ATNP/WG2 WP

ATNP/JWG/JSG1 WP

AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL

WG2

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ATN Summary MIB

and

ATN ICS Summary Management Information

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SUMMARY

This document describes and discusses the principle of using a 'summary' MIB for exchanging management information across domains and makes an initial proposal for such a MIB structure and content

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1. Introduction

System management of the ATN will requires co-ordination and co-operation between the various involved organisations. The co-ordination scenarios investigated in the ATN System Management CONOPS identify requirements for the exchange of management information across domains. The agreed principles for these exchanges of management information is to rely on manager-to-manager interactions using common protocols and mechanisms.

One possible solution identified in the ATN SM CONOPS for the exchange of Management Information across domains is the implementation by each different organisation involved in the ATN of an overall 'summary' MIB where would be gathered the elements of management information on the local domain that are shared with external organisations. This summary MIB would be made accessible to other organisations via CMISE-base procedures.

This document describes and discusses the principle of using such a 'summary' MIB for exchanging management information across domains and makes an initial proposal for such a MIB structure and content

2. General Framework for the exchange of Management Information with a summary MIB

2.1 Principle of the approach

The Summary MIB concept assumes that every organisation will operate, in its Network Operation Centre, a central Network Management Station that has the capability to collect, via local System Management procedure, management information from the ATN equipment distributed in the local domain.

It is then assumed that the information gathered from the individual pieces of equipment, can be filtered, and processed for updating one global MIB providing an aggregated summary of the management information.

The principle for the exchange of management information across domain assumes then each organisation would provide other organisations with access to such a summary MIB modelling the overall characteristics of its ATN domain, and would update its content according to well defined accuracy and timeliness statements. Organisations that have been granted permission to access the Summary MIB of another organisation, would then be allowed to read, periodically or on specific need occurrence basis, the content of the Summary MIB (SMIB). Possibly, these organisations could also register themselves to receive notifications of particular events.

2.2 Functional architecture

The functional architecture for the SMIB-based cross-domain exchange of management information is based on several function blocks implemented either by the organisation providing access to its SMIB or by the organisations retrieving information from this SMIB. This is depicted in figure 1.

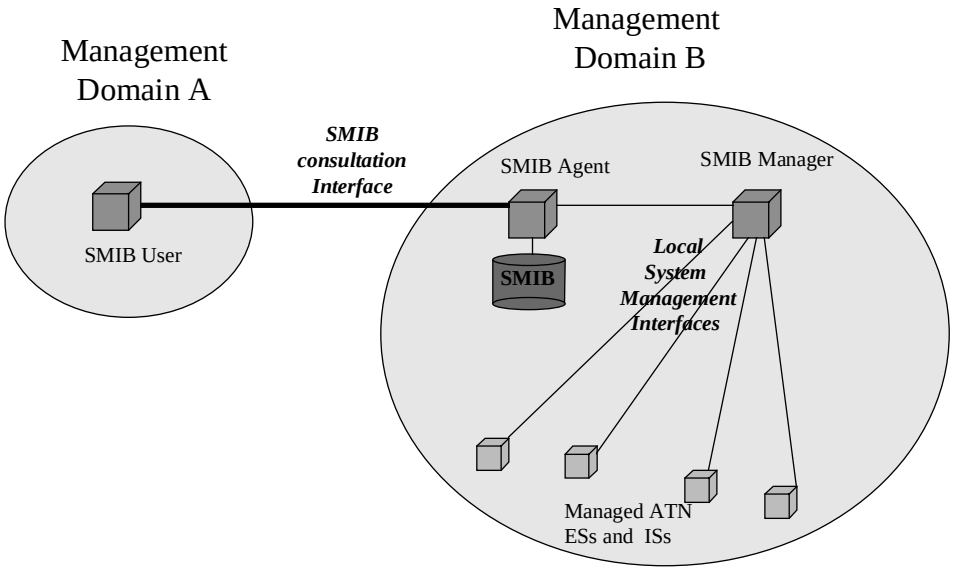
In this document, the following definitions apply:

SMIB User: This function block is a Management System operating in the manager role and to be implemented by organisations willing to retrieve information from the SMIB maintained by other organisations

SMIB Agent: This Function block is a Management System operating in the Agent role which performs the CMISE operations on the local SMIB. The SMIB Agent handles information retrieval requests from SMIB Users and information Update Requests from the SMIB Manager. This system is implemented by the organisation providing SMIB services.

