Product Technical Specification

Cell Site Access Service (CSAS)

CSAS Interim Terms

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Contents

1. Scope and purpose

1.1 Purpose

This Product Technical Specification sets out the technical specifications for the Cell Site Access Service (**CSAS**).

1.2 Scope

Sections 2 to 7 of this Product Technical Specification describe the features of the CSAS, as offered by NBN Co.

1.3 Definitions

Capitalised terms used but not defined in this Product Technical Specification have the meaning given in the CSAS Dictionary.

If a capitalised term used in this document is not defined in the CSAS Dictionary, then that term has the ordinary meaning commonly accepted in the industry.

2. Supported Service Types

This section provides a brief overview of the service types that Customer may choose to deploy using the CSAS.

2.1 Cell Site Access Service

The CSAS is a high performance symmetrical point-to-point Ethernet Bitstream access service from a NNI at the POI to a UNI at a CSAS Point.[1]

The CSAS provides Ethernet access services from POIs located in Regional, Outer Metro and Metro areas to CSAS Points.

The CSAS Product provides high quality access specifications, including low latency, the potential to provide high bandwidths, low frame loss and low frame delay variation to cater for the peak demands that can be generated by 3G and 4G radio access networks and for technically essential features of mobile telephony networks such as synchronisation.

CSAS does not cover facilities access or other site sharing requirements or backhaul from a POI to Customer's core network.

A CSAS Ordered Product is identified by a single Product Instance ID which identifies one UNI and AVC. The AVC product component will support the following features:

- A logical circuit between the UNI and NNI, tailored to the delivery of a single service to a CSAS Point (i.e. the UNI functionally supports a single, bi-directional, unicast AVC)

- Two Traffic Classes (TC-1 and TC-2), each with different performance attributes

- A range of TC-2 bandwidth profiles

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[1] The NBN Co Fibre Network over which the CSAS is provided includes aggregated fibre links. The point to point Ethernet service does not indicate or imply point to point fibre architecture.

3. Service Addressing

This section describes the options for service addressing, as required for accessing:

- AVC logical circuits through the NNI

- AVC logical circuits and Traffic Classes through the UNI

This section describes the IEEE802.1ad S-TAG/CE-TAG structure, the allocation of S/CE-VID values, and the addressing options available at the UNI. It describes the structure of the service frame with regard to fields used for individual service identification.

3.1 Service Identification Overview

The NBN Co Network will forward packets received at NBN Co Network Boundaries based on a one-to-one binding between an AVC and VLAN tag(s).

For downstream traffic entering the NBN Co Network from a NNI, the AVC is identified by the S-Tag at the NNI.

For upstream traffic entering the NBN Co Network from a UNI, the AVC is identified by the UNI (no tag; NULL encapsulation).

The Unicast service is transparent to user data. Frames that ingress the service will have the same source and destination MAC addresses and content at egress from the service.

The Customer's CE-VID will be used for upstream traffic classification but it will be preserved and otherwise transparent to the NBN Co Network. This provides flexibility to Customer to carry multiple IP-based services and allows for separate VLANs for different traffic types (e.g. synchronisation, signalling, management, streaming, data (high priority) and data (low priority)).

3.2 Addressing AVC Services through the NNI

3.2.1 VLAN Tag Structure

When required for AVC service addressing (as described below), each S-TAG and CE-TAG is required to contain the following fields:

- S/CE-TPID – Tag Protocol Identifier, used to identify the tag type

- S/CE-PCP – Priority Code Point Identifier, used for priority marking

- S/CE-CFI – Canonical Format Identifier, not used

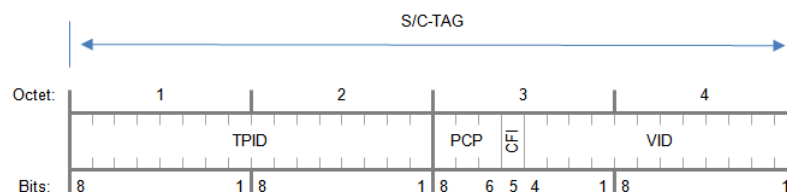- S/CE-VID – VLAN Identifier, used for service identification

Figure 1: S/CE-TAG Structure (4 Bytes)

These fields will be validated for all service frames at ingress to the NBN Co Network.

3.2.2   Tag Protocol Identifier (TPID) Formats (NNI)

Customer must include S-TAG markings consistent with this section 3 for all traffic presented at the NNI. Table 1 below shows the required TPID values for service frames at the ingress to the NBN Co Network at the NNI.

