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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
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Ethernet over Transport aspects

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INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Internet protocol aspects – Transport

Architecture of service management in multi bearer, multicarrier environment

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Architecture of Service Management in multi bearer, multicarrier environment

Summary

This Recommendation defines a set of requirements that are applicable to Client Service Management in multi-carrier, multi-transport-technology networks.

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ITU-T Recommendation G.8601/Y.1391

Architecture of Service Management in multi bearer, multicarrier environment

1	Scope	4
2	References.....	4
3	Terms and definitions	4
4	Acronyms and abbreviations	6
5	Conventions	7
5.1	Nomenclature	7
6	Introduction	7
7	Generic Description of Client Service Management	8
7.1	Generic Management Areas	9
7.1.1	End-to-End Management.....	10
7.1.2	Access Link Management	10
7.1.3	Edge-to-edge Management.....	10
7.1.4	Transport Management.....	10
7.2	OAM flow categories.	11
7.2.1	Customer OAM	11
7.2.2	UNI OAM.....	11
7.2.3	Path OAM.....	11
7.2.4	Service OAM.....	11
8	Business Relationship Models: Service Provider to End Customer	11
8.1	Single Carrier: Ownership Model 0 (OM-0)	12
8.1.1	Single Carrier Dark Fibre connection.....	13
8.2	Multiple Carriers	15
8.2.1	Ownership Model 1 (OM-1).....	15
8.2.2	Ownership Model 2	18
8.2.3	Incompatible Edge device	20
8.3	Composite Carrier Scenarios	21
9	Network Transport Technology	25
9.1	Drawing Conventions	26
9.2	Candidate Technologies	26
9.3	Technology Models	26
9.3.1	Single Technology Model	26

9.3.2	Multiple Technology Models	26
9.4	Applicability of Technology Models to Ownership Models	29
10	Applicable Client Service Types	31
11	Management Communication Functions	31
11.1	Performance Information	32
11.2	Commands and responses	34
11.3	Autonomous Notification	34
11.4	Remotely Located NE (CLE) Software Up-grades	35
12	Testing Requirements	35

1 Scope

This Recommendation defines architectural requirements for the edge-to-edge management and/or control of client services transported over various transport network topologies and technologies. The services for which such management capabilities are required are included.

The requirements for the transference of the management and/or control data between the edge points is described along with the requirements for accessibility to management and/or control information at some point in the network, other than the end point.

The provision of such management services is also considered in the context of business relationships that may be involved in the delivery of a service to, for example, the Service Provider, Network Operator(s) and the Enterprise End customer. Consideration is also given to the management and/or control of Customer Located Equipment which is owned by the Service Provider and carrying said services.

Although the client service management detail is not within the scope of this recommendation, consideration is given to three generic management and/or control functions: performance reporting, status reporting and client service control (e.g. loopback, end node configuration etc).

This Recommendation describes the architecture for service management and/or control, and includes the reference points of the architecture. It does not define the implementation methodology or any of the interfaces that may need to be specified.

2 References

ITU-T Recommendation G.707/Y.1322 (2000), *Network node interface for the synchronous digital hierarchy (SDH)*.

ITU-T Recommendation G.709/Y.1331 (2003), *Interfaces for the Optical Transport Network (OTN)*.

ITU-T Recommendation G.806 (2004), *Characteristics of transport equipment – Description methodology and generic functionality*.

3 Terms and definitions

This Recommendation defines the following terms:

3.1 Anomaly: (See G.806)

“The smallest discrepancy which can be observed between the actual and desired characteristics of an item. The occurrence of a single anomaly does not constitute an interruption in the ability to perform a required function. Anomalies are used as the input for the Performance Monitoring (PM) process and for the detection of defects.”

3.2 Defect: (See G.806)

“The density of anomalies has reached a level where the ability to perform a required function has been interrupted. Defects are used as input for PM, the control of consequent actions, and the determination of fault cause.”

3.3 Degrade: A degrade is the presence of a defect for a sufficient period of time that impairs the ability of a resource to perform the desired function.

