Product Technical Specification – Interim Satellite Service

14 DECEMBER 2012

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Bringing broadband to life

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NBN Co Limited

Product Technical Specification - Interim Satellite Service

14 December 2012

VERSION: 1.1

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Environment

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Contents

1 Scope and Purpose

1.1 Document Purpose

This Product Technical Specification describes the functional and high-level operational aspects of NBN Co's Interim Satellite Service (**ISS**).

It is intended for a technical audience that is responsible for integrating NBN Co's Products into their own service delivery architecture.

This document is specific to the ISS and may be updated by NBN Co from time to time in accordance with the Satellite Wholesale Broadband Agreement Modules.

1.2 Definitions

A capitalised term that is used in this Product Technical Specification has the meaning given to that term in the Dictionary in section 8 of this Product Technical Specification.

If a capitalised term is not defined in the Dictionary for this Product Technical Specification, it has the meaning given to that term in the Satellite Wholesale Broadband Agreement Modules or the Satellite WBA Product Catalogue, as the case may be.

2 Supported Service Types

2.1 Unicast Data Services

The ISS supports the flexible delivery of unicast data services. Unicast data services may be used for a variety of data applications, such as Session Initiation Protocol (**SIP**)-based telephony services and Internet access.

These unicast data services provide a hub and spoke based point-to-multipoint (aggregated) connectivity between one or more UNIs located at the Premises and an NNI.

2.2 Telephony Services using an External ATA Device

The ISS may be used by Customer for the provision of SIP-based telephony services to End Users, using external Customer-supplied Analogue Terminal Adapter (**ATA**) devices connected to a UNI. NBN Co is not responsible for the supply, operation or maintenance of Customer-supplied ATA devices.

All protocols and functions that the Customer utilises to implement the SIP-based telephony services will pass transparently through the ISS Product Components.

If Customer wishes to use the ISS for the delivery of SIP-based telephony services, Customer must:

(1) provide and manage its own core telephony network capabilities that operate across the NBN Co Satellite Network; and

(2) operate the AVC in a manner that recognises the relative priority and sensitivity to network quality of the telephony traffic and select the appropriate AVC Traffic Class accordingly.

3 Service Addressing

3.1 Service Frames

The ISS uses a combination of single-level VLAN identifier and IP addressing in a hub and spoke topology to identify the CVC and AVC accordingly.

For the ISS, the 802.1Q VLAN addressing information encapsulates the S-TAG. The IPv4 address (RFC791) and DSCP (RFC2474) fields in the IP packet header define the AVC addressing (equivalent to the NBN Co Fibre Access Service C-TAG) for each End User.

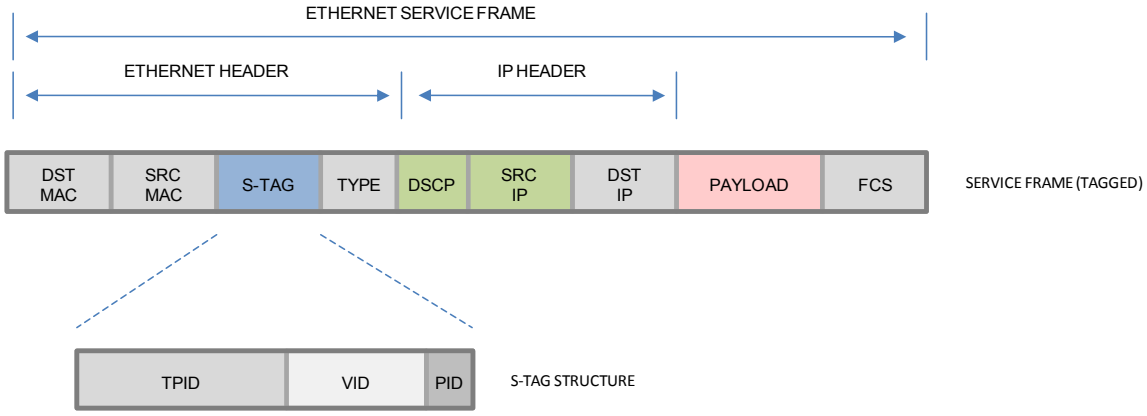

Figure 1 Interim Satellite Service Addressing

3.2 AVC Addressing

The NBN Co Satellite Network provides logical connectivity between the NNI and UNI using the IP address and DSCP fields in the IP packet header.

The NBN Co Satellite Network routing will be configured as a traffic class aware IP spoke within a hub and spoke topology, sending all upstream traffic received (from the End User) to the NNI only. No End User to End User communication will be possible without first traversing the Customer Network.

The entire IP address range, including public and private addresses is available to Customer, per CVC, with the exception of the 10.248.0.0/13 address range which is reserved for use within the NBN Co Satellite Network itself.

The NBN Co Satellite Network manages any request for overlapping use of IP address ranges between Customer and Other NBN Co Customers through the application of the CVC VLAN. It is possible for the same IP address to appear through different S-TAGs (CVCs) on a single NNI or multiple NNIs.

The ISS only supports IP version 4 (IPv4).

