The ATM Forum
Technical Committee

Network Management

AAL Management
for the
M4 "NE View"
Interface

af-nm-0071-000

January, 1997

AAL Management for the M4 “NE View” Interface

af-nm-0071-000

November 1996

(C) 1996 The ATM Forum. All Rights Reserved. No part of this publication may be reproduced in any form or by any means.

The information in this publication is believed to be accurate as of its publication date. Such information is subject to change without notice and The ATM Forum is not responsible for any errors. The ATM Forum does not assume any responsibility to update or correct any information in this publication.

Notwithstanding anything to the contrary, neither The ATM Forum nor the publisher make representation or warranty, expressed or implied, concerning the completeness, accuracy, or applicability of any information contained in this publication. No liability of any kind shall be assumed by The ATM Forum or the publisher as a result of reliance upon any information contained in this publication.

The receipt or any use of this document or its contents does not in any way create by implication or otherwise:

- Any express or implied license or right to or under any ATM Forum member company’s patent, copyright, trademark or trade secret rights which are or may be associated with the ideas, techniques, concepts or expressions contained herein; nor
- Any warranty or representation that any ATM Forum member companies will announce any product(s) and/or service(s) related thereto, or if such announcements are made, that such announced product(s) and/or service(s) embody any or all of the ideas, technologies, or concepts contained herein; nor
- Any form of relationship between any ATM Forum member companies and the recipient or user of this document.

Implementation or use of specific ATM standards or recommendations and ATM Forum specifications will be voluntary, and no company shall agree or be obliged to implement them be virtue of participation in The ATM Forum.

The ATM Forum is a non-profit international organization accelerating industry cooperation on ATM technology. The ATM Forum does not, expressly or otherwise, endorse or promote any specific products or services.

NOTE: The user’s attention is called to the possibility that implementation of the ATM interoperability specification contained herein may require the use of an invention covered by patent rights held by ATM Forum member companies or others. By publication of this ATM interoperability specification, no position is taken by The ATM Forum with respect to validity of any patent claims or of any patent rights related thereto or the ability to obtain the license to use such rights. ATM Forum member companies agree to grant licenses under the relevant patents they own on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. For additional information contact:

The ATM Forum
Worldwide Headquarters
2570 West El Camino Real, Ste 304
Mountain View, CA, CA 94040-1313
Tel: +1-415-949-6700
Fax: +1-415-949-6705

Table of Contents

1. Introduction 1
2. Overview of AAL Management 1
3. M4 Logical MIB 9
3.1. AAL1 Profile 9
3.2. AAL3/4 Profile 10
3.3. AAL5 Profile 10
3.4. AAL1 Protocol Current Data 11
3.5. AAL3/4 Protocol Current Data 13
3.6. AAL5 Protocol Current Data 15
3.7. AAL1 Protocol History Data 16
3.8. AAL3/4 Protocol History Data 17
3.9. AAL5 Protocol History Data 19
4. M4 CMIP MIB 21
4.1. Managed Object Classes 21
4.1.1. aalProfile 21
4.1.2. aalProtocolCurrentData 21
4.1.3. aalProtocolHistoryData 22
4.2. Conditional Packages 22
4.2.1. aalTypeOnePerformanceParameterPkg 22
4.2.2. aalTypeOnePerformanceParameterHistoryDataPkg 23
4.2.3. aalTypeOneProfilePkg 24
4.2.4. aalTypeThreeFourPerformanceParameterPkg 24
4.2.5. aalTypeThreeFourPerformanceParameterHistoryDataPkg 25
4.2.6. aalTypeThreeFourProfilePkg 26
4.2.7. aalTypeFivePerformanceParameterPkg 26
4.2.8. aalTypeFivePerformanceParameterHistoryDataPkg 26
4.2.9. aalTypeFiveProfilePkg 26
4.3. Attributes 27
4.3.1. aalMode 27
4.3.2. aalProfileId 27
4.3.3. aalType 27
4.3.4. bETagMismatch 28
4.3.5. bomsEomsUnexpectedMID 28
4.3.6. bufferOverflows 28
4.3.7. bufferUnderflows 28
4.3.8. cbrRate 29
4.3.9. cellLoss 29
4.3.10. cellLossIntegrationPeriod 29
4.3.11. cellMisinsertion 29
4.3.12. clockRecoveryType 30
4.3.13. comsEomsUnexpectedSN 30
4.3.14. crcViolations 30
4.3.15. forwardErrorCorrectionMethod 30
4.3.16. headerErrors 31
4.3.17. lengthBASizeMismatch 31
4.3.18. lengthMismatch 31
4.3.19. maxCpcsSduSize 32
4.3.20. midRange 32
4.3.21. numberOfAborts 32
4.3.22. partiallyFilledCells 32
4.3.23. reassemblyTimerExpirations 33
4.3.24. sarCrcViolations 33

4.3.25. sequenceViolations 33
4.3.26. sriTimeOuts 33
4.3.27. sscsType 34
4.3.28. stdPointerParityFailures 34
4.3.29. stdPointerReframes 34
4.3.30. structuredDataTransfer 34
4.3.31. subType 35
4.3.32. sumOfIncorrectCSFFieldErrors 35
4.3.33. sumOfIncorrectSARFieldErrors 35
4.3.34. sumOfInvalidCSFieldErrors 36
4.3.35. sumOfInvalidSARFieldErrors 36
4.4. Name Bindings 36
4.4.1. aalProfile-managedElementR1 36
4.4.2. aalProtocolCurrentData-interworkingVCTTPBidirectional 37
4.5. Supporting ASN.1 Productions 38
5. Figures 41

List of Figures

Figure 1 Containment Tree Diagram..... 41
Figure 2 Inheritance Tree Diagram..... 41

List of Tables

Table 1 AAL Type 1 Protocol Monitoring Summary....4
Table 2 AAL Type 3/4 Protocol Monitoring Summary....4
Table 3 AAL Type 5 Protocol Monitoring Summary....5

1. Introduction

This contribution proposes a set of requirements, logical information model, and CMIP specification to support AAL Management. The contents of this contribution are supplements to af-nm-0020.000 (*M4 “NE View” Interface Requirements & Logical MIB*) and Section 2 of af-nm-0027.000 (*CMIP MIB for the M4 “NE View” Interface*). This model has been coordinated with the CES model in af-nm-0072-000.

2. Overview of AAL Management

2.1.X. AAL Configuration Management

AAL management criteria vary depending on the AAL Type (i.e., Type 1, Type 3/4, or Type 5).
Note that although most AAL processing is done outside the public network, there are expected to be some ATM PVCs for which AAL processing resides in the public network. Connections that terminate on Inter-Working Units, connections that terminate on higher-layer Packet Handlers, as well as connections that support signaling or operations message transfer are just a few examples. The criteria presented in this paper applies only to those connections for which AAL processing and associated management is the responsibility of the public network.

The ATM Forum UNI Specification Version 4.0 defines an *AAL Parameters Information Element* and B-ICI Version 2.0 defines an *AAL Parameters Parameter.* This *information element* is used during the SVC set-up process to negotiate AAL-specific parameters that characterize the desired AAL processing to be performed at both ends of the SVC. While the UNI and B-ICI Specifications only address the configuration of AAL parameters from an SVC perspective, the need to configure AAL parameters applies to some network-terminated PVCs as well.

(R) CM-1 The M4 Interface shall support management system requests to configure the AAL Type for a given VCC termination point in an ATM NE. Valid values are: AAL Type 1, Type 2(for future use), Type 3/4, and Type 5.

2.1.X.1. AAL Type 1 Configuration Information

If the ATM NE supports AAL Type 1 on a connection, it must support the ability to read the following information:

- Subtype
- CBR Rate
- Clock Recovery Type
- Forward Error Correction Type
- Structured Data Transfer
- Partially Filled Cells
- Cell Loss Integration Period

Furthermore, if the ATM NE does not automatically configure this information, then the M4 interface must support configuration of this information by the Management System.

(R) CM-2 For connections supporting AAL Type 1, the following information shall be readable by the Management System across the M4 Interface. If the ATM NE needs this information to be configured by the Management System, this information shall also be configurable across the M4 interface.

1. The AAL type 1 subtype used by the CBR service application (e.g. 64 kbps voiceband signal transport, circuit transport);

2. The CBR service application rate (e.g. 64 kbps, 1544 kbps, 44736 kbps, n x 64 kbps)

3. The source clock frequency recovery method in use

   – Synchronous, or

   – Asynchronous - Synchronous Residual Time Stamp (SRTS), or

   – Asynchronous - Adaptive Clock.

4. Structured Data Transfer (SDT) Block Size ($1 \leq$ Blk Sz $\leq 2^{16} - 1$ in octets) (optional)

5. Partial Cell Payload Fill (0 < Payload Fill < 47 octets of AAL user information) (optional)

6. Forward Error Correction (FEC) Type (optional)

   – No forward error correction

   – FEC for Loss Sensitive Signal Transport (i.e., (128,124) Reed-Solomon encoded long interleaver)

   – FEC for Delay Sensitive Signal Transport (i.e., (94, 88) Reed-Solomon encoded short interleaver).

7. Cell Loss Integration Period (in milliseconds)

2.1.X.2. AAL Type 3/4 Configuration Information

If the ATM NE supports AAL Type 3/4 on a connection, it must support the ability to read the following information:

- Max CPCS SDU Size
- MID Range
- Mode
- SSCS Type

(R) CM-3 For connections supporting AAL Type 3/4, the following information shall be readable by the Management System across the M4 Interface. If the ATM NE needs this information to be configured by the Management System, this information shall also be configurable across the M4 interface.

