NBN ALLIANCE

Submission for consideration by the Senate Select Committee on the National Broadband Network

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Additional notes, sources, and references can be found on the NBN Alliance Wiki website:

wiki.nbnalliance.org

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Executive summary

The NBN Alliance has prepared this submission to address, in an apolitical and balanced perspective, a number of concerns regarding technologies, scenarios, and end user outcomes presented by the NBN Co Strategic Review.

NBN Co has, under the instruction of the current government, modelled a number of alternative rollout scenarios which could be implemented in place of the current FTTP scheme. In doing so, it has recommended that a number of additional 'last mile' access technologies be used in the rollout.

Of key concern is that all of the proposed alternative rollout scenarios *vastly increase the complexity* of an already complex project, and do not adequately address projected demand past a 10 year horizon. This increase in complexity manifests in a number of ways.

From an RSP's perspective, there is significant additional work to implement Business and Operational Support Systems and Services for multiple product and platform offerings, an inability to offer 'guaranteed' service tiers and resultant issues managing customer expectations, and increased complexity related to fault and general network management. All of these issues result in a cost, and these costs will ultimately be passed on to the consumer.

From an end user perspective, quality of service can no longer be guaranteed due to a mix of 'best effort' access technologies, there is a limited capacity to meet future customer bandwidth demand, and the significantly increased management and maintenance costs (OPEX) of a highly fragmented network will ultimately drive up customer access costs over the longer term.

From an overall project perspective, we note:

- A number of immature, commercially untested, or non-standardized technologies have been specified in the alternative rollout scenarios
- A large increase in disparate skills and disciplines required to complete the rollout
- Inability to leverage economies of scale due to fragmented skillsets and technologies
- Unanswered concerns regarding regulatory and compliance issues
- Heavily redacted and incomplete financial models and costings
- Many more 'unknowns' which are addressed later in this document

The context of the NBN debate thus far has largely revolved around download speeds and entertainment services. We feel that this is myopic, and not representative of the significant benefits to economic and social development. Upload speeds and quality of service are key factors to which sustained attention needs to be drawn.

The NBN Alliance feels that the Strategic Review does not adequately encompass the long term fiscal and technology outlook over the useful lifespan of the infrastructure. Further, the NBN Alliance feels that the NBN Co Strategic Review has failed to achieve its core aim – to provide the certainty that is required to maintain program momentum.

NBN Alliance

Broadband Outlook

Current State of Broadband in Australia

The current technology and regulatory framework treats broadband as a 'best effort' service, resulting in issues around quality of service and fault resolution:

- Telecommunications regulation and fault reporting does not cover data faults, only voice. Data faults are not tracked by, or reported to the regulator
- Minimum 'fault condition' threshold for data appears to be in the order of 1Mb/s, irrespective of what should or could be theoretically possible on a given line
- Fault resolution is a long and tedious process, with customers often giving up reporting faults
- Customers are charged for fault investigation if there is 'no fault found'. Customers therefore shoulder the risk when reporting faults
- Telco technicians are not given adequate time on each job to carry out more time-intensive permanent fixes

Broadband Investment

Investment in broadband infrastructure in Australia is hindered by a number of factors:

- Uncertainty around regulation and legislation
- High barriers to entry for new players
- Successive Government policy uncertainty has created a climate where investment in broadband has been risky
- The incumbent carrier (Telstra) has for many years had no incentive to invest in upgrades or new networks
- Successive governments and Telstra management have been unable to agree on a framework to upgrade the networks, resulting in stagnation of infrastructure
- The extent of unprofitable low-density areas
- Building competitive networks in residential areas is uneconomic and wasteful

Customer Facing Issues

- Services are provided based on 'up-to' performance characteristics with fixed prices
- Customers pay the same price for differing service levels and quality, and have no idea what they will get until the install is complete
- Inability to choose a faster / higher quality service:
    - The product offering is usually constrained by the physical networks that are available
    - In most cases there is no service offering to improve the quality, speed or reliability - essentially there is no way to pay for a better service
    - Situation has resulted in apparent "lack of demand" for faster service - simply put, the demand cannot be measured, because there is no suitable offering
- Restrictive contracts
    - Contracts that carry relatively large installation costs or 24 month minimum terms can be a dis-incentive for some consumers
    - Minimum terms may be incompatible with the personal circumstances of the customer, e.g. lease term
    - Such contracts are likely a consequence of the costs of provisioning service, which likely require a truck-roll by Telstra to unbundle a copper pair
- Current market structure makes it difficult for providers to offer alternative pricing structures

Underlying Infrastructure Issues

- Well understood to be an issue in Remote and Regional areas
- Issues with poor infrastructure and coverage in metropolitan areas are often overlooked
- Issues with high levels of variability within a building and street create a lottery for end-users
- A single monopoly incumbent infrastructure provider creates a number of issues:
    - In a number of locations where physical infrastructure is limited, competition for services is poor
    - Poor competition in retail market leads to poor service and lack of investment

- Poor regulation leading to an environment where the end-user has no standing to complain about the quality and performance of the wholesale service

- Outrageous quotes and indeterminate timelines for providing connections and resolving faults

International Context

At the time that the National Broadband Network was announced by the former government, this was a world-leading initiative. Since then, the number of international government-led 'national broadband network' initiatives has grown tremendously. So too has the number of rollouts from private enterprise.

A number of factors influence the technologies utilized in these rollouts, however it is clear that the 'gold standard' is FTTP, and this is the goal wherever realistically possible – typically dependant on factors such as population density and economic climate.

It is important to keep abreast of international developments in this space, as a country without a national broadband plan may quickly find itself uncompetitive on the international stage in IT and knowledge industries.

Table: Countries currently deploying FTTP (both public and private enterprise initiatives)

Andorra	Greece	Macedonia	Slovenia
Argentina	Hong Kong	Malaysia	South Africa
Australia	Hungary	Mexico	South Korea
Brazil	Iceland	Moldova	Spain
Brunei	India	Netherlands	Sweden
Bulgaria	Indonesia	New Zealand	Switzerland
Canada	Ireland	Norway	Taiwan
Chile	Israel	Peru	Thailand
China	Italy	Philippines	Turkey
Croatia	Japan	Portugal	Ukraine
Cyprus	Jersey	Qatar	United Arab Emirates
Czech Republic	Jordan	Romania	United Kingdom
Denmark	Kenya	Russia	United States
Dominican Republic	Kuwait	Saudi Arabia	Uruguay
Estonia	Latvia	Serbia	Uzbekistan
Finland	Lebanon	Singapore	Venezuela
France	Lithuania	Slovakia	

Broadband Leaders vs Access Technology

The following table includes a number of the 'fastest' broadband offerings grouped by country. This table is not intended to be representative of the 'average' rollout, nor an exhaustive list of all such rollouts. It is however clear to see that FTTP dominates, as no other technology is currently capable of delivering these speeds.

Country	Provider	Download (Mbps)	Upload (Mbps)	Technology
USA	Google	1000	1000	FTTP
USA	Comcast	505	100	FTTP
USA	Verizon	500	100	FTTP
Japan	So-Net	2000	1000	FTTP
Japan	NTT West	1000	~	FTTP
Sweden	Telia	1000	100	FTTP
Sweden	Bredbandsbolaget	1000	100	FTTP
Sweden	Com Hem	500	50	FTTP
Norway	VikenFiber	400	400	FTTP

International Case Studies

Very few case studies exist on the topic of rolling out a ubiquitous national FTTP network. In fact, the original NBNCo rollout to 93% of premises was used as a leading example by such associations as the FTTH Council Europe in its introduction to an FTTH Toolkit to promote the usage of FTTH technology. However, the FTTH Council Europe have assembled a large number of case studies of smaller deployments of FTTP technology.

USA

A study of 223 businesses and organisations using FTTP in three communities in the U.S. revealed significantly increased revenues. Prior to FTTP, 91 of these businesses had broadband connections while 132 did not.

The study finds that the reliability of FTTP connections allow the business community to transform their models to leverage the Internet to deliver their products and services, and to receive services from other businesses. The businesses in Strategic Networks Group's study increased sales by increasing sales, reducing costs for services, improving customer service, reaching new customers, and reducing time to market.

After 2 years of using FTTP and being able to transform the business model to an Internet-reliant one:

For non-broadband users, after receiving FTTP:

- Total sales raised from $707,950 to $1,392,000
- Cost savings of $479,555 were realised

For broadband users, after receiving FTTP:

- Total sales raised from $158,300 to $1,184,000
- Cost savings of $118,900 were realised

"It is the reliability of FTTP that enables the adoption of new processes that transform business operations. Such transformations would only be undertaken once users have full confidence that Internet connectivity is at a ‘mission critical’ level of reliability (i.e. no downtime) before customer order systems, financial systems, etc. would be integrated with the Internet. The charts below show the 12-month impacts on cost savings." Strategic Networks Group, Inc. March 31, 2008

Stockholm

The City of Stockholm formed AB Stokab in 1994 to provide a passive fibre-optic communications network to the Stockholm region. For several years, the service sector including IT has been responsible for the majority of new jobs in Sweden as well as an increasing percentage of export revenue.

Local companies such as Skype, Spotify and Transmode have gone on to become global players in their respective industries. In a 2011 edition of its Cities of Opportunity study, PwC examined 26 countries and identified Stockholm as having the best network for schools, the second best broadband quality and the best digital economy.

Since its inception, the city council have considered AB Stokab a public infrastructure company, much like an organisation responsible for roads. The deployment was initially financed by loans from the City of Stockholm and it connected mainly public institutions and universities. The network expanded rapidly as private businesses started purchasing fibre.

The high-speed network has also made implementation of e-services very straightforward. Stockholm's infrastructure makes it easy to develop joint solutions. As almost all citizens use the Internet, the current demand for e-services is vast. Access to a robust fibre network is proving absolutely essential for the local economy. In fact, the number of jobs actually increased during the financial crisis.

New Zealand

Having completed a national FTTN rollout in 2011, which delivered average downstream speeds of 13 Mbps, the New Zealand Government has committed to a FTTP rollout in its Ultra-Fast Broadband initiative. The program will deliver 100 Mbps downstream speeds and 50 Mbps upstream speeds to 75 per cent of New Zealanders by 2020.

Understanding the educational and economic benefits of ultra-fast broadband, they have prioritised the fibre rollout to schools, hospitals and businesses, promising to connect 90% of these institutions by 2015.