During the on-boarding of Customer, NBN Co and Customer will agree the method for pre-allocating IP address pools. The default method is the allocation of addresses to the NBN Co Satellite Network in multiples of Class C IP address ranges (/24). If Customer wishes to request smaller address ranging, Customer must provide reasons to NBN Co that clearly justify the criticality and impact associated with the differing addressing scheme. NBN Co may consider such requests and accept or reject such requests in its discretion.

Allocated address ranges are pre-configured throughout the NBN Co Satellite Network in readiness for AVC provisioning according to the allocation method agreed between NBN Co and Customer during the on-boarding phase. As each AVC is ordered, the NBN Co Satellite Network will assign to the AVC an IP address range within the pre-configured IP addresses.

Due to this pre-allocation of IP addressing, the initial allocation of IP addresses applied during the on-boarding phase will require multiple address ranges to be released - up to a maximum of 11 address ranges - according to the geographic area being served and the maturity of the NBN Co Satellite Network at the time.

3.3 CVC Addressing

CVCs are identified at the NNI using a single 802.1Q VLAN S-TAG contained within each service frame. Each CVC within an NNI is therefore addressed and operated independently, allowing adjacent CVCs to be configured differently.

The S-TAG (VLAN tag) is required to contain the following fields, as shown in Figure 1:

- S-TPID – Tag Protocol Identifier, used to identify the tag type
- S-VID – VLAN Identifier, used for service identification

Note that the Priority Code Point (**PCP**) identifier is not used and can remain at a zero (0) value, irrespective of the DSCP markings for Traffic Class selection.

Customer must ensure that each supplied S-TAG VID field is as per the agreed service configuration. The ISS will discard any service frames received at the NNI with an S-VID that does not map to an agreed identifier for an active CVC.

At egress from the NNI, the ISS will insert a single 802.1Q S-TAG with the agreed S-VID for identification of the CVC to Customer.

The NNI addressing requires traffic flowing in the downstream direction (from the Customer Network into the NNI) be tagged with the appropriate S-VID settings. The NNI addressing also requires traffic flowing in the upstream direction (from the NNI into the Customer Network) be tagged by the NBN Co Satellite Network with the appropriate S-VID settings. It is the responsibility of Customer to ensure that all traffic flowing in the downstream direction (ingress traffic) is compliant with the assigned VID settings for each respective service. It is NBN Co's responsibility to ensure that traffic flowing in the upstream direction (egress traffic) will always be tagged by the NBN Co Satellite Network with the appropriate S-VID settings.

4 Class of Service (CoS)

4.1 Traffic Classes Description

The ISS provides two traffic classes that are distinguished in capability and performance, designed to accommodate a range of higher-layer applications. These are described in Table 1.

Table 1 Interim Satellite Traffic Classes

Traffic Class	Suitable Applications	Specification
TC-1	Voice (Limited to SIP-based applications only)	CIR
TC-4	Best-effort data	PIR (AVC) CIR (CVC)

Customer is able to use these classes to allocate service capacity in a manner that reflects the demands and operation of their end-to-end applications. The performance attributes of the respective ISS Product Component Traffic Classes are detailed in section 6.2.

These Traffic Classes are aligned to the application definitions within the 'Configuration Guidelines for DiffServ Service Classes (RFC4594)' to facilitate the support of Customer's higher-layer, end-to-end IP quality of service policies.

4.1.1 TC-1 Description

TC-1 is designed to be used for real-time, interactive multimedia applications, with the following characteristics:

- low bit-rate
- low frame delay
- frame delay variation
- frame loss

The attributes of Traffic Class 1 are aligned to the characteristics of the DSCP Expedited Forwarding (EF) per-hop behaviour described in RFC4594, section 1.5.3.

TC-1 provides capacity with a committed performance level with no ability to burst above its CIR, and is designed for applications that require deterministic performance and are likely to be sensitive to packet loss or jitter.

Refer to section 6.2 for the performance characteristics for TC-1.

4.1.2 TC-4 Description

TC-4 is designed to be used for “best efforts” applications, as characterised by the DSCP Default Forwarding (DF) per-hop behaviour, described in RFC4594, section 1.5.1.

No performance characteristics apply to TC-4 over the ISS.

4.2 Traffic Class Scheduling

The NBN Co Satellite Network prioritises TC-1 over TC-4 using strict priority scheduling.

4.3 Bandwidth Profile Parameter Definitions

This section 4.3 provides clarification of the bandwidth profile parameters used by the ISS.

4.3.1 Calculation of Information Rate

All Information Rates across the ISS and NBN Co Satellite Network are calculated on Customer IP service frames, over the series of bytes from the first bit of the IP version tag through the last bit of the data payload. Note that all Ethernet and lower level protocol fields are not included in the calculation of Information Rate. This is depicted in Figure 2.

