The ATM Forum
Technical Committee

M4 Interface Requirments and Logical MIB

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1. Introduction

This document presents functional requirements for interfaces used to manage ATM networks. It specifies requirements for managing individual ATM Network Elements (NEs) using the interface labeled "M4" in the ATM Forum Management Interface Reference Architecture shown in Figure 1-1. This document also defines managed entities of a logical, protocol-independent Management Information Base (MIB) for the M4 Interface that models the exchange of information between ATM devices and the systems that manage them.

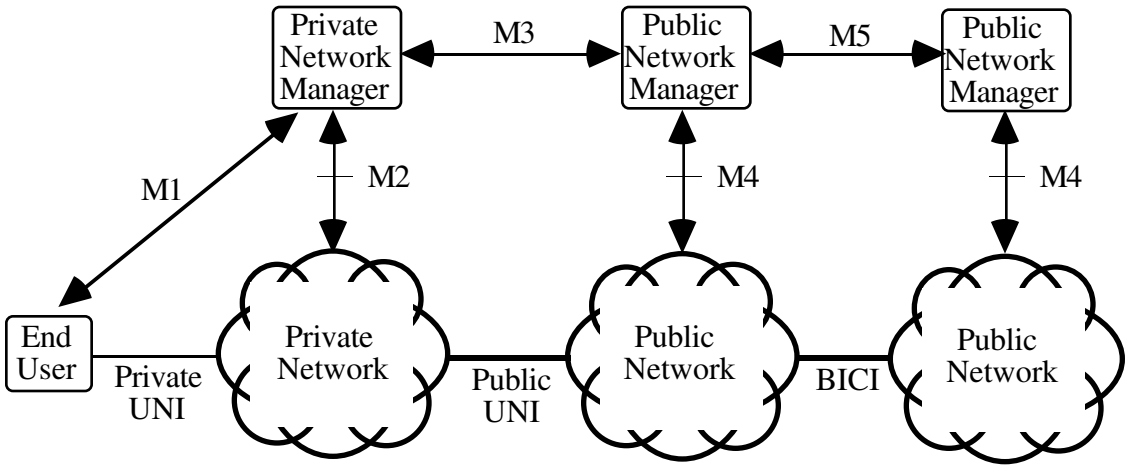

Figure 1-1 The ATM Forum Management Interface Reference Architecture

The management interface requirements and logical MIB outlined in this document are intended to guide the development of protocol-specific ATM NE management interface specifications in the ATM Forum. The purpose of defining a logical MIB is to provide a common frame of reference for the development of protocol-specific MIBs such as those based on CMIP or SNMP. The definition of protocol-specific MIBs from a common logical MIB should facilitate their potential coexistence within a public carrier's network.

1.1 Scope

This document addresses the following areas of ATM network management:

- Configuration Management

  The Configuration Management requirements covered in this document include (1) ATM NE configuration identification and change reporting; (2) the configuration of UNIs, BICIs, and BISSIs; (3) the cross-connection of VP and VC links and the configuration of VPCs and VCCs; (4) the configuration of VPC and VCC segment end-points; and (5) management system control (e.g., suppression) of automatically generated ATM NE reports.

- Fault Management

  The Fault Management requirements covered in this document include (1) the autonomous reporting of ATM NE component failures, physical facility failures, and ATM link/connection failures; and (2) the initiation of ATM OAM cell loopback tests.

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Other Fault Management aspects such as the initiation of basic ATM NE supplier-specific diagnostics are for further study.

- Performance Management

  The Performance Management requirements covered in this document include (1) physical layer (e.g., SONET and DS3 path level) performance monitoring; (2) Transmission Convergence Level performance monitoring; (3) ATM Layer protocol monitoring; and (4) UPC/NPC violation monitoring. Other Performance Management aspects such as ATM NE congestion monitoring, for real-time performance assessment; and ATM NE utilization monitoring and congestion monitoring, for network capacity planning, are for further study.

- Security Management

  Security Management requirements are for further study.

The M4 Interface requirements defined in this document are intended to support Permanent Virtual Connections (PVCs). Their applicability to Switched Virtual Connections (SVCs) is for further study.

The focus of this specification is on the M4 Interface aspects needed to support ATM NE management, where an ATM NE may be realized as either a standalone device or geographically distributed system. M4 Interface aspects specific to managing NEs in aggregation (e.g., as a single ATM subnetwork entity) are not addressed in this document and are for further study in the ATM Forum.

1.2 Relationship to TMN

ITU's M.3010 [1] defines a five layer model of operations (see Figure 1-2)[1]. The levels of this model are defined such that as one moves up the hierarchy, low-level detail is abstracted, and additional functionality is performed to ensure effective service and resource management. The definitions and views provided by each of the lower three layers are described in Section 1.3. The upper two layers, however, are beyond the scope of this document. Note that the layers in the model represent functional components, not physical systems, and the interactions between the layers are labeled as functional reference points which, in a physical implementation, may or may not be realized as open interfaces.

[1] Note that ITU Recommendation M.3010 [1] uses the terms Network Element Management Layer and Network Element Layer rather than Element Management Layer and Element Layer, respectively.

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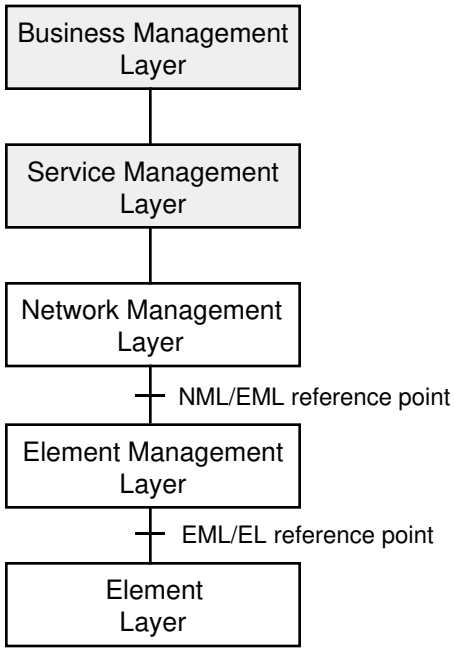

Shading was used to highlight layers of the model that are beyond the scope of this document.

Figure 1-2 The Multi-Layered Reference Architecture for Operations

The reference architecture shown in Figure 1-2 may be realized in a number of different ways. Representative examples of four alternative physical realizations are shown in Figures 1-3a, b, c, and d. Figure 1-3 illustrates just a few examples of how the multi-layered model of operations may be realized. It by no means represents an exhaustive set.

The ATM NE management interface requirements defined in this document focus on EML-to-EL and NML-to-EML interactions needed to support ATM NE management, where an ATM NE may be realized as either a standalone device or geographically distributed system. With respect to Figure 1-3, the requirements defined in this document are relevant to ATM NEs supporting either EL functions or a combination of EL and EML functions as well as to the operations support system(s) that manage them.

1.3 Definitions

The primary focus of this document is on the interactions between the lower three layers of ITU's TMN Model (see Figure 1-2). A brief definition of each of these lower layers is provided in the subsections that follow. The reader, however, is advised to consult ITU Recommendation M.3010 for a more comprehensive description of these layers and their role in the overall multi-layered TMN Model.

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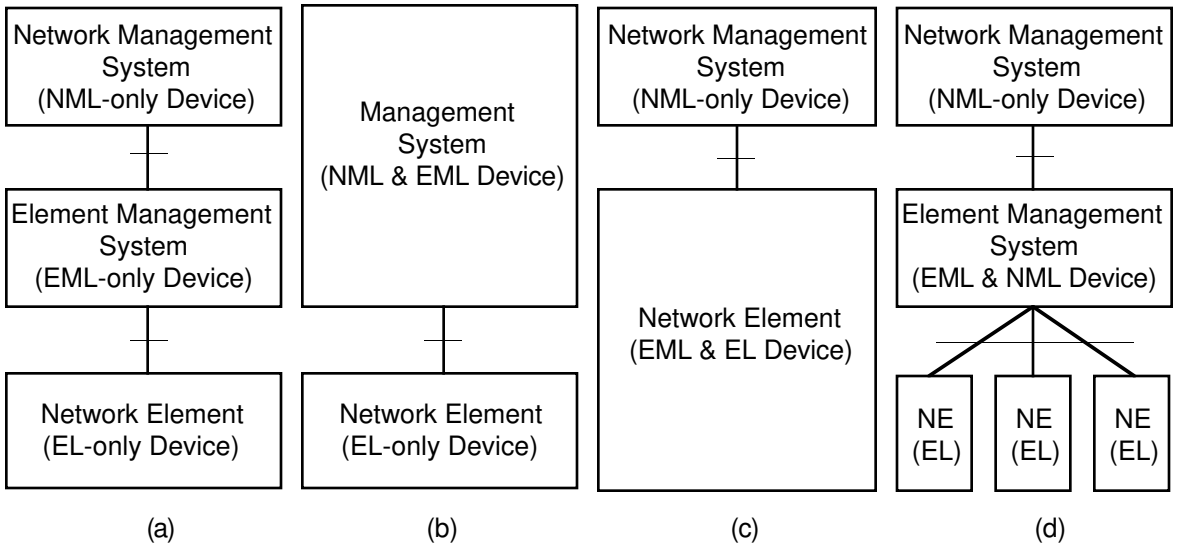

— Identifies interfaces to which this specification applies.

* The ATM NEs in the above figures refer to ATM Switches, ATM Transport Devices (e.g., ATM Cross Connect Systems and ATM Concentrators), Remote ATM Switches, Distributed ATM Switching Systems, etc..

Figure 1-3 Physical Realization Examples of the Multi-Layered Model

1.3.1 Network Management Layer (NML)

The NML has responsibility for the management of all ATM NEs, as presented by their EML(s), both individually and as a set. The NML is not concerned with how a particular element provides services internally.

The NML contains those functions used to manage an end-to-end telecommunications network. NML access to the network is provided by the EML. The NML controls and coordinates the provision or modification of network resource capabilities in support of services to the customer through interactions with higher layer functions. It also provides higher layers with information such as the performance, availability, and usage data.

1.3.2 Element Management Layer (EML)

The EML manages each network element on an individual basis and supports an abstraction of the functions provided by the Element Layer.

1.3.3 Element Layer (EL)

The EL contains functions related specifically to the technology, vendor, and the network resources or network elements that provide basic communications services.

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2. ATM NE Management Interface Requirements

This section addresses M4 Interface requirements needed to manage ATM networks for the following areas of network management: Configuration Management, Fault Management, Performance Management, and Security Management.

The M4 Interface requirements defined in this document are intended to support Permanent Virtual Connections (PVCs). Their applicability to Switched Virtual Connections (SVCs) is for further study.

Within the context of this document, specifications are presented as either *requirements*, denoted by **(R)**, or *objectives*, denoted by **(O)**. In this document, *requirements* are considered functions that are necessary for operational compatibility; while *objectives* are considered features that are viewed to be desirable but not essential for managing ATM networks.

2.1 Configuration Management

Configuration management provides functions to exercise control over, identify, collect data from and provide data to NEs [2]. From an ATM network management perspective, this involves the following:

- ATM NE Configuration Identification and Change Reporting
- Configuration of UNIs, BICIs, and BISSIs
- Configuration of ATM VP/VC Link Termination Points and Cross Connections
- Configuration of ATM VPC and VCC Termination Points
- Configuration of VPC and VCC OAM Segment End-Points
- Event Flow Control (i.e., Suppression of Autonomous Notifications)

2.1.1 ATM NE Configuration Identification and Change Reporting

In order for a management system to effectively manage the ATM network, it's view of the various ATM NEs within it must be current. To ensure such accuracy, each ATM NE is expected to make available to the management system an abstract view of its current configuration and report to the management system all subsequent configuration changes that were not explicitly requested by the management system via the M4 interface. Such configuration changes may be the result of:

1. Operations performed over the craft interface
2. Human intervention (removal/insertion of equipment modules)
3. Customer control channels (e.g., ILMI)
4. Network failures
5. Protection switching events
6. Sub-ATM NE component initialization
7. Secondary effects of atomic operations performed by the management system

The following operations interface functions are required to support the automatic node configuration identification and change reporting capability:

(R) CM-1 The M4 Interface shall support ATM NE notifications that report when the ATM NE has been installed/initialized and is now available to the management system for subsequent provisioning. These notifications need only provide a simple indication that the installation/initialization of the ATM NE is complete. Information regarding the detailed

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configuration of the newly installed/initialized ATM NE need not be included as part of this notification.

(R) CM-2 The M4 Interface shall support management system requests for information that describes the current configuration of the ATM NE. Information that describes each externally manageable physical and logical component of the ATM NE (e.g., circuit packs, equipment, equipment holders, software, physical path termination points, performance/threshold data stores, and logs) and the inter-relationships between these components (e.g., rack/shelf/slot/line-card relationships) shall be logged and made available (on-demand) to the management system over the M4 Interface.

(R) CM-3 The M4 Interface shall support autonomous notifications that reflect recent changes in the configuration of the ATM NE, including those that were not directly initiated by the network management system over the M4 Interface (e.g., the insertion of a new plug-in unit).

(R) CM-4 The M4 Interface shall support notifications that reflect changes in the operational state of the various managed entities within the ATM NE. When possible, only the root operational state change shall be reported. Operational state changes that may be derived from the root state change should not be reported.

Note that this specification adopts the OSI state management model defined in ITU-T Recommendation X.731 [3].

2.1.1.1 Related Managed Entities

Section 3 provides a logical model, based on the definition of Managed Entities, that further describes the exchange of information across the M4 Interface. The purpose of this sub-section and all sub-sections like it is to show how specific functional requirements relate to the Managed Entities in Section 3. The Managed Entities identified include both those that are directly involved in supporting the requirements as well as the Managed Entities that support those that are directly involved.

The managed entities defined in Section 3 that are required to support the ATM NE configuration identification and change reporting function are as follows:

- ATM Cross Connection Control
- ATM NE
- Attribute Value Change Record
- Equipment
- Equipment Holder
- Event Forwarding Discriminator
- Latest Occurrence Log
- Log
- Managed Entity Creation Log Record
- Managed Entity Deletion Log Record
- Physical Path Termination Point
- Plug-in Unit
- Software
- State Change Record
- TC Adaptor
- TC Adaptor PM Current Data
- Threshold Data

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Figure 2-1 has been provided to illustrate how the Equipment Holder managed entity is used to model the rack/shelf/slot hierarchy of equipment within an ATM NE. Note that, in this figure, a box within a box represents a containment relationship between managed entities.

