NICC ND 1613 V 1.2.1 (2008-10)

NICC Document

NGN Interconnect:

Transport Service Layer Management

Network Interoperability Consultative Committee,
Ofcom,
2a Southwark Bridge Road,
London,
SE1 9HA.

If you have any comments concerning the accuracy of the contents of this document, please write to:

The Technical Secretary,
Network Interoperability Consultative Committee,
Ofcom,
2a Southwark Bridge Road,
London SE1 9HA.

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to NICC.

Pursuant to the NICC IPR Policy, no investigation, including IPR searches, has been carried out by NICC. No guarantee can be given as to the existence of other IPRs which are, or may be, or may become, essential to the present document.

Foreword

This NICC Document (ND) has been produced by the NICC TSG Management Working Group.

1 Scope

This document identifies:

- Capacity criteria to be considered when planning MSI;
- Common transport attributes that each CP needs to identify and exchange when interconnecting with another CP;
- Changes to MSI capacity while in-service;
- Accounting and settlement aspects.

This document describes procedures for management of Purple and Green Release NGN MSI. The procedures described here may also be suitable for the management of subsequent releases of NGN MSI provided the underlying transport technology is unchanged.

Each CP will use their own procedures to manage their internal transport functions. For the purposes of interconnect an agreement must be reached on common parameters to enable a common understanding of the transport function management.

2 References

For the particular version of a document applicable to this release see ND1610 [3].

2.1 Normative references

[1] ND1614 NGN Interconnect; PSTN/ISDN Service; General Connectivity Management

[2] ND1611 Multi-Service Interconnect Common Transport for UK NGNs

[3] ND1610 Multi-Service Interconnect of UK Next Generation Networks

2.2 Informative references

[4] ND1615 Voice Line Control; General Connectivity Management

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AES	Advanced Encryption Standard
ATM	Asynchronous Transfer Mode
CP	Communications Provider
DES	Data Encryption Standard
ESP	Encapsulated Security Payload
ETSI	European Telecommunication Standards Institute
GFP	General Framing Protocol (ITU G.7041)
HMAC-SHA1-96	Security Hash Algorithm 1, IETF standard RFC3174
HMAC-MD5-96	Message Digest 5 algorithm, IETF standard RFC2085
IETF	Internet Engineering Task Force
IKE	Internet Key Exchange
IP	Internet Protocol
IPsec	IP Security
ISDN	Integrated Services Digital Network*
LCAS	Link Capacity Adjustment Scheme (ITU G.7042/Y.1305)
MSI	Multi-Service Interconnect

ND	NICC Documentation
NGN	Next Generation Network
NICC	Network Interoperability Consultative Committee
PSTN	Public Switched Telephone Network*
SA	Security Association
TDM	Time Division Multiplex
UK	United Kingdom
VCG	Virtual Concatenated Group

* PSTN and ISDN when used with the term 'service' define the replication of the service set applied to NGNs rather than the legacy networks themselves.

4 Introduction

A significant driver for Next Generation Networks (NGNs) is the realisation of a common network that can simultaneously support multiple services on the same platform infrastructure. NGNs use a number of packet technologies for service transport, of which the most common is Internet Protocol (IP). However, an NGN interconnect also has to support services that are not IP based, therefore the underlying interconnect transport technology needs to accommodate the range of services that require interconnect. In order to use interconnect physical connections efficiently, i.e. fibres, the underlying interconnect transport infrastructure needs to be able to be flexibly configured to allow a range of services to share these connections.

The approach for NGN Multi Service Interconnect (MSI) is to define a common transport infrastructure that is service independent and can offer different transport capabilities to the services requiring interconnect. As new services are added to the scope of the NGN MSI, a new service-specific specification will be produced that will define how the service works and its use of the underlying common transport. This new service specification, or any enhanced service specification, will be included in the scope and associated document references of the NGN MSI Release document.

In order to manage the complex relationship between the services that are defined for using the NGN MSI and other associated UK standards at any one point in time, interconnect release is defined by a top level document for each release.

5 Document Structure

NGN interconnect has been structured into a number of functional layers as shown in figure 1. This document describes the management aspects of the Transport Capability Layer, which provides transport services to a number of Generic Connectivity Layer services, including Purple Release PSTN/ISDN emulation service, Green Release Voice Line Control service and Broadband services.

The transport layer provides physical connectivity based on various transmission technologies, e.g. SDH and Ethernet Physical. The transport capability layer offers a number of transport types with various characteristics, e.g. TDM, ATM, and IP to the services they support.

