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Temporary Special Services White Paper

CustomNet Spectrum on the nbn™ Ethernet Bitstream Service

Contents

nbn provides product capability to enable the industry to develop solutions for the migration of Telstra CustomNet Spectrum business services to the national broadband network.

nbn provides key product capabilities suitable to support the migration pathway for services including Telstra CustomNet to the **nbn**™ Ethernet Bitstream Service (NEBS).

NEBS can help the industry simplify and standardise the provisioning and management of their access infrastructure around solutions comprised of the fibre-based access technologies of Fibre to the Premises (FTTP), Fibre to the Node (FTTN) and Fibre to the Building (FTTB). It also offers a range of Enhanced Service Levels facilitating additional support to businesses and other End Users.

The purpose of this White Paper is to outline how **nbn**'s product capabilities for the fibre-based NEBS access technologies of FTTP, FTTN and FTTB can enable the industry to develop business packages and bundles that are the same as, or better than their legacy copper-based equivalents in the TSS product class of Telstra CustomNet.

Temporary Special Services (TSS) are a set of telecommunication products delivered on copper, primarily targeted at the business market. The complete list of more than 20 Telstra Retail & Wholesale Special Services is available on **nbn**'s website[1]. This White Paper is aimed at the TSS product class of Telstra CustomNet. Telstra CustomNet provides enterprise telephony between handsets connected to a central node via POTS copper for the delivery of business and collaboration solutions.

This document forms part of a series of White Papers to illustrate the capability of the **nbn** as a suitable migration pathway for TSS services. For the full schedule of proposed White Paper releases, please refer to the Integrated Product Roadmap on **nbn**'s website[2]. This is a White Paper published by **nbn** in accordance with the Subscriber Agreement between **nbn** and Telstra.

[1] http://www.nbnco.com.au/connect-home-or-business/information-for-home-or-business/will-it-work-over-the-nbn/what-services-will-be-switched-off.html

[2] http://www.nbnco.com.au/content/dam/nbnco/documents/Integrated-Product-Roadmap.pdf

[3] Note: Some minimum speeds, features and capabilities may not be available for fibre- based FTTN and fibre- based FTTB where the Line Rate of the service cannot accommodate this

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Service overview

In today's networking world, Ethernet access services offer a mix of speed, cost, equipment support and simplicity. Fibre-based NEBS services provide a Layer 2 Ethernet-based connectivity circuit between a UNI that serves an End User's premise and a Point of Interconnection (POI)/ Network-Network Interface (NNI). If **nbn** deploys fibre-based FTTP, it replaces an existing copper access service with fibre all the way from the POI/NNI to the End User's premises. For services delivered via fibre-based FTTN or FTTB, the length of the copper access service path is optimised for broadband speeds by placing a DSLAM either in, or as close as reasonable and practicable, to the End User premises.

When NEBS is delivered via the FTTP network, the virtual circuit is terminated on a Gigabit Ethernet port on the **nbn**™ NTD. For services delivered across FTTN/B, the Service Provider (or End User, depending on the Service Provider's service model) can select any VDSL2 equipment that is compatible with the **nbn**™ technical specification and satisfies the value proposition for their intended End User. **nbn** publishes the criteria and specification to ensure equipment compatibility, while preserving flexibility to the Service Provider and their End Users to the extent practical.

Best practice and industry standards alignment

nbn™ solutions deliver consistent, predictable performance and business-level reliability for Service Providers and their End Users.

In addition, ITU-T Y.1731[4] is widely used by the **nbn** teams for internal network management purposes, and all the benefits of **nbn**'s widespread adoption of this standard are passed on to the Service Provider.

[4] Note. ITU-T Y.1731 provides standards-based Ethernet performance monitoring that encompasses the measurement of Ethernet frame delay, frame delay variation, and frame loss and throughput as outlined in the ITU-T Y-1731 specification and interpreted by the Metro Ethernet Forum.

What is Traffic Class 2 (TC-2) and how does it work?

nbn's Traffic Class 2 capability provides Service Providers and their End Users with performance objectives covering bandwidth, delay, jitter and packet loss:[5]

Traffic Class	nbn™ Network	Frame Delay (one way)	Frame Delay Variation	Frame Loss
TC-2	NEBS-FTTP	≤ 6 ms	≤ 10 ms	≤ 0.01%
	NEBS-FTTN/B	≤ 25 ms	≤ 16 ms	≤ 0.04%

TC-2 is engineered to address the needs of business services that require tighter performance commitments than a 'best-efforts' solution, such as those carrying high-bandwidth, real-time, interactive multimedia applications. Every fibre-based[6] NEBS service may be configured to use TC-2 by selecting a bandwidth rate from a flexible menu of standardised profiles.[7]

The TC-2 traffic performance undertakings for bandwidth are enforced by a set of values prescribing burst rates. For TC-2 class traffic, a bi-directional, fixed burst period of 10 ms applies. The NEBS product is built of four product components, including two key logical components that are dimensioned by the Service Provider to deliver the value proposition required to secure their target market.