Interface	S-TPID	C-TPID
NNI	0x88A8 or 0x8100	N/A

Table 1: PID NNI Requirements

Any received frames that do not comply with these values will be discarded at ingress to the NBN Co Network.

3.2.3   Allocation of S-VID Values at the NNI

The allocation of S-VID values at the NNI must be co-ordinated between Customer and NBN Co.

When requested by Customer as part of a Product Order Form for an AVC, NBN Co will allocate each new AVC an internally-generated S-VID. This S-VID value will be returned to Customer in accordance with the CSAS Operations Manual, and must be used for accessing the AVC at the NNI.

Customer may optionally elect to nominate the S-VID used to address each AVC service instance through the NNI by specifying a S-VID in the Product Order Form for the AVC, for the purpose of further alignment to its own backhaul network addressing schemes.

3.2.3.1 AVC Service Addressing

Figure 2 below describes the frame structure for service frames presented at ingress to the NNI for this type of service, highlighting the S-TAG provided by Customer, which is required to associate the service frame with an AVC and identifies the destination UNI.
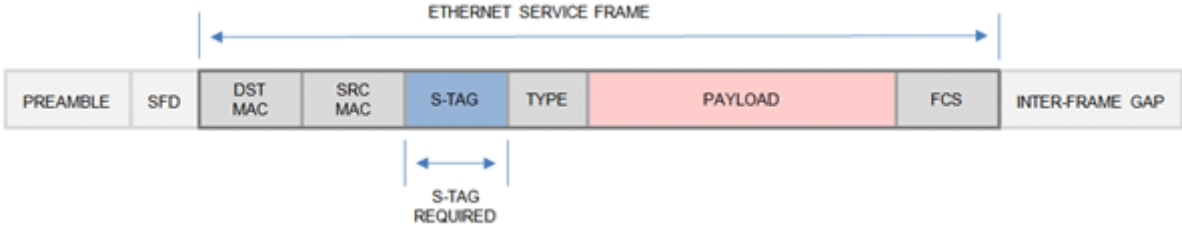

Figure 2: AVC Service Addressing - Service Frame Format

3.3   Addressing AVCs and Traffic Classes at the UNI

The UNI does not support any S-TAG at ingress to the NBN Co Network.[2] Any frames with S-TAG at the ingress to the UNI may be discarded.

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[2] An S-TPID will be appended by the NBN Co Network.

3.3.1 Tag Protocol Identifier (TPID) Formats (UNI)

For any traffic presented at the UNI with CE-TAG, the T-PID value must be set to 0x8100.

Any received frames that do not comply with this value will be discarded at ingress to the NBN Co Network.

4. Class of Service (CoS)

The NBN Co Network implements a number of Traffic Classes that are distinguished in capability and performance, designed to accommodate the widest variety of higher-layer applications. Customer may take advantage of these Traffic Classes to provide more tailored performance and effective utilisation of the NBN Co Network.

4.1 Traffic Classes

CSAS offers symmetric TC-1 and TC-2 services. The supported Traffic Classes are described in Table 2 below.

Traffic Class	Example Applications	Specification
TC-1	Synchronisation, signalling and OAM traffic	CIR
TC-2	Streaming Data (High/low priority)	CIR

Table 2: Supported Traffic Classes

4.1.1 TC-1 Description

The TC-1 Traffic Class is targeted towards real-time applications, with the following characteristics:

• Low bit-rate

• Low frame delay, frame delay variation, frame loss

TC-1 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to packet loss.

4.1.2 TC-2 Description

The TC-2 Traffic Class is targeted towards real-time, interactive multimedia applications, with the following characteristics:

• High bit-rates, and large Ethernet frame sizes

• Low frame delay, frame delay variation, frame loss

TC-2 provides a committed level of premium capacity with limited ability to burst above its CIR, suitable for applications that require deterministic performance and are likely to be sensitive to frame delay variation (FDV/jitter) and frame loss (FLR).

4.2 Traffic Class Scheduling

Traffic is scheduled within the NBN Co Network using strict priority, according to the Traffic Class.

4.3 Bandwidth Profile Parameter Definitions

This section provides clarification of the bandwidth profile parameters used within the NBN Co Network.

4.3.1 Calculation of Information Rate

All Information Rate limitations, including as set out in this Product Technical Specification, are enforced at ingress to the NBN Co Network, and are calculated on Customer Layer 2 Ethernet service frames, over the series of bytes from the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence as defined at the NNI.

IEEE802.3 physical-layer fields such as the Preamble, Start of Frame Delimiter and Inter-Frame Gap are not included in the bandwidth profile.Where the bandwidth profile is equivalent to the negotiated physical port speed, a degraded useable payload results.

