



nbn—the challenges of transforming an industry

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1. Why the industry transformation?

The reasons that led to what is the largest telecommunications industry transformation in Australia can be broken into four categories: exponential growth in internet-based services; a digital divide where millions had no access to the internet; limited capability where internet access was available; and a less-than-ideal retail competitive landscape.

Exponential growth in internet-based services

Data consumption at the end-user level has been growing year-over-year thanks largely to a plethora of new digital applications that require internet access. Video streaming applications such as Netflix and YouTube are growing in popularity and require vast amounts of data streaming in and out of homes or businesses. Furthermore, small and medium-sized businesses are eager to access 'cloud-based' software services that bring higher productivity and greater efficiency to their operations. As a result, end-user broadband requirements are evolving with this need for greater volumes of data and faster speeds than ever before.

Some Australians had no access to broadband internet

Since the privatisation of Telecom Australia, Australia has relied on the private sector to build residential digital infrastructure to those homes where it proved economical to do so. Not all homes fell into this category, especially in low-density, high-cost-to-build areas. It is estimated around 700,000 homes had no access to broadband services due to these poor investor returns. Given the benefits of the emerging internet-based applications, this digital divide became an even greater social and economic concern.

Average speeds of 9Mbps and limited data consumption

Even for those who did have infrastructure access, the average speed across the country was only 9Mbps, and the network was designed to serve an average of less than 10 gigabytes/user/month (compared to the near 200 gigabytes today over nbn's network). The network design was and remains inadequate to meet the mass market needs associated with emerging digital applications. Most of the nation was served by asymmetric digital subscriber line (ADSL) and ADSL2 technology, which meant speeds would vary from 1-2Mbps up to about 20Mbps. In the '80s, Telstra and Optus built Hybrid Fibre Coaxial (HFC) broadband networks to roughly 2 million of 11 million premises. This technology evolved to offer a speed range of 15-100Mbps downstream; this may be sufficient for today's data speed requirement, but there were no plans to expand this infrastructure beyond its current footprint.

An uneven playing field

As Telstra was the predominant source of infrastructure and had a Universal Service Obligation to offer telephony services to every home and business across the country, retail competition was limited to a few big players. It was not economically viable for new entrants to build a national infrastructure to compete with Telstra's network, which had been built over decades. The option to resell Telstra's network was not considered a successful levelling of the playing field, given the naturally inherent benefits for Telstra as the country's key wholesaler and major retailer.



2. The original design

In 2009, the then federal government launched its plan to transform the industry. A key part of this transformation was to establish NBN Co as a for-profit, non-tax-subsidised, wholesale-only access network company. This company, along with a new regulatory framework, would help create a level playing field with an easy entry for retailers.

NBN Co would be required to roll out and operate the **nbn**[™] broadband 'access network' to homes and businesses across the nation. The company would be obligated to offer non-discriminatory pricing and services to all telco and internet companies who wanted to connect their networks to the **nbn** access network. This model was designed to give retailers a lower cost of entry and greater economies of scale, while still allowing them to differentiate their services to address all market segments. Accountabilities were well defined, with **nbn** responsible for the network that runs from the first point in the home to the point where **nbn** connects to the telco/internet company network – known as the point of interconnection. The industry was adamant that all end-user services, including the point of contact, be the responsibility of the telco/internet company.

Rather than building all new network infrastructures from scratch, NBN Co would pay Telstra for the use of its ducts, pits and exchanges. Furthermore, NBN Co would utilise third-party contractors to build and operate parts of the network with the intent of leveraging existing resources across the nation.

A for-profit, wholesale-only access infrastructure company

While many options to resolve the broadband access problem were considered, the then federal government chose to establish NBN Co as a wholesale-only access company. It was established as a for-profit enterprise that would be wholly owned by the Australian Government. By doing so, one-off government/taxpayer subsidies would not be used, thereby leaving the resellers – or retail service providers (RSPs) – of the network to pay NBN Co a price that would ultimately pay for the **nbn**[™] access network, the company's ongoing operations, and a modest profit. The RSPs would, in turn, offer their services to end-users at a price that recovered their costs and make their expected profits.

A level playing field for the RSPs

In order to generate enough revenue to pay for the cost of NBN Co, the end-user take-up rate needed to be significant and the Average Revenue Per User (ARPU) higher than historic levels to keep the business model commercially viable. To support this,

a 'level playing field' with a robust retail competitive market was factored into the design. In order to drive take-up of services provided over the **nbn**[™] access network, NBN Co struck deals with Telstra and Optus requiring them to progressively disconnect certain legacy services that fell within NBN Co's fixed line network footprint. The idea was to help challenger brands compete with the incumbents. The anticipated increased retail competition was designed to improve service levels, lower prices and see the development of new products to suit different end-user needs.