What is an AVC?

The NEBS Access Virtual Circuit (AVC) provides a direct, one-to-one connection at Layer 2 between the Service Provider and its End User's premises. Traffic crossing the AVC is structured to identify the owning customer and moves securely through the NEBS infrastructure between the Service Provider's connection to the POI/NNI on one side and the UNI which serves the Premises on the other. For FTTP, the location of the UNI port is found on the **nbn** provided NTD, for FTTB the customer side of the MDF or for FTTN through the telecommunications outlet. This gives the Service Provider a high degree of control and management over many aspects of service configuration and performance. When **nbn** terminates NEBS on an NTD it does so on an Ethernet interface. For fibre-based FTTP, the maximum size of an Ethernet frame at the UNI-D is 1,992 bytes for default-mapped or DSCP or 1,996 bytes for Priority-Tagged and Tagged modes. For fibre-based FTTN/B, the maximum size of an Ethernet frame at the UNI-DSL is 1,596 bytes from destination MAC Address to Frame Check Sequence (FCS) inclusive, which matches standard Ethernet behaviour.

AVC bandwidth options

NEBS gives Service Providers the bandwidth capacity and flexibility to control their End User's traffic profiles. Each AVC automatically supports a TC-4 subscription, which is a 'best-efforts' bandwidth allocation. At order time, Service Providers may choose an AVC profile that allows it to carry an amount of TC-2 traffic to support the provision of high-bandwidth, business-critical interactive multimedia applications. The TC-2 bandwidth capability of up to 20 Mbps on fibre-based FTTN/B, or up to 40 Mbps (planned to soon be up to 100 Mbps) on fibre-based FTTP, matches or exceeds the upper end of many DSL-based retail Ethernet services available in the Australian market today.[8] **nbn** also provides differing modes of addressing the Traffic Class 2 AVCs at the UNI, including Default-Mapped, DSCP, Priority-Tagged and Tagged options.

What is a CVC?

The NEBS connectivity virtual circuit (CVC) collects AVCs from a connectivity serving area (CSA) and presents them in an aggregated bundle to the Service Provider at the POI/NNI, again using a selectable mix of highly scalable, cost-effective and widely supported physical Ethernet interfaces. A single CVC may contain AVCs that are presented to End Users and delivered across all fibre-based NEBS access technologies. The maximum Ethernet frame size at the POI/NNI depends on whether a particular AVC is presented to a UNI-D or UNI DSL. For an AVC to a UNI D, the maximum Ethernet frame size is 2,000 bytes, which comfortably exceeds the maximum size of a standard Ethernet frame. For an AVC to a UNI-DSL, the maximum Ethernet frame size is 1,600 bytes from destination MAC to FCS (inclusive), which matches standard Ethernet behaviour for double-tagged (802.1ad) frames.

[5] Note: Some minimum speeds, features and capabilities may not be available for fibre-based FTTN and fibre-based FTTB where the Line Rate of the service cannot accommodate this.
[6] Fibre=based NEBS refers to Fibre to the Premise (FTTP), Fibre to the Node (FTTN) and/or Fibre to the Building (FTTB).
[7] Some bandwidth rates are only available for NEBS supplied using FTTP.
[8] Note: Some minimum speeds, features and capabilities may not be available for fibre-based FTTN and fibre-based FTTB where the Line Rate of the service cannot accommodate this.

CVC bandwidth options

CVC bandwidth profiles are flexible and can be 'mixed-and-matched' between traffic classes to achieve a granular assortment of traffic class capacities. The CVC profile is a customised set of single traffic class-specific values. The Service Provider may choose a particular bandwidth for one traffic class independently of the bandwidth chosen for another traffic class on the same CVC. In some cases, the CVC might only specify and carry one or two of the available traffic classes if it has no need to support the others.

The speed tiers for each traffic class on a CVC are always symmetric, even for those (like TC-4) that are asymmetric when considered for an individual AVC.

