



**Wholesale NBN Co Satellite Access Service**

**Product Overview**

**Satellite Access Services**

**August 2010**





**Copyright**

This document is subject to copyright and must not be used except as permitted below or under the Copyright Act 1968 (CTH). You must not reproduce or publish this document in whole or in part for commercial gain without prior written consent of NBN Co. You may reproduce or publish this document in whole or in part for educational or non-commercial purposes.

**Disclaimer**

This document sets out NBN Co's proposals in respect of certain aspects of the National Broadband Network. The contents of this document are intended for public consultation and represent NBN Co's current position on the subject matter of this document. The contents of this document should not be relied upon by our stakeholders (or any other person) as representing NBN Co's final position on the subject matter of this document, except where stated otherwise. The views expressed by NBN Co in this document may change as a consequence of NBN Co finalising formal technical specifications. NBN Co's position on the subject matter of this document may also be impacted by legislative and regulatory developments in respect of the National Broadband Network

**Environment**

NBN Co asks that you consider the environment before printing this document

## Table of Contents

1	INTRODUCTION .....	5
	Benefits of NSAS.....	7
1.1	NSAS Key Product Features.....	8
2	SATELLITE PRODUCT OVERVIEW.....	10
2.1	Key Satellite Wholesale Product Components .....	11
2.2	Service Locations.....	15
3	NSAS WHOLESALE PRODUCT .....	17
3.1	Ethernet Bitstream Services (EBS) .....	17
3.2	Ethernet Bitstream Service Features for Business.....	18
3.3	VLAN Tags .....	18
3.4	Interconnection Arrangements.....	19
3.5	Class of Service (CoS) .....	19
3.6	Battery Back-Up .....	20
3.7	Voice.....	21
3.8	Multicast .....	21
3.9	PEP – Protocol Enhancing Proxies.....	23
3.10	AVC Link Encryption .....	24
3.11	Service OAM and Reporting.....	24
4	WHOLESALE SATELLITE PRODUCT CATALOGUE.....	26
4.1	Catalogue Structure .....	26
5	SERVICE MANAGEMENT .....	32
6	END USER PREMISES .....	32
7	NSAS ACCESS CONFIGURATION EXAMPLES.....	33
7.1	Residential Gateway Internet and VoIP Connection.....	33
7.2	High Speed Corporate VPN Connectivity .....	34
7.3	Corporate VLAN Application .....	34
8	ANNEXURE A1 – INFORMATION AND DOCUMENT HIERARCHY RELEASE SCHEDULE .....	36
8.1	Document Availability Schedule. ....	37
9	ANNEXURE A2 – GLOSSARY OF SATELLITE TERMS.....	38

## List of Figures

---

FIGURE 2.1 - HIGH-LEVEL NSAS ACCESS SERVICES USED FOR INTERNET CONNECTIVITY.....	10
FIGURE 2.2 - NSAS NETWORK CONNECTION ARCHITECTURE .....	11
FIGURE 2.3 - LOGICAL NSAS NETWORK DELIVERY COMPONENTS .....	11
FIGURE 2.4 - MULTIPLE CONNECTIVITY VC (CVC) LOGICAL CONFIGURATION.....	14
TABLE 2.5 – KEY NSAS COMPONENT RELATIONSHIPS .....	15
FIGURE 3.1 – NSAS EBS STRUCTURE .....	17
FIGURE 3.2 – ENTERPRISE FEATURES .....	18
FIGURE 3.4 - MULTICAST REPLICATION .....	21
TABLE 4.1 – NTU OPTIONS.....	26
TABLE 4.2 – UNI OPTIONS.....	27
TABLE 4.3 – AVC PIR OPTIONS .....	27
TABLE 4.4 – AVC CIR OPTIONS.....	28
TABLE 4.5 – OTHER OPTIONS.....	29
TABLE 4.6 – CVC OPTIONS .....	30
TABLE 4.7 – NNI OPTIONS.....	31
FIGURE 5.1 SERVICE MANAGEMENT DOMAINS .....	32
FIGURE 7.1 - RESIDENTIAL GATEWAY .....	33
FIGURE 7.6 – NSAS ENTERPRISE ACCESS NETWORK.....	34
FIGURE 7.8 –ENTERPRISE VLAN APPLICATION.....	35

---

# 1 Introduction

NBN Co Satellite Access Service (NSAS) is a wholesale Ethernet access product suite utilising third generation broadband satellite technology to enable high speed connectivity access for all Australians, including businesses.

The purpose of releasing this Satellite Product Overview is to obtain direct feedback from the industry on the proposed design of the Satellite Access Products.

This document provides Access Seekers with an overview of NSAS products, the key features, product components and their attributes, major network connection elements including Access Seeker interconnection arrangements and product pricing structures.

NBN Co's objective is to be open and transparent in its dealings with the industry and interested stakeholders. We are keen to provide our stakeholders with the opportunity to directly provide their views on key issues related to the Satellite Access Products. Accordingly, this Satellite Product Overview is intended to serve as the starting point for a discussion with our stakeholders.

**We welcome written submissions from interested parties on this Product Overview, and will be consulting directly with interested parties where appropriate. Interested parties have until 2 September 2010 to provide written submissions. Submissions can be sent via email to: [feedback@nbnco.com.au](mailto:feedback@nbnco.com.au).**

All submissions will be published on NBN Co's website. Therefore, NBN Co would like submitters to provide a document suitable for publication. If submitters have confidential information they wish to provide, NBN Co asks that these sections are highlighted and that a public version of the submission is also provided.

As part of the overall development of our commercial products, and the further definition of the network architecture, NBN Co is also developing the following papers:

- POI Consultation Paper
- NSAS Pricing Paper
- NSAS Product Technical Specification
- Service Management and Operations Manual
- Deployment Guide
- Systems Manual

Annexure A1 identifies the planned consultation and information release activities.

The NSAS Product described in this Product Overview are available to retail and wholesale service providers to deliver services to End User Premises.

A glossary of acronyms and abbreviations is included in the Glossary of Terms Section in Annexure A2

In a number of places in this paper, NBN Co has provided details of the speeds at which the NBN or a particular wholesale product offering is capable of operating. However, it is important for acquirers of NSAS to recognise that the speeds actually achieved by an end-user will depend on a number of factors, including the terms of the retail broadband plan, the end-user's chosen hardware and their in-premises connection.

## Benefits of NSAS

The NSAS product offering will provide wholesale high speed broadband satellite access services including mass market and business services with the characteristics:

### **High Speed and High Quality Broadband Access**

NSAS is initially designed to provide broadband 12 Mbps download speeds with a development and migration path to higher speed services. Product features and service availability will use up-to-date technology to provide high quality services.

### **Flexibility**

The product structure has been designed with a wholesale component approach that will provide Access Seekers a high degree of flexibility to construct services that satisfy the needs of their target market. Compatibility between access technologies and services will be maintained so Access Seekers can develop services and deliver to the market with minimal modification between fibre, wireless and satellite delivery mechanisms.

### **High Quality Service Management**

Access Seekers using NSAS will be supported by automated systems and processes for service ordering and provisioning, service assurance and reporting/billing. Quality online service reporting and management tools will greatly assist the End User and Access Seeker service management and communication process during the service lifecycle.

### **National Footprint**

NSAS will be accessible within the designated Satellite Serving Areas, including all populated remote Australian territories.

### **Service Migration**

NSAS services and support systems are designed to enable a predictable transition from existing satellite access services to the NSAS.

## 1.1 NSAS Key Product Features

The following section outlines the high level features to be delivered in the initial release of the NSAS product set.

### 1.1.1 At the End User Premises

- Satellite NTUs with either a single Ethernet Port (User Network Interface – UNI) or four Ethernet ports.
- The ability for one Access Seeker to offer multiple End User services (such as Triple Play) using the NSAS product.
- The ability for multiple Access Seekers to provide services to a single End User via one NTU (where multiple Ethernet ports are deployed).
- Satellite based access services with initial bandwidths of up to 12 Mbps downstream and 4 Mbps upstream suitable for consumer and business End Users.
- Specialist Satellite based access services for Access Seekers.
- IP Multicast capability for streaming applications such as TV services, digital advertising, executive presentations to staff or training sessions.

### 1.1.2 Within the NBN Co Network

- Flexible bandwidth levels to facilitate up-sell opportunities for Access Seekers.
- The ability for an Access Seeker to assemble product components to support their own unique business and deployment model.
- A network that allows Access Seekers to control/ manage Points of contention to align with retail product offerings.
- A Class of Service (CoS) model that enables Access Seekers to map their existing end to end Quality of Service (QoS) strategies into the NSAS product set.
- A range of additional services and features such as VoIP support, IP Multicast delivery.
- Selectable Protocol Enhancement techniques to improve application performance and reduce the impact of network latency.
- Enhanced service monitoring including OAM to support flexible Access Seeker service levels.