- 3.4 Edge Service:
The service from the perspective of a single SOF.
- 3.5 Edge-to-edge:
The path serving the service that source at a local SOF (Service Origination Function) and sinks at a remote SOF.
- 3.6 End-to-end:
The complete path that the customer/client signal takes that sources at a local Customer Equipment (CE) and sinks at the remote CE.
- 3.7 Failure: (See G.806)
- “The fault cause persisted long enough to consider the ability of an item to perform a required function to be terminated. The item may be considered as failed; a fault has now been detected.”
- 3.8 Fault: (See G.806)
- “A fault is the inability of a function to perform a required action. This does not include an inability due to preventive maintenance, lack of external resources, or planned actions.”
- 3.9 MAP: Management Access Point.
- The Management Access Point is the point in the transport network where the Management System has its point of contact for purposes of management and/or control. This MAP may be at any point in the transport network including at the edge of the transport network.
- 3.10 Network resource:
- Resources that are owned and managed by the SP in support of the offered customer service.
- 3.11 Service Status:
- Service status indicates that the service is in one of four states.
- 1) Operational: Service is operating within the bounds of the established SLA.
 - 2) Degraded: Service is operational; however, its performance is degraded in reference to the SLA.
 - 3) Failure: Service failure has occurred and is not operational.
 - 4) In-test: Service is under control of service/network operator for maintenance actions.
- Service failure may be attributed to path level defects, service failures at the client link, or significant disparity in achieving adherence to the SLA.
- The Service Status is generated by each SOF. The Service Status is generated by comparing local edge-service PMs and remote edge-service PMs (conveyed between edges) to formulate edge-to-edge service PMs. These edge-to-edge service PMs are then compared to SLA thresholds to determine the operational disposition of the service.
- 3.12 SMF: (Service Management Function.) A logical entity found within a service-aware NE that performs Management Access Point (MAP) and/or Test Access Point (TAP) functions.

- 3.13 SOF: (Service Origination Function.) Network Element (NE) function, managed by the Service Provider (SP) which represents the edge optical service point. It performs customer frame/signal mapping to the SP optical network. Typically incorporates a SMF.
- 3.14 UNI: (User Network Interface.) The UNI is the bearer between the CPE and the Network

4 Acronyms and abbreviations

This Recommendation uses the following abbreviations:

ETH	Ethernet MAC layer network
ETY	Ethernet Physical interface
CE	Customer Equipment
CLE_NE	Customer Located Equipment Network Element
CPE	Customer Premise Equipment
C/R	Command Response
CSM	Client Service Management
EM	Element Management
FD	Flow Domain
MAP	Management Access Point
NE	Network Element
NM	Network Manager
NMS	Network Management System
NNI	Network to network interface
NO	Network Operator
OAM	Operations, Administration and Maintenance
OAMiF	OAM in Frame
OM-n	Ownership Model n
OSS	Operator Supervisory System
OTN	Optical Transport Network
PE	Provider Edge
PL	Private Line
PM	Performance Monitoring
PDH	Plesiochronous Digital Hierarchy
PTE	Path Terminating Equipment
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
SM	Service Management
SMF	Service Management Function

SNC	Sub Network Connection
SOF	Service Origination Function
SP	Service Provider
SS	Service Status
TAP	Test Access Point
UNI	User Network Interface

5 Conventions

5.1 Nomenclature

For purposes of signal identification the following nomenclature will be used in this recommendation

Signal Names will have the format: Letter.number.number

Where Letter represents the Service Provider (SP)

(e.g. R = Red SP; B = Blue SP; G = Green SP; P = Purple SP)

Number represents the individual signal number belonging to the SP

Number represents the Ownership Model (OM)

Examples:

R.3.1 is Owned by Red SP (SP_R), and is SP_R's 3rd signal and is configured as OM-1

B.1.0 is Owned by Blue SP (SP_B), and is SP_B's 1st signal and is configured as OM-0

P.2.2 is Owned by Purple SP (SP_P), and is SP_P's 2nd signal and is configured as OM-2

Note: The ownership model at each edge of a client signal connection may be different; this is dependant of the location of the MAP and whether the SP owns the edge device.

