Report on Assessment Methodology: extent to which the nbn access network is built and fully operational

November 2020

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Preface

In 2010 the average broadband speed was only eight megabits per second (Mbps), hundreds of thousands of homes had little to no connectivity, and access prices were higher than today. Now, the average broadband speed approaches 40 Mbps and the national broadband network (nbn) is available right across the nation, with all the benefits to competition that brings. NBN Co Limited (NBN Co) is proud to have built one of Australia's largest and most important infrastructure projects. Over the past decade, the company has implemented government policy by meeting the requirements of three editions of the Statement of Expectations (SOE) – each reflecting a stage in the development of the Company and its network.

Broadly, the construction of the network has been a journey in three parts: the foundation stage, the construction stage and the operation stage. In the foundation stage, there was the implementation study, employment of staff, industry consultations and establishment of the regulatory and legislative environment. The Company started developing systems and tools that would allow delivery partners to plan and construct the network and to facilitate retailers selling broadband services to their customers.

Next came the construction phase, where the volume rollout was the primary motivator and the Company focused on hitting rollout targets. Few companies have moved so quickly from a standing start to connecting a thousand new customers every hour at the peak of construction. In this context 'volume rollout' refers to the industrialised system NBN Co developed to connect a continent within a decade. This involved the large-scale design and construction of discrete modules that, on completion, were each handed over to retailers to commence selling broadband services.

As NBN Co now transitions from the build to its operational phase, it is working to maximise the public benefit of the capital invested by continuing to develop and enhance products and services that lift the digital capability of the nation. This third phase involves operating, maintaining and continuing to expand and upgrade the network. This is where NBN Co becomes a full-scale service delivery organisation centred on customer experience.

All three phases of NBN Co's development have been customer and industry led. Following the initial Implementation Study, the Company undertook a wide-ranging industry consultation on the building-blocks of its products and services, initial pricing and its network deployment plan. By working with the industry and following those plans, NBN Co is now a company with well-established processes and systems providing broadband services across Australia.

Following the 2013 Strategic Review, NBN Co adopted the Multi-Technology Mix (MTM) as the mechanism for achieving the Government's objectives of providing fast, reliable broadband to all Australians as quickly as possible and at least cost to taxpayers. In 2016, the release of the current SOE outlined the fundamental performance characteristics of the proposed network, including peak wholesale speeds of at least 25 Mbps services to all premises and at least 50 Mbps to 90 per cent of fixed-line premises as soon as possible. The 2016 SOE also focussed attention on the market environment and the requirement for NBN Co to compete and innovate like other companies in this environment. It highlighted NBN Co's role as a key industry player that needs to work collaboratively with a range of stakeholders, industry and government bodies to achieve stated objectives. Now as a mature company with a full suite of services suitable for the residential, business and enterprise markets, NBN Co is providing an essential underpinning of the economic growth and development of the nation.

As NBN Co has developed, so too have the policies, regulations and ecosystem of inter-related business and commercial arrangements that moderate and assure its operations. It is this system of contracts and regulations, such as the Wholesale Broadband Agreement (WBA) and the Special Access Undertaking (SAU), together with new legislative requirements, such as the Statutory Infrastructure Provider (SIP) obligations, that work to ensure that services are provided when and where required, under expected terms and conditions, with penalties and consequences for non-performance, and commercial drivers and rewards for success.

It is important to note here that a telecommunications network, by its very nature, is in a constant state of evolution. Connections are required as new premises are built and old ones removed; new technologies emerge and customer requirements continue to evolve. It is vital, therefore, that network operators are able to forecast and meet future demand; it is vital that systems and processes are in place to deal with outages or service interruptions to minimise impact on customers; and it is vital that NBN Co and its industry partners can continue to operate in a sustainable and efficient way. As broadband becomes more and more enmeshed in everyday life and in the wider economy, these exigencies only grow in importance.

Telecommunications companies, like other utilities, always have issues to resolve and parts of the network that need attention. The measure of a network's maturity is in the ability to adapt, to meet and overcome challenges and to grow with emerging demand. Within this context, NBN Co management puts forward the evidence below in relation to the maturity of the Company, its networks, the skills and experience of NBN Co's people, the deep relationships with industry and suppliers, and the understanding of the environment in which the Company operates.

Executive Summary

The first premises were connected to the national broadband network (nbn) just a decade ago. NBN Co's mandate then – as it is now – was to encourage retail-based competition, productivity and help drive economic and social benefits for Australians through the provision of a ubiquitous broadband network regardless of location. Set up as a wholly-owned Government Business Enterprise (GBE) under specific underpinning legislation, NBN Co is subject to various compliance requirements and is expected to operate in accordance with relevant policies and regulations to:

- Be the central means of delivering on government policy to provide access to broadband for all Australians;
- Offer wholesale-only, open-access network services to all qualified retail service providers on non-discriminatory terms, promoting efficient and effective retail-level competition, primarily via Layer 2-bit stream services;
- Operate as a commercial entity; and
- Facilitate national security and resilience in the design and ongoing operation of the network.

Section 48 of the *National Broadband Network Companies Act 2011* (the Act) requires that the Communications Minister must declare that in his opinion the nbn should be treated as built and fully operational, or declare a "pre-termination" period prior to a subsequent declaration, by 31 December 2020. This assessment report has been prepared in response to this part of the Act and follows a request from the Minister for NBN Co's advice upon which to inform a declaration that the nbn should be treated as built and fully operational.

In formulating its advice, NBN Co has provided supporting evidence against several criteria. NBN Co has addressed each of the criteria of the methodology in detail and incorporated evidence comprising descriptions of each area of activity, evidence that supports the declared status of a particular component of the network, and/or key documents and data. The report includes advice on NBN Co's processes and systems that support:

1. Identification of addressable locations to be connected to the network;
2. Tracking of Ready to Connect (RTC) and Yet to RTC premises;
3. Identifying and making services available to Yet to RTC premises and associated timescales;
4. RSPs interconnecting to the network and providing services to customers;
5. Making services available to premises in new developments;
6. Operating the nbn under all reasonable circumstances;
7. Assessing and addressing emerging Retail Service Provider (RSP) and customer service quality and product needs;
8. Risk management and appropriate mitigations;
9. Delivering the speeds set out in NBN Co's Statement of Expectations (24 August 2016) and the Statutory Infrastructure Provider legislation; and
10. Measuring and monitoring of actual peak speeds on the network.

Sensitive detail about NBN Co's security arrangements has been provided to the Minister separately.

In summary, NBN Co's response provides evidence that the company has remained focused on achieving the Government's policy intentions for this period and continues to do so. NBN Co is at an important juncture with more than 11.8 million premises Ready to Connect (RTC) and 60,000 premises Yet to RTC, and with the skills and capabilities in its workforce to be responsive to the needs of its retailers and customers and operate as an efficient and exemplary enterprise.

The response demonstrates that there are adequate processes in place to connect the diminishing number of premises Yet to RTC and to support customers with the migration of their services from their legacy network to the nbn. Furthermore, NBN Co has proven its ability to operate under all reasonable circumstances with the performance of the network and NBN Co's response to national emergencies, most recently with the 2020 Black Summer bushfires and the COVID-19 pandemic.

NBN Co has tested and refined the effectiveness of its risk management frameworks and processes, as well as its approach for identifying emerging customer needs and enabling RSPs to onboard and sell NBN Co products and services. The nbn is supporting 50 Mbps to more than 90 per cent of the fixed line footprint and 25 Mbps to approximately 98 per cent of all premises, with ongoing proactive and reactive programs in place to resolve the remaining lines. The volume of lines that do not satisfy this criteria are continuously changing as lines are improved above 25/5 Mbps through ongoing programs while simultaneously other lines fall below 25/5 Mbps due to environmental and operational factors. This is consistent with global best practice and in-line with or better than other global copper network operators.

NBN Co sets out within this report its evidence for the Minister to take into consideration in his evaluation in order to form the opinion that the network should be treated as built and fully operational for the purposes of Section 48 of the Act.

Assessment Methodology

1 The extent to which the NBN has been built

1.1 Identification of addressable locations for the volume build

NBN Co should provide evidence of the process the company went through to identify addressable locations for the volume build. This should include documentation of what was and was not an addressable location and how the company established, developed, maintained and updated its database of addressable locations.

Overview

This section documents the definition of addressable locations (i.e. premises) that NBN Co has applied in order to ensure that coverage objectives for the volume build were met. It also documents the addressing system implemented by NBN Co to manage addressable locations across Australia. A key feature of this addressing system is that it is a 'live' system whereby locations are added and removed dynamically to ensure accuracy and that there are checks in place to ensure businesses or homes are not missed.

Definition of premises

The Statement of Expectations (SOE) first published in 2010, included a definition of premises which NBN Co was required to offer a connection and of non-premises, which it was permitted but not required to connect[1]. Restating this definition in its 2021-24 Corporate Plan, a premises which NBN Co is required to connect is:

- An addressable location currently used on an ongoing basis for residential, business (whether for profit or not), government, health or educational purposes;
- A school as defined by the Department of Education, Employment and Workplace Relations;
- Within a new development at an addressable location for which NBN Co is the wholesale provider of last resort; or
- A standard telephone service activated in compliance with the Universal Service Obligation (USO).

NBN Co has incorporated these definitions in its operational processes to facilitate its addressing system to capture premises that meet the criteria for addressable locations to be connected. There are similar definitions of premises included in Telstra's Migration Plan[2] and contractual arrangements held by NBN Co such as the Wholesale Broadband Agreement (WBA), which are applied by NBN Co in the relevant contexts.

Development of NBN Co's addressing system

NBN Co has implemented an addressing system to manage addressable locations across Australia. Importantly, this is a 'live' system whereby locations are added and removed dynamically over time, including the investigation and resolution of customer enquiries.

NBN Co's core address and location system is known as the Enterprise Location Management System (ELMS).

[1] nbnco.com.au/content/dam/nbnco/documents/statement-of-expectations.pdf

[2] accc.gov.au/system/files/Telstra%27s%20Migration%20Plan%20-%2018%20November%202019.pdf

This system creates and maintains a master temporal location database, established on numerous address sources and interaction points. This includes drawing on base data from the Geocoded National Address File (G-NAF) dataset of geocoded address data for Australia (on an ongoing basis), data from interactions with Telstra, field walk-out (i.e. site inspection) data, enquiries from customers, and other sources. The system maintains a location hierarchy that, for example, maps locations to buildings or buildings to complexes.

At the commencement of the base data for NBN Co's addressing system it was developed primarily from the G-NAF dataset. This dataset is published by PSMA Australia Limited, and it seeks to record all physical addresses in Australia, as of 2020 distilling down from 30 million contributed addresses to more than 14.9 million G-NAF addresses. The dataset is built from addresses supplied by 10 contributors, including the land agencies in each State and Territory of Australia.

In addition to using the base G-NAF data, NBN Co has developed and continues to develop and maintain the addressing database via a number of processes, capturing premises which meet the criteria for addressable locations to be connected by NBN Co. These include, but are not limited to:

1. Interactions with third parties such as Telstra to validate addressing, including capturing any missing addresses and removing invalid locations;
2. Field walk-outs to validate and ensure that addressable locations are accurately captured in areas which have been made Ready for Service (RFS);
3. When NBN Co receives an enquiry from a customer, matching that enquiry to an existing addressable location in the database or adding another one if it cannot be matched;
4. Managing moves, additions and changes such as new developments or knock downs of existing addressable locations including incorporating changes in G-NAF data over time;
5. Maintenance of the addressing database using external data sources beyond G-NAF data such as satellite imagery or carrying out changes to improve addressing data quality. This maintenance is carried out on both an ongoing and periodic basis each year; and
6. Ongoing engagement with Telstra to share data with NBN Co to support processes reviewing the alignment of addresses and the validation of new addresses associated with legacy copper services.

As no external data source is fully accurate in capturing all addressable premises, these processes have enabled NBN Co to improve its addressing data to be as accurate and comprehensive as possible. It has meant that, over time, NBN Co has developed perhaps the most comprehensive and accurate database of Australian addresses ever compiled. This continuous improvement in data quality year by year has resulted in a number of changes to the total count of premises reported in NBN Co's Corporate Plans over time.

Customer interactions with NBN Co's addressing system

NBN Co's addressing system supports address-related interactions with customers. Each addressable premises is tagged with a unique location ID (LOC ID). Interactions include the provision of information to customers related to addressable locations as well as the receipt of requests related to addressable locations. The addressing system incorporates a feedback mechanism through customer enquiries ensuring that any missing addresses are investigated and resolved.

In order to facilitate retailer marketing and sales activities, NBN Co makes information available regarding addressable locations that are due to become RFS. This information includes:

1. The Proposed Footprint list (PFL): a detailed list of premises that are in the process of becoming RFS. This contains address level information, and LOC IDs.
2. The Historical Footprint list (HFL): a detailed list of premises that are in RFS areas. This contains address level information and LOC IDs. It also contains Service Class information, which provides detail on whether a premises is serviceable or has an active nbn connection.

As part of the tools offered to RSPs, NBN Co offers a service to enable the determination of whether a particular location is serviceable at a given point in time via a Site Qualification Enquiry. Where a RSP cannot locate a premises in a search, but believes the premises may be serviceable, the RSP may raise a Service Request for NBN Co to investigate via an Address Enquiry. These processes are described in the WBA Operations Manual.

Upon receipt of an Address Enquiry, NBN Co will either match the location in question to an existing addressable location in its database or add a new one if it cannot be matched. In compliance with NBN Co's SIP obligations, this process ensures that even where data mismatches may occur, no home or business is denied a connection based on location data issues.

Conclusion

NBN Co reasonably considers it has applied appropriate systems and processes to identify addressable locations to be connected and ensure that the database is as accurate and comprehensive as could reasonably be expected. These processes include use of internal and external data sources and interactions, field walk-outs in RFS areas, and a feedback mechanism whereby enquiries from customers are investigated and resolved.

Other Key Documents	Link/Attachment
Original Statement of Expectations	nbnco.com.au/content/dam/nbnco/documents/statement-of-expectations.pdf
WBA Operations Manual	nbnco.com.au/sell-nbn-services/supply-agreements/wba

1.2 Status of the Build

NBN Co should provide evidence relating to the current status of the network build. This should include information on Ready to Connect (RTC) premises and Yet to RTC premises.

Overview

On 30 June 2020, NBN Co achieved its objective of completing the volume build of the network[3], solving many complex challenges and, in the final year of construction, overcoming the impact of unprecedented bushfires and floods, along with the COVID-19 pandemic. By the end of the fiscal year 2020 (FY20), NBN Co had delivered 11.734 million premises Ready to Connect (RTC), exceeding its 2020 Corporate Plan target by more than 230,000 premises. At this time, NBN Co confirmed its position set out in the 2020 Corporate Plan that at the completion of the volume build, there would be approximately 100,000 complex connections to be delivered beyond FY20.

At 30 June 2020, there were 109,000 premises Yet to RTC, in line with Corporate Plan expectations. NBN Co has made significant progress in connecting these premises, reducing this volume to 60,000 as at 20 November 2020. As a result, NBN Co has delivered 11.854 million premises RTC, representing 99.5 per cent of its footprint.

NBN Co has detailed project plans and construction underway to resolve a significant portion of the remaining Yet to RTC premises by 31 December 2020 (see Section 1.3 below).

In practical terms, the RTC footprint can never reach 100 per cent, with a small proportion of premises being unserviceable at a given point in time, due to 'business as usual' reasons such as new developments, updated address data (i.e. appreciation), changes within existing buildings (e.g. partitioning of commercial buildings), and changes to network boundaries. NBN Co's operational processes are designed so that any such instances are resolved as quickly as possible.

NBN Co provides public transparency of these details through a weekly update on the current status of the build via the Weekly Progress Report at the NBN Co website. The Weekly Progress report sets out the number of premises in RFS areas, the number of premises RTC and number of premises RFS but Not Yet RTC. NBN Co also provides its RSPs an indicative timeframe of the RTC date for the remaining Service Area Modules (SAMs)/sites via its Monthly Rollout Plan.

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[3] NBN Co's build completion commitment was that all standard installation premises in Australia are able to connect to the nbn access network as at the build completion date. This excludes premises in future new developments which will be an ongoing activity for the Company beyond the build completion date. It also excludes a small proportion of premises defined as 'complex connections' – which includes properties that are difficult to access, culturally significant areas and heritage sites – where connection depends on factors outside NBN Co's control such as permission from traditional owners, and where network construction to allow such premises to connect will be an ongoing activity of NBN Co beyond the build completion date (NBN Co 2021 Corporate Plan, page 6).

Development of the Network Deployment Plan

Given the immense size of the Australian continent, the network deployment plan was designed to be rolled out in a modular manner with defined network boundaries (rollout regions).

The rollout regions were defined as SAMs, an area typically serving 2,000-2,500 premises for the Fixed Line footprint (smaller for Fixed Wireless areas, with the remainder being served by Satellite).

Each SAM was issued to an NBN Co design and construction Delivery Partner (DP) and progressed through each of the phases of design and construction to eventually reach the stage that the area could be declared RFS. The RFS status for the SAM signifies that the majority of premises are passed by the nbn, and significantly, that RSPs are able to begin selling services in that SAM.

Diagram 1 – Network Deployment Plan

It is important to note the distinction between RFS and RTC:

1. **RFS**: A SAM is Ready for Service (RFS) when the majority of premises are passed by the nbn and RSPs are able to begin selling nbn services in that SAM.
    a. In order to declare a SAM RFS, most premises in the SAM must also be RTC.
    b. At the time a SAM is declared RFS, in practice, for each SAM there will be a proportion of connections that are subject to complex design, access or build issues, and require additional work before these premises can be made RTC. Complex connections are discussed in further detail at Section 1.3.
2. **RTC:** A premises is Ready to Connect (RTC) when a service order can be placed, and the service can be connected within an area that has been declared RFS. Also referred to as a premises being Serviceable – see below for further detail on Service Classes.

NBN Co, in conjunction with RSPs and other stakeholders, agreed on an appropriate threshold of minimum serviceability (proportion of premises that could be made RTC) before a SAM could be declared RFS. This threshold, which varied according to the access technology, was set to provide nbn services to as many customers as possible as early as possible, while also ensuring that there was sufficient critical mass to maintain customer experience, support RSP marketing efforts and Service Delivery Partner capability.

Rolling out the network in this manner allowed the deployment to scale rapidly, while systematically resolving the remaining premises via dedicated specialist teams.

An important point to note is that a proportion of unserviceable premises in each RFS SAM at the time of declaration is a normal outcome of these processes. The alternative would be to ensure that every premises in every SAM was RTC prior to declaring an area RFS. This approach would have led to significant delays to other SAMs and to the entire rollout.

Service Classes

Once a SAM is declared RFS, each premises (LOC ID) is recorded on NBN Co's database of records for RFS premises – this is referred to as the Historical Footprint List (HFL). As set out in Section 1.1, the HFL includes the relevant data attributes that allow the RSPs to market their services.