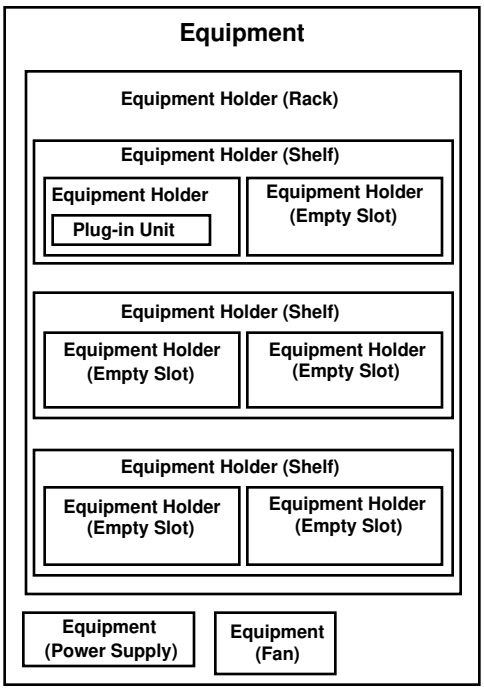

Figure 2-1 Modeling the Rack/Shelf/Slot Hierarchy

2.1.2 Configuration of UNIs, BICIs, and BISSIs

The following M4 Interface functions are required to support the configuration of UNIs, BISSIs, and BICIs in an ATM NE:

(R) CM-5 The M4 Interface shall support management system requests to configure physical path terminations on an ATM NE as either a User Network Interface (UNI), Broadband Inter-Switching System Interface (BISSI), or Broadband Inter-Carrier Interface (BICI). The following information shall be provided with each configuration request:

1. Interface ID

2. ID of the Underlying Physical Path Termination Point

3. Maximum Number of Simultaneously Active VPCs Supported

   This parameter identifies the maximum number of VPCs that may be active across the UNI, BISSI, or BICI at any one point in time.

4. Maximum Number of Simultaneously Active VCCs Supported

This parameter identifies the maximum number of VCCs that may be active across the UNI, BISSI, or BICI at any one point in time.

5. Number of Allocated VPI Bits

   This parameter identifies the number of allocated bits of the VPI sub-field for the UNI, BISSI, or BICI. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface. This information is needed by the ATM NE to support the ILMI. This parameter is also used by the ATM NE to select appropriate VPI values when establishing ATM connections.

6. Number of Allocated VCI Bits

   This parameter identifies the number of allocated bits of the VCI sub-field for the UNI, BISSI, or BICI. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface. This information is needed by the ATM NE to support the ILMI. This parameter is also used by the ATM NE to select appropriate VCI values when establishing ATM connections.

7. ATM Subscriber Address (parameter applies to UNIs only)

   This parameter identifies the address (e.g., directory number) or list of addresses assigned to the UNI.

8. Preferred Carrier (parameter applies to UNIs only)

   This parameter identifies the name of the default carrier to use when establishing an inter-LATA SVC.

9. ILMI Channel Identifier (parameter applies to UNIs only)

   This parameter identifies the VPI/VCI pair used to support the ILMI across the UNI. The default value for this parameter is 0/16.

10. Far-End Carrier Network (parameter applies to BICIs only)

    This parameter identifies the adjacent carrier to which the BICI transmission path is connected. This parameter is only needed by the ATM NE to support SVCs.

(R) CM-6 The M4 Interface shall support management system requests to retrieve configuration data associated with each UNI, BISSI, or BICI terminating on the ATM NE.

(R) CM-7 The M4 Interface shall support management system requests to reconfigure the data elements identified in **CM-5**.

2.1.2.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support the configuration and reconfiguration of UNIs, BICIs, and BISSIs in an ATM NE are as follows:

- ATM NE
- BICI
- BISSI
- Physical Path Termination Point

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- TC Adaptor
- UNI

2.1.3 Configuration of VPL/VCL Termination Points and Cross-Connections

Figure 2-2 illustrates the hierarchical relationship between physical paths, ATM links, and ATM connections. This figure illustrates the following key points:

- A physical path, once terminated, may be channelized into one or more VPLs
- A VPC, once terminated, may be channelized into one or more VCLs
- VPCs are composed of one or more (cross-connected) VPLs
- VCCs are composed of one or more (cross-connected) VCLs

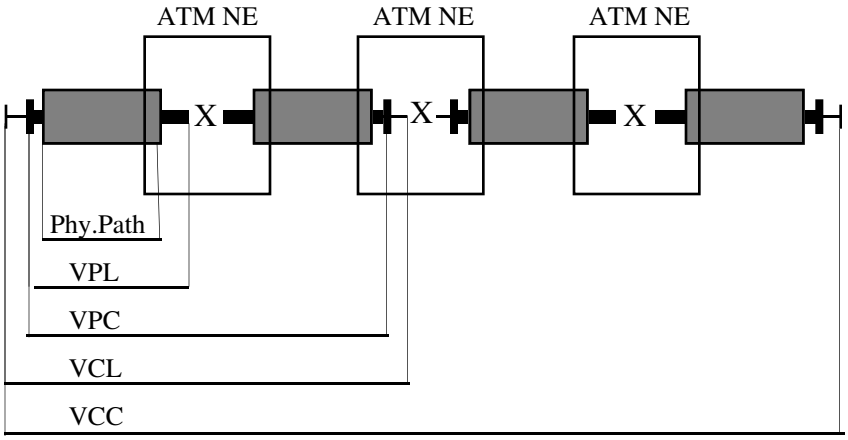

Figure 2-2 ATM Transport Network Hierarchy

These key points are reflected in the operations interface functions that follow:

(R) CM-8 The M4 Interface shall support management system requests to establish VPL-to-VPL cross-connections and VCL-to-VCL cross-connections in an ATM NE. In order to establish a point-to-point ATM cross-connection, the management system must supply the ATM NE with the following information:

1. Each end-point to cross connect, specified as (a) or (c) for VPL-to-VPL cross-connection, and (b) or (d) for VCL-to-VCL cross-connection:
   a. the VPI value of a VPL termination within a specific ATM Interface
   b. the VCI value of a VCL termination within a specific VPC
   c. the identity of the supporting ATM Interface termination point (Agent selects the VPI value within the ATM Interface)
   d. the identity of the supporting VPC termination point (Agent selects the VCI value within the VPC)
2. Ingress and Egress Peak Cell Rate for CLP=0 and CLP=0+1 Traffic
3. Ingress and Egress Sustainable Cell Rate for CLP=0 and CLP=0+1 Traffic
4. Ingress and Egress Burst Tolerance for CLP=0 and CLP=0+1 Traffic
5. Ingress and Egress CDV Tolerance for CLP=0 and CLP=0+1 Traffic

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6. Ingress and Egress QOS class[2]

(R) CM-9 The M4 Interface shall support management system requests to tear-down existing VPL and VCL cross-connections in an ATM NE and release the resources (e.g., bandwidth) assigned to the individual VPLs or VCLs being cross-connected.

(R) CM-10 The M4 Interface shall support management system requests to inhibit and allow the switching of ATM cells through the fabric for a particular VP/VC cross connection. While cell flow is inhibited, the ATM NE shall continue to maintain the cross-connect relationship and resources assigned to the termination points.

(R) CM-11 The M4 Interface shall support management system requests to retrieve the following configuration data associated with previously configured VPL and VCL termination points in the ATM NE:

1. The ATM Interface Supporting the VPL or VCL being Terminated
2. VPI or VCI Value
3. Ingress and Egress Peak Cell Rate for CLP=0 and CLP=0+1 Traffic
4. Ingress and Egress Sustainable Cell Rate for CLP=0 and CLP=0+1 Traffic
5. Ingress and Egress Burst Tolerance for CLP=0 and CLP=0+1 Traffic
6. Ingress and Egress CDV Tolerance for CLP=0 and CLP=0+1 Traffic
7. Ingress and Egress QOS class

(R) CM-12 The M4 Interface shall support management system requests to establish multipoint VPL and VCL cross-connections in the ATM NE. Provided with each multipoint cross-connect request shall be the following information:

1. Multipoint Connection Type (multicast, merge, multicast/merge, full multipoint)
2. Primary VPL or VCL Termination Point
   For broadcast, merge, and multicast/merge cross-connect types, this parameter identifies the VPL or VCL termination point that generates traffic to be broadcasted and/or receives traffic that has been merged (see Figure 2-3). This parameter shall be set to NULL for full multipoint cross-connection types.
3. Traffic Descriptors and QOS Class of the Primary Termination Point (if one exists)
4. Common VPL or VCL Termination Points
   This parameter identifies all VPL or VCL termination points involved in the multipoint cross-connection except the primary VPL or VCL termination point (see Figure 2-3).
5. Traffic Descriptors and QOS Class for each Common Termination Point

NOTE: While Item 1 above has multiple values, allowing for several different forms of "multipoint" cross-connections, it should be noted that the ATM Forum UNI Specification [4] only defines point-to-multipoint (i.e., multicast) connections at this time. Therefore, all other forms of multipoint support beyond point-to-multipoint arrangements are considered optional.

[2] As defined in [4]. Existing QOS class definitions from [4] are currently under review within the ATM Forum.

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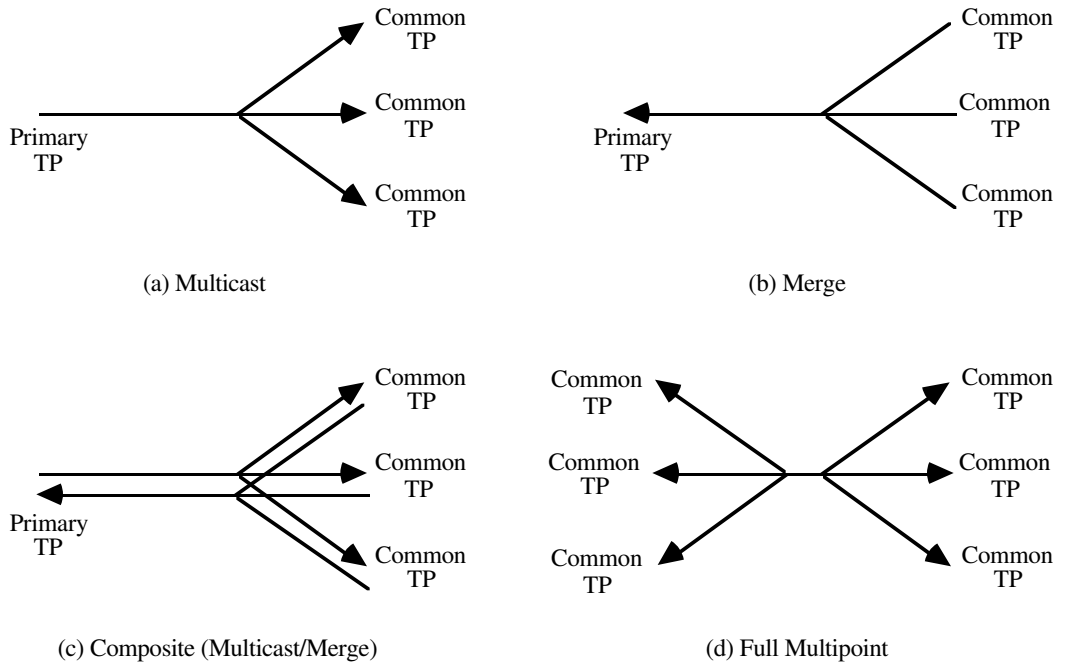

Figure 2-3 Multipoint Connection Types

(R) CM-13 The M4 Interface shall support management system requests to tear-down multipoint VPL and VCL cross-connections in an ATM NE.

(R) CM-14 The M4 Interface shall support management system requests to individually inhibit and allow the flow of ATM cells to and from each VPL or VCL termination of a multipoint cross-connection.

(R) CM-15 The M4 Interface shall support management system requests to add VPL or VCL termination points to an existing multipoint cross-connect arrangement.

(R) CM-16 The M4 Interface shall support management system requests to remove VPL or VCL termination points from an existing multipoint cross-connection.

(O) CM-17 The M4 Interface should support management system requests to configure specific ATM VP/VC cross-connect relationships as either "recoverable" or "non-recoverable". Recoverable cross-connect relationships remain intact regardless of the operational state of the supporting VP/VC. A non-recoverable cross-connection is one that is automatically torn down (i.e., released) by the ATM NE upon detection of a service affecting failure.

2.1.3.1 Related Managed Entities

The managed entities defined in Section 3 that are needed to support ATM VP/VC cross-connection are as follows:

- ATM NE

- ATM Cross Connection
- ATM Cross Connection Control
- Multipoint Bridge
- TC Adaptor
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

2.1.4 Configuration of VPC and VCC OAM Segment End-points

This section defines the ATM NE management interface functions that enable management systems to configure VPL or VCL termination points as either a *segment* or *non-segment* end-point. The ATM Forum UNI Specification [4] and BICI Specification [5] documents define fixed single-link VPC and VCC segments across the UNI and BICI, respectively. Therefore, the management system need not request the ATM NEs to configure such link terminations as *segment* end points. Such assignments would be automatically performed by the ATM NEs terminating the UNIs and BICIs at the time the VPLs and/or VCLs are configured. The management system may, however, configure and reconfigure other VP/VC link terminations as *segment* end-points. Figure 2-4 shows some example scenarios of how segments may be configured in a carrier's network.