Symmetric speed tiers available		
TC-1 traffic class speed tiers	5, 10, 20, 25, 30, 40, 50, 60, 80, 100 120, 150, 200, 250, 300, 400 and 500 Mbps	✔
TC-2 traffic class speed tiers	5, 10, 20, 25, 30, 40, 50, 60, 80, 100, 120, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900 and 1000 Mbps	✔
TC-4 traffic class speed tiers	100, 150, 200, 250, 300 to 10,000 Mbps (in 100 Mbps increments).	✔

Contention management

The NEBS interconnection architecture allows each Service Provider to use the aggregating CVC into a serving area to directly influence its End Users' traffic experience. **nbn** does not prescribe the AVC bandwidth ratios applied to a CVC for fibre-based NEBS, so the Service Provider is free to scale the CVC to either:

- Protect the performance metrics for that class for traffic crossing each AVC; or
- Experience some degree of contention among AVCs, to strike an economic balance between performance and cost.

Provided the Service Provider doesn't oversubscribe the CVC, and maintains an average utilisation level that does not exceed the recommendations for NEBS (70%), the general performance levels of TC-2 are expected to provide an appropriate migration path for existing SHDSL-based exchange-fed copper services available in Australia today. Service Providers are responsible for testing the operation of their services, including contention and dimensioning, to ensure they obtain desired performance and other service characteristics.

Traffic class signalling

NEBS is designed to allow the Service Provider and/or End User's equipment to set the IEEE 802.1Q PCP field in the Ethernet header of a tagged Ethernet frame presented at the UNI or POI/NNI (available for the UNI if Tagged or Priority Tagged mode is selected). By using this field in supported modes, the frame can declare the traffic class membership (TC-1, TC-2 or TC-4) for the journey over the AVC while leaving the IP Precedence/DSCP field to signal end-to-end Class of Service (CoS).

For the purposes of CPE compatibility and/or management simplicity, the Service Provider or End User may prefer to use the IP Precedence/DSCP field in an IP packet, or employ a default class membership for every frame at the UNI. NEBS can also support this requirement and **nbn** has published the required values for IP Precedence/DSCP mapping of each traffic class.

Compatible NTD CPE

For Service Providers looking to migrate CustomNet End Users to services delivered over NEBS, there are two options in terms of NTD CPE, depending on the nature of the migration:

1. Replacement of the passive copper access component in CustomNet with an active Ethernet access service based on NEBS (using a customer supplied emulation device) or
2. Migration of the End-User away from CustomNet to an IP-Centrex based solution or Voice over IP offering (e.g. Carrier-hosted IP Centrex).

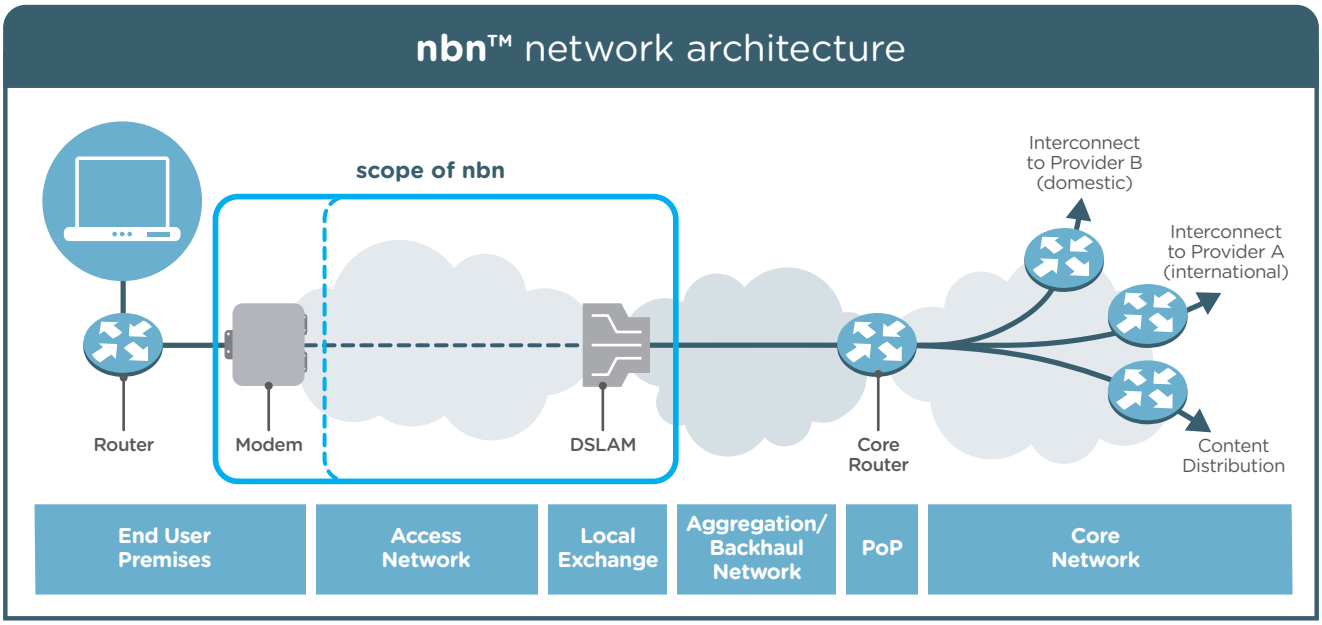
A migration of the CustomNet service from a copper access to any form of fibre-based NEBS service (FTTB/N or FTTP) will require the introduction of a suitable ATA or (Analogue Terminal Adaptor) at each End-User premises that will enable the encapsulation of CustomNet Traffic to and from the End-User handsets for delivery to Telstra's DMS-100 Points of Presence. Such an implementation would typically be delivered in a similar fashion to a VOIP Gateway, simplifying deployment and management of the ATA environment.