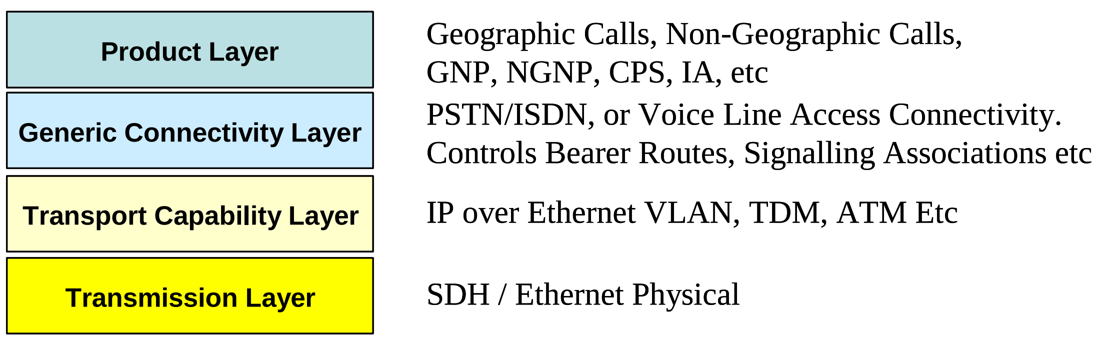


Figure 1:- Layering of functions for PSTN over a Multi-service Interconnect

Figure 2 shows interconnect functional layers overlaid with the broad areas of management activity. This document is concerned with the management activities at the Transport Connectivity Layer. For management areas related to the PSTN/ISDN Capability Layer see [1]. For management areas related to the Voice Line Control Capability Layer see [4].

The section of this document where the management area is addressed is indicated in figure 2.

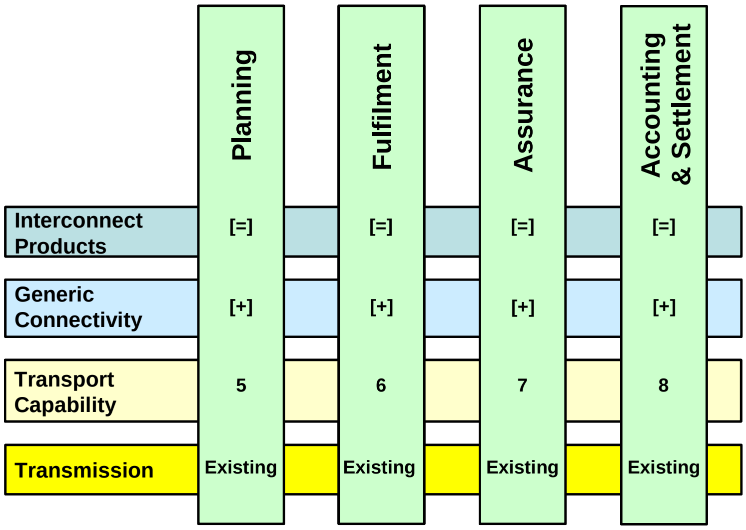


Figure 2:- Structure of NGN Interconnect Management areas

[=] For PSTN/ISDN service the interconnect products already exist, and management procedures are not separately documented. For Voice Line Control interconnect product management aspects see [4].

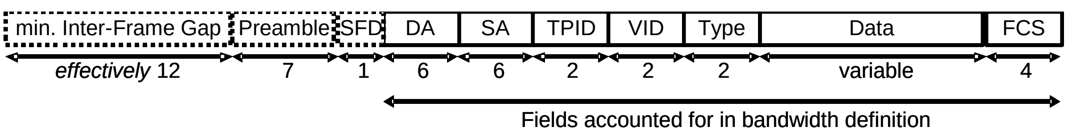
[+] For management aspects of PSTN/ISDN Connectivity Layer see [1].

6. Planning

Planning and operation of interconnection is greatly facilitated if there is a common agreement for how bandwidth is defined, together with a common set of supported bandwidths. This section discusses both these topics.

6.1 VLAN Bandwidth definition

It is necessary that CPs adopt the same definition for VLAN bandwidth in order to avoid the possibility that traffic is lost either side of the CTF due to mismatches in police or shaper behaviour. In other words, there should be a common understanding of which protocol fields or transmission overheads should be counted or excluded in each frame for the purposes of bandwidth accounting. CPs **should** use the following bandwidth definition:



Note that this definition excludes SFD, IFG, and Preamble, but includes FCS and all other fields.

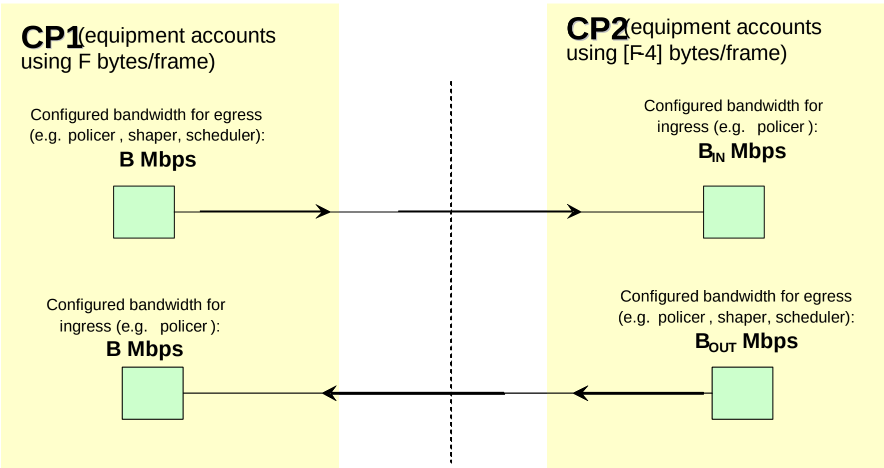
Using this definition, each IP packet will require an additional 22 bytes to encapsulate it within an Ethernet VLAN. To calculate the total impact on the Ethernet bandwidth by the IP packet, a further 20 bytes must be added.