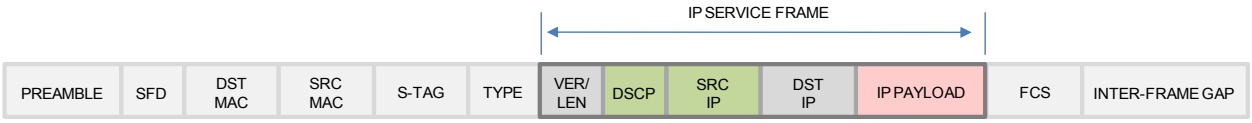

Figure 2 Service Frame Definition[1]

The effective IP payload rate of any ISS will degrade slightly for lower-sized service frames. This is the expected behaviour for IP based services whose bandwidth profile is based on the service frame definition as per Figure 2. Customer is responsible for accommodating any payload rate degradation as a result of IP frame sizes in the design and dimensioning of Customer ISS Products.

4.3.2 Committed Information Rate

CIR defines a level of data throughput for which service frames are delivered according to the performance objectives of the respective Traffic Class.

4.3.3 Peak Information Rate

PIR is defined as the maximum data throughput that may be delivered by the service. Note that traffic capacity in excess of the CIR and within the PIR will be carried through the NBN Co Satellite Network without any performance objectives. Traffic that exceeds the PIR will be discarded at ingress to the service.

[1] Refer IEEE802.3 for explanation of service frame fields

4.4 Bandwidth Specification Model – AVC

Customer must select the desired amount of capacity for each Traffic Class required for the AVC at time of submitting an AVC order (**AVC Bandwidth Profile**). The selectable CIR and PIR capacities are detailed in the Product Description - Interim Satellite Service.

The AVC Bandwidth Profile for the ISS is shown in Table 2.

Table 2 Bandwidth Profile – AVC

Traffic Class	Component	Units	Description
TC-1	CIR	Mbps	CIR requirement for TC-1
TC-4	PIR	Mbps	PIR requirement for TC-4

Note that the TC-1 CIR capacity resides within the TC-4 PIR capacity. For example, a 6 Mbps TC-4 PIR with a 60 kbps TC-1 CIR will be delivered with a total AVC capacity of 6.0 Mbps.

4.5 Bandwidth Specification Model – CVC

Customer is required to nominate the capacity for each required Traffic Class within the CVC at the time of submitting a CVC order. The selectable capacities are subject to provisioning rules, and are detailed in the Product Description - Interim Satellite Service.

The CVC Bandwidth Profile for the ISS is shown in Table 3.

Table 3 Bandwidth Profile – CVC

Traffic Class	Component	Units	Description
TC-1	CIR	Mbps	CIR requirement for TC-1.
TC-4	CIR	Mbps	CIR requirement for TC-4.

4.6 Traffic Contention and Congestion Management

Customer is able to control their own End User experience through contention applied by the dimensioning of capacity between the AVCs and CVC, within the limits defined in the Satellite Wholesale Broadband Agreement and the Business Rules specified in section 5 of the Product Description - Interim Satellite Service.

Customer may apply contention at the Traffic Class level, allowing Customer to independently control the economics and operation of each Traffic Class. This is controlled by dimensioning of AVC and CVC capacity on a Traffic Class basis, to ensure a level of contention appropriate for each respective higher-layer application.

Customer acknowledges that contending the ISS will effectively degrade the performance of Customer Products that rely on the ISS as an input.

4.7 DSCP Marking

Customer must align to the DSCP settings indicated in Table 4 to map traffic into Traffic Classes at the UNI and NNI.

These ingress assignments are valid for purchased Traffic Classes only.

Customer will be required to identify and validate all required UNI and NNI DSCP assignments during the on-boarding phase.

Table 4 ISS Class of Service Encoding

Traffic Class	DSCP	DSCP (Decimal)
TC-1	CS5, EF	40 – 47
TC-4	CS1, AF 11 – 13 CS0, Default	8 – 15, 0 – 7

Ingress traffic with a DSCP assignment of 16 – 39 (used by other NBN Co services for TC-2 and TC-3) will be carried by the NBN Co Satellite Network and be treated as TC-4 traffic.

Ingress traffic with a DSCP assignment other than 0 – 47 will be discarded at ingress.

5 ISS Product Components

This section 5 describes the technical and operational requirements of each of the ISS Product Components.

5.1 UNI

The ISS includes 10/100BaseT/TX (electrical) Ethernet data port connectivity to the UNI at the End User's Premises.

Each UNI is logically connected to an NNI via an AVC and CVC.

For the ISS, a UNI can only support a single AVC.

5.1.1 UNI Scalability Factors

Each UNI has two capacity metrics that define its ability to carry Customer ISS Products.

5.1.1.1 Line Rate

The line rate defines the rate at which the physical interface will transfer data (**Line Rate**). The UNI supports the following Ethernet Line Rates:

- 10Mbps half-duplex
- 100Mbps half-duplex

Customer acknowledges the inherent limitations of Ethernet in relation to the impact of framing overhead and asynchronous operation on bandwidth efficiency. Customer is responsible for accommodating these limitations when allocating ISS capacity and designing and dimensioning Customer ISS Products.

By default, the UNI will be configured to auto-negotiate the Line Rate with the equipment at the End User's Premises. An active UNI may be configured by NBN Co as a fixed 10 Mbps or 100 Mbps, if required.