Rolling out new and upgraded infrastructure across Australia

The original network architectural design called for new fibre infrastructure to ~93 per cent of Australian homes and businesses, leaving the remaining seven per cent to be served by new satellite and Fixed Wireless access technologies. It was understood then that these (approximately) one million premises serviced by wireless technologies would, comparatively, have far lower data consumption limits and far slower connection speeds than their fixed line counterparts. It is important to recognise that most other countries of comparable size and topology have yet to see a for-profit company find a solution to reach every home, no matter how expensive it may be. While the NBN Co model appears to solve this problem, it must be understood that the additional cost to reach every home puts the burden on all end users as they will ultimately need to pay higher fees than before but, albeit, with faster speeds and greater data consumption.

Leasing Telstra ducts, exchanges, fibre and more

To keep the costs down and accelerate the rollout, NBN Co reached a long-term agreement with Telstra to allow the company to use its existing infrastructure including ducts, pits and exchanges for the purpose of rolling out the fixed line network. For most incumbent companies (e.g. Telstra, BT and AT&T) these assets have usually been 'written-down' (or depreciated) over the past decades and, therefore, would not have the same level of necessary cost recovery when building out a new network like the NBN Co model has. While likely cheaper than building new infrastructure, this is still a substantial expense for NBN Co and is also why, when you combine this with the national reach mentioned above, the cost-per-premises and wholesale price is often higher than network operators that are able to leverage their own legacy infrastructure.



Contracting the majority of the work to external parties

The design called for a third-party construction company to build, activate and operate the **nbn**[™] access network. Taking this approach, the company would leverage the industry to quickly mobilise a workforce to begin the construction. This is a logical approach given the one-off nature of much of the work required to transform the industry. The challenge, however, is yet another set of companies that must be coordinated with a common goal and focus on the end user.

The separate and distinct roles of NBN Co and the RSPs

The design set the network boundaries that isolated NBN Co's responsibility from the end-user and RSP. The **nbn**[™] access network generally begins just inside the end-user home or business and ends at the Point of Interconnect (POI) location where RSPs' end-users' data is passed between the **nbn**[™] access network and the RSPs' networks. The country was divided into 121 geographical areas, each with its own POI. Furthermore, NBN Co is a 'layer 2' (or wholesale) service provider, leaving the RSPs to provide the various 'layer 3' services such as voice calls, wholesale internet connectivity, different quality levels of service and more.

The design also set the service boundaries between NBN Co and the RSP. For example, the RSP would be the only interface to the end-user for installing, using or fixing a fault. RSPs would access NBN Co's internal systems through a service portal or business-to-business interface. Appointment timeslots for the **nbn**[™] access network's third-party installation or repair contractors would be visible to the RSPs through these portals. The RSPs would then, in turn, speak to the end-user about which timeslot is best for them to book a home or business visit. If an appointment change is requested by any party, the RSP is the go-between in coordinating this activity. A similar process is followed when an existing service needs to be repaired. There is a specific protocol that must be followed for either NBN Co or the RSP to advance through the various stages of work. If not properly followed, then delays, missed appointments or rework may be required. To ensure **nbn** provides the service provider with a predictable and acceptable level of service, agreed-upon service levels were defined within the Wholesale Broadband Agreement (WBA).

3. The modified design

In late 2013, at the direction of the then newly appointed Australian Government, NBN Co conducted a strategic review to assess and select alternative approaches that would improve the commercial viability and time to complete nationwide access to high-speed broadband.

While the original design had three access technologies in the mix, NBN Co and the newly appointed Australian Government decided to add two additional access technologies: Fibre-to-the-Node (FTTN) and Hybrid Fibre Coaxial (HFC). Furthermore, the Australian Government's statement of expectations called for the network to provide peak wholesale download data rates (and proportionate upload rates) of at least 25Mbps to all premises, and at least 50Mbps to 90 per cent of fixed line premises. This equates to roughly 81 per cent of the nation with a minimum peak rate of 50Mbps and the rest with 25Mbps.

The newly added technologies would (and continue to) leverage portions of the existing infrastructure previously built by Telstra and Optus. The first is FTTN, which connects the final home/business-side portion of existing copper (a range from 50m to roughly 1km) to new fibre brought to a neighbourhood entry point. FTTN has two additional variants: Fibre-to-the-Building (FTTB); and Fibre-to-the-Curb (FTTC), which extends the fibre closer to the premises. The other new technology is the existing HFC network, which is upgraded with new state-of-the-art electronics and improved network conditioning. With the use of these two pre-existing access technologies, NBN Co is able to accelerate the build, reduce the cost associated with the build and meet the wholesale speed requirements set by the Australian Government. To use these two existing networks, a revised agreement was needed with Telstra and Optus. While there were no costs associated with taking ownership of these networks, NBN Co is obligated to compensate the previous owners for their costs associated with the asset transfer.