Note that the effective Layer 2 payload rate of the NBN Co Network will also degrade slightly for lowest-sized Ethernet service frames. This is the expected behaviour for Ethernet-based services for which the bandwidth profile is based on the service frame definitions within section 3. It is the responsibility of Customer to accommodate any payload rate degradation as a result of Layer 2 frame sizes and physical-layer overhead.

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 applicable Traffic Class.

4.3.3 Committed Burst Size (CBS)

The CBS is set by NBN Co for each CIR specification, and cannot be modified. The CBS may differ between Traffic Classes, and may be specified differently for the UNI and NNI, as per Table 3.

The CBS is used by the policing functions of the NBN Co Network at ingress to the NBN Co Network to determine whether a stream of ingress data complies with the subscribed CIR. Customer is responsible for ensuring that all ingress traffic is shaped to comply with the CIR/CBS as specified for the required Traffic Class and interface, before presentation to the UNI or NNI as relevant.

4.4 Bandwidth Specification Model – AVC

Customer is required to select the desired Bandwidth Profile for the AVC TC-2 component at time of order, as part of submitting a Product Order Form for CSAS.

The AVC bandwidth profile components are shown in Table 3 below. Specified limitations are enforced at the UNI.

Traffic Class	Component	Units	Description
TC-1	CIR	Mbps	CIR requirement for TC-1. Settings are described in section in 5.3.2.1
	CBS[3]	Bytes	16,000
TC-2	CIR	Mbps	CIR requirement for TC-2 Available settings are described in section 5.3.2.2.
	CBS[4]	msec	10

Table 3: Bandwidth Profile Components - AVC

4.5 Priority Identification

At the NNI, QoS classification utilises the P-bit in the S-Tag.

All traffic, regardless of CE-VID, is mapped to one AVC at the UNI to implement port-based Ethernet Private Line-only bundling of traffic as per MEF33. Traffic will be classified into different Traffic Classes based on the PCP marking within Customer Ethernet frames (**CE-PCP**). An frames without CE-TAG will be classified into TC-2.

4.6 Priority Encoding

This section describes how Customer Equipment should encode priority information into service frames that ingress the NBN Co Network in order to ensure those frames are forwarded in the correct NBN Co Traffic Classes.

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

PCP marking supported is listed below:

CE PCP Value	Traffic Class	Behaviour
7	TC-1	Forward
6	TC-1	Forward
5	TC-2	Forward
4	TC-2	Forward
3	TC-2	Forward
2	TC-2	Forward
1	TC-2	Forward
0 (default match)	TC-2	Forward

Table 4: PCP marking for different Traffic Classes

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[3] The AVC TC-1 CBS is bi-directional, set by NBN Co, and cannot be modified by Customer.
[4] The AVC TC-2 CBS is bi-directional, set by NBN Co, and cannot be modified by Customer.

4.7 Priority Decoding

Service frames carried in NBN Co Traffic Classes will have priority encoded at the egress from the NBN Co Network. Egress CoS decoding is also described in Table 4 above.

5. Product Component Attributes

5.1 User Network Interface (UNI)

The **User Network Interface** or **UNI** is a physical port on the NTD that must be deployed at each CSAS Point and acts as the network and service boundary between the Customer Network and the NBN Co Network.

The UNI supports a 1Gbps interface and MEF33 'Access EPL (port-based UNI)' Service Type and will be provided to a CSAS Point which must have at least one pair of NBN Co fibres available.

Further details regarding the NTD are set out in section 7 below.

5.1.1 UNI

5.1.1.1 UNI Interface Attributes

The following interface modes are supported for the UNI:

- 10/100/1000 BASE-T (electrical, auto-negotiated speed and full/half-duplex)

- 1000Base-LX (optical, auto-negotiated speed and full-duplex)

When no AVC logical services are active on the UNI (i.e. all AVCs have been logically disconnected), the UNI will be de-activated in accordance with this Agreement.

5.1.1.2 UNI Scalability Factors

The UNI is scalable in terms of capacity and services. Each UNI has two capacity metrics that define its ability to carry Customer Products and Downstream Products.

5.1.1.2.1 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   (10/100/1000BASE-T copper port)

- 100Mbps   (10/100/1000BASE-T copper port)

- 1000Mbps   (10/100/1000BASE-T copper port & 1000Base-LX optical port)

The Line Rate sets the maximum bound on the information-carrying capacity of the link. Customer must be familiar with the inherent limitations of Ethernet in relation to the impact of framing overhead and asynchronous operation on bandwidth efficiency, and accommodate this within any capacity allocation.

