additional data charges. TPG offers an IPTV service with a limited selection of foreign language channels available without a set-top box. iiNet is preparing an advanced IPTV service that will use a set-top box. Optus has considered offering an IPTV service for several years.

An NBN wholesale video service resolves the structural barriers to providing access to a broad cross-section of subscribers. Retail distributors will now be able to offer a video service directly to consumers without having to enter into an agreement with an infrastructure owner who may lack the incentive for open access (assuming competitive backhaul). The NBN wholesale video service will also give providers the ability to offer a triple-play product suite, which is likely to spur competition between providers.

An NBN wholesale video market will enable different business models to emerge within the current regulatory framework. We anticipate a variety of OTT and video-over-Ethernet competitors to take advantage of the NBN.

Pay-per-view VoD

Pay-per-view VoD is similar to the on-demand model that is present on Foxtel and Austar, although the customer usually purchases content to own. For example, Apple provides on-demand services to PCs, portable media players and STBs via the iTunes Store and is expected to offer a subscription television service in some markets in late 2010. This could be delivered either over-the-top or over IPTV.

Advertising-supported VoD

Advertising-supported VoD is similar to the traditional broadcast model because it generates advertising revenue by broadcasting content to broad audiences. Hulu offers an

advertising-supported VoD service in the US that offers free streaming of movies and television episodes. The company is jointly owned by the media conglomerates that control 3 of the 4 major US television networks (NBC Universal, News Corp, the Walt Disney Company) and an investment firm.

The free-to-air broadcast networks in Australia could join together and offer a Hulu-type service. While the major US networks chose to distribute Hulu via OTT to gain independence from the cable distributors, the service could be offered OTT via the NBN or as a dedicated IPTV platform for a better quality experience.

Content aggregation platform

This model offers software that aggregates and organises OTT free content. Boxee is a company that offers customers software and a set-top box to aggregate OTT free content (e.g. Hulu, YouTube, Pandora, Flickr) and certain subscription services (e.g. Netflix). Social networking is integrated into the platform so that users recommend content to friends and can see user's viewing lists.

To be successful in the Australian market, a content aggregation platform will need access to more free and subscription content than is currently available. In addition, metered data pricing limits the full potential of a content aggregation platform if the platform is independent of an ISP.

Consortium of publishers on IPTV

A consortium of publishers could join to share the expenses of providing an IPTV platform. Because the shared video infrastructure and customer acquisition costs require sufficient subscriber scale to be profitable, publishers without an established video product (e.g. newspapers or magazines) could share those costs and serve niche consumer segments with narrowly tailored television services (e.g. specialty sports or foreign language programming).

IPTV platforms

An existing pay television distributor or a new entrant could provide a basic television service over IPTV with limited interactivity and on demand features. This service would target the customer who is not satisfied with free-to-air offerings but is unwilling to pay for advanced pay television.

Alternatively, existing pay television providers (Foxtel, Austar) or new entrants may choose to transition their customers to a full featured IPTV platform.

In its most advanced form, IPTV is a fully functional video and content services platform. An advanced version of IPTV will require significant investment of up to $70–100 upfront capex per subscriber with a minimum scale of 1 million customers. It is expected

that this version of IPTV will be provided either by companies with a strong existing customer base or by new entrants with sufficient capital and appetite for the investment risk associated with bringing a new video platform to market. A current example is AT&T U-verse, which provides a premium IPTV service to parts of the US. U-verse offers more than 110 HD channels, full digital recording, interface customisation, extensive VoD, access to games and data, with continuous improvements expected in the future. U-verse currently serves more than 1 million subscribers.[66]

IPTV can also exist as a more basic service, with channel offerings and quality similar to standard definition, broadcast linear television and basic VoD. This version of IPTV requires platform investment of less than $70 per subscriber with a minimum scale of 30,000 to 40,000 customers.[67] Additional expense may be required for an STB in the home. It is expected that this version of IPTV will be provided by regional distributors or companies focused on niche consumer segments.