The migration of the End User onto an IP-Centrex environment has far greater implications in terms of the NTD/CPE environment, and would require a wholesale change to infrastructure in the End User's environment including Handsets and any associated peripheral applications. Such a scenario would require that the End User has a suitable IP/Ethernet enabled LAN environment into which the new solution can be deployed.

While the NTD/CPE environment would change with a migration to NEBS, if the Service Provider elects to move End-Users to an IP-Centrex solution such as Voice over IP offering, the core functionality would be equal to or better than that offered over CustomNet.

Standardised broadband network architecture

Each variant of **nbn**'s fibre-based NEBS solution involved will either modify or replace the existing copper access provided as part of a current CustomNet service. The solution aggregates End Users within a service area and backhauls their Ethernet traffic to and from an NNI/POI for interconnection to the Service Provider. This is consistent with broadband architectures used in Australia and other parts of the world, and helps to standardise changes at the End User's premises. The diagram below shows an illustrative comparison of the scope of the **nbn** access replacement within a standardised broadband network architecture.



For the Service Provider, the use of **nbn**'s fibre-based NEBS service will see the modification, replacement or elimination of these access components, depending on the access technology:

- The provision of an **nbn**-supplied NTD for FTTP or a Service Provider-/ End User-supplied VDSL2 modem for FTTN/B
- The existing copper access service will be replaced with fibre for FTTP or modified by **nbn** for FTTN/B
- DSLAM infrastructure is not required for FTTP and is provided by **nbn** for FTTN/B

The Service Provider and/or End-User may elect to preserve CustomNet functionality using an access substitution approach that involves some combination of specialised packetisation equipment (including a compatible Analogue Terminal Adaptor – or ATA) at each end user premise and at the central CustomNet node. Alternatively, the Service Provider and End-User can replicate industry trends and move entirely to a contemporary IPT/UC architecture, maintaining a highly featured telephony environment that is controlled and delivered by a different host platform. In either case, the TC-2 traffic class can be ordered in bandwidth profiles which include enough capacity for many concurrent calls over a single NEBS link, provided the Service Provider and End-User configure the NEBS link and services running over it appropriately, for example by scaling the class subscription with sufficient bandwidth, and correctly managing the consumption and QoS treatment of other applications.

The result is a simplified access network for the Service Provider, with a standardised Ethernet access virtual circuit terminating on the UNI at the End User's premises.

Commercial advantage

For a Service Provider, **nbn**'s TC-2 and Enhanced Service Levels for assurance would be considered cost inputs into an end-to-end solution offered to an End User e.g. **nbn**'s TC-2 will be one of the many costs and input parameters in the overall solution. **nbn**'s product capabilities provide attractive commercial pricing for Service Providers to deliver an End User solution.

Specifically, **nbn**''s architecture allows multiple services to be consolidated and delivered using a single wholesale access service, which can deliver operational benefits to customers. s

Highly secure

As NEBS uses GPON infrastructure, traffic is highly secure as a traffic encapsulation method called GEM that applies AES 128 encryption is applied to all transmissions over fibre-based FTTP. The encryption is applied at the **nbn**-provided NTD. Each NTD is managed and controlled by **nbn**, excluding direct management access by the Service Provider or End User. AES 128 with a good quality key is generally acknowledged to be very resistant to unsophisticated cracking attempts, meaning that fibre-based FTTP offers good quality protection against such attacks on its shared access network. The fibre-based FTTN/B does not require the same traffic encapsulation and encryption methods as it does not use a shared resource in the last mile, but provides the End User with a dedicated access tail, similar to exchange-fed copper services today.

Network demarcation

A move of CustomNet End Users to a customer supplied emulation device (ATA) solution would introduce two new Network Demarcation points for the Service Provider within their network which vary by access technology. Namely:

For FTTP – The UNI at the End-User premises and the **nbn** NNI at the POI.

For FTTN/B – the UNI used to serve the End-User site, and the **nbn** NNI at the POI.

