

Product Description

NGA VUA Products

Version Control

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Acronyms

AF	Assured Forwarding
AN	Access Node
BE	Best Effort
BP	Bitstream Plus
BTV	Broadcast Television
CoS	Class of Service
CPE	Customer Premises Equipment
CSID	Calling Station ID
EF	Expedited Forwarding
FTTC	Fibre to the Cabinet
FTTH	Fibre to the Home
GPON	Gigabit-capable Passive Optical Network
GLUMP	Geographic Local Unbundled Metallic Path
IGMP	Internet Group Management Protocol
M-VPN	Multicast – Virtual Private Network
MPLS	Multi-Protocol Label Switching
NGA	Next Generation Access
NGA-AN	Next Generation Access – Access Node
NGN	Next Generation Network
NTP	Network Termination Point
NTU	Network Terminating Unit
OLT	Optical Line Terminal
ONT	Optical Network Terminal
PB	POTS Based
PoH	Point of Handover
PON	Passive Optical network
POTS	Plain Old Telephone Service
QoS	Quality of Service
RG	Residential Gateway
SA	Standalone
SAB	Service Access Bandwidth
SB-WLR	Single Billing - Wholesale Line Rental
STB	Set-top Box
UG	Unified Gateway
ULMP	Unbundled Local Metallic Path
VLAN	Virtual Local Area Network
VLL	Virtual Leased Line

Product Description – open eir NGA VUA

VPLS	Virtual Private LAN Service
VAS	Value Added Service
VoIP	Voice over Internet Protocol
VOD	Video on Demand
VDSL	Very high bit-rate Digital Subscriber Line
WEIL	Wholesale Ethernet Interconnect Link

1. Introduction

This document provides the product description for the open eir¹ Virtual Unbundled Access (VUA) product set. It is subject to review and may be re-issued to reflect changes, as new products are added to the range, or enhancements to existing products are made. All such changes will be communicated in accordance with agreed Industry Practices.

Virtual Unbundled Access (VUA) Products form part of open eir’s Next Generation Access (NGA) product portfolio. They provide Generic Ethernet Access between an end-customer’s premises and a local handoff point within the serving NGN Aggregation Node. VUA Products are intended to support a mix of time sensitive and high volume applications including voice, general entertainment (including Broadcast TV) and high speed Internet. They can use either copper or fibre as the physical access medium to the end-customer’s premises. The VUA product set enables Operators to combine their own transport network with the open eir Next Generation Access network in order to deliver high speed advanced services to both consumer and business end customers. The table below outlines the individual products covered by this product description.

<i>Access Medium</i>	<i>POTS² Support</i>	<i>Product</i>
Fibre to the Home (FTTH)	No	FTTH VUA SA (Standalone)
	Yes	FTTH VUA PB (POTS-based)
Fibre to the Cabinet (FTTC)	No	FTTC VUA SA (Standalone)
	Yes	FTTC VUA PB (POTS-based)

Figure 1: open eir NGA VUA Products

¹ open eir is a trading name of eircom Limited, Registered as a Branch in Ireland Number 907674, Incorporated in Jersey Number 116389, Branch Address: 1 Heuston South Quarter, St. John’s Road, Dublin 8

²POTS is an acronym for ‘plain old telephone service’, and refers to the analogue telephone service provided over a copper twisted pair landline. It is used to distinguish that service from other voice services, such as a Voice over Internet Protocol (VoIP) service provided over an all-digital network.

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VUA products give operators the flexibility to configure and manage their end-customers traffic in a manner similar to an unbundled product, while also having the advantage of an active, managed, access network. Two variants, Standalone (SA) or POTS-Based (PB), are available.

This document should be read in conjunction with the associated documents, listed on page 2. Any specific technology mentioned in this document is current as at date of issue and is for guidance purposes only. open eir reserves the right to adapt the technology used to deliver the Virtual Unbundled Access product, at any time.

2. Products Overview

The Virtual Unbundled Access (VUA) product range consists of Layer 2 Ethernet-only access products, giving the operator full control of network protocols and core transport solutions. Each VUA product provides an enhanced broadband access service, between the service termination / demarcation point at an end-customer premises and a WEIL³ at an Operator's nominated handover point⁴ within the NGN Aggregation Node. All VUA products support traffic-based Class of Service to allow time-critical applications, such as Voice over IP, be prioritised. Further flexibility is provided by including Multicast Support, for cost-effective distribution of TV and other broadcast services.