1. Message Identifier (MID) field range (i.e. the lowest and highest MID field values);

2. Maximum CPCS_SDU Size (i.e. upper bound on the AAL type 3/4 CPCS_SDU size in octets where the SDU size range is $0 \leq SDU \leq 2^{16} - 1$ octets)

   – for the forward direction (i.e., the calling user to called user direction for SVC service) and

   – for the backward direction (i.e., called user to calling user direction for SVC service);

3. Mode of operation (e.g. Message or Streaming, Assured or Unassured);

4. Identify AAL type 3/4 convergence sublayer protocol options applicable to the specific service application supported by the AAL (i.e., AAL type 3/4 SSCS).

2.1.X.3. AAL Type 5 Configuration Information

If the ATM NE supports AAL Type 5 on a connection, it must support the ability to read the following information:

- Max CPCS SDU Size
- Mode
- SSCS Type

(R) CM-4 For connections supporting AAL Type 5, the following information shall be readable by the Management System across the M4 Interface. If the ATM NE needs this information to be configured by the Management System, this information shall also be configurable across the M4 interface.

1. Maximum CPCS_SDU Size (i.e., upper bound on the AAL type 5 CPCS_SDU size in octets where the SDU size range is $0 \leq SDU \leq 2^{16} - 1$ octets)

   – for the forward direction (i.e., the calling user to called user direction for SVC service) and

   – for the backward direction (i.e., called user to calling user direction for SVC service);

2. Mode of operation (e.g., Message or Streaming, Assured or Unassured);

3. Identify AAL type 5 convergence sublayer protocol options applicable to the specific service application supported by the AAL (i.e., AAL type 5 SSCS).

2.2.Y AAL Fault Management

For connections that terminate on IWUs supporting DSn Circuit Emulation, there is a need to generate an alarm (to the OS) when a receiving AAL Type 1 entity spends an excessive amount of time in the Starvation Condition. Note that a receiving AAL Type 1 entity enters a Starvation Condition when AAL-SDU information is needed to construct the DSn bit stream and none is available for the number of milliseconds specified by Cell Loss Integration Period. This is described further in Bellcore GR-1248-CORE.

FM-1 The M4 Interface shall support autonomous notifications used to report AAL Type 1 failures such as Cell Starvation.

Note: This requirement is supported by the information model described in af-nm-0072-000.

2.3.Z. AAL Performance Management - Protocol Monitoring

The approach for AAL performance monitoring is based on maintaining counts of errors in received Segmentation And Reassembly (SAR) and Convergence Sublayer (CS) Protocol Data Units (PDUs) per VCC termination point. Tables 1, 2, and 3 summarize information regarding AAL protocol monitoring for AAL Types 1, 3/4, and 5. Note that, as in the case of TC Sublayer and ATM Layer protocol monitoring, the granularity period for AAL protocol monitoring shall be 15 minutes. Also 8 hours of history shall be maintained in the ATM NE.

Table 1 AAL Type 1 Protocol Monitoring Summary

Parameter	Simple Counter	Thresholded
AAL Header Errors	√	√
Sequence Violations	√	√
Cell Loss	√	√
Cell Misinsertion	√	√
Buffer Underflow Events	√	√
Buffer Overflow Events	√	√
SDT Pointer Reframes	√	√
SDT Pointer Parity Check Failures	√	√

Table 2 AAL Type 3/4 Protocol Monitoring Summary

Parameter		Sum of Errors	Simple Counter	Thresholded
CS	Invalid Fields (Invalid CPI + Invalid Alignment + Invalid BASize)	√		√
	Incorrect Fields	√		√
	BTag ≠ ETag		√	
	BASize not consistent with Length		√	
	Actual length not consistent with Length		√	
SAR	Invalid Fields (Invalid MID + Invalid Length Indication)	√		√
	Incorrect Fields	√		√
	Incorrect CRC		√	
	Unexpected Sequence Number		√	
	Unexpected MID		√	
	SRI Time Outs		√	√
	Number of Aborts		√	

Table 3 AAL Type 5 Protocol Monitoring Summary

Parameter		Sum of Errors	Simple Counter	Thresholded
CS	Invalid Fields (Invalid CPI + Oversized Received SDU + Length Violation)	√		√
	Incorrect Fields (CRC-32 Violation)		√	√
	Reassembly Timer Expirations		√	√

2.3.Z.1. AAL Type 1 Protocol Monitoring

(R) PM-1 In support of AAL Type 1 protocol monitoring, the M4 Interface shall provide management systems the ability to retrieve current (15 minute) counts of the following errors (at the CS layer) at each connection end point where receiving IWF functions (with an AAL Type 1 supporting UDT) are performed:

1. AAL Header Errors (i.e., the number of AAL1 header errors detected, including those corrected. Header errors include correctable and uncorrectable CRC plus bad parity.)

2. Sequence Count Violationstotal violations (i.e., the count of incoming AAL Type 1 SAR-PDUs where the sequence count in the PDU header causes a transition from the SYNC state to the OUT OF SEQUENCE state as defined by ITU-T Rec. I.363.1), (optional)
   - lost cells (i.e.,the number of lost cells, as detected by the AAL1 sequence number processing, for example. This count records the number of cells detected as lost in the network prior to the destination interworking function AAL1 layer processing.), (optional)
   - misinserted cells (i.e., the number of sequence violation events which the AAL CS interprets as misinserted of cells as defined by ITU-T Rec. I.363.1), (optional)

3. Buffer Underflows (i.e., the number of times the reassembly buffer underflows. In the case of a continuous underflow caused by a loss of ATM cell flow, a single buffer underflow should be counted. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit evel buffer, then either buffer underflow will cause this count to be incremented). Buffer underflow may be caused by slight clocking differences between the node at which seqmentation takes place and the node at which reassembly takes place. Buffer underflow may also result from unexpectedly large CDV.

4. Buffer Overflows (i.e., the number of times the reassembly buffer overflows. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer overflow will cause this count to be incremented). Buffer overflow may be caused by slight clocking differences between the node at which seqmentation takes place and the node at which reassembly takes place. Buffer overflow may also result from unexpectedly large CDV.

5. SDT Pointer Reframes (i.e., the number of events in which the AAL1 reassenbler found that a structured data pointer is not where it is expected, and the pointer must be reacquired. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. (mandatory for structucterd data transfer)

6. SDT Pointer Parity Check Failures (i.e., the number of times the AAL reassembler detects a parity check failure at the point where a structured data pointer is expected. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers.), (optional for structured data transfer).

(R) PM-2 The M4 Interface shall support management system requests to define at least one set of threshold values (i.e., threshold value packages) for the supported parameters listed in **PM-1** and selectively assign each set to one or more AAL Type 1 entities in the ATM NE.

(R) PM-3 The M4 Interface shall provide management systems the ability to modify threshold values for the supported performance parameters identified in requirement **PM-1**.

(R) PM-4 The M4 Interface shall support autonomous notifications (generated by the ATM NE) used to report threshold crossings for the supported parameters identified in requirement **PM-1**.

(R) PM-5 The M4 Interface shall provide the management system the ability to retrieve history counts (thirty-two 15 minute counts) of the supported performance parameters identified in **PM-1**.

2.3.Z.2. AAL Type 3/4 Protocol Monitoring

(R) PM-6 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve a single, aggregate, thresholded current (15 minute) sum of errors count that reflects the following errors:

1. Invalid Message Identifier (MID); i.e., MID = 0 when there is multiplexing, or MID not equal to 0 when there is no multiplexing.

2. Invalid SAR-PDU Length Indication; i.e., Length Indication not equal to 44 octets for a BOM or COM, not in the set of values [4, 8, ..., 44] octets or 63 octets for an EOM, or not in the set of values [8, 12, ..., 44] octets for an SSM. The value "63" is used in the abort procedures, as described in ITU-T Rec. I.363.3.

(R) PM-7 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve a current (15 minute) sum of errors count that reflects the following errors:

1. SAR-PDU CRC incorrect when computed

2. COM/EOM Segment with unexpected SAR Sequence Number, i.e., SAR Sequence Number not incremented by 1 (modulo 16) relative to the previous (non-EOM) SAR-PDU received over the same VPC/VCC, and containing the same MID.

3. BOM/EOM Segment with unexpected MID, i.e., a BOM is received with a currently active MID (a MID for which an EOM has not yet been received), or an EOM received for which a MID is not currently active.

(R) PM-8 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve separate performance counters on each connection end point that terminates the AAL Type 3/4 protocol, for each of the SAR-PDU incorrect field error types listed in **PM-7**.

(R) PM-9 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve current (15 minute) counts of the number of SRI time-outs that occur on each connection end point that terminates the AAL Type 3/4 protocol.

(R) PM-10 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve current (15 minute) counts of the number of aborts that occur on each connection end point that terminates the AAL Type 3/4 protocol.

(R) PM-11 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve a current (15 minute) sum of errors count that reflects the following errors:

- BASize Field value not valid on an incoming AAL Type 3/4 CS-PDU; i.e., < 37 octets for multi-segment messages
- Common Part Indicator not valid (i.e., not equal to 0)
- Alignment Field not equal to 0.

Note that not all ATM NEs that terminate AAL Type 3/4 will check for these errors.

