eircom wholesale

Technical Handbook

Wholesale NGN Ethernet Products

Document Control

Revision History

Version	Date	Revised by	Revision details
1.0	23rd February 2010	eircom	Initial version
1.1	23rd February 2010	eircom	IBH and ISH solutions added
1.2	29th March 2010	eircom	Information on Planning Ratios added
1.3	26th October 2010	eircom	1. Traffic based CoS option added 2. Correction made to ISH distances in Section 8.2 3. WEIL max service limits added in Table 3: 4. Traffic based COS EtherType restriction in Section 8 5. Clarification on OAM PDU support added to 3.4
1.4	17th December 2010	eircom	1. Capability for Operators to optionally specify S-VLAN ID at E-NNI added to Section 3.4. Additional network performance figures added to Section 6.4
1.5	7th February 2011	eircom	1. Information on request for configuration of loopbacks on WSEA connections added in Section 9. 2. WEIL Ethertype options added to Table 20, Table 21, and Table 22 in Section 8 3. Statement added to end of Section 3.4 regarding Operator obligations associated with specifying S-VLAN IDs at E-NNI.
1.6	28th March 2012	eircom	Addition of the following: 1. WEIL ENH 2. Increased limits for EF and AF 3. Updates for APT 4. WSEA IBH 5. Revised technical performance figures. 6. Multi-service WSEA 7. circuit based class of service Option 6 , 100% AF 8. WEIL ENH 1+1 9. Added p-bits 6,7

Table of Contents

List of Figures

List of Tables

Glossary

AF	Assured Forwarding
APT	Access Packet Transport
CIR	Committed Information Rate
CoS	Class of Service
C-VLAN	Customer Virtual Local Area Network
EF	Expedited Forwarding
E-Line	Ethernet Line
ENH	Edge Node Handover
E-NNI	External Network to Network Interface
EXP	Experimental
FC	Forwarding Class
IBH	In-building handover
ISH	In-span handover
L2CP	Layer 2 Control Protocol
LAG	Link Aggregation Group
LAN	Local Ethernet Network
LLF	Link Loss Forwarding
MPLS	Multiprotocol Label Switching
MTU	Maximum Transmission Unit
NGN	Next Generation Network
NTU	Network Termination Unit
ODF	Optical Distribution Frame
PIR	Peak Information Rate
PoH	Point of Handover
QoS	Quality of Service
SAB	Service Access Bandwidth
SFP	Small Form-factor Pluggable
STD	Standard
S-VLAN	Service - Virtual Local Area Network
TLI	Transparent LAN Interconnect
UNI	User Network Interface
VLAN	Virtual Local Area Network
VLL	Virtual Leased Line
WEIL	Wholesale Ethernet Interconnect Link
WSEA	Wholesale Symmetrical Ethernet Access

1 Introduction

The purpose of this document is to provide a technical description of the eircom Wholesale Next Generation Network (NGN) based Ethernet products in order to assist Operators in the design and development of their own product offerings.

Please note that this is a working document and therefore subject to regular updates as new products and product enhancements are introduced.

2 Products Overview

The section provides a high level overview of the eircom Wholesale Symmetrical Ethernet Access (WSEA) product, and the Wholesale Ethernet Interconnect Link (WEIL) product.

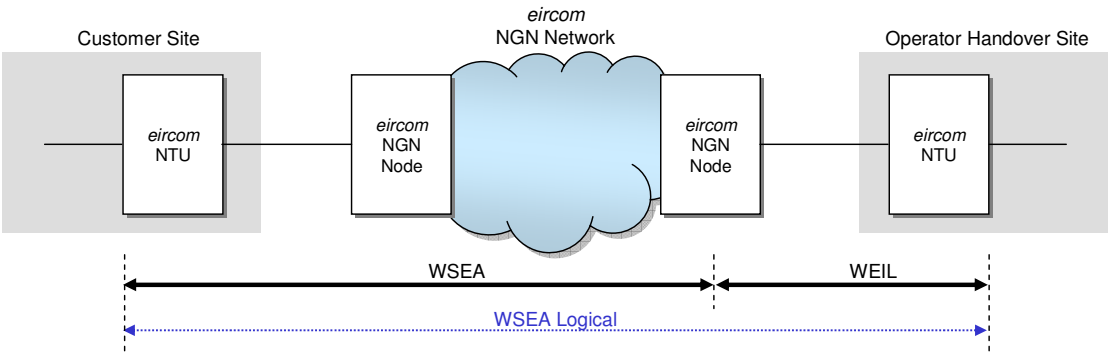

Figure 1: Products Overview

The eircom Wholesale NGN products consist of a number of components:

Wholesale Symmetrical Ethernet Access (WSEA) provides (physical) connectivity from a customer site to the eircom NGN.

WSEA Logical connection provides a (logical) E-line service between an Operator's end user site and the Operator's handover site.

Wholesale Ethernet Interconnect Link (WEIL) provides (physical) connectivity from an Operator's handover site to the eircom NGN.

Multiple WSEA connections may be aggregated within the eircom NGN network and handed-over to an Operator on a WEIL. Multiple WSEA logical connections may be supported on an individual physical WSEA and each WSEA logical connection may be terminated on a single WEIL or different WEILs.

3 Network Solution Overview

This section provides a high-level technical overview of how the eircom Wholesale NGN Ethernet products are supported on the eircom NGN network and illustrates the interaction of the WSEA and WEIL products.

3.1 WSEA (UNI) → WEIL (E-NNI) Traffic Flow

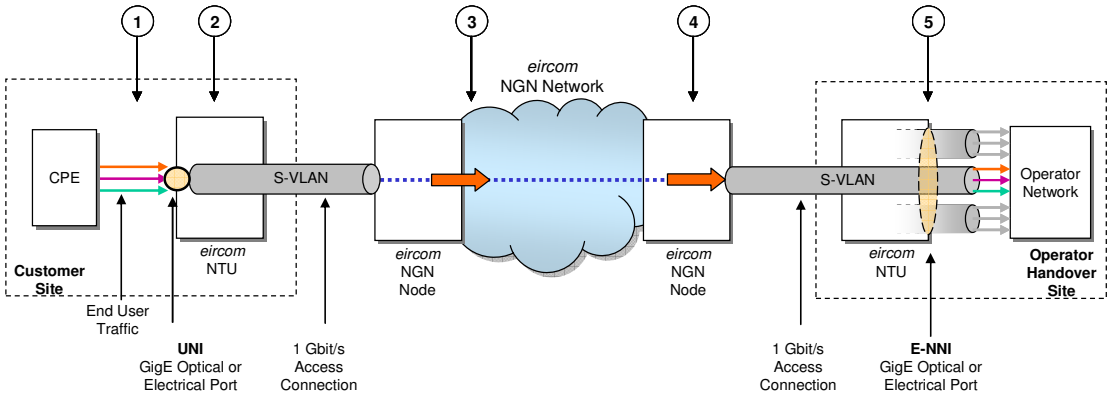

Figure 2: UNI → E-NNI Traffic Flow

The following describes how customer traffic is treated in the UNI → E-NNI direction:

End User traffic is presented to the eircom network at a physical port (UNI) on an eircom managed NTU which is installed at the end user site. The UNI port is configured as an 802.1Q trunk.

The WSEA product is a Transparent LAN Interconnect (TLI) service and hence the end user traffic presented at the UNI may be tagged or untagged. The end user can present double tagged frames at the UNI. The C-VLAN tag(s) are carried transparently across the eircom network.

Only one UNI port on the eircom NTU may be used for end user traffic per WSEA logical connection.

An S-VLAN tag is added to the end user traffic at the UNI on the eircom NTU. The assigned S-VLAN ID is not visible to either the end user or the Operator.

A service policy (i.e. CoS profile/bandwidth) is applied to end user traffic associated with the S-VLAN and the end user traffic is mapped to the appropriate Forwarding Class (FC) within the core NGN network (Please refer to Section 5 for the WSEA bandwidth options and Section 6 for a description of the CoS solution). The S-VLAN tag is removed and the end user traffic is carried within a Virtual Leased Line (VLL) across the eircom Core NGN network.

An S-VLAN tag is added to the end user traffic on egress of the eircom Core NGN network and the appropriate service policy is applied to the end user traffic.

The end user traffic is passed to the eircom managed NTU located at the Operator handover site. The S-VLAN on the network-facing port is mapped to the Operator facing port on the NTU (E-NNI port). The E-NNI port is configured as an 802.1ad port. The S-VLAN ID is assigned by eircom or selected by the Operator and is used to identify the end user traffic associated with an individual WSEA logical connection.

In the event that an Operator has more than one WEIL, an Operator must specify which WEIL is to be associated with each WSEA logical connection. The WEIL can only support services that originate in an end user site.

3.2 WEIL (E-NNI) → WSEA (UNI) Traffic Flow

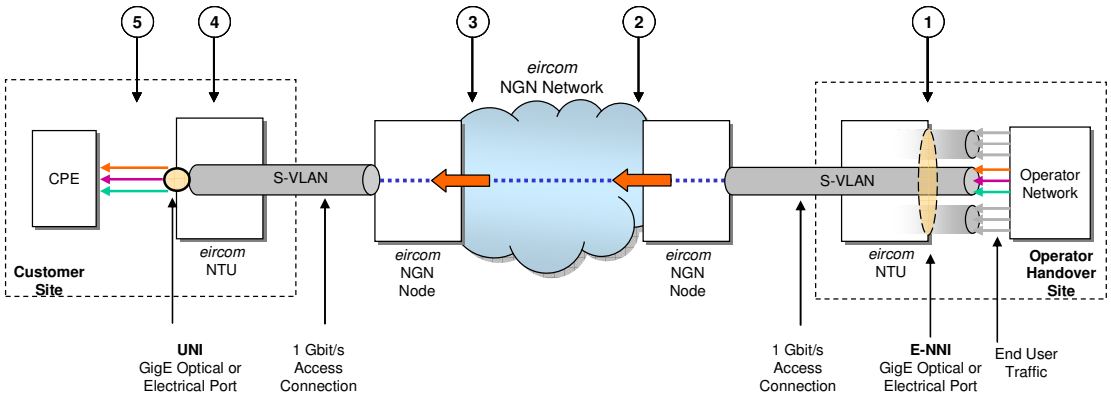

Figure 3: E-NNI → UNI Traffic Flow

The following describes how Operator traffic is treated in the E-NNI → UNI direction:

Operator traffic is presented to the eircom network at a physical port (E-NNI) on an eircom managed NTU located at the Operator handover site. The E-NNI port is configured as an 802.1ad port. The Operator must add an S-VLAN tag to their traffic prior to presentation at the E-NNI. The S-VLAN tag is assigned by eircom and is associated with the destination WSEA connection.