SMIB Manager: This Function block is a Management System operating in the Manager role which is implemented by the organisation providing SMIB services. It retrieves necessary management information from the managed ATN equipment in the local domain, processes it, and generates information update requests to the SMIB agent.

The SMIB Agent and the SMIB Manager can be collocated on the same system.



2.3 Characteristics of a SMIB consultation interface

The SMIB consultation interface relies on a direct CMIB-based manager-agent association between the SMIB User and the SMIB Agent. An SMIB User willing to retrieve information from SMIBs of different organisations will have to establish one management association with each of the associated SMIB Agents. The model does not include any notion of cascade relationships (such as in ITU-T TD1079) where a SMIB agent could potentially provide access to the summary management information of a third party organisation by relaying the information retrieval requests received from a SMIB User to another SMIB Agent.

Between an SMIB User and a SMIB Agent, the information will generally be exchanged on a demand basis: the SMIB User starts the management information retrieval through a CMIP operation sent to the SMIB Agent. The procedure is as follows:

First, the SMIB User sets up an association with the SMIB Agent. The association may be permanently set based on the agreement of both organisations or on a demand basis. The application context to be used and the functional unit negotiation rules are to be specified.

The SMIB User may then send either a CMIP M_GET or a CMIP M_CANCEL_GET PDU to the SMIB Agent. Having received the CMIP PDU, the SMIB Agent interprets what kind of requirement it has received and perform a management operation such as retrieval of an element of

management information in the SMIB. The result is returned to the SMIB User in the form of a CMIP result PDU.

The management information can possibly be exchanged on an event occurrence basis: in such a case the SMIB Agent takes the initiative and issues a notification to the SMIB Users that have registered themselves to receive notification of the event. The procedure is as follows:

First, the SMIB Agent sets up an association with the SMIB User. The association may be permanently set based on the agreement of both organisations or on a event occurrence basis.

The SMIB agent sends CMIP M_EVENT_REPORT to the SMIB User.

2.4 Connectivities between SMIB Users and agents

A single SMIB user may communicate across the SMIB consultation interface to one or more SMIB Agents using at least one association for each SMIB Agent.

A single SMIB Agent may support simultaneous associations with several SMIB Users.

2.5 Communication profile

The communication profile supporting the SMIB consultation interface is to determined. The possible choices are:

1. AOM12

2. FastMIP

2.6 Authentication control for the service

The SMIB Service provider may authenticate the identity of the requesting SMIB User for the purpose of security. Access of the SMIB User to the management information is allowed when conditions of authentication and qualification defined by the SMIB service provider are satisfied. If access is not permitted, the SMIB agent may notify the SMIB user that the access has been refused. Details on security mechanisms are out of scope of this document.

2.7 Role of the SMIB Manager

The SMIB Manager in charge of maintaining up to date information in the SMIB. This could be done in several manners:

1. On a periodical basis: Management Information is periodically transferred from the ATN equipment in the local domain to the SMIB Manager, which then filters/summarises the information and updates the SMIB.

2. event occurrence basis: any events (notifications) in relation to management information presents in the SMIB can be caught by the SMIB Manager. The SMIB manager may then update the SMIB information accordingly.

3. On demand basis: The SMIB Manager starts the action of updating the SMIB when a management information retrieval request is received by the SMIB Agent

Which method is used for updating the SMIB may be considered as a local issue to the organisations, or may be a topic which requires standardisation (considering that different methods may not provide the same timeliness and accuracy of the information in the SMIB).

Note: A combination of the 3 methods could be envisaged, with a different method being used for a different type of data. For instance, status of ATN systems or links could be updated on en event occurrence basis, configuration information could be updated on demand basis, and performance statistics could be updated on a periodical basis.

3. Summary MIB services

3.1 Introduction

The objective of this section is to identify which cross-domain management information exchange services could be implemented with the Summary MIB architecture introduced in the previous chapter.

3.2 Assumed Requirements

The primary set of services that are expected to be provided with the implementation of Summary MIBs are Customer Network Management (CNM) services similar to the ones defined in ITU-T Recommendation X.161. The CNM services are defined to resolve requirements for the exchange of management information between a communication service provider and its customers.