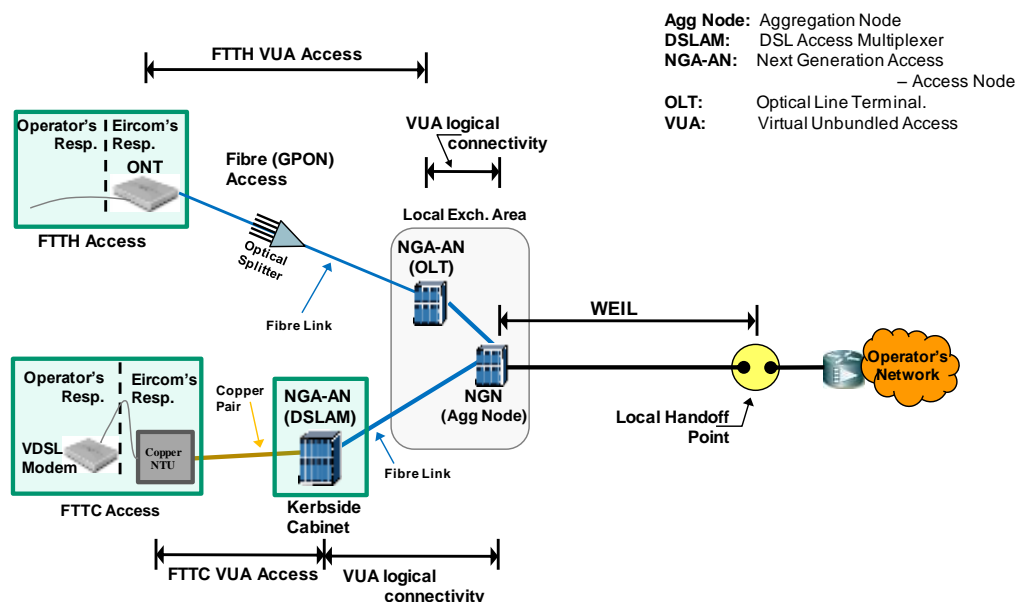


Figure 2: FTTx Virtual Unbundled Access

VUA products are designed to use either copper or fibre as the physical access medium, as shown in Figure 2. FTTH⁵VUA products are used where fibre is the access medium and FTTC⁶VUA

³Wholesale Ethernet Interconnect Link

⁴Generally known as the Point of Handover (POH)

⁵Fibre to the Home

⁶Fibre to the Cabinet

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where copper is the access medium. Two variants of each, Standalone (SA) or POTS-based (PB), are available.

The demarcation point varies, depending on the access medium used. Where services are delivered over fibre, the demarcation point is an interface on an Optical Network Terminal. Where Services are delivered over copper, the demarcation point is a copper Network Terminating Unit.

2.1 Virtual Unbundled Access Components

Virtual Unbundled Access products comprise a number of distinct components that can be divided into two categories:

- Connectivity components, common to all end-customers.
- Access mechanisms, ordered individually for each end-customer.

In addition, provision of any element of the product is dependent on the presence of a Wholesale Ethernet Interconnect Link (WEIL) connection to the Operator network upon which capacity is nominated specifically for VUA traffic.

There are two types of connectivity services available, namely Unicast and Multicast. The basic Virtual Unbundled Access service is based on Unicast⁷, which is mandatory for all VUA products. This supports an individual connection between the **Operator's network and each active session** for an end-customer, or Application. Unicast is ideal for applications such as Internet browsing and Video on Demand.

Virtual Unbundled Access products also support Multicast⁸, which is available as an additional VUA service. Multicast allows multiple end-customers to access a single broadcast stream, such as **a TV program and makes more efficient use of the Operator's network for this type of material**. Multicast connectivity also requires Unicast connectivity to be in place.

⁷**Unicast** transmission is the sending of messages to a single network destination identified by a unique address.

⁸**Multicast** is the delivery of a message or information to a group of destination computers simultaneously in a single transmission from the source.

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Once the WEIL is in place, an Operator can order Unicast and Multicast logical connectivity, for each of its resellers⁹, to be configured within the NGN Aggregation Node on which the WEIL is terminated. The existence of a Unicast logical connection to the NGN Aggregation Node is a prerequisite to providing service to individual end-customers served by the node. In addition, if an Operator wishes to provide Multicast services, they must have the Multicast logical connection configured on the NGN Aggregation Node before service can be provided to an individual end-customer.¹⁰

⁹ An Egress Group is required for each of an Operator's Bitstream Plus resellers

¹⁰ Multicast connectivity (per Egress Group) is not standalone and is only provided in conjunction with associated Unicast connectivity per Egress Group.

3. Product Features

All VUA products share the following feature set:

- Layer 2 Ethernet-only access - allowing Operators to differentiate their services at the Internet Protocol (IP) Layer and above.
- Support for traffic-based Class of Service (CoS).
- Support for Multicast Injection and Replication.¹¹
- Handover of Ethernet Traffic to Operator using a WEIL.^{12,13}
- Connectivity is extended automatically as the available footprint, within a Local Exchange Area, expands.
- Supports multiple local handovers¹⁴, for traffic management and resilience.
- Core services based on Virtual Private LAN Service (VPLS), for maximum flexibility and scalability.
- The support of multiple-VPLS, to enable an Operator to resell service to multiple operators
- NGN Infrastructure will be managed by open eir to ensure that there is no network congestion.^{15,16}

3.1 Fibre Product Features

The following additional features apply to VUA products delivered to the end customer over fibre:

- Guaranteed Unicast Bandwidth, downstream and upstream.
- Additional bandwidth available for Multicast.

3.2 Copper Product Features

The following additional features apply to VUA products delivered to the end customer over copper:

- **Products are 'Up To'** – i.e. the maximum attainable bandwidth, for a typical access line, are specified.¹⁷
- Individual installations can be configured for High Speed Internet¹⁸ or with a Stable Profile.¹⁹

¹¹Multicast Solution supports IGMPv2 and IGMPv3.