By default, the UNI will be configured to auto-negotiate the Line Rate with the Customer Equipment or Downstream Customer Equipment attached to the UNI.

Customer is responsible for ensuring that the UNI is operating with a Line Rate that is sufficient to carry the requested AVC capacity, using auto-negotiation or a fixed Line Rate setting requested by Customer.

Customer is also responsible for the Duplex mode of the UNI.

NBN Co is not responsible for any traffic loss at the UNI that may result due to the UNI negotiating a Line Rate or Duplex mode with any attached device beyond the NBN Co Network boundary, or being configured to a specific Line Rate that is insufficient to deliver the required AVC capacity.

5.1.1.2.2 Information Rate

The Information Rate defines the amount of logical Layer 2 capacity assigned to the UNI (**Information Rate**). This is calculated using the aggregate AVC bandwidth profiles active on the UNI.

The Information Rate is also subject to the limitations described in section 7 of the CSAS Product Description.

Note that once provisioned, AVC capacity will not be automatically re-adjusted as a result of changing Line Rates through auto-negotiation. Should a UNI auto-negotiate to a Line Rate less than the requested AVC rate, Customer may experience increased frame loss in excess of the frame loss targets for each Traffic Class on the provisioned AVC.

5.1.1.2.3 AVC Support

Each UNI functionally supports a single, bi-directional, unicast AVC.

5.1.1.3 UNI Functional Attributes

5.1.1.3.1 Auto-Negotiation

The UNI provided at the NTD supports auto-negotiation as per IEEE802.3ab.

5.1.1.3.2 Resiliency

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

5.2   Access Virtual Circuit (AVC)

5.2.1   Overview

The AVC represents a particular service tunnel connecting a UNI to a NNI.

Each NNI can terminate multiple AVCs but only one AVC can be terminated by the UNI.

Multiple AVC TC-2 bandwidth profiles are available. Customer must select the profiles for a particular CSAS Point based on the services and applications it wishes to support.

5.2.2   AVC Scalability

AVCs are logically isolated from each other via the use of distinct S-VIDs, and are designed to be individually dimensioned by Customer from a set of selectable parameters according to the service needs of Customer at each CSAS Point. An AVC is designed to be scaled in capacity (through its bandwidth profile), within the bounds of the product constructs and the physical limits of the underlying access network technology.

A maximum of 4,000 AVCs can be defined at the NNI (due to the relevant limit on the S-VID address space).[5]

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[5] Other limitations also apply to the number of AVCs that may be associated with an NNI. For example, the maximum interface rate of the NNI.

5.3 Access Components

Access Components, for the purposes of this Product Technical Specification only, comprise each instance of the UNI and AVC Product Components supplied by NBN Co to Customer to use as an input to a Customer Product or Downstream Product.

The **configuration attributes** of CSAS will be fixed, so each CSAS Ordered Product will be delivered by selecting **service attributes** through a Product Order Form.

5.3.1 Service Attributes

This section describes the service attributes Customer must select at the time of ordering an Ordered Product.

5.3.1.1 NTD Unit

Customer cannot directly order an NTD. The provision and operation of the NTD is the responsibility of NBN Co.

5.3.1.2 UNI Service Attributes

The following service attributes must be specified at time of order for the UNI:

Component	Service Attribute	Specification (Provided by Customer)
UNI	Physical Interface Type	Electrical: 10/100/1000BASE-T copper port
		Optical: 1000Base-LX port
	Speed/Duplex Setting	AUTO (Speed)/AUTO (Duplex)
	(Applies to Eletrical Interface Only)	1000Mbps/AUTO (Duplex)

Table 5: Service Attributes for UNI

5.3.1.3 UNI Bearer Attributes

The following distances and small form-factor pluggable transceivers (SFPs) are supported on the UNI. Optical distances and wavelengths must conform to IEEE 802.3z and 802.3ah to support 1000Base-LX10.

Parameter	1000BASE-LX
Wavelength	1310nm
Fibre Type	Single Mode (Separate TX/RX Fibre)
Connector Type	SC-APC
Launch Power (max) (dBm)	-3
Launch Power (min) (dBm)	-11.0
Receiver Power (max) (dBm)	-3
Receiver Power (min) (dBm)	-19

Table 6: Optical Interface Parameters (UNI Bearer)

The figures in the table above are for guidance only. It is recommended that Customer calculate its own optical path loss budgets.