A service policy (i.e. CoS profile/bandwidth) is applied to the traffic associated with the S-VLAN and the Operator traffic is mapped to the appropriate Forwarding Class (FC) within the eircom Core NGN network. The S-VLAN tag is removed and the Operator traffic is carried within a Virtual Leased Line (VLL) across the eircom Core NGN network.

An S-VLAN is added to the Operator traffic and the appropriate service policy is applied. The assigned S-VLAN ID is not visible to either the end user or the Operator.

The S-VLAN tag is removed from the Operator traffic on the eircom NTU.

Operator traffic is presented to the end user at the UNI port on the eircom NTU.

3.3 WSEA – WEIL Connection Scenarios

The previous sections described at a high-level the network solution whereby the WSEA and WEIL connections are provided off different eircom NGN Nodes and the WSEA logical connection is carried across the eircom NGN core network. In certain cases the WSEA and its associated WEIL connection may be within the same serving exchange area and therefore may be connected to the same eircom NGN Node. The technical description of the Wholesale NGN Ethernet products in this document is based on different eircom NGN Nodes being used for the WSEA/WEIL connections (i.e. Scenario A below) in order to provide a comprehensive description of the products.

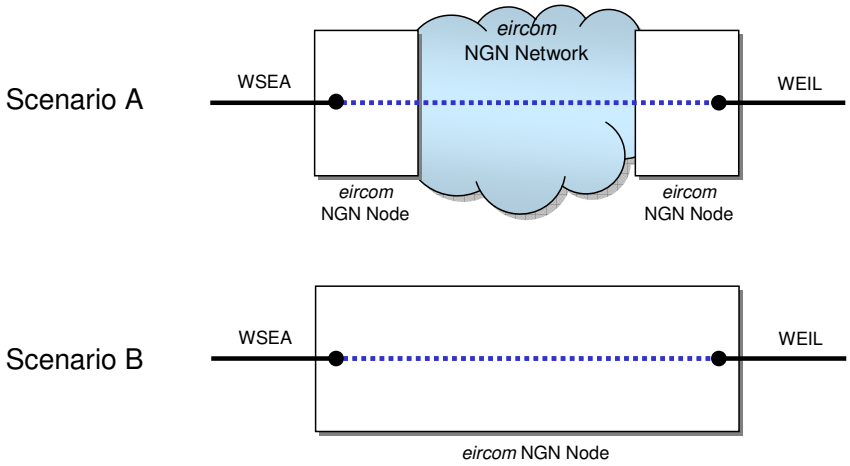

Figure 4: WSEA/WEIL Connection Scenarios

However, the technical functionality and parameters associated with the eircom Wholesale NGN Ethernet products which are described in this document are unchanged if the WSEA and WEIL are both connected to the same eircom NGN Node as per scenario B above.

WSEA/WEIL connections served off the same eircom NGN Node provide the capability to configure the WSEA logical connection as an uncontended connection. The eircom NGN Node is a non-blocking device and therefore the Operator may inventory manage the WEIL to ensure that it is not overbooked, i.e. that the sum of the WSEA bandwidths do not exceed the Service Access Bandwidth on the WEIL (see Section 5.2 for description of Service Access Bandwidths). In this scenario QoS is not required on the WSEA as the connection is uncontended and is not carried across the eircom core NGN network (Circuit based QoS Option 5 as described in Section 6.1.1 should be specified for these connections).

Conversely, the Operator may inventory manage the Wholesale Ethernet Interconnect Link which may result in the Wholesale Ethernet Interconnect Link being overbooked, i.e. that the sum of the Wholesale Symmetrical Ethernet Access bandwidths exceed the Service Access Bandwidth on the Wholesale Ethernet Interconnect Link (see Section 5.2 for description of Service Access Bandwidths). In this scenario QoS may be required on the Wholesale Symmetrical Ethernet Access and the required level of circuit based class of service should be specified by an Operator.

It should be noted that more than one eircom NGN Node may be installed in some serving exchange sites. These eircom NGN Nodes within the same serving exchange site will not be connected locally.

3.4 VLAN Tagging Model

This section summarises the VLAN tagging model used for the Wholesale NGN Ethernet products:

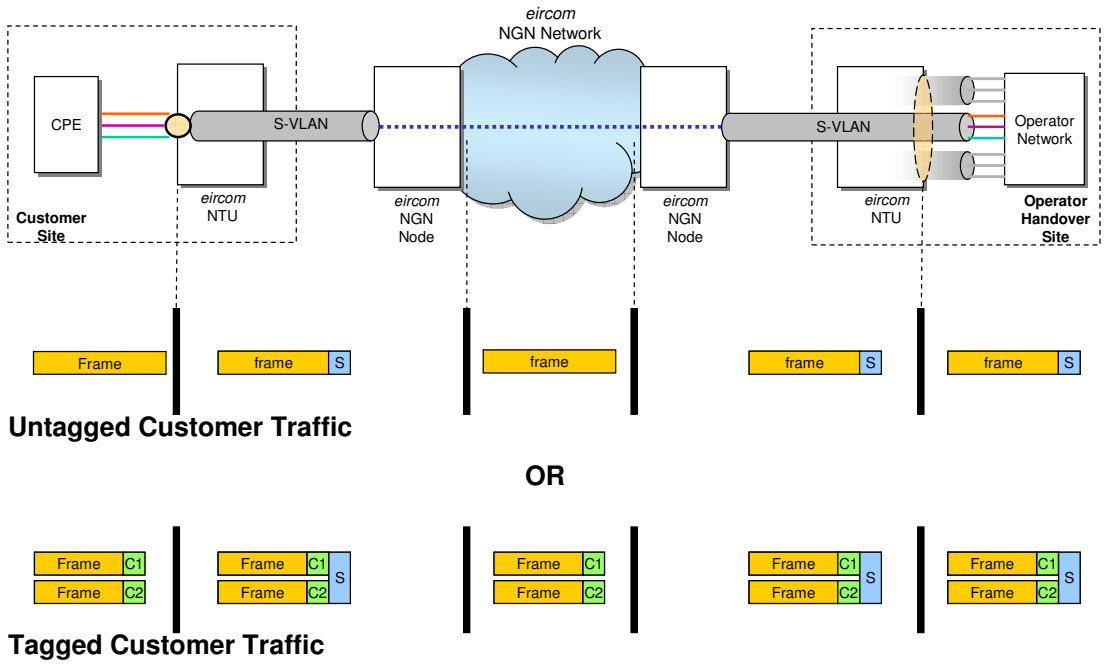

Figure 5: VLAN Tagging Model

The Operator can use the full C-VLAN ID range (i.e. 1 – 4096) to tag their end user traffic. The C-VLAN IDs are carried transparently across the eircom network.

Default is for eircom to assign the S-VLAN ID presented at the E-NNI. The assigned S-VLAN IDs will be in the range 10 – 4000. The Operator can optionally specify the S-VLAN ID presented at the E-NNI. If the Operator chooses to specify their own S-VLAN ID's on a specific E-NNI, then the Operator will be responsible for specifying all S-VLAN IDs within the range 10 - 4000 on that E-NNI.

4 WSEA and WEIL Service Parameters

This section summarises the service parameters associated with the WSEA and WEIL products:

Parameter	Value
MAC Address learning	Off
Max Frame Size	9000 bytes
Max no. of S-VLANs per E-NNI	3990
Max number of C-VLANs per UNI	4096
C-VLAN ID Preservation	Yes
C-VLAN CoS Preservation	Yes
Multicast traffic limit	No limit
Broadcast traffic limit	No limit
Unknown Unicast traffic limit	No limit

Table 1: WSEA and WEIL Service Parameters

Protocol	Behaviour
Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP)	Tunnelled
PAUSE (802.3x)	Discarded
Link Aggregation Control Protocol (LACP)	Tunnelled
Marker Protocol	Tunnelled
Authentication (802.1x)	Tunnelled
All LANs Bridge Management Group Block of Protocols	Tunnelled

Generic Attribute Registration Protocol (GARP) Block of Protocols	Tunnelled
Cisco Discovery Protocol (CDP)	Tunnelled
Cisco VLAN Trunking Protocol (VTP)	Tunnelled

Table 2: Layer 2 Control Protocol Processing

Due to the finite minimum buffer allocation assigned to a WEIL port, Table 3: details the theoretically maximum number of service that can be supported on a WEIL without service degradation being experienced.

Queue PIR/CIR	Default Buffer allocation No. of Services Supported
10M	125
50M	125
100M	94
500M	18
1G	9

Table 3: WEIL Maximum Service Number Limits

5 Bandwidth Profiles

5.1 WSEA Bandwidth Profile

The WSEA bandwidth options are shown in the following table:

Bandwidth (Mbit/s)
10*
20*
30*
40*
50*
75*
100*
150*
200*
250*
300*
450
500
600
750
1000

Table 4: WSEA Bandwidth Options (Mbit/s)

*One of these values (10M to 300M) will have to be selected if the WSEA connection is delivered over an APT system. In all other cases the WSEA bandwidth will default to 1 Gbit/s for a 1G WSEA physical

Bandwidth limits apply to WSEA connections when associated with the selected QoS option (please refer to Section 6 for a description of the QoS options):

- 300 Mbit/s upper limit will apply to the amount of EF traffic which can be ordered on an individual 1 Gbit/s WSEA connection.
- 600 Mbit/s upper limit will apply to the amount of AF traffic which can be ordered on an individual 1 Gbit/s WSEA connection.
- 600 Mbit/s upper limit will apply to the sum of EF and AF traffic which can be ordered on an individual 1 Gbit/s WSEA connection (300 Mbit/s upper limit for EF traffic still applies).

The above limits apply to the aggregate of the WSEA Logicals supported on a WSEA physical.

- For Circuit Based CoS the WSEA logical bandwidth is used for the calculation of the upper limits.
- For Traffic Based CoS the % values of traffic mapped to the EF and AF queues is used for the calculation of the upper limits.

The bandwidth values listed in Table 4: above include the Ethernet frame overhead, preamble, and interframe gap. The bandwidth/throughput on the WSEA connection is not dependent on frame size.