One of the key attributes captured in the HFL is the Service Class of each premises. This refers to the classification of a premises according to the access technology and the status of the physical infrastructure applicable to that premises. A Service Class of 0 (or equivalent for each technology) indicates that the premises is unserviceable (Yet to RTC). A higher service class for each technology indicates that more of the necessary physical infrastructure is in place to allow that premises to order a service.

These service classes are set out in Table 1 below for each technology (or in the case of Service Class 7, where NBN Co has not yet determined the nbn footprint that will apply):

Table 1 – Service Class by Technology Type

Technology	**Service Classes**	
	Unserviceable (Yet to RTC)	**Serviceable (RTC)**
FTTP	0	1, 2, 3
FTTN/B	10	11, 12, 13
HFC	20	21, 22, 23, 24
FTTC	30	31, 32, 33, 34
FW	4	5, 6
SAT	7	8, 9

More detailed definitions of the various service classes are outlined in the WBA Dictionary - Definition of Service Classes (p.74-79)

Volume Rollout

On 30 June 2020, NBN Co achieved its objective of completing the volume build of the nbn. The volume rollout refers to the delivery of all of the SAMs/sites in the nbn, other than 109,000 premises as at 30 June 2020 that were endorsed for delivery beyond FY20 and fell within one of the three categories listed below. More detail about NBN Co's progress with these remaining premises since 30 June can be found at Section 1.3.

1. **Complex Connections (67,000)**
    a. Completing construction works in difficult-to-access locations and at heritage and culturally significant sites, reliance on third parties for approvals (including Fixed Wireless towers), natural

disasters (including destruction of in-progress construction from bushfires), COVID-19 site access constraints (e.g. nursing homes and some retail businesses), and late premises identification.

2. **Telstra New Development sites in Brownfield areas (25,000)**

    a. Premises that are within new developments that have been contracted to Telstra for telecommunications infrastructure at or around the same time that the nbn rollout is being deployed in the relevant area are not included in NBN Co's footprint data. There were 25,000 of these types of premises identified during FY20 that had insufficient time to undertake design work and construction to deliver these premises by the end of FY20.

3. **Technology Changes – Re-design and construction of nbn fixed line infrastructure to service premises that were previously designated to receive Fixed Wireless services (17,000)**

    a. Inability to secure a suitable site acquisition despite lengthy negotiations;

    b. Upstream capacity constraints, delays in site integration; and or

    c. Third party, environmental, landlord disputes, power or civil delays.

Current Status – Network Build

As at 20 November 2020, NBN Co had delivered a total of 11,854,082 premises RTC, with 60,106 premises Yet to RTC, meaning 99.5 per cent of the total network is RTC.

Table 2 – Percentage of Premises RTC by Technology Type

Technology / Status	Ready to Connect (RTC)	Yet to RTC[4]	Total Premises	% of Total that are RTC
FTTN	4,154,519	3,285	4,157,804	99.90%
HFC	2,513,158	9,475	2,522,633	99.60%
FTTP	2,028,956	3,553	2,032,509	99.80%
FTTC	1,478,532	17,043	1,495,575	98.90%
FTTB	621,820	15,504	637,324	97.60%
FW	620,610	10,232	630,842	98.40%
Satellite	436,487	0	436,487	100.00%

[4] The higher percentage of Yet to RTC for FTTC and FTTB technologies is reflective of the larger proportion of these footprints released closer to June 2020 than other technologies. This has meant that the progressive uplift of the complex connections is occurring later than for other technologies.

TBC [5]	0	1,014	1,014	0.00%
Total	11,854,082	60,106	11,914,188	99.50%

While premises may be deemed RTC based on the standards required for network construction, there are instances where in the process of connecting the premises upon order receipt, an infrastructure shortfall is identified. This shortfall could include faulty or degraded equipment, or complicated connection from the nearest nbn point into the premises. The clearance of these shortfalls can mean the order is unable to be completed on the initial connection appointment, and the order is placed in a hold state whilst the shortfall is resolved by dedicated teams at NBN Co. It is NBN Co's practice to retain those premises as RTC to maintain the order information and progress the order once the shortfall is cleared. As of 20 November 2020, NBN Co had 5,100 orders on hold whilst the shortfalls are resolved.

Conclusion

While a small number of premises remain to be serviced, NBN Co expects this will always be the case due to a number of factors. Importantly, NBN Co has completed the build to 99.5 per cent of the premises in Australia that it currently intends to rollout to, and reasonably considers it has appropriate processes and systems to provide access to currently unserviceable premises and to premises that continue to emerge.

Other Key Documents	Link/Attachment
Weekly Progress Report	nbnco.com.au/corporate-information/about-nbn-co/corporate-plan/weekly-progress-report
WBA Dictionary – Definition of Service Classes	nbnco.com.au/content/dam/nbnco2/2021-wba4/wbadocs/sfaa-wba-dictionary-20201129.pdf

[5] As these premises go through the design stage, a decision will be made as to the optimal technology to serve the locations. The majority of these are complex connections.

1.3 Processes for premises awaiting coverage (Yet to RTC premises)

NBN Co should provide evidence that it has appropriate processes in place to identify and make services available to Yet to RTC premises. This should include details on timescales for build and processes for addressing serviceability for yet to RTC premises where the company is aware ADSL services are being withdrawn

Overview

As outlined in the preceding section, NBN Co previously estimated in its 2020 Corporate Plan that approximately 100,000 premises in difficult-to-access locations, heritage and culturally-significant sites (i.e. complex connections) would be delivered after 30 June 2020. In the lead up to 30 June 2020, NBN Co made important headway in resolving many of these complex builds, revising its estimate to around 67,000 premises (as at 30 June 2020). This included many success stories, including resolving extremely complex sites, such as Australia's airports.

At 30 June 2020, NBN Co also incorporated an additional 42,000 premises in scope for Yet to RTC that were not originally in NBN Co's plans to provide a fixed service and were thus not part of the original 100,000 estimate. These included 25,000 premises in Telstra-served new development sites and the redesign and construction of nbn fixed line infrastructure to service 17,000 premises that were previously designated to receive Fixed Wireless services.

As a result, Yet to RTC premises as at 30 June 2020 was estimated at 109,000. NBN Co has made significant progress in connecting these premises, reducing this volume from 109,000 at 30 June 2020, to 60,000 as at 20 November 2020. NBN Co expects that a significant portion of the remaining premises will be made RTC by 31 December 2020.

At this date, NBN Co estimates that premises Yet to RTC will be approximately 35,000, meaning that approximately 99.7 per cent of the footprint will have been delivered, and NBN Co reasonably considers it has a robust plan and supporting processes in place for any remaining premises to be made RTC as soon as possible, and a plan to have just over 5,000 premises remaining Yet to RTC by June 2021.

Constrained premises

As set out in the 2020 Corporate Plan, NBN Co's build completion commitment was that all standard installation premises in Australia would be able to connect to the nbn at the build completion date. This excludes premises in future new developments which will be an ongoing activity for NBN Co beyond the build completion date. It also excludes a small proportion of premises defined as 'complex connections' – which includes properties that are difficult to access, culturally significant areas and heritage sites – where connection depends on factors outside of NBN Co's control such as permission from traditional owners, and where network construction to allow such premises to connect will be an ongoing activity of NBN Co beyond the build completion date. Outlined below and in Table 3 are the main drivers for delayed delivery of the nbn to premises:

- **Complex Connections (67,000)**
    - Completing construction works in difficult to access locations – e.g. aerial premises, sub-sea cables;

- Heritage and culturally significant sites – e.g. Aboriginal Heritage permits at Parramatta (NSW) sites;
- Reliance on third parties – e.g. in some situations, Utility assets (poles and wires) require upgrading or replacement before they are suitable for attachment of telecommunications equipment;
- Unforeseen circumstances – e.g. natural disasters, COVID-19; and or
- Late premises identification – e.g. address data matching identified one premises at a location, but at connection, an additional premises was identified in an additional dwelling. This late premises requires additional network infrastructure to be built and is classed unserviceable until remediated.

- **Telstra New Development sites in Brownfield areas (25,000)**
  - These are premises that were contracted to Telstra for telecommunications infrastructure at or around the same time that the rollout was being deployed in the relevant area.
  - Telstra's new development applications are not part of NBN Co's design and construction. As a result, these types of premises are not included in NBN Co's initial build footprint data.
  - 25,000 of these types of premises were identified during FY20, leaving insufficient time to undertake design and construction work to deliver these premises by the end of FY20.
- **Technology Changes – Re-design and construction of nbn fixed line infrastructure to service premises that were previously designated to receive Fixed Wireless services (17,000)**
  - Inability to secure a suitable site acquisition despite lengthy negotiations;
  - Upstream capacity constraints, delays in site integration; and or
  - Third party, environmental, landlord disputes, power or civil delays.

Table 3 – Examples of Yet to RTC SAMs/sites as at 30 June 2020

SAM/Sites	Area	Delay Driver
2PAR-01 and 61	Parramatta	Lengthy Aboriginal Heritage Impact Permit (AHIP) required; also impacted by the Light Rail construction
3MCT-20	Mallacoota	Bushfire impacted SAM and Transit
47 Fixed Wireless Sites	Various	a) Site Access b) Capacity Constrained
2MON-27	Scotland Island	a) Multiple complex build and approvals b) Delayed aerial material due to COVID-19
2DUR-22 and 23	Dural	NBN Co unable to supply DPUs to Delivery Partner due to air freight / supply issues

SAM/Sites	Area	Delay Driver
2MSP-20-02	Batemans Bay	Bushfire impacted SAM; ADA-02 was worst impacted area and declared a no-go zone
Net 5 Fixed Wireless Sites	Various	Site Acquisition (SAED) and Build Constraints impacting RFS of Fixed Wireless sites

Categories of constrained premises and numbers across each category

As at 20 November 2020, Yet to RTC Premises comprised 60,000, with 51,000 remaining from the baseline volume and 9,000 from newly identified premises (i.e. appreciation) post 30 June 2020, which also includes customer enquiries that have led to the inclusion of additional premises that are Yet to RTC. Since the end of FY20 through to 20 November 2020, NBN Co has received a total of 576 new address enquiries, and has to-date resolved 265.

Table 4 – Baseline and Current Yet to RTC

Yet to RTC	Baseline (30 June 2020)	Current (20 November 2020)	Net RTC Achieved (20 November 2020)
Total ('000s)	**109**	**60**	**49**
Complex Connections	**66**	**35**	**31**
Technology Changes	**17**	**11**	**6**
Telstra New Developments	**25**	**14**	**11**

Timeframes for completion

NBN Co has detailed delivery plans for the Yet to RTC premises, such that the remaining Yet to RTC will be approximately 35,000 premises at the end of calendar 2020. Note that these Yet to RTC totals include newly identified premises in FY21 thus far.

There are 5,200 premises currently expected to be outstanding beyond FY21, made up of 4,300 premises in the Parramatta (New South Wales) SAMs impacted by lengthy Aboriginal Heritage Impact Approvals and 800 premises in four Fixed Wireless sites constrained by Site Access Issues, Complex Site Acquisitions and or Planning Appeals.

For whole SAMs/sites, the expected delivery date is available to RSPs via the Monthly Rollout Plan. The expected delivery date is also available to customers by searching for their address at NBN Co's website.

Table 5 – Forecast Yet to RTC

Yet to RTC	31 December 2020	30 June 2021
Total ('000s)	**35**	**5**
Complex Connections	**24**	**5**
Technology Changes	**7**	**-**
Telstra New Developments	**4**	**-**

Identification of premises

Premises classified as unserviceable in the HFL (Service Class 0 or equivalent) are identified by NBN Co at various stages in the process leading to the declaration of RFS. In regard to premises unknown to NBN Co at the time of RFS, these are typically identified via an incoming external address enquiry or via a SIP Connection request.

Where NBN Co receives a SIP Connection request from an RSP it will assess whether the request is reasonable in accordance with NBN Co's Connections Approval Policy, accept or reject the request within legislated timeframes and then undertake the build activities required to make the premises RTC. Once the premises is RTC the RSP can order a service under the WBA.

NBN Co has a process to investigate and resolve any newly unserviceable premises:

1. **New Unserviceable Premises identified**
    a. This may be at the time that a SAM is made RFS, or subsequently, via an incoming external address enquiry.
2. **Desktop assessment**
    a. Many of these premises can be resolved via a desktop assessment, which can identify instances where the location does not require design or construction work, but can be resolved with data remediation.
    b. Alternatively, the assessment also identifies instances where the location is not in scope (e.g. Obsolete, Unmarketable).
3. **Location triage**
    a. Root-cause analysis undertaken to determine whether design and construction is required, and premises assigned to the relevant delivery program for resolution.
4. **Design and construct**
    a. Where design and construction is required, the location is assigned to the relevant delivery program for resolution and recorded in NBN Co's Yet to RTC database.

b. All options are explored to fast-track the delivery of each unserviceable location.

c. Any risks to the delivery timeframe are escalated via existing governance frameworks.

5. **Governance**

a. Each location on the Yet to RTC database is tracked until it is made RTC.

b. Any additions/deletions to the Yet to RTC database are managed via a Change Request process.

c. Progress on Yet to RTC is reviewed on a weekly basis by NBN Co's Chief Operating Officer and senior leaders at the Weekly Operations Performance Review forum.

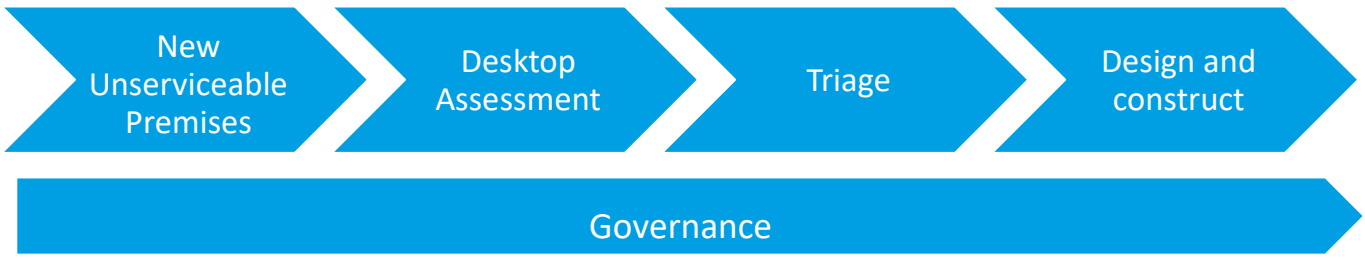
d. Actions to address escalated risks/issues are endorsed by NBN Co's Chief Operating Officer.

Process for newly discovered unserviceable premises

As outlined earlier, even with the volume rollout being complete the network will never be 100 per cent RTC due to constant changes in the footprint (e.g. new developments, updated address data and service assurance incidents). There is clear visibility of the remaining SAMs/sites to be delivered by NBN Co, with the timeline to delivery being transparent to RSPs and customers via the NBN Co website or Monthly Rollout Plan.

In addition, through NBN Co's existing processes focusing on newly unserviceable premises, any incoming unserviceable premises are identified and monitored on a daily basis by a dedicated process to ensure they are addressed as quickly as possible.

Diagram 2 – Process for New Unserviceable Premises



Impact on migration and disconnection processes in these areas

Premises Yet to RTC are typically served by existing broadband services from non-nbn providers. The most-up-to-date estimated RTC date for Yet to RTC premises is available to customers by searching for their address at the NBN Co website.

The migration/disconnection associated with the nbn rollout typically spans a period over 18 months starting with the declaration of 'Region Ready for Service' (RRFS) and ending on the Disconnection Date (DD). Post the Disconnection Date a managed disconnection regime is initiated that effectively results in premises without a valid extension being forcefully disconnected from legacy copper and HFC services. It should be noted that there are adequate mechanisms in place to extend the legacy disconnection where orders have been placed, but remain not connected by the disconnection date or where there is not a suitable nbn offering for a particular legacy service (e.g. legacy business grade services).

Premises are generally made serviceable quite early in the migration window facilitating the migration of premises to the nbn prior to the forced disconnection regime for impacted services being initiated. However, there are certain circumstances, generally associated with complex builds where premises have remained unserviceable for some time and potentially past the disconnection date.

In these circumstances NBN Co has contractual arrangements in place with Telstra, and endorsed by the regulator, to support continuity of legacy services and providing adequate additional time for NBN Co to make these complex premises serviceable post the region disconnection date. There is also a further disconnection extension afforded to the premises that are made serviceable late in the 18-month migration window to facilitate time for RSPs to market and have orders placed and completed prior to a forced disconnection regime being initiated. These arrangements have been agreed to facilitate customer service continuity, a smooth migration process and the provision of additional time for NBN Co to address serviceability for complex premises. These arrangements extend to April 2022. Further detail on the migration of services to the nbn is available for RSPs through the Telstra Wholesale portal, including dates and extensions of timeframes.

Conclusion

With 99.5 per cent of the footprint delivered and the Company on track to have 99.7 per cent of the footprint delivered by 31 December 2020, NBN Co reasonably considers this is indicative of a network that is built. NBN Co also reasonably considers it has suitable processes and plans in place to identify and resolve any Yet to RTC premises as soon as possible and has adequate arrangements available to support service continuity.

Other Key Documents	Link/Attachment
Check Your Address Webpage	nbnco.com.au/connect-home-or-business/check-your-address
Telstra Wholesale portal	telstrawholesale.com.au/nbn.html

1.4 Ability for RSPs to interconnect and provide services

NBN Co should provide evidence that it has appropriate processes for RSPs to interconnect and provide services to end users.

Overview

NBN Co reasonably considers it has established mature onboarding processes and systems to enable RSPs to seamlessly integrate and operate on the nbn. NBN Co also provides access to required information and applications for RSPs to effectively market and sell services, as well as deal with customer complaints and resolve issues as they arise during the end-to-end customer life journey.