For example, consider a single G711 Media stream with 10ms framing interval consisting of 120byte IP packets transmitted every 10ms, with a corresponding IP bandwidth of 96kbps. According to the above definition, with IP packets encapsulated within a single Ethernet VLAN, the frame size is considered to be 142bytes and the stream bandwidth is 113.6kbps. Though not included in the above definition, IFG, SFD, and Preamble are important for Capacity Planning when considering the total available bandwidth that may be assigned to VLANs on a particular Ethernet port. For the same example, the frame-size including these additional fields is 162bytes, and the stream bandwidth is 129.6kbps.

6.2 Implications of bandwidth definition on equipment configuration

It is possible when performing bandwidth-defining operations such as policing, shaping or scheduling, that a CP's equipment may not naturally account for bytes per frame exactly according to this definition. In such cases it **may** be necessary for CPs to compensate by making suitable adjustments to numerical configuration values used on equipment, rather than necessarily making these values exactly equal to the required VLAN bandwidth. Such considerations may not be necessary for all services, but are most important when the NGN interconnect VLAN is itself the "bottleneck" for determining maximum traffic levels, i.e. when there are no other limits in place such as session-control, or other clearly quantified constraints on generated traffic level.

Where the packet-size associated with a VLAN for particular service is fixed and known, a straightforward conversion factor based on this packet-size can be used in deriving the configuration values for both input or output direction. Where the packet-size is not fixed or known, more care may be needed to avoid the possibility of unexpected packet-loss. This is illustrated by the following example, where two CPs wish to interconnect via a VLAN of particular bandwidth, B, as defined in this document. In this example, CP1's equipment accounts for bandwidth exactly as per the above definition while CP2's equipment excludes FCS from bandwidth accounting , and therefore considers a frame to be 4 bytes smaller. CP1 may use the value B directly in configuring equipment but CP2 should use adjusted values.



For services where the packet-size is fixed and known , then CP2 may choose to set both B_{IN} and B_{OUT} to a value equal or close to B x (F-4)/F, where F is the frame-size according to the definition. For the G711 traffic example given above, this factor would be: 138/142 = ~ 0.972. For services where packet-size is not known, for any CP whose equipment does not account for bandwidth according to the stated definition, the general principle should be one of being conservative with what is transmitted and generous in what is allowed to be received. In this example CP2 should base the conversion factor applied for B_{IN} on a high estimate of likely average frame-size, and the conversion factor for B_{OUT} on a low estimate. For example, upper and lower estimates of average frame-size of 1522bytes and 278bytes yield corresponding conversion factors for B_{IN} and B_{OUT}) of 1518/1522 (= ~ 1) and 274/278 (0.986) respectively.

6.3 Supported VLAN sizes

The following VLAN sizes **should** be supported at the Transport Service Layer, where the numbers signify Mbps. Other VLAN sizes **may** be supported by bi-lateral agreement.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
22	24	25	26	28	30				
32	34	35	36	38	40				
42	44	45	46	48	50				
55	60	65	70	75	80	85	90	95	100
105	110	115	120	125	130	135	140	145	150
155	160	165	170	175	180	185	190	195	200
205	210	215	220	225	230	235	240	245	250
255	260	265	270	275	280	285	290	295	300
305	310	315	320	325	330	335	340	345	350
355	360	365	370	375	380	385	390	395	400
405	410	415	420	425	430	435	440	445	450
455	460	465	470	475	480	485	490	495	500
510	520	530	540	550	560	570	580	590	600
610	620	630	640	650	660	670	680	690	700
710	720	730	740	750	760	770	780	790	800

The actual range and granularity of VLAN bandwidth sizes offered for a given Connectivity Layer service **may** be a subset of the VLAN sizes offered at the Transport Service Layer, dependent on the Connectivity Layer service.

7. Fulfillment

7.1 Common Transport Function Attributes.

The following are attributes that **should** be known by and exchanged between CPs to facilitate the management of the common transport function. The following addresses the transmission through to the transport capability layers of the Purple Release as represented in the layer diagrams currently in ND1614 [1].

7.2 Attributes that should be exchanged between interconnecting CPs to enable successful management

7.2.1 Physical Attributes

The physical location of fibre ends.

CPs should note that in a protected configuration there will be more that one fibre and that these may be in more than one location.

7.2.2 SDH Transmission Attributes

The transmission size indicates the size of the SDH transport circuit used over the interconnect; e.g. STM-1, STM-4, STM-16 or STM-64.

The Protection Type indicates whether protection is used. These may be SDH unprotected and SDH MSP 1+1 (Multiplex Switching Protection).

It will be required to identify the transport capability per SDH VC or VCG. Refer to ND1611 [2] for a list of supported transport capabilities.