In the ATN, each administrative domain may view its partnering organisations as customers and/or as providers. Cross organisation management interactions in the ATN may then be considered as customer network management functions.

Examples of potential requirements for CNM services in the ATN case are listed below:

1. In order to speed up trouble diagnosis activities, an organisation may be willing to implement a viewer representing in real time the operational, administrative and performance (e.g. congestion) status of the ATN ESs and ISs of another organisation and upon which the local organisation is dependent to get access to a given ATN service.

2. In order to speed up trouble diagnosis activities, an organisation may be willing to have a real time view on the global quality and performance of the services provided by another organisation.

3. For trouble diagnosis activities, an organisation may be willing to be warned as soon as a problem occurs on the ATN ESs and ISs of another organisation that provide the local organisation with a given ATN service.

3.3 X.161 Services

The following CNM services are defined in ITU-T Recommendation X.161:

For fault management:

- CNM Alarm Notification Service
- CNM Fault History Service
- CNM Trouble Report Service
- CNM Loop set up Service
- CNM Test Host Service
- CNM Protocol Monitoring Service

For configuration management:

- CNM Configuration Inquiry Service
- CNM Reconfiguration Service
- CNM Ordering Service, CNM Service Request Service

- CNM Systematic Call Redirection Service
- CNM Inventory inquiry Service

For Accounting management:

- CNM Periodic billing Service
- CNM Detailed accounting Service
- CNM Quota Control Service
- CNM Real Time Charging Information Service

For Performance management:

- CNM Traffic Information Service
- CNM QoS information Service
- CNM Network statistics Service

For Security management:

- CNM Password Change Service
- CNM Access Right Service

3.4 ATN CNM services

It must be possible to define X.161-like ATN CNM services equivalent to the X.161 services but applied to the particular case of the ATN. The transposition to the ATN case of each of the X.161 CNM services listed above could potentially present an interest. For instance, an ATN Internetwork Service provider may be willing to provide ATN CNM Detailed accounting Service to its customers.

However, as far as the production of ATN SARPs on ATN System Management is concerned, it is assumed that the only ATN CNM services to be considered are the ones which are required to maintain operation and uniform quality of the ATN.

According to the ATN SM CONOPS, the real time cross-domain management information exchange requirements to be resolved for insuring global operation and uniform quality of the ATN are:

1. The real time exchange of operational performance statistics (including traffic and QoS information) between organisations

2. Possibly, the real time exchange of configuration information between organisations

3. The exchange of incident reports

4. The exchange of trouble reports

Note: This list may be extended with cross-domain exchange of information pertaining to security management.

The ATN CNM services that would cover these requirements are:

- the ATN CNM Alarm Notification Service
- the ATN CNM Fault History Service
- the ATN CNM Trouble Report Service

- the ATN CNM Traffic Information Service
- the ATN CNM QoS Information Service
- the ATN CNM Network statistics service
- the ATN CNM Configuration Inquiry Service

Note: This list may have to be extended with ATN CNM services pertaining to security management.

3.5 Support of ATN CNM Services with a SMIB architecture

With the exception, possibly, of the ATN CNM Trouble Report Service, all ATN CNM services proposed in the previous section seem a priori implementable with the SMIB architecture introduced in section 2.2.

The ATN CNM Alarm Notification Service would require the support by the SMIB Agent of the ISO 10164-4 Alarm Reporting Function, and of the ISO 10164-5 Event Report Management Function and the implementation of Event Forwarding Discriminator MO within the SMIB.

The ATN CNM Fault History Service would require the support by the SMIB Agent of the ISO 10164-6 Log Control Function.

Note: The support of ATN CNM Trouble Report Service may require cross-domain management interfaces different to the CMISE-based one of the SMIB architecture (the definition of EDI/AMHS-based procedures might be required; this is being investigated)

4. Summary MIB Structure and Content

4.1 Introduction

The purpose of this section is to discuss possible ways to structure an SMIB and to identify an initial first set of SMIB Managed Objects and attributes.

4.2 Approach

An organisation involved in the ATN will likely operate a complex infrastructure consisting of multiple components such as subnetworks, routers, End Systems, the whole being architectured to meet local and external requirements, and taking into account constraints of various types, including economical, geographical, and technical considerations. The process of summarisation of the management information will have as main objective to hide details which have no interest for external management information users and to focus on the main points.