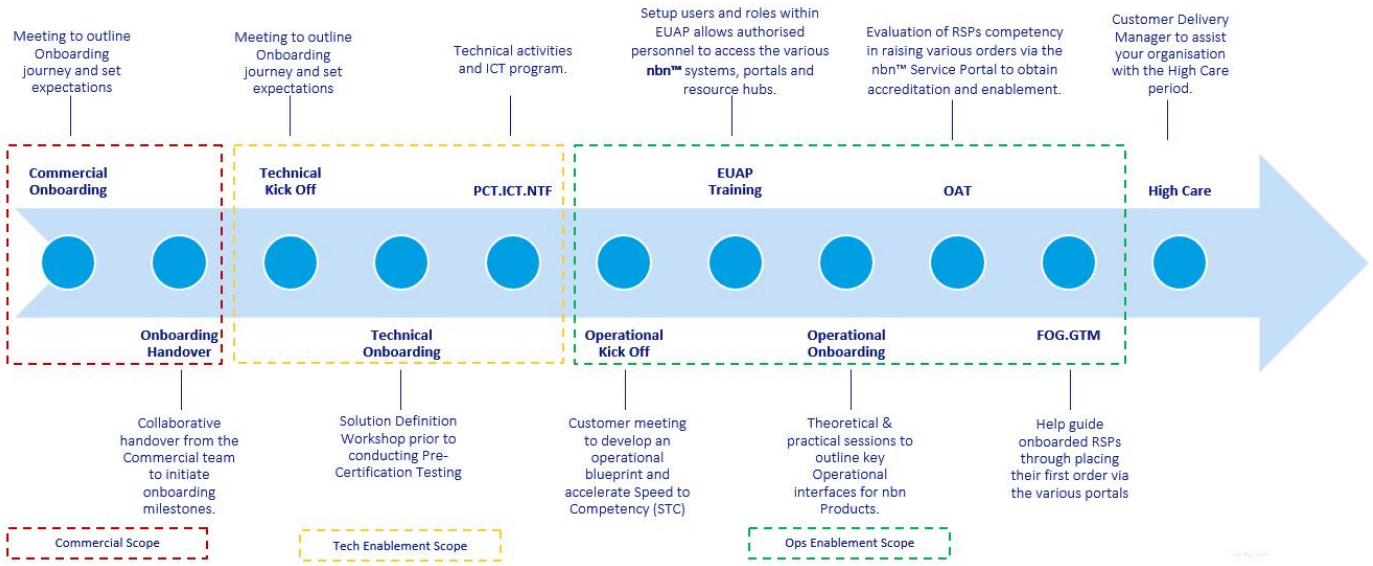
Indeed, when NBN Co surveyed RSPs last year to evaluate its 'Easy to do Business With' score (which is an evolution from previous RSP engagement surveys NBN Co has conducted), one of the key findings was praise from RSPs of NBN Co's people, and that they live the values such as 'we care' (empathy) and 'we are one team' (cooperation). The evaluation also highlighted that operational improvements were noted and appreciated by RSPs. Further, in instances where RSPs expressed a desire for further information or to be kept up to date on innovations and product developments, NBN Co has responded to feedback with improvements such as the release of an Enhanced Roadmap, which provides RSPs with a granular view of RSP-impacting developments.

Onboarding Process

Onboarding a retailer involves three phases: Commercial Onboarding; Technical Onboarding; and Operational Onboarding. This process is intended to provide the retailer with a greater understanding of NBN Co's technical requirements and operational processes to ensure that the retailer's own systems, processes and proposed Customer Products or technologies are aligned and compatible with NBN Co's network, systems and products. Each phase of Onboarding consists of several stages and each stage is composed of a sequence of activities.

Diagram 3 below illustrates the stages and activities involved.

Diagram 3 – Onboarding Process



Commercial Onboarding

For a prospective retailer, applications are submitted to NBN Co**,** by completing a Pre-qualification questionnaire on NBN Co's website. The questionnaire is to determine whether a prospective retailer is eligible to be considered to sell nbn products and services directly with NBN Co.

Subsequent to the above, the prospective retailer will complete Commercial Onboarding, which commences with the RSP completing a more detailed questionnaire, to collect further information about the company, their ability to connect and assure nbn services, and connection forecasts for nbn services.

Commercial Onboarding is then completed on the execution of the relevant commercial agreements between the relevant RSP and NBN Co. Following initial On-boarding, retailers may wish to order Products, Product Components or Product Features. Before retailers can place such orders, NBN Co may require retailers to undergo supplemental Onboarding activities. For example, NBN Co's Enterprise Ethernet and Business Satellite Services products are vastly different in construct to NBN Co's Ethernet Products. Where a retailer has initially onboarded for Ethernet Products expresses interest in expanding their offering to Business Satellite Services, NBN Co will require the retailer to undergo associated onboarding activities to ensure the retailer is adequately prepared and equipped.

Supplemental onboarding activities are initiated by advising the responsible NBN Co Virtual team member to initiate the process.

Table 6 – Onboarding Pre-Requisites

Requirements	Purpose	Document
Commercial Agreements	The Wholesale Broadband Agreement (WBA) and other commercials, such as Launch, Test and Interim agreements are required to be executed and signed prior to product onboarding and enablement.	Signed WBA and/or ILA where applicable
Contact Matrix	When complete, the Contact Matrix sets out the contact details for the Personnel from both NBN Co and the retailer who can be contacted in relation to the interactions described in the WBA.	Access Seeker Portal Administrator Contacts Form
Service Portal Request Form	Prior to Operational Onboarding, NBN Co will provide the retailer with a form to request the creation of nbn™ Service Portal accounts for the organisation's Delegated Administrator(s) and Authorised Users.	NBN Co C-User Account Request Form (v4.00.43)
EPID Code	Defines the arrangements to allow Eligible Parties to apply for Communications Alliance Eligible Party Identification Codes (EPID) and the Communications Alliance processes for the allocation and publication of those codes. Application and more information can be found via commsalliance.com.au/about-us/membership	NA
IP Range	The retailer is required to provide their Public IP range prior to Operational Accreditation Testing (OAT) so that NBN Co could whitelist those IP ranges to provide RSP access to the nbn Testing Service Portal.	NA

Technical Onboarding

The purpose of Technical Onboarding is to explain NBN Co's networks and products, network integration equipment requirements and to confirm that the RSPs technology and systems, can interoperate effectively with the nbn and products. There are two main deliverables contained within this phase of onboarding:

1. Solution Definition Workshops (conducted via face to face or video conference).
2. Interoperability Certification Testing (conducted at the National Test Facility (NTF)).

In addition, NBN Co has established systems and processes to provision RSPs with the ability to interconnect with NBN Co's Point of Interconnection (POIs) and back into their Points of Presence once onboarded.

Solution Definition Workshops

Retailers' Personnel must attend Solution Definition workshops to explain each of the following:

- NBN Co products and access technologies;
- Interfaces and related integration requirements;

- Requirements for Interoperability Certification Testing; and
- How the construction, technology and hardware architecture associated with the RSPs' Network, IT Platforms, End Customer Products, systems and services, generally need to successfully interact with the nbn, nbn Platform and Products.

Following completion of the Solution Workshops, the RSP must create a Solution Brief document which represents the network elements and configuration modes the RSP must test, in order to successfully complete network Interoperability Certification Testing.

Interoperability Certification Testing

Interoperability Certification testing is conducted at the nbn NTF, located in Victoria, to confirm that the RSP's network technology and systems can interoperate effectively with the nbn Network and Products.

NBN Co will complete a set of predefined test cases on the RSP equipment, that align with configuration modes selected by the RSP in the initial Solution Brief.

At conclusion of the Interoperability Certification Testing, NBN Co will provide a test report to the RSP, confirming test module outcomes.

Further information about NBN Co's technical onboarding can be found at Section 2 of the **nbn** Operations Manual.

Process for RSPs to interconnect

RSPs have several options to interconnect with the nbn in order to deliver broadband and phone services to households and businesses in Australia. RSPs can choose to interconnect to one, some or all of NBN Co's 121 POIs via:

- Network to Network Interconnect (NNI) – the most common way RSPs connect with NBN Co, offered as single or diverse chassis and with multiple interface options.
- Virtual NNI – enables RSPs to connect at a POI, without physical presence, via an NNI Link created by a wholesale provider.
- Intra state aggregation – available on Enterprise Ethernet only, enables a service provider to have NBN Co aggregate their customer traffic from a local POI to an NNI at one of five capital city POIs.

For access to nbn Ethernet for Satellite, RSPs must interconnect via NNI at a single, centralised POI in Sydney which covers the entire Satellite Network footprint.

RSPs can provide connectivity between their network Points of Presence to NBN Co's POIs using backhaul services either on their own network, or through a third-party backhaul provider of their choice. The backhaul services are then connected to the physical NNI via Optical Distribution Frame (ODF) Termination at NBN Co's POIs which is orderable via the Service Portal. An RSP may also choose to co-locate their equipment at a POI. There are various ways RSPs can connect these elements at a POI as depicted below, and as documented in the WBA. The elements described can be ordered, modified and disconnected via the NBN Co Service Portal as an RSP's customer base grows and moves.

NBN Co provides systems access to RSPs which provides them an ability to interact with NBN Co for the purposes of facilitating transactions involved in the establishment and ongoing management of nbn services.

This digital platform is referred to as the nbn Platform Interfacing Service (NPIS). The NPIS comprises B2B API Access (i.e. System to System) and the NBN Co Service Portal (Graphical User Interface), which RSPs may use individually or together.

The Key Business Transactions offered by the NPIS are:

- Activation Transactions;
- Appointment Transactions;
- Assurance Transactions;
- Billing Transactions; and
- Test and Diagnostic Transactions.

Underneath these Key Business Transactions are multiples of sub-transactions used by RSPs to interact with NBN Co to ensure a complete and seamless customer journey can be provided to customers.

The NPIS covers both the nbn Ethernet and nbn Enterprise Ethernet products with clear Performance Objectives for platform availability and Operational Targets for B2B response times which are made available in the respective WBA NPIS SLA Module.

Other Key Documents	Link/Attachment
Service Description, nbn Platform Interfacing Service	nbnco.com.au/content/dam/nbnco2/2021-wba4/npis/sfaa-wba-npis-service-description-20201129.pdf
Service Terms, nbn Platform Interfacing Service	nbnco.com.au/content/dam/nbnco2/2021-wba4/npis/sfaa-wba-npis-service-terms-20201129.pdf
Service Terms (nbn Enterprise Ethernet – Portal & B2B Access)	nbnco.com.au/content/dam/nbnco2/2021-wba4/npis/sfaa-wba-service-terms-nbn-enterprise-ethernet-portal-and-b2b-access-20201129.pdf

Operational Onboarding

The objective of Operational Onboarding is to transfer the knowledge required for RSPs to sell and place orders as well as enabling access to required systems and products.

The activities typically occur through a program of workshops (face-to-face or video conference) that is based on learning objectives aligned to the Products and Segments the retailer is targeting.

Admin Portal Training

The objective of Admin Portal training is to provide access and training for three critical retailer portals:

1. **nbn Customer Centre** – contains exclusive product, marketing and operations resources for RSP partners, including training documentation and user guides that can assist retailers with continuous learning and understanding of nbn products and portals (nbnco.com.au/nbn-customer-centre).
2. **nbn External User Administration Portal (EUAP)** – is a Portal that allows authorised Delegated Administrators nominated by the retailer access to nbn systems or physical access to nbn facilities (or both). Retailers are provided training on the setup, self-service capabilities and the User Account Management processes performed by the Delegated Administrator.
3. **nbn Service Portal** – is a tool that allows onboarded organisations to qualify, provision, support and assure nbn services. Retailers are provided extensive training on processes and procedures relevant to their organisational needs. The nbn Service Portal does not include direct access to, or direct use of NBN Co's core systems. An organisation can utilise this portal if they choose not to adopt B2B access or Application Programming Interface (API) integration.

Operational Onboarding Workshops

Operational Onboarding workshops involve a mix of theoretical and practical sessions to outline key operational interfaces, processes and business rules for nbn Products. The workshops focus on the following areas of NBN Co's product offerings:

- Product Overview
- Service Activation
- Service Assurance

Operational Accreditation Testing

During Operational Accreditation Testing NBN Co will complete a set of predefined test cases to evaluate the retailer's competency in raising various orders via the nbn virtual test environment.

At conclusion, NBN Co will provide a test report to the RSP and provide an accreditation notice to retailers on successful completion.

RSP Testimonials

NBN Co welcomes feedback from RSPs relating to their onboarding experience and ways NBN Co can continuously improve relevant processes, tools and systems. The duration for RSPs to onboard and interconnect is dependent on the interconnect solution an RSP selects and the resources available with the RSP. On average, between signing the WBA to an RSP placing their first order can vary between 3-12 months.

By way of an example, in 2016 one RSP had taken eight months from signing the WBA (February 2016) to placing their first customer order (October 2016). NBN Co Technical and Operational Onboarding for this RSP was completed in May 2016 and Interconnect Completed in September 2016.

However, more recently in 2020, RSPs both large and small have completed their NBN Co onboarding within only three months, e.g. for Business Satellite Service products.

The following is a sample of recent RSP testimonials given about NBN Co's operational onboarding experience:

> *'A big thank you for the time, patience and assistance provided to us in training and onboarding. Looking forward to placing our first order.'* (nbn RSP, October 2020)
>
> *'Thank you very much to everyone in the NBN team engaged to ……. complete the required ABS3 Certification. A very special thank you to:*
>
> > *….for being available (and very patient) all the time to provide the required updates, E2E support, documentation and escalations…*
> >
> > *….for their prompt and excellent support during trial on-boarding and certification…'* (nbn RSP, August 2020)

Complaint and Dispute Management

Complaints are managed through the nbn Service Portal with access provided to the retailer's delegated admin and retailer personnel nominated during onboarding. Ongoing user access is self-managed by the RSP via the EUAP portal.

Under the Wholesale Broadband Agreement (WBA3), NBN Co and its Customers agree to manage and resolve disputes that may arise under or in relation to WBA3 in accordance with a set of rules that are set out in Module G of the Head Terms of WBA3 (the Dispute Management Rules 1). The same Dispute Management Rules apply to other Agreements that NBN Co uses to supply other products to its wholesale customers, such as the Satellite Mobility (LCPA) Agreement, and Testing Arrangements that are published as Standard Forms of Access Agreement at NBN Co's website.

For further information about NBN Co's dispute process, please refer to the key documents listed below.

Other Key Documents	Link/Attachment
NBN Co Complaint Policy	nbnco.com.au/content/dam/nbnco/documents/complaint-policy.pdf
NBN Co Dispute Process	nbnco.com.au/content/dam/nbnco/documents/complaint-policy.pdf

Wholesale Broadband Agreement (WBA)

The WBA is the primary supply agreement with RSPs that sets out the terms of supply for NBN Co's products, including nbn Ethernet and nbn Enterprise Ethernet, together with supporting products Facilities Access Service, nbn Platform Interfacing Service (NPIS) and the Sandpit.

The WBA and NBN Co's Special Access Undertaking (SAU) (explored further below) may be considered as complementary arrangements. While the SAU is a framework containing commitments to the Australian Competition and Consumer Commission (ACCC) until 2040, the WBA is a commercial contract that provides more detailed terms and conditions of supply and has a standard term of two years.

In accordance with Part XIC of the *Competition and Consumer Act 2010*, NBN Co publishes the WBA as a Standard Form of Access Agreement (SFAA) at its website. It is available at nbnco.com.au/sell-nbn-services/supply-agreements/wba

The WBA forms the basis of bilateral Access Agreements between NBN Co and each RSP. The WBA, along with the Access Agreements based on it, underpin the revenues generated from the supply of nbn products to RSPs, and manage the risk associated with such supply. In this way, the WBA is a critically important agreement in the Australian telecommunications industry. From the original WBA, first published on 30 November 2011, it has evolved into a modular, framework-style agreement that has proven capable of scaling in line with industry growth and RSP purchasing decisions.

WBA objectives and key features

It has been vital that NBN Co's supply arrangements are responsive to many variable factors over the years, such as technology and market changes, customer experience, and RSP engagement. Nonetheless, the development of the WBA has consistently been informed by the following objectives:

- Affording certainty about the terms of access to NBN Co's products and services.
- Delivering a mix of wholesale products and services that enable RSPs to connect and serve Australians, while offering an appropriate return on investment to NBN Co shareholders, on behalf of taxpayers.
- Fostering competition and innovation by offering direct access to qualifying service providers, regardless of their size.
- Providing attractive wholesale products that are designed to encourage better customer experience while maintaining the flexibility required by RSPs to differentiate their retail offerings.
- Flexibility to take account of variants as NBN Co deployed its network, including policy or regulatory change (e.g. wholesale service standards, new developments).

WBA evolution

When setting the first WBA (WBA1), NBN Co completed multiple rounds of industry consultation, inviting written submissions and opportunities to participate in deep dive sessions to discuss feedback to gain knowledge of the issues and concerns of industry. This was used to revise and improve the drafting of the WBA to address the needs of both NBN Co and RSPs in a balanced and appropriate manner.

The current WBA (WBA3) expires on 30 November 2020. NBN Co has been negotiating with RSPs to agree the terms of the next WBA (WBA4) – which is projected to govern the supply of more than 8 million services – since May 2019. NBN Co is currently working towards making revised commercial terms of access available to Access Seekers from December 2020. There are over 70 groups of changes proposed to be made as part of WBA4, thus ensuring that the agreement is optimised for the next supply period. There are presently 63 WBA3 signatories and this number continues to grow.

Testing arrangements

It is also worth noting that an SFAA in the form of a Test Agreement has also been made available on NBN Co's website (available at nbnco.com.au/sell-nbn-services/supply-agreements/testing-arrangements), consisting of Standard Test Terms and numerous Test Descriptions that set out terms specific to the various particular testing programs in which RSPs can choose to participate. These testing arrangements have proven to be a highly effective way of allowing NBN Co and RSP participants to trial or conduct business-readiness testing in relation to the supply of test products, features, facilities, systems and processes ahead of the commercial supply of those products and services.

Enabling our Retail Service Providers (RSPs)

There are a number of strategic enablers that NBN Co deploys to ensure that it delivers systems and information that are easy to use, tools that are effective, and processes that remove complexity and overhead. This is exemplified by the following:

- **Virtual Teams** are in operation to ensure cross-functional alignment between NBN Co teams supporting RSPs. Specifically, Virtual Teams are assigned leads from all relevant parts of the company to ensure coordination and focus within each account. Virtual team meetings are held with regular cadence, and RSP scorecards are produced to help measure the success of the RSP engagement approach.
- For over five years, NBN Co has offered RSPs a co-investment program called the **Marketing Development Fund** (MDF) where NBN Co matches RSP funding at a proportion appropriate for the program for approved nbn focussed activities. Through the MDF, NBN Co provides funding to support an RSP's marketing and channel activities that result in new activations on the nbn. As a result of the completion of the volume build, and the consequent decline in the need to migrate and acquire legacy technology customers, the MDF Program has recently expanded to include two new programs:
    1. the RSP Development Fund (RDF): which provides funding for internal RSP nbn focussed operational and customer support improvement activities; and
    2. Base Development Fund (BDF): which provides funding for RSPs to manage their nbn connected customers via base management activities that result in an increase or extension of Customer Lifetime Value.
- The **nbn FSA Profiling Tool** has been developed in conjunction with a data analytics agency to provide unique insights into Fibre Serving Areas (FSAs). This online tool combines multiple data sets to build an nbn take-up model and breakdown of the key demographics and other insights for each FSA profiled. It covers FTTx, HFC and limited Fixed Wireless areas and can be used in several ways to help RSPs maximise their marketing effectiveness, facilitated by a greater understanding of the nature of the inhabitants of each FSA. For example, the tool provides insights that could assist an RSP to: plan when to be in market by FSA; better target communications and messages; offer the most suitable product mix; and choose locations based on projected success rates. The FSA Profiling Tool is available to all RSPs who have signed an agreement with NBN Co. For regional areas, NBN Co has also developed the Regional Media Coverage tool, which is used to help identify the media options available outside of metro areas, and the availability of nbn in these regional media coverage zones. The Regional Media Coverage tool provides footprint

numbers overlayed on regional media coverage zones and enables the planning process for RSPs to be accelerated by facilitating quick analysis of available nbn and media markets.