5.3.1.4 Unicast AVC Service Attributes

The following service attributes must be specified at time of order for each CSAS Ordered Product:

Component	Service Attribute	Specification (provided by Customer)
AVC	S-VID at NNI	$0 - 4000^6$
	Bandwidth Profile (TC-2 only)	Specified from list of supported unicast AVC TC-2 bandwidth profiles in Table 8

<div align="center">Table 7: Service Attributes for Unicast 1:1 AVC</div>

5.3.2 Bandwidth Profiles

The rate of traffic accepted from Customer depends on the agreed AVC bandwidth and the Traffic Class being used. The current release supports a two class of service model (Traffic Class 1 and 2). For each AVC Traffic Class, a bandwidth profile is required that determines the UNI Information Rate for that class of service.

Traffic entering the UNI that is in excess of the agreed rate per Traffic Class will be policed per Traffic Class at the agreed rate.
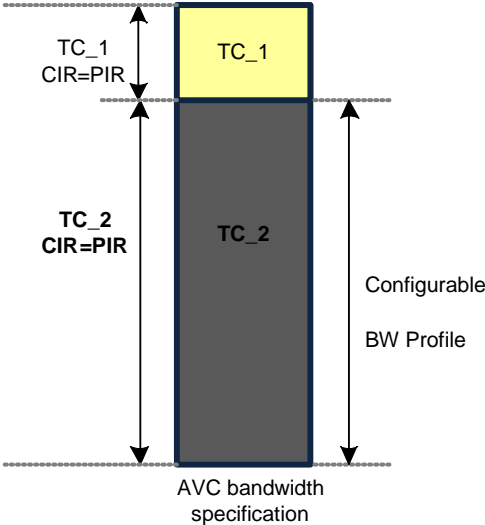

<div align="center">Figure 3 AVC bandwidth specification</div>

5.3.2.1 TC-1

TC-1 bandwidth defines a level of data throughput for which service frames are delivered according to the performance objectives. Traffic that exceeds the TC-1 bandwidth will be discarded within the service.

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[6] The value of zero indicates that NBN Co will select the S-VID, and does not indicate that a S-VID of zero may be used.

The following bandwidth profile is supported:

Bandwidth Profiles	
Traffic Class	TC-1 Symmetrical CIR (Mbps)
TC-1	5

Table 8: TC-1 Bandwidth Profiles

5.3.2.2 TC-2

TC-2 bandwidth defines a level of data throughput for which service frames are delivered according to the performance objectives. Traffic that exceeds the TC-2 bandwidth will be discarded within the service.

The following bandwidth profiles are supported:

Bandwidth Profiles	
Traffic Class	TC-2 Symmetrical CIR (Mbps)
TC-2	50
TC-2	100
TC-2	150
TC-2	200
TC-2	300
TC-2	500
TC-2	900

Table 9: TC-2 Bandwidth Profiles

5.4   Network-Network Interface (NNI)

An NNI instance is a physical, aggregated Ethernet interface, accessed by Customer at the POI.

An NNI Bearer is configured as a member of an NNI Group using IEEE802.1ax Link Aggregation (LACP enabled) within the EFS.

One NNI can be associated with multiple CSAS services, but cannot be shared with other NBN Co products (such as NEBS), because of the difference in the addressing models between CSAS and products such as NEBS.

5.4.1   NNI Group

The NNI Group has the following attributes:

- Location

- Interface Rate

- Redundancy Mode

- Set of NNI Bearers

- Layer 2 Functional Characteristics

5.4.1.1 NNI Group Location

The location of the NNI Group must be specified at the time of NNI Group creation.

In order to change the location of an NNI Group (i.e. re-locate NNI Bearers to a different location), it is necessary to purchase a new NNI Group in the intended location and transition existing AVCs from the old NNI Group. Once completed, the previous NNI Group may be cancelled.

5.4.1.2 NNI Group Interface Rate

A new NNI Group will be configured with a group interface rate that determines the interface rate of each NNI Bearer within the NNI Group. The following group interface rates are supported:

- 1Gbps

- 10Gbps

The group interface rate is set through the selection of the first NNI Bearer (Single Chassis mode), or pair of NNI Bearers (Diverse Chassis mode) at the time the NNI Group is created (each mode is described in section 5.4.1.3).

The group interface rate is fixed per NNI Group and will restrict the type of NNI Bearer that can be added to the NNI Group. For example, if the NNI Group is created with an initial NNI Bearer operating at 1Gbps, then any further NNI Bearers added to this group must also have an interface rate of 1Gbps.

In order to change the group interface rate of an NNI Group (i.e. change all 1Gbps NNI Bearers to 10Gbps), it is necessary to purchase a new NNI Group in the intended group interface rate and associated NNI Bearers, and transition existing AVCs from the old NNI Group. Once completed, the previous NNI Group may be cancelled by Customer.