7.2.3 Ethernet over SDH Attributes

The size of each GFP-F mapped Ethernet link shall be indicated both by its nominal Ethernet capacity and by the size of the virtual circuit Group (VCG) supporting it.

This VCG size shall comprise data on the SDH virtual container type used (VC-12, VC-3 or VC-4) and the number of virtually concatenated VC channels used.

The ability to configure and coordinate the SDH VCG channel count via the LCAS protocol shall be indicated.

7.2.4 Ethernet Transmission Attributes

It will be required to identify the size of the Ethernet transmission link. Refer to ND1611 [2] for the size of Ethernet transmission links.

7.2.5 Fibre / Ethernet attributes

Fibre and Ethernet attribute types that need to be checked against the transmission type are included in section 5 of ND1611 [2].

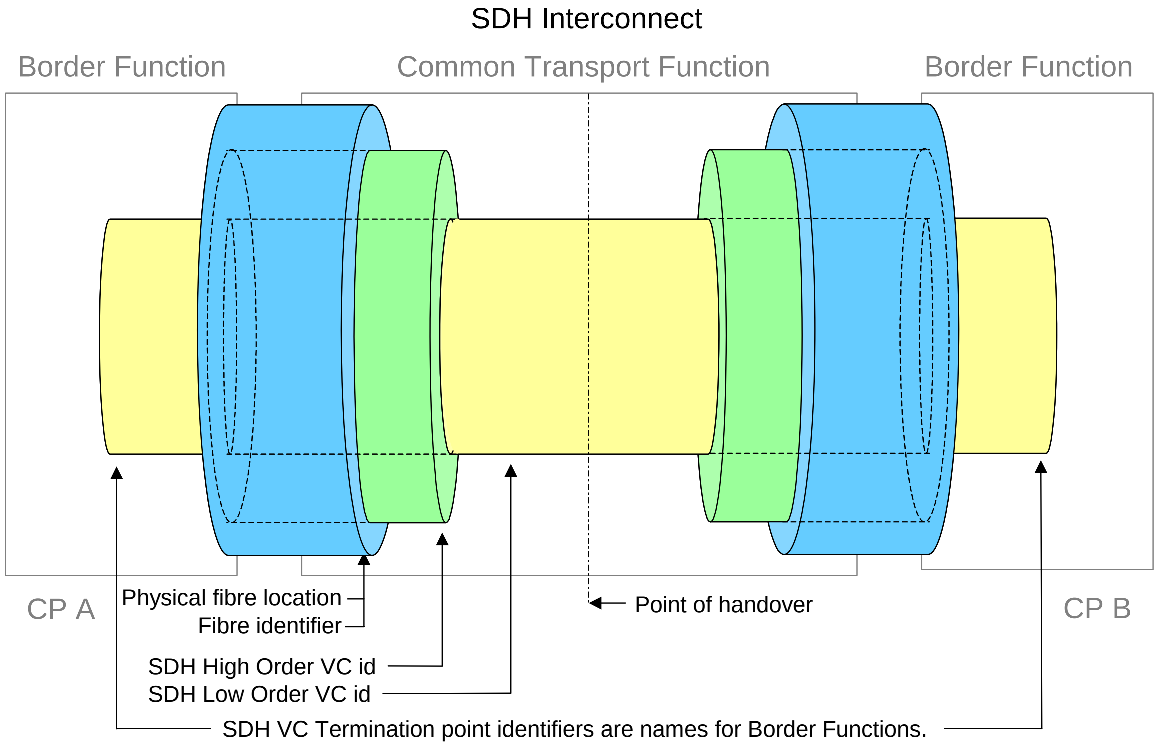
The protection type indicates whether the Ethernet uses protection. The options available are Ethernet unprotected or Eth LAG (Link Aggregation, IEEE 802.3ad).

7.2.6 SDH Transport Capability

The SDH hierarchy needs to be identified for:

a) low order and high order SDH Virtual Containers and
b) Virtual Container end points.

The identifiers required for the SDH transport capability are shown in Figure 1.



This allows CPs to configure their services to understand what is connected to the SDH VC. For example:
CP A – SDH VC Termination point = Bristol 2367. CP B – SDH VC Termination point = CDF12.
It is expected these “names” or “labels” have a meaning to higher layer service systems e.g. an IP address.

Figure 1:- SDH Interconnect Identifiers

7.2.7 Ethernet over SDH Transport Capability

The SDH hierarchy needs to be identified for:

a) low order or high order SDH Virtual Containers Groups and
b) Virtual Container Group end points.

The following Ethernet attributes need to be specified:

a) Whether single or double VLAN tags are used.
b) Maximum transmission rate set by VCG
c) Maximum transmission unit size.
d) Which 802.1 P-bits (Priority) are used.
e) List the Ethernet VLAN IDs.

Per Ethernet VLAN the following needs to be identified:

a) VLAN termination points.
b) Bandwidth.
c) Burst size.

The mixed identifiers required for the Ethernet over SDH transport capability are shown in Figure 2.