6 Introduction

Service providers are demanding a simple service model for transport of Client Data Services over networks that fits their existing operational model. That is, the Client Data private line service must be analogous to existing private line services, and more importantly must interface into existing management systems.

This Recommendation is structured with **numbered requirements** integrated into the descriptive normative clauses. In some instances where a requirement is applicable to more than one clause there will be a reference to the original instance of that requirement. All requirements will appear on a separate line in **Bold**.

Note: The numbering is not always contiguous to allow for insertion of requirements if and when this document is updated.

R1 Management of the Client Private Line Service should interface to existing management systems.

R2 A defect or failure in a given layer network should not cause multiple alarm events to be raised, nor cause unnecessary corrective actions to be taken, in any higher level client layer networks. This applies to all client layer network types that the Private Line service is required to carry.

- R3** If a network defect or failure occurs in an interface, mapping function, or path, it is necessary to detect it, diagnose it, localise it, notify the NMS/OSS and take corrective actions appropriate to the type of defect. The primary objective is to reduce operating costs by minimising service interruptions, operational repair times and operational resource.

The business drivers for managed Client Services are: -

- Manageability of the network
- Management of the service offered to the customer
- Interconnection of billing/management data to carrier OSS systems
- Accessibility of Performance data for confirmation of Service level agreement (SLA) conformance.

Also of importance is the manageability of remotely located Customer Located Equipment (CLE).

Several business models are used to define the requirements for Client Service Management (CSM).

The Network Technologies and combinations thereof are defined, as are the applicable Client Service types.

- R4** To confirm SLA compliance with the customer, the Service Provider (SP) must have visibility of the performance of the Client Interface at the edge of the transport network.

- a) The edge NE must support the ability of a remote device to query service configuration information. (i.e., Service or Circuit ID, service PM, thresholds, etc...)

- R5** To confirm SLA compliance with the customer, the SP must have visibility of the mapping function performance at the edge of the transport network.

- a The edge NE must support the ability of a remote device to query the edge devices mapping function performance.

7 General Description of Client Service Management

Client Service Management (CSM) is the management and/or control of the client services by the Service Provider (SP), regardless of the location of the SP (within the topology of the transport network) and consists of the following general management and/or control functions: -

- a Performance Monitoring at the edge of the transport network.
- b Monitoring of the Status of the Edge-to-edge transport connection.
- c Control of the 'edge' device (commands & responses to/from the edge device).
- d Generation and reception of anomalous conditions of the service and the NE at the edge.

The components of CSM will be dependant on:

- I) Business relationships between SP and enterprise customer.
 - i) Single Carrier configuration
 - ii) Multiple Carrier configuration
- II) Network Transport Technologies (and combinations thereof)
- III) Communications between SP and edge device necessary for *a – d* above

7.1 General Management Areas

While more complex network diagrams are possible, a simple model of a Client Data network to show the management areas would only show the endpoints of a single carrier's network. This is based on the relationship shown in Figure 1/G.8601.

The simple Client Data network management areas shown in Figure 1/G.8601 are: -

- A. End-to-End: CE - CE (i.e., service - customer to customer): Customer OAM
- B. Access Link: CE - PE (i.e., facility - carrier to customer): Access OAM
- C. Edge-to-Edge: PE - PE (i.e., service - intra carrier): Service OAM
- D. Transport (i.e., facility - intra carrier): Path OAM

FCAPS (fault-management, configuration, accounting, performance, and security) is an acronym for a categorical model of the working objectives of network management. The carriage of management information is often dependent on the network or service that is being managed. Each of these four areas would have a carriage and FCAPS component.

- R6 The OAM functionality of optical PL service should not be dependent on any specific server or client-layer network. This is architecturally critical to ensure that layer networks can evolve (or new/old layer networks be added/removed) without impacting other layer networks.**
- R7 The use of Service OAM functions should be optional for the operator. Network operators should be able to choose which OAM functions to use and which connections they apply them to.**
- R8 In the case of failures, OAM mechanisms provided should ensure (as far as reasonably practicable) that customers should not have to detect failures. It is therefore necessary that service faults be detected and notifications sent to the SP.**
- R9 In the case of degraded performance, OAM mechanisms provided should ensure (as far as reasonably practicable) that customers should not have to detect service degrades. It is therefore necessary that service degrade conditions be detected and notifications sent to the SP.**