4. The challenges

Costs to build are higher in Australia

There are many attempts to compare NBN Co's cost-per-premises to that of other countries, particularly the Fibre-to-the-Premises (FTTP) costs. This is often with the belief that other access network companies are doing this with less money and NBN Co should be able to follow suit. There are three main factors why NBN Co typically has higher build costs:

1. The need to pay Telstra for the use of its ducts, pits, and racks, while incumbent operators in other countries have only marginal cash costs involved in using these assets.
2. The need to build to every home and business in Australia, regardless of the extreme costs for those in remote or hard-to-get-to areas.
3. Typically higher material and labour costs in Australia.

Monetising the data-consumption growth

The business model assumes new internet-dependent applications will continue to grow and bring greater value to end-users. The corresponding need for increased data consumption and speed performance will need to be monetised by the RSP through a 'pay more when you use more' proposition. This is expected to, in turn, drive the needed take-up rate and lift NBN Co's average revenue per user to a level necessary to recover costs and make a modest profit. If data demand fails to grow or the RSPs fail to monetise this growth, NBN Co's business model could fail to produce a profit.

While research indicates end-users are willing to pay more for fast broadband, no end-user wants to pay more than they have to. With every Australian having a choice of provider (many for the first time) the retailers are competing to lock down market share as quickly as possible – this is known as a 'land grab' phenomenon. With a 'land-grab', heavy-price-competitive market taking place, some RSPs have found it difficult to raise prices, even though end-users are demanding higher speeds and consuming more data.

Connecting millions of homes and businesses over a short period

NBN Co is building a national network at an unprecedented pace with construction required in nearly every neighbourhood of the country. Furthermore, providing broadband access to every home and business in the country requires NBN Co and the RSPs to build new IT systems, new scalable processes, as well as hire and train thousands of new

employees over a short period of time. Add to this the complexity of seven access technologies, more than 180 RSPs, multiple third-party contractors and an expansive land mass with great distance between cities. The consequence has left too many end users, albeit a minority, with an unsatisfactory experience when connecting to the **nbn**TM access network, accessing or using the internet, or getting adequate help with a service issue.

Satellite and Fixed Wireless have limitations

As more digital applications emerge, higher speeds will be needed and the total data consumption will increase. While NBN Co's Sky MusterTM satellite and Fixed Wireless access technologies provide a solution to these low-density, high-cost-to-build areas, there is a limit on both speed and data consumption. As with any wireless broadband solution, capacity is not infinite and needs to be carefully monitored and managed in order to deliver a network that can provide the best customer experience. Internet usage and take-up of these technologies will need to be monitored in order to ensure they continue to keep up with end-user demand.

Consequences and trade-offs of using existing infrastructure

While the use of the existing copper and pay TV networks has led to a faster network build and a lower cost-per-premises, there are consequences to this approach.

The first and most notable consequence is the maximum speed limitations of copper versus the previous fibre-based model. A third-party review (the Vertigan report) analysed and concluded a minimum peak speed of 15Mbps would be adequate for most households now and into the near future. The copper-based FTTN network would, therefore, be sufficient until the demand exceeded these levels.

A second consequence of the use of copper in the last (approximately) 1km of the network is the increased fault rate and operating costs versus the all-fibre alternative. These incremental costs are factored into the improved economics and are a small fraction of the incremental costs to build fibre to every home. The incremental fault rate was felt to be within reason.

A third consequence of the expanded Multi-Technology Mix (MTM) is related to the 'co-existence period'. This is a contracted period that begins when NBN Co declares an area Ready For Service. During this time, Telstra and Optus legacy voice and broadband services remain active even though **nbn** has begun to offer its access services to all service providers.



While in the co-existence period, NBN Co is responsible for operating and maintaining all services over the network, including any Telstra legacy services provided by that portion of the network. For the HFC network, **nbn** must reserve a portion of the spectrum for Telstra until the end of the co-existence period. This is in addition to the spectrum that must be reserved for Foxtel services that could last in perpetuity. While this is all technically achievable, the sharing of the spectrum requires **nbn** to adjust and plan for earlier network capacity enhancements.

While there are exceptions, the co-existence period for HFC is 18-months. For FTTN, however, the co-existence period is typically much longer as we need to migrate or manage all interfering services off the node before we can end co-existence and move to full power at the node equipment. These interfering services include ADSL equipment at non-premises or premises not within NBN Co's fixed-line network but passing through the node. During co-existence, NBN Co is required to alter the configuration of nodes which means reducing the transmission power of services. This power reduction limits the maximum speed available for FTTN services. As a result the minimum target speed for services on the FTTN network during co-existence is 12/1Mbps. At the end of the co-existence period, NBN Co can optimise node configurations and maximise the speeds achievable for services and move to the expected minimum peak data speeds of 25/5Mbps.

