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FS-VDSL EMS to NMS Interface Functional Requirements

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FS-VDSL EMS to NMS Interface Functional Requirements

1. Introduction

1.1 Purpose

The purpose of this working text is to provide high-level functional requirements describing a north-bound interface from an FS-VDSL Element Management System (EMS) to the Network Layer Network Management System (NMS) for ATM-based FS-VDSL access networks. The architecture of an FS-VDSL access network is defined in ITU-T Recommendation H.610 [13]. This working text defines an interface that is based on the ATM Forum's M4 Network View-logical MIB [2] and ITU M.3100 network management standards [6]. FS-VDSL-specific requirements such as NE-level VDSL configuration and operational data should be exposed over the FS-VDSL EMS to NMS interface described herein. These functional requirements will provide input to subsequent EMS/NMS interface information modeling work as well as provide a basis for a future protocol-dependent interface specification. The working text uses requirements contained in ITU-T Recommendation H.611 [4] and in the DSL Forum TR-30 [5].

1.2 Document Road Map

This contribution addresses the following areas for the EMS/NMS interface in the FS-VDSL environment:

- Section 2 addresses the network management architecture.
- Section 3 addresses the functional perspective of the EMS and NMS.
- Section 4 addresses the interface functional requirements including
  - general requirements and assumptions,
  - configuration management,
  - fault management,
  - performance management
  - security management.
  - accounting management
- Section 5 addresses the references for this document

2. Network Management Architecture

This section describes a typical Full-Service Broadband Network Management Architecture for managing an ATM-based FS-VDSL access network which provides the basis for this working text. In a Full-Service Broadband OSS architecture, an NMS provides end-to-end network management functions for a multiple-supplier, multiple-technology network. This architecture leverages the capabilities of network-supplier EMS products and also supports gateway interfaces to upstream Operation Support Systems (OSS).

Figure 1 depicts the typical environment in which the FS-VDSL EMS and Full-Service Broadband NMS could co-exist. Note that the Full-Service Broadband NMS interfaces to sub-network management systems to actually manage the network. The network managed by the NMS could include ATM, SDH, FS-VDSL and other broadband type network elements and EMS(s).