(R) PM-13 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve a current (15 minute) sum of errors count that reflects the following errors:

1. Beginning Tag (BTag) not equal to End Tag (ETag)
2. Buffer Allocation Size (BASize) and Length fields not equal when message mode is used, or BASize < Length when streaming mode is used. (When supporting SMDS, BASize must always be = Length.)
3. Actual length of CS-PDU Payload not consistent with Length field. For clarification, the length is consistent in the following cases. In a proper CS-PDU composed of multiple segments, the number of octets in the partially assembled CS-PDU plus the SAR Length Indication field must be in the range [Length + 4, Length + 7], because the last SAR-PDU will contain 4 octets CS trailer and 0-3 octets Pad. (A range is specified because the size of the Pad is not known by the CS layer.) In a proper CS-PDU composed of only a single segment, the SAR Length Indication field must be in the range [Length + 8, Length + 11], because the SAR-PDU will contain 4 octets CS header, 4 octets CS trailer, and 0-3 octets Pad.

(R) PM-14 In support of AAL Type 3/4 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve separate performance counters for each connection end point that terminates the AAL Type 3/4 protocol, for each of the CS-PDU incorrect field error types listed in **PM-13**.

(R) PM-15 The M4 Interface shall support management system requests to define at least one set of threshold values (i.e., threshold value packages) for the parameters listed in **PM-6**, **PM-7**, **PM-9**, **PM-11**, and **PM-13**; and selectively assign each set to one or more AAL Type 3/4 entities in the ATM NE.

(R) PM-16 The M4 Interface shall provide management systems the ability to modify threshold values for the performance parameters identified in requirements **PM-6**, **PM-7**, **PM-9**, **PM-11**, and **PM-13**.

(R) PM-17 The M4 Interface shall support autonomous notifications (generated by the ATM NE) used to report threshold crossings for the parameters identified in requirement **PM-6**, **PM-7**, **PM-9**, **PM-11**, and **PM-13**.

(R) PM-18 The M4 Interface shall provide the management system the ability to retrieve history counts (thirty-two 15 minute counts) of the performance parameters identified in requirements **PM-6** to **PM-14**.

2.3.Z.3 AAL Type 5 Protocol Monitoring

(R) PM-19 In support of AAL Type 5 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve current (15 minute) sum of errors count of the following errors at each connection end point where AAL Type 5 is terminated:

1. Invalid CPI
2. Oversized Received SDU
3. Length Violation (a length violation results in an invalid Pad field size).

(R) PM-20 In support of AAL Type 5 protocol monitoring, the M4 Interface shall provide the management system the ability to retrieve current (15 minute) counts of CRC-32 violations.

(R) PM-21 In support of AAL Type 5 protocol monitoring, if a reassembly timer is implemented, the M4 Interface shall provide the management system the ability to retrieve current (15 minute) counts of the number of reassembly timer expirations on each receiving connection end point where AAL Type 5 is terminated.

(R) PM-22 The M4 Interface shall support management system requests to define at least one set of threshold values (i.e., threshold value packages) for the parameters listed in **PM-19**, **PM-20**, and **PM-21** and selectively assign each set to one or more AAL Type 5 entities in the ATM NE.

(R) PM-23 The M4 Interface shall provide management systems the ability to modify threshold values for the performance parameters identified in requirement **PM-19**, **PM-20**, and **PM-21**.

(R) PM-24 The M4 Interface shall support autonomous notifications (generated by the ATM NE) used to report threshold crossings for the parameters identified in requirement **PM-19**, **PM-20**, and **PM-21**.

(R) PM-25 The M4 Interface shall provide the management system the ability to retrieve history counts (thirty-two 15 minute counts) of the performance parameters identified in **PM-19**, **PM-20**, and **PM-21**.

3. M4 Logical MIB

3.1. AAL1 Profile

This managed entity is used to organize data that describes the AAL Type 1 processing functions of the ATM NE. It is used with the Interworking VCC Termination Point object class defined in af-nm-0072-000.

In an ATM environment, AAL Type 1 performance monitoring parameters are associated with an Interworking VCC Termination Point object through a pointer relationship. Each instance of this object class defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point objects.

Attributes

AAL Profile Id: This is an attribute whose distinguished value can be used as an RDN when naming an instance of the AAL1 Profile managed object class.

Sub Type: This attribute is used to identify the AAL subtype. Valid values for this attribute are NULL, Voice-band based on 64 kbps, Circuit Emulation (synchronous), Circuit Emulation (asynchronous), High-quality Audio, and Video.

CBR Rate: This attribute represents the rate of the CBR service supported by the AAL.

Clock Recovery Type: This attribute indicates whether the clock recovery type is Synchronous, SRTS (Synchronous Residual Time Stamp), or Adaptive Clock Recovery.

Forward Error Correction Type: This attribute indicates the FEC method: no FEC, FEC for Loss Sensitive Signal Transport, or FEC for Delay Sensitive Signal Transport. (optional)

Structured Data Transfer: This attribute indicates whether Structured Data Transfer (SDT) has been configured at the AAL. A value of TRUE means SDT has been selected. This attribute value cannot be set to TRUE when the Forward Error Correction Type attribute equals TRUE. (optional)

Partially Filled Cells: This attribute identifies the number of leading octets in use. (optional)

Cell Loss Integration Period: This attribute represents the time in milliseconds for the cell loss integration period. If cells are lost for this period of time, the Interworking VCC Termination Point entity will generate a cell starvation alarm.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

One instance of this managed entity shall exist for each combination of AAL1 parameter values used within an ATM NE.

3.2. AAL3/4 Profile

This managed entity is used to organize data that describes the AAL Type 3/4 processing functions of the ATM NE. It is used with the Interworking VCC Termination Point object class defined in af-nm-0072-000.

In an ATM environment, AAL Type 3/4 performance monitoring parameters are associated with an Interworking VCC Termination Point object through a pointer relationship. Each instance of this object class defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point objects.

Attributes

AAL Profile_Id: This is an attribute whose distinguished value can be used as an RDN when naming an instance of the AAL Profile managed object class.

Max_CPCS_SDU_Size: This multi-valued attribute represents the maximum CPCS_PDU size that will be transmitted over the connection in both the incoming (forward) and outgoing (backward) direction of transmission.

MID Range: This attribute represents the range of MID values supported at the AAL for the supporting VCC.

AAL_Mode: This attribute indicates whether the AAL for the supporting VCC is operating in message mode or streaming mode, assured or unassured.

SSCS_Type: This attribute identifies the SSCS type for the AAL. Valid values are NULL, Data SSCS based on SSCOP (assured operation), Data SSCS based on SSCOP (non-assured operation), or Frame Relay SSCS.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

One instance of this managed entity shall exist for eachcombination of AAL 3/4 parameter values used within the ATM NE.

3.3. AAL5 Profile

This managed entity is used to organize data that describes the AAL Type 5 processing functions of the ATM NE. It is used with the Interworking VCC Termination Point object class defied in af-nm-0072-000.

In an ATM environment, AAL Type 5 performance monitoring parameters are associated with an Interworking VCC Termination Point object through a pointer relationship. Each instance of the object class defines a combination of parameter values that may be associated with multiple Interworking VCC Termination Point objects.

Attributes

AAL Profile Id: This is an attribute whose distinguished value can be used as an RDN when naming an instance of the AAL Profile managed object class.

Max CPCS SDU Size: This multi-valued attribute represents the maximum CPCS_PDU size that will be transmitted over the connection in both the incoming (forward) and outgoing (backward) direction of transmission.

AAL Mode: This attribute indicates whether the AAL for the supporting VCC is operating in message mode or streaming mode, assured or unassured.

SSCS Type: This attribute identifies the SSCS type for the AAL. Valid values are NULL, Data SSCS based on SSCOP (assured operation), Data SSCS based on SSCOP (non-assured operation), or Frame Relay SSCS.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

One instance of this managed entity shall exist for eachcombination of AAL5 parameter values used within the ATM NE.

3.4. AAL1 Protocol Current Data

This managed entity contains the current performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

Instances of this managed entity shall be inherently created by the managed system whenever an instance of the Interworking VCC Termination Point managed entity is created that represents AAL functions.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

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 AAL1 Protocol History Data creation when the current interval terminates with “all-zeroes” performance measurements.

Header Errors: This attribute represents a count of the number of AAL1 header errors detected, including those corrected. Header errors include correctable and uncorrectable CRC plus bad parity.

Sequence Violations: This attribute represents a count of incoming AAL Type 1 SAR-PDUs where the sequence count in the PDU header causes a transifion from the SYNC state to the OUT OF SEQUENCE state as defined by ITU-T Rec. I.363.1. A negative value indicates that this attribute is not supported.

Cell Loss: This attribute represents a count of the number of lost cells, as detected by the AAL1 sequence number processing, for example. This count records the number of cells detected as lost in the network prior to the destination interworking function AAL1 layer processing. A negative value indicates that this attribute is not supported.

Cell Misinsertion: This attribute represents a count of sequence violation events which the AAL CS interprets as misinserted of cells as defined by ITU-T Rec. I.363.1. A negative value indicates that this attribute is not supported.

Buffer Underflows: This attribute represents a count of the number of times the reassembly buffer underflows. In the case of a continuous underflow caused by a loss of ATM cell flow, a single buffer underflow should be counted. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit evel buffer, then either buffer underflow will cause this count to be incremented.

Buffer Overflows: This attribute represents a count of the number of times the reassembly buffer overflows. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer overflow will cause this count to be incremented.

SDT Pointer Reframes: This attribute represents a count of the number of events in which the AAL1 reassenbler found that a structured data pointer is not where it is expected, and the pointer must be reacquired. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. A negative value indicates that this attribute is not supported, however it must be supported when pointers are used.