- The **Wholesale Support Program** has been established to allow Downstream Access Seekers to receive certain nbn related information directly from NBN Co or via the nbn Customer Centre. In these cases, the Downstream Access Seeker signs an Information Agreement with NBN Co and is verified as a Downstream Access Seeker by their participating Wholesale Provider.
- Multiple RSP Communications channels are managed by NBN Co to deliver crucial information to RSPs in a timely and effective manner. This includes:
    - **Contract communications (via Wholesale Supply Contract Manager):** this covers communications sent from a Contract Manager mailbox to a defined class of recipients within each RSP organisation. Examples include WBA consultations as well as notifications issued in accordance with the WBA change process.
    - **Operational and automated communications:** NBN Co has created lists of contacts, as advised by the account team and RSPs, that fall into three main categories: Operations; Commercial; and Sales and Marketing. For operational matters, Operations Bulletins are sent to all RSPs via their nominated representative. Similarly, with any commercial communications (for those which are not distributed by contract communications), NBN Co will provide information on RSP incentive campaigns, briefing packs, etc.
    - **Direct communications with RSPs:** This can be informal (i.e. communications exchanged between NBN Co Account Managers and their RSPs where the Account Manager discusses information relating to only that account) or formal communications between the NBN Co Account Manager and their RSP(s). In these cases, an Account Manager can direct the information to the most relevant contact in the business, particularly where it pertains to that RSP or does not otherwise fall into one of the clear categories above. All Account Teams are instructed in this instance to send a pre-prepared communication (with no changes apart from personalisation). To ensure that there is no information asymmetry, NBN Co also highlight these emails to all RSPs in a Friday Bulletin called the Weekly Wrap. If for any reason an RSP did not receive the email, or more likely missed the email, it can follow up with the NBN Co Account Team.
    - **Product Development Forum (PDF):** For completeness, NBN Co also distributes PDF papers and notices as a further category of formal communications. The PDF is explored in more detail in other parts of this Report.

Conclusion

NBN Co reasonably considers it has developed comprehensive processes and systems to facilitate RSPs easily interconnecting to the nbn and providing services to customers.

Other Key Documents	Link/Attachment
Wholesale Broadband Agreement SFAA	nbnco.com.au/sell-nbn-services/supply-agreements/wba

Other Key Documents	Link/Attachment
Test Agreement SFAA	nbnco.com.au/sell-nbn-services/supply-agreements/testing-arrangements
FSA Profiling Tool summary	Attachment 1

1.5 Processes for new premises (premises in new developments)

NBN Co should provide evidence that it has appropriate processes in place to make services available to premises in new developments in accordance with the Telecommunications in New Developments Policy and its Statutory Infrastructure Provider (SIP) obligations.

Overview

The market for new developments is diverse, comprised of:

- Highly-profitable broadacre developments in which NBN Co competes with a range of carriers for developer contracts.
- Larger urban Multi-Dwelling-Unit contracts which are also served on a competitive basis.
- Smaller developments and urban infill projects which are less commercially attractive and generally fall to NBN Co as provider of last resort.

NBN Co's New Developments program commenced in 2011 and since then, NBN Co has worked closely with developers to build relationships and products that make it a competitive and attractive construction partner for larger developments, and implement systems and processes to ensure residents of other new developments have access to fast, reliable broadband. As of 12 November 2020, NBN Co has delivered 948,717 premises in new developments RFS, with 618,099 premises activated on the network.

Background

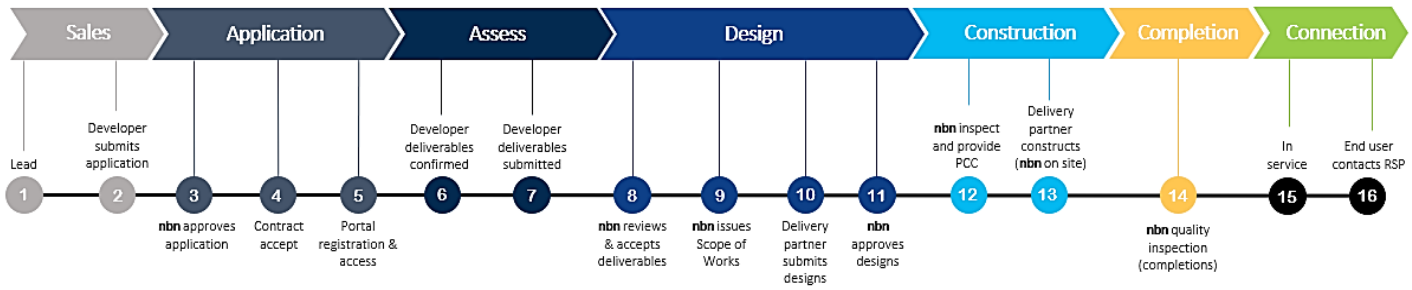
NBN Co's obligations in new developments have historically been defined by Government policy. In June 2010, the Government announced that from 1 January 2011, NBN Co would be the provider of last resort for telecommunications services in new developments within or adjacent to its long-term fibre footprint and would meet the cost of doing so. An update released in June 2011 clarified the arrangements applying from 1 January 2011 making NBN Co responsible for:

- New developments of 100 or more premises, whether broadacre or infill, which receive Stage 5 (civil works) planning approval after 1 January 2011.
- Developments, irrespective of size or type, in areas where NBN Co has already rolled out fibre and the fibre is ready and capable of connection.
- Developments in areas where NBN Co has publicly identified the area as a rollout region—this is on the basis rollout regions will be announced 12 months prior to the ready-for-service date.

On 1 March 2015 the Government, responding to industry concern with the original policy, released the *Telecommunications in New Developments* (TIND) policy, with recent amendments issued in September 2020. Under the TIND policy, NBN Co is obliged to service new developments with broadband infrastructure upon reasonable request; i.e. it is the default infrastructure provider. NBN Co is also expected to charge developers for the infrastructure and services it provides. NBN Co has operationalised a range of processes and systems to facilitate meeting the most important objective of this policy; i.e. that people moving into new developments receive ready access to modern telecommunications.

The types of new developments that NBN Co services include empty lots or subdivisions of land including Single Dwelling Units (SDUs), multi-dwelling/high rise buildings (MDUs) or Horizontal MDU/townhouse projects and super lots (lots that will be subdivided at a later stage).

Diagram 4 – NBN Co's New Developments process



NBN Co's responsibilities for new developments extends to:

- Assessing and confirming a new development application, and charges involved;
- Reviewing and approving plans, designs and site inspections, and providing feedback to the developer (as needed);
- Providing applicable approval documents; e.g. letter of conditional approval (also known as a council letter);
- Installing, testing and activating network infrastructure at a new development premises; and
- Where there is no wholesale telecommunications carrier at a new development, undertaking NBN Co's role as default SIP for Australia, and installing and activating nbn service/s at the premises.

Developer responsibilities for new developments include:

- Providing telecommunications infrastructure at the development.
- Selecting a wholesale telecommunications carrier to serve their development.
- For NBN Co infrastructure:
    - submitting an online nbn New Developments application and plans for assessment.
    - entering into an agreement with NBN Co for the installation of network infrastructure by NBN Co and paying the relevant charges.

- designing and building any works to be performed by the developer to NBN Co's standards.
- submitting as-built designs and Notice of Practical Completion (PCN) (if applicable) to NBN Co.

- Installing fibre-ready pit and pipe for use by wholesale telecommunications carriers. Exemptions from pit and pipe installation requirements can be sought for certain types of developments, for example in rural bushland and remote locations that meet strict criteria. NBN Co maintain a register of developments exempt from these requirements.

Statutory Infrastructure Provider (SIP) regime

Once a declaration is made that the nbn can be treated as built and fully operational, NBN Co will be the default SIP for all of Australia and will be the designated SIP for the majority of Australia consistent with its obligations.

This is in accordance with the *Telecommunications Legislation Amendment (Competition and Consumer) Act 2020 (CC Act)* which amends the *Telecommunications Act 1997* to incorporate the SIP regime. In most instances, where non-nbn wholesale telecommunications carriers are contracted to service new developments those carriers will be the SIP for those areas.

The key obligations of SIPs are to connect premises upon reasonable request from a customer via a carriage service provider to a network capable of providing qualifying carriage services. Qualifying carriage services are wholesale broadband services with peak speeds of at least 25/5 Mbps. On fixed line or fixed wireless networks, the qualifying carriage service must also be capable of supporting voice services.

SIPs must publish the terms and conditions on which they offer to connect premises and supply eligible services to carriage service providers. NBN Co's Connection Terms and Conditions governing SIP connection requests are published at its website and the supply of eligible services is governed by NBN Co's WBA. Connection requests for new developments are managed according to NBN Co's standard New Developments process (and not the Connection Terms and Conditions) which is outlined below.

NBN Co has also published a Connections Approval Policy (CAP) which sets out the circumstances when NBN Co will consider that a request is not reasonable under the CC Act. The CAP and the Connection Terms and Conditions will be reviewed periodically by NBN Co after the built and fully operational declaration.

Application process for developers

NBN Co's processes (including charges) for developers to apply for the installation of nbn infrastructure at a new development are outlined at its website. If a developer approaches NBN Co, they can enter into an agreement with NBN Co to provide telecommunications infrastructure (voice and broadband services) at their development. NBN Co's guidance for developers regarding the timeframes to be met for services to be delivered ahead of occupancy, highlights the importance of early planning. Developers are advised to apply at least six-months prior to the first occupancy date to help ensure services can be provided in a timely fashion, though processing times for smaller developments may only require three months' notice. Developers are charged in accordance with the rates specified at Annex A of the TIND policy and are consistent with the charging policy and schedule NBN Co has lodged with the Minister for Communications. The end-to-end process for connecting new developments to the nbn is also outlined for developers at NBN Co's website.

Non-standard developments

A non-standard development occurs when a developer has not submitted an application to NBN Co or another network carrier and has not installed fibre-ready facilities or pathways at a development, and as such there is no network connection at the premises. When a customer moves into this type of development, they may contact NBN Co for an nbn connection and it is at this stage a New Development application is initiated (by NBN Co).

In this scenario, NBN Co does not receive developer charge contributions, a developer access agreement or any design documentation. NBN Co is required to undertake a more complex process to get pit and pipe installed at council verges or make arrangements with the property owners or body corporates to access the development.

For apartment projects in vertical (high-rise) multi-premises locations, the absence of fibre-ready facility pathways and spaces can lead to a more complex bespoke deployment. Bespoke solutions often require a technology other than FTTP. This scenario involves a higher cost per premises for NBN Co to deploy its infrastructure and additional obligations for owners' corporations to provide space and long-term power for the alternative technology equipment.

These non-standard cases primarily occur in regions without a telecommunications provisioning requirement in local planning arrangements. NBN Co proactively engages with Commonwealth, State and Local Governments and industry groups to promote and encourage the inclusion of telecommunications provisioning in local planning schemes.

Communication channels with developers

There are numerous avenues for developers to find information and interact with NBN Co in relation to connecting new developments, including:

1. **Website** – the New Developments section of the NBN Co website provides step-by-step instructions and guidance on how to get a new development connected, as well as FAQs and avenues for contacting NBN Co via the Contact Centre support team.
2. **Contact Centre** – the NBN Co Contact Centre team is trained to address New Development enquiries and a process is in place to refer and assign more complex cases to technical response teams.
3. **Portal** – the NBN Co New Developments portal is available for developers who require civil works as part of their build. The portal provides information on build progress, advises developers of timelines and when items are due (e.g. designs). Enquiries from the Portal are managed by the Contact Centre team, who direct cases to back office teams that support developers in their preparation activities.
4. **Technical teams** – specialist teams are available to assist developers including NBN Co's Account Manager team (Sales) and deployment specialists who interact directly with developers throughout the build process and can assist with designs and build elements.
5. **Industry consultants** – developers are encouraged to engage an-nbn trained supplier for better project outcomes. NBN Co works closely with industry consultants on standards and customer education.

New developments completed, in train, forecast

As of 12 November 2020, NBN Co has delivered network infrastructure to a total of 948,717 new development premises (life to date).

- The majority of these premises are located in Victoria and New South Wales with approximately 300,000 premises per state, accounting for 63 per cent of the total. Queensland makes up a further 190,000 and Western Australia, 110,000.
- 92 per cent of all connected premises within new development areas are connected with FTTP, ~40,000 are FTTN, ~26,000 are HFC and the remainder are connected with FTTB or FTTC. The installation of FTTN/B/C or HFC primarily occurs in small infill projects where the local technology (FTTN and HFC) can support the connection and is the most cost-effective way to deliver the small increase in the number of premises (typically four premises or under).

NBN Co is expecting to deliver a further ~103,000 developments by FY21, which will take the life to date total to just over 1.02 million premises RFS.

- Total Work in the pipeline (defined as developer contract signed, and not yet RFS) as 1 November 2020 equates to ~293,000 premises, with 90 per cent planned to be FTTP.

Late delivery of nbn services to customers is primarily (more than 85 per cent) caused by developers lodging their application late (less than 6 months to occupancy date) and/or not submitting an application to NBN Co at all, meaning NBN Co is first aware of this issue when residents try to order a service with an RSP.

The following is a summary of NBN Co's developer delayed sites as at 1 November 2020:

- Delayed sites equate to <2 per cent of all New Development applications.
- Of these, the majority (85 per cent) of these applications continue to be from small developers with late or non-standard applications.
- In some cases, a delayed site may have an occupant (person residing in the premises). These are referred to as 'occupied sites'. Of these occupied sites, we have seen a strong trend downwards reducing month on month by an average of 12 sites per month for the 2020 calendar year.
- The majority of delayed sites (81 per cent) are delivered within 6 months of the reported Estimated First Service Connection Date (EFSCD), and 98 per cent now within 12 months.
- There are currently 150 delayed sites in NBN Co's New Developments program. Of these, New South Wales, Victoria and South Australia account for the majority with 117.

Process for tracking new developments including overbuilding, non-fixed line connections and charging

The process for tracking NBN Co's new developments are as follows:

- **Web form:** The webform enables the developer or their representatives to register development details and relevant masterplan designs for NBN Co to review and assess. Once the webform is completed, the applicant receives a reference number and an email confirming the lodgement of their project.

If the application is under NBN Co's premises threshold and is outside NBN Co's fixed line footprint, the applicant is advised that the development is unable to receive nbn fixed line infrastructure as it does not meet NBN Co's criteria for this type of connection, for example it's cost prohibitive to install fixed-line infrastructure to the development. The applicant is encouraged to consider their eligibility for an nbn Fixed Wireless or nbn Sky Muster satellite connection.

- **Project assessment:** Once an application is submitted on the webform, the information is stored in NBN Co's Customer Relationship Management (CRM) system, Salesforce. NBN Co's assessment process includes validation of requirements (e.g. location, build type, available technology, number of Network Termination Devices (NTDs) and timings). Once approved, the contribution charges are confirmed as per the Government's TIND policy, and the terms of the agreement are provided to the developer and/or authorised representative for acceptance.

  If an application for a new development (over NBN Co's premises threshold) is outside NBN Co's fixed line footprint, it is assessed and if the cost per premises (CPP) for a fixed line installation is cost prohibitive, NBN Co will not proceed further. The Account Management team will discuss this with the applicant including the reasons for not proceeding with the application in Salesforce due to high CPP. The applicant is advised to engage with NBN Co's RSPs available at this address to supply a Fixed Wireless and/or Satellite service to the development. A record of all application rejections including reasons are maintained in Salesforce.

- **Developer Portal:** Once an agreement is signed, the developer and/or their representatives are given access to the nbn New Developments Portal; the portal is available for developers who require civil works as part of their build. The portal provides information on build progress, advises developers of timelines and when items are due (designs etc). Enquiries from the Portal are managed by NBN Co's Contact Centre who direct cases to back office teams/Relationship Managers that support developers in their preparation activities. Alternatively, developers and/or their representatives can contact the respective Relationship Managers for updates on their projects.

  For large projects where multiple stage applications are required, the developer and/or their representative can submit stage applications via the portal and follow the same steps for design reviews and inspection of pathways/pit and pipe leveraging the support of their Relationship Manager when required.

- **nbn EVO Maps:** All NBN Co's new developments data and footprint are stored in a system called EVO Maps. This system allows for other relevant parts of NBN Co to have visibility of greenfield projects within the nbn footprint.

Conclusion

NBN Co reasonably considers it has appropriate processes in place to make services available to premises in new developments in accordance with the Telecommunications in New Developments Policy and the SIP obligations.

Other Key Documents	Link/Attachment
Connections Approval Policy (CAP)	nbnco.com.au/corporate-information/about-nbn-co/policies/telecommunications-policies
Connection Terms and Conditions	nbnco.com.au/corporate-information/about-nbn-co/policies/telecommunications-policies
NBN Co New Development Process	nbnco.com.au/develop-or-plan-with-the-nbn/new-developments/application-process
NBN Co New Development Charges	nbnco.com.au/develop-or-plan-with-the-nbn/new-developments/government-policy-for-new-developments

2 The extent to which the NBN is operational

2.1 Ability to operate under all reasonable circumstances

nbn should provide evidence that it has an appropriate suite of processes, metrics, and systems to operate under all reasonable circumstances. This should include a set of operational metrics and their associated descriptions and targets used to monitor operational, service management and network management systems

Overview

When it comes to network operations and assurance, the aim is firstly to prevent and minimise network incidents to the greatest extent possible and to respond quickly to restore services when incidents do arise. NBN Co has built and matured its network management and operations environments, processes and systems as the network build has progressed at pace. Today, NBN Co reasonably considers it operates state-of-the-art network-monitoring capabilities 24 hours a day, 365 days a year across the entire multi-technology network. The Network Management Centre (NMC) is the nerve centre of the nbn and is accountable for a range of operations processes including network monitoring, network diagnostics and network restoration to help ensure the nbn is available around the clock for all connected Australians. In addition to these business-as-usual processes NBN Co reasonably considers it also has mature processes and systems to prepare for and respond to widespread weather events and natural disasters under an emergency management framework.

In its early days, NBN Co managed a single operations centre covering both single service faults and network faults affecting large numbers of services. This environment served NBN Co well when the network was comparatively smaller and less complex. As the network build accelerated and the size and complexity of the network requiring assurance expanded, it became necessary for NBN Co to scale its operations teams and capabilities in order to meet its contractual, regulatory and customer targets. For the past 10 years, NBN Co has carefully balanced the network build and infrastructure rollout while operating a live network in parallel. This has presented many unique and complex challenges over the years and organically led NBN Co to constantly improve and strengthen its systems and processes at every opportunity.

Today, NBN Co operates a multi-tiered assurance framework with dedicated specialist teams accountable for the management and resolution of single service customer faults, resolution of unplanned outages impacting the network, provision of highly specialist technical and vendor support, as well as planned network maintenance and upgrades. The NMC is responsible for managing the availability of the production network and restoring unplanned network outages through industry-standard event and incident-management processes.

Across key operational and assurance metrics, NBN Co has seen significant and continuous improvement. Two years ago, for example, the average time it took to restore services following a network fault affecting customers was 10.6 hours. Today, that is at less than six hours and NBN Co continues to improve and refine its processes.