¹²A Wholesale Ethernet Interconnect Link (WEIL) is a separate product with its own product description, and supporting collateral.

¹³The full range of available WEIL handoffs, e.g. in-building, in-span and customer-sited, are supported.

¹⁴Each handover must be to a WEIL connected to the local Aggregation Node.

¹⁵On-going capacity management of the handoff WEIL, to ensure sufficient Unicast and Multicast bandwidth, is the responsibility of the Operator.

¹⁶Under normal network conditions

¹⁷The actual attainable bandwidth depends on the characteristics of the individual copper line, and associated DSL equipment.

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- Service terminates on a **Copper NTU in a “Wires Only” solution.**
- Operator provides own DSL Modem.²⁰
- Multicast Traffic shares available bandwidth with Unicast.
- The DSL Line Profile can be changed by the Operator, up to the maximum bandwidth supported by the copper line.

Line Test Parameter	Normal minimum standard
A-Earth	>1MΩ
B-Earth	>1MΩ
A-B	>250kΩ
B-Neg	>1MΩ
B-Neg	>1MΩ
AC Voltage	<3V
DC Voltage	<5V
Balance (Capacitance)	>85%

Figure 3: Copper Line Minimum Standard

3.3 Key Benefits

The foregoing features provide the following key benefits, for Operators:

- Operators can add ultra high speed Broadband, and multi-play options, to their product portfolio.
- Operators can choose their own AAA (Authentication, Authorisation & Accounting) solution.
- Operators can design individual Multicast Solutions, independent of other Operators implementation.²¹
- Operators can prioritise individual customer services, in terms of the Quality of Service required.
- Operators can provide their own VoIP Solution, or use open eir-provided POTS.
- Operators can resell to multiple resellers

¹⁸High Speed Internet is ‘Rate Adaptive’ in both directions. It gives maximum bandwidth, with minimum latency.

¹⁹The Stable profile is designed primarily for IPTV and is non Rate Adaptive in the downstream direction.

²⁰Choice of equipment is a matter for the Operator. The DSL Modem could be a standalone item or the functionality could be incorporated into more complex Customer Premises Equipment, such as a Residential Gateway. In any case the DSL functionality must comply with the Copper Loop Frequency Management Plan, and any other criteria that might be specified by open eir from time-to-time.

²¹An Operator can use any valid Multicast Address Range, regardless of what addressers other Operators use.

3.4 Redundancy

Virtual Unbundled Access redundancy allows the Operator to order multiple VUA connections to multiple WEILs, in order to provide redundancy for the same VUA access traffic. This protects against failure of the WEIL. Broadcast traffic (e.g. DHCP Discover messages) will be forwarded to both WEILs. Unicast traffic will be forwarded to one WEIL based on MAC learning in the VPLS. Split horizon is applied to the VPLS to prevent routing loops.

3.5 VLAN Management

End-user CPE: The Operator is required to tag traffic with a VLAN (VLAN ID 10).

3.6 Vectoring Standard (FTTC)

Operators are obliged to ensure that all equipment connected to the network is compliant with Recommendation ITU-T G.993.5 for vectoring and with the FTTC CPE Requirements section of the Technical Handbook - open eir NGA National Deployment.

3.7 NTU Installation (FTTC)

Operators have the option to install the customer NTU on behalf of open eir on an exchange by exchange basis. Once an Operator has selected an exchange where they will install the NTU then all customers of that Operator in that exchange that do not have an existing NTU, must have the NTU installed by that Operator.

4. Virtual Unbundled Access logical connectivity

Virtual Unbundled Access products avail of the logical connectivity to configure the connection **between the Operator’s network and the NGN Aggregation Node**. This VUA logical connectivity links each access node (DSLAM)²² and the nominated Wholesale Ethernet Interconnect Link (WEIL)²³. The means of ordering and assuring this Virtual Unbundled Access logical connectivity service is common, across all VUA products. It must be ordered individually for each reseller, for each NGN Aggregation Node. Multiple local handoffs, for resilience or load sharing, are supported with a separate logical connection required for each. As the open eir NGA footprint expands, and additional NGA access nodes are added to a NGN Aggregation Node, the connectivity is automatically extended, without further Operator intervention

4.1 Virtual Unbundled Access Unicast

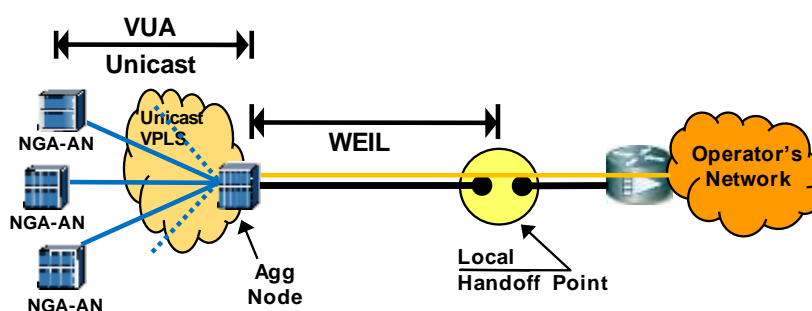


Figure 4: Unicast Handoff to Operator

The core Virtual Unbundled Access logical connectivity is Unicast which supports an individual connection for each active session for an end-customer, or Application. Unicast traffic, from each access node within an NGN Aggregation Node footprint is assigned to a single Virtual Private LAN Service (VPLS)²⁴. Additional access nodes within that area will be joined to the VPLS by open eir, as the Virtual Unbundled Access footprint expands. Traffic from individual end-customers is uniquely identified by means of the CSID (Calling Station Identifier) which is included in each information frame transmitted. Aggregated traffic, from all end-customers

²²Each end-Customer is connected to the NGN network via an access node. The type of node varies, depending on the access medium. For copper it is a Digital Subscriber Line Access Multiplexer or DSLAM.