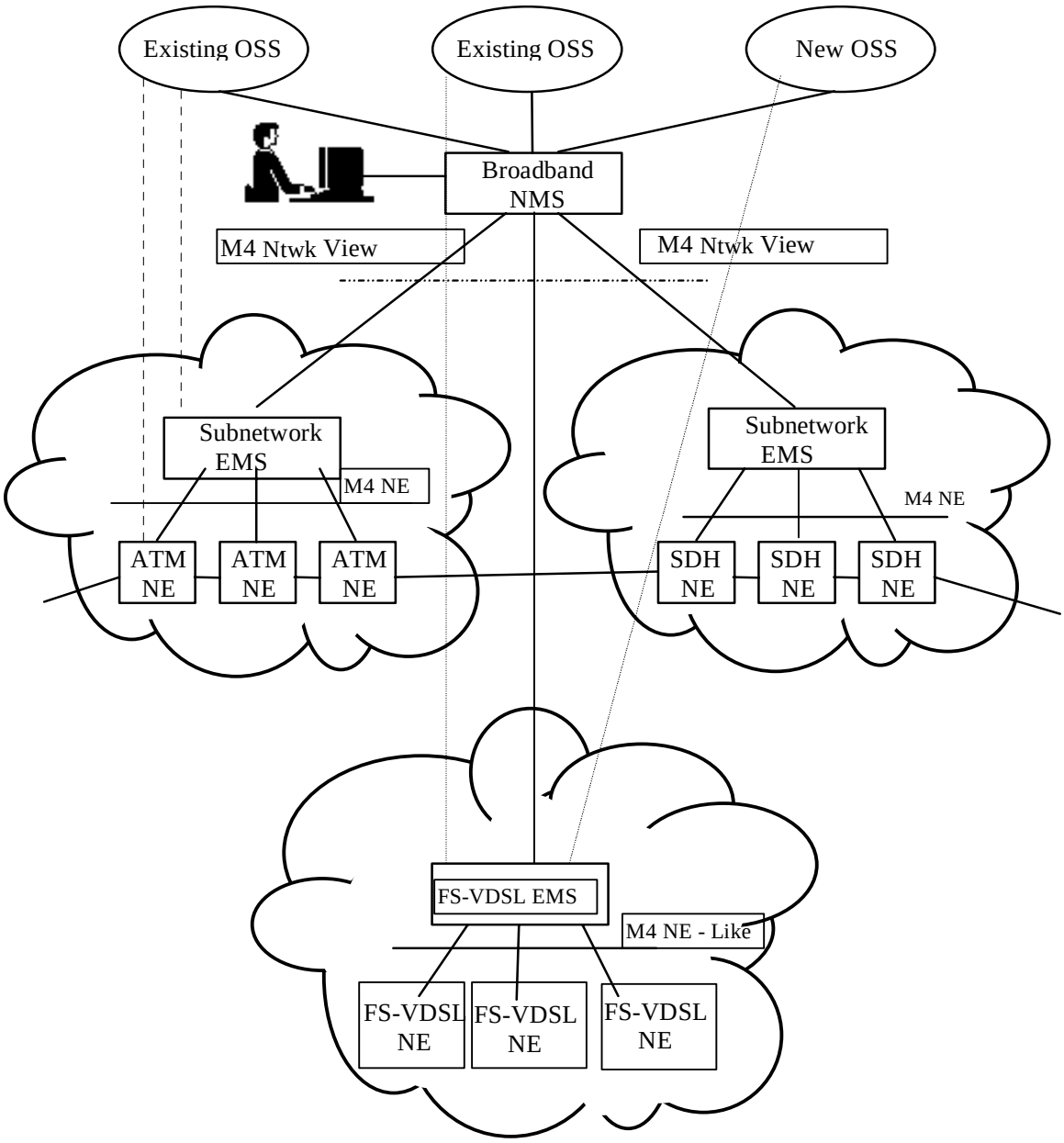

Figure 1. Example of Full-Service Broadband NMS Environment

3. Functional Perspective

For informational purposes only, this section addresses the functional perspective of the FS-VDSL EMS and Full-Service Broadband NMS, and EMS to NMS interface implementation guidelines. NEs typically interface to an FS-VDSL EMS as shown in

Figure 2. This EMS can be considered a supplier-specific EMS. The supplier typically provides documentation on the capabilities of that EMS. The EMS may have either an open interface or a proprietary interface to allow it to manage a sub-network of NE(s). If there is a choice between a standards-based versus proprietary interfaces standard MIBs are preferred. [1]

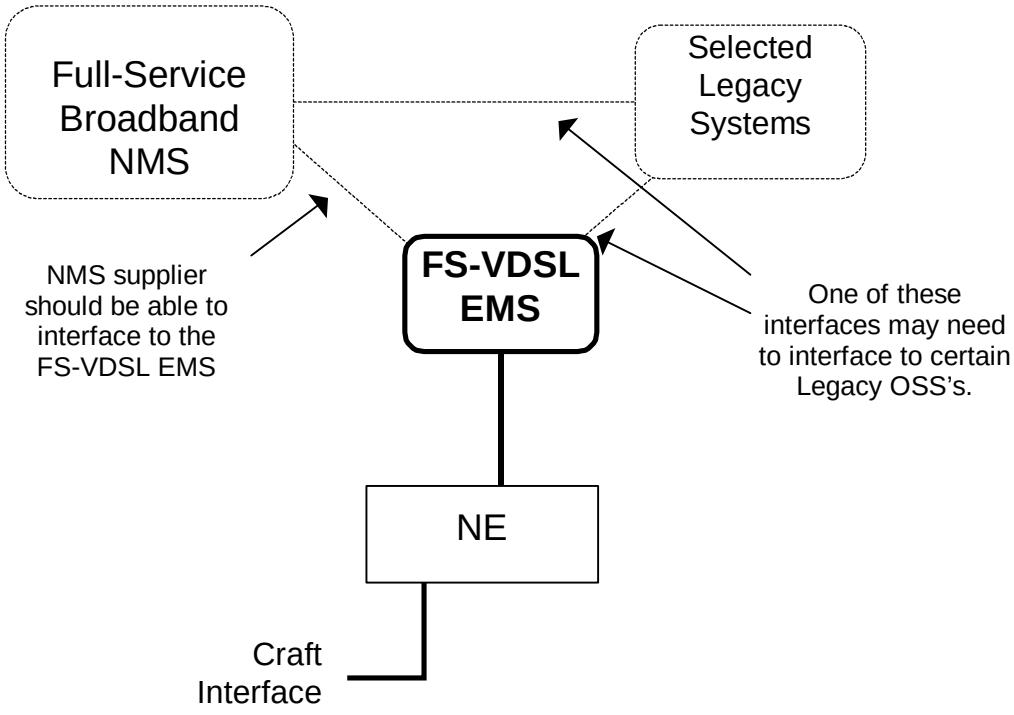

Figure 2 Example of an FS-VDSL Network Management Architecture

3.1 Assumed Functions of the EMS

The FS-VDSL EMS provides element-level management of the ATM-based FS-VDSL platform [13] made up of the IWCN, OLT, OTU-Cs, OUT-Rs, ONUs, VTU-Cs, and VTP/Ds. Element management capabilities to be performed include, but are not limited to, the following:

- Inventory and Utilization Management for aiding network planning.
- Configuration Management for creation/deletion of the VDSL line parameters between the VTU-C and VTP/D
- Connection Management for setting up/tearing down VCC(s) between the user and the network
- Access Management for broadcast video channels

[1] An "open" interface is one which has been published in sufficient detail for other manufacturers to build equipment that can inter-operate. A "standard open" interface is not only published, but has been agreed to in a standards body, such as the IETF.