5.2 WEIL Bandwidth Profiles

The Wholesale NGN Ethernet products may use one or more WEIL Service Access Bandwidths (SABs) on a single physical WEIL bearer as shown in the flowing diagram:

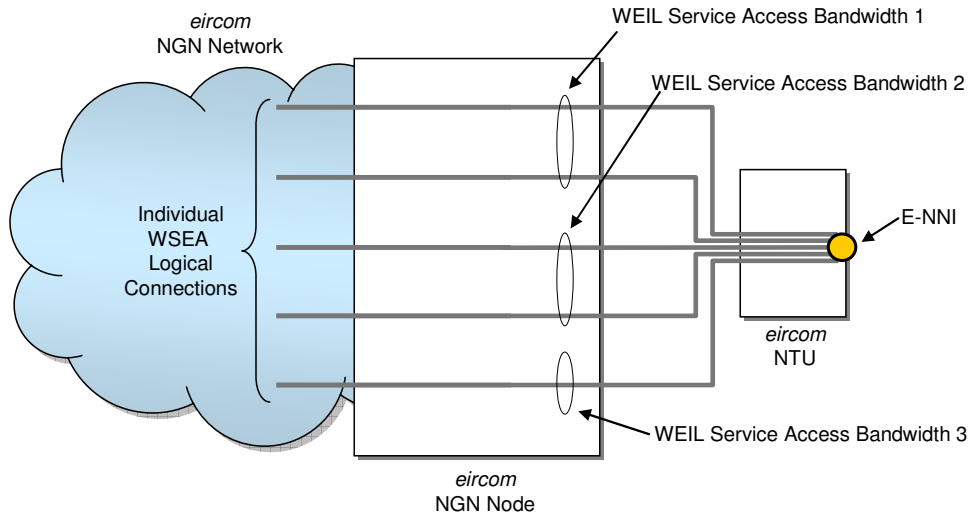

Figure 6: WEIL Service Access Bandwidths

The Operator must specify which one of the WEIL Service Access Bandwidths is associated with a WSEA logical connection on a per-order basis.

The Operator may specify a maximum of 10 WEIL Service Access Bandwidths on a WEIL bearer.

The Operator is required to specify the WEIL Service Access Bandwidth(s) on the WEIL bearer. The WEIL Service Access Bandwidth options are shown in the following section.

1 Gb/s WEIL Service Access Bandwidths (Mbit/s)	10 Gb/s WEIL Service Access Bandwidths (Mbit/s)
10	10
20	20
30	30
40	40
50	50
75	75

100	100
250	250
500	500
750	750
1000	1000
	2000
	3000
	4000
	5000
	6000
	7000
	8000
	9000
	10000

Table 5: SAB Bandwidth Options (Mbit/s)

The sum of the WEIL Service Access Bandwidths which share the same physical WEIL bearer cannot exceed the physical speed of the connection (i.e. 1 Gbit/s or 10Gbit/s).

6 Class of Service (CoS)

This section describes the basic Class of Service (CoS) design for the Wholesale NGN Ethernet products. It is broken down into the CoS design on the WSEA connections and the CoS design on the WEIL connections.

There are three forwarding classes, or network queues, used within the eircom Core NGN network for the Wholesale NGN Ethernet products: the Expedited Forwarding (EF) class, the Assured Forwarding (AF) class, and standard/best effort (STD) class.

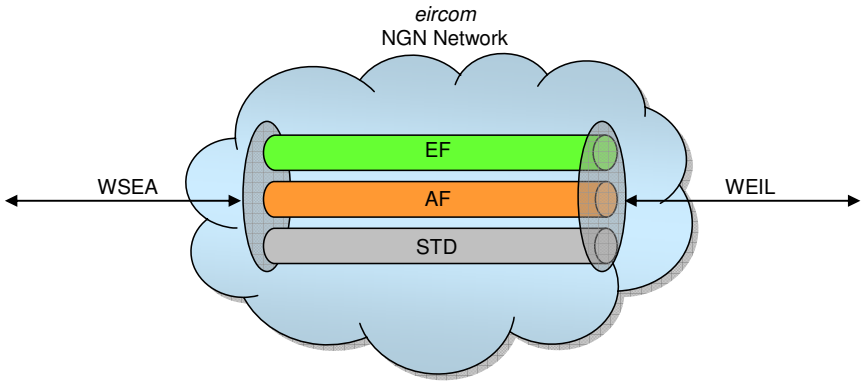

Figure 7: Network Forwarding Classes / Queues

The Expedited Forwarding class is serviced before the Assured Forwarding class and is intended to be used for real-time delay-sensitive traffic. There is a committed information rate (CIR) associated with the Expedited Forwarding class. End user traffic which exceeds the configured CIR will be dropped on ingress to the eircom Core NGN network.

The Assured Forwarding Class is serviced before the Standard Forwarding class and is intended for business applications which require priority access to available bandwidth over standard applications. There is a committed information rate (CIR) and peak information rate (PIR) associated with the Assured Forwarding class. The Assured Forwarding class provides the ability to classify ingress traffic as either in-profile or out-of-profile based upon the traffic arrival rate. A queue is considered in the in-profile state if the rate at which the queue is being serviced is less than its configured CIR. A queue is considered out-of-profile if the rate at which the queue is being serviced is greater than its CIR, but less than its PIR. After the profile state of the packet is determined at network ingress, the profile state of the packet influences the packets queuing priority and drop preference.

The Standard forwarding class is used for carrying all remaining traffic. This remaining traffic generally uses protocols that are capable of maintaining some form of connectivity during congestion.

For the Wholesale NGN Ethernet products the end user traffic is mapped to the appropriate forwarding class on ingress to the eircom Core NGN network for both the WSEA and WEIL connections.

6.1 WSEA CoS Models

There are two CoS options available for the WSEA product; Circuit-based QoS and Traffic-based QoS which are described in more detail in the following sections. Only one of these options can be selected for an individual WSEA logical connection.

6.1.1 Circuit-based QoS

With circuit-based QoS eircom will not inspect the end user 802.1p CoS markings (if present) on network ingress. All customer traffic is mapped to a single forwarding class on

ingress to the eircom Core NGN network. The following options are available for circuit-based QoS:

Table 1: Circuit-based QoS Options

	CIR	PIR	Queuing
Option 1	CIR = 100%	PIR=100%	All traffic mapped to EF queue
Option 2	CIR = 50%	PIR=100%	All traffic mapped to AF queue
Option 3	CIR = 10%	PIR=100%	All traffic mapped to AF queue
Option 4	CIR = 5%	PIR=100%	All traffic mapped to AF queue
Option 5	CIR = 0%	PIR=100%	All traffic mapped to STD queue
Option 6	CIR = 100%	PIR=100%	All traffic mapped to AF queue

Table 6: Circuit-based QoS Options

The percentage values in Table 1 refer to the percentage of the WSEA bandwidth.

The end user 802.1p CoS markings (if present) will be carried transparently across the eircom network and will not be re-marked by eircom.

6.1.2 Traffic-based QoS

With traffic-based QoS the end user marks the 802.1p bits in their Ethernet frame headers on network ingress. End user traffic is mapped to a forwarding class on ingress to the eircom Core NGN network based on the 802.1p markings.

The following table shows the policy map associated with the traffic-based CoS option:

Policy Map Name	Policy Map (allocation and allowed values)		
802.1p CoS	7/6/5/4	3/2	All traffic mapped to EF queue
Flexible CoS	A %	B %	All traffic mapped to AF queue

Table 7: Traffic-based CoS

- Traffic with 802.1p marking of 7 or 6 or 5 or 4 will be mapped to the EF queue
- Traffic with 802.1p marking of 3 or 2 will be mapped to the AF queue
- Traffic with 802.1p marking of 1 will be mapped to the STD queue

Traffic with other 802.1p markings not specified above will be mapped to the STD queue.

The **A %** value will define the CIR associated with the Expedited Forwarding class.

The **B %** value will define the CIR associated with the Assured Forwarding class.

The Operator will specify the **A %** value and **B %** value on a per WSEA logical order basis. These values will be expressed as percentage values. The sum of **A** + **B** cannot exceed 95% of the WSEA physical bandwidth. The WSEA bandwidth will define the PIR associated with the assured forwarding class and standard forwarding class.

	CIR	PIR
EF Queue (<=300M)Note 1	A %	A %
AF Queue (<=600M)Note 1	B %	WSEA Bandwidth
STD Queue	0 %	WSEA Bandwidth

Table 8: Traffic-based CoS - CIR and PIR Values

Note 1: Sum of EF and AF queues cannot exceed 600M (see section 5.1)

The end user 802.1p CoS markings will be carried transparently across the eircom network and will not be re-marked by eircom.

Percentage	EF/AF Mix	Increment
1-5%	EF only	1%
5%	EF and AF	5%
10-20%	EF and AF	10%
25%	Fixed option	EF=50% AF=25%
30-50%	EF and AF	10%
55%	Fixed option	EF=20% AF=55%
55%	EF only	
60-70%	EF and AF	10%
75%	Fixed option	EF=0% AF=75%
80-90%	EF and AF	10%
95%	Fixed option	EF=95% AF=0%

Table 9: Traffic-based CoS Options

6.2 WEIL CoS Model

This section describes the CoS model for the WEIL associated with the Wholesale NGN Ethernet products. The WEIL CoS model is shown in the following diagram:

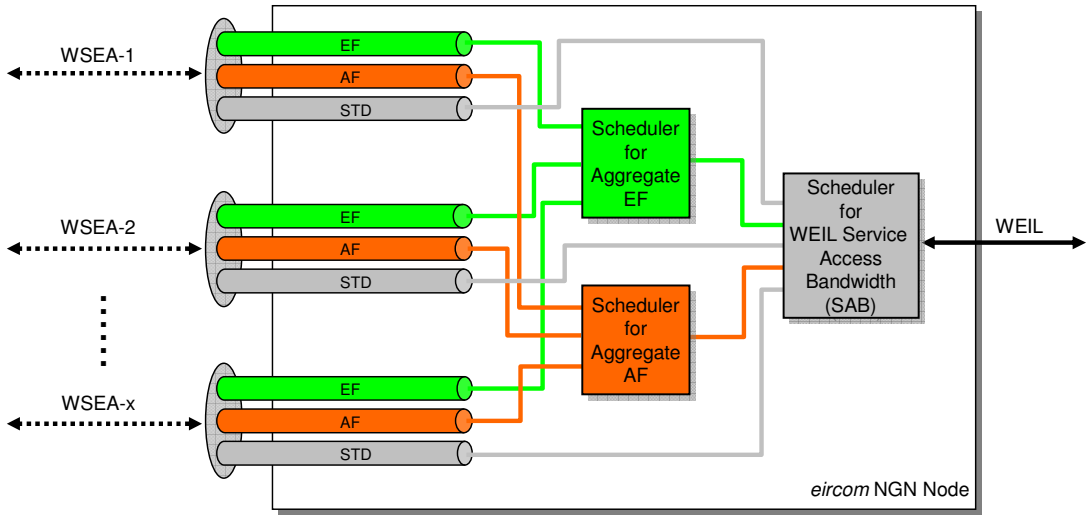

Figure 8: WEIL CoS Model

The Operator selects a WEIL Service Access bandwidth (SAB) for a WEIL. The Operator can specify a maximum of 10 WEIL Service Access Bandwidths (SABs) on a WEIL bearer.