²³A Wholesale Ethernet Interconnect Link (WEIL) is a separate product with its own Product Description.

²⁴Multiple VPLS is supported for multiple resellers

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within that NGN Aggregation Node footprint is then presented in a single VLAN, at the Point of Handover.

The handoff to the Operator is over a Wholesale Ethernet Interconnect (WEIL), within the NGN Aggregation Node footprint. The Operator nominates a SAB²⁵ on the WEIL on which the VLAN carrying this traffic is to be presented.

The Option82 Calling Station ID (CSID) format is as follows:

Fibre access:

<OLT Name>xpon<Frame>/<Slot>/<Port>:<ONT>.<GEM>.<VLAN>
e.g. SND99 xpon 0/1/0:6.1.10

VDSL2 access:

<MDF>_<Cabinet><Node> eth <Frame>/<Slot>/<Port>
e.g. DDM1_061A eth 0/2/0

4.2 Multicast Principles

Unicast is inefficient for Broadcast TV applications where multiple end-customers simultaneously consume the same information. Even if hundreds of consumers were watching the same TV Station, each would receive a unique stream from the Service Head-end.

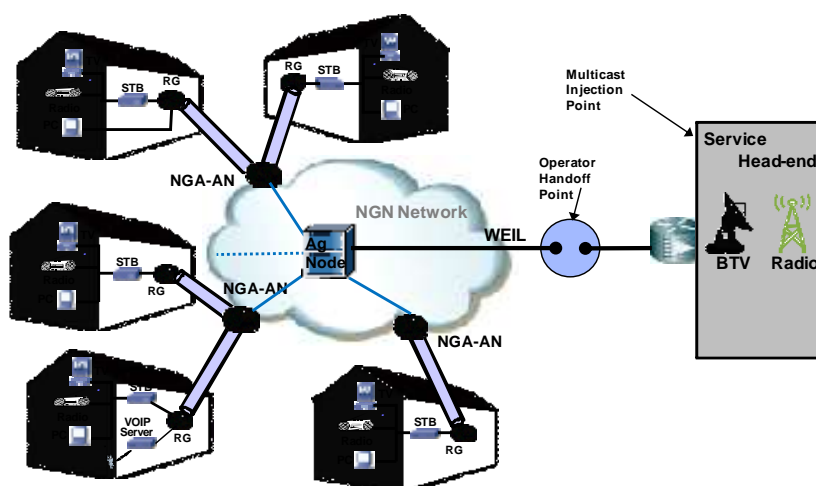


Figure 5: Multicast Principles

²⁵Service Access Bandwidth (SAB) is a logical partitioning of bandwidth in the WEIL.

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With Multicast, see Figure 3, a single copy of each stream, e.g. every TV Channel offered by an **Operator, is carried from the Operator’s hand-off point**, through the core network, to the NGA-AN and through the access network. At no point in this path is the broadcast stream replicated unnecessarily.

The CPE (e.g. a Set-top Box) on the end-users premises uses the Internet Group Management Protocol (IGMP) for requests to “Join” or “Leave” a broadcast stream.

The End-User’s CPE sends an IGMP Join to multicast group 239.1.1.1 (IGMP v.2 is supported) to the ONT/DSLAM.

4.3 Virtual Unbundled Access Multicast

All VUA products support Multicast, which is available as an additional service. Internet Group Management Protocol (IGMP) Version 2 and Version 3 are supported.

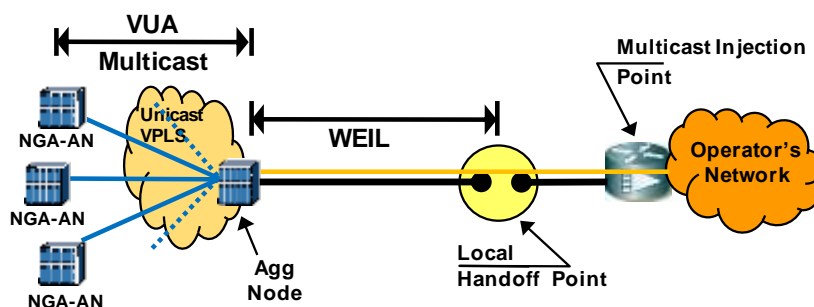


Figure 6: Multicast Handoff to Operator

Where Multicast is required for a single Egress Group, a dedicated VPLS to handle all Multicast broadcasts within a NGN Aggregation Node is set up. Multicast traffic can be presented on a VLAN on the same SAB as the Unicast traffic, or on a second SAB as shown in Figure 6.²⁶ Using a Multicast-VPN means that each Operator can use any valid Multicast Address Range, even where Multicast IP Addresses overlap between different Operators using the open eir Network. Further details are given in the Bitstream Plus & Virtual Unbundled Access Technical Handbook.