- Fault Management for assessing the impact of VDSL line and ODN failures
- Security Management for partitioning the element layer view and control
- Accounting management to extract parameters used in billing
- Establishing and monitoring the communication between the EMS and NE(s)

3.2 Assumed Functions of the NMS

The Full-Service Broadband NMS will provide end-to-end network-level management of Broadband networks composed of ATM, FS-VDSL and other potential broadband sub-networks. Network Management capabilities to be performed include but are not limited to the following:

- Planning management for controlling network build.
- Configuration Management for creation/deletion of network links that connect sub-networks
- Connection Management for setting up/tearing down end-to-end VCC(s) using inter-sub-network routing
- Access Management for video broadcast channels
- Fault Management for assessing the impact of network link failures on existing VCC(s)
- Security Management for partitioning the network view and control
- Accounting Management for billing purposes
- Communication with EMS systems for managing individual sub-networks.

The Full-Service Broadband NMS should provide gateway interfaces to existing OSS and new OSS to support service activation, service assurance, network planning, network engineering and billing.

The Broadband NMS should provide a cut-through capability from the NMS GUI to a specific EMS as if the NMS user is using the EMS GUI.

The NMS shall be responsible for data synchronization between the NMS and the EMS(s) by on-demand auditing of the EMS database(s). The NMS shall also be able to audit a specific part of the EMS database(s). The steward for interface objects is the EMS, but the NMS is responsible for synchronization.

3.3 Implementation Guidelines

3.3.1 NMS to EMS Interface

The NMS commands are targeted for the EMS(s). How the command is processed by the EMS is an internal EMS design choice. For example, an EMS may respond to the NMS command by looking at its database, or it may send a request to its subtending NE(s) to obtain the requested information and then respond back to the NMS. Furthermore, to

respond to a NMS request, an EMS may need to issue multiple commands in its domain to perform the requested NMS operations. It is up to the EMS to perform such tasks.

3.3.2 EMS Translation to Vendor-Specific Parameters

The intent is to provide a unified EMS/NMS interface across all the EMS(s). The EMS(s) should be responsible for translating all standard information (e.g. Managed Object representation) to vendor-specific representation.

4. Interface Functional Requirements

This section addresses the EMS to NMS functional requirements categorized by the systems management functional areas defined by the ITU [6]: Configuration Management, Fault Management, Performance Management and Security Management and Accounting Management.

4.1 General Requirements

4.1.1 EMS Responses to NMS Messages and Their Correlation

The EMS response to NMS messages will contain a correlation indicator to the NMS input command. In the response to an NMS message, the EMS could echo back the same correlation indicator contained in the NMS message. The NMS is responsible for the uniqueness of the correlation indicator across all its subtending EMS(s).

4.1.2 Sequence Number for Autonomous EMS messages to NMS

For each EMS autonomous message to the NMS, the EMS shall assign a sequence number for that message. Such a sequence number should be included in all EMS autonomous messages. Note that these autonomous messages may be EMS-generated or NE-generated alarms, events or report database changes. These sequence numbers are used by the NMS to identify the missing autonomous EMS messages.

4.1.3 Logging of Autonomous EMS messages

The EMS should provide a logging function for all autonomous messages generated by the EMS or the NE.

4.1.4 Logical NE Definition

A Logical NE (LNE) is a collection of NE(s) which can be viewed from an NMS perspective as a single provisionable and/or maintainable entity. To implement an NMS logical NE command, an EMS may need to issue multiple commands to perform the requested logical NE operations in its domain. For provisioning, the NMS needs only to define the entrance and exit points to the FS-VDSL platform. The EMS will then take care of all appropriate cross-connects and routing in its domain.

Logical NE sub-network is required for ATM connection management to set up, release, and modify point-to-point and multi-point ATM sub-network connections. Network

View objects will be used even though the EMS will send objects per NE. It is recommended that atomic sub-networks be supported.

4.1.5 Association of Flow ID to NE Autonomous Messages

The circuit ID is an important concept in a Service Provider's environments. Traditionally, this circuit ID is applied to network physical entities. It is proposed that this concept be extended to the logical ATM entities such as VCCs and VPCs by using flow_ID.