5.1.1.2 Information Rate

The information rate defines the amount of logical capacity assigned to the UNI (**Information Rate**). This is calculated as the sum of all AVC Bandwidth Profiles active on the UNI. The UNI is capable of supporting an aggregate Information Rate up to the active Line Rate.

5.1.1.3 AVC Support

The ISS supports a single AVC per UNI due to the limitations of IP address management. Each AVC and associated UNI must be under the control of the same Customer.

5.1.2 UNI Functional Product Features

5.1.2.1 Frame Forwarding

The UNI implements forwarding of service frames as defined in Table 5, provided that all CVC VLAN tag conditions are met.

Table 5 UNI Frame Forwarding Details

MAC Address	Application	Default Behaviour	Optional Configurable Behaviour
01-80-C2-00-00-00	Bridge Group Address	Discard	None
01-80-C2-00-00-01	IEEE Std 802.3 PAUSE	Discard	None
01-80-C2-00-00-02	LACP/LAMP	Discard	None
	Link OAM	Discard	None
01-80-C2-00-00-03	IEEE Std. 802.1X PAE address	Discard	None
01-80-C2-00-00-04 - 01-80-C2-00-00-0F	Reserved	Discard	None
01-80-C2-00-00-10	All LANs Bridge Management Group Address	Discard	None
01-80-C2-00-00-20	GMRP	Discard	None
01-80-C2-00-00-21	GVRP	Discard	None
01-80-C2-00-00-22 - 01-80-C2-00-00-2F	Reserved GARP Application addresses	Discard	None
01-80-C2-00-00-3X	CFM	Discard	None

In table 5 above, **Discard** means that the service frame will be discarded at ingress to the NBN Co Satellite Network.

5.1.2.2 MAC Address Limitations

In regard to the ISS, no limitation applies to the number of MAC source addresses associated with a UNI. NBN Co recommends that Customer maintains its own controls over the number of connected MAC devices to retain consistency with NBN Co Fibre Access Service.

5.1.2.3 DHCP & Default Gateway

Each UNI is assigned an IP address range by the NBN Co Satellite Network, according to the allocation methodology agreed between NBN Co and Customer during the On-boarding phase in the NBN Co Satellite Operations Manual. From this address range, the NTD assigns a single address to the UNI interface to act as the default gateway for the Ethernet LAN.

The remaining IP addresses are then assigned to the CPE using Dynamic Host Configuration Protocol (**DHCP**). This imposes a limit on the number of IP devices that Customer can connect directly to a UNI. Any attempt to connect a volume of devices to a UNI that exceeds the available IP addresses will leave the later connected devices without any IP addressing configuration.

The IP protocol also requires the use of the first address and last address in an IP address range to be used as the LAN network and broadcast addresses respectively. The available number of addresses that can be assigned to the CPE is therefore $2^{(32-n)} - 3$, where n is the subnet mask allocated to the UNI.

The DHCP response will also communicate to the CPE the primary and secondary DNS address ranges assigned to the CVC.

5.1.2.4 Resiliency

By default, the UNI is an unprotected physical interface. If an unprotected UNI suffers a failure, all Customer Products and other services being delivered across that UNI will be disrupted.

5.1.3 UNI Product Features

Table 6 Product Features – UNI

Component	Product Features	Product Features Description	Selectable Options
Installation Options	Power source	Electrical power source for the NTD	240V AC
			12-24V DC
	Site clean	Disconnection of existing satellite equipment	Not required
			Required
PHY Product Feature	Speed & duplex	Configure the physical parameters of the Ethernet port. This may be required to be a service-attribute.	Auto-negotiation
			10Mbps Half Duplex
			100Mbps Half Duplex

5.2 AVC

5.2.1 Overview

The AVC implements the IP spoke within a hub and spoke topology component of the ISS, as described in section 3.

Customer may deliver multiple End User applications (such as voice and data) using a single AVC, with the optional use of class of service to manage the capacity between applications.

5.2.2 AVC Scalability

Only one AVC can be supported per UNI.

An AVC can only be associated with a single CVC.

AVCs are isolated from each other via the use of distinct S-TAG VID and IP addressing, and can be individually dimensioned according to the speed tiers specified in the Product Description - Interim Satellite Service. An AVC can be scaled in capacity (through the AVC Bandwidth Profile), within the bounds of the ISS product construct and the physical limits of the underlying access network technology.