SDT Pointer Parity Check Failures: This attribute represents a count of the number of times the AAL reassembler detects a parity check failure at the point where a structured data pointer is expected. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. A negative value indicates that this attribute is not supported.

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

One instance of this managed entity shall exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL1 functions.

3.5. AAL3/4 Protocol Current Data

This managed entity contains the current performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

Instances of this managed entity shall be inherently created by the managed system whenever an instance of an Interworking VCC Termination Point managed entity is created that represents AAL 3/4 functions.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

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 AAL3/4 Protocol History Data creation when the current interval terminates with “all-zeroes” performance measurements.

Sum Of Invalid SAR Field Errors: This attribute provides a sum-of-errors count for invalid Segmentation And Reassembly (SAR) field errors. For AAL Type 3/4, this attribute provides a single count of the number of SAR_PDUs discarded due to one of the following error conditions: MID=0 when there is multiplexing, MID not equal to 0 when there is no multiplexing, Length field not equal to 44 octets for a BOM or COM, Length field not in the set [4, 8, ..., 44] octets or 63 octets for an EOM, or Length field

not in the set
[8, 12, ..., 44] octets for an SSM.

Sum Of Incorrect SAR Field Errors: This attribute provides a sum-of-errors count for incorrect Segmentation And Reassembly (SAR) field errors. For AAL Type 3/4, this attribute provides a single count of SAR_PDUs discarded due to one of the following errors: CRC violation, unexpected Sequence Number (SN) field value, or unexpected MID field value

SAR CRC Violations: This attribute represents the number of CRC violations that were detected for the incoming SAR PDUs.

COMS EOMS Unexpected SN: This attribute represents the number of COM and EOM segments received with an unexpected Sequence Number (SN). For a particular message (i.e., MID) transported over a VPC or VCC, this attribute is incremented by one each time a COM or EOM is received with a SAR Sequence Number (SN) that is not correct relative to the SN in the previous (non-EOM) segment.

BOMS EOMS Unexpected MID: This attribute represents the number of BOM/EOM segments with an unexpected MID value. This attribute will be incremented by one each time a BOM is received with a currently active MID (a MID for which an EOM has not yet been received), or when an EOM is received for which a MID is NOT currently active.

SRI Time Outs: This attribute represents a count of the number of SRI time-outs that occurred on an ATM connection.

Number Of Aborts: This attribute provides a count of the number aborts (i.e., EOM with SAR_PDU Length Indication = 63) that are received for the underlying VPC or VCC.

Sum Of Invalid CS Field Errors: This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL Type 3/4, this attribute provides a single count of the number of CS_PDUs discarded due to one of the following error conditions: Common Part Indicator (CPI) field not equal to 0, Alignment field value not equal to 0, or BASize field value < 37 octets for multi-segment messages.

Sum Of Incorrect CS Field Errors: This attribute provides a sum-of-errors count for incorrect Convergence Sublayer (CS) field errors. For AAL Type 3/4, this attribute provides a single count of CS_PDUs discarded due to one of the following error conditions: BETag mismatch, BASize field value not consistent with Length field value, or Length field value not consistent with CS_PDU length.

BE Tag Mismatch: This attribute represents the number of times an incoming CS_PDU had a BTag field value that did not equal the ETag field value.

Length BA Size Mismatch: This attribute represents the number of CS_PDUs in which the Length field value was not consistent with the BASize field value. The definition of consistent depends on the mode in which CS_PDU fragments are being processed. In the message-mode, the BASize field must equal the Length field. In the streaming mode, the BASize field must be less than the Length field.

Length Mismatch: This attribute represents the number of CS_PDUs received with a Length field value that does not represent the actual length of the CS_PDU payload.

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

One instance of this managed entity shall exist for each instance of an Interworking VCC Termination Point managed entity that represents AAL 3/4 functions.

3.6. AAL5 Protocol Current Data

This managed entity contains the current performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

Instances of this managed entity shall be inherently created by the managed system whenever an instance of the Interworking VCC Termination Point managed entity is created that represents AAL 5 functions.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

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 AAL5 Protocol History Data creation when the current interval terminates with “all-zeroes” performance measurements.

Sum Of Invalid CS Field Errors: This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL Type 5, this attribute provides a single count of the number of CS_PDUs discarded due to one of the following error conditions: Invalid Common Part Indicator (CPI), oversized received SDU, or length violation.

CRC Violations: This attribute represents the number of CRC violations that were detected for the incoming AAL PDUs.

Reassembly Timer Expirations: This attribute provides a count of reasembly timer expirations. A negitive value indicates that this attribute is not supported. (mandatory if reassembly timer is implemented)

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

One instance of this managed entity shall exist for each instance of the Interworking VCC Termination Point managed entity that represents AAL5 functions.

3.7. AAL1 Protocol History Data

This is a managed entity that contains the past performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

Number of Suppressed Intervals: This read-only attribute is non-zero only if the ATM NE is suppressing AAL1 Protocol History Data creation when the current interval terminates with "all-zeroes" performance measurements.

Header Errors: This attribute represents a count of the number of AAL1 header errors detected, including those corrected. Header errors include correctable and uncorrectable CRC plus bad parity

Sequence Violations: This attribute represents a count of incoming AAL Type 1 SAR-PDUs where the sequence count in the PDU header causes a transition from the SYNC state to the OUT OF SEQUENCE state as defined by ITU-T Rec. I.363.1. A negative value indicates that this attribute is not supported.

Cell Loss: This attribute represents a count the number of lost cells, as detected by the AAL1 sequence number processing, for example. This count records the number of cells detected as lost in the network

prior to the destination interworking function AAL1 layer processing. A negative value indicates that this attribute is not supported.

Cell Misinsertion: This attribute represents a sequence violation events which the AAL CS interprets as misinserted of cells as defined by ITU-T Rec. I.363.1. A negative value indicates that this attribute is not supported.

Buffer Underflows: This attribute represents a count the number of times the reassembly buffer underflows. In the case of a continuous underflow caused by a loss of ATM cell flow, a single buffer underflow should be counted. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit evel buffer, then either buffer underflow will cause this count to be incremented.

Buffer Overflows: This attribute represents a count of the number of times the reassembly buffer overflows. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer overflow will cause this count to be incremented.

SDT Pointer Reframes: This attribute represents a count of the number of events in which the AAL1 reassenbler found that a structured data pointer is not where it is expected, and the pointer must be reacquired. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. A negative value indicates that this attribute is not supported, however it must be supported when pointers are used.

SDT Pointer Parity Check Failures: This attribute represents a count of the number of times the AAL reassembler detects a parity check failure at the point where a structured data pointer is expected. This count is only meaningful for structured data transfer modes as unstructured modes do not use pointers. A negative value indicates that this attribute is not supported.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

A new instance of this entity is created at the end of each 15-minute interval for each current data object. This managed entity will create a copy of the performance management attributes that are present in the AAL1 Current Protocol data managed entity at the end of the 15-minute interval. From zero to thirty-two instances of this object shall be supported for each current data object.

3.8. AAL3/4 Protocol History Data

This is a managed entity that contains the past performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

Number of Suppressed Intervals: This read-only attribute is non-zero only if the ATM NE is suppressing AAL3/4 Protocol History Data creation when the current interval terminates with “all-zeroes” performance measurements.

Sum Of Invalid SAR Field Errors: This attribute provides a sum-of-errors count for invalid Segmentation And Reassembly (SAR) field errors. For AAL Type 3/4, this attribute provides a single count of the number of SAR_PDUs discarded due to one of the following error conditions: MID=0 when there is multiplexing, MID not equal to 0 when there is no multiplexing, Length field not equal to 44 octets for a BOM or COM, Length field not in the set [4, 8, ..., 44] octets or 63 octets for an EOM, or Length field not in the set
[8, 12, ..., 44] octets for an SSM.

Sum Of Incorrect SAR Field Errors: This attribute provides a sum-of-errors count for incorrect Segmentation And Reassembly (SAR) field errors. For AAL Type 3/4, this attribute provides a single count of SAR_PDUs discarded due to one of the following errors: CRC violation, unexpected Sequence Number (SN) field value, or unexpected MID field value

SAR CRC Violations: This attribute represents the number of CRC violations that were detected for the incoming SAR PDUs.

COMS EOMS Unexpected SN: This attribute represents the number of COM and EOM segments received with an unexpected Sequence Number (SN). For a particular message (i.e., MID) transported over a VPC or VCC, this attribute is incremented by one each time a COM or EOM is received with a SAR Sequence Number (SN) that is not correct relative to the SN in the previous (non-EOM) segment.

BOMS EOMS Unexpected MID: This attribute represents the number of BOM/EOM segments with an unexpected MID value. This attribute will be incremented by one each time a BOM is received with a currently active MID (a MID for which an EOM has not yet been received), or when an EOM is received for which a MID is NOT currently active.

SRI Time Outs: This attribute represents a count of the number of SRI time-outs that occurred on an ATM connection.

Number Of Aborts: This attribute provides a count of the number aborts (i.e., EOM with SAR_PDU Length Indication = 63) that are received for the underlying VPC or VCC.

Sum Of Invalid CS Field Errors: This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL Type 3/4, this attribute provides a single count of the number of CS_PDUs discarded due to one of the following error conditions: Common Part Indicator (CPI) field not equal to 0, Alignment field value not equal to 0, or BASize field value < 37 octets for multi-segment messages.