The general philosophy is as follows: the NMS requests a particular flow across the FS-VDSL Platform to a specific VTP/D; the EMS checks that such a flow is possible and then assigns a flow_ID. The EMS then stores the flow_IDs and appends them to the associated NE autonomous messages, whenever they are forwarded from the EMS to the NMS. This would require an EMS to be able to relate the flow_IDs to:

- ATM VCC(s) (an end-to-end connection consisting of multiple VPL(s))
- Cross EMS Virtual Paths (VP(s))
- Cross EMS physical transmission facilities (e.g., VDSL, PON)
- VDSL lines

Hence, the flow_ID relates to both, physical facilities as well as ATM logical entities.

If an autonomous message is associated with the high level failure (e.g., an OLT), then the flow_IDs affected by that failure shall be appended to the message which is sent from the EMS to NMS.

4.1.6 Support of NMS/EMS Link Heartbeat

The EMS should send periodic heartbeat notifications to the NMS to indicate that it is alive at user-definable intervals. The option to disable this notification should also be provided.

4.1.7 EMS Acknowledgment

If the actual response to specific NMS messages cannot be generated within a pre-specified time period, the EMS shall send an appropriate acknowledgment to the NMS. An acknowledgment is a response to an NMS request. This acknowledgement may be implemented for specific commands for which a response could take a long time. If the response to an NMS input command takes longer than a pre-specified time interval, the EMS shall periodically issue an acknowledgment message indicating the pending state of the NMS-requested operations. These acknowledgments imply the command is being executed. The EMS should continue to send acknowledgment messages at every interval of the designated delay period until the "completed" or "denied" response is sent back to the NMS. The periodicity of acknowledgments should be a settable parameter. This feature prevents the NMS operator from issuing a command multiple times due to not receiving a response in a reasonable timeframe.

Example: If the NMS requests an EMS to perform NE software restoration and completing such task could take approximately 20 minutes, then that EMS should send an appropriate acknowledgment to the NMS indicating that the requested operations is being performed.

4.1.8 EMS Information

Information about the EMS should be available on demand to the NMS, ie disk space, memory, CPU usage against resources allocated to the EMS, status of links between the EMS and nodes.

4.1.9 Event Handling

The first instance of an event should be recorded. All identical events within ***n*** seconds should be counted and made available for inspection. ***n*** is configurable via the NMS-EMS interface.

An event shall be considered cleared after the last recorded event has not reoccurred for ***m*** seconds. ***m*** must be configurable across the NMS-EMS interface.

4.1.10 Software Upgrades

It shall be possible to initiate software upgrades for any part of the FS-VDSL Platform via the NMS-NMS Interface. It should be possible to group network elements together in various logical ways to initiate the upgrade of multiple elements with a single command. As a minimum this should include all VTP/Ds on an OLT.

4.2 Configuration Management

4.2.1 Retrieval of the NE List

The NMS shall be able to request an EMS to provide the list of NEs under its domain. This will include the following information where applicable: software version, hardware version, serial number, MAC address, IP address, ATM address, vendor and model number, together with the flow_IDs they support.

4.2.2 Manipulation and Application of EMS Profiles

The NMS operator should be able to retrieve, create and distribute EMS profiles through the NMS/EMS interface. The NMS shall also have the capability to request an EMS to apply a specific profile or a QOS class (i.e., super profile).

It is assumed that at the time of installation, when the NE is activated, it will automatically come with factory default parameters. However, if a different profile (other than the factory default profile) is needed, the NMS operator must have the capability to request the EMS to apply the NMS-requested profile. The NMS operator shall be able to perform this function across the EMS via an NMS/EMS command. Hence, the NMS

must have the capability to specify and request the EMS to apply a specific EMS-stored profile.

Retrieval of profiles and their content is a requirement. Creating and deleting profiles is also useful, however, modifying profiles would not be required. The VDSL profile and traffic descriptor profiles as well as any other VDSL-related profiles should be exposed through the interface. Profiles need not necessarily exist in the NMS.

4.2.3 ATM Level Cross-connection (Logical Provisioning)

The EMS shall be able to receive an ATM level cross-connection request from the NMS. To activate a service, one or multiple cross-connect commands from the NMS to EMS may need to be issued. The cross-connection may be at the VC level or VP level, as required. The following information shall be included in a cross-connect message:

- Ingress assigned port on an NE (or logical NE) and specific VPI/VCI or VP
- Egress assigned port on NE (or logical NE) and VPI/VCI or VP
- Identification of ATM traffic descriptor profiles, as appropriate
- VCC ID associated with ATM VCCs and VPC ID, as appropriate
- Type of cross-connection (point-to-point, multi-point, broadcast, etc.)

The NMS shall also be able to request to disconnect (i.e., tear down) the existing VPL and VCL cross-connections.

4.2.4 VDSL Line Configuration

The NMS shall be able to set and read the VDSL Line parameters defined in Reference 12 as appropriate.