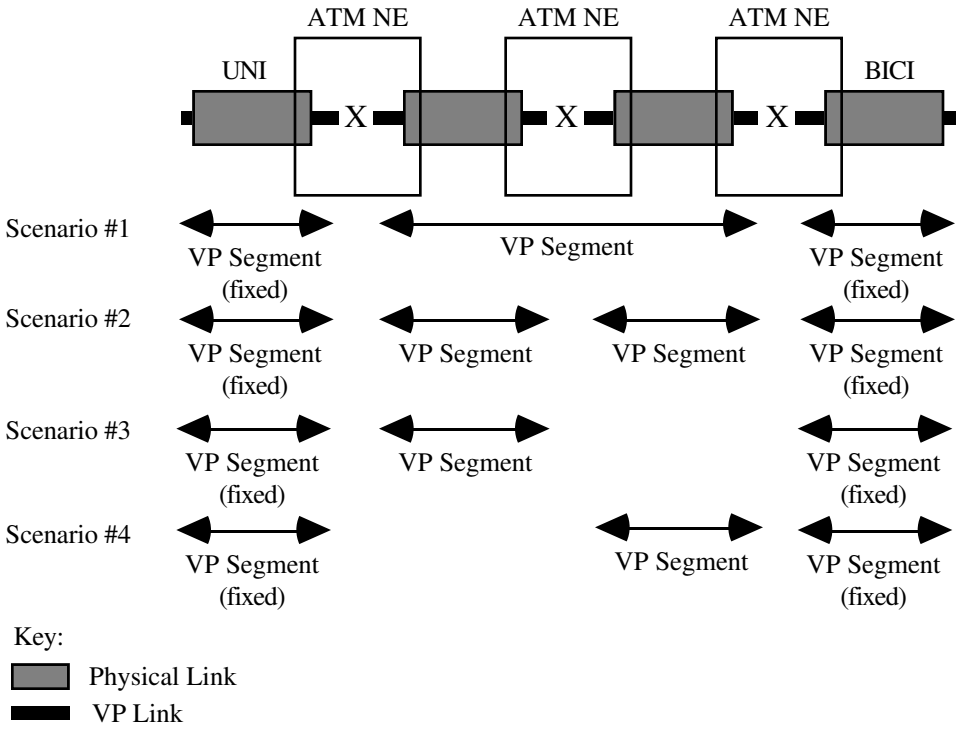

Figure 2-4 Example VPC Segment Configuration Scenarios

The following operations interface functions are required to support the configuration and reconfiguration of VPC and VCC segments:

(R) CM-18 The M4 Interface shall support management system requests to configure and reconfigure active VPL and VCL termination points as either *segment* or *non-segment* end-points.

(R) CM-19 The M4 Interface shall support management system requests to retrieve the data stored in the ATM NE that identifies whether a particular VPL or VCL termination point has or has not been configured as a segment end-point.

2.1.4.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support the configuration and reconfiguration of VPC and VCC segments are as follows:

- ATM NE
- TC Adaptor
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

2.1.5 Event Flow Control - Event Forwarding Discriminator Function

There are a variety of notifications that are autonomously generated by the ATM NE to the management system. Examples include alarms, configuration updates, and threshold crossing alerts. At times, it may be necessary for the management system to configure the ATM NE to selectively suppress outbound notifications and only pass up to the management system those notifications that meet a specified set of criteria. The suppression of ATM NE-generated notifications would be based on one or more of the following: (1) notification type; (2) specific detail(s) of a notification type (e.g., the severity of an alarm); (3) type of managed entity reporting the notification; or (4) specific detail(s) about the managed entity reporting the notification .

(R) CM-20 The M4 Interface shall support management system messages used to configure the ATM NE to suppress specific notifications. The management system shall be able to configure the ATM NE such that notifications are suppressed based on one or more of the following:

- Notification Type (e.g., specific alarm or threshold crossing alert)
- Specific Aspect(s) of a Notification Type (e.g., perceived severity)
- Type of Managed Entity Reporting the Notification
- Specific Aspect(s) of the Managed Entity Reporting the Notification

2.1.5.1 Related Managed Entities

The following managed entities are required to support the suppression of ATM NE-generated notifications:

- ATM NE
- Event Forwarding Discriminator

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2.2 Fault Management

Fault management is a set of functions that enable the detection, isolation, and correction of abnormal operation of the telecommunications network and its environment [2]. From an ATM network management perspective, this involves the following:

- Notifying the Network Management System of a Detected Failure
- Logging Failure Reports
- Isolating Faults (via on-demand testing)

2.2.1 Failure Reporting

The following operations interface functions are required to support the notification of ATM NE failures:

(R) FM-1 The M4 Interface shall support notifications used to report failures detected by ATM NEs. Each failure notification (i.e., alarm) shall include the following information:

1. The failed component or list of potentially failed components (if known by the ATM NE)

   Components identified should represent the smallest replaceable/repairable unit(s) of hardware or software.

2. Generic Trouble Description (see Table 2-1 for a list of generic troubles to be used if applicable)

3. Specific Problems (optionally provided)

   This parameter identifies further refinements (e.g., sub-cause indicator information) to the generic trouble description of the alarm.

4. Severity (i.e., critical, major, minor, warning, indeterminate, and cleared)

   Critical - Indicates that a service affecting condition has occurred and immediate corrective action is required. Such a severity is used when the managed entity is totally out of service and its capability must be restored.

   Major - Indicates that a service affecting condition has occurred and urgent corrective action is required. Such a severity is used when there is a severe degradation in the capability of the managed entity and its full capability must be restored.

   Minor - Indicates that a non-service affecting condition has occurred and that corrective action should be taken in order to prevent a more serious fault.

   Warning - Indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt.

   Indeterminate - Indicates that the severity level cannot be determined.

   Cleared - Indicates the clearing of one or more previously reported alarms.

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Alarm severities can be assigned by the management system only for equipment alarms and physical layer communications alarms.

5. Back-up Status

   This parameter indicates whether or not the entity emitting the alarm has been backed-up. A value of "true" indicates that the entity has been backed-up; a value of "false" indicates that the entity has not been backed-up.

6. Back-up Entity

   This parameter identifies the managed entity that is providing back-up services to the failed managed entity. If no back-up service is being provided, the value of this parameter shall be NULL.

7. Additional Text (optionally provided)

   This parameter is used to allow for additional text to be supplied with the alarm. Such text may further describe problem and/or failed entity (e.g., name and location).

8. Proposed Repair Actions (optionally provided)

   This parameter, when present, is used if the cause of the alarm is known and the ATM NE can suggest one or more solutions.

9. Time and Date Failure was Detected.

(R) FM-2 The M4 Interface shall support management system requests to assign a severity (i.e., critical, major, minor, or warning) to each alarm generated by each externally managed physical component of the ATM NE.

(R) FM-3 The M4 Interface shall provide management systems the ability to retrieve entries from the ATM NE log of alarm notifications.

2.2.1.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support ATM NE failure reporting functions are as follows:

- Alarm Record
- Alarm Severity Assignment Profile
- ATM NE
- Equipment
- Physical Path Termination Point
- Plug-in Unit
- Software
- TC Adaptor
- VCC Termination Point
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

A mapping of the various generic troubles to the management entities listed above is provided in Table 2-2.

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Table 2-1 List of Generic Troubles

Alarm Category	Generic Trouble
Communications Alarms	Alarm Indication Signal (AIS)
	Loss of Cell Delineation (LCD)
	Loss Of Frame (LOF)
	Loss Of Pointer (LOP)
	Loss Of Signal (LOS)
	Payload Type Mismatch
	Transmission Error
	Path Trace Mismatch
	Remote Defect Indication (RDI)
	Signal Label Mismatch
Equipment Alarms	Back-plane Failure
	Call Establishment Error
	Congestion
	External Interface Device Problem
	Line Card Problem
	Multiplexer Problem
	Power Problem
	Processor Problem
	Protection Path Failure
	Receiver Failure
	Replaceable Unit Missing
	Replaceable Unit Problem
	Replaceable Unit Type Mismatch
	Timing Problem
	Transmitter Failure
	Trunk Card Problem
Processing Error Alarm	Storage Capacity Problem
	Memory Mismatch
	Corrupt Data
	Software Environment Problem
	Software Download Failure
	Version Mismatch
Environmental Alarms	Cooling Fan Failure
	Enclosure Door Open
	Fuse Failure
	High Temperature
General	Vendor Specific

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Table 2-2 Mapping of Generic Troubles to Managed Entities

Generic Trouble	Managed Entity(ies)
Alarm Indication Signal (AIS)	Physical Path Termination Point VCC Termination Point VCL Termination Point VPC Termination Point VPL Termination Point
Loss of Cell Delineation (LCD)	TC Adaptor
Loss Of Frame (LOF)	Physical Path Termination Point
Loss Of Pointer (LOP)	Physical Path Termination Point (SONET only)
Loss Of Signal (LOS)	Physical Path Termination Point
Payload Type Mismatch	Physical Path Termination Point (SONET only)
Transmission Error	Physical Path Termination Point
Path Trace Mismatch	Physical Path Termination Point (SONET only)
Remote Defect Indication (RDI)	Physical Path Termination Point VCC Termination Point, VPC Termination Point VCL Termination Point, VPL Termination Point
Signal Label Mismatch	Physical Path Termination Point (SONET only)
Back-plane Failure	ATM NE, Equipment
Call Establishment Error	ATM NE, Equipment
Congestion	ATM NE, Equipment, Plug-in Unit
External Interface Device Problem	ATM NE, Equipment
Line Card Problem	Plug-in Unit
Multiplexer Problem	Equipment, Plug-in Unit
Power Problem	ATM NE, Equipment
Processor Problem	ATM NE, Equipment, Plug-in Unit
Protection Path Failure	ATM NE, Equipment
Receiver Failure	Plug-in Unit
Replaceable Unit Missing	Plug-in Unit
Replaceable Unit Problem	Plug-in Unit
Replaceable Unit Type Mismatch	Plug-in Unit
Timing Problem	ATM NE, Equipment, Plug-in Unit
Transmitter Failure	Plug-in Unit
Trunk Card Problem	Plug-in Unit
Storage Capacity Problem	ATM NE, Equipment
Memory Mismatch	ATM NE, Equipment
Corrupt Data	ATM NE, Equipment
Software Environment Problem	ATM NE, Equipment
Software Download Failure	ATM NE, Equipment
Version Mismatch	ATM NE, Equipment, Plug-in Unit, Software
Cooling Fan Failure	ATM NE, Equipment
Enclosure Door Open	ATM NE, Equipment
Fuse Failure	ATM NE, Equipment
High Temperature	ATM NE, Equipment

Note: The Equipment managed entity may be used to represent a variety of different supplier-specific components of the ATM NE being managed. It is, therefore, the responsibility of each supplier to determine, based on the ATM NE component being represented, if all or a subset of the troubles listed above apply to a particular instance of the Equipment managed entity.

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2.2.2 OAM Cell Loopback Testing

The following operations interface functions are required to support VPC/VCC OAM cell loopback testing:

(R) FM-4 The M4 Interface shall support management systems requests to perform OAM Cell Loopback tests. An OAM Cell Loopback test is performed (by the ATM NE) by inserting a Loopback OAM cell, with the Loopback Location field set as specified by the management system, into the cell stream of the VPC/VCC connection or connection segment under test and verifying its return. The following information shall be supplied with each management system request to perform an OAM Cell Loopback test:

1. The Loopback OAM Cell Insertion Point

   This is the identity of the ATM connection or link termination point responsible for inserting the Loopback cell.

2. The OAM Cell Loopback Point

   This is either an indication that the OAM cell loopback is to be performed at the end of the segment/connection, or a code that uniquely identifies an intermediate point along the connection/segment responsible for logically looping-back the received OAM cell. This code is administered on an ATM interface termination point basis.

3. Segment or End-to-End Indication

   This indicates whether the Loopback cell to use during the test shall be a *segment* OAM cell or an *end-to-end* OAM cell.

(R) FM-5 The M4 Interface shall support ATM NE reply messages used to autonomously report the results of a previously requested OAM Cell Loopback test. These results shall be provided to the management system as a Boolean Pass/Fail indication.

2.2.2.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support the OAM Cell Loopback Testing capability are as follows:

- ATM NE
- TC Adaptor
- VCC Termination Point
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

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2.3 Performance Management

Performance management provides functions to evaluate and report upon the behavior of telecom equipment and the effectiveness of the network or network element. Its role is to gather statistical data for the purpose of monitoring and correcting the behavior and effectiveness of the network, network element, or equipment and to aid in planning and analysis [2].

From an ATM network management perspective, this involves the following:

- Performance Monitoring
- Traffic Management
- UPC/NPC Disagreement Monitoring
- Performance Management Control
- Network Data Collection

2.3.1 Physical Layer (PMD Level) Performance Monitoring

(R) PM-1 The M4 Interface shall support current ITU-T standards such as Recommendation G.774-01 [6] and ANSI T1.231 [7] for monitoring the performance of SDH (SONET) transport facilities.

(R) PM-2 The M4 Interface shall support current ANSI T1 standards such as ANSI T1.pmnew [8] and ANSI T1.231 for monitoring the performance of DS3 transport facilities.

2.3.2 ATM Cell Level Protocol Monitoring

Cell Level protocol monitoring involves collecting and thresholding data counts that measure an ATM NEs ability to successfully process and deliver incoming ATM cells. Cell Level protocol monitoring is particularly concerned with protocol abnormalities detected at the Transmission Convergence Sublayer and ATM Layer of the broadband protocol stack. Cell Level protocol monitoring also entails logging detailed information (in the ATM NE) that may be retrieved and used by a management system to diagnose cell processing malfunctions.

The following M4 Interface functions are required to support Cell Level protocol monitoring:

(R) PM-3 The M4 Interface shall provide management systems the ability to retrieve current (15-minute) counts of the following data from each ATM interface terminating on the ATM NE:

1. Discarded Cells due to HEC Violation

   This parameter provides a count of the number of incoming ATM cells discarded due to a Header Error Check (HEC) violation.

2. Discarded Cells due to Protocol Errors

   This parameter provides a count of the number of ATM cells discarded due to an unrecognizable cell header field value (e.g., unassigned VPI/VCI value, out-of-range VPI/VCI value, or invalid Payload Type Identification value).

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(R) PM-4 The M4 Interface shall support management system requests to define multiple sets of threshold values (i.e., threshold value packages) for the parameters listed in **PM-3** and selectively assign each set to one or more interfaces terminating on the ATM NE.

(R) PM-5 The M4 Interface shall provide management systems the ability to modify threshold values for the performance parameters identified in requirement **PM-3**.

(R) PM-6 The M4 Interface shall support autonomous notifications (generated by the ATM NE) used to report threshold crossings for the parameters identified in requirement **PM-3**. Such notifications are often referred to as "threshold crossing alerts".