3.3.5 ACKNOWLEDGING VIDEO MARKET STRUCTURE AND CONTENT BOTTLENECKS

The structure of the Australian television industry will make it challenging for new entrants to achieve scale with new video services, even with the NBN. While a market will exist for an NBN wholesale video service without changes to the current regulatory framework, it is unlikely that a new pay television provider will invest in a full-featured IPTV platform until current content agreements expire or are renegotiated.

Identifying characteristics of the Australian television market

Free-to-air television continues to be in a relatively strong market position in Australia relative to markets like the US. While more than 80 percent of US households have access to more than 100 channels, low penetration of pay TV in Australia means that most households have typically had access to five main free-to-air channels, expanding to up to 15 free channels with digital television. This difference is a function of historically favourable regulation for free-to-air television including the late entry of Pay-TV and anti-siphoning provisions for major sporting events.

Pay television in Australia is provided mostly by Foxtel and Austar with monopoly-like positions in their respective regions. The two providers share content rights mostly acquired by Foxtel, which also distributes that content to other pay television distributors.

The pay television distributors and telecommunications providers do not compete with the same kind of offers that are typical in many other developed markets. Most obviously, there is limited true triple-play competition—Telstra has focused its video strategy on the

66 AT&T 2008, *AT&T Inc. 2008 Annual Report*

67 Industry interviews

PC rather than the television and Foxtel does not offer voice and broadband in competition with Telstra, its 50–percent owner. As a result, consumer prices are high (a basic Digital Video Recording (DVR) package is 1.8 times the comparable US package) and penetration rates remain low at approximately 30 percent of households even accounting for the later introduction of Pay TV.

Recognising content bottlenecks and limitations for new market entrants

We expect that service providers will use the NBN to offer a triple-play suite of voice, data and video services. In other markets, multiple product bundles reduce churn by up to 150 basis points and permit providers to gather and monetise additional information on consumer behaviour.

Notwithstanding these new business models, barriers to success still exist in programming and scale. The free-to-air networks broadcast most preferred video content in Australia. Without carrying free-to-air networks, a distributor is not likely to gain the subscribers necessary to achieve profitability with a full scale television platform.

Content drives consolidation within the Australian television industry. Foxtel acquires a majority of the content distributed on pay television platforms in Australia. Television distributed on the future NBN will most likely develop similarly to the current market. Rights to distribute content on the Internet are already being consolidated in the same way as terrestrial. As a result, the NBN wholesale video service will most likely benefit the existing providers.

In addition, IPTV and online distributors are not currently subject to anti-siphoning restrictions. This leaves open the possibility that an individual distributor could lock up critical sports events and foreclose the retail market.

Foxtel, Austar, Telstra, Optus, iiNet and a few other companies have an existing customer base that gives them the scale necessary to succeed in marketing a television service to Australian consumers. Because most of the value derived from consumers is passed through to the content provider, scale is necessary for distributors to negotiate preferable programming costs. Without access to content, minimal incentive exists for an international or domestic provider to enter the market. Unless the content obstacles change, it is not likely that the NBN will enable another full-scale pay television platform like Foxtel or Austar to enter the market.

3.4 Enabling future e-government capabilities

There is significant potential for the improved delivery of Government and public services over broadband. As a publicly-funded network, the NBN will play a critical role as the connectivity platform to enable these opportunities. However, the scope of e-government is extremely broad, and the deployment of new services relies as much on policy, legislation, and core applications systems as on network components. This section outlines the opportunities for delivery of e-government services and implications for the NBN.

3.4.1 Envisaging a range of e-government services

3.4.2 Translating needs into service requirements

3.4.3 Delivering the network capabilities to support e-government services.

3.4.1 ENVISAGING A RANGE OF E-GOVERNMENT SERVICES

E-government is a term used to describe the use of information and communications technology (ICT) to enable improved delivery and administration of Government services.[68] This definition can apply to a broad range of services and outcomes, many of which are available using existing networks and technology.