4.2.5 ONU and OLT Configuration Parameters

The NMS shall be able to set and read any configurable ONU and OLT parameters as required.

4.2.6 Start Service

The NMS shall be able to initiate service by commanding the EMS to set up an appropriate flow as determined by the relevant profile. Once service is verified the EMS will respond with the allocated flow_ID and a date/time stamp.

4.2.7 Cease Service

The NMS shall be able to cease service by commanding the EMS to stop a specific flow_ID. It may also be able to cease multiple services by commanding the EMS to stop a list of flow_IDs. The EMS shall supply the date/time stamp showing when the flow_ID was stopped.

4.2.8 VTP Identifier

The EMS shall be able to communicate a specific VTP_ID to the NMS. If null any VTP_ID can be accepted.

4.2.9 Allow/Inhibit Switching of ATM Cell Flow

The EMS to NMS interface shall support the NMS request to inhibit/allow the switching of ATM cell flow for a particular VP/VC cross-connection. When the cell flow is inhibited, the EMS shall continue to maintain the existing cross-connect relationship.

4.2.10 Request EMS to Retrieve NE Inventory Data

The NMS shall be able to request an EMS to retrieve NE physical and logical inventory data. The EMS shall respond to the NMS query by either retrieving the data from its database or directly from the NE(s).

The physical inventory data includes a list of all cards (including hardware & software versions), associated ports and their current state, if available, such as:

i) in-service,
ii) available (installed but not in service), and
iii) pending or reserved designations. (The pending or reserved state indicates that the port has been assigned by the EMS, but it has not yet been put into service.)

The logical inventory data includes a list of all VC and VP cross-connect tables in a NE with associated current states (e.g., inhibit/allow switching, QOS, VCC ID, etc.)

The NMS shall be able to request the EMS to provide the current software version of a specific NE, including all cards. The NMS shall also be able to request the software version of all the NEs under an EMS domain. It is up to the EMS to respond to this request based on the information in its database or to query such data from the NEs.

4.2.11 Request EMS to Provide an Available Port Assignment

The NMS shall have the option to request the EMS for an available port assignment. The EMS shall respond back by assigning a specific port from its inventory and changing the state of that port from "available" to "reserved" so that it can not be re-assigned before service activation. If the "pending" state of a port is not changed to "working" state after a user-defined time, the EMS shall send a warning message to the NMS. If no action is taken by the NMS, the EMS shall change the port status back to "available". This is to avoid indefinite tying up of the network resources if the service activation has not taken place.

4.2.12 Notification of Resource Requirements

If there are no spare resources to fulfill a service request then the EMS shall propose a list of equipment that needs to be installed to allow the request to be fulfilled. The equipment list shall indicate:

- the type of equipment to be installed;
- the location where it is to be installed (rack/shelf/slot, OLT or ONU, etc.);
- the software and hardware versions that are compatible with the existing version of installed hardware.

4.2.13 "On-Demand" Discovery of Network Topology

The NMS shall be able to request, on demand, the EMS to provide the view of the sub-network of the EMS for all physical hardware and software components. This should include associated facility link information and link terminations for the network elements. The NMS shall be able to construct an updated physical network map/topology view from such information.

If the EMS automatically and autonomously performs network discovery and has updated information in its database, then it should provide such information to the NMS, upon request. The information will also indicate the status of any component of the sub-network, ie in-use, spare, faulty.

4.2.14 Auto-discovery

The NMS-EMS interface will allow for the transmission of the auto-discovered information from the EMS to the NMS. This transparent flow-through of EMS information to the NMS is considered critical to the successful operation of a Broadband NMS.

4.2.14.1 Auto-discovery of "Physical Network" to NMS

Whenever the EMS creates, deletes or discovers a new NE, card, port, VTP/D, or facility termination, the EMS shall send an autonomous message to the NMS informing it of the new discovery with appropriate identification. The message shall also indicate the result of any self-test of a newly discovered component. This requirement does not specify "how" an EMS creates, deletes or discovers the underlying resources. Such discovery function could have been performed:

- Manually by the EMS user
- NE autonomous messages
- EMS automatic inquiry

In the case of a VTP/D the VTP_ID shall be passed to the NMS.

4.2.14.2 Auto-discovery of "Logical Network" to NMS

Whenever the EMS creates or deletes a new ATM flow, the EMS shall send an autonomous messages to the NMS informing it of the action with appropriate identification, ie its flow_ID (which will include the VTP_ID of the VTP/D that terminates the flow).

4.2.15 Retrieve EMS Software Version

The NMS shall be able to request the EMS to report it's software version.

4.2.16 Edit User Definable Labels

The NMS shall have the ability to edit all user definable labels, such as circuit IDs, for connections, ports, and NE(s) is required.