5.2.3 AVC Product Features

Table 7 Product Features –AVC

Component	Product Features	Product Feature Description	Selectable Options
End-Point Identification	CVC ID	Identification of the CVC that the AVC is to be delivered on.	CVC ID
	IP Addressing	IP address and range to be allocated to the AVC. If not supplied, any IP address from the supplied address pool may be allocated, using the default mask.	IP Address / mask
	UNI ID	UNI identifier, if the UNI exists prior to the AVC order	UNI ID
Bandwidth Profile	Bandwidth Profile	Downstream Traffic Class profile Optional traffic class allocations not available for Default-Mapped UNI.	AVC TC-1 CIR
		Downstream Traffic Class profile	AVC TC-4 PIR
		Upstream Traffic Class profile Optional traffic class allocations not available for Default-Mapped UNI.	AVC TC-1 CIR
		Upstream Traffic Class profile	AVC TC-4 PIR
Eligibility	Eligibility ID	Service eligibility identifier as supplied by the NBN Co Broadband Service Locator	BSL ID
	Surname	End User surname as used in the NBN Co Broadband Service Locator	BSL Surname
	Site Location	Latitude and longitude of site as used in the NBN Co Broadband Service Locator	BSL Latitude, BSL Longitude
Customer Free-form Fields	AS Field 1	Free-form text field for the Customer to use	Text

Component	Product Features	Product Feature Description	Selectable Options
	AS Field 2	Free-form text field for the Customer to use	Text
	AS Field 3	Free-form text field for the Customer to use	Text

5.3 CVC

5.3.1 Overview

The CVC is defined by the 802.1Q VLAN tagging of service frames being carried across the NBN Co Satellite Network. The CVC is an Ethernet virtual circuit that provides connectivity between an NNI and a CSA. It is dimensioned with a specific configured amount of bandwidth capacity to deliver a higher-layer service for a range of AVCs to a particular CSA.

For the ISS, only one CSA exists, servicing all eligible End Users within the CSA. Note that this CSA geographically overlaps the other NBN Co defined connectivity serving areas.

The NNI, and all CVCs delivered through the NNI, are specific to Customer. Customer may have multiple CVCs delivered using one or more NNI at a given location.

Customer may request the cancellation of a CVC. CVC cancellations can only proceed once all associated AVCs have been cancelled.

5.3.2 CVC Scalability

In regard to the ISS, a single CVC can support a number of AVCs limited only by the number of IPv4 addresses. Customers must recommend the CVC volume be limited to 4000 AVCs for quality of service reasons.

A CVC can only be associated with a single NNI.

A CVC can have associated with it any IP addressing across the full range of IP addresses, with the exception of the 10.248.0.0/13 address range which is reserved for use within the NBN Co Satellite Network itself.

The number of CVCs that Customer may purchase is limited only to the continued availability of new VLAN IDs in the NBN Co Satellite Network

NBN Co recommends that Customer consider scalability in conjunction with contention. Customer may control their own End Users' experience through contention applied by dimensioning of capacity between the AVC and CVC.

5.3.3 CVC Interfacing & IP Addresses

The CVC is directly accessed by Customer at the NNI. The S-VID VLAN tagging options for interfacing to the CVC at the NNI are described in section 3.

The CVC S-VID will be validated at ingress to the NNI. Any traffic that does not comply with this tagging structure, or contains S-TAG VID settings that are not as per agreed values, will be discarded at ingress to the NNI.

The IP routing interface between the NNI and Customer POI router requires an IP configuration per CVC. Each CVC will use the IP addressing defined in Table 8. Routing configuration across this interface will be statically mapped by NBN Co.

Table 8 CVC POI IP Addressing

POI Component	IP Address
NNI address per CVC	10.250.[CVC ID].3 / 27
Customer POI router address per CVC	10.250.[CVC ID].30 / 27

5.3.4 CVC & DSCP Markings

The CVC itself does not incorporate a unique priority marking, but instead uses the DSCP markings applied to the IP packet for the purpose of AVC priority marking. The S-PCP field is ignored by the NBN Co Satellite Network.

5.3.5 CVC & DSCP Discard

Under congestion, any discard of service frames from a CVC will be in accordance with section 4.

5.3.6 Performance Enhancing Proxies

The CVC includes the configuration options for enabling performance enhancement techniques deployed within the NBN Co Satellite Network, collectively referred to as **Performance Enhancing Proxies**. For an introductory understanding of the general techniques and application of Performance Enhancing Proxies, refer to RFC3135.

Performance Enhancing Proxies are applications that improve the end-to-end performance of some communications protocol such as TCP to overcome the satellite end to end latency issues.

The Performance Enhancing Proxies operate across all relevant traffic within a CVC and associated AVCs, benefiting all Customer traffic running through the CVC.

The following settings will be made available to Customers as part of the CVC configuration:

Table 9 Performance Enhancing Proxy Settings

PEP Components	Options
TCP Acceleration & Header compression	Enabled [default] / Disabled
HTTP Acceleration	Enabled [default] / Disabled
Payload compression	Enabled / Disabled [Default]

TCP Acceleration will be applied to the first 200 simultaneous TCP connections per NTD. Additional concurrent TCP connections will continue to function, but will not have the TCP Acceleration proxy applied.

HTTP Acceleration will be applied to the first 2 simultaneous HTTP connections per NTD. Additional concurrent HTTP connections will continue to function, but will not have the HTTP Acceleration proxy applied. Note that a HTTP connection exists only between the time of initial HTTP request for a web page and the web page being loaded. User browsing of a loaded web page does not consume HTTP Acceleration proxy resources.

Disabling either the TCP Acceleration or HTTP Acceleration proxy will have a material impact on the observed performance of normal Internet activities such as web browsing, file downloads and email transmissions.