### 1.1.3 At the Access Seeker Point of Interconnect

- A range of physical interfaces and speed options to cater for Access Seekers with varying levels of network infrastructure and End User scale.
- Resiliency options to enable Access Seekers to deliver a high grade of service and to differentiate their offerings.

### 1.1.4 Exclusions

The NSAS does not include the provision of:

- Facility based infrastructure (co-location, hosting data centre etc) at the PoI.
- Backhaul transmission infrastructure from the PoI to the Access Seeker Point of Presence (PoP).
- Content or applications including IP Transit, Internet Gateway Connection, BNG capability or Soft Switching infrastructure.
- Leasing of satellite (transponder) capacity.

## 2 Satellite Product Overview

The NSAS product consists of a number of components which are used by Access Seekers as “building blocks” to provide an end-to-end service. NSAS represents the “access network” portion of the overall network chain and is used as a conduit for delivering the Access Seeker’s applications and services, as illustrated in the ISP application environment, Figure 2.1.

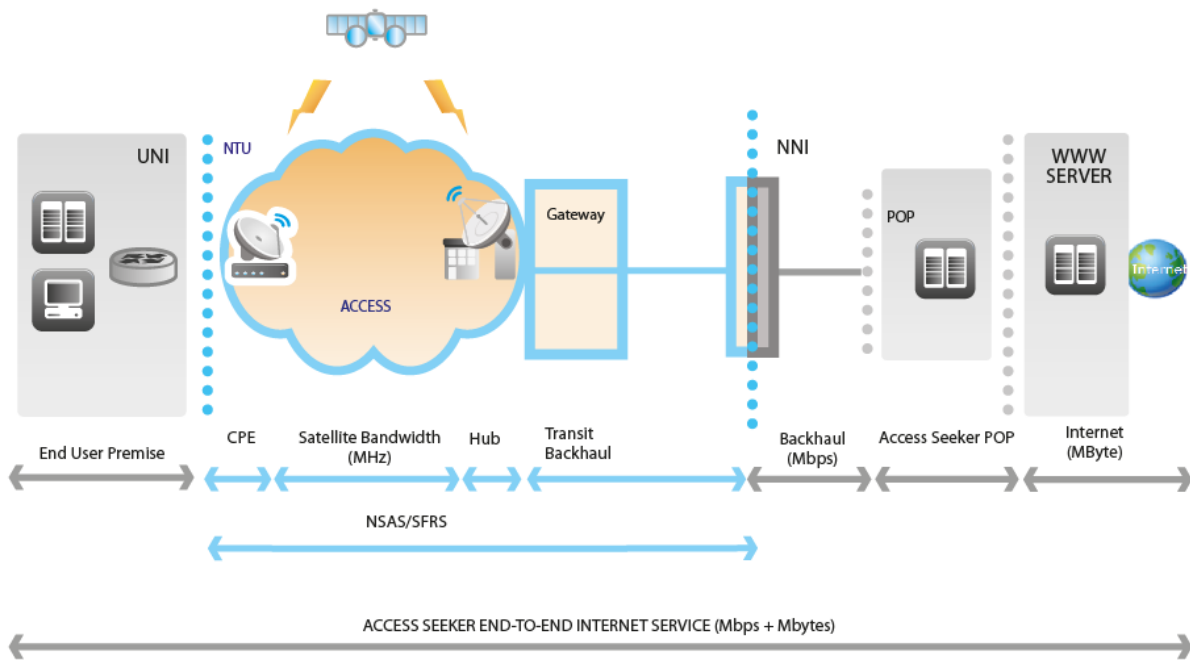


FIGURE 2.1 - HIGH-LEVEL NSAS ACCESS SERVICES USED FOR INTERNET CONNECTIVITY

NSAS delivers an active Ethernet Bitstream connection from the NBN Co Points of Interconnect to and Ethernet data port at the End User premises within the NBN Co Satellite footprint. Access Seekers can interconnect at designated NBN Co Pols which serve defined geographical Satellite Serving Areas (SSA) as shown below in Figure 2.2.

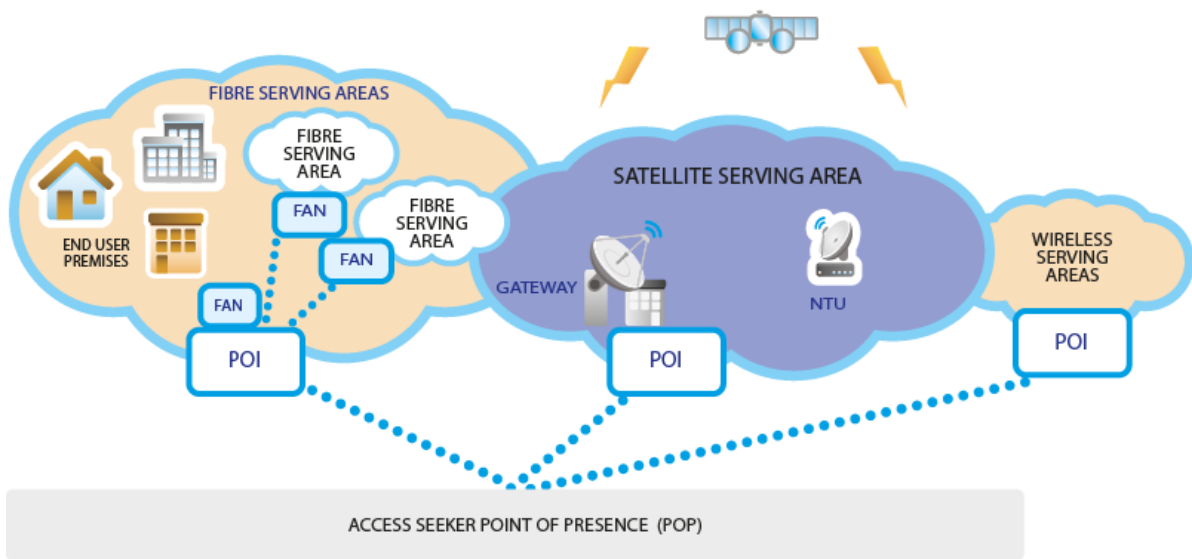


FIGURE 2.2 - NSAS NETWORK CONNECTION ARCHITECTURE

## 2.1 Key Satellite Wholesale Product Components

The NSAS product consists of four key product components in line with the NFAS offering. Access Seekers can build value-added service offerings with significant flexibility using this modular approach. These components are illustrated in Figure 2.3, which depicts the Network Terminating Unit (NTU) in End User premises, the Points of Interconnect (POI), the Satellite Serving Area, the virtual circuits that connect these key logical network elements and the two logical points of connectivity.

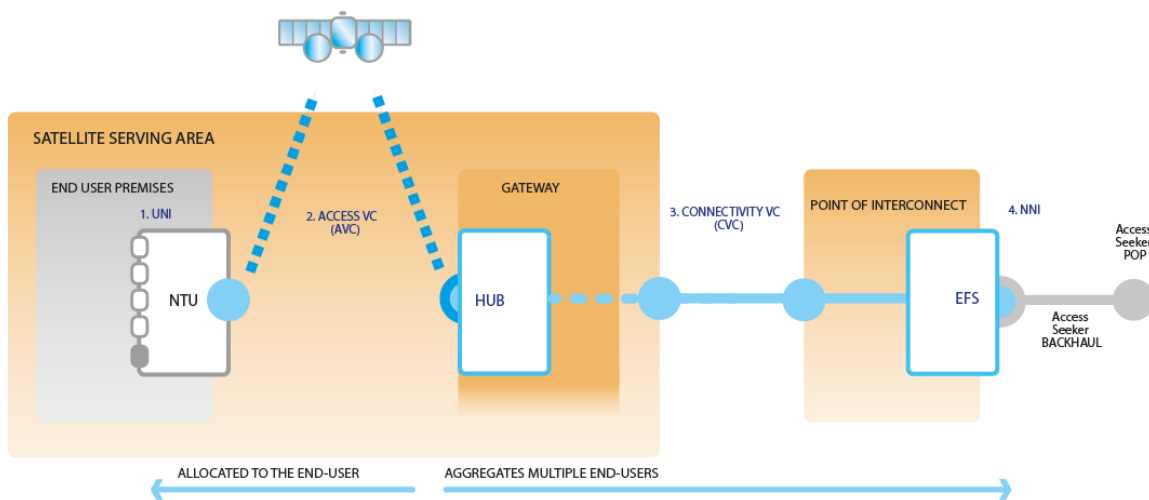


FIGURE 2.3 - LOGICAL NSAS NETWORK DELIVERY COMPONENTS

NSAS Network Acronyms (see the NSAS Technical Specification for detailed definitions), and the attached Glossary

UNI – User Network Interface

NNI – Network to Network Interface

NTU – Network Terminating Unit

HUB – NBNCo Satellite Gateway

Pol – Point of Interconnect

EFS – POI Ethernet Fanout Switch

### 2.1.1 User Network Interface (UNI)

The UNI is depicted as product component 1 in Figure 2.3. It is the physical data interface on the VSAT NTU at an End User’s premises and represents the NSAS network boundary. NBN Co will provide a VSAT NTU device which offers one or four UNI data ports through which an Access Seeker can deliver services.