(R) PM-7 The M4 Interface shall provide management systems the ability to retrieve current (15-minute) counts of the number of OAM cells that have entered the ATM NE per interface.

(R) PM-8 The M4 Interface shall provide management systems the ability to reset to zero each count for the performance parameters identified in requirements **PM-3** and **PM-7**.

(R) PM-9 The M4 Interface shall provide management systems the ability to retrieve history counts (thirty-two 15-minute counts) of the performance parameters identified in requirement **PM-3**.

(R) PM-10 The M4 Interface shall provide management systems the ability to retrieve history counts (two 15-minute counts) of the performance parameters identified in requirement **PM-7**.

(R) PM-11 Failures, testing routines, and reconfigurations of UNIs, BISSIs, and BICIs may affect the collection of data identified in requirements **PM-3** and **PM-7**. When such events occur, the ATM NE is expected to flag the collected data as "suspect". The M4 Interface shall provide management systems the ability to retrieve an indication as to whether the counts identified in requirements **PM-3** and **PM-7** are reliable or suspect.

(R) PM-12 For each UNI, BICI, and BISSI terminating on the ATM NE, the ATM NE is expected to maintain a "latest occurrence" log containing the following information for ATM cells that were discarded due to protocol errors (see **PM-3**, Item 2):

1. The Abnormality Type

   This attribute identifies the type of protocol error that resulted in the discarding of the ATM cell. Valid values are: (1) unassigned VPI/VCI value, and (2) out-of-range VPI/VCI value.

2. VPI/VCI Value of Discarded Cell

3. Time and Date

The term "latest occurrence" is used to indicate that the ATM NE only logs the latest occurrence of each abnormality type per interface. For a given interface, the ATM NE is not required to record another occurrence of any abnormality type within one second.

The M4 Interface shall provide management systems the ability to retrieve entries from the log of discarded ATM cell headers. Both individual entry retrievals as well as group retrievals (based on criteria specified by the management system) shall be supported over

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the M4 Interface. The receipt of the threshold crossing alert referred to in **PM-6** may trigger such a retrieval.

(R) PM-13 The M4 Interface shall support the suppression of all-zero performance monitoring counts, as identified in **PM-7**.

2.3.2.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support Cell Level protocol monitoring are as follows:

- ATM Cell Protocol Monitoring Current Data
- ATM Cell Protocol Monitoring History Data
- ATM Cell Protocol Monitoring Log Record
- ATM NE
- BICI
- BISSI
- Latest Occurrence Log
- TC Adaptor
- TC Adaptor Protocol Monitoring Current Data
- TC Adaptor Protocol Monitoring History Data
- Threshold Data
- UNI

2.3.3 UPC/NPC Disagreement Monitoring

UPC and NPC algorithms are intended to police incoming cells to ensure that each access connection supported by the ATM NE is complying with pre-negotiated traffic descriptors. Based on the UNI and BICI specifications developed by the ATM Forum (see [4] and [5], respectively), non-compliant traffic may result in cell discarding or tagging. Since cells discarded due to UPC/NPC functions (a fault of the user) and cells discarded due to transmission errors and malfunctions (a fault of the network) will have the same effect on the end-to-end performance of a VPC/VCC, it is important for trouble shooting and trouble sectionalization purposes to provide network managers with the tools needed to distinguish between these two events.

The following operations interface functions are required so that management systems can retrieve ATM NE collected data that reflects the extent to which individual users are violating their pre-negotiated traffic descriptors.

(R) PM-14 The M4 Interface shall support management system requests to initiate UPC/NPC Disagreement Monitoring on a limited number of VP/VC links at any one point in time (e.g., 30 ATM links per DS3 and 90 ATM links per STS-3c).

(R) PM-15 The M4 Interface shall support management system requests to cease UPC/NPC Disagreement Monitoring that was previously activated for a VP/VC link. The identity of the VP/VC link shall be provided along with the request.

(R) PM-16 The M4 Interface shall provide management systems the ability to retrieve current (15-minute) counts of the following data from each VP/VC link for which UPC/NPC Disagreement Monitoring is being performed:

- Discarded Cells due to UPC/NPC Disagreements

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This parameter provides a count of the number of ATM cells discarded due to traffic descriptor violations detected by the combined CLP=0 and CLP=1 UPC/NPC policing function.

- Discarded CLP=0 Cells due to UPC/NPC Disagreements

  This parameter provides a count of the number of high priority (CLP=0) ATM cells discarded due to traffic descriptor violations detected by the CLP=0 UPC/NPC policing function. This counter is only required if CLP=0 traffic is separately policed.

- Successfully Passed Cells

  This parameter provides a count of the number of cells that have been passed (i.e., not discarded) by the combined CLP=0 and CLP=1 UPC/NPC policing function.

- Successfully Passed CLP=0 Cells

  This parameter provides a count of the number of high priority cells that have been passed (i.e., not discarded) by the CLP=0 UPC/NPC policing function. This counter is only required if CLP=0 traffic is separately policed.

(R) PM-17 The M4 Interface shall support management system requests to define multiple sets of threshold values (i.e., threshold value packages) for the parameters listed in **PM-16** and selectively assign each set to one or more interfaces terminating on the ATM NE.

(R) PM-18 The M4 Interface shall provide management systems the ability to modify threshold values for the "Discarded Cells" and the "Discarded CLP=0 Cells" performance parameters identified in requirement **PM-16**.

(R) PM-19 The M4 Interface shall support autonomous notifications (generated by the ATM NE) used to report threshold crossings for the parameters identified in requirement **PM-16**. Such notifications are often referred to as "threshold crossing alerts".

(R) PM-20 The M4 Interface shall provide management systems the ability to reset to zero the performance parameters identified in requirement **PM-16**.

(R) PM-21 The M4 Interface shall provide management systems the ability to retrieve history counts (at least two 15-minute counts) of the parameters identified in **PM-16**.

(R) PM-22 Failures, testing routines, and reconfigurations of VPCs and/or VCCs may affect the collection of data identified in requirement **R-16**. When such events occur, the ATM NE is expected to flag the collected data as "suspect". The M4 Interface shall provide management systems the ability to retrieve an indication as to whether the counts identified in **R-16** are reliable or suspect.

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2.3.3.1 Related Managed Entities

The managed entities defined in Section 3 that are required to support UPC/NPC Disagreement Monitoring are as follows:

- ATM NE
- TC Adaptor
- UPC/NPC Disagreement Monitoring Current Data
- UPC/NPC Disagreement Monitoring History Data
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

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2.4 Security Management

The following security functions need to be considered for the M4 interface:

- Identification:

  Identification is the process of recognizing a session's requester's unique and auditable identity such as the user-ID. It is the "name" by which a valid user is recognized by the ATM NE. The user-ID need not be confidential.

- Authentication:

  Authentication is the process of verifying the claimed identity of the session requester. For example a password check can be used for this verification. It is desirable that reusable passwords are not transmitted in clear text over the M4 Interface.

- Resource Access Control:

  Resource Access Control provides the capability of denying access to the ATM NE resources in the absence of proper authorization (e.g., user privilege, channel privilege).

- Integrity:

  Data and system integrity deals with consistency and reliability issues associated with the ATM NE, its data, and its software resources. It refers to protection from modification, deletion or creation without proper authorization.

- Audit:

  Security audit provides tools to establish a trail and is used for detection and recovery from intrusions or disruptions and establishing user accountability.

- Security Administration:

  Security Administration consists of proper activation, maintenance, and usage of the security features of the ATM NE. This service is necessary to administer the security-related functionality.

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3. Protocol Independent MIB

This sections defines a protocol independent MIB used to describe the exchange of information across the ATM NE Management Interface. This logical MIB is intended to form the basis from which protocol-specific models (e.g., CMIP Information Models) for ATM are defined. As a guideline, protocol-specific MIB implementations should resemble the protocol independent MIB as much as is possible and practical. The protocol independent MIB should not, however, place unnecessary constraints on its protocol-specific implementations.

The protocol independent MIB presented in this document has been defined in terms of *managed entities*. In this document, managed entities are abstract representations of resources and services in an ATM NE. The managed entities defined in this document are:

- Alarm Record
- Alarm Severity Assignment Profile
- ATM Cell Protocol Monitoring Current Data
- ATM Cell Protocol Monitoring History Data
- ATM Cell Protocol Monitoring Log Record
- ATM Cross Connection
- ATM Cross Connection Control
- ATM NE
- Attribute Value Change Record
- BICI
- BISSI
- Equipment
- Equipment Holder
- Event Forwarding Discriminator
- Latest Occurrence Log
- Log
- Managed Entity Creation Log Record
- Managed Entity Deletion Log Record
- Multipoint Bridge
- Physical Path Termination Point
- Plug-in Unit
- Software
- State Change Record
- TC Adaptor
- TC Adaptor Protocol Monitoring Current Data
- TC Adaptor Protocol Monitoring History Data
- Threshold Data
- UNI
- UPC/NPC Disagreement Monitoring Current Data
- UPC/NPC Disagreement Monitoring History Data
- VCC Termination Point
- VCL Termination Point
- VPC Termination Point
- VPL Termination Point

A detailed description of each managed entity is provided in the subsections that follow. The descriptions include (1) the purpose of the entity, (2) the attributes of the entity, (3) the management operations (actions) that may be performed on the entity, (4) the notifications generated by the managed entity, and (5) the relationship(s) that the entity supports with

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other managed entities. Note that additional uses, attributes, actions, notifications, and relationships may be defined for these managed entities as more operations interface functions are defined.

The VCC/VCL/VPC/VPL Termination Point managed entities and the ATM Cross Connection and ATM Cross Connection Control managed entities were defined to support PVCs. Their applicability to SVCs is for further study.

In this document, all relationships should be interpreted as being bidirectional, that is, if Managed Entity A is documented as having a relationship with Managed Entity B, then Managed Entity B has a reverse relationship with Managed Entity A, although this may not be explicitly documented. Attributes whose value is documented as a pointer to some other managed entity shall be interpreted as expressing the existence of a relationship between the two managed entities. In agreement with the preceding, these relationships are also bidirectional.

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The relationships between the managed entities described in this section are summarized in Figures 3-1, 3-2, and 3-3.

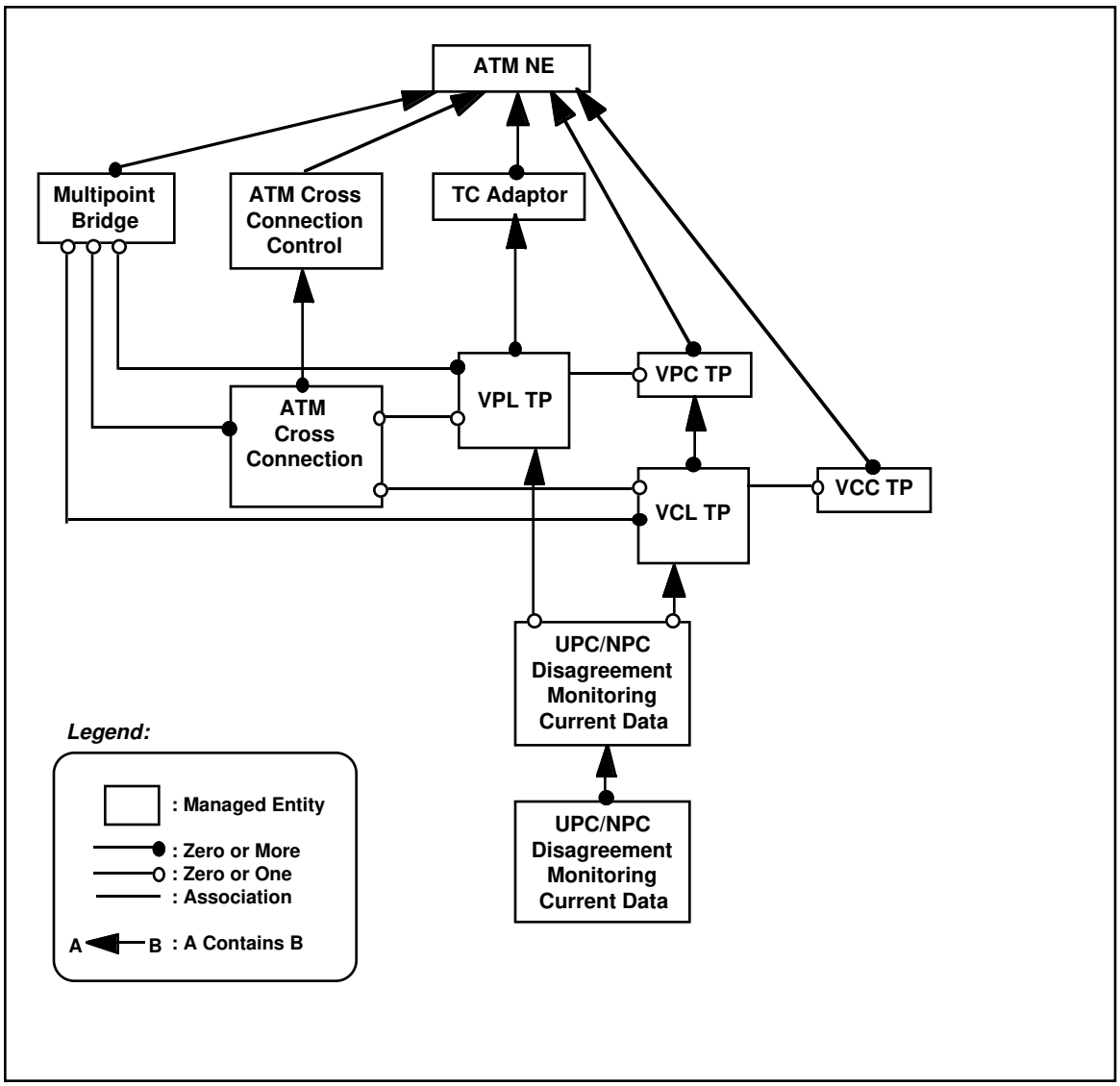

Figure 3-1 Managed Entity Relationship Diagram (1 of 3)