Specifically, 97.7 per cent of schools (equating to 99.9 per cent of students) will receive an ultra-fast fibre broadband connection by 2016. The remaining schools, in areas too remote for a fibre connection, will receive either wireless or satellite broadband services. For state schools, the connection to the fibre network will be fully funded by the government.

The New Zealand Government has specifically stated that copper, cable, satellite and fixed wireless networks would be "unlikely to be able to meet [their] ultra-fast broadband objectives"; however it still understands the role of these technologies in rural and remote locations. For those areas not covered by the planned fibre rollout (where fibre is not a feasible option), the Rural broadband initiative will use a mix of copper and fixed wireless broadband to deliver minimum downstream speeds of 5 Mbps to rural homes and businesses.

Future Requirements

Bandwidth Projections

A number of international organisations collect and tabulate data related to overall data use and future trends. Cisco and TeleGeography are two of the most widely quoted sources. The Australian Bureau of Statistics also collates information on data traffic within Australia, and it the definitive source for such data in the Australian context.

- Australian Bureau of Statistics (ABS) recorded growth of fixed line broadband data transfer of 61% from June 2012 - June 2013 (389PB to 629PB). This is significantly above comparative figures we have seen from other organisations. ABS has advised via private correspondence that it collects this data directly from ISPs, and that their survey methods are comprehensive.

- Cisco forecasts Compound Annual Growth Rate (CAGR) of 27% for end-user (consumer) internet traffic in the Asia Pacific region (2012-2017).

- Assuming the conservative Cisco figure, this equates to a 10.9x growth in traffic over the next 10 years

- Assuming the less conservative ABS data, this equates to a 123x growth in traffic over the next 10 years

It is important to note that these figures are based on total data transfer, and are only indicative in terms of the bandwidth required to support this underlying transfer. We have seen however that access technology line-speed tracks roughly in step with total data transfer.

It is clear from historical data (going back more than 20 years) that this rate of growth is consistent, and there is no indication that this will slow in the foreseeable future.

In the view of the NBN Alliance, the National Broadband Network fixed-line component must be deployed via a physical medium (fibre/twisted pair copper/coaxial copper) that will support this rate of growth well into the future. If the underlying physical medium will not support the projected bandwidth requirements in 15 years, *why are we building it*?

Future Broadband Applications

- Applications requiring significant upstream bandwidth will be the most constrained if adequate broadband infrastructure is not built - Telepresence, Cloud Computing, Content Creation, Business Apps, Social Sharing

- These applications likely have more of an impact on productivity (GDP) than downstream bandwidth limited applications

- High bandwidth entertainment applications such as 4k Video, Console Game Downloads, etc will stress downstream FTTN bandwidth from day one

- The provision of Telehealth services remotely can substantially reduce the cost of health care delivery

- A Monash University study into patients with diabetes found, 'the use of web-based tools for supporting collaborative care management for patients with diabetes has the potential for transformative change in best-practice care.

- Estimated savings through the adoption of health services delivery through telehealth run to billions of dollars per year. A 10 per cent reduction in chronic disease costs through telehealth would be almost $8bn every year.

- The Western Local Health District in NSW spent $600,000 in six months in 2013 on plane tickets flying doctors from Sydney to Dubbo to deliver psychiatric services. Rural Doctors Association of Australia says there should be a greater focus on tele-health to remove the need for travel. That is, $600,000 was spent in six months by one health district in one state on the delivery of a single health program.

- If the NBN allowed just 5% of elderly people to stay in their homes for an extra year, it would enable a huge reduction in the costs of providing aged care facilities. If 5% of elderly people stay in their homes for an extra year, Australia would save more than $4 billion a year in daily bed costs as well as up to $20 billion in capital costs. Over 10 years this represents a saving of $60 billion.

Defining 'Fast Broadband'

We often see the phrase 'fast broadband' in policy documents and media statements, as though it were a quantitative performance benchmark. This couldn't be further from the truth - the phrase is essentially meaningless.

There are a number of metrics by which we measure the 'quality' of an internet connection, and each of these metrics has an arbitrary threshold at which one might consider their own idea of 'high performance' satisfied. These metrics include:

- Downstream Bandwidth (or *speed*)
- Upstream Bandwidth (or *speed*)
- Latency
- Jitter
- Packet Loss

A detailed explanation of each of these properties is beyond the scope of this submission, however the key point in the context of this submission is:

Performance is not just about download speeds!

A combination of the above metrics is often referred to as 'Quality of Service' (QOS). Overall QOS affects the ability to deliver certain applications across the wire to an acceptable standard.

Different 'last-mile' access technologies have their own characteristics with regards to QOS:

Access Technology	**Downstream Bandwidth**	**Upstream Bandwidth**	**Latency**	**Jitter**
FTTP	Excellent	Excellent	Excellent	Excellent
FTTN/B/dp	Fair*	Ok/Fair*	Acceptable	Good
HFC	Good*	Fair*	Good	Good
Fixed Wireless	Fair	Ok	Ok	Ok/Variable
Satellite	Just Ok	Just Ok	Poor	Just Ok

Economic Impacts

Impacts of Broadband on GDP

Studies have been carried out into the impact on GDP of broadband infrastructure investment, however this is an area that would benefit from further research.

A 2012 study by Chalmers University and Ericsson conducted over 3 years in 33 OECD countries found that a doubling of broadband speeds results in an increase in GDP of 0.3%. Given Australia's total 2012 GDP of $1.542 trillion (est) this equates to a GDP increase of ~$4.6 Billion (or ~$46 Billion over 10 years).

The ubiquity of broadband is also a strong economic growth factor. Dr Pantelis Koutroumpis at the Imperial College in London has determined in his study that for OECD countries with low broadband penetration (under 20%), an increase of 1 per cent in broadband adoption contributes to 0.008% of GDP, while in countries with medium penetration (between 20% and 30%), the effect is of 0.014% and in countries with penetration higher than 30 per cent, the impact of 1 per cent increase in penetration reaches 0.023% of GDP.

Factors impacting Australian technology business productivity include:

- Lack of addressable local market if ubiquitous fast broadband is not available to end users in Australia
- Increasingly services will be provided from offshore and profits to offshore enterprise if Australian companies do not have a local market to develop for

The National Cloud Computing Strategy released in May 2013 encourages Australian businesses to adopt cloud services. The strategy notes:

- Australia lags in the use of online technologies relative to other OECD countries
- Organisations that adopt cloud services are generally more productive, innovative and operate with greater agility
- Slow download and upload speeds have limited the adoption of cloud services

Regional & Global Landscape

Australia is uniquely geographically isolated. Our distance from major world markets and other first-world economies means that the effectiveness of our communications infrastructure significantly affects our global competitiveness.

We are no longer a manufacturing nation, and we need to plan for economic growth as our resources boom slows. We are in a very good position to become a major player in the high-value knowledge and digital economies, provided that we invest in the enabling infrastructure.

A number of our regional competitors are already well advanced in terms of 'next generation' broadband penetration – notably Singapore, Japan, and South Korea. The fact that these countries are all leaders in technological innovation needs no further explanation.

The NBN Alliance is very concerned that poor broadband investment choices today could leave us stranded tomorrow. Additionally, recent comments by Mr Turnbull that "the idea that you would invest in a technology which will last for thirty years is pretty naive", and that it is better to invest in technology "that works now" is myopic in the extreme.

Factors impacting international business include:

- The cost and time to travel overseas makes forming business relationships difficult
- Time-zone issues compound geographic location
- High quality broadband that enables high-quality and high-reliability Video conference is increasingly important to mitigate the above issues

Strategic Review Scenarios

NBN Co has, under the instruction of the current government, modelled a number of alternative rollout scenarios which could be actioned from this point forward, in place of the current FTTP scheme.

In this submission we have considered the following scenarios:

- Scenario 1 - FTTP Revised Outlook
- Scenario 2 - Radically Redesigned FTTP
- Scenario 6 - Optimised Multi-Technology Mix

NBN Alliance Summary

The NBN Alliance does not believe that the terms of reference used for the Strategic Review adequately encompass the long term fiscal and technology outlook over the useful lifespan of the infrastructure. We should approach vital national infrastructure projects with a long term vision.

Further, the NBN Alliance feels that the NBN Co Strategic Review has failed to achieve its core aim – to provide an 'unvarnished' outlook of the technology and economic position going forward. The certainty that is required to maintain program momentum is not forthcoming in this review:

- Key sections and figures in the Strategic Review are redacted, obfuscated, or omitted entirely - to the degree that it is impossible to independently validate the economic models used;

- There is a fundamental lack of detail related to the technologies in question and their limitations, both now and into the future;

- The significant increase in overall project complexity from the introduction of multiple additional last-mile technologies has not been adequately addressed;

- Many regulatory and compliance issues have not been adequately addressed;

- The impacts of the above on overall project risk are significant, and have not been adequately addressed.

- There are several material inconsistencies within the Strategic Review (addressed, in part, in this submission).

While this submission has been prepared in an apolitical context, it has been noted that the majority of the redactions and material inconsistencies favour the policy platform of the current government.

In the NBN Alliance's view, the closest we have to an independent assessment of present state and future policy, from those privy to all of the fundamental data, is the leaked 'NBN Co Corporate Plan 2013' prepared during the caretaker period.

Scenario 1 - Revised FTTP Outlook

Summary

- Rollout strategy is to continue as per current FTTP rollout
- Key savings from latest NBN Co Corporate Plan have not been included in this assessment
- Key figures are redacted, obfuscated, or missing entirely
- Very difficult to assess financial outlook on this basis

Strategic Review Assessment of Current Rollout

- Strategic Review assumes lower total cumulative revenues than in Corporate Plan (SR 2.5.1), on the basis of:
    - Delays to the rollout - fewer active services producing revenue
        - The revised outlook creates its own delays by planning to spend billions less on capital expenditure between 2014 and 2016 (SR 2.5.0). The revised outlook plans on spending only $2.9bn, $3.6bn and $4.5bn (totalling $11bn) on capital expenditure in the years 2014, 2015 and 2016, while the CP12-15 plans to spend $3.9bn, $5bn and $4.9bn (totalling $13.8bn) over the same period. This creates prolonged delays in revenue which become magnified in cherry-picked figures such as 'Cumulative Revenue FY11-21' (SR p17.) This significantly hampers NBNco's ability to reach peak deployment rates, which can take up to 5 years to achieve (SR 3.1).
    - This reduces forecast revenue by $11.6 billion (FY11-21)
- Strategic Review assumes higher than expected decline in ARPU for residential broadband services than in the Corporate Plan (SR 2.5.1)
    - ARPU declines primarily due to capture of larger market share, with growth occurring primarily at the bottom of the market
    - Net revenue is still steadily increasing
    - Corporate Plan projects 0.3 percent real decline in ARPU for FY16-40
    - The Strategic Review assumed real ARPU declines of between 0.3 percent (as per long run Corporate Plan average) and 2.5 percent
    - This reduces forecast revenue by $0.3-0.5 billion (FY11-21)
    - THE APRU was actually higher than expected in the NBN 2013 annual report was just offset by lower activation numbers P19
- Strategic Review assumes fewer active residential services than in Corporate Plan (SR 2.5.1), on the basis of
    - Accelerated migration to mobile-only
        - ABS statistics do not support this claim. The amount of data downloaded on fixed-line services in Australia increased by 61% between June 2012 and June 2013, while wireless only increased by 8%.