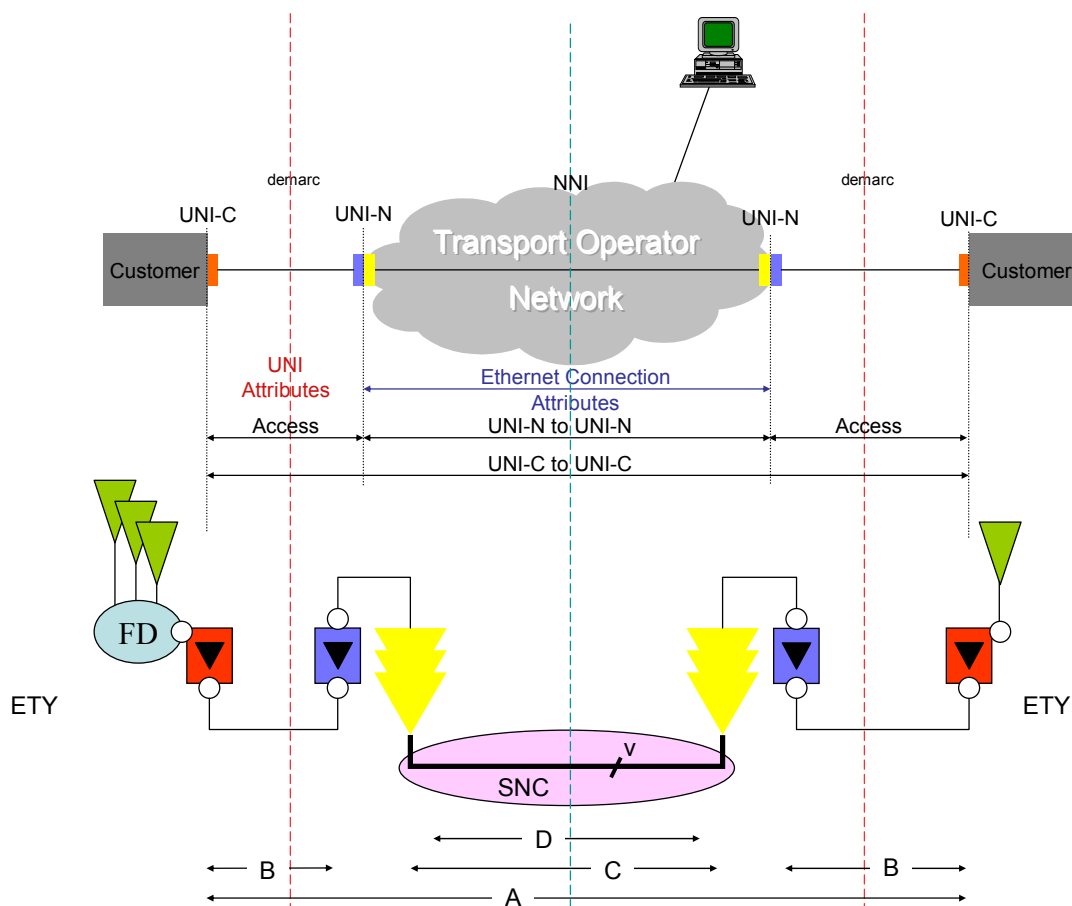


Figure 1/G.8601: Simple view of General Management Areas

7.1.1 End-to-End Management

This is the management performed by the Enterprise customer between clients at both ends (A in Figure 1/G.8601). This service management of live traffic assumes the Client Data link through the transport network to be transparent.

7.1.2 Access Link Management

This is the enterprise customer to transport portion of the Client Data connection (B in Figure 1/G.8601).

7.1.3 Edge-to-edge Management

This is the management of Client Data Services over the transport network (C in Figure 1/G.8601). This will carry data relating to the service edge function/process and also relevant information from the terminated link management.

7.1.4 Transport Management

This is the network management of the carrier's facilities, for example, fault isolation within the carrier's network (D in Figure 1/G.8601). It is performed using well-defined transport network management techniques.