This section focuses on some specific areas of Government that stand to benefit particularly from the improved use of ICT in the context of the NBN. It also highlights the other necessary components of e-government capability, outside of the network. We acknowledge the work completed on this topic in the recent Government forum, *Realising our Broadband Future*. This section does not address the wealth of materials published through that process or in other literature on the digital delivery of Government and social services, but rather focuses on the role the NBN may play in enabling these services.

[68] Australian Government Information Management Office 2006, *2006 e-Government Strategy: Responsive Government: A new service agenda*, Canberra

Addressing policy goals through e-government

Government departments are starting to define ways in which e-government can help to deliver their policy goals. We engaged with a range of Government departments and stakeholders on the types of e-government services they expect from the NBN. A number of areas of Government were discussed as priorities for the continued development of e-government services:

- e-education;
- e-health;
- Smart infrastructure;
- Government processes and online services.

Exhibit 3–17 provides examples of e-government services envisaged in each of these areas.

Exhibit 3–17. Examples of priority e-government services

Category	Description	Examples
e-health	A means of delivering health information and services in a secure electronic form for the purpose of optimising the quality and efficiency of health care	■ Remote consultations via video-conference ■ Remote and/or real-time diagnosis of tests and scans ■ High-speed transfer of medical imaging ■ Remote health monitoring
e-education	Ability for educational institutions to publish materials online, students and teachers to collaborate online, students to participate in remote learning and researchers to instantly access information	■ Remote learning ■ Collaboration networks for special-interest/ research groups ■ High-speed transfer of large data files (e.g. space monitoring)
Smart infrastructure	Networked infrastructure that uses sensors and communications technologies to better utilise or sustain resources	■ Smart grids ■ Remote monitoring of dam levels ■ Remote traffic monitoring
Government processes and online services	Use of ICT to enable improved government processes and increased efficiency in the administration of government services	■ E-forms and filing (e.g. online tax submission/ records) ■ Online procurement ■ Networking between Departmental sites

Source: DBCDE 2009, *BroadbandFuture.gov.au*, viewed 1 December 2009, <http://www.broadbandfuture.gov.au>

Identifying the components of e-government capabilities

There are a number of components to e-government capabilities. While network and technology services are an important part of the equation, and have spurred development in markets such as South Korea (Exhibit 3–18), a range of additional components are required to deliver most of the services outlined above. Examples include:

- **Policy and funding.** Broad policy changes may be required to align incentives to shift activities online. For example, widespread implementation of remote medical consultations will require changes to the current funding model. Medicare funding currently discourages remote medicine as practitioners are only funded for actual visits.
- **Regulation.** Legal or regulatory issues can prevent the development of some e-government services. For example, privacy concerns are an obstacle to the collection and use of online health records.
- **Training.** Changing behaviour to adopt new technologies is challenging, and can absorb much time and cost. For example, teachers may require training in how to use video-conferencing or Web-based tutorials if they are to utilise the benefits of e-education. End-users would need training to interact online instead of expecting face-to-face interaction for the delivery of selected Government services.
- **Operations and processes.** Many of the e-government services outlined in Exhibit 3–17 require a fundamental change in the way Government departments operate. For example, real-time remote analysis of medical imaging may require processes to ensure availability of specialists in central locations, whenever demanded from remote locations.
- **Equipment and infrastructure.** New equipment will be needed with the required functionality. For example, remote medical diagnosis may require desktop video-conferencing units in rural doctors' surgeries, with the capability to connect to a network of other doctors or large hospitals.
- **IT platforms.** Real-time access to applications and data will require the upgrade or replacement of IT platforms. For example, online health records require reliable databases with secure interfaces for remote access.

Highlight. Network and technology services are only one component of an e-government capability—other components include policy and funding, regulation, training, operations and processes, equipment and infrastructure, and IT platforms.