Management of network issues

Network Event Management

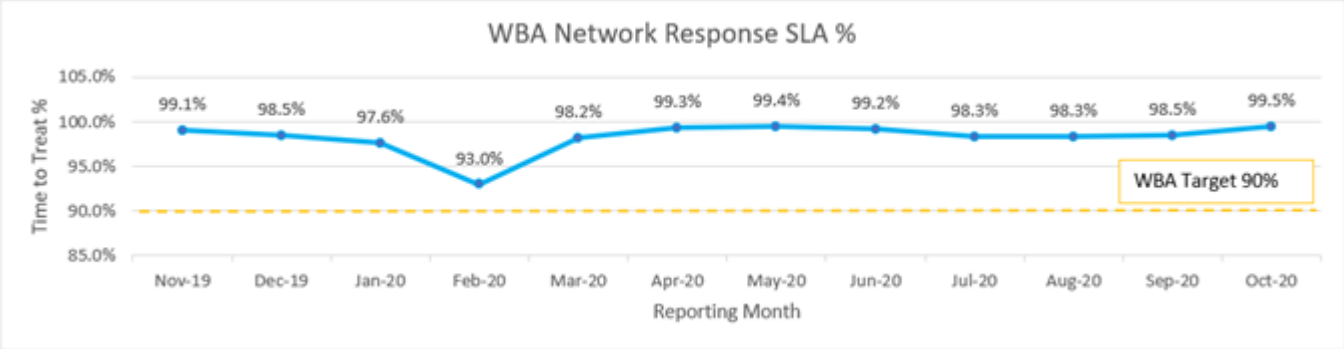
Event management is the process by which the NMC responds to events occurring within and across the national network.

These events are presented to a team of network engineers through network alarms, which trigger when a change to normal operating behaviour is detected by any of the multitude of network devices located around the

network. Every device that comprises the nbn is remotely managed by an element management system (EMS). The purpose of an EMS is to collect alarms from network devices and aggregate them into one point for easy viewing by network engineers. The EMS can also be used to execute remote troubleshooting steps and provision new services across the network. NMC Engineers undertaking the role of event management will primarily use the Tivoli Netcool platform developed by IBM to monitor network alarms.

NBN Co manages an expansive production network and as such its element management systems generate hundreds of thousands of alarms every day. It is important that these alarms are managed quickly and where an alarm indicates the presence of a network outage impacting customers it is critical that the alarm is 'treated', and an incident created through the incident management process to progress resolution of the issue, with appropriate urgency to meet in accordance with the WBA terms. The NMC performance is measured on how quickly it assesses alarms generated in Netcool and progresses the alarm onwards to the incident management process for diagnosis and informing our customers via the nbn Service Portal. This measure is called 'WBA Network Response SLA' and measures how frequently NBN Co communicates unplanned network outages to customers within the target timeframe. The WBA sets out a service level of 90 per cent each month; however, NBN Co manages its operations to an internal stretch target of 95 per cent. In the 12 months to October 2020, NBN Co was performing at an average of 98.2 per cent, peaking at 99.5 per cent.

Diagram 5 – WBA Network Response SLA %, 12-month performance chart



**** WBA Network Response SLA % across the 12 months from November 2019 – October 2020.The dip in performance over January and February 2020 is attributed to Black Summer bushfires.***

Network Incident Management

Incident management is the handling of an unplanned outage that has occurred within the nbn and consequently caused a disruption of service to multiple customers. An incident may be triggered as an output of the event management process through a network alarm, a fault reported by customers via their RSP, or via technicians reporting an issue out in the field. When a network outage has been identified, the NMC will begin by performing an impact assessment using data from NBN Co's Physical Network Inventory (PNI) database to determine the volume of customers affected.

Following this, the NMC will immediately begin diagnosis to determine the cause of the outage and once confirmed will develop a restoration plan to restore services as quickly as possible. Depending on the affected network technology, this plan may include collaboration with NBN Co partners such as Ericsson, dispatch of field technicians to site and provision of spares or replacement equipment.

An incident is resolved when all disrupted services are restored; this may occur either remotely or through field attendance depending on the root cause of the outage.

Incidents are managed in 'Remedy', which is a platform designed to record notes and a log of events against each individual incident. NMC Engineers work on these incidents by progressing them through the diagnosis and restoration lifecycle in Remedy, recording detailed notes, and relating them to other incidents or items across the Remedy database to allow easier management of network outages, complex customer impacting events, trending and future improvement opportunities.

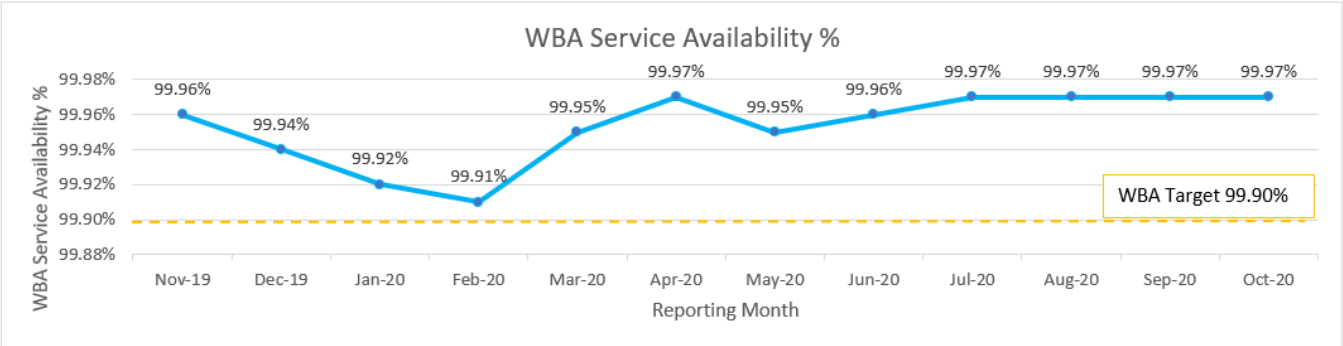
Metrics for performance

NBN Co has many operational and customer centric metrics, as well as contractual and regulatory metrics, which are used to assess the performance of its incident management processes. Some of these metrics are published externally and viewable by the public at NBN Co's website here.

Of the many network management and operations metrics NBN Co tracks, the most critical are:

a) **WBA Service Availability:** WBA Service Availability is a metric described in the WBA which measures how available the nbn is to customers. The metric assesses all the downtime experienced by customers due to both unplanned network outages and single service faults and calculates the percentage of network uptime based on the number of active services connected to the nbn. The WBA sets out a target of 99.90 per cent availability each month; however, NBN Co manages its network to an internal stretch target of 99.95 per cent as it recognises the inherent link between network availability and customer satisfaction. NBN Co has consistently met and exceeded both its WBA and stretch targets, averaging 99.95 per cent over the last 12 months, peaking at 99.97 per cent.

Diagram 6 – WBA Service Availability %, 12-month performance chart



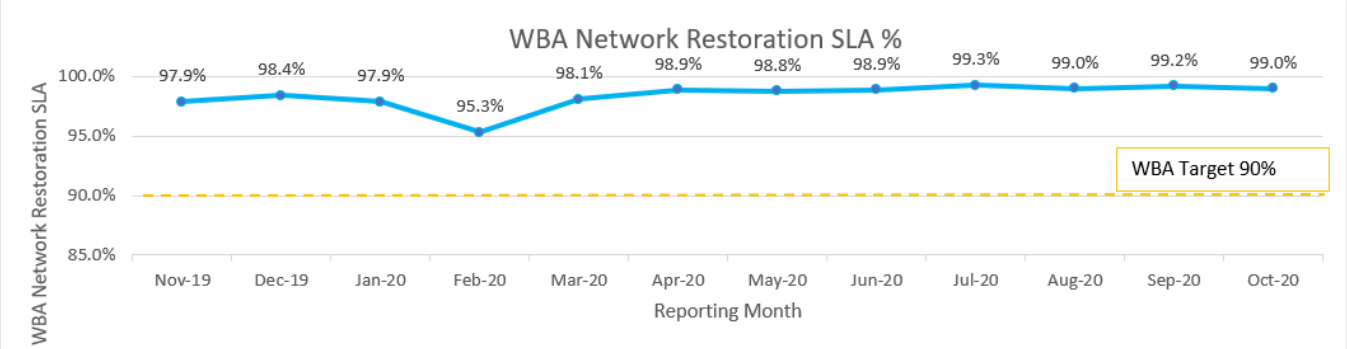
**** WBA Service Availability % across the 12 months from November 2019 – October 2020. The dip in performance over January and February 2020 is attributed to Black Summer bushfires.***

b) **WBA Network Restoration SLA %:** NBN Co uses a priority matrix as set out in the WBA to classify the urgency and priority of customer impacting network outages by assessing the volume of customers affected and the location of the fault in the network. The resulting priority (critical, high, medium, low) determines the Service Level Agreement (SLA), which is the timeframe within which NBN Co must resolve the network outage and restore services.

The WBA Restoration SLA % measures NBN Co's performance against these restoration timeframes with a target of 90 per cent of faults restored on time written into the WBA. While NBN Co has a contractual target of 90 per cent it manages internal operations to a stretch target of 95 per cent.

In the 12 months to October 2020 NBN Co consistently outperformed its stretch target, managing network restoration to an average SLA of 98.4 per cent.

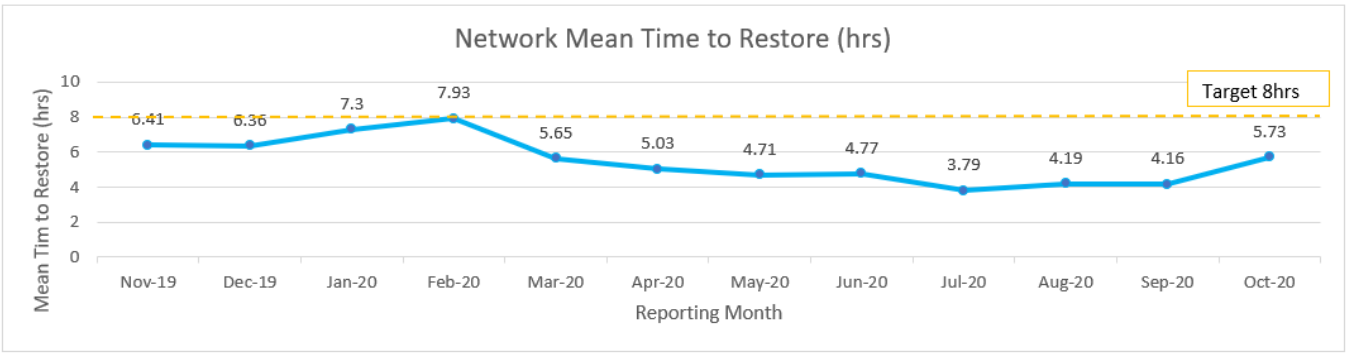
Diagram 7 – WBA Network Restoration SLA%, 12-month performance chart



**** WBA Network Restoration SLA% across the 12 months from November 2019 – October 2020. The dip in performance over January and February 2020 is attributed to Black Summer bushfires.***

c) **Network Mean Time to Restore (MTTR):** Mean Time to Restore is a telco industry standard measure used by wholesale telecommunications providers around the world. It is a measure of how long on average it takes a provider to restore services from the moment it becomes aware of a network fault affecting customers. With a target of eight hours, this is a measure which NBN Co has made significant progress on through various improvement initiatives, particularly over the last two years. Network Mean Time to Restore has been steadily improving month-on-month and as of October 2020 was sitting at 5.73 hours.

Diagram 8 – Network Mean Time to Restore (hrs), 12-month performance chart



****Mean Time to Restore network outages performance across the 12 months from November 2019 – October 2020, displayed in hours. The degradation in performance over January and February 2020 is attributed to Black Summer bushfires.***

Network Change Management

The function of change management is helping ensure that planned network outages (changes) due to maintenance or upgrades are started and concluded within their scheduled time window. This process also tracks any maintenance activity that could impact network operations to assess for conflicts with existing events or incident management activities. Changes are generally planned days, weeks or months ahead of the scheduled start time, based on a defined process with enough lead time to inform our customers.

Managing these changes effectively is critical because if a planned change occurs and the NMC is not notified, then it may be treated by the NMC as a new network outage and the incident management process will be triggered, which may change the way in which customers perceive the nature of the outage.

Network Problem Management

During the incident management process, the NMC may identify that a systemic problem is the root cause of reoccurring incidents or that an issue with process or technology exists that may require in-depth problem analysis. When such a problem is identified, a problem investigation record is raised into Remedy for the NBN Co Problem Management team to investigate and resolve. The NMC is responsible for highlighting new problems during the lifetime of the nbn and relating existing and new incidents to problems as they occur. This process is critical for identifying and addressing systemic issues and reducing unplanned outage volumes through prevention in order to keep the network operating effectively.

Conclusion

While the way in which NBN Co operates the network has evolved considerably since the Company's inception, NBN Co understands that it will need to continue constantly improving and adapting as new technologies emerge and efficiencies are identified. Pivotal to this continuous improvement is regular training and upskilling of operations staff, improvement of processes and systems, and the introduction of new capabilities to allow NBN Co to keep up with the community's expectations of network availability.

NBN Co reasonably considers that it has appropriate frameworks and processes in place to effectively operate the network and to measure its performance against key targets under all reasonable circumstances, noting of course that the Company will continue to refine and develop these processes and its performance to deliver an improved broadband experience for all Australians.

Other Key Documents	Link/Attachment
Network Outages (for customers to check the nbn network status at their premises)	nbnco.com.au/support/network-status
Monthly Progress Report - performance of certain incident management processes	nbnco.com.au/corporate-information/about-nbn-co/updates/dashboard-september-2020

2.2 Processes to assess and address future needs of end-users and RSPs

NBN Co should provide evidence that it has in place an appropriate set of processes to assess and address emerging RSP and end-user service quality and product needs.

The needs of customers and RSPs are constantly evolving and changing due to a number of drivers that include, but are not limited to:

- Market and technology changes in consumer devices
- Changes in content or service offerings by over the top (OTT) and other service providers
- Competitive forces in the RSP market
- Evolution of technology standards and trends
- Evolution of equipment and software vendor solutions
- Changes in global usage trends

In order to manage and respond to these market and technology changes in a timely manner, NBN Co needs to manage priorities and timeframes to balance the forecast arrival of these changes and the lead-times to deliver appropriate solutions or responses. Furthermore, there needs to be strategic alignment of these responses and solutions with NBN Co's strategic objectives and shareholder expectations.

The monitoring, forecasting and management of emerging RSP and customer needs requires an ongoing cross-business and cross-industry approach which is detailed below.

Monitoring market and emerging needs

NBN Co is committed to building products that address emerging RSP and customer service quality and product needs, that have sufficient demand to be commercially viable, and from which RSPs and customers gain value.

NBN Co has developed and implemented a comprehensive Product Development Framework (the framework), which encompasses three key components – NBN Co's Product Development Process, Product Development Forum and the Integrated and Enhanced Product Roadmap. NBN Co's execution of this framework facilitates meeting future customer demands and enabling RSPs to access viable products which address customer needs. In addition to implementing robust controls and mechanisms to govern NBN Co's product development activities, NBN Co is also obligated to adhere to the terms under its SAU. These regulatory obligations require NBN Co to establish and operate a multi-party forum where NBN Co, RSPs and Consumer Advocacy Groups can consult and communicate regarding the development of new product ideas, components or features (or variations to existing NBN Co's products, components or features).

The framework fulfils NBN Co's responsibility to ensure new products and changes are communicated and validated to meet end-user demands, are commercially viable, and have the ability to integrate with RSPs strategic systems and operations whilst adhering to NBN Co's legal and regulatory obligations.

Product Development Process (PDP)

The PDP is NBN Co's standardised go-to-market process to drive customer and RSP-impacting initiatives from concept to launch. Product concepts and ideas are submitted internally within NBN Co or externally by RSPs by

completing the Product Idea Submission form and submitting it via the nbn Customer Centre Product Idea Submission Page.

The PDP overall supports NBN Co's objectives to:

- Prepare RSPs and internal stakeholders for change by engaging widely and consulting early.
- Focus NBN Co's efforts on initiatives that add the most value to NBN Co, RSP and customers by providing a mechanism to proceed, fail non-viable ideas fast or pivot.
- Aligns with SAFe, the IT development methodology NBN Co uses to provide an efficient and streamlined way to launch customer and RSP impacting changes.

The PDP encompasses two governance forums: Concept Advisory Team (CAT) and NBN Co's level 2 executive sponsored Product Committee (ProdCo). ProdCo is the primary PDP governance body and provides cross-functional decision-making and governance of RSP-impacting projects at critical junctures in the product lifecycle.

Product ideas formulated within NBN Co are submitted to CAT in the first instance, which facilitates early engagement across NBN Co and provides an opportunity for product concept owners to obtain valuable feedback on the product idea's viability and feasibility if launched. Product concept owners can be from any NBN Co business unit, such as Products, Service Experience or Operations. Once CAT feedback is addressed, product concept owners submit their product concept to ProdCo. If a product submission is RSP-impacting and endorsed at ProdCo, it will be communicated for RSP consultation via the PDF and placed on the nbn Integrated and Enhanced Product Roadmaps.

NBN Co's Products team and Chief Technology Office are responsible for the ongoing assessment and evolution of NBN Co's long-term product strategy to address customers' diverse needs. The Products team guides the focus of NBN Co's development activities which follow the Product Development Framework. NBN Co's Product team is also informed by both domestic and international market research including:

- Customer applications and use cases;
- Market segment needs across residential and business broadband;
- Industry trends for data usage, speeds, adoption and performance;
- Emerging technologies in access and core network architectures; and
- Financial metrics and commercial viability.

Product Development Forum (PDF)

The PDF is the primary mechanism by which NBN Co consults and communicates with RSPs and Consumer Advocacy Groups in relation to nbn Product Development. Consultation and engagement with industry is intended to ensure that the products and services NBN Co develops and delivers generate maximum RSP and customer value. Therefore, consultations are held across technical, operational, and commercial product aspects as appropriate.

Product Ideas submitted via NBN Co's Customer Centre Product Idea Submission Page may originate through two key avenues:

- RSPs and Consumer Advocacy Groups may submit ideas for NBN Co Product Development via the PDF. If validated in the PDF, such ideas will be submitted for review and further developed.
- NBN Co will capture detailed RSP and Consumer Advocacy Group requirements via bilateral consultations, which may then lead to an RSP, a Consumer Advocacy Group or NBN Co raising a Product Idea to the PDF for broader industry feedback.

There are multiple decision points during the PDP, and a product initiative may be discontinued at any of those points.

The objectives of the PDF are described within the SAU. The nbn PDF is used to promote:

1. **Innovation** – PDF Members can use the forum to submit ideas for development of new nbn products (including components or features), or for variations to existing nbn products.
2. **Consultation** – NBN Co will use it to seek feedback from PDF Members on proposed product developments and related activities; and
3. **Communication** – NBN Co will use it to keep PDF Members updated on the status of nbn product developments and withdrawals.