For the End-User, these changes in Network Demarcation points would be transparent to their CustomNet service.

A migration to an IP-Centrex solution would also have an impact on the Network Demarcation points.

Like the migration to a Service Provider supplied emulation device, the Carrier-hosted IP Centrex option would result in the Service Provider replacing the current Copper based access services with NEBS services – as such the demarcation point identified for a migration to a customer supplied emulation device would also apply to a migration to an IP-Centrex solution.

Sophisticated customer reporting, monitoring and diagnostics tools

Customer reporting

A key element of the migration of services to the **nbn**™ network is the ability for the Service Provider to continue to deliver a level of reporting services to its Business End Users.

nbn provides Service Providers with a series of service management and self-management tools to support core operational functions including ordering, activation, management and assurance across all **nbn**™ product and access technologies, including fibre.

Service management information will be accessible via four methods:

1. Database access via the B2B interface
2. An online, browser-based graphical management dashboard
3. Standardised reports with regular delivery timeframes, including regulatory and technology-specific reports that roll up to the dashboard
4. Customised ad-hoc and incident-based reports including the ability for the Service Provider to build their own specific reports.

Self-Service tools will be accessible by two methods:

1. B2B interface into testing tools and database
2. An online, browser-based graphical dashboard

Customer reporting tools available and in plan as part of nbn's NEBS service		
Connection reporting	By status, geography and priority, connection appointment performance	✓
Order and ticket management	Including AVC and CVC MACS performance, fault rectification performance	✓
Network availability	Network availability, sortable by geography, product, volume of Service Providers impacted (updated hourly)	✓
Operational Support tools	• Dashboard reporting on incidents • Monthly trouble ticket reporting • Total active services by product type • Reports on Response KPI performance • Port error statistics	✓

Internal reporting, monitoring and diagnostics

The offering based on **nbn**'s NEBS fibre services provides the Service Provider a range of diagnostics capabilities:

Diagnostics Capabilities		
UNI-D NTD Status (NEBS-Fibre)	Retrieves information about the UNI-D port from the Access Network. **Key attributes:** • NTD Status Information • UNI-D Status Information **Diagnostic uses:** • General information about the NTD/UNI port and its operational status	✔
Loopback Connectivity Test[9] (NEBS-Fibre)	Ethernet OAM based end-to-end connectivity test (for fibre based FTTP based services only) **Key attributes:** • Loopback test result (i.e. pass/fail) • Number of packets sent vs. number of packets received • Number of out-of-order packets **Diagnostic uses:** • Troubleshooting connectivity issues • Aid in fault localisation (be it in a Service Provider's or **nbn**'s network) in the form of Y.1731 loopback (LBM/LBR)	✔
Performance Tests[10] (NEBS-Fibre)	Testing of services over a fixed period of time to provide performance metrics (Frame Delay, Frame Delay Variation, Frame Loss Ratio) **Key attributes:** • Frame Delay • Frame Delay Variation • Frame Loss Ratio **Diagnostic uses:** • Troubleshooting throughput related issues • Ensuring end to end performance of service (Ethernet layer) within **nbn**'s network according to product specifications as specified in the product specification document using Y.1731 (DMM/DMR)	✔

[9] The Internal loopback test for fibre based FTTN/B is run between the NNI and DSLAM port

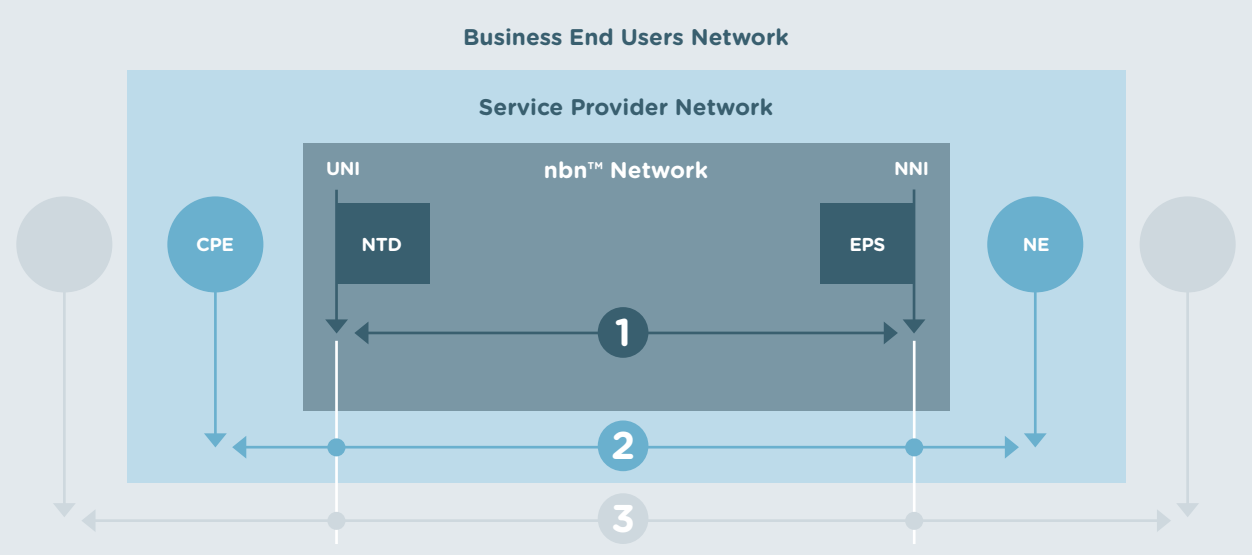
[10] The Performance testing capability for fibre-based FTTN/B is planned to be made available to Service Providers by 1H 2017, as per Integrated Product Roadmap. http://www.nbnco.com.au/content/dam/nbnco/documents/Integrated-Product-Roadmap.pdf