Sum Of Incorrect CS Field Errors: This attribute provides a sum-of-errors count for incorrect Convergence Sublayer (CS) field errors. For AAL Type 3/4, this attribute provides a single count of CS_PDUs discarded due to one of the following error conditions: BETag mismatch, BASize field value not consistent with Length field value, or Length field value not consistent with CS_PDU length.

BE Tag Mismatch: This attribute represents the number of times an incoming CS_PDU had a BTag field value that did not equal the ETag field value.

Length BA Size Mismatch: This attribute represents the number of CS_PDUs in which the Length field value was not consistent with the BASize field value. The definition of consistent depends on the mode in which CS_PDU fragments are being processed. In the message-mode, the BASize field must equal the Length field. In the streaming mode, the BASize field must be less than the Length field.

Length Mismatch: This attribute represents the number of CS_PDUs received with a Length field value that does not represent the actual length of the CS_PDU payload.

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

A new instance of this entity is created at the end of each 15-minute interval for each current data object. This managed entity will create a copy of the performance management attributes that are present in the AAL3/4 Current Protocol data managed entity at the end of the 15-minute interval. From zero to thirty-two instances of this object shall be supported for each current data object.

3.9. AAL5 Protocol History Data

This is a managed entity that contains the past performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring.

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 Interval Flag: This attribute is used to indicate that the performance data for the current period may not be reliable.

Number of Suppressed Intervals: This read-only attribute is non-zero only if the ATM NE is suppressing AAL5 Protocol History Data creation when the current interval terminates with “all-zeroes” performance measurements.

Sum Of Invalid CS Field Errors: This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL Type 5, this attribute provides a single count of the number of CS_PDUs discarded due to one of the following error conditions: Invalid Common Part Indicator (CPI), oversized received SDU, or length violation.

CRC_Violations: This attribute represents the number of CRC violations that were detected for the incoming AAL PDUs.

Reassembly Timer Expirations: This attribute provides a count of reasembly timer expirations. A negitive value indicates that this attribute is not supported. (mandatory if reassembly timer is implemented)

Actions

No actions have been defined for this managed entity.

Notifications

No notifications have been defined for this managed entity.

Relationships

A new instance of this entity is created at the end of each 15-minute interval for each current data object. This managed entity will create a copy of the performance management attributes that are present in the AAL5 Current Protocol data managed entity at the end of the 15-minute interval. From zero to thirty-two instances of this object shall be supported for each current data object.

4. M4 CMIP MIB

The following managed object classes, conditional packages, attributes, name binding, and ASN.1 productions are a supplement to the existing ATM Forum M4 NE View CIMISE MIB (af-nm-0027.001).

4.1. Managed Object Classes

4.1.1. aalProfile

```
aalProfile MANAGED OBJECT CLASS
    DERIVED FROM "ITU-T Rec. X.721 | ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        aalProfilePkg PACKAGE
            BEHAVIOUR aalProfileBeh;
            ATTRIBUTES
            aalProfileId
                GET,
            aalType
                GET;;;
    CONDITIONAL PACKAGES
        aalTypeOneProfilePkg
        PRESENT IF "the aalType attribute is set to  aal1",
        aalTypeThreeFourProfilePkg
        PRESENT IF "the aalType attribute is set to  aal34",
        aalTypeFiveProfilePkg
        PRESENT IF "the aalType attribute is set to  aal5";
REGISTERED AS {atmfM4ObjectClass 30};

aalProfileBeh BEHAVIOUR
    DEFINED AS
"The aalProfile object class is a managed support object used to organize data that describes the AAL
processing functions of the ATM NE.  The attribute aalType identifies the type of AAL processing (i.e.,
AAL1, AAL3/4, or AAL5).  The AAL profiling information is contained in packages which are present
based on the value of the aalType attribute. ";
```

4.1.2. aalProtocolCurrentData

```
aalProtocolCurrentData MANAGED OBJECT CLASS
    DERIVED FROM "ITU-T Rec. Q.822: 1993": currentData;
    CHARACTERIZED BY
        aalProtocolCurrentDataPkg PACKAGE
            BEHAVIOUR aalProtocolCurrentDataBeh;;;
    CONDITIONAL PACKAGES
        aalTypeOnePerformanceParameterPkg
            PRESENT IF "AAL Type 1 processing is being performed",
        aalTypeThreeFourPerformanceParameterPkg
            PRESENT IF "AAL Type 3/4 processing is being performed",
        aalTypeFivePerformanceParameterPkg
            PRESENT IF "AAL Type 5 processing is being performed";
REGISTERED AS {atmfM4ObjectClass 31};
```

aalProtocolCurrentDataBeh BEHAVIOUR
DEFINED AS
"The aalProtocolCurrentData object is a managed support object that contains the current performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring. The granularityPeriod attribute inherited from the scanner object class shall be set to 15-minutes. Instances of this object class shall be inherently created by the managed system whenever an instance of the Interworking VCC Termination Point object class is created that represents AAL functions.";

4.1.3. aalProtocolHistoryData

```
aalProtocolHistoryData MANAGED OBJECT CLASS
    DERIVED FROM "ITU-T Rec. Q.822: 1993": historyData;
    CHARACTERIZED BY
        aalProtocolHistoryDataPkg PACKAGE
            BEHAVIOUR aalProtocolHistoryDataBeh;;;
    CONDITIONAL PACKAGES
        aalTypeOnePerformanceParameterHistoryDataPkg
            PRESENT IF "AAL Type 1 processing is being performed",
        aalTypeThreeFourPerformanceParameterHistoryDataPkg
            PRESENT IF "AAL Type 3/4 processing is being performed",
        aalTypeFivePerformanceParameterHistoryDataPkg
            PRESENT IF "AAL Type 5 processing is being performed";
REGISTERED AS {atmfM4ObjectClass 32};
```

aalProtocolHistoryDataBeh BEHAVIOUR
DEFINED AS
"The aalProtocolHistoryData object is a managed support object that contains the past performance monitoring data collected as a result of performing Segmentation and Reassembly (SAR) Level and Convergence Sublayer (CS) protocol monitoring. Instances of this object class can only be created locally by an agent (managed system) according to the value of the historyRetention attribute specified in the aalProtocolCurrentData object. ";

4.2. Conditional Packages

4.2.1. aalTypeOnePerformanceParameterPkg

```
aalTypeOnePerformanceParameterPkg PACKAGE
    ATTRIBUTES
        sequenceViolations
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        cellLoss
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
```

```
        cellMisinsertion
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET,
        bufferUnderflows
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET,
        bufferOverflows
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET,
        headerErrors
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET,
        stdPointerReframes
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET,
        stdPointerParityFailures
                REPLACE-WITH-DEFAULT
                DEFAULT VALUE ATMMIBMod.integerZero
                GET;
REGISTERED AS {atmfM4Package 20};
```

4.2.2. aalTypeOnePerformanceParameterHistoryDataPkg

```
aalTypeOnePerformanceParameterHistoryDataPkg PACKAGE
    ATTRIBUTES
        sequenceViolations
                GET,
        cellLoss
                GET,
        cellMisinsertion
                GET,
        bufferUnderflows
                GET,
        bufferOverflows
                GET,
        headerErrors
                GET,
        stdPointerReframes
                GET,
        stdPointerParityFailures
                GET;
REGISTERED AS {atmfM4Package 21};
```

4.2.3. aalTypeOneProfilePkg

```
aalTypeOneProfilePkg PACKAGE
    ATTRIBUTES
        cbrRate
            GET,
        cellLossIntegrationPeriod,
            GET,
        clockRecoveryType
            GET,
        forwardErrorCorrectionMethod
            GET,
        partiallyFilledCells
            GET,
        structuredDataTransfer
            GET,
        subType
            GET;
REGISTERED AS {atmfM4Package 22};
```

4.2.4. aalTypeThreeFourPerformanceParameterPkg

```
aalTypeThreeFourPerformanceParameterPkg PACKAGE
    ATTRIBUTES
        sumOfInvalidSARFieldErrors
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        sumOfIncorrectSARFieldErrors
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        sarCrcViolations
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        comsEomsUnexpectedSN
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        bomsEomsUnexpectedMID
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        sriTimeOuts
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        numberOfAborts
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
```

```
            sumOfInvalidCSFieldErrors
                    REPLACE-WITH-DEFAULT
                    DEFAULT VALUE ATMMIBMod.integerZero
                    GET,
            sumOfIncorrectCSFieldErrors
                    REPLACE-WITH-DEFAULT
                    DEFAULT VALUE ATMMIBMod.integerZero
                    GET,
            bETagMismatch
                    REPLACE-WITH-DEFAULT
                    DEFAULT VALUE ATMMIBMod.integerZero
                    GET,
            lengthBASizeMismatch
                    REPLACE-WITH-DEFAULT
                    DEFAULT VALUE ATMMIBMod.integerZero
                    GET,
            lengthMismatch
                    REPLACE-WITH-DEFAULT
                    DEFAULT VALUE ATMMIBMod.integerZero
                    GET;
REGISTERED AS {atmfM4Package 23};
```

4.2.5. aalTypeThreeFourPerformanceParameterHistoryDataPkg

```
aalTypeThreeFourPerformanceParameterHistoryDataPkg PACKAGE
    ATTRIBUTES
            sumOfInvalidSARFieldErrors
                    GET,
            sumOfIncorrectSARFieldErrors
                    GET,
            sarCrcViolations
                    GET,
            comsEomsUnexpectedSN
                    GET,
            bomsEomsUnexpectedMID
                    GET,
            sriTimeOuts
                    GET,
            numberOfAborts
                    GET,
            sumOfInvalidCSFieldErrors
                    GET,
            sumOfIncorrectCSFieldErrors
                    GET,
            bETagMismatch
                    GET,
            lengthBASizeMismatch
                    GET,
            lengthMismatch
                    GET;
REGISTERED AS {atmfM4Package 24};
```