5.4.1.3 NNI Group Redundancy Mode

The NNI Group must be configured in one of the following redundancy modes:

- **Single Chassis** (where all NNI Bearers are connected to the same EFS chassis)

- **Diverse Chassis** (where NNI Bearers are connected across a pair of EFS chassis)

5.4.1.3.1 Single Chassis Redundancy Mode

When an NNI Group is configured in Single Chassis mode, all NNI Bearers of the NNI Group will be provisioned on the same EFS chassis.

These NNI Bearers will operate in an N:1 protection mode, meaning that if any NNI Bearer within the NNI Group fails, the NNI Group will continue to operate at an aggregate capacity that is reduced by the capacity of the failed NNI Bearer.

5.4.1.3.2 Diverse Chassis Redundancy Mode

When an NNI Group is configured in Diverse Chassis mode, half of the NNI Bearers of the NNI Group will be provisioned on one EFS (working) chassis, and the other half will be provisioned on a second EFS (protect) chassis.

The NNI Group will operate in a 1:1 protection mode, meaning that if any NNI Bearer on the working EFS fails, traffic will be re-directed to the NNI Bearers on the protect EFS chassis.

5.4.1.3.3 Redundancy Mode Modification

The redundancy mode is configured per NNI Group at the time that the NNI Group is ordered, and cannot be modified once activated.

In order to change the redundancy mode of an NNI Group, Customer must purchase a new NNI Group in the intended redundancy mode and transition existing AVCs from the old NNI Group. Once completed, the previous NNI Group may be cancelled.

5.4.1.4 Set of NNI Bearers

An NNI Group can support up to 8 NNI Bearers[7] . All NNI Bearers within an NNI Group must be consistent with the group interface rate for that NNI Group[8] (i.e. 1Gbps, or 10Gbps). The following activities may be performed on an NNI Group, with respect to the set of NNI Bearers:

- establish a new NNI Group through ordering at least one NNI Bearer (Single Chassis mode) or at least one pair of NNI Bearers (Diverse Chassis mode)

- modify an existing NNI Group through adding/removing NNI Bearer(s)

- cancel an existing NNI Group – all underlying NNI Bearers will be automatically cancelled

For NNI Groups configured as Single Chassis, NNI Bearers may be ordered as single interfaces.

For NNI Groups configured as Diverse Chassis, NNI Bearers must be ordered in pairs, with each NNI Bearer of each pair provisioned on different EFS.

For NNI Groups comprising 1Gbps Ethernet interfaces, NBN Co intends to use reasonable endeavours to provide the ability to seamlessly scale an NNI Group up to four NNI Bearers. Beyond four NNI Bearers, NBN Co will schedule an Outage with Customer unless NBN Co notifies Customer that an Outage is not necessary.

For NNI Groups comprising 10Gbps Ethernet interfaces, NBN Co intends to schedule an Outage with Customer in order to augment the NNI Group with additional NNI Bearers unless NBN Co notifies Customer that an Outage is not necessary.

5.4.1.5 LACP Peering

The determination of the working/protect status of the links within an NNI Group is based only on whether or not the NNI is able to connect to an LACP partner on the link. It cannot be influenced by LACP signalling (IN_SYNC/OUT_OF_SYNC messages) from Customer Equipment. Only loss of LACP connectivity between the NNI and Customer Equipment (as a result of a fibre break or interface failure for example), will prevent a link from being selected for working status.

5.4.1.6 Layer 2 Functional Characteristics

5.4.1.6.1 TPID Setting

The NNI Group must be configured with an S-TPID that is common across all NNI Bearers within the NNI Group. This must be selected by Customer in the NNI Product Order Form at time of order. S-TPIDs are described in section 3.2.2. Allowable settings are as follows:

- 0x88A8 (default); and

- 0x8100.

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[7] Note that the addition of NNI Bearers to an NNI Group may result in the degradation of aggregate NNI Group link efficiency, as a result of IEEE802.3ad frame distribution.

[8] Optical characteristics may vary, providing the interface rate is consistent.

5.4.1.6.2 Customer Network Restrictions

All service frames exiting the NNI (i.e. from the NBN Co Network to Customer's core network through the NNI) must traverse an IP device before being injected back into the NBN Co Network. This is necessary to avoid CPE MAC addresses from appearing as source addresses on traffic ingress to the NNI. This operating restriction must be observed by Customer even if service frames are being switched between VLANs or forwarded via other service provider networks.

5.4.1.6.3 Class of Service

The Traffic Class model will operate transparently across an NNI.