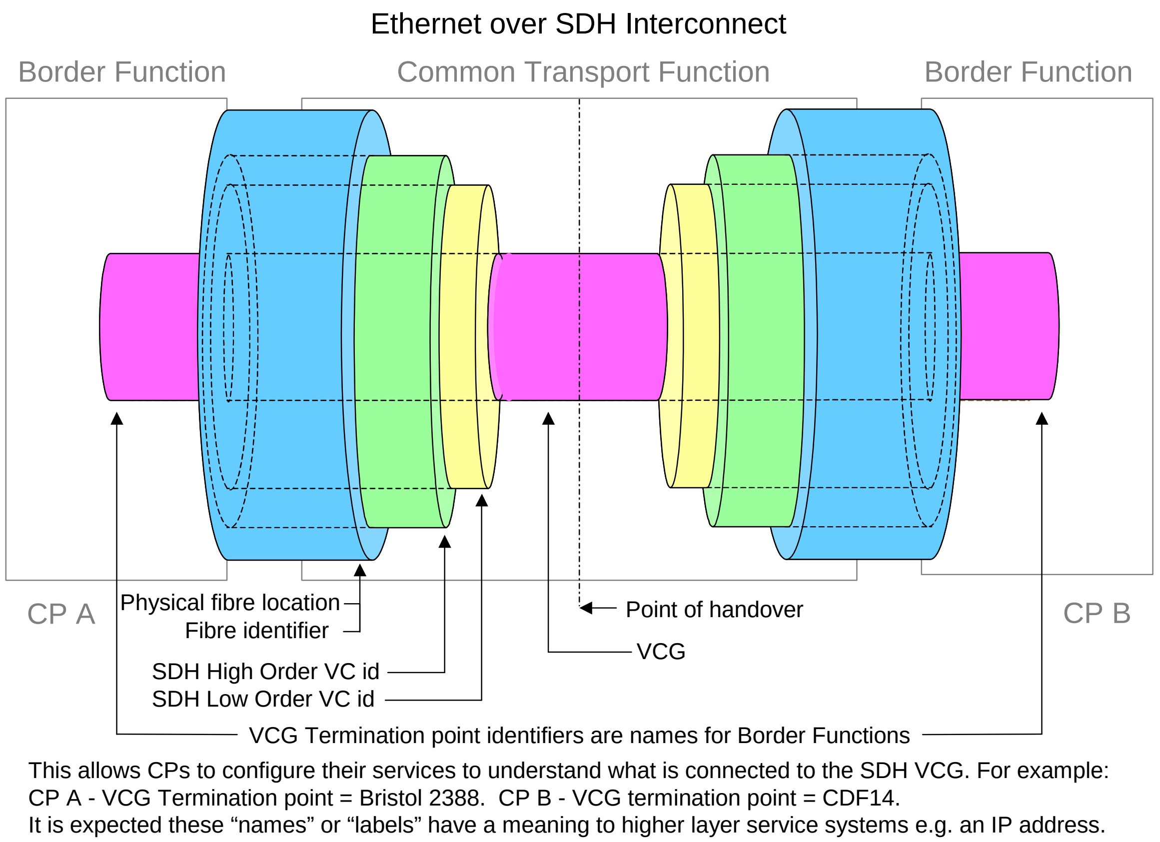


Figure 2:- Ethernet over SDH Interconnect Identifiers

7.2.8 ATM Transport Capability

There is a 1:1 mapping with SDH VCs. The VC end points need to be identified. The identifiers required for the ATM transport capability are shown in Figure 3.