Membership of the PDF is open to all RSPs and Consumer Advocacy Groups. Any PDF member, including NBN Co as the PDF owner, may submit ideas for nbn Product Development to the PDF. Ideas may relate to entire products, variants of existing products, new and varied product features and ideas relating to pricing, technical attributes, and service levels. In addition to those access products currently covered by the SAU (FTTP, Fixed Wireless, Satellite) NBN Co will also use the PDF to consult on ideas in relation to those access products that are not currently covered by the SAU (e.g. FTTB, FTTN, FTTC and HFC). NBN Co will always qualify an idea internally via ProdCo before submitting it to the PDF for discussion and feedback. Similarly, PDF members are requested to qualify ideas for development of nbn products via their own internal processes before submitting them to the PDF for further discussion.

nbn Integrated Product Roadmap and the nbn Enhanced Roadmap

NBN Co's Integrated Product Roadmap and Enhanced Roadmap are the source of truth for communicating details about RSP-impacting products and changes to industry, government, regulators, and the general public. The nbn Integrated Product Roadmap is a high-level summary published at NBN Co's website on a quarterly basis and can be accessed by the wider Australian public. The nbn Enhanced Roadmap provides further detail to RSP WBA signatories and is published at **nbn**'s Customer Centre on a monthly basis. The nbn Enhanced Roadmap supplements regular, more detailed communications via other channels, such as the PDF. The content of the roadmap includes items such as product and pricing launches, nbn Platform Interfacing Services (NPIS) launches, and other RSP-impacting initiatives.

Other Key Documents	Link/Attachment
Wholesale Broadband Agreement (WBA)	nbnco.com.au/sell-nbn-services/supply-agreements/wba
Product Development Participation Agreement	nbnco.com.au/sell-nbn-services/industry-consultation/product-development-forum
NBN Co Integrated Product Roadmap	nbnco.com.au/sell-nbn-services/products-services-pricing/product-roadmap
NBN Co Special Access Undertaking (SAU)	nbnco.com.au/sell-nbn-services/special-access-undertaking-sau
NBN Co Customer Centre	nbnco.com.au/sell-nbn-services/customer-centre

Monitoring and forecasting nbn usage

Transit

Broadly, NBN Co manages network capacity and performance over two timescales:

a) Short term by adding capacity to shared network segments in response to increasing utilisation; and

b) Long-term performance via introduction of new network technology solutions with increased capabilities.

NBN Co has processes in place to augment and upgrade the network for adding more capacity or new capability. These processes enable the company *to assess and address emerging RSP and end-user service quality and product needs*. This includes steps such as traffic forecasting and capital expenditure planning, monitoring of the network utilisation, triggering of capacity upgrades and/or traffic re-balancing. These steps are described in more detail below.

- Capacity Plans are triggered and revised based on continuous monitoring of actual network capacity utilisation level.
- Future demand forecast, long-term traffic forecasting, understanding impact of new traffic demand sources, burstiness of the traffic, current usage profile, speed tiers, organic growth, busy hours usage etc. are analysed to determine capacity upgrade requirements. These forecasts, usage and speed tier profiles underpin the capacity management processes enabling NBN Co to pivot the capacity augmentation and technology upgrade plans to address future customer requirements.
- For special events and new products, an impact assessment is conducted to determine impact and adjustments are made to capacity plans to stay ahead of the demand.
- There are two different methods of managing capacity. Assessment is done to use the most cost-effective method to manage future demand:
    1. Optimisation or rebalancing; and or
    2. Capacity augmentation.

NBN Co leverages detailed processes and rollout mechanisms to deliver capacity augmentation, including steps such as:

a) Triggering of capacity upgrades, including material dispatch to sites.

b) Deployment teams building physical infrastructure and the equipment racks for the capacity augmentations.

c) Field workforce physically deploying the materials at the sites, connecting the equipment to the network.

d) Integrations team logically configuring the equipment, adding the capacities into network and activating the traffic pipes.

e) Migrations teams creating new traffic/transport pipes for new traffic and/or re-balancing the existing traffic.

The Capacity Upgrades and Migrations are tracked and driven via the Transit Governance process, all necessary prioritisation and scheduling work is discussed and agreed upon with the necessary stakeholders to help ensure all upgrades are completed in the timeframe required to mitigate any risk of capacity impacts on customers.

A weekly network surge projection activity achieving identification of at-risk transit network segments linking to an upgrade delivery prioritisation process with agreed expedited SLAs is in place to deliver a fast-tracked augmentation or network migration for any at risk segments. This facilitates NBN Co's transit capacity team to handle un-forecasted traffic surge events, such as the effects of widespread community lockdowns driving up traffic usage rapidly and responses to large gaming platform software releases. Such processes are key for capacity management to tactically adjust to rapidly changing demands. This process enables NBN Co to condition the transit network to handle traffic surges with minimal to no transit network performance degradation during these events.

The primary objective of capacity forecasting is to allow the planning and triggering of Network Upgrades with sufficient lead-time in order for the links and network elements to be upgraded, prior to any expected breach of our leading and critical Key Performance Indicators (KPIs). Future demand forecast, burstiness of the traffic, current usage profile, speed tiers, organic growth, busy hour usage etc. are analysed to determine the timing and scale of the capacity upgrade requirements. These traffic forecasts, actual network utilisation data and speed tier profiles underpin the capacity management processes enabling NBN Co to plan and prioritise the necessary capacity augmentation to address future business and customer requirements.

Distribution Fibre

Distribution fibre from the FAN/POI site to the first node or splitter in all FTTx networks has been designed to provide built-in capacity to support future requirements where possible. By using the physical network inventory data distribution fibre ribbon, utilisation is monitored by NBN Co against agreed thresholds. As designs in the network seek to use fibre ribbons in the distribution cables beyond the threshold limits, warnings are triggered preventing those fibres from being allocated without investigation. Following investigation, case-by-case decisions are made on the management of that cable and fibre capacity augmentation is triggered as required.

Fibre to the Node/ Fibre to the Basement (FTTN/B)

The FTTN/B network has dedicated copper lines to each premises from the DSLAM node and as such the capacity components in this network are primarily to facilitate connection growth. These elements include ports on the pillar as well as ports and line cards in DSLAMs. These components are forecast at both aggregate and granular levels based on housing growth forecasts annually and then reforecast quarterly or as required.

A series of metrics based on thresholds of the proportion of ports used are collated and reviewed weekly based on telemetry data collected from the network. Where components near or exceed thresholds, those components are analysed in detail and augmentation decisions are made based on expected growth requirements for that component. Augmentations include rearrangements of connections to load balance across components with surplus capacity or to augment the network with new or larger components to create more available ports to support future connections. These augmentation activities are triggered and performed by NBN Co or Delivery Partner technicians to meet specific time-based SLAs.

Utilisation and channel capacity from the DSLAM to the FAN/POI site is managed and augmented under the transit network.

Fibre to the Curb (FTTC)

The FTTC network has a network of fibre cables with specific optical splitter ratios throughout it to ensure that the overall splitter ratio from the Optical Line Termination (OLT) to the customer is 1:8, the fibre to copper Distribution Point Unit (DPU) located close to the premises is then a 1:4 device giving an overall ratio of 1:32 premises to Passive Optical Network (PON) port at the OLT. The primary components that are forecast and monitored to manage port capacity required to support growth in connections are DPUs and splitters in the network. These components are forecast at an aggregate level based on housing growth forecasts annually and then reforecast quarterly or as required.

A series of metrics based on thresholds of the proportion of splitter ports used are collated and reviewed weekly based on data collected from the network. Where components near or exceed thresholds, those components are analysed in detail and augmentation decisions are made based on expected growth requirements for that component. Augmentations include rearrangements of connections to load balance across components with surplus capacity or to augment the network with new or larger components to create more available ports to support future connections.

Each premises in the FTTC footprint is allocated a DPU port for their first nbn connection, however where subsequent connections are required to a premises there may not be sufficient spare port capacity in the network. Since it is not feasible to predict which premises will order a subsequent line, where a new DPU is required to support a subsequent connection these augmentations are completed reactively to meet SLAs defined under NBN Co's WBA. This SLA has a consistent rate of achievement above 99.9 per cent.

These augmentation activities are triggered and performed by NBN Co or Delivery Partner technicians to meet specific time-based SLAs.

Fibre to the Premises (FTTP)

The FTTP network has a network of fibre cables with specific optical splitter ratios throughout it to ensure that the overall splitter ratio from the OLT to the customer is 1:32. The primary components that are forecast and

monitored to manage port capacity required to support growth in connections are splitters in the network. These components are forecast at an aggregate level based on housing growth forecasts annually and then reforecast quarterly or as required.

A series of metrics based on thresholds of the proportion of splitter ports used are collated and reviewed weekly based on data collected from the network. Where components near or exceed thresholds, those components are analysed in detail and augmentation decisions are made based on expected growth requirements for that component. Augmentations include rearrangements of connections to load balance across components with surplus capacity or to augment the network with new or larger components to create more available ports to support future connections.

These augmentation activities are triggered and performed by NBN Co or Delivery Partner technicians to meet specific time-based SLAs.

Hybrid Fibre Coaxial (HFC)

The HFC access network manages network capacity by adding capacity to shared network elements through augmentations or spectrum allocations in response to increasing utilisation in the short term while maintaining a pipeline of new network technology solutions in development to provide for future needs.

The ongoing program of maintaining capacity to meet short term needs is managed via an iterative process of forecasting demand, monitoring and releasing localised augmentation projects to an implementation program. The demand in the HFC Network is monitored and the headroom pressures are reviewed on a daily and weekly basis with a weekly capacity report. Both upstream and downstream traffic have different characteristics which are both monitored on a weekly basis with augmentation solutions tailored to the specific capacity needs of specific network segments.

HFC capacity augmentation projects are planned and implemented well ahead of forecast congestion date for a given network element to ensure that the lead time for the augmentation project does not exceed the time before forecast congestion. In the event of unexpected demand increase in a HFC segment, an immediate augmentation is triggered and escalated, with processes that support this expedited process.

For special events and new products, an impact assessment is conducted by the Transit team and communicated to the HFC team to determine any impact. Adjustments are made to plans as necessary to stay ahead of the traffic demand.

The augmentation projects and forecast congestion dates are tracked and governed via internal cross-business forums with necessary internal stakeholders to ensure all upgrades are completed in the timeframe required to mitigate any risk of capacity impacts to customers.

Where a network segment experiences a period of congestion this is always a temporary state which is tracked and monitored for network behaviour changes with internal escalation paths to expedite augmentation projects in response.

Fixed Wireless

NBN Co's Fixed Wireless network was deployed to serve the premises within the designated Fixed Wireless footprint using a time division long-term evolution (TD-LTE) network for the radio access component and a mix of microwave and fibre links to provide connectivity between wireless sites and the nbn transit network.

Approximately 2,300 sites and more than 18,000 Radio Cells have been deployed using either B40 or B42 spectrum, typically using 20 Mhz of spectrum per cell and dimensioned to serve a planned number of premises that will enable no less than 6 Mbps throughput experience in the Busiest Hour of the day. The microwave links utilise apparatus licensed spectrum and are dimensioned to deliver sufficient capacity to support the peak traffic demands on the network during the busiest hour of each day. Traffic levels are constantly increasing and in order to support this growth the engineering team proactively upgrades these links utilising a number of techniques including channel bonding, higher order modulations, and multi-band link aggregation. Upgrades are designed to support up to two years traffic growth in order to reduce the volume of upgrade work required at any one time. Extensive monitoring is performed across the network on an hourly basis to ensure that there is no congestion or packet drops across the microwave links as the utilisation increases during the busiest hours of the day.

There are several KPIs for the various domains of the Fixed Wireless network that are monitored for performance and capacity management of the network. Number of connected users, traffic payload, cell and link utilisation, throughputs and packet drops are used to determine the performance rectifications required and are used as inputs into the forecasting process.

The forecasting process uses these inputs to run machine learning algorithms to predict the capacity trend of the network including the forecasted dates that a design threshold may not be met.

Along with inputs from network monitoring, network forecasts for concurrency, connected users, take-up rate, utilisation and future demand are used to provide a future state view of the capacity of the network. The output of the forecasting process is used to trigger the most appropriate capacity augmentation actions, taking into account relevant timeframes and cost requirements.

The augmentation actions are typically either optimisation activities or capacity upgrades. Optimisation will optimise the capacity of a site by adding new cells, implementing new network features and load balancing of users across cells. Capacity upgrades will augment the infrastructure on Fixed Wireless tower sites by adding new antennas, equipment such as radio units, and microwave dishes.

Satellite

Due to the fixed nature of spacecraft capacity a whole-of-life forecast is required for the satellite network at the time of design. Dimensioning of NBN Co's satellite network was based on the satellite footprint and the population within, as per the 2010 Geocoded National Address File (GNAF). As a result NBN Co designed, built and launched two purpose built high capacity satellites to provide service right across Australia. The capacity on each satellite is split across 101 beams. The capacity required for each satellite beam was selected based on the population density of the satellite footprint within the associated geographical area and is determined by the spectrum allocated (MHz) to that beam.

As the communications payload design is fixed for the life of the spacecraft, this becomes the limiting element when determining capacity of the satellite network and requires NBN Co to manage demand within that pre-

determined maximum. Hence the satellite network was dimensioned for the predicted capacity required at 2030, the nominal end-of-life date for NBN Co's two spacecraft.

While the Space Segment capacity was fully in place upon the launch of the second Sky Muster spacecraft in 2016, components of the Ground Segment have been installed and augmented only as required.

There are two key systems monitored regularly and expanded as capacity needs demand.

1. The first is the **Transparent Performance Enhancing Proxy (TPEP)** system located at the Data Processing Centre (DPC), which provides Transmission Control Protocol (TCP) and Web Acceleration. Aggregated traffic is managed by six clusters. Each cluster performs the acceleration and contains up to 19 virtual nodes (Vnodes) on active and backup hardware blades. Additional blades and clusters can be added as traffic load increases.
2. The second is the **Satellite Modem Termination System (SMTS)** located at each of the 10 RF Gateways (9 active + 1 disaster recovery). Each SMTS has 12 chassis, six per spacecraft, with each chassis supporting a demodulation system for up to 500 MHz of transmit and up to 500 MHz of receive satellite spectrum.

Forecasting is managed at a beam level based on population in the geographical satellite footprint with a take-up rate determined by presence of local market competition from 4G, ADSL etc. Review of trends in recent orders is also used to refine take-up rate in each beam on a 6-monthly basis.

Detailed modelling was developed to determine an Allocated Information Rate (AIR) per customer for each residential product type to maintain customer experience during peak periods. Based on the individual beam capacity and the AIR the maximum number of subscribers per beam can be determined.

In addition to monitoring the number of customers in each beam per spacecraft against the forecast, NBN Co reviews several parameters that are indicators of network capacity trends. These include:

1. **Beam utilisation** – each beam is split into one or more RF segments and the percentage utilisation of each is monitored and compared to threshold.
2. **Average Busy hour throughput per customer** – the average throughput during the busiest hour of the day is compared to the AIR.
3. **Average total data usage per customer** – total download and upload (GB per month) is calculated.
4. **TPEP throughout** – the maximum traffic throughput in each TPEP node is compared to threshold.

If uptake increases to greater than 80 per cent of total beam capacity, actions can be taken to maintain services within capacity limits:

- Move ground hardware from underutilised beams to heavily loaded beams where possible.
- Augment ground segment – additional cards in SMTS where not maxed out and satellite capacity allows.
- Manage customers between the two spacecraft. The loading on each beam is balanced between the two Sky Muster spacecraft by directing new installs to one satellite or the other. This selection is on a per beam basis and can be updated regularly.
- Moving customers to adjacent beams or another channel within the same beam on multi-channel beams.

- Offloading customers to other technologies e.g. Fixed Wireless has identified where capacity is available in cells that can be utilised.

Thresholds are set at beam and aggregate levels in order to trigger augmentation of the SMTS and TPEP systems within required timeframes.

Element Management Systems

Network Element Management System capacity (i.e. GPON and DSL platform system AMS, DSL network test and diagnostic system NA-C) has required progressive software and capacity upgrades as the MTM has been evolved to include FTTN, FTTB, HFC and FTTC as well as the original set for FTTP, Fixed Wireless and Satellite. IT System changes continue to put demands on Network System interfaces and so transaction volume capacity requires ongoing forecasting and proactive management.

These systems are monitored and managed with metrics specific to those platforms and upgraded when warning thresholds are reached. These capacity management and monitoring systems enable NBN Co to maintain capacity on the network.

How NBN Co manages and responds to emerging needs

TechCo

NBN Co has established TechCo to provide oversight and executive leadership of tactical and strategic technology issues. As a level 2 governance forum, TechCo has an escalation path to NBN Co's Executive Committee (ExCo) where required. Alignment of architecture for end to end integration, upcoming architectures for delivery as well as governance compliance on avoidance of technical debt. Items tabled at TechCo are listed below as examples.

Any architecture decisions that:

a) Include options that are not in alignment with NBN Co's strategic direction.

b) Include options to delay moving to NBN Co's strategic direction.

c) Result in the introduction of a new network technology carrying customer traffic (e.g. G.Fast).

d) Would change the interface between network and IT (e.g. introducing/removing interfaces, changing protocols, changing the understood boundary domains).

e) Require a change in the way operational areas work together for service activation/assurance.

f) With a cost impact, reviewed on a case by case basis.

g) Change the route of customer traffic or control or management of traffic without exceeding the performance requirements (e.g. centralised Wireless Evolved Packet Gateways (EPGs) to achieve cost savings).

h) To address shortfalls in performance requirements (e.g. changing CVC burst size to address perceived customer experience impacts).

i) Would result in the introduction of a new network technology carrying management traffic (e.g. IPv6).

Technology Plan

NBN Co's Technology Plan is intended to provide insights into the development and management of the nbn networks and systems. The combined Network and IT System plan provides a holistic high-level view of what is happening across the Networks (FTTx, HFC, Fixed Wireless, Satellite and Transit) and Systems over the next 48 months. It has been designed to:

- Provide an overview of the Network and Systems Architecture, Technology, Lifecycle, Capacity and Performance initiatives being worked on over the next 48 months.
- Highlight value streams which the Network and Systems initiatives align with.
- Communicate the Network and System lifecycle decisions and planning across technologies.
- Communicate the Systems Digital Roadmap (SDR).

The Technology Plan comprises initiatives from all sponsors across the organisation that impact/change the architecture or technologies. It consists of three high level processes:

1. **Manage EOL/EOS process**: architects from all technology domains routinely examine the network asset database for lifecycle decisions triggers. This method is aimed at ensuring uninterrupted network performance by facilitating the continuous operational purpose of assets installed in the nbn.
2. **Develop technology plan initiatives:** various considerations prior to inclusion of initiatives in the Technology Plan that are required to be consistently performed to understand business problems and outcomes to begin with. This is followed by considering options, impact assessment and understanding architecture changes to ensure optimal planning and dependencies. The process facilitates capturing these considerations from inception of the initiatives that will be included in the Technology Plan. The key aspects evaluate triggers and triage plan, development of options including high level assessment of impacts and architecture and identify which of the initiatives to be included into the Technology Plan
3. **Update and release Technology plan:** once initiatives are identified, this process facilitates production and release of NBN Co's Technology Plan.