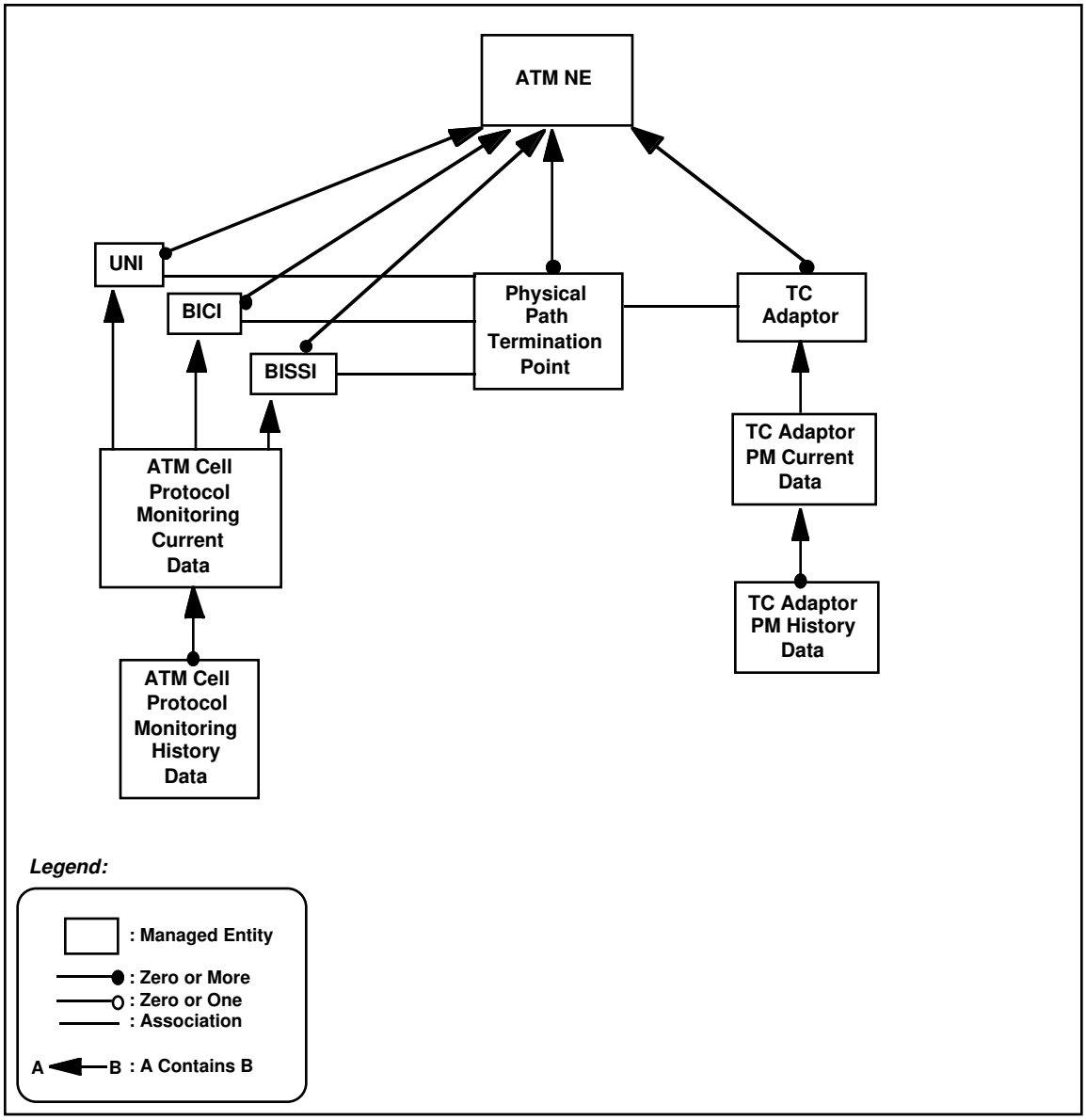

Figure 3-2 Managed Entity Relationship Diagram (2 of 3)

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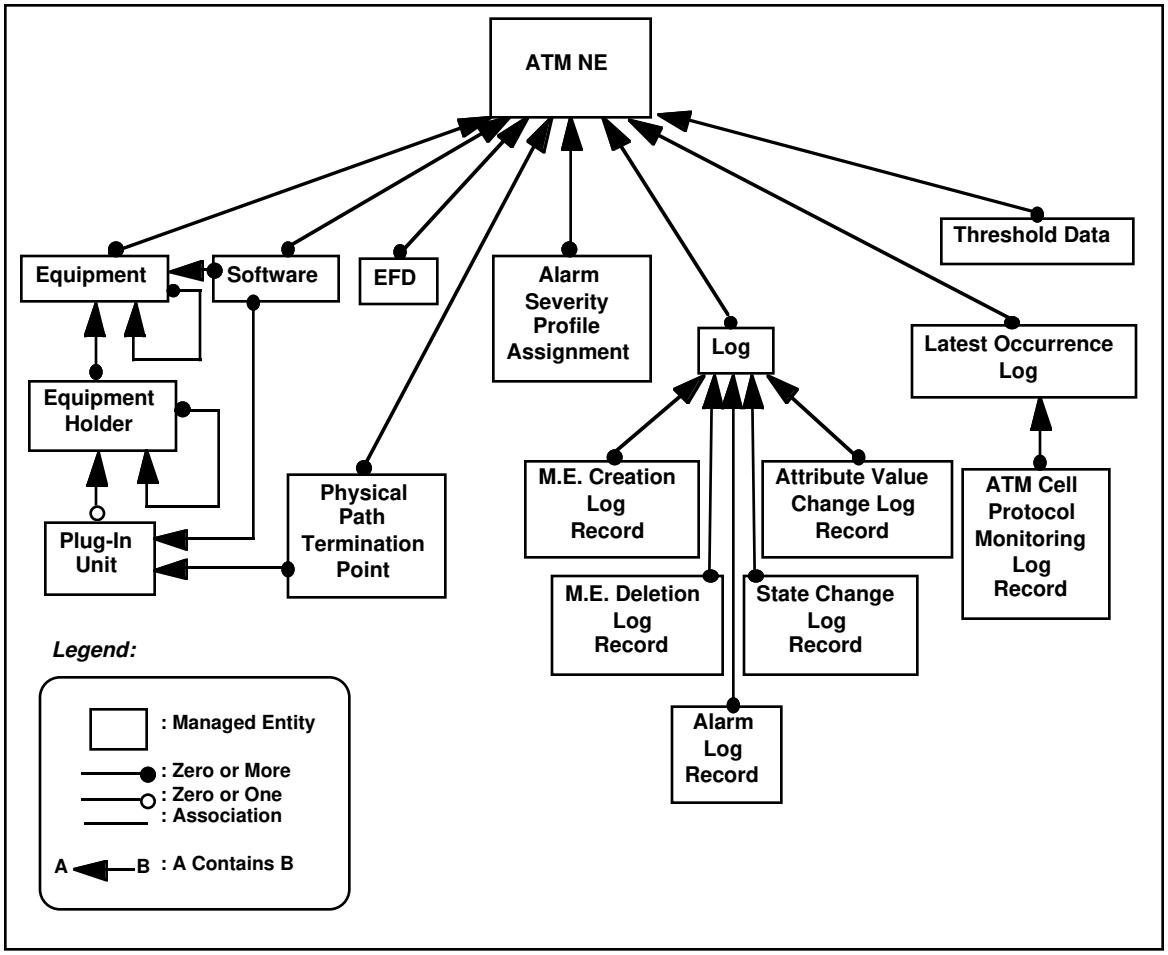

Figure 3-3 Managed Entity Relationship Diagram (3 of 3)

3.1 Alarm Record

This managed entity is used to represent logged information that resulted from ATM NE generated alarm notifications. An instance of this managed entity shall be automatically created for each notification generated by the managed entities within the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Managed Entity: This read-only attribute identifies the type and instance ID of the managed entity that generated the alarm notification.

Generic Trouble Description: See Table 2-1 for a list of generic troubles.

Specific Problems: This read-only attribute identifies further refinements (e.g., sub-cause indicator information) to the generic trouble description of the alarm. This information is only logged if provided in the alarm notification.

Severity: This read-only attribute identifies the severity assigned to the alarm notification (i.e., critical, major, minor, warning, indeterminate, and cleared).

Back-up Status: This read-only attribute indicates whether or not the entity emitting the alarm has been backed-up, and services provided to the user have, therefore, not been disrupted. A value of "true" indicates that the entity has been backed-up; a value of "false" indicates that the entity has not been backed-up.

Back-up Entity: This read-only attribute provides the identity of the managed entity that is providing back-up services to the failed managed entity. If no back-up service is being provided, the value of this parameter shall be NULL.

Additional Text: This read-only attribute is used to allow for additional text to be supplied with the alarm. Such text may further describe problem and/or failed entity (e.g., name and location). This information is only logged if provided in the alarm notification.

Proposed Repair Actions: This read-only attribute is used if the cause of the alarm is known and the ATM NE can suggest one or more solutions to the problem. This information is only logged if provided in the alarm notification.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

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Multiple instances of this managed entity may exist for each instance of the Log managed entity.

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3.2 Alarm Severity Assignment Profile

This managed entity is used to identify the alarm severity assignments for alarm-reporting managed entities. There may be multiple instances of this managed entity within the ATM NE. Instances of this managed entity are referenced by the "Alarm Severity Assignment Profile Pointer" attribute in the alarm-reporting managed entities (e.g., ATM NE, Equipment, Physical Path Termination Point, etc.).

Instances of this managed entity shall be explicitly created and deleted by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Alarm Severity Assignment List: This read/write attribute identifies one or more alarm/severity pairs.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Alarm Severity Assignment List attribute of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the ATM NE managed entity.

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3.3 ATM Cell Protocol Monitoring Current Data

This managed entity contains the current performance monitoring data collected as a result of performing ATM layer protocol monitoring.

An instance of this managed entity shall be created automatically by the ATM NE for each UNI, BICI, and BISSI managed entity.

Attributes:

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the data collection function performed by this managed entity.

Suspect Flag: This read-only attribute indicates the reliability of the current performance monitoring data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Elapsed Time: This read-only attribute represents the difference between the current time and the start of the present summary interval.

Threshold Data ID: This read/write attribute provides a pointer to an instance of the Threshold Data managed entity that contains the threshold values for the performance monitoring data collected by this managed entity.

Number Of Suppressed Intervals: This read-only attribute is non-zero only if the ATM NE is suppressing ATM Cell Protocol Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to protocol errors: This read-only attribute provides a raw, thresholded count of the number of ATM cells that were dropped (per interface) due to an unrecognized field or set of fields in the ATM cell header.

Received OAM Cells: This read-only attribute provides a raw, unthresholded count of the number of OAM cells received by the AM NE over the associated interface.

Actions

No actions have been defined for this managed entity.

Notifications

Threshold Crossing Alert: This message is used to notify the management system when one of the above values exceeds a pre-set threshold. The following information shall be supplied with this notification:

- The ID of the Managed Entity Reporting the Threshold Crossing Alert
- The Type of Performance Parameter that Exceeded the Threshold

Relationships

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An instance of this managed entity shall exist for each instance of the UNI, BICI, and BISSI managed entity.

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3.4 ATM Cell Protocol Monitoring History Data

This managed entity contains all the previous performance monitoring data collected as a result of performing ATM layer protocol monitoring .

Measurement attributes in this managed entity are an exact copy of the attributes in the corresponding ATM Cell Protocol Monitoring Current Data managed entity at the end of the interval. The time at the end of the interval is indicated by the value of the attribute "Period End Time."

Instances of this managed entity are automatically created by the ATM NE.

Attributes:

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Period End Time: This read-only attribute records the time at the end of the interval.

Suspect Flag: This read-only attribute indicates the reliability of the performance monitoring data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Number Of Suppressed Intervals: This read-only attribute is present only if the ATM NE is suppressing ATM Cell Protocol Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to Protocol Errors: This read-only attribute provides a count of the number of ATM cells that were discarded (per interface) due to an unrecognized field or set of fields in the ATM cell header.

Received OAM Cells: This read-only attribute provides a count of the number of OAM cells received by the AM NE over the associated interface.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the ATM Cell Protocol Monitoring Current Data managed entity.

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3.5 ATM Cell Protocol Monitoring Log Record

This managed entity is used to represent logged information that resulted from performing ATM Cell Protocol Monitoring in the ATM NE.

Instances of this managed entity shall be automatically created by the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Cell Header Abnormality Type: This read-only attribute identifies the reason for discarding the ATM cell (i.e., unassigned VPI/VCI value or VPI/VCI value out-of-range).

Interface ID: This read-only attribute identifies the instance of the UNI, BICI, or BISSI managed entity that represents the interface over which the errored cell was received.

VPI Value: This read-only attribute identifies the VPI value of the discarded cell.

VCI Value: This read-only attribute identifies the VCI value of the discarded cell.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Multiple instances of this managed entity may exist for each instance of the Latest Occurrence Log managed entity.

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3.6 ATM Cross Connection

For point-to-point ATM cross-connections, this managed entity is used to represent the cross-connect relationship between two VPL or VCL termination points.

For multipoint ATM cross-connections, this managed entity is used to represent the cross-connect relationship between an instance of the VPL (or VCL) Termination Point managed entity and an instance of the Multipoint Bridge managed entity.

Instances of this managed entity shall be automatically created and deleted by the management system based on ATM Connect and ATM Disconnect actions performed on an instance of the ATM Cross Connect Control managed entity.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Termination Point A: For point-to-point cross connections, this attribute identifies the instance of the VPL (or VCL) Termination Point managed entity that represents one of the two cross-connected VPLs (or VCLs). For multipoint cross connections, this attribute identifies the instance of the VPL (or VCL) Termination Point managed entity that represents one VPL (or VCL) termination point of a particular multipoint cross connection.

Termination Point Z: For point-to-point cross connections, this attribute identifies the instance of the VPL (or VCL) Termination managed entity that represents the other cross-connected VPL (or VCL). For multipoint cross connections, this attribute identifies the instance of the Multipoint Bridge managed entity used to support the multipoint cross connection.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) cell flow through the ATM cross-connection. Assigning a VPI or VPI/VCI translation but reserving it for future activation is performed by initially setting this attribute to "locked".

Operational State: This read-only attribute identifies whether or not this instance of the ATM Cross Connection managed entity is capable of performing its normal function (i.e., switching cells).