Enabling payload compression risks limiting the speed of the ISS to less than the allocated peak speed of the ISS.

Performance Enhancing Proxies will not function on encrypted or tunnelled traffic. If Customer or End User applied encryption is used, Performance Enhancing Proxies should be implemented by the Customer within the encrypted communication link.

5.3.7 CVC Product Features

Table 10 Product Features – CVC

Component	Product Features	Product Feature Description	Selectable Options
End-Point Identification	NNI ID	Identification of the NNI bundle that the CVC is to be terminated on.	NNI Bundle ID
Bandwidth Profile	Bandwidth Profile	The CVC_CIR capacity allocation for each individual Traffic Class in the upstream direction. Note that the CVC is currently restricted to symmetric operation only.	CVC_TC-1_CIR
			CVC_ TC-4_CIR
Satellite Enhancements	TPEP TCP Ack	Inclusion of TCP acceleration performance enhancing proxy for all services on this CVC Includes header compression on all packets	Enabled
			Disabled

	TPEP HTTP	Inclusion of HTTP acceleration performance enhancing proxy for all services on this CVC	Enabled
			Disabled
	Payload compression	Allow NBN to perform payload compression on all packets	Enabled
			Disabled
IP Addressing	DNS addresses	Primary DNS Server	IP Address
		Secondary DNS Server	IP Address
		IP address range for allocation to DNS lookup NAT (/27 mask)	IP address / 27
	IP Address Pools	List (string) of IP Address pools for pre assignment to AVCs.	IP Address/Mask, IP Address/Mask, …

5.4 NNI

5.4.1 Overview

Each NNI is configured as a physical interface (**NNI Bearer**) and as member of a logical interface (**NNI Group**) using IEEE802.1ax link aggregation which associates a number of Ethernet links together into a logical bundle.

Customer may request the cancellation of an NNI. NNI cancellations can only proceed once all associated CVCs have been cancelled.

5.4.2 NNI Product Features

The two physical interface options for the NNI Bearer are described in Table 11:

Table 11 NNI Bearer Parameters

Parameter	1000BASE-T (Equinix only)	1000BASE-LX
Wavelength	N/A	1310nm
Cable type	CAT-6 or better	Single Mode (separate TX/RX fibres)
Connector type	RJ-45	SC / PC
Launch Power (max) (dBm)	N/A	-3

Launch Power (min) (dBm)	N/A	-9.5
Receive Power (max) (dBm)	N/A	-3
Receive Power (min) (dBm)	N/A	-20

5.4.3 NNI Resiliency

Two resiliency options exist for Customer to configure a higher availability across the NNI.

5.4.3.1 Single Chassis

Single chassis configuration allows Customer to logically bundle a number of physical NNIs from the same NBN Co chassis (**Single Chassis**).

Under this option, the interfaces will be grouped into a standard IEEE802.1ax link aggregation relationship, allowing a load-shared operation. For example, if a physical link within the NNI Group fails, its load will be transferred to the remaining links within the group. NBN Co is not responsible for any further traffic congestion that may result.

NBN Co will aim to arrange for member links of an NNI Group terminating on the same chassis exhibit a degree of diversity across line cards and internal control cards, but NBN Co is not obliged to do so.

5.4.3.2 Chassis Diversity

An NNI Group may be delivered across two separate chassis within the same POI (**Chassis Diverse**).

For Chassis Diverse configured NNI, the interfaces will be grouped into an active/standby (1+1) relationship, defined at the chassis level. One chassis will be active, and the other will be on standby. If a failure occurs within any one of the active links, then a full switchover to the standby chassis will occur.

5.4.4 NNI Scalability Factors

5.4.4.1 NNI Group Scalability

Each NNI Group may comprise of up to 8 physical NNIs, which may be required to be ordered individually, or in pairs, depending on the resiliency mode.

NBN Co may, but is not obliged to, add NNIs to an NNI Group if requested to do so by Customer.

5.4.4.2 Line Rate

For an NNI Group configured as Single Chassis, the aggregate Line Rate is determined by the sum of the constituent interface rates.

For an NNI group configured as Chassis Diverse, the aggregate Line Rate is determined by the sum of the constituent interface rates divided by two.

For example, an NNI Group with 4x1Gbps links configured as Single Chassis will have an effective line rate of 4Gbps. This means that Customer can provision up to 4Gbps of CVC capacity onto the NNI Group.

The same NNI group operated as Chassis Diverse, or site diverse will have an effective Line Rate of 2Gbps.

5.4.4.3 Information Rate

The NNI information rate is calculated as the sum of all CVC Bandwidth Profiles active on the NNI Group (**Information Rate**).

The NNI is capable of supporting an aggregate Information Rate up to the active Line Rate (taking into account adjustments for NNI Groups as per section 5.4.4.2).

NBN Co will perform a feasibility check before adding a CVC to an NNI to determine whether sufficient Information Rate capacity exists on the interface to support the incremental CVC Bandwidth Profile. This feasibility check takes into account the programmed Line Rate of the NNI. A feasibility check will fail if the amount of available Information Rate capacity on the NNI is less than the new CVC aggregate CIR.