4.2.17 Access Control

Once a service is provided it is required to be able to download across the NMS-EMS interface an access control bit map that defines what multicast ATM flows a customer is able to connect to. The bit map can be associated with either a flow_ID or a VTP_ID. If a flow_ID is not specified then the access control bit map applies to all flows that contain the VTP_ID.

The NMS should also be able to read the access control bitmap from the EMS, along with its associated VTP_ID or flow_ID.

4.3 Fault Management

4.3.1 Forwarding of the NE Alarms/Events from EMS to NMS

The EMS shall provide appended information associated with NE messages before they are forwarded to the NMS. The EMS must forward all alarms/events (i.e., the ones passing through the filter residing in the EMS, see subsequent sections) originating from the NEs. This section addresses reporting of NE-generated alarms and events from EMS to NMS.

The EMS shall append the following information to the NE messages received at the EMS, before they are forwarded to the NMS:

i) A unique EMS sequence number for the autonomous messages.
ii) Appending of User Definable Labels and/or Platform assigned labels (i.e. flow_ID, Equipment_ID) to the NE messages are required before transmitting them to NMS. The User Defined Labels are provided, by the NMS to the EMS(s) during the capacity and service activation processes.

Appending of a label to a NE-generated message should be provided in the following cases:

a. For those messages which are directly related to flows. Such labels are provided by the NMS to the EMS(s) during the capacity & service activation processes. The labels should be appended to the message.
b. For those autonomous messages which are directly related to physical VDSL, ODN facilities terminating on the NE. Such a label may be manually input into

the EMS(s) during the capacity activation/resource provisioning process. The label should be appended to the message.

If an autonomous message is not directly related to a label (e.g., equipment alarm), then appending of all the impacted labels is not required.

4.3.2 Autonomous Reporting of EMS-Generated Events/Alerts

In addition to NE-generated alarms/events, the EMS will generate an autonomous message to the NMS to report the following conditions:

- EMS/NE link failure
- Internal EMS processing errors

4.3.3 Upload Autonomous Messages Upon Link Re-activation

If the NMS/EMS link goes down, the EMS shall log the autonomous messages (i.e., NE and EMS-generated alarms/events) that would have been sent to the NMS if the link was operational. Upon link re-activation, the NMS will automatically request the EMS to upload all stored autonomous messages for the duration of the time that NMS/EMS link was down.

4.3.4 Manipulation of the EMS Alarm/Event Filter from NMS

The EMS shall provide a "filter" for alarms/events which are sent from EMS to NMS. The NMS shall be able to manipulate the EMS filter for autonomous messages so that the NMS can receive only an appropriate subset of EMS-originated or NE-originated messages. The parameters specified in this message shall specify the criteria for filtering messages at the EMS level. The messages must be able to allow/inhibit EMS events from being transmitted to NMS based on parameters such as:

- Facility termination, ATM VCC(s), equipment, subscriber, etc.
- EMS-initiated, NE-initiated, etc.
- NE ID
- Severity of alarms such as Critical, Major, Minor, etc.
- Message type (Alarms, TCA(s), PM, etc.)
- User Definable Label (for both physical and logical entities)

If specific type of EMS autonomous messages are inhibited, this should not impact other commands issued by NMS and responses provided by that EMS.

The following two features may be implemented as a separate feature or as a specific implementations of the above filtering capability.

4.3.5 Allow/Inhibit EMS Uplink Autonomous Messages to NMS

The NMS shall be able to allow/inhibit "all" the EMS autonomous messages sent to NMS. This includes NE-generated events and EMS-generated messages. This feature

may be used to prevent flooding of the Data Communication Network (DCN). (Special case of Requirement 4.3.4)

4.3.6 Allow/Inhibit Specific NE Autonomous Messages

The NMS shall be able to allow/inhibit EMS transmittal of autonomous messages related to a particular NE. When the NMS inhibits autonomous messages from a NE, no messages from that NE are sent over the EMS/NMS link. The EMS should continue to receive autonomous messages from that NE. This requirement provides the capability to exclude a NE from being monitored by the NMS while it is behaving abnormally and too many alarms/alerts are generated by that NE. (Special case of Requirement 4.3.4.)

4.3.7 Retrieval of Current NE Status Information

This requirement allows the NMS to retrieve current NE-specific information (i.e. current problem list, operational data) from the EMS for diagnostic purposes. This data is used to evaluate the current network situation either before or after maintenance operations. The NMS shall be able to restrict the status information to specific parts of the NE (i.e. ports, boards or miscellaneous equipment (e.g. fans, power supply)). The EMS shall not apply any filtering to this data. If an EMS cannot provide this data from its database, it must query the NE to acquire the information.