Each UNI data port is allocated to a single Access Seeker. Where multiple UNI are provisioned, the End User may receive services from multiple Access Seekers simultaneously. An Access Seeker is able to deliver multiple services (e.g. Data, Voice & Video) through a single or multiple UNI data ports on the NTU.

One UNI are port type is provided:

**UNI-Data**      **UNI-D** A 10/100BaseT Ethernet port is provided for data service delivery.

### 2.1.2 Access Virtual Circuit (AVC)

The Access Virtual Circuit (AVC) is the second product component depicted in the Figure 2.3. An AVC provides logical connectivity between a UNI at the End User’s premises and the Connectivity Virtual Circuit for the Satellite Serving Area within which the End User resides. Each Access Seeker wishing to deliver a service to a given End User must order one or more AVCs per End User to access an NTU. Each AVC is mapped to a single UNI. An AVC may be defined as an IP Multicast (only) AVC, logically allocating connectivity to an IP Multicast stream.

The satellite AVC structure is asymmetrical by design. Forward AVC bandwidth (also referred to in the industry as Outbound, or Downlink circuits) is larger than Return AVC bandwidth (Inbound, Uplink) by a factor of, typically 3-6. Access Virtual Circuits are offered at specific tiered bandwidths outlined in the Product Catalogue in Section 4.

## Bandwidth Management

AVC bandwidth is assigned and managed to each NTU by a variety of industry standard and proprietary techniques. The Forward path is a broadcast style link (typically DVB-S or DVB-S2) – i.e. all NTUs in the receiving footprint receive the encoded signal. The Return path is a medium shared by all NTUs which must contend for network access and uses a TDMA based technique.

NSAS applies a bandwidth management system to manage the Forward and Return links. Bandwidth and associated class attributes can be assigned and managed on an individual AVC basis. Combined with other system features, AVC bandwidth management enables Access Seeker construction of targeted service offerings, such as VPNs and tailored Classes of Service.

The AVC is defined by the Committed Information Rate (CIR), Peak Information Rate (PIR) and the Class of Service (CoS) assigned to each AVC.

Within the overall bandwidth commitment, a number of traffic class allocations may be configured to meet the Access Seeker's Class of Service (CoS) requirements. Further details are provided in Section 3.4.

### 2.1.3 Connectivity Virtual Circuit (CVC)

The CVC is the third element depicted in Figure 2.3. In the fibre serving model, the CVC provides logical capacity between a Fibre Serving Area and Network-Network Interface at an NBN Co Point of Interconnect (POI). Similarly in the Satellite model, each Access Seeker requires at least one CVC for each Satellite Serving Area.

The CVC provides a potential contention Point in the network, and enables Access Seekers to control and manage the overall service experienced by End-Users. It also allows the Access Seeker to achieve a higher utilisation and aggregation over logical backhaul.

Access Seekers may implement multiple CVCs per Satellite Serving Area in order to create a differentiated experience for particular End User segments such as residential or business. Figure 2.4 illustrates the logical network configuration. The diagram illustrates CVC aggregation at the POI for both residential and business customers. There is no physical difference between the VCs. Access Seekers may dimension the CVCs differently based on application and market requirements. CVCs are ordered as unicast or multicast circuits.

Connectivity between the Gateway and the Pol is by NBN Co backhaul which is invisible to the Access Seeker network operation, and is managed by NBN Co.

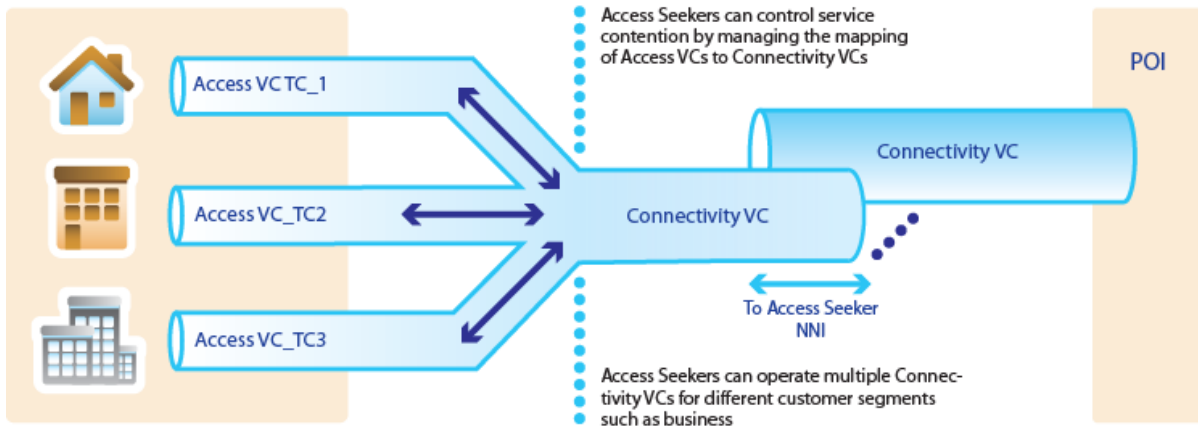


FIGURE 2.4 - MULTIPLE CONNECTIVITY VC (CVC) LOGICAL CONFIGURATION

### 2.1.4 Network-Network Interface (NNI)

The NNI is the fourth component of the NSAS product. It forms the physical service hand-off to the Access Seeker at each Point of Interconnect (PoI). All end-user services in the associated SSAs are presented to the Access Seeker at the PoI via one or more Ethernet NNI. It is anticipated that the NNI will also be able to aggregate both NFAS and NSAS services.

The NNI represents a physical aggregation where the Access Seeker’s backhaul is connected and traffic is delivered back to the Access Seeker’s Point of Presence (PoP). Each NNI physically operates at either 1Gbps or 10Gbps and is available with a number of optical interfaces.

The NNI is offered in the following modes:

- Standard NNI** A single physical interface is provided to the Access Seeker over which all NSAS services are presented.
- Protected NNI** Multiple physical interfaces are provided which enable the Access Seeker to implement diverse equipment or backhaul. Physical interfaces are configured into “NNI Redundancy Groups” to implement either 1+1 redundancy or load sharing across ports, using IEEE802.3ad link aggregation.

### 2.1.5 Summary of Satellite Product Components and Relationships

The following table provides a summary of the key NSAS product components and their context.

Component	Applies To	Notes
<b>1. User Network Interface (UNI)</b>	End User	The UNI provides physical handoff of Access VCs at an End User premises. One (or more) UNI can be ordered by an Access Seeker. An Access Seeker can map one or more Access VCs to one UNI.
<b>2. Access VC (AVC)</b>	End User	Access Seekers must order one or more Access VCs for each end-user that is to be served. AVCs can be ordered as Unicast or Multicast, and be delivered to one or a number or multiple UNIs. AVCs can be ordered with PIR and CIR.
<b>3. Connectivity VC (CVC)</b>	Satellite Serving Area	A Connectivity VC aggregates multiple Access VCs from one Satellite Serving Area. The CVC allows the Access Seeker to manage network contention. CVCs can be ordered with PIR and CIR.
<b>4. Network-Network Interface (NNI)</b>	Point of Interconnect	The NNI provides physical aggregation of several Connectivity VCs. It forms the physical handoff point to the Access Seeker at a POI and may be configured with redundant interface protection options.

TABLE 2.5 – KEY NSAS COMPONENT RELATIONSHIPS

## 2.2 Service Locations

### 2.2.1 Demand

All premises not covered by fibre or wireless access will be able to obtain satellite access. As the combined fibre and wireless footprints cover 97% of premises, satellite will be used to provide access to the remaining 3% of premises.

### 2.2.2 Coverage FootPrint

The proposed footprint of the NBN Co satellite will include mainland Australia, Tasmania and permanently populated remote territories.

An illustrative spot beam coverage map is detailed in Figure 2.8 showing satellite spot beams that match the projected take up distribution.

Note that no national beam is planned.