For each of the pre-existing infrastructures, it is important to note that the physical condition of the network is sometimes worse than anticipated. Additionally, the databases of what exists and where each network is located are sometimes absent or inaccurate. These factors have created additional challenges. This co-existence was considered as a reasonable trade-off to the faster rollout and lower cost associated with the build.

Various grades of service

Whether NBN Co uses the former three-technology MTM or the current seven-technology MTM, the nation will have universal access to the minimum defined service levels. As **nbn** compares the high end of the available services, there will be a greater level of difference. This difference depends on which technology is serving an end-user's home or business. An example of this is how Sky Muster™ satellite has limits in data consumption and peak data speed. Fixed Wireless is more generous and flexible than Sky Muster™ satellite but is still more limited in consumption than its fixed-line counterparts. FTTN has a data speed variable that is determined by the length of copper serving the home and has a higher fault rate than fibre. HFC has challenges in delivering symmetrical services. FTTP has a top-end capability

greater than all the others. As a result, an RSP that sells across the nation is required to differentiate the higher-end product offering depending on which technology and what type of service is needed.

End-user confusion

As you can gather from the above, this is a complicated industry-wide transformation with a complex build, an unprecedented pace and an often-confusing demarcation between responsible parties. Combine this with industry-wide yet-to-mature IT systems, processes and people capability, and we end up with too many, albeit the minority, who are dissatisfied with their experience.

The end user is at the 'pointy end' of all of this with some who didn't want a change at all, others who want more than what can be provided, and almost everyone who just want one company to contact, good service, a fair price and a product that meets their needs.

The impact of competition on the business model

While some of the industry is in this frustrated state, RSPs are examining their own access network options that allow them to better control the end-to-end end-user experience, their cost structure and their competitive advantage. Many RSPs understand the fact that NBN Co charges the same wholesale price for the high-density, low-cost-to-build areas as the low-density, high-cost-to-build premises. The high margins in the former offsetting the losses in the latter are what keep the NBN Co commercial model whole, but it could be an attraction for some RSPs to bypass NBN Co in the high-margin, high-density areas. Our business plan today assumes a healthy amount of competition but some are questioning whether it is enough.



5. Closing words

There is no question that the introduction of a national broadband network is impacting the lives of every Australian. The mid- to long-term impact is the reason **nbn** embarked on this journey and has to do with the broader economic and social effects of a fully connected digital nation. Much of the current focus, and rightly so, has been on the near-term impact which is defined by our individual experience as we migrate to the new industry-wide system.

Whether you choose to sign up to the **nbn** or cut the cord altogether, a choice must still be made. For the 74 per cent who are expected to connect, they must choose a provider from a long list of telco and internet companies. This is a first for many. Equally so, end users will have to consider what speed they need and how much data they think they will use. After making these decisions, most homes will require new in-house equipment to be installed by both **nbn** and either their service provider or themselves. Different tradies may be necessary to visit a single residence due to the different types of experience needed to complete the job. This translates into multiple visits and numerous attempts at coordinating across multiple companies.

NBN Co and its industry partners consider these issues a priority; we are collaborating to make these near-term impacts as least disruptive as possible. The company knows it needs to be better and is making progress on all fronts.

While there has been plenty of debate about the type of technology, the cost, and the time to complete the build, there has also been unstinting support for the concept of connecting every Australian to fast broadband. As **nbn** faces the challenges causing the short-term impacts of this industry-wide transformation, it's important to remember the mid to longer term impacts... or why it is being done in the first place.

Its original purpose was to foster productivity and drive economic and social benefits for the whole country – not just people who live in its cities.

For the first time there is evidence of real world data that proves why it's been worth it. The results are stunning and they touch every person.

nbn will help drive an additional \$10.4 billion in economic activity in 2021 – which equates to a net present value of 122 billion dollars. That benefit will flow to everyone.

nbn by 2021 will have helped create 31,000 jobs and as many as 79,700 new businesses. The annual growth rate of women entrepreneurs in **nbn** access network connected areas is 2.3 versus 0.1 per cent in non-connected areas – that's as many as 52,200 extra self-employed women by 2021.

Further, Australia is expected to move from being one of the bottom 10 OECD countries in terms of internet equality to being in the top 10 by the time the network rollout is complete.

The AlphaBeta research shows what people at **nbn** have always believed – the more connected we are, the better we are.

The work will continue in improving end user experience just as the heavily debated differences of opinion about all things **nbn** will likely continue. The issues debated will carry on until the completion of the build, and for some even beyond. The vast majority of those who have worked on this transformation since its inception know they are part of something that is bigger than any one individual, something that is making a positive difference both socially and economically.