Exhibit 3–18. Case study: e-government in South Korea

Fibre for the people: A South Korean success story

A relentless drive to disseminate and push for very high-speed broadband usage across South Korea has reduced the cost of government, while delivering a vast range of online opportunities. Outcomes in South Korea demonstrate the importance of addressing the multiple components of e-government capability. Some examples:

- **E-learning**. 99.6 percent of students use IT for their studies (second highest worldwide). Every primary and high school has free Internet access and PCs; government programs have distributed 96,000 computers to low-income students
- **E-government**. South Korea ranks sixth worldwide in the 2008 UN e-government Readiness Index. Integrated e-government platforms handle 90 percent of public administration documents (e.g. for home taxes, housing registration)
- **E-health**. Almost all medical claims are managed electronically. All medical institutions are linked to the government's high-speed fibre network; remote diagnostics and portals display live medical operations
- **ICT access**. South Korea has 94 percent broadband penetration (highest in the world), 25,000 low-cost Internet cafés, 8,600 information access centres offering used PCs and ICT know-how
- **ICT policies**. The ICT sector employs up to 8 percent of the workforce. R&D centres are subsidised (USD 1.2 billion) to develop a national core network. A public entity has been set up to develop ubiquitous networks with operators. New buildings are certified by connection speed, encouraging ICT investment.

Source: Implementation Study

3.4.2 TRANSLATING NEEDS INTO SERVICE REQUIREMENTS

Developing a set of technical and service requirements for NBN Co with respect to e-government is difficult, as many services are in the early stages of development. It is also likely that the network requirements will vary significantly across different service types. This variety of requirements is shown in Exhibit 3–19.

> *Smart grid is not an individual application or solution, rather a collection of distinct applications that have varying degrees of latency sensitivity, market availability, interference issues, and power requirements.*
>
> Alcatel-Lucent[69]

For many of these services, the network is not the bottleneck, and the services could be delivered over most ADSL2+ and cable connections today. The barriers to implementation are often the systems and processes of the relevant Government entity.

69 Alcatel-Lucent 2009, *Comments on NBP public notice #2: Implementation of Smart Grid technology,* submission to the Federal Communications Commission, GN Docket Nos. 09-47, 09-51, 09-137

Exhibit 3–19. Network requirements for select e-government services

Service	Description of needs	Network specifications
Healthcare IT services	■ Fast and reliable transmission can literally be a matter of life and death[a] ■ Includes personal healthcare information[a]	■ QoS (i.e. prioritisation) ■ Resilience ■ Security and privacy
Telemedicine	■ A single image can vary from 2 MB to 3 GB or more[b] ■ Common requirements for all clinical applications are the need for guaranteed, continuous connectivity and QoS[b]	■ Variable speed and symmetry depending on application ■ QoS ■ Reliable connectivity
Online voting	■ There are substantial technical challenges to safe and secure online voting today[c]	■ Security and privacy
Educational video-conferencing	■ Videoconferencing requires broadband to avoid pixilation and latency problems with video or audio connections[d]	■ Symmetrical high speeds ■ Latency

a. AT&T 2009, *Comments on NBP public notice #17: Health care delivery elements of national broadband plan*, submission to the Federal Communications Commission, GN Docket Nos. 09-47, 09-51, 09-137

b. American Telemedicine Association 2009, Comments on NBP public notice #17: Health care delivery elements of national broadband plan GN Docket Nos. 09-47, 09-51, 09-137

c. Open Source Digital Voting Foundation 2009, *Comments on NBP public notice #20: Moving toward a digital democracy*, GN Docket Nos. 09-47, 09-51, 09-137

d. California Imperial County Office of Education 2009, *Comments on NBP public notice #15: Broadband needs in education,* GN Docket Nos. 09-47, 09-51, 09-137

Source: Implementation Study

Highlight. e-government services have widely varying requirements at the network level, ranging from basic Internet access to sophisticated managed network functionality.

3.4.3 DELIVERING THE NETWORK CAPABILITIES TO SUPPORT E-GOVERNMENT SERVICES

The NBN will play an important role in enabling an e-government future. By greatly improving the extent and performance of superfast broadband across the country, the NBN will enable widespread delivery of services which are developed for digital delivery.