The Operator specifies the aggregate EF and AF bandwidths for each WEIL SAB.

	Aggregate EF Bandwidth	Aggregate AF Bandwidth
Range	0 - 100%	0 - 100%

Table 10: Aggregate EF and AF Bandwidth Options

The percentage values in Table 10: refer to the percentage of the WEIL Service Access Bandwidth (SAB) and the sum of the aggregate EF and AF bandwidths cannot exceed 100% of the SAB bandwidth.

The CoS profiles on the WEIL associated with the individual WSEA logical connections is the same as the CoS profiles configured for the individual WSEA connections as outlined in Section 6.1.

It is the responsibility of the Operator to ensure that the sum of the CIR values of the individual WSEA connections associated with a WEIL SAB do not exceed the WEIL SAB and aggregate EF/AF bandwidths specified for that WEIL SAB.

6.3 Mapping of UNI - E-NNI CoS Markings – Traffic Based QoS

The section describes the mapping of CoS markings across the eircom network. It should be noted that the end user C-VLAN 802.1p markings will never be remarked by eircom and will always be tunnelled across the eircom network.

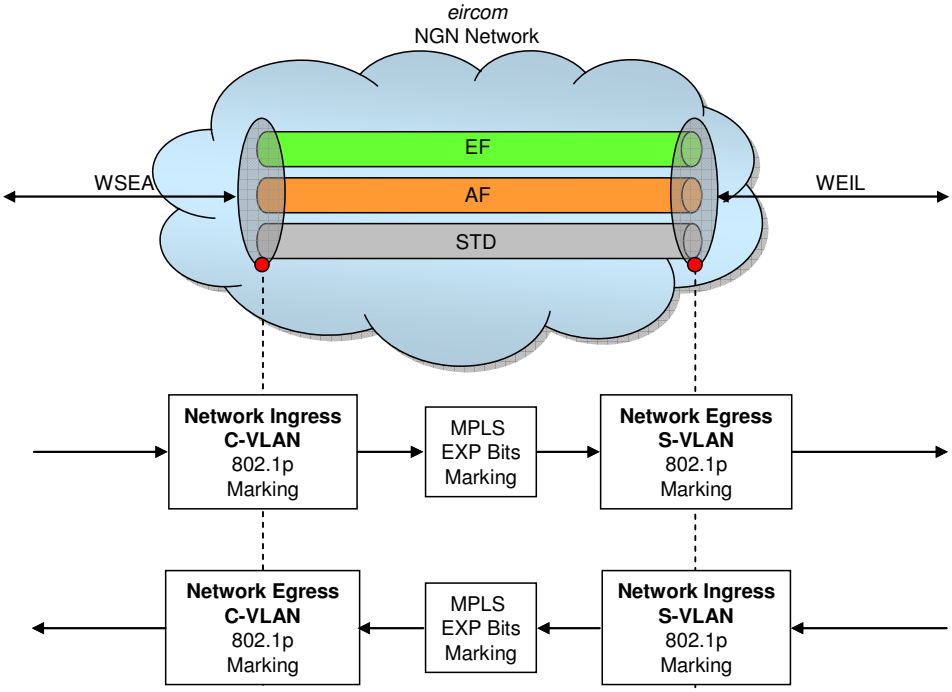

Figure 9: Mapping of UNI - E-NNI CoS Marking

6.3.1 UNI to E-NNI Traffic Flows

Classification on ingress to the eircom Core NGN network is based on the end user C-VLAN 802.1p markings. Traffic is forwarded to the core Forwarding Class based upon ingress policy (i.e. the EF and AF bandwidths if specified). As per Table 11: the mapping of the C-VLAN 802.1p markings to the core Forwarding Classes is as follows:

C-VLAN 802.1p Marking	Forwarding Class
5	EF
4	EF
3	AF
2	AF
1	STD

Table 11: Ingress Mapping of CoS Markings

On egress of the eircom Core NGN network the classification is based on the MPLS EXT bits markings associated with the different core Forwarding Classes. The MPLS EXT bits markings are mapped to the S-VLAN 802.1p markings on the E-NNI as per the following table:

Forwarding Class	S-VLAN 802.1p Marking
EF	5
EF	4
AF	3
AF	2
STD	1

Table 12: Egress Mapping of CoS Markings

The original end user C-VLAN 802.1p markings are tunnelled across the eircom network and are presented to the Operator at the E-NNI within the C-VLAN ID header.

6.3.2 E-NNI to UNI Traffic Flows

The Operator must ensure that the S-VLAN 802.1p markings are also mapped to the C-VLAN (or vice-versa) prior to presentation at the E-NNI.

Classification on ingress to the eircom Core NGN network is based on the Operator S-VLAN 802.1p markings. Traffic is forwarded to the core Forwarding Class based upon the ingress policy specified for the WSEA connection (i.e. the EF and AF bandwidths if specified). The mapping of the S-VLAN 802.1p markings to the core Forwarding Classes is as follows:

S-VLAN 802.1p Marking	Forwarding Class
5	EF
4	EF
3	AF
2	AF
1	STD

Table 13: Ingress Mapping of CoS Markings

On egress of the eircom Core NGN network the classification is based on the MPLS EXT bits markings associated with the different core Forwarding Classes. The MPLS EXT bits markings are mapped to the S-VLAN 802.1p markings on egress of the eircom Core NGN network. The S-VLAN tag is stripped off prior to presentation to the customer on the UNI and the original end user/Operator C-VLAN 802.1p markings are presented on the UNI.

6.4 Network Performance

The following table outlines indicative target network performance figures for the eircom NGN:

	Traffic Type		
Parameter	Real-Time (EF)	Business (AF)	Standard
Delay (One-way)	10ms (Note 1)	25ms (Notes 1, 2)	35ms
Delay Variation (One-way)	2.5ms (Note 1)	3.5ms(Note 2)	3.5ms
Frame Loss	0.001% (Note 1)	0.01% (Notes 1,2)	0.1%

Table 14: Indicative Target Network Performance Figures

Note 1: The specified product performance will be met when measured over any 15 minute interval. A failure to meet the product performance over this interval twice in any 24-hour period will constitute a fault. A single failure to meet the performance in each of any two consecutive 24-hour periods shall constitute an intermittent fault

Note 2: Only applies to in-profile AF traffic.

Note 3: The above figures only apply under normal network conditions.

Note 4: The above figure only apply if the Operator/End User has not caused congestion on their own access connection.

The Operator must ensure that the actual EF and AF bandwidth levels associated with a SAB on the WEIL do not exceed the selected EF and AF bandwidth values (i.e. that the aggregate EF and AF schedulers do not become congested). In the event of congestion occurring at the aggregate EF and AF schedulers, the delay figures outlined in Table 14: above may increase significantly. This is normal QoS behaviour as EF/AF traffic will start to be buffered once congestion arises at the EF/AF aggregate schedulers and the EF/AF traffic associated with individual WSEA connections will be served on a round-robin basis which will result in additional latency.

It is recommended that the end user/Operator shape their traffic to conform to the selected CoS profile prior to presentation on ingress to the eircom UNI/E-NNI interfaces. Failure to do so may result in the above performance figures being impacted.

6.5 Planning Ratios

The following planning ratios are used for capacity management purposes in the eircom Core NGN Network:

Traffic Type	Planning Ratio
EF	1:1
AF – In Profile	1:1
AF – Out of Profile	5:1
STD	5:1
1	STD

Table 15: Planning Ratios

7 WSEA Interface Specification

The section details the interface specification for the WSEA product. A WSEA connection requires the installation of an eircom NTU (RAD ETX 202A) at the end user's premises or in the Operator's rack located in an eircom exchange.

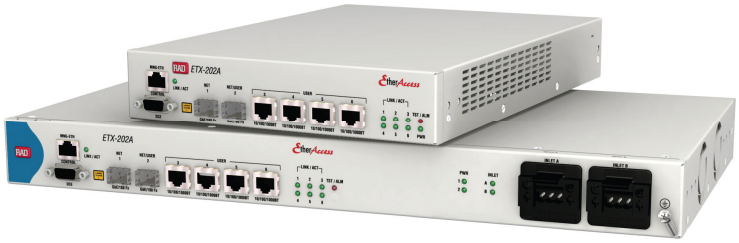

Figure 10: RAD ETX-202A

NTU Model	RAD ETX-202A
Power Supply Options	Single 220V AC PSU (Default) Dual 220V AC PSU (Optional)
Power Consumption	18.5W max
Dimensions	NTU with single PSU: • Height: 43.7 mm (1.7 in) • Width: 215 mm (8.4 in) • Depth: 300 mm (11.8 in) NTU with dual PSU: • Height: 43.7 mm (1.7 in) • Width: 440 mm (17.4 in) • Depth: 240 mm (9.5 in)
19" Rack-mountable	Yes

Table 16: WSEA NTU Accommodation Requirements

The following table details the UNI specification for the WSEA product:

UNI Physical Interface options	10/100/1000BaseT (Default) 1000BaseSX 1000BaseLX
UNI Physical interface presentation	RJ45 for 10/100/1000 Base-T (Default) LC connector for 1000BaseSX (multimode fibre) LC connector for 1000BaseLX (single mode fibre)
Optical Wavelength	1000BaseSX SFP • 850 nm 1000BaseLX SFP • 1310 nm
Optical Power Budget	1000BaseSX SFP • Input Power (dBm) Min: -17 Max: 0 • Output Power (dBm) Min: -9.5 Max: 0 1000BaseLX SFP • Input Power (dBm) Min: -20 Max: -3 • Output Power (dBm) Min: -9.5 Max: -3
Auto negotiation support	Yes
Full Duplex Support	Yes
Autosensing Enabled	Yes
UNI Port Setting Options	1000BaseSX/LX Port • Auto Negotiate (Default) • 1000M Full Duplex 10/100/1000 Base-T Port • Auto Negotiate (Default) • 100M Full Duplex • 10M Full Duplex
EtherType Support	C-VLAN • 8100 • 9100 (Not supported for Traffic based COS) • 88A8 (Not supported for Traffic based COS)
Link Loss Forwarding (LLF) Support	UNI port on the *eircom* NTU will shut-down in the event of loss of service on NTU-NGN Node connection. The tunnelling of end user/Operator LLF L2CP traffic is supported on the *eircom* network. By default all L2CP traffic is marked as 802.1p 7 and will get mapped to the STD Forwarding Class on

	ingress to the *eircom* network.