Recovery Type: This read/write attribute is used to configure an ATM cross connection as a "recoverable" cross-connection or "non-recoverable" cross-connection. Recoverable cross-connect relationships remain intact regardless of the operational state of the supporting VP/VC. A non-recoverable cross-connection is one that is torn down (i.e., released) upon detection of an affecting failure.

Actions

No actions have been defined for this managed entity.

Notifications

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

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Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Zero or more instances of the ATM Cross Connection managed entity shall exist for each instance of the ATM Cross Connection Control managed entity.

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3.7 ATM Cross Connection Control

This managed entity manages the establishment and release of VP/VC cross-connections (e.g., VPI/VCI translations) in the ATM NE.

An instance of this managed entity shall be automatically created by the ATM NE immediately following ATM NE initialization.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity in the ATM NE.

Operational State: This read-only attribute identifies whether or not the ATM NE is capable of performing its normal functions of establishing and releasing cross-connections.

Actions

ATM Connect: This operation is used to request the ATM Cross Connection Control managed entity instance to establish a point-to-point ATM VPL or VCL cross connection. This request includes parameters that identify the two VPL or VCL terminations to cross-connect, and their associated traffic descriptors and QOS class assignments (if not already known by the ATM NE).

ATM Disconnect: This operation is used to request the ATM Cross Connection Control managed entity instance to release a particular point-to-point ATM cross connection.

ATM Multipoint Connect: This operation is used to request the ATM Cross Connection Control managed entity instance to establish a multipoint ATM VPL or VCL cross connection. This request includes parameters that identify the multipoint connection type (i.e., multicast, merge, multicast/merge, or full multipoint), the root and leaf VPL or VCL termination points to cross-connect, and the traffic descriptors and QOS classes for the various legs of the multipoint cross-connection.

ATM Multipoint Disconnect: This operation is used to request the ATM Cross Connection Control managed entity instance to tear-down (release) an existing multipoint ATM VPL or VCL cross connection. This request includes a parameter that identifies the instance of the Multipoint Bridge managed entity that is supporting the multipoint cross-connection.

Add Legs to Multipoint Bridge: This operation is used to request the ATM Cross Connection Control managed entity instance to add one or more legs (VPL or VCL termination points) to an existing multipoint cross-connection. This request includes parameters that identify the Multipoint Bridge managed entity instance supporting the multipoint cross-connection, the VPL or VCL termination points to add to the connection, and the traffic descriptors and QOS classes for the additional legs of the multipoint cross-connection.

Remove Legs from Multipoint Bridge: This operation is used to request the ATM Cross Connection Control managed entity instance to remove one or more legs (VPL or VCL termination points) from an existing multipoint cross-connection. This request includes parameters that identify the Multipoint Bridge managed entity instance supporting the multipoint cross-connection and the VPL or VCL termination points to remove from the connection.

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Notifications

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed (i.e., Operational State), its old value, and its new value.

Relationships

One instance of the ATM Cross Connection Control managed entity shall exist for each instance of the ATM NE managed entity.

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3.8 ATM NE

This managed entity is used to represent ATM NEs. The ATM NEs represented by this managed entity may be stand-alone devices or multi-component, geographically distributed systems.

An instance of this managed entity shall be automatically created by the ATM NE immediately following ATM NE initialization. The automatic creation of instances of this managed entity shall be reported by the ATM NE to the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for each ATM NE managed entity instance.

External Time: This read/write attribute provides the time-of-day. This attribute functions as a reference for all time-stamp activities in the ATM NE.

Location Name: This read/write attribute identifies the specific or general location of the ATM NE.

Operational State: This read-only attribute identifies whether or not the ATM NE is capable of performing its normal functions (i.e., in-service or out-of-service).

Vendor Name: This read-only attribute identifies the vendor of the ATM NE.

Version: This read-only attribute identifies the version of the ATM NE. A value of NULL shall be used in cases where version information is not available or applicable to the ATM NE being represented.

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignments for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Actions

No actions have been defined for this managed entity.

Notifications

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity

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This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.

- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Alarm Severity Assignment Profile Pointer and Location Name attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed (i.e., the Operational State attribute), its old value, and its new value.

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3.9 Attribute Value Change Record

This managed entity is used to represent logged information that resulted from attribute value change notifications.

Instances of this managed entity shall be automatically created by the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Managed Entity: This read-only attribute identifies the type and instance ID of the managed entity that generated the attribute value change notification.

Attribute Type: This read-only attribute identifies the type of attribute whose value has changed.

Old Attribute Value: This read-only attribute identifies the previous value of the attribute.

New Attribute Value: This read-only attribute identifies the new value of the attribute.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Multiple instances of this managed entity may exist for each instance of the Log managed entity.

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3.10 BICI

This managed entity is used to organize data associated with Broadband Inter Carrier Interfaces (BICIs) terminating on the ATM NE. One instance of this managed entity shall exist for each BICI terminating on the ATM NE.

Instances of this managed entity shall be explicitly created by the management system to configure ATM interfaces terminating on the ATM NE as BICIs.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

TC Adaptor ID - This read-only attribute provides a pointer to the associated instance of the TC Adaptor managed entity.

Maximum Number of Simultaneously Active VPCs Supported: This read/write parameter identifies the maximum number of VPCs that may be active across the BICI at any one point in time.

Maximum Number of Simultaneously Active VCCs Supported: This read/write parameter identifies the maximum number of VCCs that may be active across the BICI at any one point in time.

Number of Allocated VPI Bits: This read/write parameter identifies the number of allocated bits of the VPI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

Number of Allocated VCI Bits: This read/write parameter identifies the number of allocated bits of the VCI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

Far-End Carrier Network: This read/write parameter identifies the adjacent carrier to which the BICI transmission path is connected. This attribute is needed to support SVC services only.

Loopback Location Code: This read/write attribute provides the code that shall exist in incoming OAM Loopback cells that are to be looped-back at the BICI termination point represented by the managed entity.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the attributes of this managed entity (except the Managed Entity ID attribute) . The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

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Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

Relationships

Multiple instances of the BICI managed entity may exist for each instance of the ATM NE managed entity.

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3.11 BISSI

This managed entity is used to organize data associated with Broadband Inter Switching System Interfaces (BISSIs) terminating on the ATM NE. One instance of this managed entity shall exist for each BISSI terminating on the ATM NE.

Instances of this managed entity shall be explicitly created by the management system to configure ATM interfaces terminating on the ATM NE as BISSIs.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

TC Adaptor ID - This read-only attribute provides a pointer to the associated instance of the TC Adaptor managed entity.

Maximum Number of Simultaneously Active VPCs Supported: This read/write parameter identifies the maximum number of VPCs that may be active across the BISSI at any one point in time.

Maximum Number of Simultaneously Active VCCs Supported: This read/write parameter identifies the maximum number of VCCs that may be active across the BISSI at any one point in time.

Number of Allocated VPI Bits: This read/write parameter identifies the number of allocated bits of the VPI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

Number of Allocated VCI Bits: This read/write parameter identifies the number of allocated bits of the VCI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

Loopback Location Code: This read/write attribute provides the code that shall exist in incoming OAM Loopback cells that are to be looped-back at the BISSI termination point represented by the managed entity.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the attributes of this managed entity (except the Managed Entity ID attribute). The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

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Relationships

Multiple instances of the BISSI managed entity may exist for each instance of the ATM NE managed entity.

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3.12 Equipment

This managed entity is used to represent the various externally manageable physical components of the ATM NE that are not modeled via the Plug-in Unit managed entity.

An instance of this managed entity shall be automatically created by the ATM NE immediately following the initialization/installation of the externally manageable physical component in the ATM NE.

Instances of this managed entity shall be explicitly deleted by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the function performed by the ATM NE component. This attribute may not be present in all instances of this managed entity.

Location Name: This read/write attribute identifies the specific or general location of the ATM NE component.

Operational State: This read-only attribute identifies whether or not the ATM NE component is capable of performing its normal functions (i.e., in-service or out-of-service).

Vendor Name: This read-only attribute identifies the vendor of the ATM NE component.

Version: This read-only attribute identifies the version of the ATM NE component.

User Label: This read-write attribute is used to assign a user friendly name to the associated managed entity.

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignments for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Actions

No actions have been defined for this managed entity.

Notifications

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status

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This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Alarm Severity Assignment Profile Pointer and Location Name attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Multiple instances of this managed entity may exist per instance of the ATM NE managed entity.

Instances of this managed entity may be associated with each other to represent equipment/sub-equipment relationships.

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3.13 Equipment Holder

This managed entity represents physical resources of the ATM NE that are capable of holding other physical resources. Examples of resources represented by instances of this managed entity are racks, shelves, drawers, and slots.

An instance of this managed entity shall exist for each rack, shelf, drawer, and slot of the ATM NE. Instances of this managed entity shall be automatically created and reported by the ATM NE once system initialization is complete.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Equipment Holder Type: This read-only attribute indicates whether the Equipment Holder instance is being used to represent a rack, shelf, drawer, or slot.

Equipment Holder Address: This read-only attribute identifies the physical location of the resource represented by the Equipment Holder instance.

Acceptable Plug-in Unit Types: This read-write attribute identifies the types of plug-in units that can be supported by the slot. This attribute only applies when the Equipment Holder instance represents a slot.

Slot Status: This read-only attribute provides a Boolean indication as to whether or not the slot is empty or full. This attribute only applies when the Equipment Holder instance represents a slot.

Software Load: This read-write attribute identifies the software load, if there is any, which is currently designated as the one to be loaded to the plug-in unit whenever an automatic reload of software is needed. This attribute only applies when the Equipment Holder instance represents a slot.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Acceptable Plug-in Unit Types, Slot Status, and Software Load attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

Relationships

An instance of this managed entity shall exist for each rack, shelf, drawer, and slot of the ATM NE. Instances of this managed entity shall support nested containment relationships

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that match the nested containment relationships supported by the ATM NE's racks, shelves, drawers, and slots.

An instance of Equipment Holder (particularly those that represent slots) may be associated with instances of the Plug-in Unit managed entity to model the containment of plug-in units (e.g., circuit packs) within slots of the ATM NE.

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3.14 Event Forwarding Discriminator

This managed entity is used to define the conditions that shall be satisfied by potential reports related to managed entities for the report to be forwarded to the desired destination.

Instances of this managed entity shall be explicitly created by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity in the ATM NE.

Discriminator Construct: This read/write attribute specifies the test conditions which will be used by the Event Forwarding Discriminator in testing potential reports. For example, the discriminator construct may be set such that all alarms with severity not equal to "minor" are sent via the M4 Interface.

Destination: This read/write attribute identifies the destination to which reports that have passed the test conditions will be sent. The destination may be a single application entity title or multiple application entity titles.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the functions of the managed entity.

Operational State: This read-only attribute identifies whether or not the managed entity is capable of performing its normal functions (i.e., in-service or out-of-service).

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Discriminator Construct and Destination attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Multiple instances of the Event Forwarding Discriminator managed entity may exist for each instance of the ATM NE managed entity.

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3.15 Latest Occurrence Log

This managed entity is used to group multiple log records (e.g., ATM Cell Protocol Monitoring Log Record instances) to form a latest occurrence log. If no other log record contained in the Latest Occurrence Log instance has values of the attributes identified by the Key Attribute List attribute equal to the attribute values of the log record to be added, the log record is created and contained in the Latest Occurrence Log. However, if there exists a log record contained in the Latest Occurrence Log instance having values of the attributes identified by the Key Attribute List attribute equal to the attribute values of the log record to be added, the older existing log record contained in the Latest Occurrence Log is replaced by the new log record.

One or more instances of this managed entity shall be automatically created by the ATM NE immediately following ATM NE initialization.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the logging function of the ATM NE.

Log Record Types: This read-only attribute identifies the type(s) of log records grouped by the latestOccurrenceLog managed entity. ATM Cell Protocol Monitoring Log Record is a valid value for this attribute.

Key Attribute List: This read/write attribute indicates the list of attribute types to be used as keys to uniquely identify the entries in a Latest Occurrence Log. For example, in support of ATM Cell Level Protocol Monitoring, this attribute shall identify the attributes in the ATM Cell Protocol Monitoring Log Record managed entity called "Abnormality Type" and "Interface ID".

Operational State: This read-only attribute identifies whether or not the ATM NE is capable of logging information (i.e., in-service or out-of-service).

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Key Attribute List and Log Full Action attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

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State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Multiple instances of this managed entity may be contained per the ATM NE managed entity. At a minimum, one instance of this managed entity is required for containing instances of the ATM Cell Protocol Monitoring Log Record managed entity.

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3.16 Log

This managed entity is used to group multiple instances of the Managed Entity Creation Log Record, Managed Entity Deletion Log Record, State Change Log Record, Attribute Value Change Log Record, and/or Alarm Record managed entities to form a log. This managed entity contains information that, among other things, allows the management system to control the behavior of the log.

One or more instances of this managed entity shall be automatically created by the ATM NE immediately following ATM NE initialization.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the logging function of the ATM NE.

Log Record Types: This read-only attribute identifies the type(s) of log records grouped by the log managed entity. Valid values for this attribute are: Managed Entity Creation Log Record, Managed Entity Deletion Log Record, State Change Log Record, Attribute Value Change Log Record, and/or Alarm Record

Log Full Action: This read/write attribute is used to identify the action the ATM NE shall take when the log space is full. The valid values for this attribute are "wrap-around" and "halt". The default value for this attribute shall be "wrap-around".

Operational State: This read-only attribute identifies whether or not the ATM NE is capable of logging information (i.e., in-service or out-of-service).

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Log Full Action attribute of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

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Multiple instances of this managed entity may be contained per the ATM NE managed entity. Instances of this managed entity are used to contain instances of the Managed Entity Creation Log Record, Managed Entity Deletion Log Record, State Change Log Record, Attribute Value Change Log Record, and/or Alarm Record managed entities.

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3.17 Managed Entity Creation Log Record

This managed entity is used to represent logged information that resulted from managed entity creation events. An instance of this managed entity shall be automatically created by the ATM NE upon creation of other managed entities in the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Managed Entity: This attribute identifies the type and instance ID of the managed entity that was created.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Multiple instances of this managed entity may exist for each instance of the Log managed entity.

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3.18 Managed Entity Deletion Log Record

This managed entity is used to represent logged information that resulted from managed entity deletion events. An instance of this managed entity shall be automatically created by the ATM NE upon deletion of other managed entities in the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Managed Entity: This attribute identifies the type and instance ID of the managed entity that was deleted.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Multiple instances of this managed entity may exist for each instance of the Log managed entity.