Determining the ability of wholesale services to meet e-government needs

NBN wholesale services will enable a step change in many e-government services, through ensuring ubiquitous fast access with higher bandwidths. Public agencies will be able to deploy many new services with confidence that they will be available and affordable to all Australians. The diversity of bitstream services to be offered by

NBN Co, and the availability of enterprise-speed point-to-point services, should ensure that connectivity is available to meet most public service requirements.

However, differences in platform capabilities could impact the ability of some e-government services to be delivered in some regions. For example, high-bandwidth services exceeding 12 Mbps are unlikely to be delivered to remote communities, limiting the scope for two-way high-definition services. Even in the fibre footprint, terrestrial wireless access—including wireless connectivity for some services such as smart grids—will continue to be provided by integrated operators. Although the NBN will be a substantial enabler of e-government, other networks will continue to play important roles.

The role for downstream service providers to enable e-government

For those e-government services running over the Internet, service providers will play an obvious role as the provider of Internet connectivity. In addition, some e-government requirements will require Layer 3 functionality to the end-user premises. These services are expected to be provided by managed-network providers, operating on Layer 2 NBN services. It is likely that Layer 3 wholesalers, and integrated resellers, would naturally provide such services as part of their offering—those that did not would lose market share. Nevertheless, there is a possibility that no wholesale service provider emerges which can meet the specifications on a national basis, and for key government services, some further stimulus may be required.

Highlight. If Government departments aim to develop national e-government capabilities that leverage the NBN, they should consider developing or procuring dedicated Layer 3 systems designed specifically to meet their needs. These services would be provided by intermediate wholesalers utilising NBN and other network services. If multiple Departments are pursuing similar objectives there are likely to be synergies from combined efforts.

Ensuring affordability of services for public service needs

To enable the digital delivery of Government services, it is important that the agencies and institutions which require connectivity to deliver the services can afford it. NBN Co will be required to set wholesale prices for its mass-market services at levels which ensure affordability (Section 2.3). As such, NBN Co will be pricing to encourage widespread adoption of broadband by households and businesses.

However many e-government services require broadband services with performance specifications that exceed the mass-market services NBN Co is likely to offer. This is particularly true of larger institutions which require enterprise-grade connectivity to enable large bandwidth transfers or simultaneous video conferencing links. Hospitals, schools and other educational institutions are likely to require enterprise-grade connections. For example, hospitals require enterprise-grade services to enable the

transfer of large bandwidth files such as magnetic resonance imaging (MRI) and to allow for high-quality video conferencing for remote consultations.

> *Symmetry is widely required in the contemporary education context to be necessary for adequate real-time communications, such as high-definition video-conferencing as well as end-user-created content and the sharing of multimedia.*
>
> DEEWR[70]

The Department of Education, Employment and Workplace Relations (DEEWR) states that the NBN should be capable of providing point-to-point fibre connections to schools to enable a digital education future. This could include classrooms drawing on a store of educational videos and interactive class materials as well as using video conferencing to create virtual classrooms that bring together remote students and other schools.

NBN Co is likely to price enterprise-grade services for business users at a price premium relative to mass-market services (Section 4.5). However, such prices may prove prohibitive for public institutions delivering Government services over digital platforms, which have significant ongoing needs for connectivity.

Government should aim to work with NBN Co and service providers to develop a special class of wholesale services that can be used by service providers to develop affordable services for institutions delivering Government services. Offering discounted services to these institutions could make commercial sense for NBN Co. There are many examples of the private sector offering discounts to the public-service sector—e.g. education discounts for IT equipment, in recognition that while valuable customers these institutions do not have same financial resources as private sector enterprises.

As described further in Section 4.5.2, defining specific classes of wholesale services for end users does not violate NBN Co's equivalence obligations as long as those wholesale services are offered on an equivalent basis by NBN Co to retail service providers.

70 DEEWR 2008, *Towards a National Vision of Connectivity for Australian Schools*, Canberra

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