4.3.8 VDSL Line Status

In particular the NMS shall be able to retrieve VDSL Line Status data from the EMS that the EMS has obtained from the VDSL line card. The Line Status data consists of indicators that show if any of the line performance parameters defined in reference 12 are failing pre-defined thresholds on a per modem basis. In addition, the Line Status shall indicate any of the following states:

1. No Defect
2. Data Initialization Failure
3. VTU-C failure during initialization due to bit errors corrupting startup exchange data.
4. Configuration Initialization Failure
5. VTU-C failure during initialization due to peer VTU not able to support requested configuration.
6. Protocol Initialization Failure
7. VTU-C failure during initialization due to incompatible protocol used by the peer VTU.
8. No peer modem detected
9. VTU-C failure during initialization due to no activation sequence detected from peer VTU.
10. Retrain

4.3.9 Test Initiation

Any service test, whether using loopbacks, performance monitoring data, alarms or any other test means, shall be on a per flow_ID basis. The result of the test will be associated with the flow_ID , have a date/time stamp, indicate the expected performance or test result, the actual performance or test result, and an indication of the corrective action.

4.3.10 ATM Cell Loopback (F4/F5)

The NMS/EMS interface shall support an NMS request to initiate ATM OAM Cell Loopbacks as follows:

1. The platform shall support full F4 and F5 OAM flow functionality as defined in I.610 [14]
2. It shall be possible to set up at least the following segments, VTP/D – ONU, ONU – OLT, VTP/D - OLT.
3. It shall be possible to loop cells originating from the VTP/D at the ONU and vice-versa
4. It shall be possible to carry out an inter-domain loopback to occur at the V interface.

4.3.11 Additional Miscellaneous Loopbacks

The EMS/NMS interface shall support an NMS request to perform additional miscellaneous loopbacks as supported by the NE or FS-VDSL EMS.

4.3.12 Alarm Threshold Setting

It must be possible to set alarm thresholds via the NMS-EMS interface on a per flow_ID basis where appropriate.

4.3.13 Alarm duration

It must be possible to configure the length of time alarm information is kept in the EMS.

4.3.14 Mandatory Alarms and Parameters

The following alarms and parameters are required to be provided to the NMS on a per equipment item basis.

Equipment	Alarms
VDSL Interfaces	Inability to achieve required rate at specified SNR
	Status indication of “retrain”
	Time since last instance of “retrain”
ONUs	Failure of power unit, local or remote
	External door open
	Battery temperature high
	High/low temperature

	Load and status of each CPU (OK/not OK)
	Fan failures
	Ingress of moisture
	Battery status
	Redundant mode
Optical Interfaces	Indication of Laser Diode degradation of failure
	Indication of OF transmission capabilities (SNR)

4.3.15 Alarm Format

Alarm messages must be described with the following information

- alarm text message
- default priority
- alarm type (optional)
- description
- recommended resolution

4.3.16 VTP Information

The VTP may be able to check connectivity between VTP-D and other devices in the customer premises, including round trip delay. If this feature is provided then the information must also be available via the EMS to the NMS. The management information specified in Ref. 13 shall also be made available to enable diagnostics and performance monitoring.

4.3.17 Physical Media Testing

When provided by the platform the NMS shall be able to initiate copper drop or optical fibre testing and retrieve the test results from the EMS along with any distance to fault estimation. Where this testing is obtrusive then the EMS will suppress any consequent alarm conditions and when possible ensure restoration of service on completion of the tests.

4.4 Performance Management

4.4.1 VDSL Line Operational Data

The NMS shall be able to initiate a request to the FS-VDSL EMS to obtain VDSL line operational data as defined in [12]. If a time stamp is available it should also be provided.

4.4.2 Retrieval of Performance Monitoring Register Data

The EMS shall allow the NMS to retrieve the content of any or all of the PM registers in the platform on demand. This includes parameters related to ATM QoS.

The performance of any element shall be requested by the NMS and the information provided by the EMS against Network Element ID and, when required, flow_ID.

The performance of any link shall be requested NMS and the information provide by the EMS against network IDs for the start and the end of the link.

When a monitoring function is activated, it shall be possible to specify a time period over which performance information is to be recorded. The time period shall be configurable by the NMS through the NMS-EMS Interface.

4.4.3 Auto-reporting of QOS Exceptions

The EMS shall report QOS exceptions based on downloadable thresholds in real time. The QOS exception report must have an associated location statement (Network Element ID) and suggested course of action to clear the problem that indicates the root cause and if desired only the root cause.

4.4.4 Flow QoS Exception Requests

The NMS shall be able to request for a specific flow-id information on QoS exceptions, including the QoS specified and start and stop times

4.4.5 Usage Information

To support service planning and development the EMS may supply on demand to the NMS usage information, including fixed cost services, eg viewing statistics, user demand at specific times, utilisation of path capacity.

4.4.6 Capacity information

To support service planning and development the EMS may supply on demand information on the availability of platform capacity at various levels of granularity, eg specific ONUs.