With the introduction of a proposed network demarcation point between the Service Provider and **nbn**'s infrastructure, a Service Provider's operational groups will be able to monitor and manage the **nbn**™ infrastructure as another element in their network. **nbn** has implemented an OAM framework in alignment with industry standards, which it plans to further enhance through offering visibility of **nbn**™ service boundaries at the Service Provider and Business End User level. The diagram below illustrates the monitoring architecture that is available to Service Providers.

Using the **nbn**™ network to deliver fibre access, the Service Provider will have monitoring visibility (as per diagram below) of services at a range of points throughout the **nbn**™ network including:

- Point of ingress to the **nbn**™ network via the regional broadband network
- The Access node
- The **nbn**™ NTD (in the case of fibre-based FTTP)

nbn diagnostic capabilities



▼ Diagnostic End Point
● Diagnostic Intermediate Visibility Point

1. **nbn** has the ability to perform full diagnoses and monitoring within its network boundaries
2. Service Providers have the ability to perform end-to-end diagnostics and monitoring, with visibility of **nbn**'s service boundaries
3. Business end-users have the option of performing end-to-end testing across **nbn** services, with the option of visibility of **nbn** service boundaries

The advanced reporting capabilities available on **nbn**'s NEBS fibre services will provide the Service Provider with Internal Reporting capability comparable to current capability. The ability to partition monitoring between **nbn**-provided and Service Provider-delivered services will enable more accurate root cause analysis of faults, improving the efficiency of fault management and enabling the delivery of a more consistent user experience for Business End Users.

Service levels

Service installations

nbn's service installation targets specified in its arrangements with service providers for fibre-based NEBS are between 9 and 19 business days, depending on service location and available infrastructure.

The following are **nbn**'s End User connection service levels (install target in business days). All of these service levels are subject to conditions and exceptions set out in **nbn**'s Wholesale Broadband Agreement Service Providers.

Service offering	Geographical Area	Urban Area (days)	Rural Area (days)	Remote Area (days)
NEBS-FTTP	Service Class 1	14	19	19
	Service Class 2	9	14	19
	Service Class 3	1	1	1
NEBS-FTTN/B	Service Class 10	N/A	N/A	N/A
	Service Class 11[11]	14	19	19
	Service Class 12	9	14	19
	Service Class 13	1	1	1

No service installation targets are currently published by Telstra for CustomNet.

For customers undergoing migration from CustomNet to alternative products offered by Service Providers using NEBS fibre services, the Service Provider has the opportunity to offer the following service installation targets, depending on the solution migration choice as below:

- CustomNet over **nbn** (using a customer supplied emulation device)– service installations targets can be offered on access components of the solution as per above **nbn** targets.
- IP Centrex based Solutions (eg. solutions like TIPT over **nbn**) – service installation targets can be offered on access components of the solution as per above **nbn** targets. In addition application installation targets may also be offered by the Service Provider.

In both cases the Service Provider would need to calculate the end-to-end solution service levels using the **nbn** service installation targets offered to that Service Provider by **nbn** as an input into the Service Provider's overall solution service level.

[11] Service Class 11 is not applicable to fibre-based FTTB.

End-user service fault rectification[12]

nbn has introduced a suite of standard and enhanced service levels for assurance which are expected to be of particular use with respect to Small and Medium Business End Users.