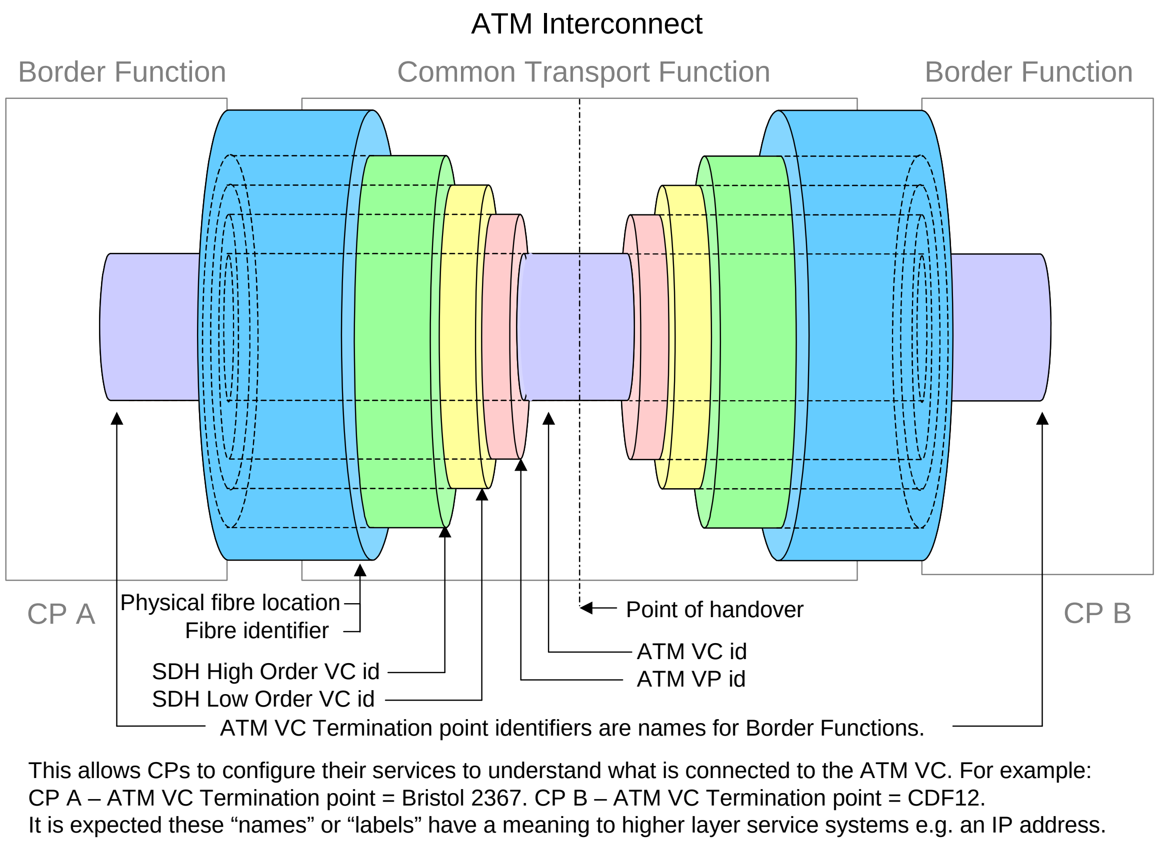


Figure 3: ATM Interconnect Identifiers

7.2.9 Ethernet Transport Capability

The following Ethernet attributes need to be specified:

a) Whether single or double VLAN tags are used.
b) Maximum transmission unit size.
c) Which 802.1 P-bits (Priority) are used.
d) List the Ethernet VLAN ids.

Per Ethernet VLAN the following needs to be identified:

a) VLAN termination points.
b) Bandwidth.
c) Burst size.

The identifiers required for the Ethernet transport capability are shown in Figures 4 and 5.

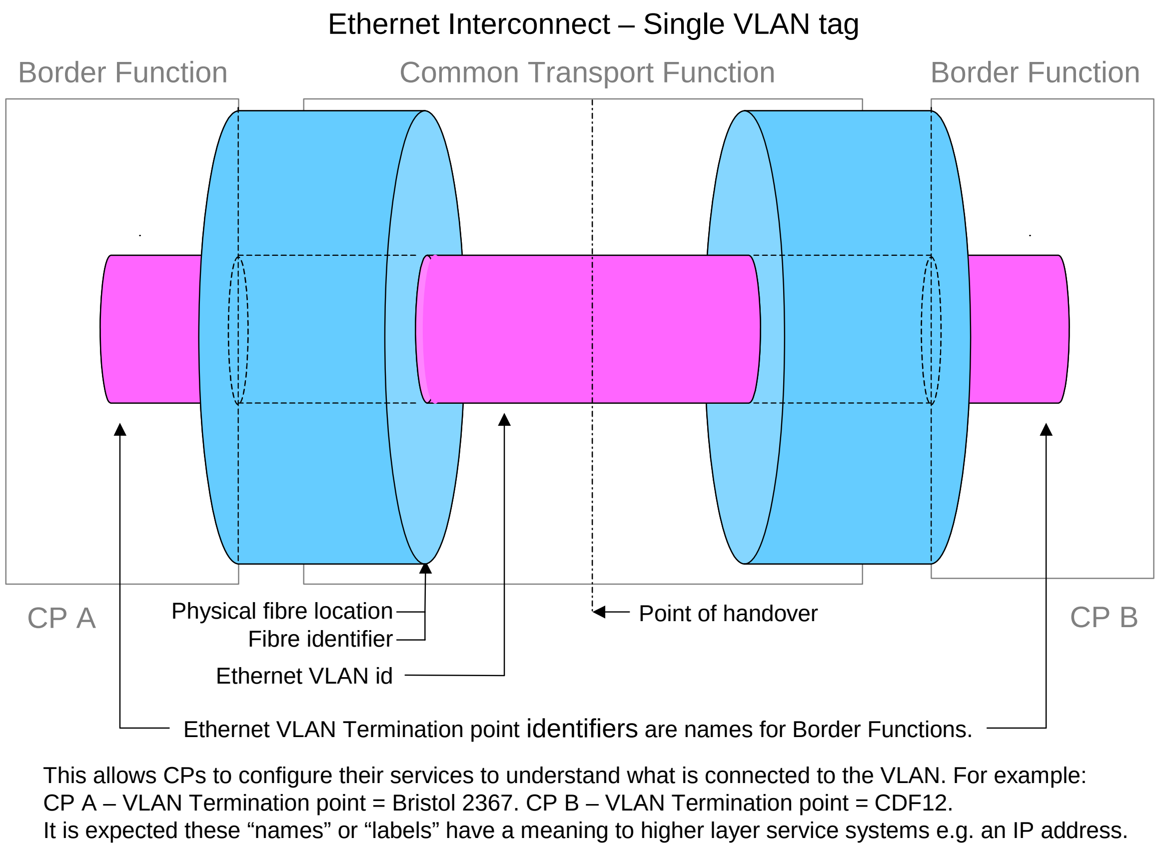


Figure 4: Ethernet Interconnect, Single VLAN method, Identifiers.