Where Multicast is required for multiple Egress Groups, a dedicated VPLS, to handle all Multicast broadcasts within a NGN Aggregation Node is set up for each Egress Group, as shown in Figure 6.

²⁶It is the Operators responsibility to nominate the WEIL and SAB on which each VPLS is to be presented.

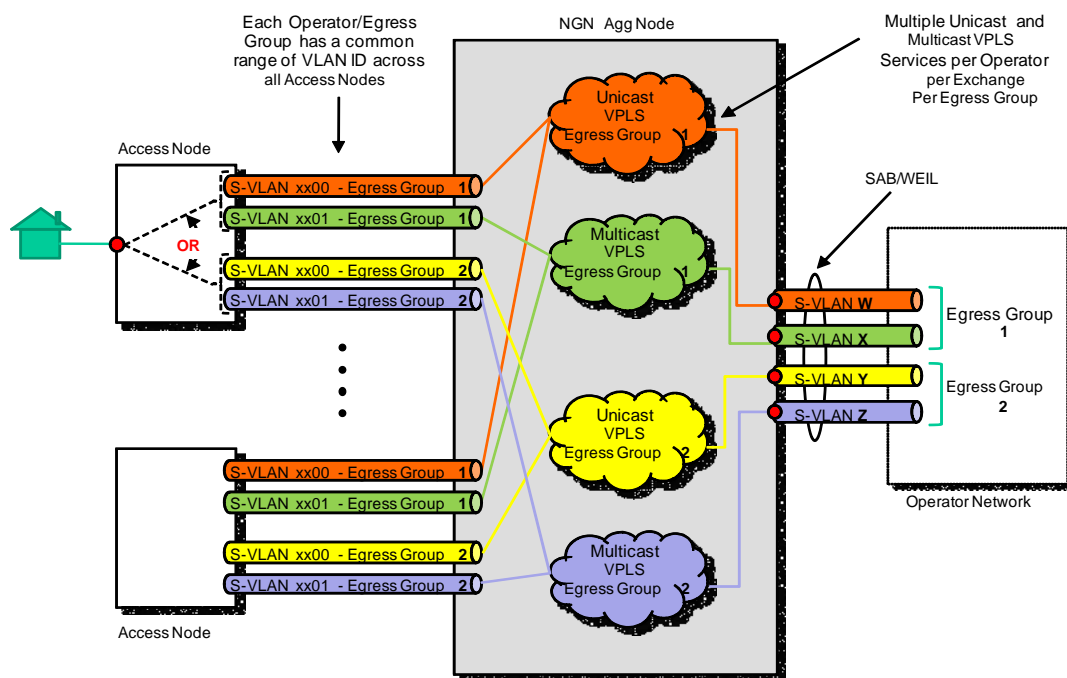


Figure 7: VUA Multicast Service with Multiple Egress Groups

4.4 Local Handoff Point

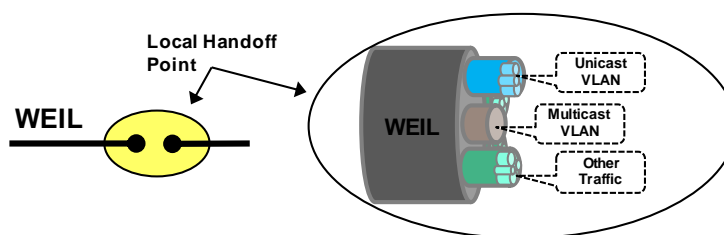


Figure 8: Local Handoff Point

A standard WEIL product²⁷ is used to provide the interconnect link between open eir's and the Operator's networks. While the WEIL is a separate product, it is important to outline how the WEIL interacts with the Virtual Unbundled Access products. The Operator nominates the WEIL and SAB on which each VLAN is to be presented. This gives the Operator maximum flexibility,

²⁷As described in the Wholesale Ethernet Interconnect Link (WEIL) Product Description.

when configuring their solutions. A typical configuration, where a single WEIL is used for all Operator Traffic, is shown in Figure 8. Where resilience is required, a second WEIL, to the same Local Aggregation Node, can be ordered.

4.5 Traffic-based Class of Service

All traffic carried in Access Network will be assigned to one of three Class of Service (CoS) queues:

- Expedited Forwarding (EF)
- Assured Forwarding (AF)
- Standard (Best Effort)

The Operator can dynamically map their end-user traffic, to any one of these three categories. This provides an Operator with the ability to manage and prioritise their upstream and downstream traffic.

Upstream and downstream traffic should be marked using 802.1p marking.²⁸ The marking scheme is as follows:

C-VLAN 802.1p Marking	Forwarding Class
4	EF
2	AF
0	BE

Figure 9: Mapping of C-VLAN p-bits to Forwarding Classes

This marking will be honoured in the Access Network and the Wholesale Ethernet Interconnect Link (WEIL).

²⁸For Multicast, an EF CoS will be automatically applied.