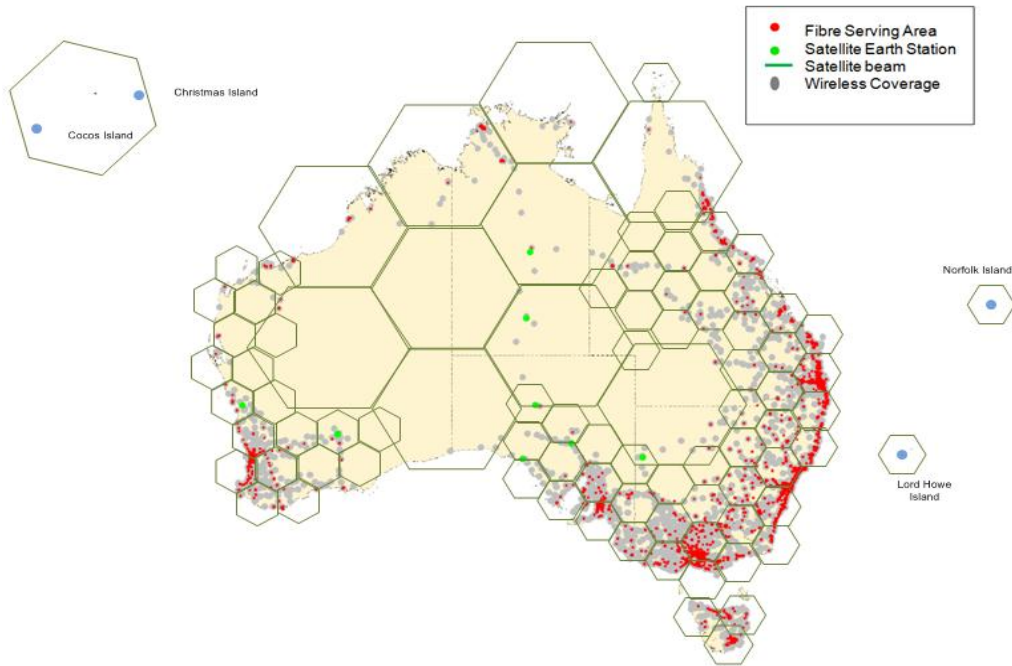


FIGURE 2.8: ILLUSTRATIVE SATELLITE FOOTPRINT

### 3 NSAS Wholesale Product

NSAS will provide the following product (services) and product capabilities:

- Ethernet Bitstream Service
- Interconnection Arrangements
- Class of service (CoS)
- Voice Capability
- Multicast (MC) Capability
- Protocol Acceleration and Enhancements
- Service OAM and Reporting

#### 3.1 Ethernet Bitstream Services (EBS)

The Ethernet Bitstream product is offered in all regions of Australia within the footprint of the satellite.

The Ethernet Bitstream Services (EBS) provides Access Seekers with a Layer 2 access service between the UNI at an End-User Premises and the NNI as illustrated in Figure 3.1. The EBS provides Access Seekers with an access network that provides a platform over which the Access Seeker can construct differentiated services. These are constructed using some inbuilt selectable features which can be augmented by value added external capabilities.

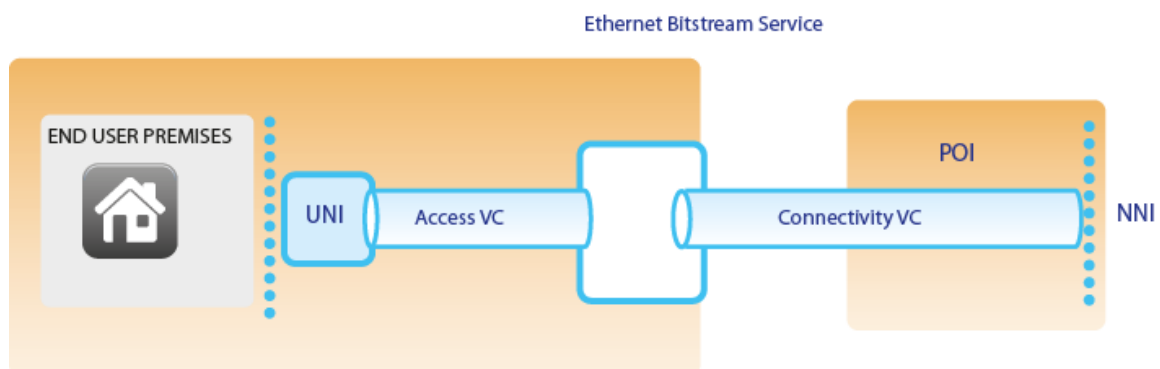


FIGURE 3.1 – NSAS EBS STRUCTURE

## 3.2 Ethernet Bitstream Service Features for Business

It is recognised that NSAS will also be used by Access Seekers to provide higher quality services to business premises. As such NSAS provides a number of enhanced features to facilitate this.

The EBS product supports the following features:

- AVC encryption
- Protocol enhancements that enable Thin Client implementations
- VLAN Transparency
- An enhanced range of service provisioning and restoration options
- Enhanced reporting
- Enhanced availability

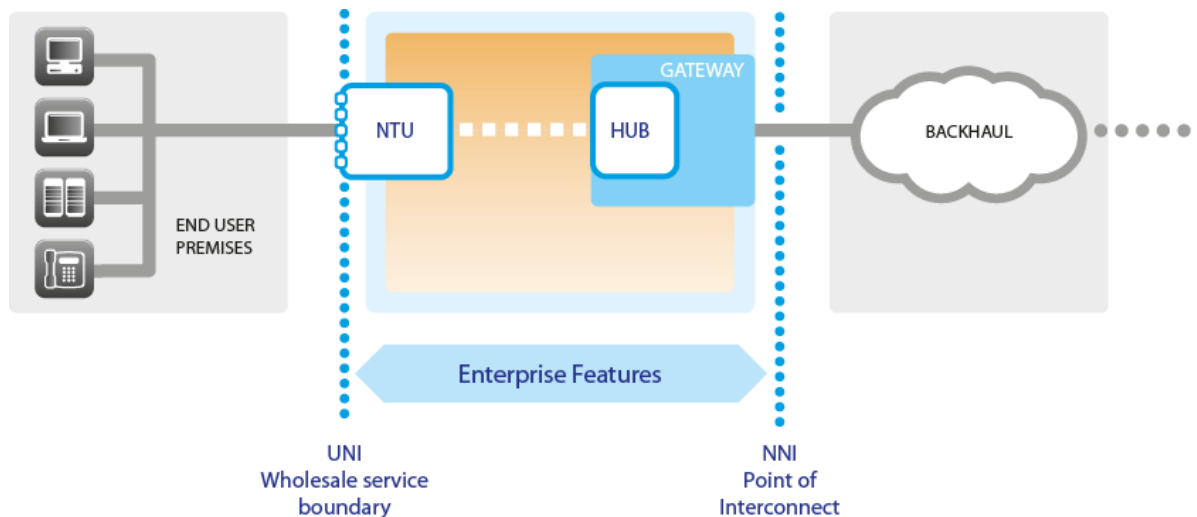


FIGURE 3.2 – ENTERPRISE FEATURES

## 3.3 VLAN Tags

The NSAS network will be designed to support network security and integrity to ensure secure delivery of services and support multiple End-Users. NSAS utilises a two-level VLAN addressing scheme to differentiate circuits, fully-compliant with IEEE802.1ad.

A high level of security is achieved by including the NTU as part of the service – it will not be possible for customers to connect directly to the satellite at the End User's premises.

Each AVC will be supplied as a separate virtual data stream within NSAS.

The Tag structure uses an inner C-TAG to indicate an individual Access VC, to an NTU UNI-Data. The outer S-TAG indicates a Connectivity VC.

An example of NSAS planned VLAN tag assignment and usage follows:

- SVLAN is used to designate the Connectivity Virtual Circuit from the Access Seeker to the Satellite Serving Area (SSA).
- CVLAN is used to designate the Access VC from the SSA to the UNI.
- Hence, the combination of SVLAN and CVLAN uniquely describes the EBS from the Access Seeker's BNG to UNI at the End User Premises.
- SVLAN tags will be unique within the scope of a POI, but may be re-used in other POIs.
- CVLAN tags will be unique within the scope of a SVLAN, but may be re-used between different SVLANs.
- NBN Co will define and manage all tags unless VLAN transparency is enabled, in which case the business End User CVLAN tags are passed transparently through the NSAS network. Access Seekers will have the option of assigning VIDs at the UNI/NNI.

### 3.4 Interconnection Arrangements

At each Point of Interconnect (PoI), two options will be provided for Access Seekers to interconnect their infrastructure to the NSAS network platform. As noted earlier in this document, no general purpose Facilities Access services are planned as part of the initial NSAS offering.

#### **Passive Interconnection**

An Access Seeker requires only optical patching between the NNI and a backhaul service provided by a third party. An allocation is made at the Optical Fibre Distribution Frame (OFDF) at the PoI. No facilities access is provided.

#### **Facilities Access**

An Access Seeker requires a physical presence in the PoI facility for the purpose of housing transmission equipment related to the provision of backhaul only. Physical accommodation and power is provided by NBN Co, and is ordered and supplied as a separate product from NSAS.

### 3.5 Class of Service (CoS)

The provision of end-to-end Class of Service (COS) is the responsibility of the Access Seeker to engineer and manage capacities, service policies, capabilities and tagging of different IP packets or Ethernet frames on the end-user UNI side of the Network Boundary and the Access Seeker's NNI side of the POI.