5.4.1.7 NNI Group Orderable Attributes Summary

A summary of attributes that must be specified for each NNI Group order is shown in Table 10.

Component	Attributes	Attribute Description	Selectable Options
Service details	Physical Location	Physical location of NNI	POI Site
NNI Group Attributes	TPID	Ability to specify the S-TAG TPID used for service frames across the NNI	0x88A8 (default)
			0x8100
	Redundancy Mode	Physical interface type	Single Chassis (default)
			Diverse Chassis

Table 10: NNI Group Orderable Attributes

Each successful NNI Group order is intended to yield an NBN Co-supplied NNI Group identification.

5.4.2 NNI Bearer

5.4.2.1 NNI Bearer Types

The physical interface options for an NNI Bearer are as follows:

- 1000BaseLX

- 1000BaseEX

- 10GBaseLR

- 10GBaseER

The selection of interface type will be restricted depending on the interface rate of the NNI Group.

All NNI Bearers must have auto-negotiation disabled.

5.4.2.2 NNI Bearer Ordering

NNI Bearers are ordered through an NNI Group (refer to section 5.4.1.4).

A feasibility check will be required upon addition of any NNI Bearer to a NNI Group, to determine whether the number of allowable NNI Bearers within the NNI Group has been exceeded.

Each ordered NNI Bearer will be provisioned by NBN Co in an administratively "down" state, and will be activated by NBN Co in co-ordination with Customer. Billing will commence when the NNI Bearer is initially provisioned, irrespective of when it is activated.

5.4.2.3 NNI Bearer Orderable Attributes

Each NNI Bearer order must specify each of the service attributes listed in Table 11.

Component	Attributes	Attribute Description	Selectable Options
Service details	NNI Group	The NNI Group to which the NNI Bearer is intended to be associated	NNI Group identification
NNI Bearer	Type	Physical interface type	1000BaseLX
			1000BaseEX
			10GBaseLR
			10GBaseER

Table 11: NNI Bearer Service Attributes

Each successful NNI Bearer order will yield an NBN Co-supplied NNI Bearer identification, which will indicate a physical port on the NBN Co ODF to which the NNI Bearer has been cabled.

Customer must separately acquire the necessary facilities access rights to connect the NNI Bearer to Customer's backhaul transmission cables or Customer Active Equipment.

5.4.2.4 NNI Bearer Attributes

The following distances and small form-factor pluggable transceivers (**SFPs**) are supported on the NNI. Optical distances and wavelengths must conform to IEEE 802.3z and 802.3ah to support 1000Base-LX10.

Parameter	1000BASE-LX	1000BASE-EX	10GBASE-LR	10GBASE-ER
Wavelength	1310nm	1310nm	1310nm	1550nm
Fibre Type	Single Mode (Separate TX/RX Fibre)	Single Mode (Separate TX/RX Fibre)	Single Mode (Separate TX/RX Fibre)	Single Mode (Separate TX/RX Fibre)
SFP Connector Type	SC-APC	SC-APC	SC-APC	SC-APC
Launch Power (max) (dBm)	-3	0	0.5	4
Launch Power (min) (dBm)	-11.0	-4.5	-8.2	-4.7
Receiver Power (max) (dBm)	-3	-3	0.5	-1

Receiver Power (min) (dBm)[9]	-19	-22.5	-10.3 (-14.4)	-11.3 (-15.8)

Table 12: Optical Interface Parameters (NNI Bearer)

The figures in the table above are for guidance only. It is recommended that Customer calculate its own optical path loss budgets.

For Customer Equipment housed within the same facility as NBN Co Equipment, SFPs will reliably run back-to-back over a few metres of patch fibre.

All NNIs will be presented on an Optical Distribution Frame as a pair of SC-APC connectors.

Only duplex optical transceivers are supported; single-fibre optical transceivers (for both transmit and receive on a single fibre) are not supported.

Fibre access from the NNI to Customer must be compliant to the ITU-T G.652.D specification.

6. Dependencies

6.1 Supported Maximum Layer 2 Frame Size

The NBN Co Network has limitations around the maximum Layer 2 frame size of ingress traffic at the NBN Co Network Boundaries.

The Layer 2 maximum frame size supported by the NBN Co Network depends on the interface (NNI or UNI) and access technology.