        - The amount of data downloaded on mobile handsets increased by 43% during the same time period.

    - The potential for existing broadband infrastructure providers to use fibre to serve residential premises such as MDUs (no citation provided)

    - This reduces forecast revenue by $0.2-0.3 billion (FY11-21)

    - Contrary to the assumption that take-up would be less than projected, the latest NBNCo report reported that "at 30 June 2013, end-users were ordering services at speeds higher than assumed in the current 2012-15 Corporate Plan" and that "Take-up in areas that have been in-service for greater than 6 months was 37.6% at 30 June 2013"

- Strategic Review assumes less revenue from business premises than in the Corporate Plan (SR 2.5.1), on the basis of

    - The market for these services being smaller than projected

    - A greater proportion of businesses utilizing 3rd party (non-NBN) fibre

    - This reduces forecast revenue by $0.3-0.4 billion (FY11-21)

- Strategic Review assumes less revenue from government sector (SR 2.5.1), on the basis of:

    - Government revenues being implicitly included in the business sector revenues, and therefore double counted

    - This reduces forecast revenue by $0.4 billion (FY11-21)

- Revised Outlook assumes that all requirements beyond the planned $30.4 billion will be funded by way of interest-bearing debt (SR 2.5.4)

    - This interest component significantly diminishes IRR

- Strategic Review has presented capital expenditures of $56b vs revenues of $10b on p17 Table 0-2.

    - But it only accounts up to FY2021 not to FY2025 when it will be completed.

    - It then presents on P56 Table 2-21 and then ignores the $15b extra revenues it states for that 42 month missing period.

    - So the table should show capital expenditures of $56b vs revenues of $25b and in not doing so understates IRR

Project Delays

- Project start delay due to protracted contract negotiations (Telstra pits/ducts, ACCC, etc) (CP12-15 p35) ("*It was originally assumed that by 30 June 2011 NBN Co would have access to the core infrastructure (Ducts, Dark Fibre and Exchange space) necessary to construct the NBN most efficiently and cost effectively. However, the final condition for the Telstra Definitive Agreements becoming unconditional, being the ACCC approval of Telstra's Structural Separation Undertaking, did not occur until 7 March 2012;*")

- Contractor disputes over pay (CP12-15 p35) (*"While the awarding of these construction contracts was later than originally planned, it was a consequence of NBN Co taking all the steps necessary to assure that 'value for money' was being achieved"*)

- Telstra remediation roadblock due to asbestos (would also impact FTTN rollout) (SR p47 *"delays in Telstra remediation, including for asbestos... the halting of duct and pit remediation due to asbestos has caused delays in 84 FSAMs [each FSAM contains upto 3,200 premises]." (p71.) "This included a complete shutdown of all remediation work between May and August 2013 while Telstra confirmed its position on remediation and augmentation of Telstra pits and ducts due to asbestos concerns."*)

- Some areas (6VIC-01&2) were areas where CAN was buried neat (no conduit). Rollout will be significantly faster in newer suburbs where pit and pipe infrastructure is in better condition.

- Significant areas for improvement are listed in the SR 2.2.6 and 3.2, were these factored in to the rollout timetable?

Risks

- Additional time being lost, and will continue to be lost, due to contractor uncertainty around the project (lack of political bipartisanship)
    - Rollout has slowed
    - OPEX is continuing to accrue during this time
- Savings and efficiencies not taken into account, despite many of these efficiencies having already been deployed in the field *(CP13-16 p47) ("Transit Network capital expenditure is forecast to total $2.3 billion over the construction period FY2011 to FY2021. Relative to the previous 2012-15 Corporate Plan, this represents a reduction of $(0.5) billion in forecast capital expenditure... [this] reflects: ... Reduced equipment costs [and] Improved capacity utilisation.")*
    - Then the Strategic Review goes on to conclude from its own heavily redacted figures that peak debt will reach $73B

Scenario 2 – Radically Redesigned FTTP

Summary

The Strategic review suggests 'radically redesigning' the NBNco FTTP deployment in order to obtain a lower Cost Per Premises, in comparison to 'Scenario 1 - Revised Outlook'. This, in theory, would reduce Capital Expenditure FY11-21 from $43bn for the 'Revised Outlook' to $35bn for the Radically Redesigned FTTP, and Cumulative Capital Expenditure FY11-24 (Incl. replacement Capex) from $56bn to $44bn (SR p17). This is achieved by making changes in the following areas:

Increased Labour Productivity

- An enhanced program management function
- Ensuring a visible, committed and continuous flow of work by streamlining the design process
- Clear roles and responsibilities to ensure internal alignment within NBN Co
- Clear gating of changes (e.g. architecture) before release into the field
- Simplified and standardised hierarchy of design rules, construction methodologies and "cookbooks", equipment, governance and accountabilities
- A joint focus on construction productivity (between NBN Co, contractors and Telstra)
- A streamlined interface with Telstra with clear rules determining decision rights for accessing Telstra assets and remediation obligations.
- Experience benefits through improved learning and feedback loops

Cost-efficient architecture and materials

- Reducing fibres per premises from 3 to 1.2
    - Originally, this was raised as an option for low growth service areas. Effectively this would result in re-visits by NBN Co to install additional fibres should they be required as a result of subdivision (which will cost a lot more then installing the additional fibres during initial installation). It is hard to see how reducing the number of fibres provided to each house would save a significant amount of money considering the cost percentage of lead-in trenching is significantly more.

  - This also limits NBNco's ability to establish a 'dark fibre' network. A dark fibre network would allow NBNco to easily manage additional subdivisions and building constructions over time. NBNco would be able to lease the dark fibre network to other carriers for additional income streams. Having a dark fibre network would also increase the selling-value of NBNco if it were ever sold by the government in the future (which will happen eventually).

- Increased use of aerial deployment
  - Understandably has the potential to accelerate and reduce the cost of a FTTP deployment for multiple reasons. This would remove the heavy reliance on Telstra pit remediations that have attributed to delays thus far. Alternative models, such as the FTTH Council EU model (Cost Model Report), identify trenching as contributing 70% - 80% to the cost of deployment.

- Removal of PON protection
  - While this would remove a level of redundancy in the last-mile network, it isn't overly different from current network architectures. Copper based ADSL is a single continuous path to the nearest exchange, in which a cut will sever the circuit leaving the service inoperable. Similar issues exist with the HFC network. Removal of this protection would provide consumers with the same level of redundancy they get today. This may result in reduced redundancy for business-grade fibre services, but this would depend on the path diversity required by the business in question. Companies that require such a service would be unlikely to obtain an NBN based service.

- Using smaller diameter fibre cables

- Use of gel-free cables

- Eliminating the battery back-up for the NTD (assumes battery back-up still provided to Priority Assist customers)
  - Given the popularity of mobile phone services, installing battery back-up equipment at all sites appears wasteful except for those that specifically request it under special circumstances. Given that mobile telephony is typically more resilient under extreme conditions and attended to quickly upon failure, it is reasonable to assume that communications are available to consumers for emergency situations. As such, it seems acceptable to remove the battery back-up as a default installation item.

Cost-efficient construction techniques

- Aerial extension methods
- Alternative customer drop implementation techniques optimising fibre testing at multiport and usage of direct bury cable
- Ongoing costs for the access network are estimated at ~$90 million per annum (~$9 per brownfields premises passed)
- Costs associated with using Telstra ducts as set out under the Telstra DAs have been excluded

Scenario 6 - Optimised Multi-Technology Mix

Summary

The Multi Technology Mix scenario involves rolling out a number of different access technologies, including the reuse of some existing infrastructure. Primarily consists of FTTN, HFC, FTTP, and (in most cases) the existing arrangements for Satellite and Fixed Wireless.

Overview

- The MTM model was designed 'in principle' and used as an election platform prior to any serious outside analysis.
- As a result of this lack of detailed modelling prior to policy announcement, estimated costs have already increased by $12 Billion.
- Given that this policy is attached to an election promise, there is concern for the subsequent impartiality of the post-hoc rationalizations (including the current Strategic Review).
- The purpose of the National Broadband Network was primarily to replace the aging copper network, however the FTTN model continues to use the network that the NBN was formed to replace.
- The strategic review was conducted using an outdated version of the NBNCo corporate plan, when there was a more recently available and approved plan to use. Had the strategic review been done on the latest plan, it would have had to take into account the advanced position of the NBNCo at that time, leading to a smaller peak funding requirement for the comparative FTTP scenarios.
- The model is proposed to be implemented with unsubstantiated assumptions about market behaviour.
- The incoming minister's briefing after being elected with this model was suppressed from FOI requests and several crucial figures have been redacted from public knowledge, leading to a situation where the total cost is unknown to the public.

Deployment Issues

- Deployment has been delayed until 2019, leaving only a 3 year gap between full FTTP and MTM models (SR p17.).
- The SR recommends that an FTTP network will need to be rolled out (superseding the FTTN/HFC network) beginning as early as 2026 (page 19 of the SR states "The Strategic Review expects that NBN Co would not need to upgrade to a second access technology sooner than five years after construction of the first access technology").

- FTTN deployments have only ever been undertaken by incumbent telecommunications companies, which NBNCo is not.

- All equipment that is required to service DSL and copper services in the FTTN network becomes obsolete after the deployment of the 'second access technology'. The cost of remediation of this equipment included with the capital purchase cost could be completely avoided by implementing a single-stage FTTP model.