The approach proposed for defining and structuring the summary information is to model in a simple and generic way the external view that an organisation may have **on the services** provided by another organisation, and then to represent each component of the model with a specific Managed Object Class, describing the main attributes of the component.

This approach is better explained with examples. The next section provides such an example: it includes a first proposal for the modelling of the external view of the domain of an ATN Internet Service provider and for the associated summary system management information.

4.3 A draft proposal for the SMIB information to be provided by an ATN internetwork Service provider

4.3.1 Introduction

The objective of this section is to develop an initial proposal for the SMIB information that could be required to be made available by an ATN organisation providing an ATN internetwork service. This section does not consider SMIB information germane to the provision of ATN application services.

4.3.2 Modelling

A simple model is defined for modelling the ATN infrastructure of an ATN organisation providing ATN internetwork service. The model makes use of the following definition:

- AISP: ATN Internet Service Provider
- AISP internetwork: the ATN internetwork of the AISP . An AISP cloud consists of one or several interconnected ATN Routing Domains or Routing Domain Confederations
- Egress Router: An ATN Ground or A/G BIS located at the boundary or the AISP Cloud
- internal linkage: the logical representation of a virtual direct link between 2 egress routers. An internal link may be physically supported by an internal subnetwork (e.g. a leased line, an X.25 WAN, etc.) or an internal ATN internetwork (e.g. a group of subnetworks interconnected by non-egress AISP ATN routers).

- external ground linkage: a link connecting an AISP cloud to another AISP cloud or to the ATN system of an ATN Internetwork service user.

- external mobile linkage: a mobile subnetwork to which one the AISP egress router is attached

The approach proposed for summarising the management information pertaining to the ATN infrastructure of an AISP, begins then by modelling the whole AISP internetwork infrastructure as a single "AISP cloud" with egress routers, internal linkages, and external ground and mobile linkages, as illustrated by Figure 1. The model hides the details of the internal architecture of the AISP internetwork (e.g. internal routing architectures, internal routers, and subnetworks, etc....) but is believed sufficient for supporting the identified requirements on the exchange of management information.

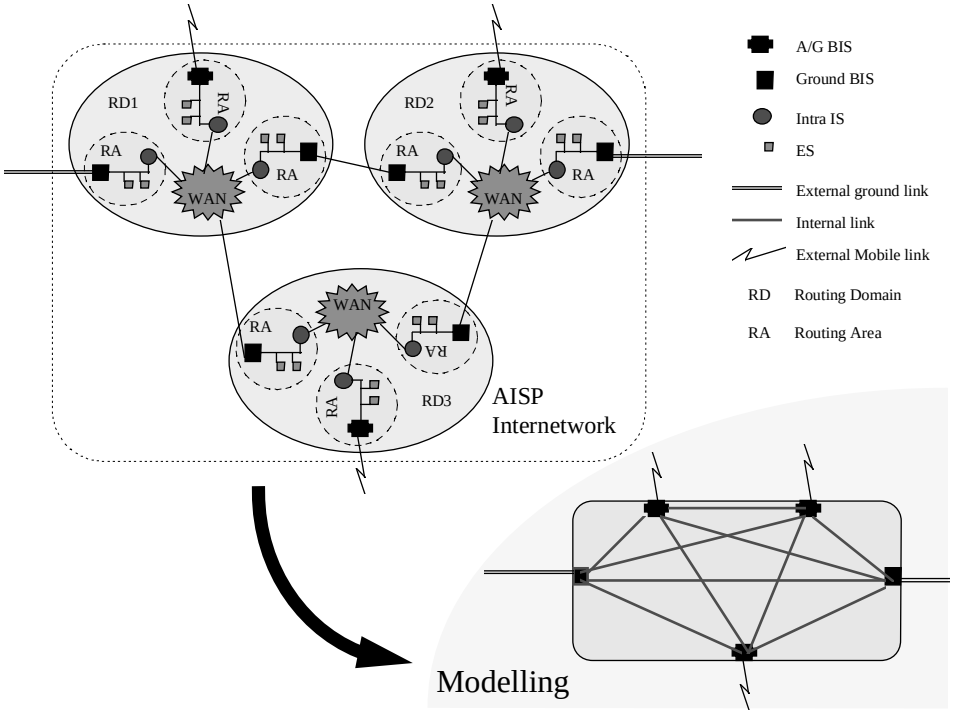


Figure 1: Modelling an ATN Internet Service Provider internetwork

The model can be recursively applied to a group of AISP internetworks, and can hence allow the summarisation of multi-organisations internetworks such as an ATN backbone or an ATN Island.