4.2.6. aalTypeThreeFourProfilePkg

```
aalTypeThreeFourProfilePkg PACKAGE
    ATTRIBUTES
        maxCpcsSduSize
            GET,
        midRange
            GET,
        aal Mode
            GET,
        sscsType
            GET;
REGISTERED AS {atmfM4Package 25};
```

4.2.7. aalTypeFivePerformanceParameterPkg

```
aalTypeFivePerformanceParameterPkg PACKAGE
    ATTRIBUTES
        sumOfInvalidCSFieldErrors
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        crcViolations
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET,
        reassemblyTimerExpirationss
            REPLACE-WITH-DEFAULT
            DEFAULT VALUE ATMMIBMod.integerZero
            GET;
REGISTERED AS {atmfM4Package 26};
```

4.2.8. aalTypeFivePerformanceParameterHistoryDataPkg

```
aalTypeFivePerformanceParameterHistoryDataPkg PACKAGE
    ATTRIBUTES
        sumOfInvalidCSFieldErrors
            GET,
        crcViolations
            GET,
        reassemblyTimerExpirations
            GET;
REGISTERED AS {atmfM4Package 27};
```

4.2.9. aalTypeFiveProfilePkg

```
aalTypeFiveProfilePkg PACKAGE
    ATTRIBUTES
        maxCpcsSduSize
            GET,
```

```
        aal Mode
                GET,
        sscsType
                GET;
REGISTERED AS {atmfM4Package 28};
```

4.3. Attributes

4.3.1. aalMode

```
aalMode ATTRIBUTE
    WITH ATTRIBUTE SYNTAX ATMMIBMod.AalMode;
    MATCHES FOR EQUALITY, ORDERING;
    BEHAVIOUR aalModeBeh;
REGISTERED AS {atmfM4Attribute 61};

aalModeBeh BEHAVIOUR
    DEFINED AS
" This attribute indicates whether  the AAL for the supporting VCC is operating in message mode or
streaming mode, assured or unassured. ";
```

4.3.2. aalProfileId

```
aalProfileId ATTRIBUTE
WITH ATTRIBUTE SYNTAX ATMMIBMod.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR aalAccessPointIdBeh;
REGISTERED AS {atmfM4Attribute 62};

aalProfileIdBeh BEHAVIOUR
    DEFINED AS
"This attribute can be used as an RDN when naming an instance of the aalProfile managed object class. ";
```

4.3.3. aalType

```
aalType ATTRIBUTE
    WITH ATTRIBUTE SYNTAX ATMMIBMod.AalType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR aalTypeBeh;
REGISTERED AS {atmfM4Attribute 63};

aalTypeBeh BEHAVIOUR
    DEFINED AS
"This attribute identifies the AAL Type.  Valid types are AAL1, AAL3/4, and AAL5. ";
```

4.3.4. bETagMismatch

bETagMismatch ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR bETagMismatchBeh;
REGISTERED AS {atmfM4Attribute 64};

bETagMismatchBeh BEHAVIOUR
DEFINED AS
" This attribute represents the number of times an incoming CS_PDU had a BTag field value that did not equal the ETag field value. ";

4.3.5. bomsEomsUnexpectedMID

bomsEomsUnexpectedMID ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR bomsEomsUnexpectedMIDBeh;
REGISTERED AS {atmfM4Attribute 65};

bomsEomsUnexpectedMIDBeh BEHAVIOUR
DEFINED AS
" This attribute represents the number of BOM/EOM segments with an unexpected MID value. This attribute will be incremented by one each time a BOM is received with a currently active MID (a MID for which an EOM has not yet been received), or when an EOM is received for which a MID is NOT currently active. ";

4.3.6. bufferOverflows

bufferOverflows ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR bufferOverflowsBeh;
REGISTERED AS {atmfM4Attribute 66};

bufferOverflowsBeh BEHAVIOUR
DEFINED AS
" This attribute represents a count of the number of times the reassembly buffer overflows. If the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit level buffer, then either buffer overflow will cause this count to be incremented.";

4.3.7. bufferUnderflows

bufferUnderflows ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR bufferUnderflowsBeh;
REGISTERED AS {atmfM4Attribute 67};

bufferUnderflowsBeh BEHAVIOUR
DEFINED AS
" This attribute represents a count the number of times the reassembly buffer underflows. In the case of a continuous underflow caused by a loss of ATM cell flow, a single buffer underflow should be counted. If

the interworking function is implemented with multiple buffers, such as a cell level buffer and a bit evel buffer, then either buffer underflow will cause this count to be incremented.";

4.3.8. cbrRate

```
cbrRate ATTRIBUTE
      WITH ATTRIBUTE SYNTAX ATMMIBMod.Integer;
      MATCHES FOR EQUALITY, ORDERING;
      BEHAVIOUR cbrRateBeh;
REGISTERED AS {atmfM4Attribute 68};

cbrRateBeh BEHAVIOUR
      DEFINED AS
" This attribute represents the rate of the CBR service supported by the AAL.";
```

4.3.9. cellLoss

```
cellLoss ATTRIBUTE
      DERIVED FROM "ITU-T Rec. X.721":counter;
      BEHAVIOUR cellLossBeh;
REGISTERED AS {atmfM4Attribute 69};

cellLossBeh BEHAVIOUR
      DEFINED AS
"This attribute represents a count the number of lost cells, as detected by the AAL1 sequence number processing, for example. This count records the number of cells detected as lost in  the network prior to the destination interworking function AAL1 layer processing. A negative value indicates that this attribute is not supported. "
```

4.3.10. cellLossIntegrationPeriod

```
cellLossIntegrationPeriod ATTRIBUTE
      WITH ATTRIBUTE SYNTAX ATMMIBMod.Integer;
      MATCHES FOR EQUALITY, ORDERING;
      BEHAVIOUR cellLossIntegrationPeriodBeh;
REGISTERED AS {atmfM4Attribute 70};

cellLossIntegrationPeriodBeh BEHAVIOUR
      DEFINED AS
"This attribute identifies the time in milliseconds for the cell loss integration period. If cells are lost for this period of time, the containing interworkingVCTTPBidirectional object will generate a communications alarm. "
```

4.3.11. cellMisinsertion

```
cellMisinsertion ATTRIBUTE
      DERIVED FROM "ITU-T Rec. X.721":counter;
      BEHAVIOUR cellMisinsertionBeh;
```

REGISTERED AS {atmfM4Attribute 71};

cellMisinsertionBeh BEHAVIOUR
DEFINED AS
"This attribute represents a count of sequence violation events which the AAL CS interprets as misinserted of cells as defined by ITU-T Rec. I.363.1.A negative value indicates that this attribute is not supported. "

4.3.12. clockRecoveryType

clockRecoveryType ATTRIBUTE
WITH ATTRIBUTE SYNTAX ATMMIBMod.ClockRecoveryType;
MATCHES FOR EQUALITY;
BEHAVIOUR clockRecoveryTypeBeh;
REGISTERED AS {atmfM4Attribute 72};

clockRecoveryTypeBeh BEHAVIOUR
DEFINED AS
" This attribute indicates whether the clock recovery type is Synchronous, SRTS (Synchronous Residual Time Stamp), or Adaptive Clock Recovery.";

4.3.13. comsEomsUnexpectedSN

comsEomsUnexpectedSN ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR comsEomsUnexpectedSNBeh;
REGISTERED AS {atmfM4Attribute 73};

comsEomsUnexpectedSNBeh BEHAVIOUR
DEFINED AS
"This attribute represents the number of COM and EOM segments received with an unexpected Sequence Number (SN). For a particular message (i.e., MID) transported over a VPC or VCC, this attribute is incremented by one each time a COM or EOM is received with a SAR Sequence Number (SN) that is not correct relative to the SN in the previous (non-EOM) segment. ";

4.3.14. crcViolations

crcViolations ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR crcViolationsBeh;
REGISTERED AS {atmfM4Attribute 74};

crcViolationsBeh BEHAVIOUR
DEFINED AS
"This attribute represents the number of CRC violations that were detected for the incoming AAL PDUs.";

4.3.15. forwardErrorCorrectionMethod

forwardErrorCorrectionMethod ATTRIBUTE

```
    WITH ATTRIBUTE SYNTAX ATMMIBMod.FecMethod;
    MATCHES FOR EQUALITY;
    BEHAVIOUR errorCorrectionTypeBeh;
REGISTERED AS {atmfM4Attribute 75};

forwardErrorCorrectionMethodBeh BEHAVIOUR
    DEFINED AS
" This attribute indicates the FEC method: no FEC, FEC for Loss Sensitive Signal Transport, or FEC for
Delay Sensitive Signal Transport.";
```

4.3.16. headerErrors

```
headerErrors ATTRIBUTE
    DERIVED FROM "ITU-T Rec. X.721":counter;
    BEHAVIOUR crcViolationsBeh;
REGISTERED AS {atmfM4Attribute 76};

headerErrorsBeh BEHAVIOUR
    DEFINED AS
" This attribute represents a count of the number of AAL1 header errors detected, including those
 corrected. Header errors include correctable and uncorrectable CRC plus bad parity. "
```