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3.19 Multipoint Bridge

This managed entity is used to represent the logical ATM bridging function required of ATM NEs to support multipoint VCL and VPL cross-connections.

Instances of this managed entity are automatically created by the ATM NE in response to multipoint cross-connection requests from the management system. Similarly, instances of this managed entity are automatically deleted in response to multipoint cross-connect release requests from the management system. The details of the multipoint cross-connect establishment and release request messages can be found in the description of the ATM Cross Connection Control managed entity.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) an entire multipoint cross-connection in the ATM NE. In order to inhibit/enable cell flow across an individual leg of a multipoint cross-connection, the management system would re-set the Administrative State attribute in the instance of the ATM Cross Connection managed entity that connects that leg to the Multipoint Bridge.

Multipoint Connection Type: This read-only attribute identifies whether the multipoint cross-connection is a multicast, merge, multicast/merge, or full multipoint cross-connection.

NOTE: While Item 1 above has multiple values which allow for several different forms of "multipoint" cross-connections, it should be noted that the ATM Forum UNI specification only defines point-to-multipoint (i.e., multicast) connections at this time. Therefore, all other forms of multipoint support beyond point-to-multipoint arrangements are optional.

Primary VP/VC Link Termination Point: For broadcast, merge, and multicast/merge cross-connect types, this read-only attribute identifies the VPL or VCL Termination Point managed entity instance that generates traffic to be broadcasted and/or receives traffic that has been merged. This parameter shall be set to NULL for full multipoint cross-connection types.

Common VP/VC Link Termination Points: This read-only attribute is used to identify all VPL or VCL Termination Point managed entities involved in the multipoint cross-connection except that identified by the Primary VP/VC Link Termination Point attribute.

Operational State: This read-only attribute identifies whether or not this instance of the Multipoint Bridge managed entity is capable of performing its normal function (i.e., copying/merging and switching cells).

Actions

No actions have been defined for this managed entity.

Notifications

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Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the ATM NE managed entity.

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3.20 Physical Path Termination Point

This managed entity is used to represent the points in the ATM NE where physical paths terminate and physical path level functions (e.g., path overhead functions) are performed.

An instance of this managed entity shall be automatically created by the ATM NE for each physical path terminating on the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the functions performed by this managed entity.

Physical Path Type: This read-only attribute identifies the type of physical path being terminated (e.g., DS1, DS3, SONET STS-3c, etc.).

Port ID: This read-only attribute identifies the port on the linecard where the physical path terminates.

Framing Format: This read-only attribute represents the physical framing format associated with the physical path being terminated.

Operational State: This read-only attribute identifies whether or not the managed entity is capable of performing its normal functions (i.e., in-service or out-of-service).

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignment for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Actions

No actions have been defined for this managed entity.

Notifications

Alarm: This notification is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.

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- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed (i.e., Operational State), its old value, and its new value.

Relationships

Zero or more instances of the Physical Path Termination Point managed entity shall be contained in an instance of the ATM NE managed entity.

Instances of this managed entity shall be associated with an instance of the Plug-in Unit managed entity.

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3.21 Plug-in Units

This managed entity is used to represent equipment that is inserted (plugged into) and removed from slots of the ATM NE.

An instance of this managed entity shall be automatically created by the ATM NE immediately following the insertion of the plug-in unit into the ATM NE slot, and may be explicitly created by the management system.

Instances of this managed entity shall be explicitly deleted by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the functions performed by the plug-in unit. This attribute may not be present in all instances of this managed entity.

Availability Status: This read-only attribute is used to further describe the state of the managed entity. Valid values for this attribute shall include "Available", "In Test", "Failed", "Power Off", "Not Installed", "Off Line", and "Dependency". This last value is used to indicate that the plug-in unit cannot operate because some other resource on which it depends is unavailable.

Operational State: This read-only attribute identifies whether or not the plug-in unit is capable of performing its normal functions (i.e., in-service or out-of-service).

Plug-in Unit Type: This read-only attribute identifies the plug-in unit type. This attribute may be any printable string (e.g., CLEI code).

Vendor Name: This read-only attribute identifies the vendor of the plug-in unit.

Version: This read-only attribute identifies the version of the plug-in unit.

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignments for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Actions

No actions have been defined for this managed entity.

Notifications

Alarm: This message is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components

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- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Availability Status, Vendor Name, Version, and Alarm Severity Assignment Profile Pointer attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

One instance of this managed entity may exist per instance of the Equipment Holder managed entity that represents a slot.

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3.22 Software

This managed entity is used to represent logical information stored in equipment, including programs and data tables.

An instance of this managed entity shall be automatically created by the ATM NE to report to the management system the currently installed software in the ATM NE.

Instances of this managed entity shall be explicitly deleted by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) software that has been installed in the ATM NE. For example, this attribute may be used to administer the activation and deactivation of multiple software entities in the ATM NE, particularly useful when downloading new software in the ATM NE.

Operational State: This read-only attribute identifies whether or not the software being represented is capable of performing its normal functions (i.e., in-service or out-of-service).

Vendor Name: This read-only attribute identifies the supplier of the software.

Version: This read-only attribute identifies the version of the software.

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignments for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Vendor Name, Version, and Alarm Severity Assignment Profile Pointer attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute and Administrative State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

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Multiple instances of this managed entity may exist per instance of the ATM NE, Equipment, and Plug-in Unit managed entities.

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3.23 State Change Record

This managed entity is used to represent logged information that resulted from state change notifications.

Instances of this managed entity shall be automatically created by the ATM NE.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Logging Time: This read-only attribute identifies the time at which the record was entered into the log.

Managed Entity: This read-only attribute identifies the type and instance ID of the managed entity that generated the state change notification.

State Attribute Type: This read-only attribute identifies the type of attribute (i.e., operational state or administrative state attribute) whose value has changed.

Old State Attribute Value: This read-only attribute identifies the previous value of the state attribute.

New State Attribute Value: This read-only attribute identifies the new value of the state attribute.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Multiple instances of this managed entity may exist for each instance of the Log managed entity.

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3.24 TC Adaptor

An instance of this managed entity represents a point in the ATM NE where the adaptation of the ATM Layer to the underlying physical infrastructure (e.g., SDH or PDH transport network) takes place. ITU-T Recommendation I.321 [9] identifies this adaptation function as one of many functions performed at the Transmission Convergence (TC) Sublayer of the BISDN protocol stack. This managed entity is responsible for generating alarms that report the (in)ability of the managed entity to delineate ATM cells from the payload of a terminated digital transmission path.

An instance of this managed entity shall be automatically created by the ATM NE for each instance of the Physical Path Termination Point managed entity.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the functions performed by this managed entity.

Operational State: This read-only attribute identifies whether or not the managed entity is capable of performing its normal functions (i.e., in-service or out-of-service).

Physical Path Termination Point ID: This read-only attribute provides a pointer to the associated instance of the Physical Path Termination Point managed entity.

Alarm Severity Assignment Profile Pointer: This attribute provides a pointer to the instance of the Alarm Severity Assignment Profile managed entity that contains the severity assignments for the alarms reported by this managed entity. When the value of this attribute is set to NULL, default severity assignments shall be used.

Cell Scrambling Control: This attribute is used to activate/deactivate the ATM cell scrambling function. This attribute is only present for ATM interfaces where ATM cell scrambling may be controlled (i.e., activated/deactivated). The ATM Forum UNI specification requires cell scrambling for ATM/SONET interfaces but allows cell scrambling to be controlled (i.e., turned on and off) for ATM/DS3 interfaces.

Actions

No actions have been defined for this managed entity.

Notifications

Alarm: This message is used to notify the management system when a Loss of Cell Delineation condition has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., Loss of Cell Delineation)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Severity of Failure (critical, major, minor, warning, indeterminate, or cleared)
- Additional Information (optional)

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- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Cell Scrambling Control and Alarm Severity Assignment Profile Pointer attributes of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

Relationships

Zero or more instances of this managed entity shall be contained in the ATM NE managed entity.

One instance of this managed entity shall exist for each instance of the Physical Path Termination Point managed entity.

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3.25 TC Adaptor Protocol Monitoring Current Data

This managed entity contains the current performance monitoring data collected as a result of performing Transmission Convergence level protocol monitoring.

An instance of this managed entity shall be created automatically by the ATM NE for each TC Adaptor managed entity.

Attributes:

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the data collection function performed by this managed entity.

Suspect Flag: This read-only attribute indicates the reliability of the current performance monitoring data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Elapsed Time: This read-only attribute represents the difference between the current time and the start of the present summary interval.

Threshold Data ID: This read/write attribute provides a pointer to an instance of the Threshold Data managed entity that contains the threshold values for the performance monitoring data collected by this managed entity.

Number Of Suppressed Intervals: This read-only attribute is present only if the ATM NE is suppressing TC Adaptor Protocol Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to HEC violations: This read-only attribute provides a raw, thresholded count of the number of ATM cells that were discarded (per interface) due to an HEC violation.

Actions

No actions have been defined for this managed entity.

Notifications

Threshold Crossing Alert: This message is used to notify the management system when the value of the above count exceeds a pre-set threshold. The following information shall be supplied with this notification:

- The ID of the Managed Entity Reporting the Threshold Crossing Alert
- The Type of Performance Parameter that Exceeded the Threshold

Relationships

An instance of this managed entity shall exist for each instance of the corresponding TC Adaptor managed entity.

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3.26 TC Adaptor Protocol Monitoring History Data

This managed entity contains all the previous performance monitoring data collected as a result of performing Transmission Convergence level protocol monitoring .

Measurement attributes in the History Data managed entity are an exact copy of the attributes in the corresponding Current Data managed entity at the end of the interval. The time at the end of the interval is indicated by the value of the attribute "Period End Time."

Instance of this managed entity are automatically created by the ATM NE.

Attributes:

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Period End Time: This read-only attribute records the time at the end of the interval.

Suspect Flag: This read-only attribute indicates the reliability of the performance monitoring data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Number Of Suppressed Intervals: This read-only attribute is present only if the ATM NE is suppressing TC Adaptor Protocol Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to HEC violations: This read-only attribute provides a count of the number of ATM cells that were dropped (per interface) due to an HEC violation.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Instances of this managed entity shall exist for each instance of the corresponding TC Adaptor Protocol Monitoring Current Data managed entity.

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3.27 Threshold Data

This managed entity contains threshold values for the performance monitoring parameters maintained in one or more instances of other managed entities (e.g., the ATM Cell Protocol Monitoring Data managed entity).

Instances of this managed entity may be explicitly created by the management system or automatically created by the ATM NE upon initialization. Instances of this managed entity, however, shall be deleted by the management system only.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Performance Parameter and Threshold Value: This read/write attribute identifies one or more performance monitoring parameters (e.g., Discarded Cells due to HEC Violations) and their associated threshold value.

Actions

No actions have been defined for this managed entity.

Notifications

Attribute Value Change: This notification is used to report changes to the Performance Parameter and Threshold Value attribute of this managed entity. The notification shall identify the attribute that changed, its old value, and its new value.

Relationships

Zero or more instances of this managed entity shall exist for each instance of the ATM NE managed entity.

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3.28 UNI

This managed entity is used to organize data associated with User Network Interfaces (UNIs) terminating on the ATM NE. One instance of this managed entity shall exist for each UNI terminating on the ATM NE.

Instances of this managed entity shall be explicitly created by the management system to configure ATM interfaces terminating on the ATM NE as UNIs.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

TC Adaptor ID - This read-only attribute provides a pointer to the associated instance of the TC Adaptor managed entity.

Maximum Number of Simultaneously Active VPCs Supported: This read/write parameter identifies the maximum number of VPCs that may be active across the UNI at any one point in time.

Maximum Number of Simultaneously Active VCCs Supported: This read/write parameter identifies the maximum number of VCCs that may be active across the UNI at any one point in time.

Number of Allocated VPI Bits - This read/write parameter identifies the number of allocated bits of the VPI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

Number of Allocated VCI Bits - This read/write parameter identifies the number of allocated bits of the VCI sub-field. The value of this parameter is determined based on the lower supported value by the equipment on each end of the interface.

ATM Subscriber Address - This read/write parameter identifies the address (e.g., directory number) or list of addresses assigned to the UNI.

Preferred Carrier - This read/write parameter identifies the name of the default carrier to use when one is not explicitly identified in the call set-up message. This attribute is needed to support SVC services only.

ILMI Channel Identifier- This read/write parameter identifies the VPI/VCI pair used to support ILMI across the UNI. The default value for this parameter is 0/16.

Loopback Location Code: This read/write attribute provides the code that shall exist in incoming OAM Loopback cells that are to be looped-back at the UNI termination point represented by the managed entity.

Actions

No actions have been defined for this managed entity.

Notifications

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Attribute Value Change: This notification is used to report changes to the attributes of this managed entity (except the Managed Entity ID attribute). The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

Relationships

Multiple instances of the UNI managed entity may exist for each instance of the ATM NE managed entity.

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3.29 UPC/NPC Disagreement Monitoring Current Data

An instance of this managed entity is used to collect and report data associated with UPC/NPC Disagreement Monitoring functions performed by the ATM NE. Instances of this managed entity may be explicitly created by the management system for individual VPL Termination Point and VCL Termination Point managed entities so that UPC/NPC Disagreement Monitoring data may be collected and retrieved per ATM VPL and VCL, respectively.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Administrative State: This read/write attribute is used to activate (unlock) and deactivate (lock) the data collection function performed by this managed entity.

Suspect Flag: This read-only attribute indicates the reliability of the current UPC/NPC Disagreement data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Elapsed Time: This read-only attribute represents the difference between the current time and the start time of the present summary interval.

Threshold Data ID: This read/write attribute provides a pointer to an instance of the Threshold Data managed entity that contains the threshold values for the performance monitoring data collected by this managed entity.

Number Of Suppressed Intervals: This read-only attribute is present only if the ATM NE is suppressing UPC/NPC Disagreement Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to UPC/NPC: This read-only attribute provides a raw, thresholded count of the number of discarded cells due to combined CLP=0 and CLP=1 UPC/NPC policing.