Table 17: WSEA UNI Interface Specification

7.1.1 WSEA Customer Sited Handover (CSH)

The WSEA CSH option involves the installation of an eircom NTU (RAD ETX 202A) at the end user site.

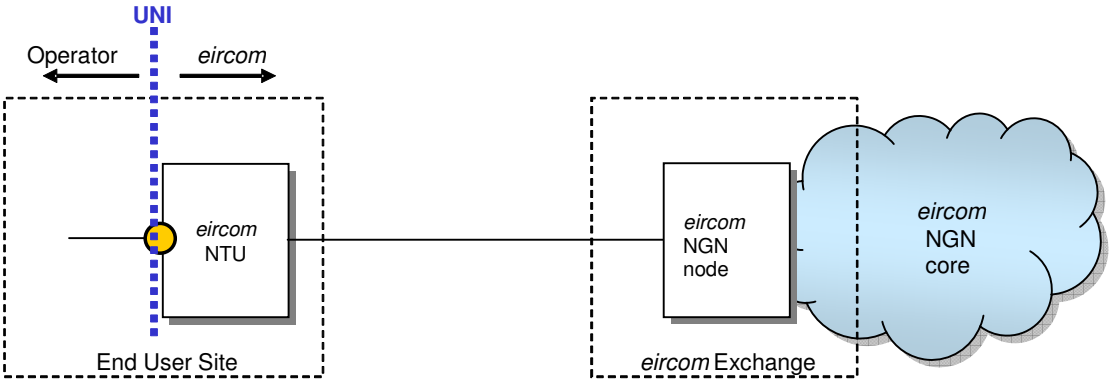

Figure 11: WSEA Customer Sited Handover (CSH)

7.2 WSEA In Building Handover (IBH)

An In Building Handover (IBH) option is supported for WSEA connections.

An eircom NTU will be installed in the Operator's rack in the same eircom Exchange as the serving eircom NGN node.

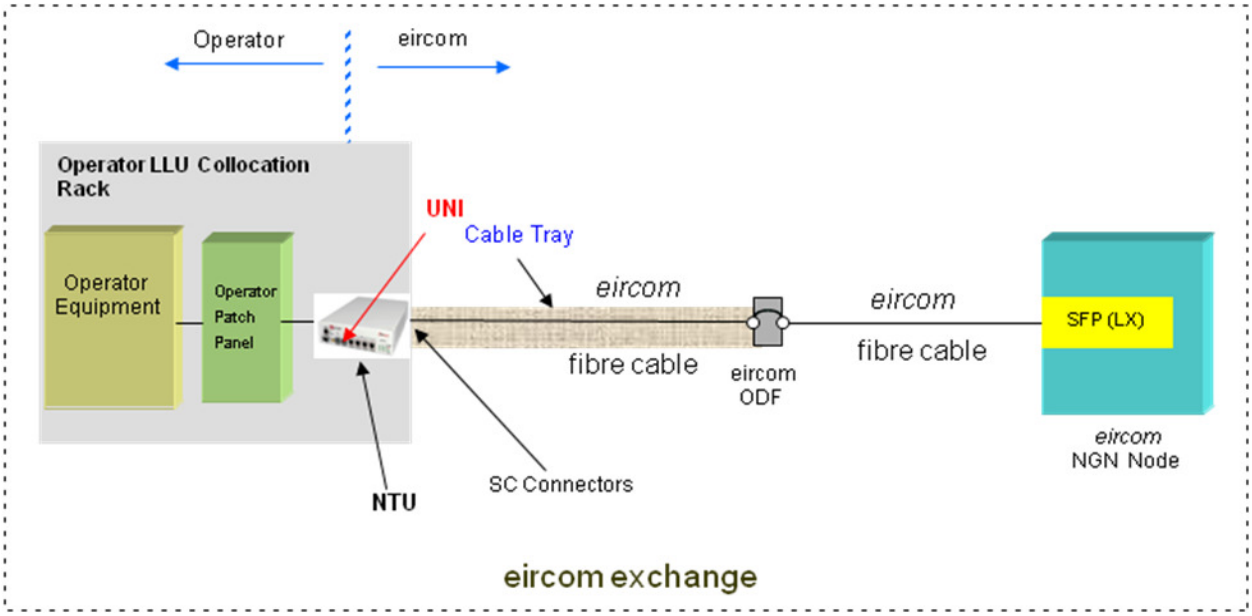

Figure 12: WSEA In Building Handover

7.3 Multi-service WSEA

The initial release of the eircom Wholesale Symmetrical Ethernet Access product was limited to a single UNI port on the eircom managed NTU installed at the End User site. This enhancement will enable the Operator to request the use of multiple UNI ports on the eircom managed NTU.

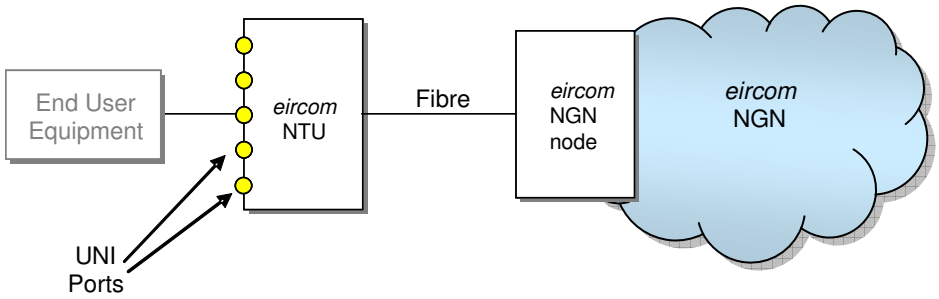

Figure 13: WSEA Multiple UNI Ports

The 1G NTU has the capability to support up to 5 UNI ports. One WSEA logical connection per UNI is supported. The port configuration for the 1G NTU is shown below:

	ETX-202A/NULL/NULL/4UTP
Port No. 1	Empty SFP slot (not available as UNI port)
Port No. 2	Empty SFP slot
Port No. 3	10/100/1000BaseT port (RJ-45)
Port No. 4	10/100/1000BaseT port (RJ-45)
Port No. 5	10/100/1000BaseT port (RJ-45)
Port No. 6	10/100/1000BaseT port (RJ-45)

Table 18: NTU Port Configuration

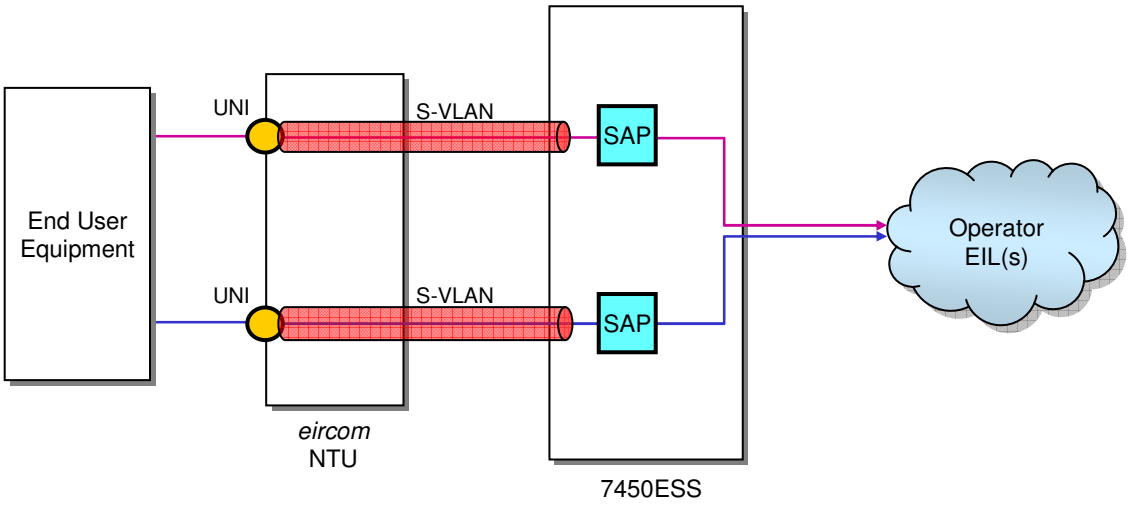

Figure 14: WSEA with Multiple Ports

The sum of all of the WSEA logical service bandwidths on an NTU has to be equal to, or less than, the WSEA bandwidth (see Table 4: for WSEA physical bandwidth options).

7.3.1 Mapping of WSEA logical Services to Different WEILs

In the event that an Operator has more than one WEIL, an Operator must specify which WEIL is to be associated with each WSEA logical service. If multiple WSEA logical services are provided on a single physical WSEA connection, each WSEA logical service can be associated with a different WEIL. The WEIL can only support logical WSEA services that originate at an End User site.