4.6 CPE Management

Operators can implement their own device management platform for their Residential Gateway (RG) and other CPE²⁹, e.g. using a protocol for communication with the RG over the open eir network. (TR69 Remote Device Protocol is one such protocol.)

4.7 Ordering the Virtual Unbundled Access logical connectivity Service

Orders for the Virtual Unbundled Access logical connectivity Service (VUA Unicast and VUA Multicast) use the existing Unified Gateway Infrastructure Orders.³⁰The Virtual Unbundled Access logical connectivity service consists of a number of individual components, each of which must be ordered separately³¹.

Virtual Unbundled Access Unicast

VAU – Virtual Unbundled Access Unicast, is the set-up of the Unicast VPLS and the connectivity between the NGN Aggregation Node and **the Operator's WEIL**. This connectivity need only be ordered once per NGN Aggregation Node per Egress Group.³²Additional Access Nodes will be joined to the VPLS, by open eir, as the VUA footprint expands.

Virtual Unbundled Access Multicast

VAM – Virtual Unbundled Access Multicast, is the set-up of the Multicast VPLS per Egress Group and the connectivity between the NGN Aggregation Node and **the Operator's WEIL**. This connectivity need only be ordered once. Additional Access Nodes will be joined to the VPLS, by open eir, as the NGA footprint expands.

²⁹In this context CPE (Customer's Premises Equipment) refers to Operator's equipment, subsequent to the Service Termination Point.

³⁰There will be no Change Orders available to move a Unicast (or Multicast) VLAN to a different SAB/WEIL. Operators should place an order for the new VLAN to be delivered on the specified SAB/WEIL. When the new VLAN has been delivered the Operator can then place a Cease Order for the original VLAN.

³¹An Operator must first order a Wholesale Ethernet Interconnect Link, before they can order any Virtual Unbundled Access service.

³²The connectivity from an NGN Aggregation Node to the WEIL covers the entire Virtual Unbundles Access footprint within that NGN Aggregation Node.

5. FTTH Virtual Unbundled Access (FTTH VUA)

FTTHVUA Access provides high speed broadband over a Fibre-based Gigabit-capable Passive Optical Network (GPON) network, which uses 1:32 optical splitters in the cabinets.

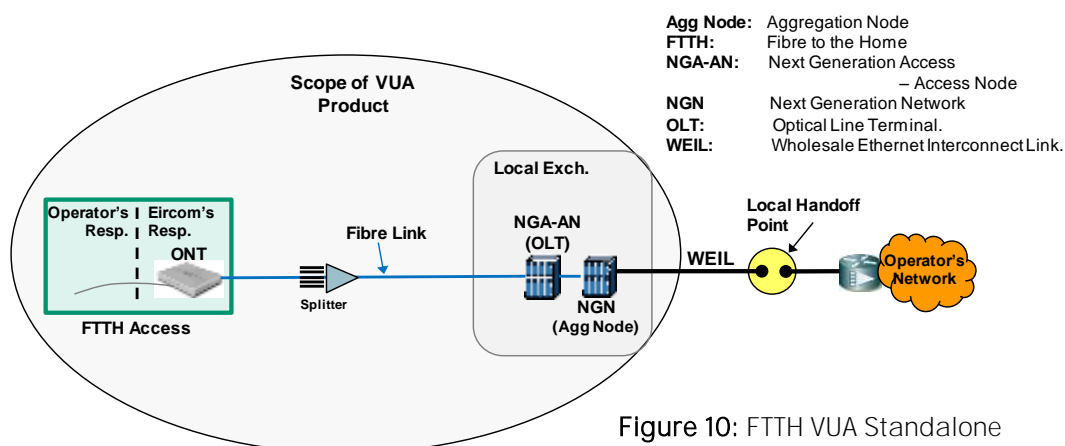


Figure 10: FTTH VUA Standalone

Three end-customer port speeds are supported, 150Mb/s Downstream with 30Mb/s Upstream, 300Mb/s Downstream with 50Mb/s Upstream and 1Gb/s Downstream with 100Mb/s Upstream.

5.1 FTTH VUA POTS-Based (FTTH VUA PB)

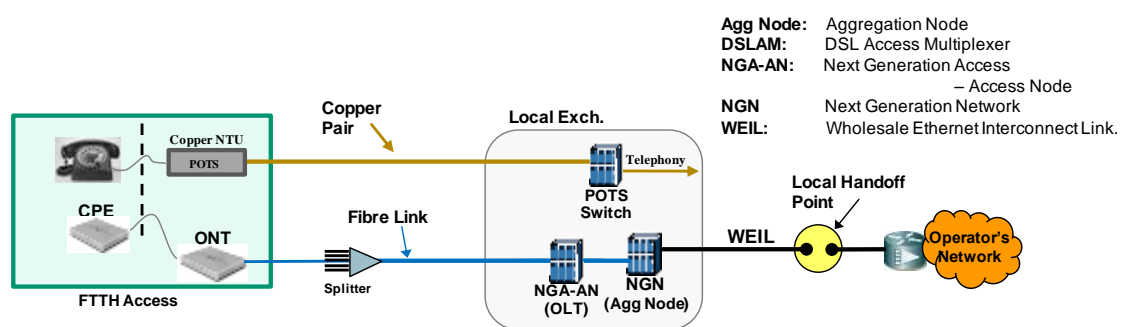


Figure 11: FTTH VUA POTS-Based

FTTH VUA PB supports a PSTN voice telephony service, as well as all the features of FTTH VUA Standalone. The PSTN service is supplied on a copper access pair, in parallel with the fibre service. All existing SB-WLR functionality, and associated Ancillary Services, are available. The

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Gigabit Ethernet port of the ONT³³, at the end-**customer's** premises, is the demarcation point for Broadband. A Copper NTU is the demarcation point for PSTN.