Discarded CLP=0 Cells due to UPC/NPC: This read-only attribute provides a raw, thresholded count of the number of discarded CLP=0 cells due to CLP=0 only UPC/NPC policing. This counter is only present if CLP=0 traffic is separately policed.

Successfully Passed Cells: This read-only attribute provides a raw, unthresholded count of the number of cells that have been passed (i.e., not discarded) by the combined CLP=0 and CLP=1 UPC/NPC policing.

Successfully Passed CLP=0 Cells: This attribute provides a raw, unthresholded count of the number of high priority cells that have been passed (i.e., not discarded) by the CLP=0 UPC/NPC policing. This counter is only present if CLP=0 traffic is separately policed.

Actions

No actions have been defined for this managed entity.

Notifications

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Threshold Crossing Alert: This message is used to notify the management system when the value of the above count exceeds a pre-set threshold. The following information shall be supplied with this notification:

- The ID of the Managed Entity Reporting the Threshold Crossing Alert
- The Type of Performance Parameter that Exceeded the Threshold

Relationships

One instance of this managed entity may exist for each instance of the VPL Termination Point and VCL Termination Point managed entities.

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3.30 UPC/NPC Disagreement Monitoring History Data

This managed entity contains all the previous performance monitoring data collected as a result of performing UPC/NPC Disagreement Monitoring.

Measurement attributes in the History Data managed entity are an exact copy of the attributes in the corresponding Current Data managed entity at the end of the interval. The time at the end of the interval is indicated by the value of the attribute "Period End Time."

Instances of this managed entity are automatically created by the ATM NE.

Attributes:

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Period End Time: This read-only attribute records the time at the end of the interval.

Suspect Flag: This read-only attribute indicates the reliability of the performance monitoring data collected by the managed entity. This attribute may take on one of two possible values: reliable and unreliable (suspect).

Number Of Suppressed Intervals: This read-only attribute is present only if the ATM NE is suppressing UPC/NPC Disagreement Monitoring History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Discarded Cells due to UPC/NPC: This read-only attribute provides a count of the number of discarded cells due to combined CLP=0 and CLP=1 UPC/NPC policing.

Discarded CLP=0 Cells due to UPC/NPC: This read-only attribute provides a count of the number of discarded CLP=0 cells due to CLP=0 only UPC/NPC policing. This counter is only present if CLP=0 traffic is separately policed.

Successfully Passed Cells: This read-only attribute provides a count of the number of cells that have been passed (i.e., not discarded) by the combined CLP=0 and CLP=1 UPC/NPC policing function.

Successfully Passed CLP=0 Cells: This attribute provides a count of the number of high priority cells that have been passed (i.e., not discarded) by the CLP=0 UPC/NPC policing function. This counter is only present if CLP=0 traffic is separately policed.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

Instances of this managed entity shall exist for each instance of the corresponding UPC/NPC Disagreement Monitoring Current Data managed entity.

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3.31 VCC Termination Point

This managed entity represents the point in the ATM NE where the VCC and associated overhead (F5 OAM cells) are terminated/originated.

Management systems shall configure/remove VCC terminations in the ATM NE by creating/deleting instances of this managed entity.

Managed entities that represent AAL functions performed at VCC termination points are for further study.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Operational State: This read-only attribute identifies whether or not the managed entity is capable of performing its normal functions (i.e., in-service or out-of-service).

Connectivity Pointer: This read-only attribute serves as a pointer to the VCL Termination Point managed entity instance (in the ATM NE) that supports the instance of this managed entity.

Actions

Loopback OAM Cell: This operation is used to request the VCC Termination Point to insert a loopback OAM cell into the ATM cell stream, verify its return, and report the results of the loopback (i.e., passed or failed) back to the management system. Along with each request will be the location where the inserted OAM cell shall loop-back and an indication as to whether a *segment* or *end-to-end* OAM cell shall be used. The Loopback Location Code attribute value of the UNI, BICI, or BISSI where the loopback is to take place may be used to identify the loopback location. Additionally, a globally unique default value (e.g., "end-point") may also be used to perform a loopback at the other end of a VCC.

Notifications

Alarm: This message is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been back-up.
- Backed-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)

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- Time and Date Failure was Detected

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Zero or more instances of the VCC Termination managed entity shall exist for each instance of the ATM NE managed entity.

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3.32 VCL Termination Point

This managed element is used to represent the termination of VC links on an ATM NE. An instance of the ATM Cross Connection managed entity may be used to relate two instances of the VCL Termination Point managed entity (i.e., for point-to-point cross connection) or an instance of the VCL Termination Point managed entity to an instance of the Multipoint Bridge managed entity (i.e., for multipoint cross connection).

Instances of this managed entity may be created automatically by the ATM NE, as a result of an ATM cross-connect request, or explicitly by the management system. Similarly, instances of this managed entity may be deleted automatically by the ATM NE, as a result of an ATM cross-connect release request, or explicitly by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

VCI Value: This read-only attribute identifies the VCI value associated with the VC link being terminated.

Traffic Descriptors: This read/write attribute identifies values for the following traffic descriptors:

- Ingress and Egress Peak Cell Rate for CLP=0+1 Traffic
- Ingress and Egress Peak Cell Rate for CLP=0 Traffic (Optional)
- Ingress and Egress CDV Tolerance for CLP=0+1 Traffic
- Ingress and Egress CDV Tolerance for CLP=0 Traffic (Optional)
- Ingress and Egress Sustainable Cell Rate for CLP=0 and CLP=0+1 Traffic (Optional)
- Ingress and Egress Burst Tolerance for CLP=0 and CLP=0+1 Traffic (Optional)

QOS Class: This read/write attribute identifies the QOS class assigned to the VCL.

Operational State: This read-only attribute identifies whether or not the VCL termination is capable of performing its normal functions (in-service or out-of-service).

Segment End Point: This Boolean attribute indicates whether or not the VCL Termination Point managed entity instance has been configured to represent a VCC Segment End Point. This is a read/write attribute.

Connectivity Pointer: This read-only attribute serves as a pointer to the instance of the VCL Termination Point managed entity instance (in the ATM NE) to which it is cross-connected, or, if it represents the last virtual channel link termination in the VCC, it serves as a pointer to the corresponding VCC Termination Point managed entity instance in the ATM NE.

Actions

Loopback OAM Cell: This operation is used to request the VCL Termination Point to insert a loopback OAM cell into the ATM cell stream, verify its return, and report the results of the loopback (i.e., passed or failed) back to the management system. Along with each request will be the location where the inserted OAM cell shall loop-back and an indication as to whether a *segment* or *end-to-end* OAM cell shall be used. The Loopback Location Code attribute value of the UNI, BICI, or BISSI where the loopback is to take place may

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be used to identify the loopback location. Additionally, a globally unique default value (e.g., "end-point") may also be used to perform a loopback at the end of a VCC.

Notifications

Alarm: This message is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Traffic Descriptors and Segment End-Point attributes of this managed entity . The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed (i.e., Operational State), its old value, and its new value.

Relationships

Zero or more instances of the VCL Termination Point managed entity shall exist for each instance of the VPC Termination Point managed entity.

An instance of the VCL Termination Point managed entity may be associated with another instance of the same managed entity to denote a VCL cross-connection. Such relationships are captured in instances of the ATM Cross Connection managed entity.

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3.33 VPC Termination Point

This managed entity represents the point in the switch where the VPC and associated overhead (F4 OAM cells) are terminated/originated.

Management systems shall configure/remove VPC terminations in the ATM NE by creating/deleting instances of this managed entity.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

Operational State: This read-only attribute identifies whether or not the managed entity is capable of performing its normal functions (i.e., in-service or out-of-service).

Connectivity Pointer: This read-only attribute serves as a pointer to the VPL Termination Point managed entity instance (in the ATM NE) that supports the instance of this managed entity.

Actions

Loopback OAM Cell: This operation is used to request the VPC Termination Point to insert a loopback OAM cell into the ATM cell stream, verify its return, and report the results of the loopback (i.e., passed or failed) back to the management system. Along with each request will be the location where the inserted OAM cell shall loop-back and an indication as to whether a *segment* or *end-to-end* OAM cell shall be used. The Loopback Location Code attribute value of the UNI, BICI, or BISSI where the loopback is to take place may be used to identify the loopback location. Additionally, a globally unique default value (e.g., "end-point") may also be used to perform a loopback at the other end of the VPC.

Notifications

Alarm: This message is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

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Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed, its old value, and its new value.

Relationships

Zero or more instances of the VPC Termination managed entity shall exist for each instance of the ATM NE managed entity.

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3.34 VPL Termination Point

This managed element is used to represent the termination of VP links on an ATM NE. An instance of the ATM Cross Connection managed entity may be used to relate two instances of the VPL Termination Point managed entity (i.e., for point-to-point cross connection) or an instance of the VPL Termination Point managed entity to an instance of the Multipoint Bridge managed entity (i.e., for multipoint cross connection).

Instances of this managed entity may be created automatically by the ATM NE, as a result of an ATM cross-connect request, or explicitly by the management system. Similarly, instances of this managed entity may be deleted automatically by the ATM NE, as a result of an ATM cross-connect release request, or explicitly by the management system.

Attributes

Managed Entity ID: This read-only attribute provides a unique name for the managed entity instance in the ATM NE.

VPI Value: This read-only attribute identifies the VPI value associated with the VP link being terminated.

Traffic Descriptors: This read/write attribute identifies values for the following traffic descriptors:

- Ingress and Egress Peak Cell Rate for CLP=0+1 Traffic
- Ingress and Egress Peak Cell Rate for CLP=0 Traffic (Optional)
- Ingress and Egress CDV Tolerance for CLP=0+1 Traffic
- Ingress and Egress CDV Tolerance for CLP=0 Traffic (Optional)
- Ingress and Egress Sustainable Cell Rate for CLP=0 and CLP=0+1 Traffic (Optional)
- Ingress and Egress Burst Tolerance for CLP=0 and CLP=0+1 Traffic (Optional)

QOS Class: This read/write attribute identifies the QOS class assigned to the VPL.

Operational State: This read-only attribute identifies whether or not the VPL termination is capable of performing its normal functions (in-service or out-of-service).

Segment End Point: This Boolean attribute indicates whether or not the VPL Termination Point managed entity instance has been configured to represent a VPC Segment End Point. This is a read/write attribute.

Connectivity Pointer: This read-only attribute serves as a pointer to the instance of the VPL Termination Point managed entity instance (in the ATM NE) to which it is cross-connected, or, if it represents the last virtual path link termination in the VPC, it serves as a pointer to the corresponding VPC Termination Point managed entity instance in the ATM NE.

Actions

Loopback OAM Cell: This operation is used to request the VPL Termination Point to insert a loopback OAM cell into the ATM cell stream, verify its return, and report the results of the loopback (i.e., passed or failed) back to the management system. Along with each request will be the location where the inserted OAM cell shall loop-back and an indication as to whether a *segment* or *end-to-end* OAM cell shall be used. The Loopback Location Code attribute value of the UNI, BICI, or BISSI where the loopback is to take place may

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be used to identify the loopback location. Additionally, a globally unique default value (e.g., "end-point") may also be used to perform a loopback at the end of the VPC.

Notifications

Alarm: This message is used to notify the management system when a failure has been detected or cleared. The following parameters shall be supplied with this notification:

- The Nature of the Alarm (i.e., see generic trouble list)
- Specific Problems (optional)
- The ID of the Managed Entity Reporting the Alarm
- The Failed Switch Component or List of Failed (or Possibly Failed) Components
- Back-up Status
  This is a Boolean indication as to whether or not the failed entity has been backed-up.
- Back-up Entity
  This is the ID of the managed entity providing back-up services to the failed entity. This parameter shall be NULL when the value of the "Back-up Status" parameter is *false*.
- Severity of Failure (critical, major, minor, warning, indeterminate, and cleared)
- Additional Information (optional)
- Proposed Repair Actions (optional)
- Time and Date Failure was Detected

Attribute Value Change: This notification is used to report changes to the Traffic Descriptors and Segment End-Point attributes of this managed entity . The notification shall identify the attribute that changed, its old value, and its new value.

Managed Entity Creation: This notification is used to report the creation of an instance of this managed entity.

Managed Entity Deletion: This notification is used to report the deletion of an instance of this managed entity.

State Change: This notification is used to report changes to the Operational State attribute of this managed entity. The notification shall identify the state attribute that changed (i.e., Operational State), its old value, and its new value.

Relationships

Zero or more instances of the VPL Termination Point managed entity shall exist for each instance of the Physical Path Termination Point managed entity.

An instance of the VPL Termination Point managed entity may be associated with another instance of the same managed entity to denote a VPL cross-connection. Such relationships are captured in instances of the ATM Cross Connection managed entity.

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4. Acronyms

AAL	ATM Adaptation Layer
AIS	Alarm Indication Signal
ATM	Asynchronous Transfer Mode
BICI	Broadband Inter Carrier Interface
BISDN	Broadband Integrated Services Digital Network
BISSI	Broadband Inter Switching System Interface
CLP	Cell Loss Priority
CM	Configuration Management
CMIP	Common Management Information Protocol
DS3	Digital Signal 3
EFD	Event Forwarding Discriminator
EML	Element Management Layer
EL	Element Layer
FM	Fault Management
ILMI	Interim Local Management Interface
ITU	International Telecommunications Union
LATA	Local Access and Transport Area
LCD	Loss of Cell Delineation
LOF	Loss Of Frame
LOP	Loss Of Pointer
LOS	Loss Of Signal
MIB	Management Information Base
NE	Network Element
NEL	Network Element Layer
NEML	Network Element Management Layer
NML	Network Management Layer
NMS	Network Management System
NPC	Network Parameter Control
OAM	Operations, Administration, and Maintenance
OCD	Out of Cell Delineation
PM	Performance Management
PMD	Physical Media Dependent
PTI	Payload Type Identifier
QOS	Quality Of Service
RDI	Remote Defect Indication
SDH	Synchronous Digital Hierarchy
SM	Security Management
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
STS-3c	Synchronous Transport Signal 3c
TMN	Telecommunications Management Network
UNI	User Node Interface
UPC	User Parameter Control
VC	Virtual Channel
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VCL	Virtual Channel Link
VP	Virtual Path
VPC	Virtual Path Connection
VPI	Virtual Path Identifier
VPL	Virtual Path Link

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