4.3.3 SMIB Containment sub-tree for modelling an Internet service

A possible containment sub-tree proposed for the SMIB of an ATN Internet Service Provider is the one represented on Figure 2.

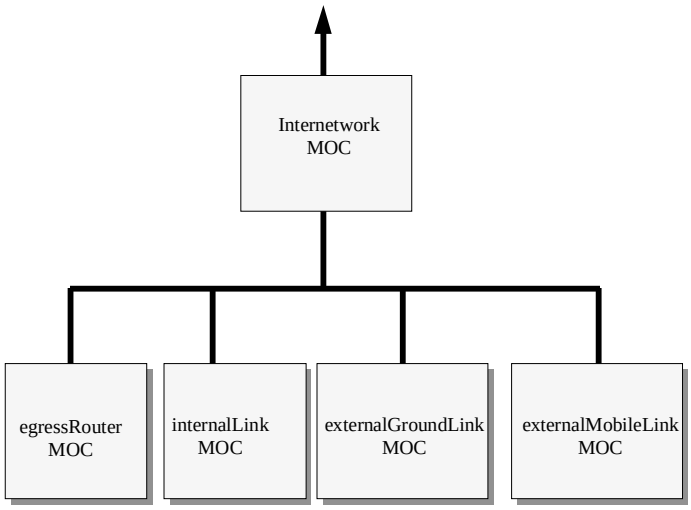


Figure 2: A containment sub-tree for the SMIB of an ATN Internet Service Provider

This containment tree has simply been derived from the model of AISP internetwork described in the previous section, by considering each element of the model as a separate object.

In the figure, the shadowed boxes represent Managed Object Classes which can have multiple instances.

4.3.4 The Internetwork MO Class

The Internetwork MO class is used to represent the whole ATN Internet Infrastructure of an AISP. Within a SMIB there should only one single MO instance of this class.

Possible attributes of this class are:

AISP Name	Name of the organisation providing the ATN Internet Service
AISP Type	Type of the organisation: ATSO, AICSP, Airport Operator, etc...
AISP Internetwork Type	e.g. Routing Domain, Routing Domain Confederation, ATN Backbone RDC, ATN Island
AISP NSAP address prefixes	List of all prefixes of the AISP NSAP addresses

4.3.5 The egressRouter MO ClassMO Class

The egressRouter MO class is used to represent one egress Router of the AISP. Within a SMIB there may be multiple MO instances of this class.

Possible attributes of this class are:

Router type	A/G BIS, Ground BIS (and possibly L1 and L2 Intra-Domain IS)
Router NET	Router Network Entity Title

RDI	Routing Domain Identifier
OperationalState	Operational Status of the Router
AdministrativeState	Administrative Status of the Router
CongestionState	Congestion Status of the Router
ForwardedCLNPPackets	Number of CLNP Packets forwarded by the Router
DiscardedPackets	Number of CLNP Packets discarded by the Routers
configuration information	a selection of the configuration attributes of the router (e.g. IDRP Timers, SNPA addresses) *to be defined*
stateChange	stateChange notification as defined in 1S0/IEC 10165-2. Used to report the changes to the OperationalState, AdministrativeState and CongestionState attribute

4.3.6 The internalLinkage MO class

The internalLinkage MO class is used to represent one internal linkage of the AISP. Within a SMIB there may be multiple MO instances of this class.