Business Model

- Concern over the accuracy of costings given that the 'fully costed' and 'bulletproof' $29B rollout has already risen to $41B (with a smaller footprint)

- Steady State OPEX value of $2.6bn for MTM model looks conservative when compared to OPEX of $2.4bn for a full fibre network

    - Or the steady state OPEX of the FTTP has been overstated

    - There is insufficient data behind these numbers in the SR to verify either claim

- Copper maintenance is currently estimated at $750m to $1B pa

- Equipment replacement cost after 5 years:

    - Confirmed by NBNCo that FTTN equipment will need to upgraded to FTTdp/FTTP as soon as 5 years after completion (2 years after FTTP would have been completed)

    - With this in mind, Scenario 6 is effectively recommending to install a solution with a lifecycle of less than 10 years.

- Equipment cost represents a large percentage of FTTN rollout cost, meaning most of the investment in FTTN will not be used in 50 years.

- FTTP will be overbuilt, nullifying the investment in copper. This scenario proposes to invest a significant amount in an existing infrastructure that will be replaced after 10 years.

- Limitations on ubiquity and equality of service and no guarantee of service quality with a mixed technology model.

- It is well known that DSL speeds are directly related to the line length, and that line lengths between premises differ. This being the case, it can never be guaranteed that an FTTN model will deliver the same service at each premises. It is true that reduced loop lengths will increase speeds on average, however loops cannot be the same length and as such longer loops will be of a lower quality.

- A network that cannot guarantee a speed or service or is unreliable will be vulnerable to being overbuilt with guaranteed services (i.e. FTTP) by another commercial interest in areas where it is profitable to do so, leading to even further inequality of services across Australian premises.

- Waste of resources when private companies inevitably construct FTTP infrastructure over FTTN/HFC infrastructure. This cost will eventually be placed on the end users, resulting in higher broadband prices. Economics teaches of a "natural monopoly" situation, in which it makes very little sense to have multiple companies building overlapping infrastructure. Examples include roads, water services, electricity and gas services. It only makes sense that one company builds the best infrastructure throughout the country, while allowing others to bid for contracts in construction; which allows for efficient costs and active competition.

Key Questions

- Does NBN Co intend on building out the FTTP network upgrade that is forecast for ~2026?
    - If so, why is this not included in financial outlook (IRR calculations etc?)
    - Has this build been costed?
    - What is the aggregate cost of the FTTN + FTTH builds, and what is the IRR for this aggregate build?

- If NBN Co does not build this network upgrade, private industry likely will, cherry-picking the most profitable NBN customers:
    - Why has this cannibalization of the NBN Co customer base not been included in the financial outlook?
    - What effect will this have on IRR?
    - What effect will this have on the terminal value of NBN Co, given that FTTN will have no way to compete against private build FTTP?

- Will the FTTN equipment generate enough revenue to pay for itself before the requirement to replace it?

- Will the equipment be resalable or reusable after being replaced?

- Will the street node cabinets be removed or replaced with smaller FDH upon FTTP being overbuilt?

- If the equipment is not usable in 20-30 years time, does this represent value for money in a national infrastructure project? Should national infrastructure project investment be expected to last more than 15 years?

Technology Outlook

There are a number of key technologies capable of delivering 'fast' broadband to end users. It is often the case that no single technology will satisfy all cost, time, and performance criteria. This is particularly the case in Australia, due to disparate (and generally low) population densities, and vast distances between population centres.

This submission focusses on the five major fixed line technologies:

- FTTP - Fibre to the Premise
- FTTN - Fibre to the Node
- HFC - Hybrid Fibre Coaxial
- FTTB - Fibre to the Basement
- FTTdp - Fibre to the distribution point

FTTN / FTTB / FTTdp are all variants of DSL technology operating over the existing voice telephony copper network, however each has unique characteristics, and each will be discussed separately in this submission.

NBN Alliance Summary

Of primary importance to the NBN Alliance is that technologies are appraised on their merits, and not on ideology. A concerning amount of misrepresentation that has taken place regarding the fundamental technical properties of these technologies, primarily to support pre-existing policy positions. We attempt to address that balance in this section.

It should be clear that additional project complexity results each time an additional 'last-mile' access technology is added to the solution. This complexity manifests in a number of significant ways:

- Many more disparate skills and disciplines involved in the rollout
- Less opportunity to leverage efficiencies of scale (both equipment and labour)
- Entirely new Business and Operational Support Systems and Services must be written
- Increased barriers to entry for Retail Service Providers – BSS/OSS interfaces must be integrated by each individual RSP
- RSPs must develop additional product offerings and support channels for each additional access technology
- Technical support and network management becomes much more complex
- Ubiquity of access and quality of service suffers

Additionally, a number of the proposed technologies are limited in their future capacity, upgradability, and extensibility, and will require upgrading within an unacceptably short period of time for a national infrastructure project.

Technology Outlook FTTP

Benefits

- 'Future-proof'
    - Limited only by the bandwidth of the optical spectrum (31Tbps has been achieved over 7200km of single fibre on prototype equipment and 1.4Tbps has been achieved on commercial production equipment
    - Can easily be upgraded from 2.5GPON to 10GPON and beyond (and this has been commercially deployed)
    - Issues that will limit future bandwidth upgrades to FTTN/HFC (namely quality of joints/terminations/signal attenuation/useable bandwidth/noise) do not (in practice) effect fibre - upgrade to 10GPON or faster could happen at any time with very low probability of performance issues & project risk
    - Future standards operate in different optical spectrum, therefore allowing legacy and future standards to operate simultaneously
    - The majority of infrastructure is passive:
        - Minimal maintenance costs
        - Upgrades only involve active electronics at either end of fibre (as opposed to FTTN or HFC for example which have active electronics at each node)
    - Biggest cost and time effort related to civil works is a one-off cost that provides capability for next 50 years
- Ability to provide free access to Government services over FTTP on dedicated NTD ports (4 available on existing NBNCo NTD) independent of any paid service:
    - This facility is not available for HFC or FTTN without significant investment in additional NTD development
    - NBN Co was well advanced with plans to reserve one of four data ports on its customer equipment exclusively for health and education providers to deliver unmetered online services into homes and had held discussions with NSW and NT Education Departments
    - Option for IP free-to-air multicast television on dedicated port (this would free up radio spectrum)
- Provides significantly greater download and upload speeds to consumers at project completion (e.g. 1000/400 plans compared to 25-100Mbps plans on FTTN/HFC):
    - Download speeds are already at 1000Mbps for customers on the NBN fibre network, with many different speed options available now and into the future

  - Upload speeds are significantly higher on the fibre network compared to any other technology, which is important for business and future applications

  - Provides for much greater flexibility in product structure with wide ranges of up/down speed and QoS that are independent of system-wide channel allocations

- Uses superior, widely field-tested technologies with a single transmission media to avoid the cost associated with overlapping and inferior infrastructure, thereby eliminating wasted investment on copper and HFC equipment and the inherent complexity of mixed-media networks:

  - Delivers a ubiquitous service to geographical areas outside of those where profitability dictates commercial investment. In comparison to a mixed model where infrastructure competition in geographic areas is only effective in profitable areas of high demand, the FTTP model dictates competition between retailers across all geographic areas.

  - In contrast, a FTTN model encourages competition in profitable areas, leading to redundant networks due to competitive overbuilding and as such less economic benefit for capital invested. Even in these areas, the incremental cost of fill-in or adding missing lead-ins is considered unprofitable, leading to availability issues where some premises may not receive full service or may receive no service at all.

  - The FTTP model invests significantly in civil works to lay the infrastructure required to deliver ubiquitous service from the exchange and does not require investment of capital in street-based equipment and does not suffer from any existing transmission problems. In order to offer a service on comparable footing, an FTTN model invests a significant proportion of capital funds into street-based equipment and re-utilises a transmission media which is widely known to have existing problems.

- Utilises a single technology design to achieve the most economical cost per bandwidth per premises.

  - Avoids interfacing between different transmission media (copper, HFC & Fibre), avoiding the need for extra network equipment and management.

  - Accounting for data usage and network operation is identical for all premises, leading to reduced costs for management systems.

  - Physical lead-in to each premises is installed and tested to be within parameters, eliminating the question of physical line quality from any troubleshooting processes.

- Creates greater equality for all Australians, with more than 90 percent having access to the same fibre services now and into the future

  - All speeds are available at every point in the FTTP network

  - Service quality does not change from street to street

  - Costs are the same in every town

  - The fastest point in your network is the "last mile"
  - Bypasses issues relating to poor in-building (MDU) copper that may be problematic to fix when under control of body corporate

- Eliminates duplicitous infrastructure rollout within the industry:
  - See the enormous waste in the Telsta / Optus cable wars
  - Infrastructure level competition is rarely a net benefit to consumers

- Significantly greater reliability of service to customers
  - Fibre is not subject to weather conditions like FTTN/FTTdp
  - Fibre does not corrode or deteriorate (polymer clad silcia, the cladding may deteriorate in elements, but the fibre will not)
  - No powered equipment (plant) between the exchange and the user, the roadside fibre optic splitter is passive
  - Can be mixed with power cables without fear of EMR, leakage, or shorting on 240v
  - Quality of Service (QoS) & Multicast (IPTV) can be managed network wide without the need for special equipment
  - Service quality does not drop with distance, or interference. 1000Mbps from <1km from the FSAM to 30km from the FSAM
  - FTTP provides for predictable well-defined performance service, rather than the "up-to" or "best effort" that has resulted in problems for many people

- Fibre will generate greater yearly revenues than other technologies, and revenues will only increase as the untapped capacity of the underlying fibre is unlocked (10Gbps etc)

- Fibre costs significantly less to maintain and use than other technologies:
  - Zero-touch service provision through software reconfiguration eliminates truck rolls previously needed to repatch copper distribution points
  - Elimination of maintenance due to corrosion or degrading joints
  - Elimination of service issues related to interference and crosstalk
  - Managed network with integrated management capability at customer end reduces fault finding effort significantly

- Can be leveraged by wireless services (LTE, LTE-A, and beyond) to deliver more reliable, smaller cells:
  - By using FTTP infrastructure, wireless providers offering 4G services are saving on backhaul costs

  - Allows for service areas to be designed with better coverage, not less backhaul, in mind
  - Spurs competition in smaller wireless markets; currently Telstra still rules the roost in regional backhaul

- Lightning strikes that can fuse the copper cable into a molten mess is not an issue with fibre.
- Upcoming technologies such as photonic routers are compatible with FTTP infrastructure.
- Junction cabinets will only need a fibre cable installer to set up as opposed to FTTN cabinets which also require the services of an electrician and copper linesmen
- The capability to build a smarter and more efficient traffic management system
- The capability to build a smarter and more efficient power grid

Disadvantages

- Lock-in to shared 2.4Gb/s GPON access network based services under the current business case model.
- Labour intensive, every home must be touched by NBN Co.
- Costs more in initial capital expenditure.
- Takes longer to roll out.
- MDUs can be challenging, and involve negotiation with each body corporate, although this can be resolved by appropriate legislation.
- Problems where there is no pit+pipe infrastructure (ie ribbon cable is problematic for direct bury cable areas)
- Lifeline services for all depend on an unmaintained local NTU battery.
- Lifetime of local NTU batteries approximately 5 years (Lead Acid), and management of remediation process is an unknown.