4.3.17. lengthBASizeMismatch

```
lengthBASizeMismatch ATTRIBUTE
    DERIVED FROM "ITU-T Rec. X.721":counter;
    BEHAVIOUR lengthBASizeMismatchBeh;
REGISTERED AS {atmfM4Attribute 77};

lengthBASizeMismatchBeh BEHAVIOUR
    DEFINED AS
" This attribute represents the number of CS_PDUs in which the Length field value was not consistent
with the BASize field value. The definition of consistent depends on the mode in which CS_PDU fragments
are being processed. In the message-mode, the BASize field must equal the Length field. In the streaming
mode, the BASize field must be less than the Length field. ";
```

4.3.18. lengthMismatch

```
lengthMismatch ATTRIBUTE
    DERIVED FROM "ITU-T Rec. X.721":counter;
    BEHAVIOUR lengthMismatchBeh;
REGISTERED AS {atmfM4Attribute 78};

lengthMismatchBeh BEHAVIOUR
    DEFINED AS
" This attribute represents the number of CS_PDUs received with a Length field value that does not
represent the actual length of the CS_PDU payload.";
```

4.3.19. maxCpcsSduSize

```
maxCpcsSduSize ATTRIBUTE
      WITH ATTRIBUTE SYNTAX ATMMIBMod.MaxCpcsSduSize;
      MATCHES FOR EQUALITY;
      BEHAVIOUR maxCpcsSduSizeBeh;
REGISTERED AS {atmfM4Attribute 79};

maxCpcsSduSizeBeh BEHAVIOUR
      DEFINED AS
" This multi-valued attribute represents the maximum CPCS_PDU size that will be transmitted over the
connection in both the incoming (forward) and outgoing (backward) direction of transmission.";
```

4.3.20. midRange

```
midRange ATTRIBUTE
      WITH ATTRIBUTE SYNTAX ATMMIBMod.MidRange;
      MATCHES FOR EQUALITY, ORDERING;
      BEHAVIOUR midRangeBeh;
REGISTERED AS {atmfM4Attribute 80};

midRangeBeh BEHAVIOUR
      DEFINED AS
" This attribute represents the range of MID values supported at the AAL for the supporting VCC.";
```

4.3.21. numberOfAborts

```
numberOfAborts ATTRIBUTE
      DERIVED FROM "ITU-T Rec. X.721":counter;
      BEHAVIOUR numberOfAbortsBeh;
REGISTERED AS {atmfM4Attribute 81};

numberOfAbortsBeh BEHAVIOUR
      DEFINED AS
" This attribute provides a count of the number aborts (i.e., EOM with SAR_PDU Length Indication = 63)
that are received for the underlying VPC or VCC. ";
```

4.3.22. partiallyFilledCells

```
partiallyFilledCells ATTRIBUTE
      WITH ATTRIBUTE SYNTAX ATMMIBMod.Integer;
      MATCHES FOR EQUALITY, ORDERING;
      BEHAVIOUR partiallyFilledCellsBeh;
REGISTERED AS {atmfM4Attribute 82};

partiallyFilledCellsBeh BEHAVIOUR
      DEFINED AS
" This attribute identifies the number of leading octets in use.";
```

4.3.23. reassemblyTimerExpirations

reassemblyTimerExpiratons ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR reassemblyTimerExpirationsBeh;
REGISTERED AS {atmfM4Attribute 83};

reassemblyTimerExpirationsBeh BEHAVIOUR
DEFINED AS
" This attribute provides a count of reasembly timer expirations. A negitive value indicates that this attribute is not supported.. ";

4.3.24. sarCrcViolations

sarCrcViolations ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR sarCrcViolationsBeh;
REGISTERED AS {atmfM4Attribute 84};

sarCrcViolationsBeh BEHAVIOUR
DEFINED AS
"This attribute represents the number of CRC violations that were detected for the incoming SAR PDUs. ";

4.3.25. sequenceViolations

sequenceViolations ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR sequenceViolationsBeh;
REGISTERED AS {atmfM4Attribute 853};

sequenceViolationsBeh BEHAVIOUR
DEFINED AS
" This attribute represents a count incoming AAL Type 1 SAR-PDUs where the sequence count in the PDU header causes a transition from the SYNC state to the OUT OF SEQUENCE state as defined by ITU-T Rec. I.363.1. A negative value indicates that this attribute is not supported. ";

4.3.26. sriTimeOuts

sriTimeOuts ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR sriTimeOutsBeh;
REGISTERED AS {atmfM4Attribute 86};

sriTimeOutsBeh BEHAVIOUR
DEFINED AS
" This attribute represents a count of the number of SRI time-outs that occurred on an ATM connection. ";

4.3.27. sscsType

```
sscsType ATTRIBUTE
     WITH ATTRIBUTE SYNTAX ATMMIBMod.SscsType;
     MATCHES FOR EQUALITY;
     BEHAVIOUR sscsTypeBeh;
REGISTERED AS {atmfM4Attribute 87};

sscsTypeBeh BEHAVIOUR
     DEFINED AS
" This attribute identifies the SSCS type for the AAL.  Valid values are NULL, Data SSCS based on
SSCOP (assured operation), Data SSCS based on SSCOP (non-assured operation), or Frame Relay
SSCS.";
```

4.3.28. stdPointerParityFailures

```
stdPointerParityFailures ATTRIBUTE
     DERIVED FROM "ITU-T Rec. X.721":counter;
     BEHAVIOUR stdPointerParityFailuresBeh;
REGISTERED AS {atmfM4Attribute 88};

stdPointerParityFailuresBeh BEHAVIOUR
     DEFINED AS
" This attribute represents a count of the number of times the AAL reassembler detects a parity check failure
at the point where a structured data pointer is expected. This count is only meaningful for structured data
transfer modes as unstructured modes do not use pointers. A negative value indicates that this attribute is
not supported. ";
```

4.3.29. stdPointerReframes

```
stdPointerReframes ATTRIBUTE
     DERIVED FROM "ITU-T Rec. X.721":counter;
     BEHAVIOUR stdPointerReframesBeh;
REGISTERED AS {atmfM4Attribute 89};

stdPointerReframesBeh BEHAVIOUR
     DEFINED AS
" This attribute represents a count of the number of events in which the AAL1 reassenbler found that a
structured data pointer is not where it is expected, and the pointer must be reacquired. This count is only
meaningful for structured data transfer modes as unstructured modes do not use pointers. A negative value
indicates that this attribute is not supported, however it must be supported when pointers are used.";
```

4.3.30. structuredDataTransfer

```
structuredDataTransfer ATTRIBUTE
     WITH ATTRIBUTE SYNTAX ATMMIBMod.Boolean;
     MATCHES FOR EQUALITY;
     BEHAVIOUR structuredDataTransferBeh;
REGISTERED AS {atmfM4Attribute 90};
```

structuredDataTransferBeh BEHAVIOUR
DEFINED AS
"This attribute indicates whether Structured Data Transfer (SDT) has been configured at the AAL. A value of TRUE means SDT has been selected. This attribute value cannot be set to TRUE when the errorCorrectionType attribute equals TRUE. ";

4.3.31. subType

subType ATTRIBUTE
WITH ATTRIBUTE SYNTAX ATMMIBMod.SubType;
MATCHES FOR EQUALITY;
BEHAVIOUR subTypeBeh;
REGISTERED AS {atmfM4Attribute 91};

subTypeBeh BEHAVIOUR
DEFINED AS
"This attribute is used to identify the AAL subtype. Valid values for this attribute are NULL, Voice-band based on 64 kbps, Circuit Emulation (synchronous), Circuit Emulation (asynchronous), High-quality Audio, and Video.";

4.3.32. sumOfIncorrectCSFFieldErrors

sumOfIncorrectCSFieldErrors ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR sumOfIncorrectCSFieldErrorsBeh;
REGISTERED AS {atmfM4Attribute 92};

sumOfIncorrectCSFieldErrorsBeh BEHAVIOUR
DEFINED AS
" This attribute provides a sum-of-errors count for incorrect Convergence Sublayer (CS) field errors. For AAL Type 3/4, this attribute provides a single count of CS_PDUs discarded due to one of the following error conditions: BETag mismatch, BASize field value not consistent with Length field value, or Length field value not consistent with CS_PDU length. ";

4.3.33. sumOfIncorrectSARFieldErrors

sumOfIncorrectSARFieldErrors ATTRIBUTE
DERIVED FROM "ITU-T Rec. X.721":counter;
BEHAVIOUR sumOfIncorrectSARFieldErrorsBeh;
REGISTERED AS {atmfM4Attribute 93};

sumOfIncorrectSARFieldErrorsBeh BEHAVIOUR
DEFINED AS
" This attribute provides a sum-of-errors count for incorrect Segmentation And Reassembly (SAR) field errors. For AAL Type 3/4, this attribute provides a single count of SAR_PDUs discarded due to one of the following errors: CRC violation, unexpected Sequence Number (SN) field value, or unexpected MID field value ";

4.3.34. sumOfInvalidCSFieldErrors

```
sumOfInvalidCSFieldErrors ATTRIBUTE
      DERIVED FROM "ITU-T Rec. X.721":counter;
      BEHAVIOUR sumOfInvalidCSFieldErrorsBeh;
REGISTERED AS {atmfM4Attribute 94};

sumOfInvalidCSFieldErrorsBeh BEHAVIOUR
      DEFINED AS
" This attribute provides a sum-of-errors count for invalid Convergence Sublayer (CS) field errors. For AAL
Type 3/4, this attribute provides a single count of the number of CS_PDUs discarded due to one of the
following error conditions: Common Part Indicator (CPI) field not equal to 0, Alignment field value not
equal to 0, or BASize field value < 37 octets for multi-segment messages.  For AAL Type 5, this attribute
provides a single count of the number of CS_PDUs discarded due to one of the following error conditions:
Invalid Common Part Indicator (CPI), oversized received SDU, or length violation. ";
```