The Technology Plan aims to provide transparency of all network/system changes to assist with understanding dependencies, identifying methods of optimising how NBN Co makes technology changes across various initiative sponsors and promotes forward planning.

Conclusion

The future needs of NBN Co's customers and RSPs are many and varied ranging from product needs to increased data demand to growth in the number of serviced premises. Furthermore, how these needs are managed varies between networks and products. NBN Co reasonably considers it has in place appropriate strategies and processes, coupled with the necessary governance and management, to support emerging RSP and customer product needs and demands across all networks and necessary systems.

2.3 Risk management processes

nbn should demonstrate that it has a set of suitable operationalised risk management processes including an appropriate risk management framework and documented critical risks and appropriate mitigations.

NBN Co is committed to implementing robust risk management practices to allow for the proactive identification, assessment and management of its key business risks. This commitment has been outlined in its Board approved Risk Management Policy. NBN Co's Risk Management Standard supports the implementation of the policy to define the approach and processes by which NBN Co can manage risk (or uncertainty) to achieving its business objectives, which has been developed in accordance with ISO 31000:2018 Risk Management — Guidelines.

Risk Management Approach – Three Lines of Defence

NBN Co's risk management approach is aligned to the principles of Three Lines of Defence (3LOD). The underlying premise being a coordinated and layered approach towards risk management, providing a holistic enterprise approach to managing risk.

The first LOD at NBN Co comprises management and staff in the business. These individuals and teams are the owners of risks that impact the objectives of their business area. They are responsible for ensuring that risks are identified and that appropriate controls are developed and implemented as needed and adhered to. These risk activities are undertaken with advice and support provided by the second LOD (i.e. Group Risk and Compliance (GRC) and other second line Risk and Assurance functions).

The second LOD monitors and facilitates the implementation of effective risk management policies and practices by first line management and staff.

They assist the risk owners and/or their delegate to apply risk management process and robust reporting of risk related information up and down NBN Co's organisational structure.

The second LOD is comprised of a dedicated central GRC function supported by specialised Risk and Assurance Teams (Health Safety and Sustainability, Security, Privacy, Corporate Finance, IT Risks and Controls, Business Resilience, and Fraud Management). Collectively GRC and the other Risk and Assurance Functions work as strategic partners to ensure that the first LOD manage their risks and associated controls appropriately.

NBN Co's Internal Audit forms the organisation's third LOD. They are responsible for providing management and the Board with independent assessment of the quality of internal controls, processes across first and second Lines of Defence and the extent to which they are assisting NBN Co in achieving its strategic and operational objectives via sound risk-management practices. A risk-based approach to audit activities is undertaken to ensure actions are prioritised.

Top-Down and Bottom-Up risk management process

NBN Co has adopted an approach to managing risks that is both top-down and bottom-up.

From a top-down perspective, NBN Co's business objectives are set out in its Corporate Plan which is developed through its annual Integrated Operating Plan (IOP) cycle. Risk management is embedded in the IOP (planning) cycle, ensuring the material risks to key operational and strategic objectives are identified, recorded and monitored. These risks form the Corporate Risk Profile which is reported to ExCo quarterly, and Audit and Risk

Committee (ARC) and the Board half yearly. The Corporate Risk Profile forms the basis for NBN Co's externally published Annual Report and Corporate Plan.

From a bottom-up perspective, each Business Unit (BU) applies NBN Co risk management process to identify, report and manage risks related to their teams, projects, and initiatives (Business risks). These risks and associated mitigations are monitored by the Business Leadership Teams on a quarterly basis as a minimum. These risks are reviewed quarterly by GRC and are used to ensure the Corporate risk profile is complete and accurate.

Both the Corporate Risk Profile and business risks identified as part of the bottom-up process (along with their mitigations) are recorded centrally in NBN Co's GRC Tool, which provides a single source of truth for material risks, as well as a recorded and traceable link between corporate risks and business risks.

Both bottom-up and top-down process follow NBN Co risk methodology, which outlines the process to support a consistent approach for identifying, assessing, managing, monitoring and communicating risks across all layers of management and business areas.

Continuous Improvements

NBN Co's Risk Management Maturity Model supports the Company's commitment to continuously review and enhance its risk management capabilities, ensuring risk maturity targets are met. The maturity model requires an annual assessment of the level of risk management maturity across NBN Co and enables senior management to gain a better understanding of what capabilities and practices are needed to enhance risk management in line with NBN Co's maturity goals. An annual report on the status of NBN Co's risk management maturity is provided to ExCo, ARC and the Board, and each BU is required to implement a maturity plan annually to maintain or improve their maturity level.

Risk Appetite

NBN Co's Board and ExCo have approved the Company's risk appetite, which is a key element of NBN Co's risk management policy and communicates NBN Co's appetite towards taking and managing risk and directs the approach for the acceptance of risk (i.e. the amount of risk that NBN Co is willing to take in key areas in the pursuit of its strategic and operational objectives). It is the conscious recognition and acceptance of the risk/return trade-off that arises as business strategy and objectives are determined and implemented.

Risk Appetite covers both the categories and amount of risk that NBN Co is willing to seek and retain in pursuit of its objectives given its context of operations and the amount of risk it has a readiness to bear at the individual risk level.

Positive Risk Culture

NBN Co's positive risk culture is essential for a robust risk management system and underpins ethical and values led behaviours that are consistent with NBN Co's overall values. NBN Co's risk culture is supported through:

- Accountabilities and responsibilities for risk management assigned in the risk policy and the standard.

- Sponsorship from NBN Co leadership through the appointment of a Risk Executive in each BU, accountable for maintaining the risk operating model in their BU, chairing a quarterly Risk Management agenda item as part of the Senior Leadership Team meeting, and championing good risk management practices.
- Risk owners assigned to each risk, accountable for making sure the required steps are taken to manage the risk to an acceptable level.
- Ensuring every employee is aware of their responsibility to identify and manage the risks associated with their role and position, through the mandatory completion of annual risk management e-learning.
- Training programs in place to support risk management activities across NBN Co.
- Allocation of appropriate resources for risk management across the business, through the appointment of Risk Managers with the responsibility to drive risk management activities in their BU.
- The adoption of a common risk management language across the organisation through the risk policy, standard and methodology.

Resilience and Business Continuity

Where risk events occur, NBN Co maintains an incident management framework that documents the approach, tiers and processes for responding to and recovering from threats, disruption events and crises. NBN Co seeks to manage incidents at the lowest practical level whilst ensuring all stakeholders are informed of any incident impacting on the business. An 'all-hazards' approach is adopted by NBN Co, enabling a proportionate and timely response to incidents, regardless of cause.

The Group Risk and Resilience Team at NBN Co provide a central coordination function for Business Continuity and for the management of major incidents or crises (Crisis Management). At the operational level, NBN Co maintains a strong capability for managing emergencies, incidents and network outages. NBN Co's Business Resilience Policy outlines the expectations for the business units and functions that support the response to and recovery from any major incident. Plans and regular exercises to test NBN Co's preparedness for major disruption events form part of the business resilience programs.

NBN Co maintains Temporary Network Infrastructure (such as POI on wheels) and other deployable capabilities (including fly away satellite kits and Muster Trucks) to support the response to and recovery from any significant network outage or disaster event. NBN Co works closely with all tiers of Government, relevant agencies and industry partners when managing disaster events.

NBN Co maintains a Business Resilience Committee that provides governance and oversight of BCM and crisis management functions, priorities and activities. Business Resilience updates are presented to the ARC every six months.

Conclusion

NBN Co reasonably considers its approach to risk management includes both top-down and bottom-up processes, which combine to deliver an effective risk management framework. This framework is underpinned by a Risk Management Policy, Appetite and Risk Standard and Risk Methodology, which delineate processes and

supporting practices for identifying, assessing, prioritising, monitoring and managing the risks. The business resilience programs help ensure the mechanisms and capabilities for effectively managing risk events are in place.

The framework provides Senior Leadership at NBN Co with a clear understanding of their business risks to support informed decision making, provide the ARC and the Board with a clear understanding of nbn corporate risks, promote a risk-aware culture across NBN Co, resulting in proactive identification and management of risks, and build shareholder and stakeholder confidence and trust through management of risks.

Other Key Documents	Link/Attachment
NBN Co Business Resilience Policy	Attachment 2
NBN Co Risk Assessment Methodology	Attachment 3
NBN Co Risk Management Policy	Attachment 4
NBN Co Risk Management Standard	Attachment 5

3 Such other matters as the Communications Minister considers relevant

3.1 Network is capable of delivering the required speeds set out in NBN Co's Statement of Expectations (24 August 2016) and the SIP legislation

***NBN Co should provide information on the peak wholesale speeds that the premises serviceable by the NBN would be able to receive if they are RTC and whether these will meet the SOE and SIP requirements. The company should explain how factors limiting the achievement of the speed requirements will be overcome and by when*.**

The nbn is built using an MTM strategy with the intent of balancing re-use of existing network assets and a consistent ethernet bitstream product regardless of the access network technology that is built to any particular premises. The primary document taken as input requirements for the network is the Australian Government's SOE issued to NBN Co on 24 August 2016. The SOE outlines minimum speed requirements across proportions of the premises in the country, however, otherwise leaves the decisions of technology to deliver those speeds at the discretion of NBN Co. The SOE defines the 'floor' performance requirements, in many cases the technologies NBN Co deploys will be able to offer well in excess of these requirements.

Each technology is designed, built and subsequently measured in different ways depending on the characteristics of the particular technologies, furthermore each technology also presents its unique challenges to achieving the designed performance.

The complementary document that defines the minimum build requirements of the nbn is the SIP regime.

The SOE states that '*The Government expects the network will provide peak wholesale download data rates (and proportionate upload rates) of at least 25 megabits per second to all premises, and at least 50 megabits per second to 90 per cent of fixed line premises as soon as possible.'* NBN Co has interpreted the proportionate upstream information rates to be 5 Mbps where the downstream information rate is 25 Mbps, and 10 Mbps where the downstream information rate is 50 Mbps. Correspondingly the terms 25/5 and 50/10 will be used to reflect this. This is measured as the *attainable peak or maximum information rate* of a particular wholesale layer 2 service, rather than the ordered rate on a particular retail service ordered by a customer from an RSP, as the customer may order retail service speeds lower than the underlying wholesale layer 2 network capability.

The nbn has been designed and built to enable NBN Co to offer 25 Mbps downstream and 5 Mbps upstream peak rate services or higher. The wholesale peak information rate that the wholesale layer 2 service that NBN Co supplies to an RSP can achieve, does not guarantee that information rate for any sustained period or that the retail service provided by the RSP to a customer will achieve those speeds.

Typical network applications – including network speed testing applications – work at higher network Layers 3-7. Some throughput of the lower layer is lost to the signalling information used by each subsequent layer of network protocol so a customer measuring a service at a higher layer, as is typical, will see results below the Layer 2 peak speed.

Since NBN Co has been built using legacy network infrastructure in many cases as part of the MTM there is a period of co-existence with legacy service providers, primarily being Telstra. Until all legacy services are migrated from the shared copper and HFC network infrastructure at the end of co-existence there are network resources that NBN Co cannot access, which may limit the peak speeds NBN Co can offer in those areas until co-existence is ended.

Given the 18-month disconnection/migration window for premises, the period of co-existence is necessary to allow consumers adequate time to migrate prior to managed disconnection, this aligns to the compliance to the Migration Assurance Framework (MAF).

In the case of FTTN, co-existence limits the speeds that NBN Co can offer to lines in co-existence during that time. This means that services still in the co-existence period may not achieve 25/5 or 50/10 Mbps, however are calculated to achieve those speeds after the end of co-existence. For the purpose of satisfying the SOE, NBN Co has planned and designed the network to achieve the SOE criteria at the end of the co-existence period.

The different access network technologies used to deliver the MTM have different inherent factors that determine the ability of that network to support the required speeds which therefore becomes the primary design consideration:

- FTTN/B — Length and quality of copper line, customer premises equipment
- FTTC — Length and quality of copper lead-in, fibre splitter dimensioning
- FTTP — Fibre splitter dimensioning
- HFC — Spectrum, user traffic demand and node dimensioning
- Fixed Wireless — Spectrum, user traffic demand, distance, obstructions, interference and cell dimensioning
- Satellite — Spectrum, user traffic demand, distance, obstructions, interference, and beam dimensioning

In addition to access technology specific behaviour, NBN Co also monitors and manages shared network capacity in our aggregation and transport networks, which are used to carry large volumes of aggregated traffic over long distances between nbn sites and hand-off to RSPs.

Other conditions that can impact the speed that a customer experiences which are outside of NBN Co's control are in-premises wiring quality, in-premises equipment, software, ordered service rate, RSP purchased CVC capacity, and how RSPs design and configure their networks. These factors were excluded from consideration for the purpose of planning, designing and building the network.

The SIP regime determines that NBN Co is the SIP for all areas that have been declared RFS unless another carrier has been designated the SIP for that area. NBN Co will also be the default SIP across Australia once the network is declared built and fully operational. From 1 July 2020, wherever NBN Co is the SIP, the SIP regime requires NBN Co, upon reasonable request from a customer via a carriage service provider, to connect a premises to a network to enable an RSP to supply a qualifying carriage service (i.e. a fixed line, fixed wireless or satellite service with wholesale peak information rates of at least 25/5 Mbps).

MTM contributions to SOE Compliance

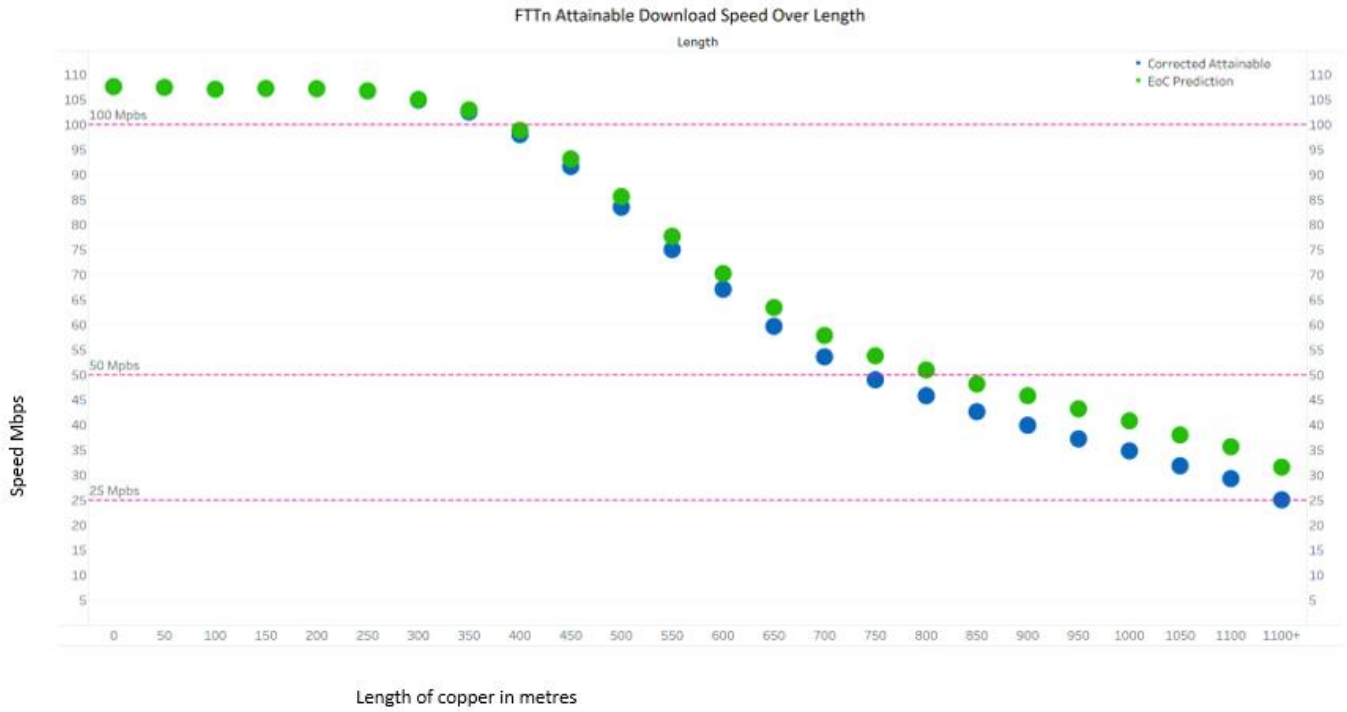
FTTN/B

The FTTN/B footprint was designed to meet the SOE by engineering design standards that set a maximum electrical signal loss budget and subsequent length of the copper wires between the equipment in the FTTN street cabinet (node) and the customer premises. The overall signal-loss is affected by the length of the entire copper path, as well as the quality or the presence of impairments and interference. This loss budget figure also assumes that the entire copper path, including the copper path within the customer premises, is of good quality and is impairment free. For most typical line copper conditions with standard gauge cable this loss budget translates to a node to modem copper loop length of ~1100 metres.

Copper quality is determined by factors such as poor or corroded terminations along the line, corroded copper cable sections due to water ingress to cables, split or faulty pairs in cables, corrosion or poor joints in the home, and the presence of unnecessary connections and star-wiring within homes. At the time of network design, the cable records of the network's former owner were used as the basis for determining whether a service address was likely to achieve 25 Mbps post co-existence. Some individual services were not able to meet this design criteria at initial design and these were deemed to be 'Long Copper Lines'. Long Copper Lines are being held from activation and are being individually addressed through NBN Co's Serviceability program. The Serviceability program addresses underperforming lines and makes them RTC. As of November 2020, all Long Copper Lines are on track to be completed in FY21.

When connected, actual line loss over the copper loop and attainable sync-rates are measured by the node and the modem, and the information is collected across the entire FTTN and FTTB networks as telemetry data. This data shows that after being connected, some services do not achieve the speed that they were designed and expected to achieve based on the estimation calculated from the original network owner's cable plant records. These discrepancies occur either because the actual copper loop length does not match the recorded cable plant record data, or that the loop has impairments either in the nbn cables or in the customer cabling, the customer supplied modem is underperforming or that there is a source of external signal interference, or any combination of these factors. Any of these factors may result in a service that was designed to achieve 25/5 Mbps failing to do so. These services are managed through NBN Co's proactive copper rehabilitation program, ongoing processes during and post co-existence, network remediation activity, and through reactive assurance processes determined in the WBA with RSPs.

Diagram 9 – Copper Loop Length vs Download Speed



FTTC and FTTP

FTTP uses optical fibre cables to carry optical signals between nbn equipment and a fibre Network Termination Device in the customer premises. NBN Co currently uses the Gigabit Passive Optical Network (GPON) technology to deliver its FTTP services which automatically shares optical transmission rates of 2.5 Gbps down and 1.25 Gbps up across up to 32 premises. For residential class services, the network can support the current demand and known traffic demand profile, including uptake of higher speed services for the foreseeable future.