The following are the standard assurance service level options for fibre-based NEBS:

Location of Premises	Service Levels (business hours)		
	End User Fault Response (hours)	End User Fault Rectification	
		nbn FTTP Network	nbn FTTN/B Network
Urban Area And other locations where End User fault does not require external or internal plant work or **nbn** attendance	1	3:00pm next Business Day	5:00pm next Business Day
Major Rural Area or **Minor Rural Area**	1	1:00pm second Business Day	5:00pm second Business Day
Remote Area	1	11:00am third Business Day	5:00pm third Business Day

A range of enhanced assurance service level options are also available for fibre-based NEBS:[13]

Location of Premises	Service Levels for Enhanced Fault rectification	
	Enhanced-8 & Enhanced-8 (24/7)	Enhanced-12 & Enhanced-12 (24/7)
	Service level (hours)[14]	
Urban Area And other locations where End User fault does not require external or internal plant work or **nbn** attendance	8	12
Major Rural Area and **Minor Rural Area** Where the fault requires external or internal plant work or **nbn** attendance at the premises	22	26
Remote Area Where the fault requires external or internal plant work or **nbn** attenance at the premises	36	40

[12] For full End User Service Fault Rectification details please refer to the Service Level Schedule section of the WBA - http://www.nbnco.com.au/sell-nbn-services/supply-agreements/wba2.html

[13] For full details on Service Levels for Enhanced Fault rectification please refer to the Service Level Schedule section of the WBA. http://www.nbnco.com.au/sell-nbn-services/supply-agreements/wba2.html

[14] The Service Levels are calculated by reference to the Operational Hours that apply to the relevant Enhanced Fault Rectification Service option. Part E of the Service Level Schedule Section of the WBA explains how Operational Hours are calculated.

Where **nbn** does not achieve an Enhanced Fault rectification service level as specified above, **nbn** will provide the Service Provider with an Enhanced Fault Rectification rebate[15].

Further Enhanced Service Levels for assurance including 6 and 4 hour variants are planned to be delivered by Q3 2016, as per the Integrated Product Roadmap, published on **nbn**'s website[16].

Network availability targets

The **nbn**™ network availability is a performance objective of 99.90%[17] across all current access technologies.

For customers currently using Telstra CustomNet, no availability targets are published.

For customers undergoing migration from CustomNet to alternative products, the Service Provider has the opportunity to offer the following availability targets, depending on the solution migration choice as below:

- CustomNet over **nbn** (using a customer supplied emulation device) – availability targets can be offered on access components of the solution as per above **nbn** targets.
- IP Centrex based Solutions (e.g. Telstra's TIPT) – availability targets can be offered on access components of the solution as per above **nbn** targets. In addition IP Telephony application availability targets may also be offered by the Service Provider.

In both cases the Service Provider would need to calculate the end-to-end solution service levels using the **nbn** availability targets offered to that Service Provider by **nbn** as an input into the Service Provider's overall solution service level.

[15] For full details of the rebates and structure please refer to the Service Level schedule of the WBA.

[16] http://www.nbnco.com.au/content/dam/nbnco/documents/Integrated-Product-Roadmap.pdf