Two Classes of Service are offered with the initial release of NSAS:

Traffic Class	Typical Use
1	Control, critical and delay sensitive applications.
4	Data download / upload applications.

Traffic Class 1 supports a Committed Information Rate with no excess information rate support, while Traffic Class 4 supports a Peak Information Rate with a Committed Information Rate set to zero.

Traffic Class 1 frames will be transmitted before Traffic Class 4 frames (i.e. a strict priority queue).

Additional Traffic Classes may be introduced in later releases of NSAS.

### Congestion Management within NSAS Services

Within an NSAS service, the Committed Information Rate (CIR) of Traffic Class 1 within an AVC is provisioned using reserved capacity. This results in deterministic performance for in-profile Traffic Class 1 traffic, under normal operating conditions. Out of profile traffic for Traffic Class 1 (i.e. traffic sent in excess of the CIR) will be discarded. For all Traffic Classes, traffic sent in excess of the PIR of that traffic class will be discarded.

Further details on COS implementation will be available in the NBN Co Satellite Access Product - Technical Specification.

### 3.6 Battery Back-Up

The NTU will be able to accommodate an optional backup battery. NBN Co will not supply, install or maintain a backup battery. It is envisaged that the ongoing supply and management of this battery power source will be handled by the Access Seekers/ End-Users. However, NBN Co will offer a remote monitoring service to Access Seekers which will enable an Access Seeker to identify when power is not being supplied to a particular NTU. It will be up to Access Seekers whether they choose to acquire this service. However, NBN Co recommends that Access Seekers notify end-users of its availability.

### 3.7 Voice

NSAS will facilitate the delivery of a telephone service via an external ATA, provided by an Access Seeker.

NSAS supports Voice over IP (VoIP) natively within the AVC via a UNI-D. Thus the Access Seekers may deliver VoIP solutions from softswitch infrastructure to end-users with VoIP-compatible handsets and/or personal computers.

### 3.8 Multicast

Multicast is a technology whereby content transmitted simultaneously to two or more End Users is carried as a single stream as far into the network as possible before being replicated (i.e. divided) and on-forwarded to end-users. Replication may occur at more than one Point along the end to end path, resulting in a tree of replicated streams, but typically occurs at the Gateways and the NNI.

The multicast technique can achieve significant bandwidth savings for the delivery of one-to-many services ensuring efficient use of the NSAS broadcast capacity and Access Seekers’ backhaul, enabling a more cost effective delivery of services such as IPTV and other streaming video services to a wide customer base.

The example shown in Figure 3.4 depicts four End Users, each receiving a 10Mbps data stream. Multicast enables the Access Seeker to inject that stream only once at the POI. Without multicast, the Access Seeker would need to inject the same stream four times at the POI (consuming 40Mbps of bandwidth). An Access Seeker is free to scale the number of End Users they can support, without incurring additional CVC and backhaul expense.

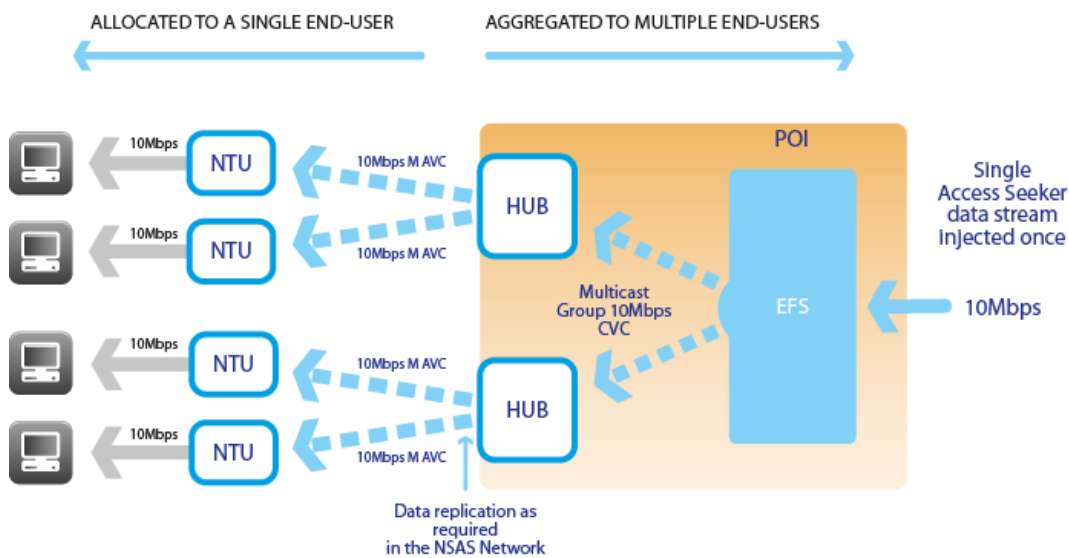


FIGURE 3.4 - MULTICAST REPLICATION

The NSAS Multicast solution consists of two components:

- Multicast Domain
- Multicast Access Virtual Circuits

### **NSAS Multicast Domain**

The NSAS Multicast Domain enables Access Seekers to efficiently distribute content from a PoI by injecting traffic only once at the Point of Interconnect (PoI) irrespective of the number of end-users.

NBN Co will manage the distribution of content to each NTU within the Satellite Serving Area.

Access Seekers will define a series of Multicast Groups for each PoI. In the context of TV content, each Multicast Group represents one simultaneous channel of content. Charges are based on the aggregate Multicast bandwidth per PoI and directly relate to the channel quantity offered by the Access Seeker.

### **Multicast Access Virtual Circuit**

Access Seekers must order a Multicast Access Virtual Circuit for each End-User who wishes to receive Multicast content. This is an additional AVC to an AVC being used by the same Access Seeker for Broadband data services. Multicast AVCs can be ordered at specific bit rates contained in the product catalogue to suit the type of content being delivered (for example, Standard Definition or High Definition). This is a separate and dedicated AVC for multicast i.e. unicast traffic such as VoD or internet cannot be delivered on this service.

In the context of TV, each Multicast AVC needs to be dimensioned at the required simultaneous viewing capacity that is to be provided to the End User.

### **Multicast Dimensioning Example**

The Access Seeker has a channel line-up as follows:

4 x Standard Definition Channels @ 5Mbps per channel = 20Mbps

1 x High Definition Channels @ 10Mbps per channel = 10Mbps

The Access Seeker would order a Multicast Domain to satisfy the total channel line-up bandwidth of 20Mbps + 10Mbps = 30Mbps.

End User Multicast Access VCs would be ordered based on the number of channels to be delivered simultaneously.

## 3.9 PEP – Protocol Enhancing Proxies

Performance Enhancing Proxies (PEPs) are devices that improve the end-to-end performance of some communications protocol such as TCP to overcome the satellite end to end latency issues. The PEP impact upon file transfers and regular network activity can be quite dramatic - with the potential to significantly improve throughput.

NSAS will include a range of PEPs. These can be selected for inclusion by the Access Seeker. Alternatively an Access Seeker may provide external PEP servers, operating over the top of the NSAS network.

### 3.9.1 PEP Features – TCP Acceleration

Transmission Control Protocol (TCP) depends on continuously receiving ACK messages for its windowing mechanism to operate efficiently. TCP acceleration works by sending ACK messages locally by the NTU (the session is said to be “spoofed”) instead of waiting for the actual ACK message from the remote end to cross the satellite link. When an actual ACK message is received from the remote end, the spoofing agent updates its state and discards it instead of forwarding it to the host.

NSAS provides this form of TCP acceleration as a standard, selectable feature.

### 3.9.2 PEP Features – HTTP Acceleration

HTTP is the protocol used by web browsers. HTTP Acceleration improves the user experience by more rapidly loading web pages during Internet browsing.

A process called “pre-fetching” can be used to increase download speeds. Pre-fetching, also called Pipeline Cache works by separating inline objects such as graphics and the HTML code of the site being requested. Once separated, the inline objects are requested first, giving them more time to load. This accelerates the loading of a web page, with a significant observable speed increase.

A process called “HTTP Tunnelling” can also be used to increase download speeds. Instead of opening a new TCP connection for every HTTP transaction, using a Remote Page Accelerator (RPA) and a Host Page Accelerator (HPA). The RPA opens a single, persistent connection to the HPA server after the first object request is received. The browser at the customer’s host and the RPA at the VSAT will establish a standard HTTP dialog, with a new TCP connection for every transaction. However these connections are established locally and do not suffer from long delays. The RPA will aggregate all the HTTP information into the single TCP link with the HPA, and the VSAT NTU will then handle it as another TCP connection, using spoofing and encapsulation.

NSAS provides these forms of TCP acceleration as a selectable product. Alternatively the Access Seeker may provide external servers to implement their own HTTP Acceleration capability.

### 3.9.3 PEP Features – Thin Client Acceleration

NSAS provides application enhancement for thin client applications such as Citrix and Pronto. These will be specialised Access Seeker selectable options.