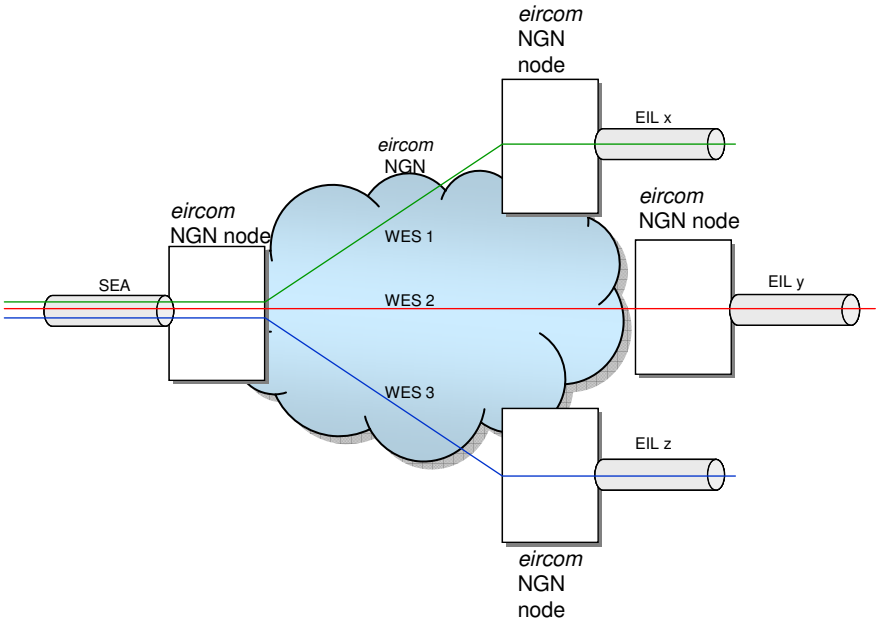

Figure 15: Mapping of WSEA logical Services to Different WEILs

8 WEIL Interface Specification

A number of handover options are supported on the WEIL product:

- Customer Sited Handover (CSH)
- In Span Handover (ISH)
- In Building Handover (IBH)
- Edge Node Handover (ENH)

The interface/E-NNI specification differs depending on which of the above option an Operator selects for the WEIL.

Master Plan Plus (MPP) SLA is not supported on 'no NTU' variants (IBH and ISH) of the WEIL product including ENH, IBH and ISH. ('no-NTU' variants are those where a physical NTU device acting as a demarcation point e.g. RAD ETX-202A is not installed and where the demarcation point is instead an ODF or Eircom patch panel.)

8.1 WEIL Customer Sited Handover (CSH)

The WEIL CSH option involves the installation of an eircom NTU (RAD ETX 202A) at the Operator site.

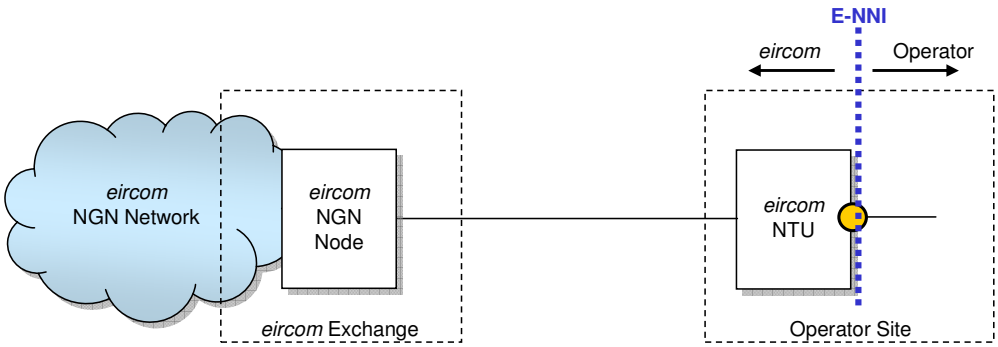

Figure 16: WEIL Customer Sited Handover (CSH)

NTU Model	RAD ETX-202A
Power Supply Options	Dual 220V AC PSU Dual -48V DC PSU
Power Consumption	18.5W max
Dimensions	Height: 43.7 mm (1.7 in) Width: 440 mm (17.4 in) Depth: 240 mm (9.5 in)
19" Rack-mountable	Yes

Table 19: CSH NTU Accomodation Requirements

E-NNI Physical Interface options	10/100/1000BaseT (Default) 1000BaseSX 1000BaseLX
E-NNI Physical interface presentation	RJ45 for 10/100/1000 Base-T (Default) LC connector for 1000BaseSX (multimode fibre) LC connector for 1000BaseLX (single mode fibre)
Optical Wavelength	1000BaseSX SFP • 850 nm 1000BaseLX SFP • 1310 nm
Optical Power Budget	1000BaseSX SFP • Input Power (dBm) Min: -17 Max: 0 • Output Power (dBm) Min: -9.5 Max: 0 1000BaseLX SFP • Input Power (dBm) Min: -20 Max: -3 • Output Power (dBm) Min: -9.5 Max: -3
Auto negotiation support	Yes
Full Duplex Support	Yes
Autosensing Enabled	Yes
E-NNI Port Setting Options	1000BaseSX/LX Port • Auto Negotiate (Default) • 1000M Full Duplex 10/100/1000 Base-T Port • Auto Negotiate (Default) • 100M Full Duplex • 10M Full Duplex
EtherType Support	S-VLAN • 0x88A8 (Default) • 0x8100 C-VLAN • 0x8100 • 0x9100 (Not supported for Traffic based COS) • 0x88A8 (Not supported for Traffic based COS)
Link Loss Forwarding (LLF) Support	E-NNI port on the eircom NTU will shut-down in the event of loss of service on NTU-NGN Node connection. The tunnelling of end user/Operator LLF L2CP traffic is supported on the eircom network. By

	default all L2CP traffic is marked as 802.1p 7 and will get mapped to the STD Forwarding Class on ingress to the eircom network.

Table 20: CSH E-NNI Interface Specification

8.2 WEIL In Span Handover (ISH)

For the Wholesale Ethernet Interconnect Link (WEIL) ISH option the eircom fibre will join the Operator fibre at a Point of Handover (PoH) outside the same eircom exchange as the serving eircom NGN node.

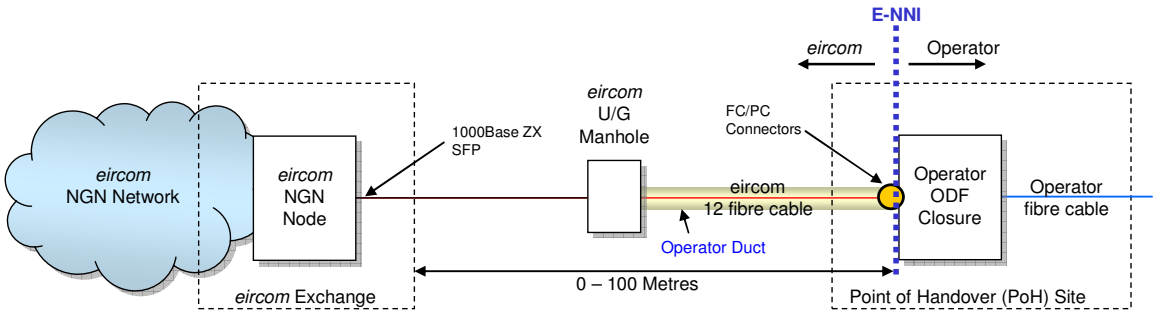

Figure 17: WEIL In Span Handover (ISH)

The PoH for a WEIL ISH is the point at which the optical fibres from an Operator's cable are connected to the optical fibres of an eircom cable. An Operator is responsible for providing a Raychem FOSC400 Xcon (ODF type closure) at the PoH. eircom will terminate its optical fibres on one side of the optical distribution frame (ODF) and an Operator will terminate its fibres on the other side of the ODF.

The PoH is housed in a U/G manhole located within 100 Metres outside the boundary of an eircom exchange. The maximum distance between the terminal ends of the ISH shall be determined with reference to the available optical power budget. The required minimum Receive Level at the PoH shall be –19 dBm at start of life, to ensure a minimum of –22 dbm to end of life, following subsequent repairs and the natural ageing of systems measured at the eircom optical distribution frame interface.

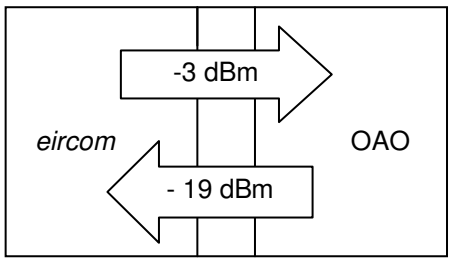

Figure 18: Minimum Power Levels – 1G In Span Interface - ZX SFP

As shown in the diagram above, eircom will provide, to an Operator, with a 1Gbit/s In Span Interface, an optical signal at -3dBm minimum at an Operator optical distribution frame interface. An Operator will provide, to eircom, an optical signal at -19dBm minimum at the eircom optical distribution frame interface.

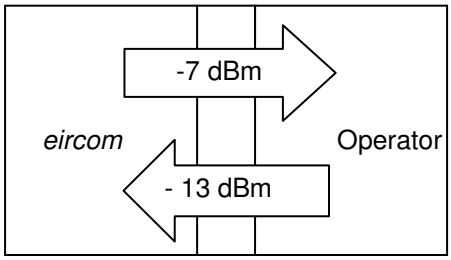

Figure 19: Minimum Power Levels – 10G In Span Interface – ER XFP

As shown in the diagram above, eircom will provide to an Operator with a 10Gbit/s In-Span Interface – ER XFP an optical signal at -7 dBm minimum at an Operator Optical Distribution Frame interface. The Operator will provide, to eircom, an optical signal at -13dBm minimum at the eircom Optical Distribution Frame (ODF) interface.

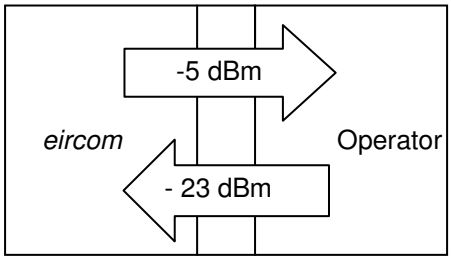

Figure 20: Minimum Power Levels – 10G In Span Interface - ZR XFP

As shown in the diagram above, eircom will provide to an Operator with a 10Gbit/s In-Span Interface - ZR XFP an optical signal at -5 dBm minimum at an Operator Optical Distribution Frame interface. The Operator will provide, to eircom, an optical signal at -23dBm minimum at the eircom Optical Distribution Frame (ODF) interface.

Note that a 3dB margin is used in the above figures to account for losses associated with connectors, ODFs, etc, between the 7450ESS port and the E-NNI.