Since auto-negotiation is not supported on NNI interfaces, the NNI Line Rate cannot change once the interface is active, unless a modification is made to the NNI Group.

5.4.4.4 CVC Support

An NNI may be associated with as many CVCs as can be supported by the NBN Co Satellite Network.

5.4.5 NNI Functional Product Features

5.4.5.1 Frame Forwarding

The NNI implements forwarding of service frames as defined in Table 12, providing all CVC VLAN tag conditions are met.

Table 12 NNI Frame Forwarding Details

MAC Address	Application	Default Behaviour	Optional Configurable Behaviour
01-80-C2-00-00-00	Bridge Group Address	Discard	None
01-80-C2-00-00-01	IEEE Std 802.3 PAUSE	Discard	None
01-80-C2-00-00-02	LACP/LAMP	Peer	None
	Link OAM	Discard	None
01-80-C2-00-00-03	IEEE Std. 802.1X PAE address	Discard	None
01-80-C2-00-00-04 - 01-80-C2-00-00-0F	Reserved	Discard	None
01-80-C2-00-00-10	All LANs Bridge Management Group Address	Discard	None
01-80-C2-00-00-20	GMRP	Discard	None
01-80-C2-00-00-21	GVRP	Discard	None

01-80-C2-00-00-22 - 01-80-C2-00-00-2F	Reserved GARP Application addresses	Discard	None
01-80-C2-00-00-3X	CFM	Discard	Peer

The capitalised terms in the table above have the following meaning:

- **Discard** – The service frame will be discarded at ingress to the NBN Co Satellite Network
- **Peer** – The service frame will be terminated within the NBN Co Satellite Network

5.4.5.2 LACP/LAMP

The NNI supports optional peering of link aggregation control frames for the ISS. Any frames identified as LACP/LAMP at ingress to the NNI will be treated according to the NNI Group policy for link aggregation (where NNI protection is active) or discarded. There is no capability to support LACP/LAMP transparency across the ISS. All frames identified as LACP/LAMP will be discarded at ingress at the UNI.

5.4.5.3 Class of Service

The ISS Traffic Class will operate transparently across an NNI Group, under all diversity configurations.

5.4.6 Configuration Attributes

Table 13 Service Attributes – NNI

Component	Attributes	Attribute Description	Selectable Options
Service details	Physical Location	Physical location of NNI	GlobalSwitch Sydney
			Equinix Sydney
	NNI Bundle Membership	NNI Bundle Identifier. Used to nominate an existing or new Bundle ID that this NNI will be a member of.	New
			Bundle ID (Existing Bundle)
Installation Options	Installation Type	Installation details and instructions	Standard
			Supporting Text (Additional installation details)
	Installation Lead Time	Installation lead time details and instructions	Standard
			Supporting Text (Additional install time

Component	Attributes	Attribute Description	Selectable Options
			details)
	NNI Initial State	The initial administrative state of the NNI once the service is provisioned.	Enabled
			Disabled
Assurance Options	Availability Options	Options for enhanced availability. Note that interface diversity requires the NNI to be part of an NNI Bundle	No redundancy
			Single Chassis redundancy
			Chassis Diverse
NNI Type	Interface Type	Physical interface type.	1000BASE-LX
			1000BASE-T (Available at Equinix only)

6 Network Attributes

This section details network level attributes and characteristics that are relevant to the delivery of end-to-end services by Customer.

6.1 Maximum Frame Size

The NBN Co Satellite Network supports IP frame size up to 1492 bytes at the NNI and UNI, as depicted in Figure 3. Note the absence of the additional Ethernet framing observed in the other NBN Co products, and the absence of the C-TAG (4 bytes) in the ISS Ethernet framing in the maximum frame size definition.

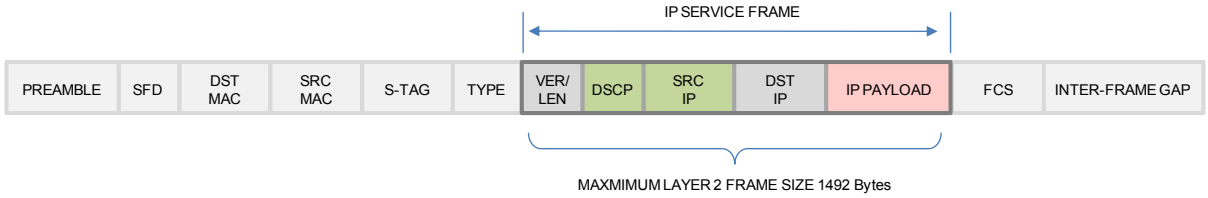

Figure 3 NNI Service Frame Definition

Any ingress service frame received at the UNI that is less than 46 bytes (defined by the minimum Ethernet payload size) will be discarded.

6.2 Traffic Class Performance

The following non-binding Traffic Class performance targets are applied to the NBN Co Satellite Network.