5.2 FTTH Service Presentation

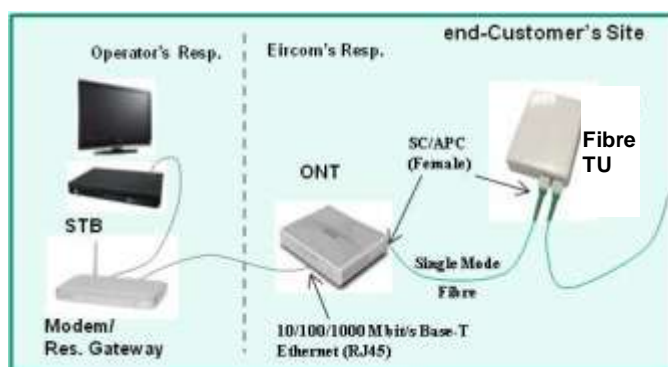


Figure 12: Fibre Demarcation Point for FTTH VUA

The end-customer Service Termination Point for the FTTH VUA Product is a Gigabit Ethernet Port on the ONT. This is an auto-sensing 10/100/1000Base-T Ethernet port (suitable for the insertion of a RJ-45 connector). A single mode fibre patch cord will be used to connect the female (adapter) SC/APC connector of the Fibre Terminating Unit to the female (adapter) single mode SC/APC connector of the ONT.

Further information on the service presentation can be found in the Bitstream Plus & Virtual Unbundled Access Technical Handbook.

The End-User traffic presented at the ONT will be VLAN tagged (VLAN 10). The End-User CPE will generate the 802.1p VLAN ID=10 frames.

ONT Specification:

Power adapter input: 100–240 VAC, 50–60 Hz

End-User Facing Port: Auto-sensing 10/100/1000M Base-T Ethernet port (RJ-45)

³³Optical Network Terminal

6. FTTC Virtual Unbundled Access (FTTC VUA)

FTTC VUA Access provides high speed broadband over a dedicated copper pair using VDSL2 Technologies from a kerbside cabinet. The kerbside cabinet is connected direct to the exchange via Fibre.

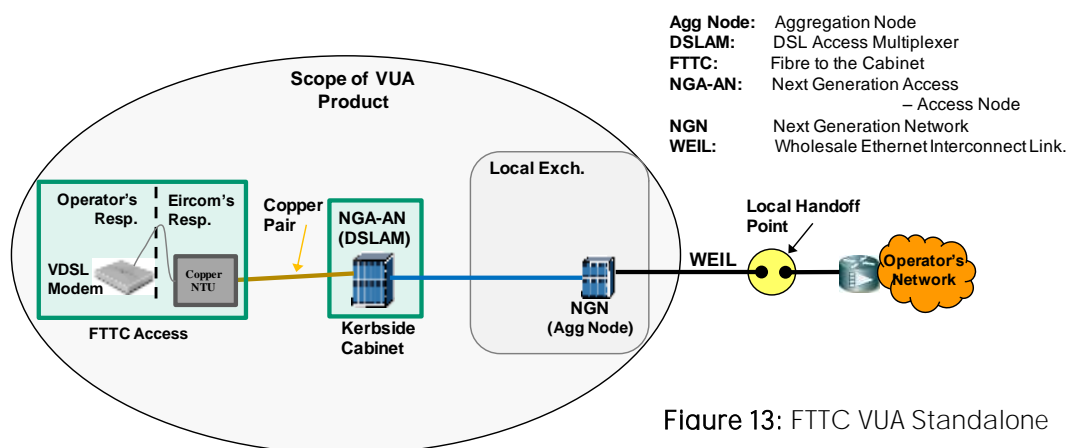


Figure 13: FTTC VUA Standalone

The end-customer port speed depends on the characteristics of the individual sub-loop up to a maximum speed of 100Mb/s Downstream, 20Mb/s Upstream.