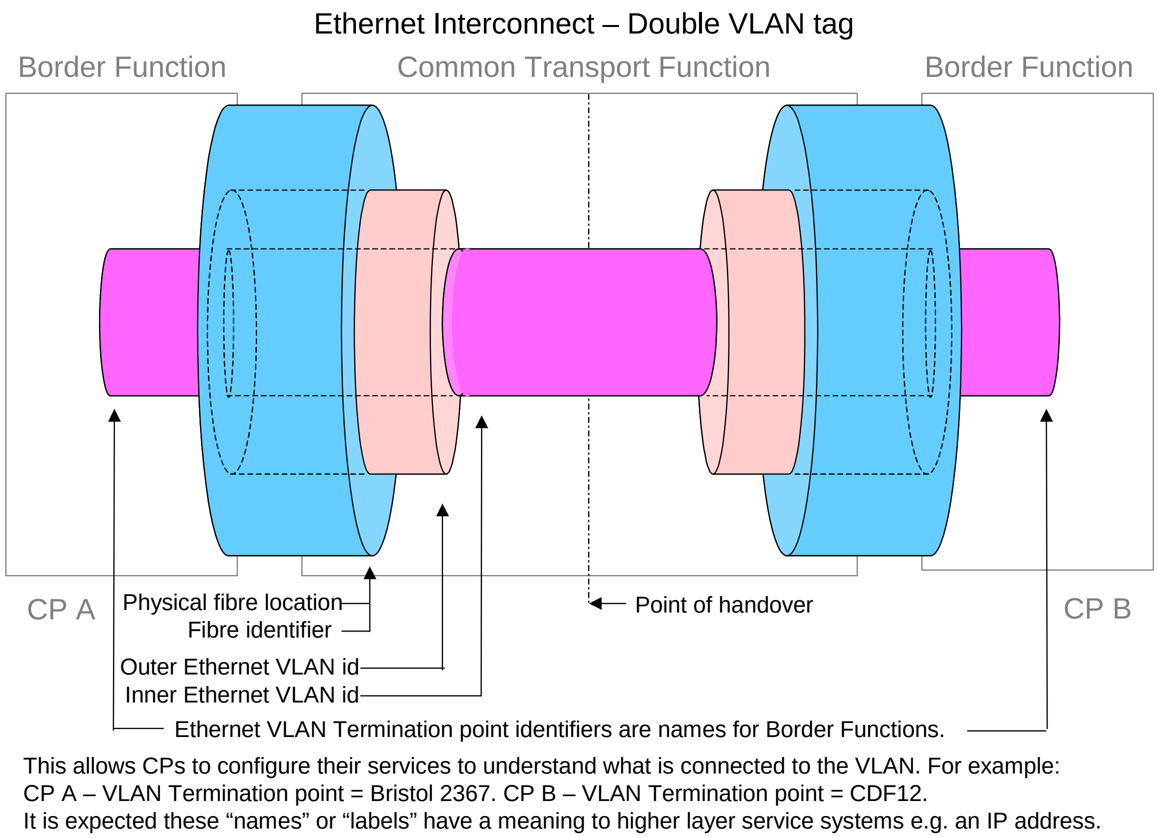


Figure 5: Ethernet Interconnect, Double VLAN method, Identifiers

7.2.10 IP Transport Capability

The following IP attributes need to be specified:

a) Whether single or double VLAN tags are used.
b) Maximum transmission unit size.
c) Which 802.1 P-bits (Priority) are used.
d) List of Ethernet VLAN ids.

Per IP VLAN the following needs to be identified:

a) VLAN termination points.
b) Bandwidth.
c) Burst size.
d) IP encapsulation type.

7.3 Fulfilment Processes

CPs offering NGN MSI service should provide processes to cover the establishment of NGN MSI service, and publicise these processes. The publicised processes should incorporate quality service levels, which should include the durations required to implement steps of the processes, and the overall duration of the fulfilment processes.

7. Fulfillment

7.1 Change of VLAN Capacity

During operation it is possible that traffic on the Connectivity Layer service utilising the Transport service may grow such that an increase in capacity from the Transport layer is required, or may reduce in volume such that Transport capacity can be released. Management co-ordination across the interconnect is required to ensure that such changes of bandwidth are achieved whenever possible without impact to either the requesting Connectivity Layer service or other Connectivity Layer services using the Transport service.