Table 14 Traffic Class Performance

Traffic Class	Frame Delay (one way)	Frame Delay Variation	Frame Loss	Availability / Connectivity
TC-1	< 350 ms	< 25 ms	< 0.01 %	> 99.5 %
TC-4	Unspecified	Unspecified	Unspecified	> 99.5 %

The TC-1 CIR performance attributes are dependent upon Customer enforcing the following traffic characteristics:

- TC-1 CVC capacity operating at ≤ 70% utilisation
- A TC-1 AVC to CVC oversubscription of greater than 10:1
- A balanced distribution of CVC demand across the associated AVCs
- Periodic frame arrivals, every 20ms
- Frame length maximum of 150 bytes at NNI

NBN Co Satellite Network links will be provisioned to an AVC CIR over-subscription rate of 10:1 on the basis of Customer TC-1 AVC to CVC oversubscription greater than 10:1.

Where a Customer under dimensions the amount of CVC capacity for a given Traffic Class relative to the aggregate AVC capacity, the observed performance of the relevant ISS will be determined by the congestion observed in the CVC capacity and therefore differ from the ISS performance objectives for that class. The figures expressed for frame delay, frame delay variation, and frame loss are indicative of traffic under non-Customer congested operating conditions only.

Customer acknowledges that where both parties to a voice call are on a geostationary satellite access network (including the NBN Co Satellite Network), the end-to-end voice delay is incurred twice (often referred to as "double hop" calls).

Customer acknowledges that disabling either the TCP Acceleration or HTTP Acceleration Performance Enhancing Proxies will also have a material impact on the observed performance of normal Internet activities such as web browsing, file downloads and email transmissions.

Network availability includes normal weather and other atmospheric interferences, averaged over a yearly cycle.

The NBN Co Satellite Network will provide TC-1 performance compliance for the SIP protocol only. Use of the TC-1 DSCP settings for other applications is also supported and will be prioritised over TC-4 traffic, but when TC-1 is used for non SIP traffic, all TC-1 traffic will be excluded from TC-1 performance targets.

7 Deployment Guidelines

7.1.1 NTD

The NTD is intended for residential and small office / home office deployments and comprises indoor and outdoor equipment. The indoor unit is depicted in Figure 4 and Figure 5.

Figure 4 NTD indoor unit - front

Figure 5 NTD indoor unit - back

The NTD is capable of servicing an NTD aggregate of 6 Mbps downstream and 1 Mbps upstream.

7.1.1.1 Physical Interfaces

The NTD supports a single 10/100Base-T Ethernet UNI port.

7.1.1.2 Power Supply

The NTD requires a local power source at the End User's Premises. The NTD is supplied with a power supply that must be connected to a dedicated standard 240V, 10A Australian General Purpose Outlet (GPO) or 12 Volt or 24 Volt DC interface type suitable for a pair of 18 AWG open wires.

NBN Co recommends that the NTD is installed within 10 metres of the power supply. Typical power consumption of the NTD is less than 75 Watts (less than 115 Watts in specific situations that require higher powered outdoor equipment). The NTD provides basic protection from and continuity of service when encountering "dirty power" events. NBN Co recommends that a clean power feed is used to ensure stable service operation.

NBN Co will not supply battery backup for the NTD. Where Customer believes battery backup is required, either for power stability or availability reasons, Customer is responsible for making arrangements with the End User regarding the supply of this additional capability.

7.1.1.3 Outdoor equipment size and weight

Where an outdoor unit is rooftop mounted, the outdoor unit will typically require an area of 1.5 metres in diameter. Where an outdoor unit is ground mounted, the outdoor unit will typically require an area of 3 metres in diameter to prevent human obstruction. Satellite dishes that are rooftop mounted weigh approximately 35 kilograms, including the mounting equipment.

8 Dictionary

AVC Bandwidth Profile has the meaning given to that term in section 4.4 of this Product Technical Specification.

Chassis Diverse has the meaning given to that term in section 5.4.3.2 of this Product Technical Specification.

Committed Information Rate or **CIR** means the Information Rate described in section 4.3.2 of this Product Technical Specification.

Information Rate has the meaning given to that term in section 5.1.1.2 or 5.4.4.3 of this Product Technical Specification, as the context requires.

Line Rate has the meaning given to that term in section 5.1.1.1 of this Product Technical Specification.

NBN Co Fibre Access Service or **NFAS** means the product with that name supplied by NBN Co and described in the Wholesale Broadband Agreement.

NNI Bearer has the meaning given to that term in section 5.4.1 of this Product Technical Specification.

NNI Group has the meaning given to that term in section 5.4.1 of this Product Technical Specification.

Peak Information Rate or **PIR** means the Information Rate described in section 4.3.3 of this Product Technical Specification.

Performance Enhancing Proxies has the meaning given to that term in section 5.3.6 of this Product Technical Specification.

Single Chassis has the meaning given to that term in section 5.4.3.1 of this Product Technical Specification.

SIP means Session Initiation Protocol.

Traffic Class means, in relation to the ISS, a traffic class specified in section 4.1 of this Product Technical Specification.

Traffic Class 1 or **TC-1** means the traffic class described in section 4.1.1 of this Product Technical Specification.

Traffic Class 4 or **TC-4** means the traffic class described in section 4.1.2 of this Product Technical Specification.