## 3.10 AVC Link Encryption

While satellite communication offers many benefits from its wide-area coverage capability, it brings with it a concern for the security of the underlying information. Encryption is the intentional scrambling or masking of digital data to protect it from compromise. If the data is not encrypted, data sent from the Hub to the End Users NTU would be accessible by anyone who could intercept the transmission.

NSAS AVCs will be provisioned with a basic level of encryption (e.g. AES128) as standard. Where advanced encryption is required, the Access Seeker can provide the encryption over the top of the NSAS network.

## 3.11 Service OAM and Reporting

### Service OAM

The NSAS product offers enhanced Service Operational, Administration and Maintenance (Service OAM) features using capabilities based on IEEE802.1ag (Connectivity Fault Management).

These features allow an increased level of visibility into the status of NSAS services, and provide diagnostic capabilities that assist in the rapid identification and isolation of faults. NSAS Service OAM is expected to appeal to Access Seekers who use NSAS to address the business market, and require a higher level of network monitoring and control for delivering premium applications.

### Reporting

The NSAS network offers enhanced reporting for selected services. This extended reporting builds upon the base level of statistics, providing further information around traffic management and discard at the Class of Service level.

These metrics help an Access Seeker monitor their congestion and traffic management within the NSAS network, to ensure preservation of their own IP-level, end-to-end QoS policies. This will

appeal to Access Seekers who offer mixed-media applications across the NSAS network (e.g. triple-play), who are expected to take advantage of the NSAS CoS and QoS mechanisms.

## 4 Wholesale Satellite Product Catalogue

NBN Co’s Satellite Product Catalogue is aligned to the key product components outlined in Section 2. It enables NSAS products to be built at a component level to provide a high level of flexibility to Access Seekers.

The Product Catalogue defines orderable elements of the product and related attributes.

**Refer to the NSAS Technical Specification for a detailed description of the configuration attributes.**

### 4.1 Catalogue Structure

The following catalogue shows the charge structure and feature elements available for ordering on an NSAS services.

NTU				
Option	Description	NRC	MRC	Comments
Standard NTU	1 Port	\$TBA	\$TBA	Standard
Optional NTU	4 Port	\$TBA	\$TBA	
NTU Power	Standard 240V AC Optional 12/24V	\$TBA	\$TBA	
Non Standard Install	Non standard dish or physical install	\$TBA	\$TBA	

NRC = Non Recurring Charge, MRC = Monthly Recurring Charge

TABLE 4.1 – NTU OPTIONS

More than one NTU can be ordered per site.

**UNI Chargeable Options and Descriptions:**

<b>User Network Interface (UNI)</b>				
<b>Option</b>	<b>Description</b>	<b>NRC</b>	<b>MRC</b>	<b>Comments</b>
UNI-D	10/100/Base TX	\$TBA	\$TBA	Std Ethernet Interface

NRC = Non Recurring Charge, MRC = Monthly Recurring Charge

TABLE 4.2 – UNI OPTIONS

**Access Virtual Circuit Chargeable Options and Descriptions:**

<b>PIR Access Virtual Circuits</b>				
<b>Options</b>	<b>Description</b>	<b>NRC</b>	<b>MRC</b>	<b>Comments</b>
Forward (Downstream) speed options	12 Mbps		\$TBA	
Return (Upstream) Speed options	1Mbps		\$TBA	Minimum upload speed for UNI-D
	2 Mbps		\$TBA	
	4 Mbps		Future	
AVC_M	As Above		\$TBA	Multicast AVC option for selected speed

TABLE 4.3 – AVC PIR OPTIONS

CIR Access Virtual Circuits				
Options	Description	NRC	MRC	Comments
Forward (Downstream) options	60 kbps		\$TBA	Voice access dimensioned to the UNI-V only
	150 kbps		\$TBA	Voice access dimensioned to the UNI-V only
	256 kbps		\$TBA	
	512 kbps		\$TBA	
	1 Mbps		\$TBA	
	2 Mbps		\$TBA	
	4 Mbps		\$TBA	
	6 Mbps		\$TBA	
	12 Mbps		\$TBA	
	Return (Upstream) options	60 kbps		\$TBA
150 kbps			\$TBA	
256 kbps			\$TBA	
512 kbps			\$TBA	
1 Mbps			\$TBA	
2 Mbps			\$TBA	
4 Mbps			\$ Future	
AVC_M	As Above		\$TBA	Multicast AVC option for selected speed

TABLE 4.4 – AVC CIR OPTIONS

Other Product Chargeable Options and Descriptions:

Options	Description	NRC	MRC	Comments
Transparency	CE-VLAN transparency		\$TBA	Business service option
Multicast Capability	Optional feature to support IP TV broadcast			
Service OAM	Monitor service in real time & diagnostic capability		\$TBA	Business service option
PEP	Protocol Enhancement Options		\$TBA	Selectable by feature
AVC Encryption	Optional feature for link security		\$TBA	
Modifications	Changes of speed or feature	\$TBA		

TABLE 4.5 – OTHER OPTIONS

**Connectivity VC Orderable Options and Descriptions**

The Connectivity VC is dimensioned by the Access Seeker according to aggregated capacity requirements and forecast growth. The smallest capacity increment starts at 10Mbps.

Connectivity VC Reoccurring Charges (CIR)				
Bandwidth Options (Mbps)	Local			Comments
	<b>Protected</b>			
10	\$TBA			All local CVC and the majority of Transit Links are protected On certain remote Links, Protection may be provided as an option
20	\$TBA			
50	\$TBA			
75	\$TBA			
100	\$TBA			
150	\$TBA			
200	\$TBA			
250	\$TBA			
300	\$TBA			
350	\$TBA			
400	\$TBA			
450	\$TBA			
500	\$TBA			
600	\$TBA			
700	\$TBA			
800	\$TBA			
1000	\$TBA			
Options	Description	NRC	MRC	Comments
Multicast Domain (CVC_M)	N:1 multicast based on CVC bandwidth option		\$TBA	
Service OAM	Monitor service in real time and diagnostic capability		\$TBA	Business Features
Modifications	Changes of speed or feature	\$TBA		

TABLE 4.6 – CVC OPTIONS

**Network to Network Interface (NNI) Orderable Options and Descriptions:**

**Standard Ethernet Interface**

The Standard Ethernet Interface ports would be charged at separate rates for the 1Gbps port and the 10Gbps port on a per port basis.

**Long Haul Interfaces**

The Long Haul Interfaces have material cost implications for NBN Co as they have different laser setups to enable long distance transmission. The Long Haul Interface ports would be charged at separate rates for the 1Gbps port and the 10Gbps port on a per port basis.

Further details are provided in the Technical Specification.

NNI Port				
Interface Speed	Description	NRC	MRC	Comments
1Gbps	1000BaseLX- 10Km range	\$TBA	\$TBA	
1Gbps	1000BaseZX-40Km range	\$TBA	\$TBA	
10Gbps	10GBaseLR-10 Km range	\$TBA	\$TBA	
10Gbps	10GBaseER-40Km range	\$TBA	\$TBA	
Link OAM	Monitor service in real time and diagnostic capability		\$TBA	For Business Services
Protected NNI	Redundancy options at the NNI	\$TBA	\$TBA	
Expedited Installation	set up NNI at faster than std provisioning time	\$TBA		
Modifications	changes of speed or feature	\$TBA		

TABLE 4.7 – NNI OPTIONS

Access Seekers can connect to all Gateways via one NNI. Multiple NNIs can be connected to Access Seeker POPS for diversity and redundancy operation.

## 5 Service Management

NBN Co’s system architecture is built around the key principles of Service Provider enablement and automation. By placing the management controls of each End User service in the hands of the corresponding Access Seeker, operational overheads and manual order processing are minimised.

NBN Co system interfaces will span across a number of different domains as shown below.