Figure 4 depicts the definition of the maximum layer 2 frame size at the NNI, highlighting the inclusion of the S-TAG.
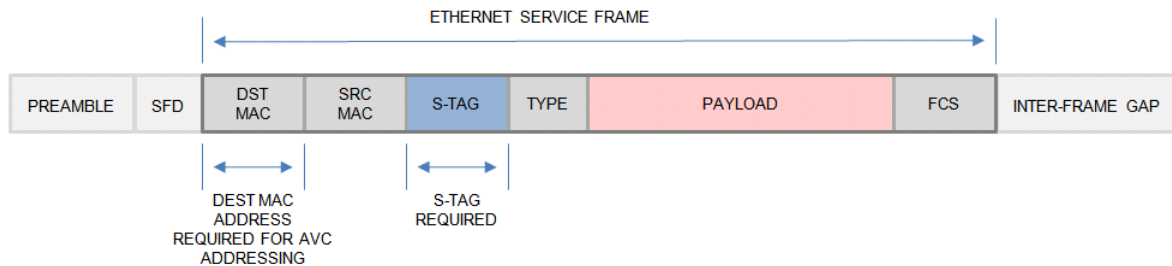

Figure 4: Definition of Maximum Layer 2 Frame Size (NNI)

Figure 5 depicts the definition of the maximum Layer 2 frame size at the UNI, highlighting the exclusion of the S-TAG.

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[9] Stress eye sensitivity values are shown, sensitivity values shown in brackets are approx. IEEE definition for informative use only.
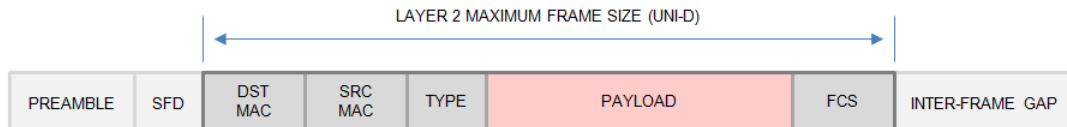
Figure 5: Definition of Maximum Layer 2 Frame Size (UNI)

Table 13 below describes the maximum Layer 2 frames sizes that will be accepted by the NBN Co Network, taking into consideration the different interfaces.

Parameter	Fibre
Maximum Layer 2 Frame Size at NNI[10]	2,000 Bytes
Maximum Layer 2 Frame Size at UNI[11]	2,000 Bytes

Table 13: Layer 2 Maximum Frame Size by Interface and NBN Co Network

In addition to discarding service frames received that are greater than the maximum allowable Layer 2 frame size, any ingress service frame received at the UNI that is less than 64 bytes (not including any VLAN tag applied by Customer) will also be discarded.

6.2 Network Performance

The performance of the TC-1 and TC-2 Traffic Classes is specified in the CSAS Service Levels Schedule.

7. Deployment Guidelines

## 7.1 CSAS Network Termination Device (NTD)

The CSAS is delivered to a CSAS Point using a physical Network Termination Device (**NTD**).

The NTD is deployed as a single unit that is intended for the supply of the CSAS.

7.1.1 Physical Interfaces

The NTD has a single UNI Port, Port 3, which is a combo port; either a 1000Base-LX optical port or a 10/100/1000BASE-T copper port.

The figure below illustrates the NTD physical port layout:

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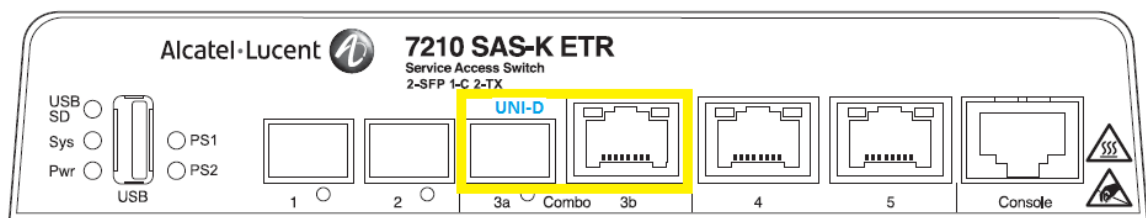
[10] Any ingress frame that exceeds this value will be discarded.
[11] Any ingress frame that exceeds this value will be discarded.

7.1.2   Throughput Limit

The NTD is capable of servicing a maximum aggregate traffic throughput of 1Gbps downstream and 1Gbps upstream in total.

7.1.3   Power Supply

The NTD is supplied with dual redundant indoor Power Supply Units, each requiring a -48V DC input.

The NTD must be left powered on from both power supplies.

7.1.4   Install

The NTD is NBN Co Equipment and will be installed in the Customer Rack.

This will require Customer to allocate a 3 RU space within their rack. The following equipment will be installed in the allocated rack space:

- 1 RU used for Fibre Tray
- 2 RU used to house the NTD and two power supplies

Please note the position of the 3RU space allocated for NBN Co can vary depending on the space availability in the Customer rack.