E-NNI Physical interface presentation	Single Mode Fibre FC/PC connector
Optical Wavelength	1550 nm
Optical Power Budget (see Figure 18:, Figure 19:, Figure 20:)	**1 Gbit/s Access – ZX SFP** Input Power (dBm) Min: -19

	Max: -3 Output Power (dBm) Min: -3 Max: +5 **10 Gbit/s Access – ER XFP** Input Power (dBm) Min: -13 Max: -1 Output Power (dBm) Min: -7 Max: +4 **10 Gbit/s Access – ZR XFP** Input Power (dBm) Min: -23 Max: -9 Output Power (dBm) Min: -5 Max: +2
Auto negotiation support	Yes
Full Duplex Support	Yes
Autosensing Enabled	Yes
E-NNI Port Setting Options	1000BaseZX Port • Auto Negotiate (Default) • 1000M Full Duplex 10000BaseER/ZR Port • Auto Negotiate (Default) • 10000M Full Duplex
EtherType Support	S-VLAN • 0x88A8 (Default) • 0x8100 C-VLAN • 0x8100 • 0x9100 (Not supported for Traffic based COS) • 0x88A8 (Not supported for Traffic based COS)
Link Loss Forwarding (LLF) Support	The tunnelling of end user/Operator LLF L2CP traffic is supported on the eircom network. By default all L2CP traffic is marked as 802.1p 7 and will get mapped to the STD Forwarding Class on ingress to the eircom network.

Table 21: ISH E-NNI Interface Specification

8.3 WEIL In Building Handover (IBH)

For a Wholesale Ethernet Interconnect Link (WEIL) In Building handover a fibre cable is installed between the Operator collocation footprint and an eircom optical distribution frame (ODF) in the same eircom exchange as the serving eircom NGN node.

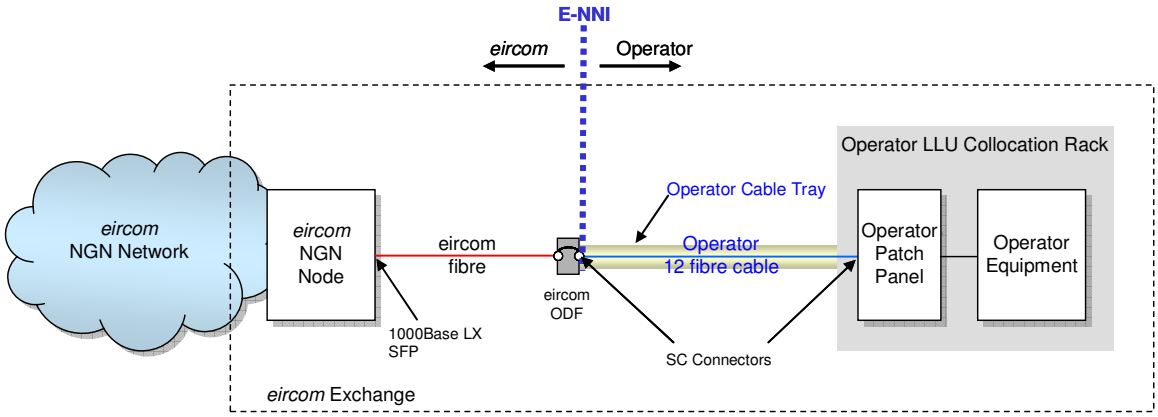

Figure 21: WEIL In Building Handover (IBH)

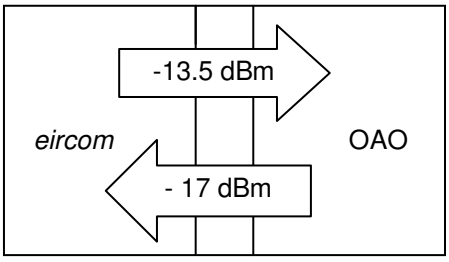

Figure 22: Minimum Power Levels - 1Gbit/s In Building Interface

As shown in the diagram above, for a 1Gbit/s IBH WEIL, eircom will provide, to an Operator, an optical signal at -13.5 dBm minimum at the eircom ODF. An Operator will provide, to eircom, an optical signal at -17dBm minimum at the eircom ODF.

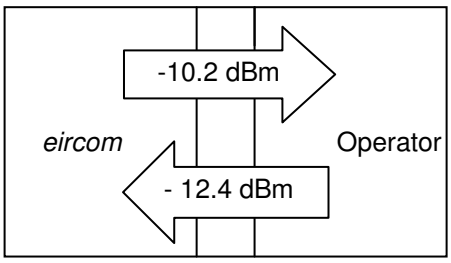

Figure 23: Minimum Power Levels - 10Gbit/s In Building Interface

As shown in the diagram above, for a 10Gbit/s IBH WEIL eircom will provide, to an Operator, an optical signal at -10.2 dBm minimum at an Operator optical patch panel. The Operator will provide to eircom an optical signal at -12.4dBm minimum at an Operator optical patch panel.

Note that a 2dB margin is used in the above figures to account for losses associated with connectors, ODF, etc, between the 7450ESS port and the E-NNI.

E-NNI Physical interface presentation	Single Mode Fibre SC connector
Optical Wavelength	1310 nm
Optical Power Budget (see Figure 22:and Figure 23:)	**1 Gbit/s Access** Input Power (dBm) Min: -17 Max: -3 Output Power (dBm) Min: -13.5 Max: -3 **10 Gbit/s Access** Input Power (dBm) Min: -10.4 Max: + 0.5 Output Power (dBm) Min: - 12.2 Max: + 0.5
Auto negotiation support	Yes
Full Duplex Support	Yes
Autosensing Enabled	Yes
E-NNI Port Setting Options	**1 Gbit/s Access** Auto Negotiate (Default) 1000M Full Duplex **10 Gbit/s Access** Auto Negotiate (Default) • 10000M Full Duplex
EtherType Support	S-VLAN • 0x88A8 (Default) • 0x8100 C-VLAN • 0x8100 • 0x9100 (Not support for Traffic based COS) • 0x88A8 (Not support for Traffic based COS)
Link Loss Forwarding (LLF) Support	The tunnelling of an Operator's LLF L2CP traffic is supported on the eircom network. By default all L2CP traffic is marked as 802.1p 7 and will get mapped to the STD Forwarding Class on ingress to the eircom network.

Table 22: IBH E-NNI Interface Specification

8.4 WEIL Edge Node Handover (ENH)

The Operator facing port on the eircom NGN node will be connected directly to an eircom patch panel for the ENH handover.

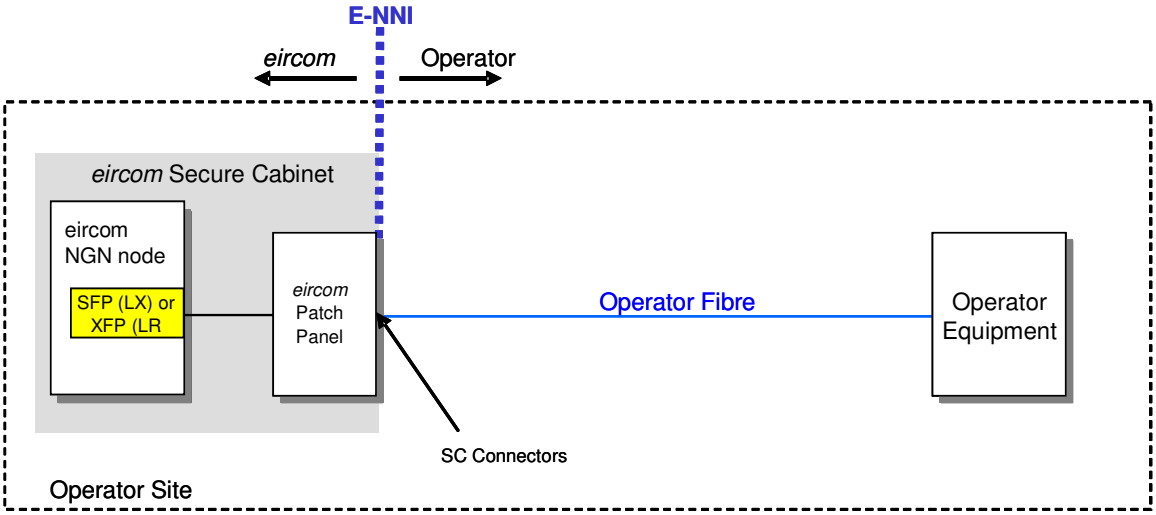

Figure 24: WEIL Edge Node Handover

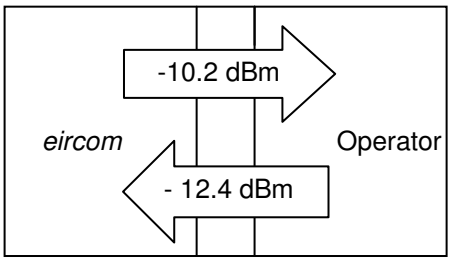

Figure 25: 10G ENH Minimum Power Levels

As shown in the diagram above, for a 10G WEIL eircom will provide, to an Operator, an optical signal at -10.2 dBm minimum at the eircom optical patch panel. The Operator will provide to eircom an optical signal at -12.4dBm minimum at the eircom optical patch panel.

Note that a 2dB margin is used in the above figures to account for losses associated with connectors, patch panel, etc, between the eircom NGN node port and the E-NNI.

The following table lists the UNI interface specification for ENH:

E-NNI Physical interface presentation	Single Mode Fibre SC connector
Optical Wavelength	1310 nm
Optical Power Budget	**10 Gbit/s Access** Input Power (dBm) Min: -10.2 Max: + 0.5 Output Power (dBm) Min: - 12.4 Max: + 0.5
Auto negotiation support	Yes
Full Duplex Support	Yes
Autosensing Enabled	Yes
E-NNI Port Setting Options	**10 Gbit/s Access** Auto Negotiate (Default) 10000M Full Duplex
EtherType Support	S-VLAN • 0x88A8 (Default) • 0x8100 (Optional) C-VLAN • 0x8100 • 0x9100 (Not support for Traffic based COS) • 0x88A8 (Not support for Traffic based COS)
Link Loss Forwarding (LLF) Support	The tunnelling of an Operator's LLF L2CP traffic is supported on the *eircom* network. By default all L2CP traffic is marked as 802.1p 7 and will get mapped to the STD Forwarding Class on ingress to the *eircom* network.

Table 23: ENH E-NNI Interface Specification

8.4.1 WEIL ENH 1+1 Protection

A 1+1 Protection option will be offered on WEIL connections to provide end users/Operators with additional protection on the NNI/WEIL interfaces. This will be achieved by grouping multiple WEILs into Link Aggregation Groups (LAGs). The WEILs which are members of a LAG will be configured in active/active mode.