Possible attributes of this class are:

router1NET	Network Entity Title of the egress router at the first end of the internal linkage
router2NET	Network Entity Title of the egress router at the other end of the internal linkage
permitted traffic	ATSC Only, non-ATSC only, or both ATSC and non-ATSC
operationalState	Operational Status of the link (possibly for each direction of transfer)
administrativeState	Administrative Status of the link (possibly for each direction of transfer)
congestionState	Congestion Status of the link (possibly for each direction of transfer)
transitDelay	Delay of transit of the link (possibly for each direction of transfer)
capacity	Capacity (i.e. throughput) of the link (possibly for each direction of transfer)
ATSCtraffic	number of ATSC CLNP packets and PDU octets having transited over the link (possibly for each direction of transfer)
AOCtraffic	number of AOC CLNP packets and PDU octets having transited over the link
ADMtraffic	number of ADM CLNP packets and PDU octets having transited over the link

SMtraffic	number of SM CLNP packets and PDU octets having transited over the link
genTraffic	number of general communication packets and PDU octets having transited over the link
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
stateChange	stateChange notification as defined in 1S0/IEC 10165-2. Used to report the changes to the OperationalState, AdministrativeState and CongestionState attribute

4.3.7 The externalGroundLinkage MO Class

The externalGroundLinkage MO class is used to represent one external ground linkage of the AISP. Within a SMIB there may be multiple MO instances of this class.

Possible attributes of this class are:

localRouterNET	Network Entity Title of the egress router at the local end of the external linkage
externalSystemNET	Network Entity Title of the system at the other end of the linkage
permitted traffic	ATSC Only, non-ATSC only, or both ATSC and non-ATSC
operationalState	Operational Status of the link (possibly for each direction of transfer)
administrativeState	Administrative Status of the link (possibly for each direction of transfer)
congestionState	Congestion Status of the link (possibly for each direction of transfer)
transitDelay	Delay of transit of the link (possibly for each direction of transfer)
capacity	Capacity (i.e. throughput) of the link (possibly for each direction of transfer)
ATSCtraffic	number of ATSC CLNP packets and PDU octets having transited over the link (possibly for each direction of transfer)
AOCtraffic	number of AOC CLNP packets and PDU octets having transited over the link
ADMtraffic	number of ADM CLNP packets and PDU octets having transited over the link
SMtraffic	number of SM CLNP packets and PDU octets having transited over the link
genTraffic	number of general communication packets and PDU octets having transited over the link
UpdateIn	number of IDRP UPDATE PDU received on this link by the local router

UpdateOut	number of IDRP UPDATE PDU sent on this link by the local router
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
stateChange	stateChange notification as defined in 1S0/IEC 10165-2. Used to report the changes to the OperationalState, AdministrativeState and CongestionState attribute

4.3.8 The externalMobileLinkage MO Class

The externaMobileLinkage MO class is used to represent one external Mobile linkage of the AISP. Within a SMIB there may be multiple MO instances of this class.

Possible attributes of this class are:

localRouterNET	Network Entity Title of the egress router at the local end of the external mobile linkage
mobileSNtype	Satellite or VDL or Mode S of HF or Gatelink
permitted traffic	type of traffic permitted over the mobile subnetwork (e.g. bit map indicating permission for ATSC, AOC, SM, ADM, and general communication traffics)
operationalState	Operational Status of the link
administrativeState	Administrative Status of the link
congestionState	Congestion Status of the link
transitDelay	Delay of transit of the link (possibly for each direction of transfer)
capacity	Capacity (i.e. throughput) of the link (possibly for each direction of transfer)
ATSCtraffic	number of ATSC CLNP packets and PDU octets having transited over the link (possibly for each direction of transfer)
AOCtraffic	number of AOC CLNP PDU packets and octets having transited over the link
ADMtraffic	number of ADM CLNP PDU packets and octets having transited over the link
SMtraffic	number of SM CLNP PDU packets and octets having transited over the link
genTraffic	number of general communication packets and PDU octets having transited over the link
octetSent	number of octets sent over the link (after compression)
octetReceived	number of octets received over the link (before decompression)
aircraftContactNumber	the total number of aircraft having been in contact over the link

aircraftDiscontactNumber	the total number of aircraft having closed the contact over the link
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
stateChange	stateChange notification as defined in 1S0/IEC 10165-2. Used to report the changes to the OperationalState, AdministrativeState and CongestionState attribute

4.4 A global containment tree for the Summary MIB

By following the approach introduced in section 4.2, section 4.3 defines a containment sub-tree for modelling the internetwork service provided by an organisation.