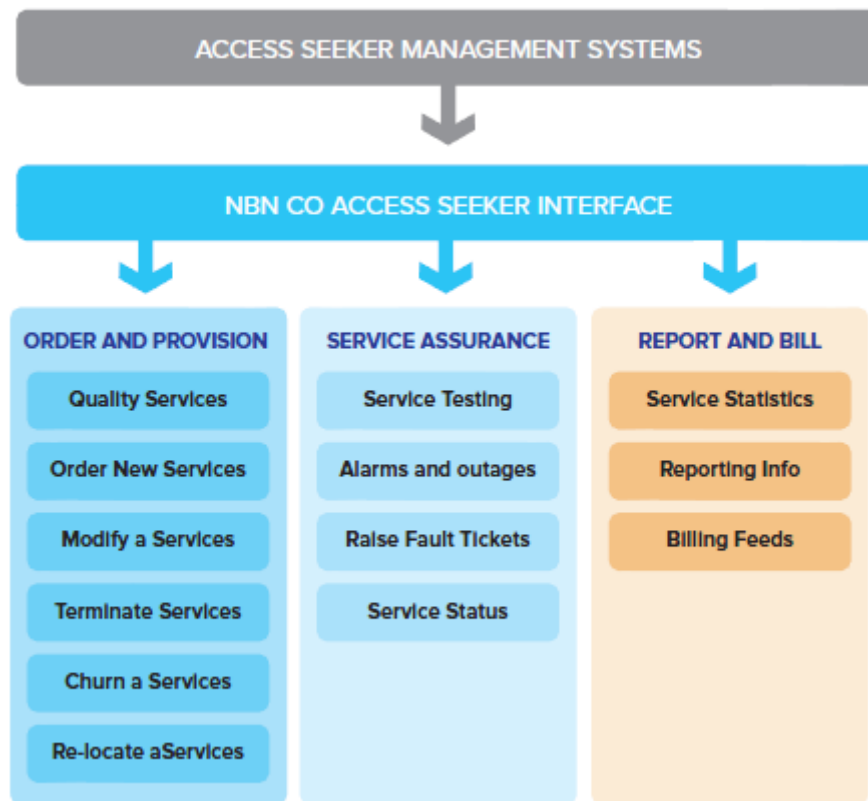


FIGURE 5.1 SERVICE MANAGEMENT DOMAINS

Details will be provided in the Service Management and Operations Manual and the Systems Manual.

## 6 End User Premises

NBN Co will provide a VSAT Network Termination Unit (NTU) at each end-user premises. Further details will be provided in the Deployment Guide.

## 7 NSAS Access Configuration Examples

The following examples illustrate NSAS use in the typical delivery of residential and business applications offered by Access Seekers. They outline both equipment and service configuration arrangements, and how components of NSAS can be utilised in varying service delivery environments.

### 7.1 Residential Gateway Internet and VoIP Connection

The Residential Gateway illustration shows residential connection for voice, video and data and the gateway CPE is the responsibility of the End User or the Access Seeker. The selection of Residential Gateway equipment will be determined by the Access Seeker and End User, depending on the Access Seeker retail service model and feature requirements.

The NTU connects to End User equipment, typically via a Residential Gateway (Wireless Access Point, IP Router etc), which maintains the Access Seeker IP address required for the network connection. Traffic classes (TCs) are illustrated, terminating on a single NTU port.

In the Figure 7.1 example the UNI port provides data connectivity to via traffic class TC\_4, Best Effort, to the Access Seeker internet connection.

The voice traffic can be dedicated to a separate AVC traffic or traffic can be shared on the same AVC as shown in the diagram

All services are delivered to the Residential Gateway from a single UNI port. Alternatively they could be delivered over separate NTU ports.

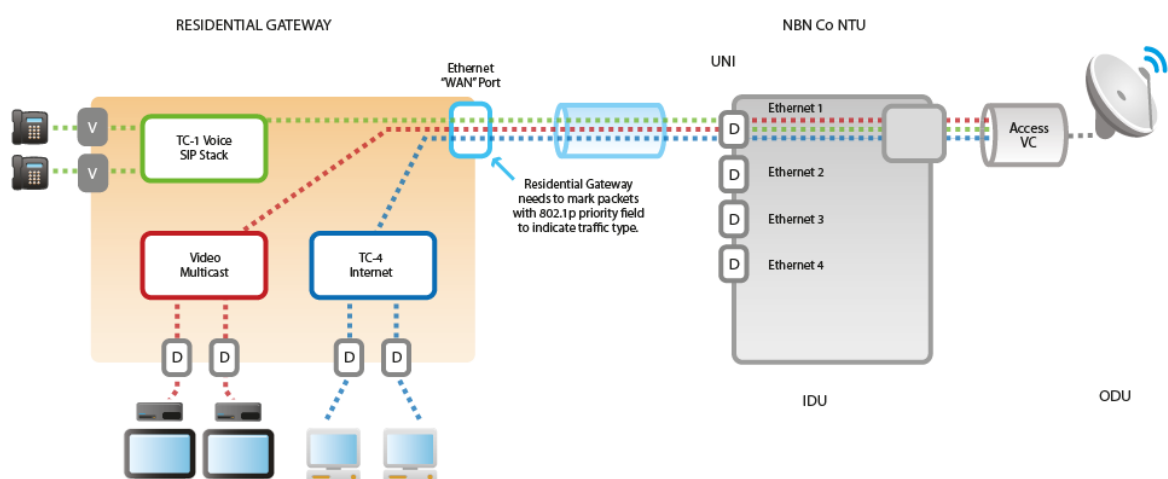


FIGURE 7.1 - RESIDENTIAL GATEWAY

## 7.2 High Speed Corporate VPN Connectivity

Multiple corporate network connections can be accessed using a single high speed enterprise network access ‘tail’.

Many businesses run multiple networks, including separate data and voice networks, and multiple virtual business private networks. It is possible to aggregate all these networks using a VPN for delivery to a single network location.

Networks can be aggregated and delivered over a single UNI, or spread over multiple UNI NTU ports. Figure 7.6 illustrates the service environment.

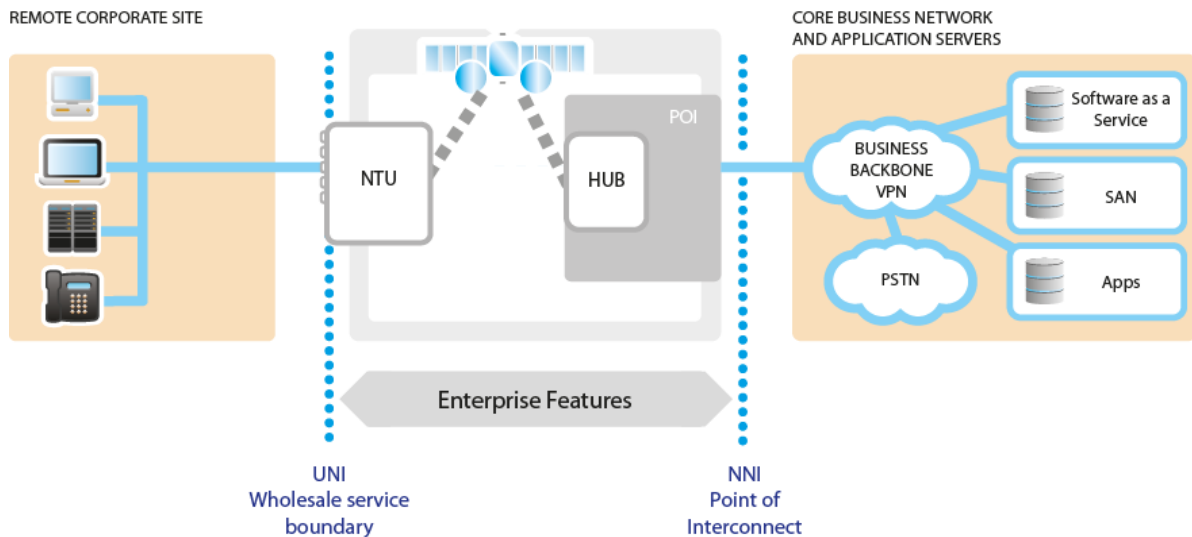


FIGURE 7.6 – NSAS ENTERPRISE ACCESS NETWORK

## 7.3 Corporate VLAN Application

The NSAS VLAN tagging implementation enables partitioning of traffic in a network using multiple VLANS and carriage over the AVC to a single NTU port, or multiple NTU ports.

NSAS supports a flexible and robust VLAN architecture. With this capability, Access Seekers can assign multiple VLANs to one, or multiple UNI-D's and use each UNI port to provide a different VLAN service as illustrated in Figure 7.8. VLAN traffic can be aggregated on a single NNI link to the hub and delivered to separate UNI ports.

The VLANs are separate so separate or overlapping IP addressing schemes can be implemented in each VLAN. Additional features can be implemented on a per VLAN basis such as configurable CIR, TCP acceleration and CoS priorities. This enables a corporation to tailor the network performance to the exact application requirements.