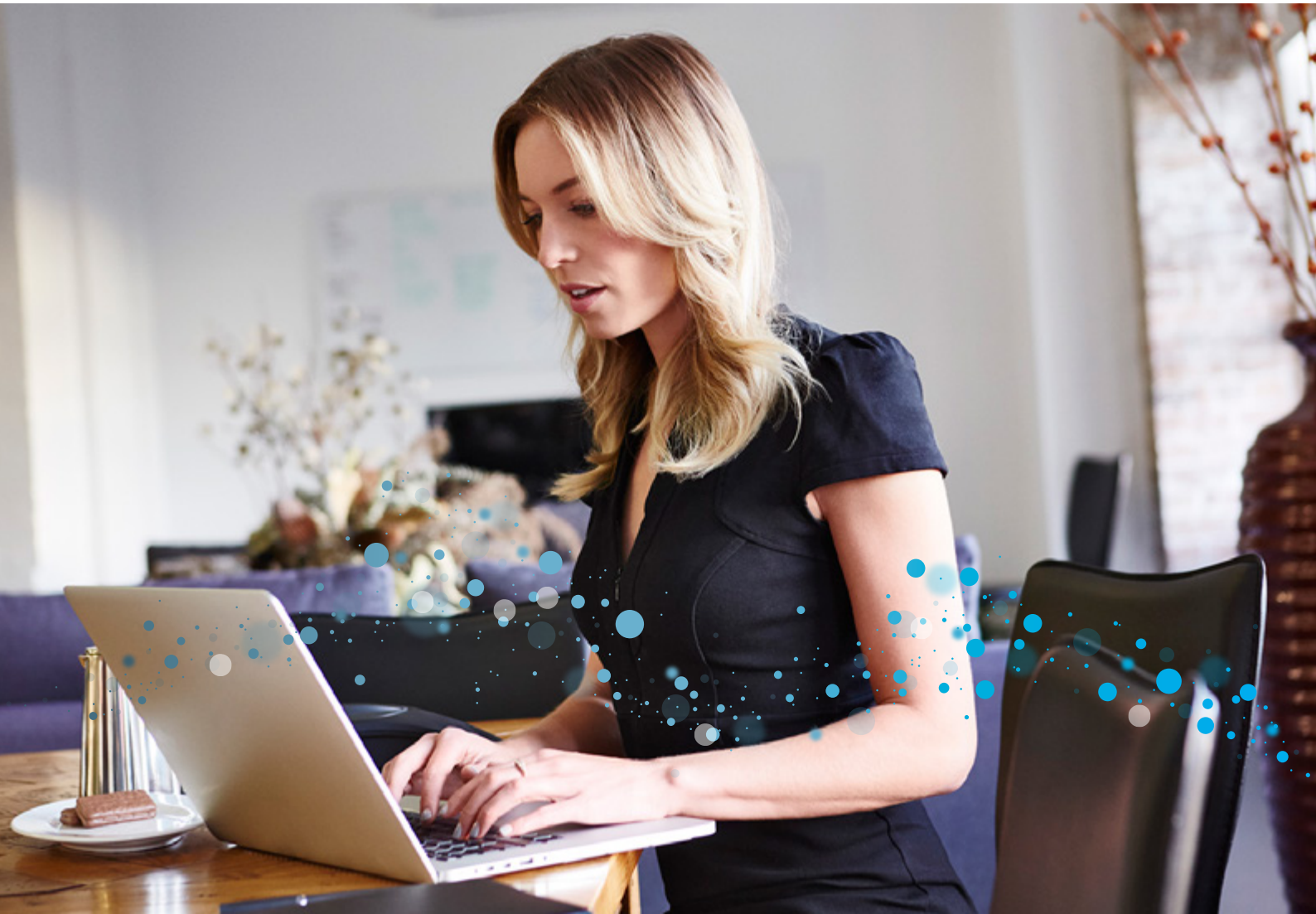
[17] For full details on the Network Availability target and its calculation methodology please refer to the Service Level Schedule section of the WBA. http://www.nbnco.com.au/sell-nbn-services/supply-agreements/wba2.html

Conclusion

nbn's Traffic Class 2 features and suite of enhanced service levels for assurance provide a clear migration path for Telstra CustomNet TSS class from exchange-fed copper-based access lines to the fibre-based **nbn**™ Ethernet Bitstream Service (NEBS).

These features and capabilities provide Service Providers with the ability to provide simple, converged solutions that satisfy a migration from legacy products to **nbn**'s solution, and also provide a variety of enhanced service levels for assurance and network feature capabilities that meet the needs and requirements of End Users.

Notes: Terms used but not defined in this White Paper have the meaning given in **nbn**™'s Wholesale Broadband Agreement, which is publicly available on **nbn**™'s website, or the Subscriber Agreement between **nbn**™ and Telstra which is confidential.



Appendix: comparison table

Security Against Opportunistic Eavesdropping	Feature or Function	Telstra CustomNet	nbn's Product Capability
Network Architecture And Product Capability	Dedicated copper POTS line from central node per handset	✓	NA
	VC based, connection orientated packet switching network	NA	✓
	Virtual Circuit hand-off models	NA	✓
	Available transmissions rates	NA	✓
	Multi-service upper-layer protocols, including IP	NA	✓
	Head end handoffs	NA	✓
	Contention Management	NA	✓
	Maximum Frame Size	NA	✓
	UNI Operating modes	NA	✓
	Contention Management	✓	✓
	Security Against Opportunistic Eavesdropping	✓	✓
Performance Metrics	Performance Targets	NA	✓
Reporting Capability	Reporting on End User service performance and/or call accounting data	✓	✓
Network Availability	High Availability Service Levels	NA	✓ 99.90% combined across NEBS, service providers and networks (excluding Satellite)
Service Levels for Assurance	Extended Business Hours (default)	✓	✓
Service Levels for Activation	Existing cabling on premises: 15 days IPVPN Connection: 20 days	NA	✓
Commercials and Pricing	Price point per service	✓	✓

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Temporary Special Services White Paper – CustomNet Spectrum on the **nbn**™ Ethernet Bitstream Service

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Disclaimer: This document provides general information about the technical requirements for connecting to the **nbn**™ network and is correct as at April 2016. Technical connection requirements may change due to factors such as legislative and regulatory requirements as well as advances in technologies. For any queries about your particular circumstances or requirements, please consult your phone and internet provider or other supplier.