By following the same approach, it must be possible to develop a model and an associated MIB containment sub-tree for each of the other types of ATN service that can be provided by an organisation, i.e. namely for:

- the AMHS service,
- the AIDC service,
- the CPDLC service,
- the FIS service,
- the CM service,
- the ADS service,
- and possibly, the ATN CNM service

The complete ATN Summary MIB containment tree could then consist of the set of all ATN service modelling containment subtrees, all hanged below a common top level containment Managed Object Class.

The **system** Managed Object Class is proposed as the common top level Managed Object Class for the Summary MIB containment tree. This object class is indeed defined in ISO/IEC 10165-2 to represent *a set of hardware and software that forms an autonomous whole capable of performing information processing and/or information transfer;* and this is a definition which can be applied to the ATN infrastructure of an organisation.

At the next level of hierarchy in the containment tree, the 3 following generic MO classes are proposed:

- The ISO/IEC 10165-2 **log** managed object class. This class must be defined in the summary MIB in support of the standard ISO/IEC 10164-6 log control function
- The ISO/IEC 10165-2 **discriminator** managed object class. This class must be defined in the summary MIB in support of the standard ISO/IEC 10165-5 Event Report Management function

- The **aTNservice** Managed object class. This class will be used as a common containment point for managed objects in a "system" that relate to the provision of a given ATN service.

The Figure 3 illustrates the proposed containment tree for the Summary MIB.

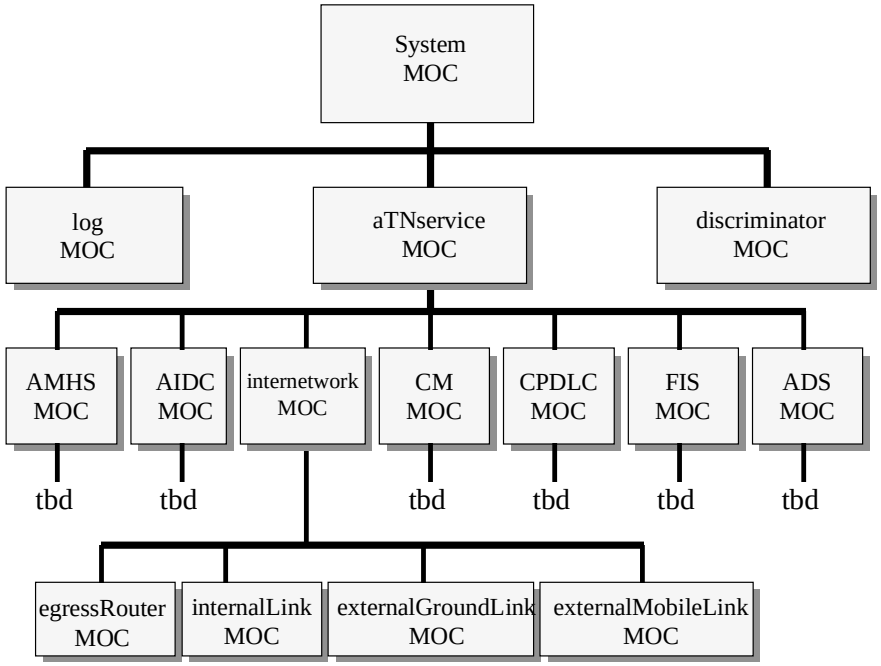


Figure 3: Proposed containment tree for the Summary MIB

5. CONCLUSION

This paper is a draft description of some general principles and of a simple framework, for exchanging management information across organisations. It also bring some ideas on the solutions for organising the management information to be exchanged.

Recommendation to WG2:

The WG2 is invited to discuss the appropriateness of the simple information exchange framework introduced in this paper.

The WG2 is invited to review and comment on the content of section 4.3 (A draft proposal for the SMIB information to be provided by an ATN internetwork Service provider)

Recommendation to JWG/JSG1:

The JWG/JSG1 is invited to:

- discuss the appropriateness of the simple information exchange framework introduced in this paper
- endorse the choice of the CMIP profile (AOM12 or FastMIP) used for the ground-ground cross-domain exchange of Management information.
- comment on the content of section 4.4 (A global containment tree for the Summary MIB)
- consider the following proposal: creation of a new section in the Subvolume 6 dedicated to the description of the Architecture for the cross-domain exchange of management information and for the definition of the ATN CNM services.