Risks

- Access to workforce
- Greater reliance on civil works, and exposure to delays inherent with civil works - cable pulling etc

Technology Outlook FTTN

Overview

- FTTN is an 'interim' technology on the path to full FTTP rollout
- FTTN deployments are popular amongst incumbent copper network owners looking to extract the last remaining value from the legacy copper network, and defer capex costs of a full FTTP rollout
- FTTN consists of a Node in a street cabinet that is fed from a fibre line. The node is then connected to the premises via the existing copper voice telephony network
- Nodes (essentially mini-exchanges the size of a refrigerator) are placed in streets, typically near an existing copper connection pillar, reducing the line length to the premise by bypassing the part of the copper line from the pillar to the exchange
- The shorter line length improves the available speed from DSL technologies such as VDSL2
- The node may support ADSL, VDSL, VDSL2, but in all cases relies on the legacy copper wires intended for voice communications, which poses a number of issues in terms of service quality, reliability, and Opex maintenance costs
- It is estimated that ~50,000 nodes would be required to implement FTTN in Australia

Capital Investment

- The economic benefits of FTTN are primarily for incumbent telecommunications companies making incremental investments on existing networks, as it allows for incremental service improvement in selected localities with 'right sized' capital investment
- This approach is better suited to ad-hoc network augmentation, not network-wide build-out
- Allows incumbent copper network owners to maximise return from their copper before end-of-life
- Defers the inevitable FTTP build out, thus deferring a larger Capex investment
- FTTN is still a significant investment however, which reduces the capital available for future FTTP rollout. For this reason many commercial providers are skipping interim technologies such as FTTN in favour of FTTP.
- The Strategic Review acknowledges that a FTTP network will need to be built as soon as 5 years after FTTN is fully deployed. The economic justification for this two-stage process has not been adequately prosecuted.

- As a newly created infrastructure company, the NBNCo is not well suited to take advantage of the economic benefits of an FTTN model.
    - In overseas markets where FTTN has been extensively rolled out, the deployment has been undertaken by the incumbent (for example BT in the UK), taking advantage of their existing copper infrastructure.
    - Deployment speed in BT's case was significantly advanced by existing contractor relationships and incumbency in the marketplace. From a standing start, NBNCo will not have the same advantages.
    - The last-mile copper access network is not currently owned by NBNCo and will represent an extra cost in the project's capital and operating expenditure.
- The coalition model projects completion of the FTTN network 3 years ahead of the FTTP network. Assuming this is accurate:
    - It has not been demonstrated that the opportunity cost benefits of having FTTN sooner justify the inherent compromises
    - Taking into account initial delays from protracted Telstra and ACCC negotiations, and subsequent asbestos remediation, this demonstrates that FTTP is still achievable at the same linear build rate as initially projected by NBNCo

Rollout Logistics

- Will roll out be bulk cut-over of copper lines or service-by-service?
    - Bulk cut-over could be cheapest, and needed to support economic and commercial basis of NBN that relies on being a monopoly provider
        - Issues identifying existing services
        - Issues managing cut-over of multiple RSP services, extended outages, breaches of minimum term contracts
        - Incompatible services take longer
        - Largely unworkable, time consuming, excessive planning needed, high-risk to end-users
        - Risk of losing services, errors to be fixed
    - One-by-one
        - Easier
        - Greatly more expensive due to repeated truck-rolls
        - VDSL issues due to interference
        - Interference to ADSL/other services from exchange that now have far-end noise added

Performance & Quality of Service

- Inability to guarantee quality of service and minimum service speeds due to the vast number of variables affecting performance
- Impossible to accurately model service speeds for given areas / premises prior to build-out without testing every copper line (which is widely believed in the industry to be infeasible)
- The 'best effort' nature of FTTN perpetuates existing issues of 'service bought' vs 'service delivered' that have been much maligned with ADSL for the previous 10 years
- No certainty has been provided on the issue of upload speeds, which is a major bottleneck for business and innovation
- Data from international VDSL rollouts indicate that upload performance will be significantly constrained
- Upload speeds may be inadequate for cloud based services, which have been flagged as a significant driver of productivity
- This will lead to a greater number of complaints and service issues once services are lit up, which will be a heavy burden on RSPs
- Creates an environment where end users lose out with no viable recourse
- Impact of internal household telephone wiring quality on VDSL service, and burden of responsibility of remediation when this is necessary
    - Mitigation of risk typically requires premises visit to install central splitter
    - The copper up to the central splitter may be degraded and installation of a splitter will not mitigate the loss of signal (therefore bandwidth), leading to a second site visit when service quality is compromised.
        - Internal distribution frames at customer premises have a history of being poorly maintained and may contain lengths of unmaintained or unterminated copper which will generate interference and impact upon the network's vectoring performance. The works cost of testing each premises for noise and interference to ensure performance may significantly impact the cost of installing per premises.
        - It has been common in the past for home owners to add extra phone sockets to their house by jumpering sockets. In this case, non-vectoring hardware may be connected to the copper bundle which will significantly impact performance for all users on that bundle. Any such defect may be very difficult to trace and fix.
        - Small MDUs have lengths of unmaintained copper from the MDF, yet may receive FTTN due to lack of suitable basement or number of premises for FTTB
- VDSL2 Vectoring is extremely susceptible to uncontrolled interference. If a customer disconnects their vectoring-capable modem and uses any non-vectoring hardware, the

vectoring for all users on that copper bundle will be nullified, leading to severely decreased speeds.

  - An example of this occuring is an end-user's vectoring modem suffers hardware failure, leading the end-user to attempt to use a non-vectoring modem such as their old ADSL2 modem in place.

Reliability & Survivability

- 50,000+ node locations, all containing active electronics - switches, routers, media converters, fans, batteries
- Vastly greater number of points of failure vs a Passive Optical Network, which has no active electronics or moving parts between the 'exchange' and the customer premise
  - Almost every part of the FTTP network has had single points of failure designed out of the system
  - FTTN topology has single points of failure throughout the system, but most notably at the roadside nodes
  - Performance and disaster recovery capability during wide scale power outages of current PSTN vs FTTN vs FTTH
- Flooding likely to cause damage resulting in full outage and entire replacement of node (FTTH likely to remain operable due to passive operation)
- Will nodes be part of a ‘protected’ ring fibre network, or point-to-point from the central exchange?
- Heat is a potential concern, cabinets may be hotter than existing ADSL rims.
  - Alcatel 7302 & 7330 VDSL2 ISAMs are both limited to a maximum operating temperature of +65 degrees Celsius
  - Telstra Research Labs note that temperatures inside FTTN style cabinets run at 40c to 60c on a regular basis
  - They also note in the same document "the service-life degradation of batteries as a function of operating temperature is well known"
  - Given that heatwaves are increasing in severity and frequency this temperature envelope is of concern.

Maintenance & Opex

- Maintenance and Opex is higher than FTTP alternative

- Exact maintenance costs are unknown (which is problematic for the proposed business model) but likely to be significant:
    - The Strategic Review projects OPEX for the FTTN network of $35 - 55 pp/pa (SR 3.2.9)
    - $25 - $35 pp/pa of this has been allocated to 'corrective maintenance' (SR 3.2.9)
    - However, Telstra has not provided NBNCo with actual data regarding maintence costs
    - Industry speculation on maintenance costs of the Telstra copper network has been centred around $750m pa
    - Assuming the most pessimistic figure accounted for by NBNCo ($35pp/pa), this equates to $2.92pp/pm
    - It has been speculated that this is not adequate to cover the actual maintenance costs of the network
    - For reference, the current Telstra Wholesale ULL rate is $16.21pm

Environmental Impacts

- Waste management - safe disposal of batteries and other toxic components
- 50,000+ node locations all require active power 24/7 in perpetuity, using a significant amount of power (vs none for a passive optical network)
- Much of this energy consumption is waste – ie losses as heat, powering of cooling fans
- 50,000+ node locations all require regular battery changes, which will be more frequent than if the batteries were operated in a climate controlled environment (see heat issues)
- Visual impact of FTTN cabinets is the most obtrusive of all access technologies.
- Significant end-of-life waste when upgrade to FTTP is implemented

Future Capacity & Extensibility

- Although discussed as a possible upgrade path, G.Fast requires extremely short line lengths of <100m, which would require in excess of 500,000 nodes to provide ubiquitous 1Gbps speeds. This is not a viable upgrade path for a low population density country like Australia.