FTTC is a hybrid fibre and copper solution. It uses the same fibre and technology as deployed for FTTP but rather than extending a fibre all the way into the home uses the existing last few-hundred metres of copper cable to connect a Distribution Point Unit (DPU) located in the street to a Network Connection Device (NCD) in the home. This is an equivalent fibre architecture as deployed for FTTP, which means that FTTC networks are upgradeable to FTTP by substituting the DPU for a FTTP multiport plus the connection of a fibre lead-in to the premises.

As a result, with the exclusion of fault conditions, both FTTP and FTTC are assumed to offer in excess of the 25 Mbps and 50 Mbps SOE and SIP requirements where it is deployed.

HFC

All nbn wholesale layer 2 services provided over the HFC network are capable of achieving a peak information rate of 100 Mbps due to the DOCSIS 3.0/3.1 protocol that is deployed on this infrastructure and the dimensioning rules of the network. As such, 100 per cent of the HFC footprint satisfies both the 25 Mbps and the 50 Mbps SOE criteria. If a particular wholesale layer 2 HFC service cannot achieve a peak information rate that satisfies the SOE criteria it is likely due to a service or network fault which is treated within SLAs by NBN Co's assurance processes.

Fixed Wireless

The Fixed Wireless footprint satisfies the 25 Mbps SOE criteria having regard to the compliance criteria below. Compliance of the Fixed Wireless footprint to the 25 Mbps SOE criteria is defined by the radio link budgets and predicted radio propagation coverage of the long-term evolution (LTE) network. The simulated predictions which include clutter, terrain and environmental attributes determine the boundaries of the Fixed Wireless network footprint.

The defined link budget dictates a Reference Received Signal Power (RSRP) signal level threshold of -99dBm to reliably determine that a premises location can support a 25/5 Mbps wholesale service. This threshold is set due to uplink path limitations and is used during the initial installation of a user terminal for service qualification of all users when connecting to the nbn.

Signal levels in radio environment are dependent on a multitude of external factors and can vary over time due to environmental changes. Although a customer connected to the nbn Fixed Wireless network passes the service qualification criteria at the time of connection, the signal levels to a particular service can degrade to a level that is lower than the link budget thresholds. Ongoing monitoring of customer radio conditions and rectification activities are undertaken to improve the required signal to customers by re-panning the customer antenna to a more optimum serving cell where possible.

For the Fixed Wireless SOE criteria which is defined as 25 Mbps for the downlink path, the RSRP thresholds are not limited to the -99dBm and a user is able to achieve a speed of 25 Mbps at a much lower RSRP. At levels of -120 dBm and Carrier to Interference Noise Ratio (CINR) levels of 7db (the theoretical value for a LTE network to achieve 25 Mbps), the Fixed Wireless network has 99.9 per cent of its services returning measured results above this range.

Satellite

The Satellite footprint satisfies the 25 Mbps SOE criteria – wholesale Satellite services are capable of achieving peak speeds of 25 Mbps due to the protocols deployed on the air interface and the dimensioning rules of the network at the time of design. If a wholesale satellite service cannot achieve the 25 Mbps SOE criteria it is likely due to a service or network fault which is treated within SLAs by NBN Co's assurance processes. NBN Co offers 12/1 Mbps and 25/5 Mbps wholesale services within the Sky Muster product range, but plans may be able to burst higher (subject to available network capacity). A large percentage of customers have selected the 12/1 Mbps service, although the majority are on 25/5 Mbps.

Transit and Aggregation

NBN Co's Transit and Aggregation networks support all of the access technologies listed above. The Aggregation network provides the Point of Interconnect for RSPs, and performs high capacity aggregation and switching of every nbn customer service between access networks and RSP interfaces, as well as implementation of NBN Co's AVC and CVC product constructs. The transit network provides transport between NBN Co's sites. Both Transport and Aggregation networks are Architected, Designed and Managed to work in concert with MTM access network technologies in providing the ordered performance for each service on the nbn, and as such consistent with the requirements of the SOE.

Conclusion

As set out above, each part of the MTM has been designed in a way that enables the network to achieve the required speeds at the wholesale layer 2 level as set out in NBN Co's SOE (dated 24 August 2016).

Where individual or groups of services do not meet these expectations, this arises mainly due to a misalignment of design assumptions and the real-world encountered conditions of legacy assets.

To support the ongoing management of the network to the SOE and SIP obligations, NBN Co actively manages the network through its agreements with RSPs and further by its operational processes so that speed expectations and commitments are addressed at the time of premises being made RFS, and at the time of and after connection of the service.

For any service that does not meet the SOE or SIP requirements at any time there are in-flight and ongoing proactive programs set up by NBN Co to address this on a rolling-basis as well as reactive operational processes to support the remediation of services to those levels. This is typical global practice for a large telco business.

Therefore, NBN Co reasonably considers that the network is capable of delivering the required speeds set out in the SOE and the SIP legislation today and on an ongoing basis.

Other Key Documents	Link/Attachment
Wholesale Broadband Agreement	nbnco.com.au/sell-nbn-services/supply-agreements/wba
SIP Regime Q & A	Attachment 6
Network Design Rules as part of NBN Co's Service Access Undertaking	nbnco.com.au/content/dam/nbnco2/2020/documents/sell/sau/Network%20Design%20Rules.pdf

3.2 Measurement of actual performance

NBN Co should describe how it monitors actual peak speeds on the network and provide statistics on the speeds received by activated premises.

As per global best-practice for network operation NBN Co consistently collates and reviews multiple large data sets from the network to manage network performance. Due to the specific criteria in the SOE, NBN Co actively monitors network speeds and other performance data and metrics on a regular basis to ensure optimised network operation and speeds for customers.

Section 3.1 discussed how the network was designed and how that design enables the network to support the SOE and SIP requirements, however network design is only one factor that determines actual network performance. Other factors relate to real-world differences to design data and assumptions as well as factors outside of NBN Co's control such as environmental factors, in-home wiring, network usage, CVC allocation, RSP equipment, and customer equipment. These factors create some variance in the actual speed measurement of any particular service supplied by NBN Co to an RSP (and the retail service ultimately supplied by an RSP to a customer) over a measurement period and as such service speeds can vary over time or in seasonal patterns over the year; this is normal network behaviour and observed by other network operators globally.

It is also important to understand that there is an ongoing churn in customer services due to typical factors such as new connections, housing development activity, and customers relocating between houses which may mean changes between nbn technologies under the MTM. As such, the actual composition of services that make up any measurement will vary between measurement periods.

How network performance is measured

nbn actual performance is measured via telemetry data collected from network devices across the network then processed centrally to gain insight into network operation and performance. As described at Section 3.1 due to the inherent technical differences between the various technologies in the MTM service performance is determined by different key factors in different network technologies.

As such, different network metrics and data are monitored for different networks; however, there are two main types of data that are observed to determine:

1. Sync rates
2. Capacity metrics

Network technologies where the wholesale layer 2 speed is determined by line length and quality (FTTN/B) sync rates are primarily observed; where the wholesale layer 2 speed is determined by capacity (FTTP, HFC, Fixed Wireless and Satellite) utilisation rates are primarily observed.Wholesale layer 2 FTTC speeds are determined by both sync rates and capacity metrics.

NBN Co's network performance metrics are collected from the network daily with most networks sampled at 15-minute intervals giving 96 data points per 24-hour period. For network performance management reporting this data is summarised and averaged over a seven-day period to be reported weekly. If summarised weekly metrics warrant further attention in a given week, granular raw data is then analysed further as required. All network metrics are reported and reviewed by multiple layers of NBN Co's management on a weekly basis with actions and responses to those metrics taken as necessary. Some of these metrics are publicly reported in NBN Co's Transparency Metrics.

Actual Performance of the network

It is important to note that references to network speeds reflect attainable wholesale layer 2 data rates and speeds measured by RSPs or customers will be different based on the factors described above. As at 5 November 2020, more than 90 per cent of the fixed-line footprint could access speeds of 50 Mbps or higher, and approximately 98 per cent of connected services received speeds of 25 Mbps or higher.

As NBN Co has discussed publicly, there are a number of reasons that a particular premises may not receive 25 Mbps, including co-existence, in-home wiring issues, and other network issues. It is important to note that the vast majority of premises that can not currently obtain 25 Mbps, can access more than 20 Mbps. NBN Co uses a combination of proactive and reactive measures to systematically address these issues, and these are set out below.

Programs to address premises not meeting 25 Mbps

There are several ongoing proactive and reactive programs at NBN Co to resolve the lines that do not meet 25 Mbps. Proactive programs include:

- End of co-existence
- Ongoing copper rehabilitation program
- Ongoing program to remove logical faults that cause crosstalk noise

FTTN end of co-existence is achieved on a SAM-by-SAM basis with an inflight program to progress end of co-existence to the whole FTTN network. This program works to identify the SAMs that can progress as they become eligible and to resolve the logical and physical issues per SAM.

The remaining premises fall within NBN Co's copper rehabilitation program or other programs set up to remove logical faults. The ongoing copper rehabilitation program reviews network telemetry data on a continuous basis to prioritise copper network areas and services for field investigation. At field investigation, components are either fixed at the time or details recorded for subsequent work to replace components such as cable joints and/or segments of cable with new for old. NBN Co's ongoing program/s to remove logical faults that cause crosstalk noise involves locating and resolving logical faults created through operational work or augmentation activity that creates crosstalk or vectoring issues on lines which can impact customer speeds in localised pockets.

In addition to the proactive programs to address services that do not achieve 25 Mbps there are also reactive activities, including service assurance, in-home wiring fixes, network remediation and network augmentation that are performed upon receipt of fault and trouble tickets raised by RSPs. The most recent update to the wholesale broadband agreement strengthens the provisions and incentives for NBN Co to complete these reactive assurance, remediation and augmentation activities and achieve 25 Mbps for all customers.

Due to the ongoing impacts to network performance due to environmental and operational factors there are services that previously achieved 25 Mbps which fall below that threshold. The ongoing proactive and reactive programs to address these issues described above subsequently restore services above 25 Mbps. The effect of services moving into then out of the group of services below 25 Mbps causes the volume of lines that do not meet 25 Mbps to remain consistent; however, the composition of the lines that make up that volume is continuously changing. This is normal practice for network operation globally.

Conclusion

Actual speed and performance measurements of wholesale layer 2 services on the nbn indicate that the network is operating congestion free and supports that the SOE criteria of 50 Mbps to 90 per cent of the fixed line footprint is satisfied. In regard to the SOE criteria of 25 Mbps to all premises, NBN Co has ongoing proactive and reactive programs in place to resolve these lines, including the progressive end to co-existence, addressing in-home wiring issues and the ongoing network assurance program. As such the quantity of lines operating below the 25 Mbps criteria is continuously changing as lines are improved and other lines fall below the threshold due to environmental and operational factors. This is consistent with global best practice and in-line with, or better than other global copper network operators.

Other Key Documents	Link/Attachment
Network Design Rules as part of NBN Co's Service Access Undertaking	nbnco.com.au/content/dam/nbnco2/2020/documents/sell/sau/Network%20Design%20Rules.pdf
Transparency Metrics – Network Usage Dashboard	nbnco.com.au/corporate-information/about-nbn-co/updates/dashboard-september-2020

Glossary

Term	Description
A	
ADSL	Asymmetric Digital Subscriber Line: Technology for delivering broadband over copper telephone lines. Used for connecting to the Internet
API	Application Programming Interface
AS	Access Seeker: Organisation buying access to nbn for re-sale / Customers of NBN Co's network, be they Retail Service Providers (RSPs) or Wholesale Service Providers (WSPs)
AVC	Access Virtual Circuit
B	
B2B	Business to Business: Integration of NBN Co applications with similar applications operated by Access Seekers
Backhaul	Backhaul typically refers to the mid-to-long-distance transport of data from a series of disparate locations back to a more centralised location. This transport may involve some level of concentration (also referred to as aggregation)
BCM	Business Continuity Management
BDF	Base Development Fund
BSS	Business Satellite Services
BU	Business Unit
Burstiness of traffic	Variability in data transfer rates due to changing traffic demand
Busiest hour of the day	Refers to the Busy Hour Cell Performance on the Fixed Wireless network. The download speed performance of the Wireless Network in the busiest hour of that cell, averaged over the last 30 days
C	
CAP	Connections Approval Policy
CAT	Concept Advisory Team
CINR	CINR is defined as Carrier-to-Interference-and-Noise Ratio. The ratio between the power of the Radio Frequency (RF) carrier bearing the wanted signal and the total power of interfering signals and thermal noise
Customer	The end-user of the nbn network service
CVC	Connectivity Virtual Circuit

D	
Delayed Site	A site in which the EFSCD is in the past and it has been confirmed that a resident has taken occupancy
DFN	Distribution Fibre Network: provides the underground fibre pathways between the FAN sites and the Fibre Distribution Hubs (FDH). The FDH then connects the DFN with the Location Fibre Network (LFN)
DP	Delivery Partner sub-contractor for Design and Construction
DPC	Data Processing Centre
DPU	Distribution Point Unit Device used in FTTC access network, typically installed in the pit closest to the customer's premises. Functional equivalent to a DSLAM. Converts signal from fibre optic network to copper network
DSL	Digital subscriber line: The most common is ADSL. Uses your existing telephone line to deliver high-speed Internet access. Allows voice communication and high-speed data transmission on the same line at the same time
DSLAM	Digital Subscriber Line Access Multiplexer Network device / technology that sits between fibre optic cable and copper telephone lines. Located at exchanges or in roadside cabinets that take the copper lines from a customer's premises and converts signals on/off them into a high-speed pipeline to the internet
E	
EFSCD	Estimated First Service Connection Date
EoC	End of co-existence meaning when the last legacy services are removed from a DSL service area
EPG	Wireless Evolved Packet Gateway
EPID	Eligible Party Identification Codes
ELMS	Enterprise Location Management System
EMS	Element Management System Application that manages elements of the Active network
EUAP	External User Administration Portal
F	
FAN	Fibre Access Node: A facility (normally in Telstra exchanges) that houses the active equipment providing services to a Fibre Serving Area (FSA). They connect up to a POI to provide retail services to customers
FDH	Fibre Distribution Hub: Street side cabinets which are used to house the Gigabit Passive Optical Network (GPON) splitters used to facilitate connectivity between the Distribution Fibre Network (DFN) and the Local Fibre Network (LFN)

FSA	Fibre Servicing Area
FTTB	Fibre to The Building: fibre optic cable to an office or apartment building, and then utilising building infrastructure to individual premises (e.g. copper, Ethernet etc.)
FTTC	Fibre to the Curb: fibre optic cable to a DPU (Delivery Point Unit) then utilising existing copper lead-in cable to premises
FTTN	Fibre to The Node: fibre optic cable to a node like a kerbside cabinet, and then utilising existing copper line to premises
FTTP	Fibre to The Premises: fibre optic cable right to the premises – requires fibre optic NTD (i.e. modem/router) in premises
FTTx	Generic term used for fixed line services
FW	Fixed Wireless nbn Access Technology that uses LTE (4G) and microwave backhaul to provide customers' premises an nbn service
G	
Gbps	Gigabits per second
Geocode	A physical location in Australia specified by latitude and longitude coordinates
G-NAF	Geocoded National Address File
GPON	Gigabit Passive Optical Network: the fibre optic portion of the nbn
GRC	Group Risk and Compliance
H	
HFC	Hybrid Fibre Coaxial (Cable)
HFL	Historical Footprint List
I	
IOP	Integrated Operating Plan
IPOLR	Internet Provider of Last Resort
L	
Late Applications	New Developments Program – the application was submitted to NBN Co with less than six months to the EFSCD
LFN	Local Fibre Network: is installed from the FDH to the customer's premises
LOD	Line of Defence

LOC ID	nbn Location ID: Each addressable premises is tagged with a unique location ID (LOC ID). Used to distribute nbn location information consistently across platforms, processes, and the Address Query interfaces used by nbn customers (RSPs)
LFN	Local Fibre Network: The connection between the Fibre Distribution Hubs (FDHs) and the individual premises
M	
Mbps	Megabits per second
MDF	Marketing development fund
MDU	Multi Dwelling Unit e.g. apartment building, blocks of flats
MTM	Multi Technology Mix
MTTR	Mean time to restore
N	
NA-C	Network Analyzer (Network Analyzer for Copper)
NCD	Network Connection Device: is used only in FTTC technology. It is located in the customer's premises and contains a modem and Reverse Power Unit (RPU) connected to the premises power supply. The RPU is connected into the in-premises copper network, between the nbn boundary and the modem
NMC	Network Management Centre
NNI	Network to Network Interface
NPIS	nbn Platform Interfacing Service
NTD	Network Termination Device: Essentially a modem for premises connected directly to fibre optic cable / connects a premises to the nbn. These devices provide up to 4 UNI-D ports, allowing customers to connect up to 4 separate data services from different providers
NTF	National Testing Facility
O	
OAT	Operational Accreditation Testing
ODF	Optical Distribution Frame
OLT	Optical Line Terminal
P	
PDF	Product Development Forum
PDP	Product Development Process

PIR	Peak Information Rate (PIR) is the theoretical speed that a customer could receive if there were no other end-users using at the same time. PIR is limited by the speed of the physical port of connection
PFL	Proposed Footprint List
PNI	Physical Network Inventory
POI	Point of Interconnect: Connection points where RSPs (ISPs, or phone providers) and WSPs connect to nbn. RSPs connect their network to the nbn to service customers
PON	Passive Optical Network
ProdCo	NBN Co's Level 2 executive sponsored product committee
R	
Radio Access	Component of the Access Network that is carried by Radio. Typically used in the context of the 'last mile' of Fixed Wireless
RDF	RSP Development Fund
RFS	Ready for Service
RRFS	Region Ready for Service
RSP	Retail Service Provider of NBN Co voice/data services to customers. Have a direct relationship with the customers
RSRP	RSRP is defined as Reference Signal Received Power. It is a measure of the signal strength of a wireless service. When a Fixed Wireless installer performs a signal check prior to installing a service
RTC	Ready to Connect
S	
SAM	Serving Area Module: A geographical subset of premises typically containing between 2000 — 2,500 premises
SAU	Special Access Undertaking
SDR	Systems Digital Roadmap
SFAA	Standard Form of Access Agreement
SIP	Statutory Infrastructure Provider
SL	Serviceable locations
SLA	Service Level Agreement - formally defined delivery time for a service/process
SMP	Sky Muster Plus

SMTS	Satellite Modem Termination System
SOE	Statement of Expectations - latest version (2016) can be found at: nbnco.com.au/content/dam/nbnco2/2018/documents/Policies/soe-shareholder-minister-letter.pdf
T	
TIND	Telecommunications in New Developments Policy
TPEP	Transparent Performance Enhancing Proxy
U	
USO	Universal Service Obligation
W	
WBA	Wholesale Broadband Agreement: Terms and conditions of access to nbn products and services. Copy can be found at : nbnco.com.au/sell-nbn-services/supply-agreements/wba