7.2 Increase of VLAN Capacity

When a CP forecasts that an increase in VLAN capacity will be required, that CP should notify the interconnected CP of a capacity increase request quoting the increased bandwidth size, which should be in accordance with the constraints specified in section **Error! Reference source not found.**. The CPs should ensure the increased VLAN bandwidth can be accommodated by the MSI and by each CP's internal transport facilities. Where the increased capacity cannot be supported on the path (either on the MSI or internally within a CP's network) and it is not possible to release capacity on other VLANs using the same Transport facilities, then an alternative path will need to be found, possibly on a different MSI. A disruption to Connectivity Layer service is likely during the switch over to this alternative path, see section 0.

Assuming capacity is available for the new VLAN size, and assuming bandwidth policing is in force, then each CP should increase the receiving policing bandwidth limit before either end increases the VLAN transmit size and shaper bandwidth. Once the VLAN bandwidth increase procedure has been completed by both CPs the Connectivity Layer service can be instructed to utilise the available bandwidth.

7.3 Decrease of VLAN Capacity

When a CP wishes to reduce VLAN capacity, that CP should notify the interconnected CP of a capacity decrease request quoting the reduced bandwidth size, which should be in accordance with the constraints specified in section **Error! Reference source not found.**.

At the agreed activation time, the CPs should ensure that the Connectivity Layer instance using the VLAN has been restricted to the reduced bandwidth, and adjust the transmit shaper to the reduced VLAN bandwidth. Once both CPs have reduced the VLAN transmit size, the receiving policing bandwidth limit can be adjusted downwards to the new bandwidth.

7.4 Cease of VLAN Capacity

When a CP wishes to cease an existing VLAN, that CP should notify the interconnected CP with a capacity cease request.

At the agreed cease time, the CPs should ensure that the Connectivity Layer instance using the VLAN has been stopped, and both CPs can then remove the VLAN from their transport systems. Charging for the VLAN facilities shall stop after an agreed notification period after the cease request.

7.5 Use of LCAS

LCAS is recognised as a technique for varying the capacity of an Ethernet link carried using GFP-F over an SDH VCG, without the need for an outage on the Ethernet link. LCAS is not a Purple or Green Release Requirement, but may be used across an MSI by bilateral agreement.Note: LCAS modifies only the size of the SDH VCG for GFP; the size of the service layer Ethernet VLANs using the GFP need to adjusted separately.

7.6 Rearrangement of Capacity

During operation it is possible that either CP may need to make a planned alteration to their internal Transport facility arrangements. This may, for instance, be to optimise use of transmission facilities, or to rearrange paths to allow a new VLAN or to allow a VLAN bandwidth increase.

Where the Transport Layer facility rearrangement would cause disruption to a Connectivity Layer service the CP requiring the change should inform the interconnected CP using a planned works order. The actual rearrangement should be undertaken at a time of low impact to the Connectivity Layer services, as mutually agreed by the CPs.

Where the Transport Layer facility rearrangement would cause no disruption to any Connectivity Layer service, the CP requiring the change may make the rearrangement without informing the interconnected CP.

7.7 Assurance Service Level Agreements

CPs offering NGN MSI service should provide processes to cover the establishment of NGN MSI service, and publicise these processes. The publicised processes should incorporate quality service levels, which should include the durations required to implement steps of the processes, and the overall duration of the fulfilment processes.

8. Accounting and Settlement

The charging arrangement associated with a MSI service offering is a commercial matter to be agreed between the interconnecting parties. Some technical aspects of the Transport Service Layer service offering which could influence charging are described in Appendix A.

Annex A (informative): Technical Basis for MSI Charging

Charging arrangements between interconnected CPs are to be agreed bilaterally. Some technical aspects of the Transport Service Layer service offering which might influence charging include:

- Type of handover (e.g. in-building or in-span).
- Distance covered by the MSI, including the use of extension VLANs
- VLAN Bandwidth.
- Class of Service.
- Burst size.
- Use of encryption, and encryption type.
- Type of connectivity service carried.

Charges might be levied for initial service establishment, changes to service characteristics (for example a change of bandwidth) and the duration of use.

Where a MSI is used to provide services for both interconnected CPs, the cost of the MSI might be split between the CPs on some agree basis, for example in proportion to the bandwidth of traffic owned by each party.

The type of handover and the distance related element, if charged, would normally be a charging aspect of the Transmission Layer, but in practice might be bundled in as factors affecting charging at the Transport Capability Layer.

VLAN bandwidth charges, at the Transport Layer, would typically be based on the total bandwidth available in the VLAN, not the actual bandwidth used. Likewise, any charge for burst mode would typically be based on its availability and not on the actual frequency of use of the burst mode.

In a strictly layered charging structure, differential charging based on the type of connectivity service carried would not be a function of charging at the Transport Capability Layer: different types of connectivity service would be charged independently by each Connectivity Layer charging function. However, in practise some Connectivity Layer services using a VLAN might result in different charging policies at the Transport Capability Layer. For example, signalling VLANs for PSTN/ISDN service and Voice Line Control service might be provided without charge at the Transport Capability Layer.

History.

Document history		
Issue 1	December 2006	Initial issue
v1.2.1	October 2008	Clarifications and alignment with Green release