- All access technologies operate via a physical medium, and all physical mediums are subject to maximum throughput limitations resultant from fundamental laws of physics. FTTN is limited by the throughput of the legacy Telstra Copper Access Network (CAN), which even in the best case scenario, is orders of magnitude slower than FTTP and future HFC standards according to the 'Shannon Limit'

- Current FTTP rollout allows for Point-to-Point 'dark fibre' topology from almost anywhere to almost anywhere by simple patching in the Fibre Distribution Hub (FDHs)

- This degree of flexibility allows for additional income streams, not realizable with FTTN & HFC

- Inability to effectively re-use the vast majority of node infrastructure when upgrading to a full FTTP network

    - FTTN and FTTP network topologies are very different

    - All active electronics at node locations (switches, routers, media converters, fans, batteries) become redundant

Civil Works

- Electricity supply must be trenched to 50,000+ node locations to power the electronics

Systems Integration

- Additional OSS / BSS interfaces must be built for FTTN access technologies

- Each Retail Service Provider must then develop their own systems to integrate with these new interfaces

- Each Retail Service Provider must create their own product offering, support channels, etc for each additional access technology

- This creates a barrier to entry for RSPs, and therefore a barrier to competition

- Each additional ‘last-mile’ access technology creates significantly more complexity in the software environment

Customer Premise Equipment

- Customer Premise Equipment (CPE) VDSL modems are assumed to be BYO, vs supplied by NBNCo in FTTP rollout

    - Shift of multiple Billions cost off the project ledger and onto end users

- Loss of purchasing power vs buying 8+ Million identical FTTP CPE modems
- Question whether a nationwide transition to VOIP is logistically feasible using BYO equipment

- In practise this would often be provided by the Retail Service Provider as part of a service contract

- This removes the responsibility of network performance to the very edge of the network from NBN Co

Fault Management & Resolution

- Resolving faults and performance issues becomes complex
  - 'Finger pointing' between ISP, NBN Co, Premise owner/occupier
  - Resident owns the VDSL modem, and is also responsible for interference created by other devices connected to the telephone lines within the premise
  - Resident is responsible for the internal building copper beyond the first Telstra socket
  - NBN Co is responsible for the FTTN node and local distribution network
  - ISP is responsible for the packet level data stream (contention etc)
  - BYO CPE results in negative impact on network management and diagnostics from NBNCo Network Operations Center (NOC)
  - Increased complexity and cost of technical support provided by Retail Service Provider (RSP)

- The burden of this complex fault resolution process falls primarily on the RSP (Retail Service Provider)

Technology Risks

- VDSL2 Vectoring is an immature technology. No commercial deployments are in service as at December 2013. This carries significantly higher project risks than GPON, non-vectored VDSL2, or DOCSIS3.0, which have been widely deployed and characterized in the field.

- VDSL2 Vectoring has significant limitations, even in best-case scenario:
  - All lines to/from DSLAM must use vectoring, if not, all lines are degraded

- NBN Co cannot guarantee that customer supplied 'BYO' modems will support vectoring / have vectoring enabled. Again, a single non-vectored line degrades all services.

- All cables in copper bundle must use vectoring from a single DSLAM (or multiple DSLAMS with coordinated vectoring) or all lines are degraded

Legacy POTS Voice Circuit

- Will POTS voice circuits continue to be supplied from the node over the copper pair in FTTN model ?

    - If not, how will this impact Universal Service Obligation (USO) re access to voice telephony?

    - How will this impact upon access to emergency services such as '000'?

    - HFC has been stated to not support USO obligations. Does this imply POTS will be retained? At what cost?

    - If POTS is supplied over copper, therefore enabling legacy POTS devices, will this impact the performance of VDSL 'vectoring' technology?

    - POTS support (via fiber) and ergo USO, access to emergency services was built in to the FTTP model

The Copper Network

- Cost of access to the copper infrastructure is unknown

- Significant remediation of the copper network will be required to support VDSL2 speeds

    - The scope of this is completely unknown at this time
    - The cost is completely unknown at this time

- Largely uncharacterized real-world performance of (vectored) VDSL2 in Australia, which would be impacted by the following issues:

    - Copper gauge - the bulk of our copper is 0.40 Paper Insulated Unit Twin (PIUT), which is thinner than the international experience, and significantly degrades performance
    - Bridge taps
    - Load coils
    - Weather related service faults (primarily water ingress)
    - Electro-Magnetic Interference from other sources such as AM radio, motors
    - Insulation resistance mismatches (most commonly due to high resistance joints or a splice fault)
    - Persistent chronic service faults (poor joint conductivity due to corrosion, poor maintenance, etc)

  - Only one copper pair can be assumed to be available per premise – some equipment vendors quoting speeds over 2 pairs
  - Condition of internal household wiring may significantly impact performance, NBNCo will not remediate this as it is property of the householder.

- Special Services (existing copper services that cannot be easily migrated to the NBN, and may reduce the speed and service distance possible for vectored VDSL2).

- Unknown number of nodes required to achieve performance targets (has been estimated at 50-70,000)

  - Telstra has not audited the condition of the copper network

  - Nor have they supplied NBNCo with any data on the condition of the network

  - This raises serious concerns regarding the accuracy of models NBNCo has used when forecasting quality of service and remediation cost

- Contracts with Telstra regarding the CAN will need to be renegotiated with Telstra in a much stronger bargaining position.

Technology Outlook HFC

Overview

Telstra and Optus both currently operate HFC (Hybrid Fibre Coaxial) networks. These were due to be retired with the introduction of FTTP, however the option of delivering 'fast' broadband over these existing networks is now being proposed. Significant network remediation would be required, including footprint infill where streets are not currently covered, and construction of lead-ins to premises that are not already connected to a HFC network.

DOCSIS (Data Over Cable Service Interface Specification) is the industry standard for HFC, developed by CableLabs (a non-profit industry body). Both networks currently utilize DOCSIS3.0, for maximum theoretical speeds of 400/108Mbps.

Benefits

- Speed of deployment, given that a significant part of the network is already built out (though we have no estimation of time-frame for the necessary upgrades and infill).
- DOCSIS3.1 has recently been standardized, offering an upgrade path to providing 'up to' 10Gb/s down / 1Gb/s up services to end users (but there are a number of issues that could prevent these speeds from being realized in Australia).
- Standardization allows hardware vendors (such as Arris, and Cisco Systems) to start developing commercial equipment, with soft targets of 2015/16 timeframe.
- DOCSIS3.1 offers a degree of backwards compatibility with existing systems.
- Option for NBN Co to develop custom HFC NTUs which would provide multiple dedicated LAN ports (as per FTTP NTUs) for free access to Government services (though this may be costly).
- Potential to provide significantly greater download and upload speeds to consumers than FTTN/B/dp (but not FTTP) if DOCSIS3.1 is implemented. Already HFC network providers (ONO in Spain, Com Hem in Sweden) are offering 500Mb/s download 50Mb/s upload Services based on existing DOCSIS3.0 technology. (e.g. theoretically 1000/400 plans could be provided compared to 25-100Mbps plans on FTTN, but above 500/50 plans have not been tested in real-world scenarios).
- Provides investment flexibility by matching investment in technology to actual demand for services from users. Unlike alternatives where 1 port matches 1 customer lead in (FTTH, FTTN) and all potential future customer access points must be pre-installed, HFC can add customers without pre-investment. This simplifies scenarios where you might want two or more separate services in one (shared or rented) premises.
- Allows investment (capital, personnel resources, disruption) in civil works to be concentrated into areas without HFC coverage. As the HFC network is complete (with

exception of infill), construction resources can be concentrated on areas of Australia without access to NBN Co services.

- 2.5million homes can be immediately connected to NBN Co services with no truck-roll (existing coax lead-in, Strategic Review, P89) and no disruption to the streetscape, gardens, or homes of customers.

- Centralised power supplies (as per Optus network currently) can support centralised network powering for life-line telephone services, reducing the risk to the aged or disadvantaged who just want a plain old phone service.

- Significantly decreases the NBN Co time to revenue, by bringing 2.5 million customers onto NBN Co network much sooner than with other options. Reduces the need for capital (and hence increases likelihood of completion) for the network expansion into non-HFC areas.

Disadvantages

- Current HFC networks (Telstra / Optus) are theoretically capable of 400/108Mbps, however real world speeds are significantly less than this, and contention is a common complaint amongst existing customers.

- The work required to infill the network footprint is significant.

- Building HFC lead-ins to all premises that do not have them is no less work that building FTTP lead-ins.

- Given that upgrade to FTTP will be necessary in future, building HFC lead-ins without simultaneously laying/pulling fibre is economically questionable.

- Spectrum must be managed carefully, and interference issues may make certain 'theoretical' performance metrics unobtainable in practice.

- Complications integrating another technology platform into the NBN network (network operations / billing / etc)

- Breaks 'ubiquity' target that FTTP offers

- DOCSIS3.1 has not been deployed in the field, and data related to maximum speeds and service quality is only theoretical. This presents significant risks.

- Network maintenance costs are higher than with FTTH networks. Operational costs for HFC networks have been estimated at approximately 5 times those of FTTP networks, to maintain identical operational outcomes. In perspective, this is approximately $25 per subscriber per year for HFC (Strategic Review, Page 90, $15 to $25) versus approximately $5 per subscriber per year for FTTP.

- MDUs can be challenging, and involve negotiation with each body corporate.

- Significant network upgrades will be required, even to maintain the existing 100Mbps service level (network would be *heavily* oversubscribed otherwise. Contention is already an issue and this would become more of an issue once the majority of premises in the footprint are migrated to HFC)

- Although it is theoretically possible to deliver power to NTU's over the coaxial cable for lifeline services, this would require significant re-engineering of the distribution network, as the Telstra and Optus HFC networks do not use compatible power standards.

Issues for Consideration

Utilisation of Networks

- Have HFC networks been used to provide an open access broadband network anywhere else in the world? Is such open access a Layer 2 or a Layer 3 service?

- What costs would be incurred in making the networks open access using existing "interconnection points"? (There are two main cost items – the physical network elements, and the OSS/BSS elements

- What costs would be incurred in redesigning the networks so that the interconnection can occur at the mandated NBN Co points of interconnection?

- Telstra and Optus have both entered into agreements to close or restrict the use of their HFC networks. Would Optus require an additional payment to transfer ownership of their HFC to NBN Co rather than close it down? Would simply moving their network to open access rather than gain access to a high speed FTTP network be regarded as a benefit or detriment to Optus? Would Telstra require an additional payment to transfer ownership of their HFC to NBN Co rather than simply cease using it for data? Would simply moving their network to open access rather than gain access to a high speed FTTP network be regarded as a benefit or detriment to Telstra?

- Are there any other impediments to transferring ownership of the HFC networks?

- The high cost and complexity of provisioning HFC to Multi-Dwelling Units (MDUs) and businesses has seen existing service providers refuse to connect such premises to their networks. It has subsequently been indicated that, under the coalition's plan, MDUs and businesses within the HFC footprint will be serviced by FTTN instead due to that cost and complexity. How much, if any, of the HFC network will be overbuilt with fibre to service these users? How will service be provided to MDUs that are subsequently built in HFC areas that do not have existing FTTN services? If MDUs are to be connected via HFC within the footprint, who will bear costs and what is the per-premise cost of provisioning service?