6.1 FTTC VUA POTS-Based (FTTC VUA PB)

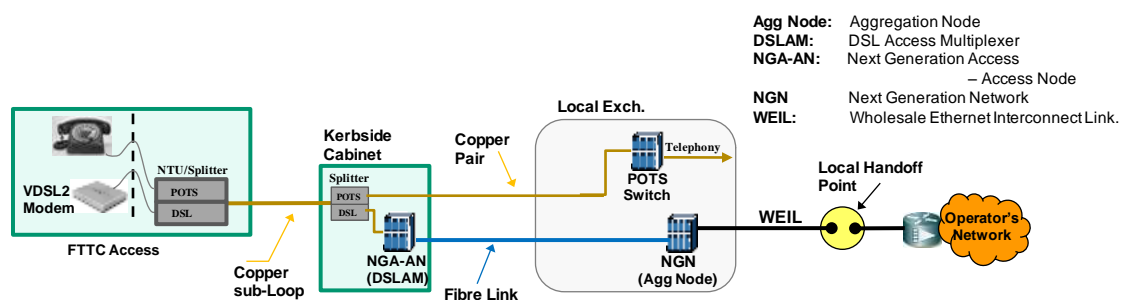


Figure 14: FTTC VUA POTS-Based

FTTC VUA POTS-based supports a PSTN voice telephony service, as well as all the features of standalone FTTC VUA, on a single copper pair. All existing SB-WLR functionality, and associated

Ancillary Services, are available. The dual NTU/Splitter, at the end-customer's premises, is the service demarcation point.³⁴

6.2 FTTC Line Profiles

A 'Profile' is a set of configuration parameters that govern how a DSL line operates. The FTTC Line Profile determines the maximum downstream and upstream speed for that end-customer and whether that speed is fixed or adapts to varying line conditions. The VUA FTTC Access Product supports two profile ranges – one for 'High Speed Internet' and one 'Stable or Non Rate-adaptive' range, intended primarily for Broadcast TV.

Stable/Multicast		High Speed Internet	
Downstream	Upstream	Downstream	Upstream
100	20	100	20
85	20	90	20
80	20	80	20
70	20	70	20
60	20	60	20
50	16	50	20
43	16	50	15
40	16	40	10
34	16	30	8
28	15	25	7
20	10	18	5
20	8	15	3
18	7	12	1
12	1	7	1
10	1		
4	1		

Figure 15: FTTC Sub-Loop Profiles

The High Speed Internet (HSI) range is 'Rate Adaptive' in both directions – this means that the line speed in each direction varies, depending on local line conditions, up to the maximum value specified by the profile currently set on that line. The 'Stable' range is 'Rate Adaptive' upstream and 'Fixed' downstream. This means that the downstream speed is set by the applied profile and

³⁴ The technical specification for the NTU/Splitter is given in the Technical Manual.

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does not vary. High Speed Internet or Stable/TV is selected at Order Submission, but can be changed subsequently.

6.3 FTTC Service Presentation

At the end-customers' premises the Operator will access the VDSL2 Service via open eir's Network Termination Unit (NTU). The NTU will present the Operator with an RJ-11 female connection. In certain circumstances NTU equipment will need to be installed, where a suitable Service Termination Point does not already exist.

The end-customers' side of the Network Termination Unit (NTU) is the final point of open eir responsibility for the FTTC VUA Access Product. Provision, installation, replacement and maintenance of any additional equipment/connections on the end-customer's side of the NTU is the responsibility of the Operator. An RJ11 interface is provided for POTS and an RJ45 is provided for VDSL.

The End-User traffic presented at the NTU will be VLAN tagged (VLAN 10). The End-User CPE will generate the 802.1p VLAN ID=10 frames.

7. Virtual Unbundled Access – Ordering and Assurance

The Unified Gateway (UG) should be used for all orders in relation to the provisioning or assurance of the Virtual Unbundled Access products. The products will be available within a defined footprint which will be published on the open eir website. The product may be ordered for new end-customer connections and a suite of both inter-Operator and intra-Operator order types are available. The Multicast element may be ordered as part of the initial transaction, or may be added at a later date. In addition to the normal ordering activity, Operators have the ability to amend the end-customer line profile, for the FTTC delivery mechanism. The UG will process and validate the relevant orders and will provide appropriate notifications for Acceptance and Delivery.

More detailed information can be found in the NGA Bitstream Plus and Virtual Unbundled Access Industry Process Manual.

8. Billing

There are connection and rental charges associated with the Virtual Unbundled Access Product. Once an order is completed billing shall commence in the next billing cycle.

In the event that an Operator has a query regarding the bill, they should contact their open eir Customer Relationship Manager.

9. Commercial

9.1 Pricing

Prices for the open eir Fibre Unbundled Access Product will be published in the relevant open eir Price List.

9.2 Terms and Conditions

Terms and conditions will be published in the open eir Access Agreement.

Version Control History

Version	Status	Update	Effective Date
1.0		Notification Issue	October 18th 2012
2.0		Added Section 3.6 and Section 3.7	April 15th 2013
2.1		Additional HSI Profiles added to Table 14	July 9th 2013
2.2		Additional Stable Profiles added to Table 14	September 6th 2013 (Effective November 20th 2013)
2.3		Additional HSI and Stable Profiles added to Table 14 (vectoring) Reference to FTTC CPE requirements of Technical Handbook added to Section 3.6. Table 14 updated to reflect that all vectoring and non-vectoring profiles will remain in place until vectoring is fully rolled out (as advised at the NGA Forum on 5th February 2014)	February 7th 2014
2.4		Addition of new Profiles to Section 5 & 6 Minor correction to text in Section 6	January 30th 2015
2.5		Addition of Copper Line Minimum Standard - Section 3.2.	November 2nd 2015
V3.0	Final	This document is based on V2.5 Implementation of Standardised Change Control.	16/06/2017