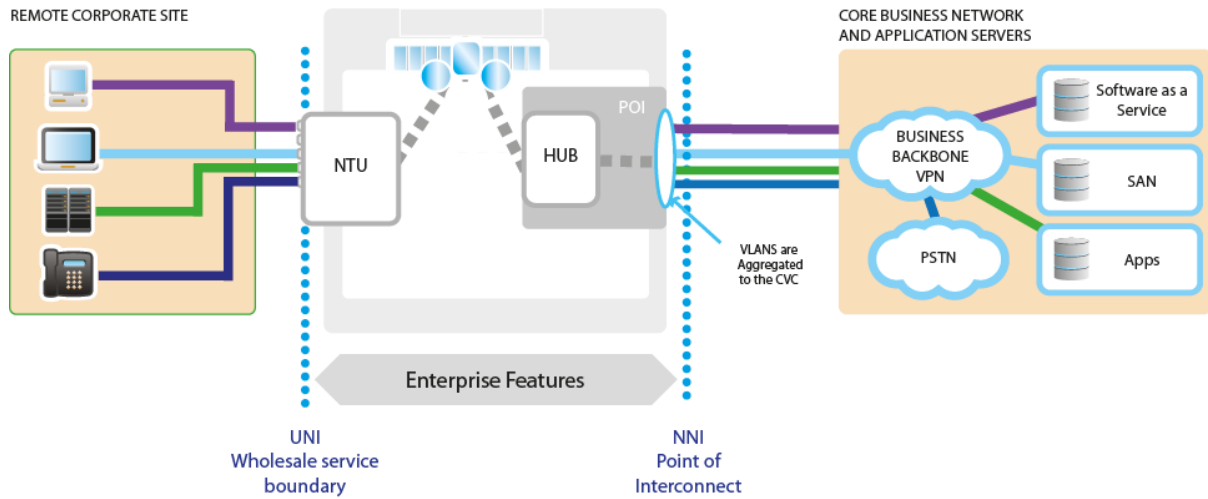


FIGURE 7.8 –ENTERPRISE VLAN APPLICATION

## 8 Annexure A1 – Information and Document Hierarchy Release Schedule

Following is a draft document hierarchy and draft schedule dates.

PoI Consultation Paper:	A discussion paper on POIs.
Product Overview	<p>A high level product and pricing structure document that provides the Access Seeker sufficient product description details to identify key architectural and business considerations required to use the NSAS service, including:</p> <ul style="list-style-type: none"> <li>• Product Components</li> <li>• Product Ordering Catalogue</li> <li>• Application Examples</li> </ul>
NSAS Pricing Guide	The NSAS product price list, charge structure and conditions.
Rollout Schedule	The indicative NSAS national network rollout locations and dates.
NSAS Product Technical Specification	<p>The NSAS Technical Specification defines the product technical details, ordering information and service levels.</p>
Service Management and Operations Manual	<p>A service manual that defines operational processes, service levels, including:</p> <ul style="list-style-type: none"> <li>• B2B Interface</li> <li>• Ordering Services</li> <li>• Service Modification</li> <li>• Churn Process</li> <li>• Service Qualification</li> <li>• Assurance Process</li> <li>• POI setup and management</li> </ul>

Deployment Guide	<p>A manual that defines the geographical and physical aspects of the network rollout and related party obligations, including:</p> <ul style="list-style-type: none"><li>• In building cabling</li><li>• Demarcation Points</li><li>• Service Testing</li><li>• Power requirements</li><li>• Space Requirements</li><li>• Environmental</li><li>• Migration</li></ul>
Systems Manual	<p>A manual that defines operational, systems and Access Seeker Business to Business IT and network interfaces.</p>

## 8.1 Document Availability Schedule.

POI Consultation Paper

Product Overview

NSAS Pricing Guide

Indicative Rollout Schedule

NSAS Product Technical Specification

Service Management and Operations Manual

Deployment Guide

Systems Manual

## 9 Annexure A2 – Glossary of Satellite Terms

The following words, acronyms and abbreviations are referred to in this and related documents.

The following words, acronyms and abbreviations are referred to in this document.

**Access network:** The part of the network that connects directly to customers from the local telephone exchange, or carrier network POI.

**Access Seeker:** A Wholesale service user who uses NBN Co or other network access services.

**ADSL (Asymmetric Digital Subscriber Line):** A technology used for sending data quickly over a conventional copper telephone line. It is used in current internet services with download speeds up to 24Mbit/s.

**ATA:** Analogue Telephone Adapter is a device used to connect one or more standard telephones to a digital system such as VoIP network.

**AVC: Access Virtual Circuit:** A dedicated Ethernet Virtual Circuit that connects the UNI to one CVC.

**Backhaul:** The middle of the network, this is a high capacity line which links the core network with the access network.

**Bandwidth:** This is the measure of the how much data can be carried across a link in the network.

**Broadband:** An internet service which provides high speed access to the internet.

**BNG:** Border Network Gateway.

**Core Network:** The backbone of a communications network, which carries different services such as voice or data around the country.

**CIR:** Committed Information Rate is the guaranteed minimum bandwidth allocated to an AVC or CVC under any circumstances.

**CVC: Connectivity Virtual Circuit:** A shared Ethernet Virtual Circuit that connects one or more AVCs to a NNI.

**DSL (Digital Subscriber Line):** general name for range of technologies that offer broadband over copper access networks, including ADSL and VDSL.

**End User Premises:** The premises of an End User to which a carriage service is or will be supplied.

**Ethernet:** A common technology which allows computers on a network to talk to each other.

**Encryption:** Encryption is the intentional scrambling or masking of digital data to protect it from compromise.

**Exchange:** A building which houses electronic equipment that connects telephone calls. Backhaul links from a content provider are terminated here to connect access links to end users.

**FAN: Fibre Access Node:** The local node that terminates fibre for a defined servicing area.

**FTP: File Transfer Protocol:** A TCP network protocol for bulk file transfer between a server and a terminal device.

**Gigabit Passive Optical Network (GPON):** A shared fibre network architecture that can be

used for next generation access.

**Gateway:** An earth station location that provides connectivity between the satellite and ground telecommunications facilities. Includes VSAT hub equipment and Antenna teleport.

**GIS :** Geospatial Information System – an IT system that holds and maintains physical service delivery location information.

**GNAF:** Geocoded National Address File is Australia’s first authoritative geocoded address index for the whole country, listing all valid physical addresses in Australia. It contains approximately 12.6 million physical addresses, each linked to its unique geocode (that is, the specific latitude and longitude of the address).

**Fibre-to-the-Premises (FTTP):** An access network structure in which the optical fibre runs from the local exchange to the end user's living or office space.

**HPA: Host Page Accelerator:** A host proxy that accelerates HTTP traffic.

**Hub:** The earth station gateway equipment that connects to a transmit/receive antenna for communication to VSAT devices via the satellite. Hub and VSAT equipment is usually supplied by the same vendor.

**MEF: Metro Ethernet Forum:** A global body of network operators and equipment vendors with the common goal of promoting the use of Carrier Ethernet.

**MBHT:** Minimum Busy Hour Throughput. Expected minimum bit rate during the peak network load period.

**Multicast:** A network technique to support IP broadcast to selected NTUs. Typically used with conditional access to deliver IPTV services.

**Narrowband:** A service which provides connections up to 56 kilobits per second (or 0.056 megabits per second). This is most commonly used for making phone calls over a copper wire, but was originally used for dial-up internet connections before broadband services were deployed.

**NGN:** Next Generation Network, including FTTP technologies

**Next Generation Networks (NGN):** An upgrade to the core or “backbone” part of the network to new technologies.

**NTU: Network Terminating Unit.** A generic term for network equipment at the End User premises which provides a point for network demarcation.

**NNI: Network to Network Interface:** The Access Seeker physical point of network connection to NFAS located at the POI. Typically a 1Gbps or 10Gbps optical transmission interface.

**NSAS:** NBNC Co Satellite Access Service. The acronym to describe the satellite technology based access network.

**NFAS:** NBNC Co Fibre Access Service. The acronym to describe the fibre technology based access network.

**OSI: Open System Interconnection:** Reference model for network infrastructure. An international recognised standard based model that defines a network element hierarchy.

**PEP: Protocol Enhancing Proxy.** PEPS are devices that improve the end-to-end performance of some communications protocol such as TCP.

**PIR: Peak Information Rate** is the maximum bandwidth allocated to an AVC or CVC under any circumstances.

**Pol: Point of Interconnect,** is a demarcation and network connection point between carriers.

**PoP: Point of Presence:** Closest Access Seeker location to a POI.

**Premises:** A physical residential or business location yet to be precisely defined.

**Retail Service Providers (RSPs):** Companies which provide telecommunications networks or services to a customer's home, such as telephone and internet services, and which usually own some infrastructure.

**RPA: Remote Page Accelerator:** A remote client that accelerates HTTP traffic.

**Satellite:** An orbital geostationary self contained piece of electronic equipment comprising power source, antennae and RF transponders for communication with ground based systems.

**Satellite:** An orbiting device that transmits and receives RF signals.

**Service providers (SPs):** Companies which provide services, such as telephone or internet services, to a customer's home or business.

**Spot Beam:** An RF signal that illuminates a geographical area.

**TDMA:** Time Division Multiple Access.

**UNI: User Network Interface:** The physical End User NSAS access point, and NSAS point of network demarcation –an Ethernet connector.

**Unicast:** Unicast IP data is data sent from one host to another host, when one device transmits a message destined for one receiver (ie point to point communication).

**VoIP:** Voice over IP – Voice services carried over a packet digital IP network.

**VPN: Virtual Private Network** – a network constructed of circuits that operate as a private network but share circuits with other access and carriage providers.

**VSAT:** Very Small Aperture Terminal – the premise equipment including a dish and IDU – Indoor modem Unit that provides the physical point of connection. Referred to in this document as the NTU.