- GPON has a 1:32 share ratio over a single fibre from the OLT. HFC on the other hand can share the single coax from the optical node with on average 200-2000 premises. Will NBN Co institute a fixed number of customers per optical node? What is the number of customers per node on the HFC network?

Cost of upgrades

- NBN Co intends to “infill” the HFC areas bounded by the existing HFC networks and foreshadows this is an additional 700,000 premises. What would be the capital cost of passing a further 700,000 premises?

- What would be entailed in “building out the network” from 750MHz to 1GHz? What capital cost will this incur? (SR P90)

- Given the forecasts on downloads and the desire to support 100 Mbps services, how many extra nodes will need to be built in the HFC footprint? What will this cost?

- How likely is it that Foxtel would “agree at some point in time to move off HFC”? (SR P90)

- Is there any other administration where VoIP over HFC would be the only fixed line voice offering provided? Can the HFC architecture provide the Traffic Class protection for this traffic available over the FTTP architecture?

- Has NBN Co performed any labour market analysis (current labour supply, expected labour demand, cost and time to train a workforce) that will be required to upgrade and maintain the expanded HFC network?

- How many optical nodes will be deployed to decrease contention ratios and at what cost? Will the number of nodes increase again alongside attempts to raise proposed speeds from 50Mbps up to speeds of 250Mbps?

End user issues

- In a HFC network the node may be a considerable distance from the customer's premises. That is, the customer's premises are much further from the nearest point of fibre in the network than if they were on the FTTN network. Is it equitable that two customers face significantly different fees to upgrade to fiber purely because of the type of technology mix used by NBN Co? Does NBN Co have any plans to ensure equity for customers should the customer wish to upgrade to a fibre connection?

- 60% of people in the HFC area do not currently access the HFC network. Will these customers be required to throw out their existing modems and purchase HFC compatible modems? Assuming 40% of households that have a lead in to their properties are utilising it for broadband, that is 1 million households. The remaining 2.4 million households will need a new modem immediately. If they obtain DOCSIS 3.0 capable modems equivalent to the Bigpond Ultimate ones used today, at those prices we are looking at $360 million in modem upgrades.

- Each upgrade to the NBN using HFC will require the customer to upgrade their modem. ADSL -> DOCSIS 3.0 HFC =New modem, DOCSIS 3.0 -> DOCSIS 3.1 = New modem, DOCSIS 3.1 -> FTTH = New modem. Does NBN Co have plans to address the added cost of upgrades to the NBN for HFC customers?

- How will issues regarding the geographic load distribution be managed? For example if one node has a high number of heavy users on 100Mbps services other users will suffer congestion. Will NBN Co limit the number of users accessing 100Mbps services on each node segment?

- The strategic review states: with 1:3 relation between upstream and downstream speed.(Page 14) Will a customers current 100Mbps download speed be lowered to achieve this 1:3 ratio, or will upload speeds be raised?

- How many customers will share an optical node under NBN Co's proposed plans?

- Will existing customers have the option of maintaining their existing speeds after NBN Co takes over the network?

- Will the prices for the same services offered over HFC be equitable to the prices offered to users on FTTN and FTTP?

- Will a VOIP line be included in the cost of a service on the NBN HFC network, including dedicated CVC, or will we still be paying line rental for a dedicated copper landline?

Technology Outlook FTTB

Overview

- FTTB is essentially FTTN, with the node being in the basement of a large MDU
- Relatively short runs of copper
- Copper is run internally within a building, therefore it is not exposed to the elements (ie water)
- Copper is generally newer than the bulk of the copper in pits + pipes
- Many of the advantages and drawbacks of FTTN apply equally to FTTB

Benefits

- Rollout is very rapid
- Rollout is generally very straightforward and tidy - the node patches directly into the MDF in the buildings basement
- Centralised (managed) power can be provided to support lifeline POTS service.
- No additional (beyond existing modems etc) NTU boxes, power supplies, batteries needed.
- No change to network service provision points. The service terminates where it does today.
- Work is generally indoors, and not subject to weather delays
- Skill set required is minimal - minimal civil works / cable pulling / etc
- There are estimated to be at least 1,000,000 dwellings which could be feasibly serviced by FTTB
- If a rapid rollout of FTTB was prioritized by NBNCo, rapid revenue growth would be achievable, and peak debt would consequently be reduced
- Most of the drawbacks of FTTN are avoided in a FTTB model

Drawbacks

- It's still only an interim step towards full FTTP
- The MDU must be large enough to make full use of an ISAM (ie, there is no financial case for installing an ISAM in an 8 premise building)
- The ISAM must be located at the buildings Telstra MDF (Main Distribution Frame) - there must be adequate space / power etc in this location.
- Resolving faults and performance issues becomes complex
- 'Finger pointing' between ISP, NBN Co, Body Corporate, Residents
- Resident owns the VDSL modem, and is also responsible for interference created by other devices connected to the telephone lines within the premise
- Body Corporate is responsible for the internal building copper between the basement and the premise
- NBN Co is responsible for the FTTB node (access to which would need to be coordinated through Body Corporate as the MDF is on private property)
- ISP is responsible for the packet level data stream (contention etc)
- The burden of this complex fault resolution process falls primarily on the RSP (Retail Service Provider)

Technology Outlook FTTdp

Overview

- FTTdp is understood to be under consideration for cases where the copper loop length from the normal FTTN node is too long to provide a suitable VDSL service
- The approach involves running fibre to a point 'close' to the destination, typically near the property boundary, where a small node is installed, and the signal is carried into the property by a short length of existing copper
- Nodes are small, and may be mounted on existing telecommunications or power poles, or installed in pits in the street
- In existing overseas markets, FTTdp is used primarily in areas of high density (e.g. UK and US markets).

Benefits

- While FTTdp makes VDSL services possible, it is difficult to identify the specific benefits this methodology offers
    - Purely a constructional work-around
- No need to replace the copper lead-in (if it is in serviceable condition)
    - My be helpful in limited cases if existing lead-in is costly to replace
        - Collapsed lead-in duct
        - Long lead-in (more typical in remote and regional areas)
        - Extensive civil work needed - concrete work, custom or decorative coverings
            - Via other neighbouring property
            - Where no alternate exists - such as aerial
    - If lead-in is damaged
- In short the cases would be where a long line length combines with a difficult civil work environment

Drawbacks

- VDSLAMs are designed to service many premises at once, areas with long loop lengths are likely to be low density and as such the justification for VDSLAM investment and maintenance decreases significantly.
- More truck-rolls as copper services cut-over is not a 'bulk' exercise

- Still requires extensive run of fibre
- If fibre is run to the boundary, it is questionable whether the cost of installing and maintaining the node is sufficiently cheaper than continuing the fibre run all the way to the property
- Nodes in pits or on poles are subject to environmental stresses
    - Environmentally hardened, small port-count nodes are likely more costly per port than other forms of node
    - Risk of higher fault rate
- Requires power from end-user or other supply
    - Unlike HFC, power cannot be injected onto backhaul medium
    - Power from the property over the copper is fraught with reliability issues due to losses and unsuitable joints
- Still requires property visit to commission, install VDSL central splitter/filter

Risks

- Risk that copper lead-in remains subject to faults despite shorter length

User Case Studies

The following anecdotal case studies have been submitted to the NBN Alliance for inclusion in our submission. They cover a range of end-user issues and frustrations with the current broadband infrastructure.

Case 1

I'm an IT professional and principal of a small consultancy. I frequently work remotely, and have employees that also work remotely. We all struggle with slow broadband speeds, but for us the most important factor is upload speeds. We are primarily content creators, not content consumers, and we're concerned that the dialogue surrounding the NBN is mostly centred around download speeds and content consumption rather than the more important issue (for business) of upload speeds. We have a strong desire to utilize cloud services, in addition to virtual presence (teleconferencing etc), which is currently not feasible when working from ADSL and Cable connections. We'd love to backup to the cloud every night – including our personal computers which are used quite heavily for business purposes – but this is just not possible at present due to the large dataset sizes that we work with. At last calculation it would take 15 days to backup just my laptop to the cloud. We'd like to virtualize more of our services, this is also very difficult with our current broadband connections. We want to pay for these things – there are opportunities for innovative Australian companies to offer these services locally - but because of poor broadband infrastructure, no one can take our money. Access to fast broadband with fast uploads would increase our productivity and revenue.

Case 2

I'm an Education Consultant who works nationally and internationally. I live in a rural area less that 150km from Canberra and Wagga and approximately 50km from the Hume Highway. Currently I have to travel by car and plane to work with my clients. If I had fast upload and download much of my work could be done virtually via virtual conferencing without travel thus reducing my carbon footprint. The poor internet access in rural areas, even those in a growth corridor like the 50km band either side of the Hume Highway, is limiting the movement of many people in similar positions from overcrowded cities to regional and rural Australia. As per Case 1, '*Access to fast broadband with fast uploads would increase our productivity and revenue*' and in my case, export revenue as well as domestic.

Case 3

We are just an average house hold in Hampton Park just outside Dandenong Melbourne 4 km from the exchange. We are receiving less than 4Mbps broadband download. This is the best we will ever get, and we are desperate to get something faster that will scale with demand over 10 to 20 years. I can only see Fibre to the home answering this for us and our kids in the future. I think it is very important that the government sets the infrastructure up once correctly the first time, so we don't have to come back to fix again in the future.

Case 4

I'm an engineer who works nationally and internationally. The company I work for produces many engineering designs and drawings from a capital city and makes heavy use of drop box to share documents, and more importantly very large engineering files. The current upload and download speeds mean that syncing between computers can take hours to share a single design and really affects the capabilities of the company.

Case 5

Our church has a bad quality copper line from the street to the premises. We get an adequate phone signal but we struggle to get a reliable and consistent ADSL connection. Part of the reason for this was the damage and subsequent repair of the cable when a new footpath was put in. Every time it rains or someone waters the garden with a hose the quality of the connection drops and the internet becomes unusable. We have spoken with Telstra in regards to fixing the line but were told "as the NBN is coming" they have decided it is not on their priority list to fix. We have put up with this for two years as the NBN was scheduled for our area (RFS date of Jan 2014). Our area has now been removed from the maps and so we are stuck without the NBN or a reliable internet service.