4.3.35. sumOfInvalidSARFieldErrors

```
sumOfInvalidSARFieldErrors ATTRIBUTE
      DERIVED FROM "ITU-T Rec. X.721":counter;
      BEHAVIOUR sumOfInvalidSARFieldErrorsBeh;
REGISTERED AS {atmfM4Attribute 95};

sumOfInvalidSARFieldErrorsBeh BEHAVIOUR
      DEFINED AS
" This attribute provides a sum-of-errors count for invalid Segmentation And Reassembly (SAR) field
errors. For AAL Type 3/4, this attribute provides a single count of the number of SAR_PDUs discarded due
to one of the following error conditions: MID=0 when there is multiplexing, MID not equal to 0 when
there is no multiplexing, Length field not equal to 44 octets for a BOM or COM, Length field not in the
set
[4, 8, ..., 44] octets or 63 octets for an EOM, or Length field not in the set [8, 12, ..., 44] octets for an
SSM";
```

4.4. Name Bindings

4.4.1. aalProfile-managedElementR1

```
aalProfile-managedElementR1 NAME BINDING
  SUBORDINATE OBJECT CLASS
     alProfile AND SUBCLASSES;
  NAMED BY SUPERIOR OBJECT CLASS
     ITU-T Rec. M.3100":managedElementR1 AND SUBCLASSES;
  WITH ATTRIBUTE aalProfileId;
  CREATE
     WITH-REFERENCE-OBJECT,
    WITH-AUTOMATIC-INSTANCE-NAMING;
  DELETE
     DELETES-CONTAINED-OBJECTS;
REGISTERED AS {atmfM4NameBinding 31};
```

4.4.2. aalProtocolCurrentData-interworkingVCTTPBidirectional

```
aalProtocolCurrentData-interworkingVCTTPBidirectional NAME BINDING
  SUBORDINATE OBJECT CLASS
     alProtocolCurrentData AND SUBCLASSES;
  NAMED BY SUPERIOR OBJECT CLASS
     interworkingVCTTPBidirectional AND SUBCLASSES;
  WITH ATTRIBUTE "ITU-T Rec. X.739":scannerId;
  CREATE
     WITH-REFERENCE-OBJECT,
    WITH-AUTOMATIC-INSTANCE-NAMING;
  DELETE
     DELETES-CONTAINED-OBJECTS;
REGISTERED AS {atmfM4NameBinding 32};
```

4.5. Supporting ASN.1 Productions

```
--The following are added to the ATMMIBMod in af-nm-0027.000

IMPORTS

  ElapsedTime
   FROM
  BCRTR836Iss1Mod {1 3 17 104 module(9) tr836(3) bCRTR836Iss1Mod(1)}

 -- additional value definitions to probableCause production

  cellStarvation ProbableCause ::= globalValue : {atmProbableCause 4}

  activeDefault ActiveInactive ::= active

  offDefault OnOff ::= off

  recDurDefault INTEGER ::= 4

AalMode ::= ENUMERATED {
     message_assured (0),
     message_unassured (1),
     streaming_assured (2)
     streaming_unassured (3)}

AalType ::= ENUMERATED {
      aal1 (0),
     aal2 (1), -- encoded for future use
      aal34 (2),
     aal5 (3)}

 ClockRecoveryType ::= ENUMERATED {
      synchronous (0),
      srts (1),
     adaptive (2)}

FecMethod ::= ENUMERATED{
      noFEC (0),
      lossSensitiveSignalFEC (1),
     delaySensitiveSignalFEC (2)}

MaxCpcsSduSize ::= SEQUENCE {
     forward [0] INTEGER (1..65535) OPTIONAL,
     backward [1] INTEGER  (1..65535) OPTIONAL}

MidRange ::=  SEQUENCE {
      lowvalue [0] INTEGER (1..66536)
      highvalue [1] INTEGER (1..66536)}
```

```
SscsType ::= ENUMERATED {
      null (0),
     dataAssured (1),
     dataNonAssured (2),
     frameRelay (3)}

SubType ::= ENUMERATED {
      null (0),
     voiceBand (1),
      circuitEmulationSynchronous (2),
      circuitEmulationAsynchronous (3),
      highQualityAudio (4),
     video (5)}
```

5. Figures

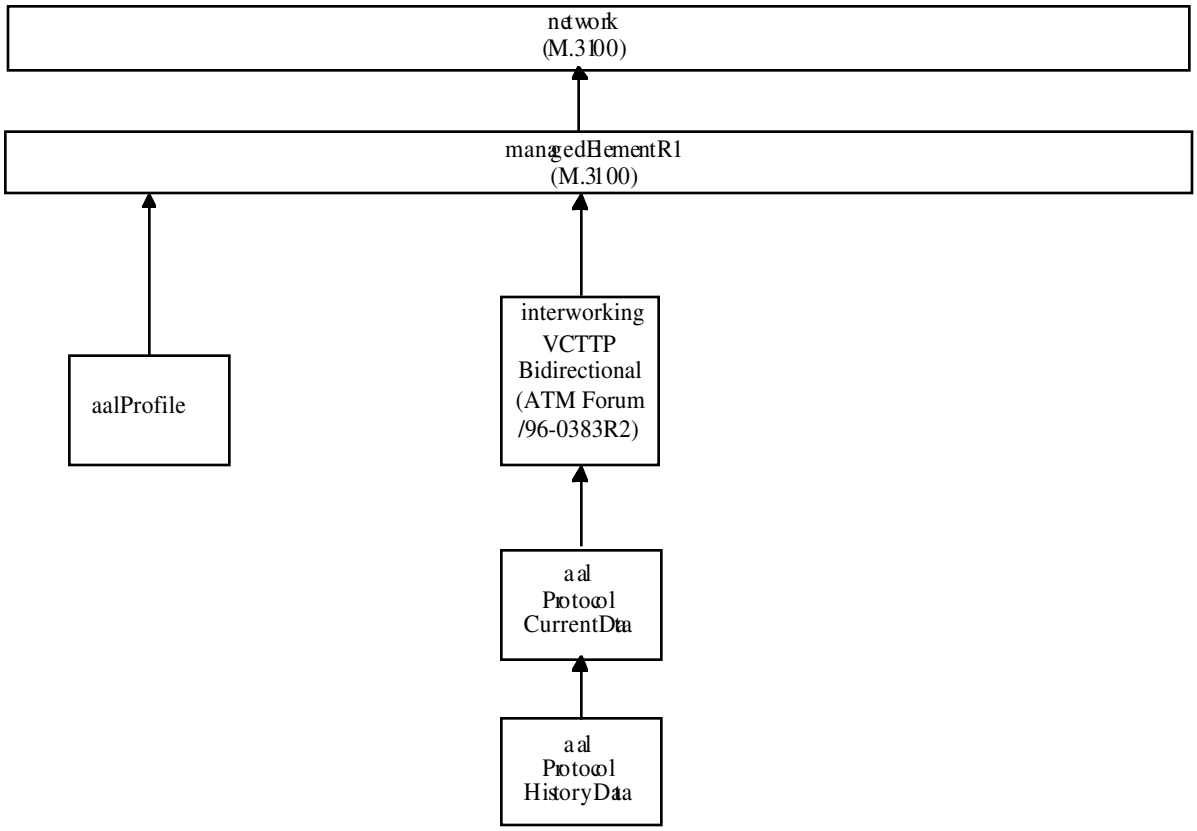

Figure 1 Containment Tree Diagram

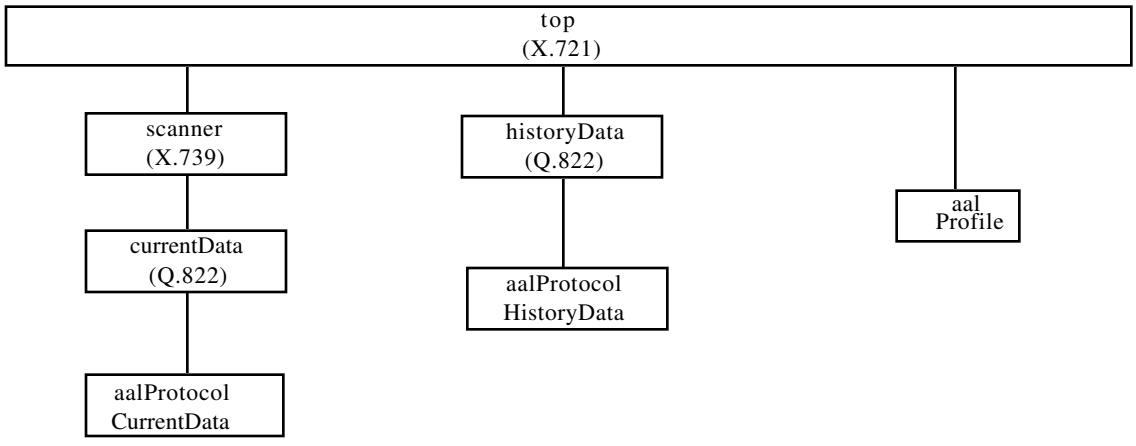

Figure 2 Inheritance Tree Diagram