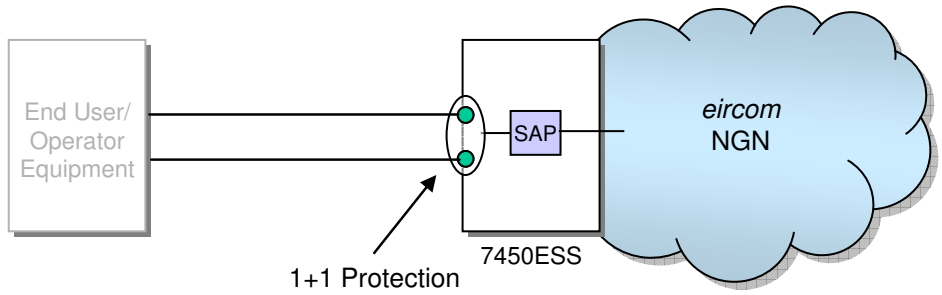

Figure 26: WEIL with 1+1 Protection

The following 1+1 Protection options are offered:

- 10G WEIL 1+1 Protection (2 * 10G LAG)

The WEIL bandwidth options as outlined in Section 5 will still apply for this option (i.e. the max bandwidth supported a 10G 1+1 Protected WEIL will be 10 Gbit/s).

This will ensure that, in the event of a failure on one of the LAG ports, the remaining link will have sufficient capacity to carry all traffic. There will be minimal service interruption due to the switchover. For WEIL ENH with 1+1 protection the two 10Gb/s customer facing ports will be allocated from different IOM card modules on the NGN node.

The following LAG parameters must be used by the Operator/end user equipment:

Parameter	Setting
LACP	Enabled
Mode	Active Active (1)
Port threshold	0 (2)
QoS	PIR enforced across both LAG ports

Table 2: LAG Parameters: WEIL with 1+1 Protection

(1) Ensures that traffic is active on both links.

(2) Indicates that the LAG is only taken down if both links are down

9 Configuration of Loopbacks on WSEA Connections

An Operator can request for a loopback to be configured on an eircom Wholesale WSEA connection. The loopback will be internally configured on the end-user facing port (UNI) on the eircom NTU deployed at the end-user site.

The Operator should use one of the following methods to submit a request for a loopback to be configured:

- The Operator can request for a loopback to be configured via the Unified Gateway by selecting 'Configuration of Loopback on NGN WSEA Circuit' on the fault reporting screen and referencing the WSEA Circuit ID (WESxxxxxxxx).
- The Operator can log a request for a loopback to be configured by calling 1800-656 656. The Operator must request a 'Configuration of Loopback on NGN WSEA Circuit' and reference the WSEA Circuit ID (WESxxxxxxxx).

The Operator must submit an additional request to have the loopback removed using the contact options outlined above (the WSEA Circuit ID must be referenced in all cases). The length of time that a loopback is applied should not exceed 24 hours.

10 NGN Node Types / Fibre Access Model

There are three possible types of fibre access model used to connect the eircom NTU at the end user site to the eircom NGN (please refer to Figure 27:, Figure 28:, Figure 29:)

1. The default fibre access model is to connect the end user site to an eircom NGN Aggregation Node by a direct fibre (Figure 27:).
2. In certain circumstances an end user may be connected to an eircom exchange which is fibre enabled but does not have an NGN Aggregation Node (i.e. a Node Reach site). An inter-exchange (core) fibre pair is required between the NGN Aggregation Node enabled exchange and the end user's local exchange. This inter-exchange fibre pair is then patched to the customer's access fibre pair (Figure 28:).
3. The Access Packet Transport (APT) network is used to connect to the NGN at certain exchanges where an NGN Aggregation Node is not deployed. The APT network is a Carrier Ethernet transport network that uses MPLS-TE and extends the reach of the NGN to remote exchanges.The end user site is connected via fibre to an APT node (Figure 29:). The APT network appears as a transparent pipe to the services delivered over it, so the service parameters remain the same as for options 1 and 2 above, with the restriction that there is a 300 Mbit/s bandwidth limit for each physical access, whereas the limit is 1Gbit/s for options 1 and 2. A customer requirement for a service > 300 Mbit/s at an APT enabled site will be delivered over direct fibre (i.e. Node Reach solution) where practicable.

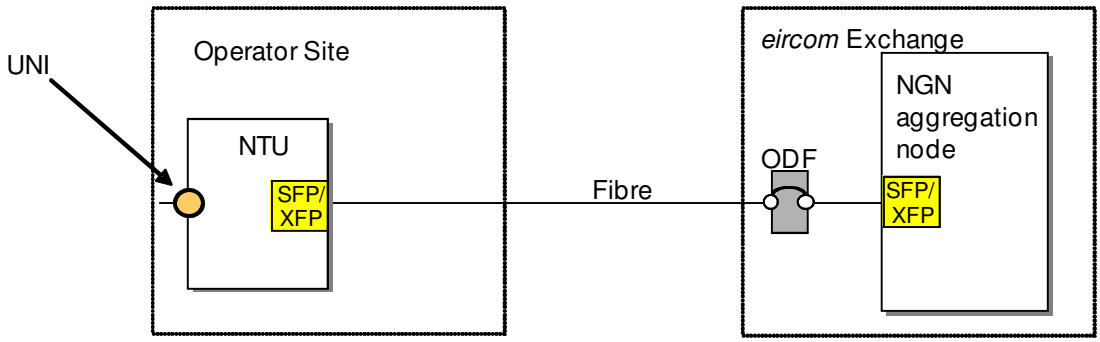

Figure 27: Direct Fibre Access to NGN Aggregation node

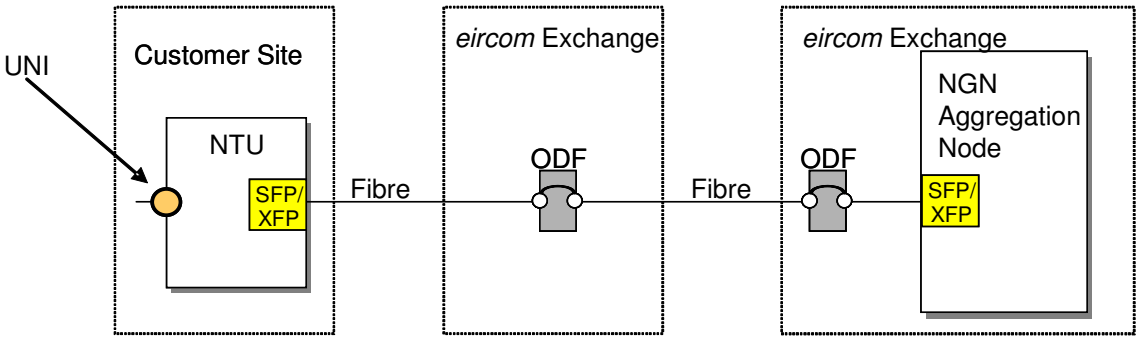

Figure 28: Fibre Access via an Intermediate Exchange

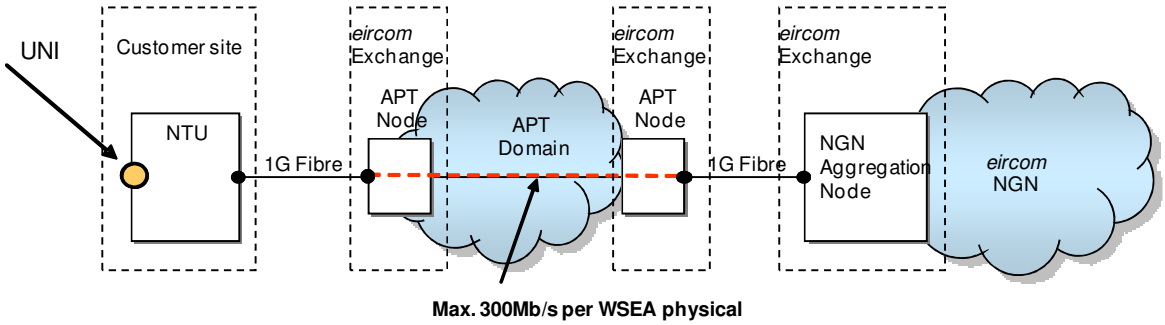

Figure 29: NGN Extended Reach using APT

For resilience, an NGN aggregation node is dual homed to 2 PE routers (Figure 30:). APT nodes are daisy-chained to a Head-End APT node that is co-located with the NGN Aggregation Node (Figure 31:). There is a single link between APT nodes, no protection is currently implemented.

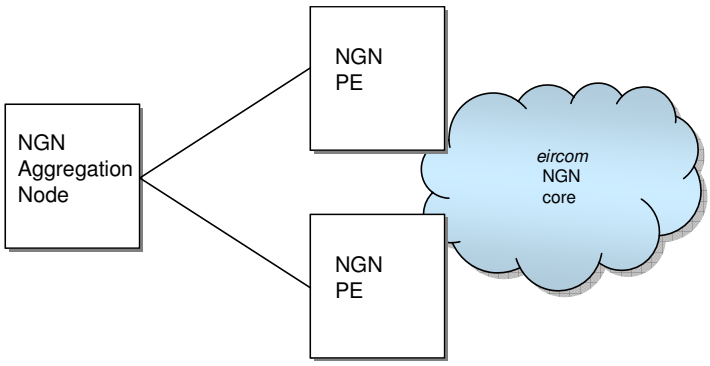

Figure 30: Aggregation node to PE connection

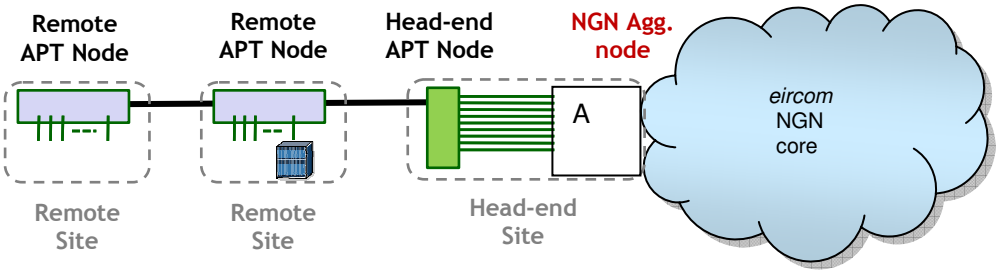

Figure 31: APT connectivity to NGN