Case 6

I'm Executive Producer of a major UK production company, working from my office in Perth. For 50 weeks of the year, I manage this role via the internet, regularly downloading or streaming heavy content from London. I regularly endure download speeds of less than 1 Mbps - despite being less than a 1km from the central GPO. Download speeds are so slow sometimes that even emails can take minutes to come down. All of this seriously affects the time it takes to process my workload.

Case 7

Upload speeds are a major problem. I have Telstra Bigpond Cable (HFC). On a good day I get downloads speeds of 30 Mbps but they do drop off to 8 Mbps - presumably when there is heavy use in my neighbourhood. The upload speed is 1 Mbps to 1.9 Mbps. As an example of how poor this upload speed is - I'm a nurse and for work I'd edited a video presentation to highlight problems with patient care. I put it onto a USB stick (a quick transfer) to take into work with me and as a precaution I started uploading a copy to the cloud. The USB copy was fine so I didn't have to access the cloud back up - just as well it wouldn't have been there. It took 6 hours for the video to upload to the cloud.

Case 8

I'm a Business Marketing student studying in Melbourne, and I also have a Diploma of IT, Website Development. My degree finishes at the end of 2014, and my plans are to start up my own small business, utilising online marketing and advanced online business tools. At home I currently get about 0.8Mbps upload speed with ADSL2, which stops me from doing things I would like to do, such as start my own video blog, create and edit YouTube videos and practice my online marketing skills. My plans to run a small online business from home has no future with FTTN technology, or the Coalition Broadband Network (CBN). Only Fibre to the home (FTTH) can provide equitable and future-proof digital infrastructure for Australia.

Case 9

I'm a student, a musician, and a gamer living in the Blue Mountains. I have lived in 5 different countries over my 16 year life, and never have I had an Internet connection as bad as it is here in my new house. I am lucky if I can utilise the peak (as measured by SpeedTest.net) speed of 6.5mbps/0.5mbps in my house, which presents some serious problems. I live in a family of heavy Internet users, with my dad trying to run his own business, dominated by use of Internet streaming, Tumblr, which is data heavy due to the number of gifs present on the site, and gaming. These all tend to load fairly slowly, and especially with the Internet streaming, we end up having to set the quality settings to 480p or lower for it to load without buffering every 10 seconds, and I have constant drop-outs during games, which annoys the friends that I game with, for some of them this is the only major way I keep in contact.

We have many friends abroad, and due to our speeds, we find it harder than ever to keep in touch. Skype drops out every 5 minutes on vocal only chats, and don't get me started on video chats. I mentioned that I am a musician. Abroad I was able to keep 2 YouTube channels active, with uploads and everything. I recently got a 1080p webcam to do my recordings on, but I will probably never be able to utilise it because videos above 720p take over a day to upload, and often they fail before getting even a quarter of the way there.

25mbps is not going to cut it. Bandwidth usage is only going to increase with the inclusion of more and more cloud services (such as is present on the new, current generation of gaming and current generation office productivity tools such as SkyDrive) and higher quality file formats, such as 4K video under the VP9 format. In Berlin, Germany I was able to get 30mbps/6mbps speeds reliably since I moved there 2 years ago, and that was on ADSL2+, which is what I have now, and they are currently in the process of upgrading to Fibre to the Premises or Basement. If you were to do a search of FTTN Berlin it attempts to correct you with FTTP Berlin, this is a sign. We are the joke of the international telecommunications industry, and Australians deserve better.

- Maxwell Dwyer, Springwood NSW, Student (Year 11)

Case 10

I manage the IT needs for several small businesses, these businesses have a small online footprint yet we have numerous problems relating to limited bandwidth and reliability of ADSL over the current copper network.

It is not uncommon for me to receive calls numerous times a week to resolve a problem with connectivity that when traced back leads to Telstra and the copper network, just last week I had two failed fax lines and static on an ADSL service line, these problems are usually due to the age and poor maintenance of the copper network, the same network that will be used for FTTN.
Another big issue for me is dealing with online/off-site backups, my preferred method of backing up clients servers is using incremental image backups. What this does is create a snapshot of all the data on a servers hard drive and convert it to a large file. These image files can then be easily restored to another server in the event of a disaster, individual files can also be recovered.
Even though the nature of these backups is incremental meaning only changes since the last backup are sent to a new file when the backup is run, these files can be very large, ranging from a few hundred megabytes to several gigabytes. One client in particular is uploading upwards of 10 gigabytes per day in incremental image backups, this means that this client is constantly uploading and this impacts the experience of employees who need to access the Internet or who login remotely to work. A FTTP NBN would allow for a much greater upload speed and therefore no degradation in connection quality for the employees, and much quicker off-site replication of the important backup files.

All businesses should have an offsite backup, currently most small businesses resort to manually taking portable hard drives off site and rotating them (in 2014 this really seems archaic), this often causes headaches as they are easily forgotten and often damaged, this would be a trivial issue with a FTTH network using online backups.

Some clients also have multiple locations, this means that the IT infrastructure is spread out over these locations, each location has at least one server and these servers are very expensive and require regular maintenance. If there was access to a FTTH network a business could have their servers centralised in one location, and expensive server equipment would not need to be duplicated. Offsite backups would be trivial and employees could login from remote locations and work without delay, having the same experience as if they were in the office.

A FTTP NBN really would be revolutionary for Australian businesses and would benefit small to medium businesses greatly. A FTTN MTM network would just perpetuate existing problems with the old copper network, it would also provide an uneven playing field with advantages to those lucky enough to get FTTH and disadvantages to those using a FTTN connection that will have reliability issues and no quality of service guarantee.

- Paul Murphy (IT Manager, Adelaide)

Case 11

I am a home user, I live 5km from the Ipswich exchange. My telephone line is aerial for a large section leading to my house. My sync speed is 2990kbps down, 790kbps up.

During the course of this current storm season, I have already lost 4 modems to induced lightning strikes, the last one leaving me with a high leg connection where one of the phone wires becomes disconnected, no dial tone, and less than 400kbps down. This was my internet service for 2 weeks.

The limited speed impacts on what I can do with the service, more so when I have to share the connection. Optus cable is too congested to use as a reliable service. My area was on the NBN Co site as 'construction to commence', but post-election, my area has been removed. A fibre to the home service would make the internet more reliable as well as provide me with a service that will better serve 3 simultaneous users.

Case 12

Like many homes today we are drowning in digital media. Everyone has a smartphone, taking photos, videos, iTunes music, etc. I have the skills and ability to set up a home network with a central storage for this sprawling replacement of the photo albums, books and record collections of years past. But the last thing I want to be doing is setting up and running a home data centre. It is difficult, expensive and not something the wife or the kids could manage without me. I've tried to move to the cloud but that just isn't possible on the ADSL connection and we will never satisfy the on-demand generation with the forecast upload speeds of the FTTN/HFC broadband solution mix. Anything other than a broadband solution which provides equivalence in upload/download will be rejected by our children.

Case 13

I assist my father who lives in a regional town on the Mid-North Coast with his IT requirements. Being an avid photographer, he generates significant amounts of photographic images in high-resolution. His images have been used in commercial and educational settings and as part of his activities, he is significantly assisting several university professors in botanical matters and associated imagery. It is realistic to expect that the quality and quantity of his many of his image sets on Australian Native flora, fauna and built environment will become historically significant over time, in addition to more recent efforts to digitise and photograph historical aspects of the region in which he lives. Over the past 2 years, his ability to protect his work has become increasingly difficult. With a poor ADSL 2+ service, and a limited opportunity to select from cost effective ISPs, my father is unable to protect his images in any substantive way. Local backups to high-capacity media are both expensive to produce and maintain, but also becoming too small to fully backup the content generated. His ability to access cloud backup providers, or even simply to copy data across a larger geographic distance for safety is impossible. Without a future that incorporates high speed internet, capable of sustaining substantial uploaded content, his works and the value inherent in them are at risk of being lost. The impact of constrained broadband services is reflected starkly in his experiences.

Case 14

My family own and operate an accommodation and event venue (weddings and corporate functions) in Phillip Island, Victoria. We have 8 rooms for guests and a separate residence onsite. Our business receives thousands of visitors per year, mostly from overseas. We offer our guests complimentary WiFi as part of their stay.

The best available fixed line internet connection tops out at a bit over 3 megabit down, with 1 megabit up. This is completely unacceptable and hinders our business daily. The multitude of cloud services we require are close to unusable and dramatically affect the services of the guests. Take a 3/1 service and split that between 16-24 people and see how that adds up.

The lack of modern communications infrastructure hinders our business, and continues to be the source of jokes and head shaking among our guests, most of whom are from overseas. We routinely receive inquiries as to the speed of our internet, and often lose bookings due to the lack thereof.

A modern, future-proof communication infrastructure is vital and long overdue. This will have immediate benefits to our business, and Australia as a whole when foreign cash enters the Australian economy.

Case 15

As a retiree on limited income my concern is over the likely increased costs to the users of FTTN when compared with FTTH. Each node will require continuing maintenance, battery replacements, servicing & consume power. On top of this there's the maintenance of the copper (including Line Rental) to the home as well as the purchase of terminal equipment. It seems to me that the overall operating costs for a FTTN network far exceed that of fibre. These costs will be passed on to the consumer.

Case 16

My family has recently moved to a new house located merely 400m from our local Telstra exchange. At this distance, our ADSL2+ connection should be capable, according to the specifications, of the full 24mbps capability of ADSL2+. However, the maximum achievable throughput on our connection has been 17mbps due to the quality of the copper connection. We are a very high tech family, our house has been cabled with Ethernet, and currently has 25 devices which are capable of internet connectivity. Our bandwidth requirements are currently unmet and we find it difficult to simultaneously use the internet for work and play on a regular basis.

We would like to be able to backup our 260gb of precious data to new cloud services, however with our upload speed maxing out at 0.75mbps, this is simply impractical and not possible. Additionally, some activities that we currently participate in (online gaming, streaming video and working from home) will degrade the connection quality to the point where others in the family cannot use the internet. A 100mbps connection would make all these things we have been attempting in 2013 and 2014 possible, and a 1000mbps connection will mean we can do many things we can't even imagine yet.

My eldest daughter recently won a Victorian state award for animation, and is interested in pursuing a career in such a field, yet doesn't understand why it takes 3hrs to upload a 2 minute video to Youtube. Sadly the area we live in isn't scheduled for any improvement at this point and hence we will have to live with the hope of a connection that might deliver "up to" 50mbps instead of looking forward to a connection that is guaranteed to deliver what it promises.