To support network inventory management and network planning and development the NMS must be able to request from the EMS:

- the capacity used by Network Element ID, including subsidiary network elements.
- the capacity available for a specific ONU port identifier and OLT port identifier and service type

The EMS will return the total capacity and the capacity used by Network Element ID, ONU port identifier, or OLT port identifier.

The NMS may be able to reserve, and release reserved, amounts of capacity by Network Element ID.

4.5 Security Management

4.5.1 Set Privileges, Authentication Data and Passwords for Access to EMS

The EMS shall allow the NMS to retrieve EMS security data including current passwords to access that EMS. The NMS will then have the ability to remotely set up user accounts with privileges and modify/change password information in the EMS(s). The EMS shall also allow the NMS to change all its passwords with one command. The EMS shall allow the NMS to add/delete a specific password on all EMS(s) with one command.

4.5.2 Autonomous Reporting of NE Security Messages

The NMS will receive (via EMS) any NE autonomous messages which are related to occurrence of NE security violation events. Filtering of these messages should be provided as on a operator-controlled basis.

4.5.3 NMS/EMS Interface Link Security

The NMS/EMS interface shall support link layer security mechanisms which may be protocol dependent.

4.5.4 NMS/EMS Interface Access Control

Access Control allows association of appropriate access permissions with resources. Resources can be either physical (modems, Links, Line Cards) or logical (VCC) entities. Only specific operations indicated by the Access Control information are permitted on a resource. NMS & EMS applications must support an Access control mechanism to associate specific permissions with resources and to protect resources from unauthorized operations. Implementation of this requirement will require joint agreements and development between the FS-VDLS EMS and Full-Service Broadband NMS suppliers.

4.6 Accounting Management

In order to support certain charging scenarios the FS-VDSL platform must allow ATM switching event logging and ATM cell count logging on a per flow_ID basis. The NMS can activate, or deactivate, these logs via the EMS-NMS interface and request their outputs at any time. Switching event and ATM cell count information shall be labeled with start and stop times.

The NMS shall be able to set the usage information storage time via the EMS –NMS Interface.

5. Glossary and References

5.1 Glossary of Terms, Acronyms and Terminology

ATM (Asynchronous Transfer Mode) - a connection-oriented high-speed communications protocol in which data is divided into 48 byte "cells" that can be individually switched and routed. Each cell is pre-appended with a 5 byte "header" containing an identifier of the connection of which the data is a part, along with quality of service parameters associated with the connection.

Customer - an entity to which the service provider provides network services.

EMS (Element Management System) - typically provided by a network element supplier and capable of managing multiple network elements of that supplier. An EMS may communicate with one or more NEs on an individual or collective. An EMS may have some network management layer capabilities, particularly, when an EMS manages multiple types of NEs and/or NEs from multiple suppliers.

MIB (Management Information Base) - a set of data elements and capabilities made available by a system to enable it to be managed. The CMIP protocol relies upon a formal definition of a system's MIB written in a language called "GDMO."

NE - a Network Element

Network - one or more sub-networks connected by network links, providing end-to-end service to one or more customers. Each sub-network is administered by an EMS and the network is administered by a service provider.

NMS (Network Management System) - responsible for end-to-end management of a network composed of network elements from multiple suppliers. Instead of directly managing network elements, it relies upon the capabilities of the EMS(s). An NMS may interface with one or more Service Management Systems and may include some service management functionality. An NMS may also include some element management layer capabilities that allow it to manage individual NEs or it may contain only network management layer functionality to manage one or more EMSs.

Port - an access point on an NE to which a link or a customer access link is attached.

PVC (Permanent Virtual Connection) - an ATM connection established to provide a "permanent" communications channel similar to the way private lines are used in narrowband communications.

QoS (Quality of Service) - parameters describing the attributes of a connection such as bandwidth, burstiness of the information on the connection, and priority.

Sunetwork - a collection of one or more NE(s), interconnected by sub-network links, with connectivity between any pair of NEs (i.e., the topology is a connected graph).

VCC (Virtual Channel Connection) - an ATM connection identified on each end of the network by the combination of a virtual channel identifier (VCI) and a virtual path identifier (VPI) unique to that interface, and having an associated quality of service (QoS).

VCI (Virtual Channel Identifier) - an integer in each ATM cell header identifying the virtual channel of which the information in the cell is a part.

VPC (Virtual Path Connection) - an ATM connection identified on each end of the network by a virtual path identifier (VPI) unique to that interface, and capable of "containing" a number of virtual channel connections to be transmitted through the network as a single stream of information.

VPI (Virtual Path Identifier) - an integer in each ATM cell header identifying the virtual path of which the information in the cell is a part.

5.2 References

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Document History

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