ATNP WG2/WG3

WG2 – WP 389

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AERONAUTICAL TELECOMMUNICATIONS NETWORK PANEL (ATNP)

WORKING GROUP 2 AND WORKING GROUP 3

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ATN Managed Objects

Presented by Paul Hennig

Summary

This attached paper from ATN Systems Inc. presents an analysis of the managed objected to be specified by ATNSI for their development of production reference router and end system (through upper layers) software.

Attachment: An Analysis of ATN Systems, Inc. RRI Managed Objects, May 8, 1997.

1. Introduction

The attached paper from ATN Systems Inc. presents an analysis of the managed objected to be specified by ATNSI for their development of production reference router and end system (through upper layers) software.

2. Recommendation

ATNP is requested to note the material in the attachment when developing SARPs and/or Guidance Material for ATN system management provisions.

ATTACHMENT

ATN Systems, Inc.

An Analysis of ATN Systems, Inc. RRI Managed Objects

8 May 1997

This document is intended to provide an analysis of the network management functionality required for the ATN Systems, Inc., (ATNSI) Router Reference Implementation (RRI).

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1. Introduction

This document is intended to provide an analysis of the network management functionality required for the ATN Systems, Inc., (ATNSI) Router Reference Implementation (RRI). This functionality has been specified in the ATNSI document: *Exhibit F3: ATNSI Network Management Subsystem Specification, Version 4.0*, [1]. Exhibit F3 focuses primarily on the specification of a set of managed objects (MO), which through their attributes and operations, provide the required management functionality. This document does not attempt to analyze those MO in the ATNSI RRI MO set which are defined in international standards. Instead, those only those MO which are newly defined for the RRI are discussed.

The ATNSI Management Information Base (MIB) comprises the set of MO which are discussed in this document. A primary objective of the MIB analysis carried out in this document is to perform a preliminary *paper* validation of the RRI MIB, as it is currently defined. Clearly, any true functional validation must come from operational experience. All of the management data collected through the RRI MIB must provide a means to effective monitor and control ATN Routers. It is normal practice to extend a MIB after operational experience has identified the need for additional management data. This document is intended to provide an initial, pre-implementation look at the contents of the RRI MIB.

1.1 ROUTER MANAGEMENT INTERFACE

Exhibit F3 contains requirements for the network management interface. This interface design and functionality are important because the network management software must coexist with the router software in an environment which must be FAA certifiable. Details can be found in the RRI Management Interface Requirements section of Exhibit F3 for the specific management interface requirements. The required certifiable architecture will be obtained through the use of a partitioned portable streams environment (PSE). A detailed description of the PSE design, the partitioning and the certification issue certification can be found in *Exhibit F1: ATNSI Router Reference Implementation Specification, Version 4.0,* [2].

1.2 ATNSI RRI MO

This section contains a list of all of the MO currently specified for the ATNSI. Table 1-1 provides a list of the RRI MO. The source column in Table 1-1 indicates the origin of the definition for each MO.

Managed Object	**Source**
ATN System MO	ATNSI
Network SubSystem MO	ISO 10733
NSAP MO	ISO 10733
Network Entitiy MO	ISO 10733
CLNP MO	ISO 10733
FIB MO	ATNSI
ES-IS MO	ATNSI
SNDCF MO	ATNSI
IDRP MO	ISO 10747
IDRP_Config MO	ISO 10747
Adj_Bis MO	ISO 10747
PIB MO	ATNSI
RIB MO	ATNSI
Adj_RIB MO	ATNSI
Loc_RIB MO	ATNSI
Transport Subsystem MO	ISO 10737
TSAP MO	ISO 10737
COTP MO	ISO 10737
CLTP MO	ISO 10737
Upper Layer Subsystem MO	ATNSI
ACSE MO	ATNSI
RRI Subsystem MO	ATNSI
ICAO_ID MO	ATNSI
Performance MO	ATNSI
Fault MO	ATNSI
Configuration MO	ATNSI

Table 1-1

2. Overview of Managed Object Hierarchy

Managed objects are abstractions which encapsulate the attributes and functionality of the real ATN resources which require management.

In the OSI system management standards there are three hierarchical views which are defined. These views are also referred to as trees. These include the inheritance hierarchy, the naming hierarchy and the containment hierarchy. The inheritance hierarchy provides information relating to how each MO is derived from a more generic super class of MO. This helps to establish categories of managed resources. The naming hierarchy is the

registration tree and may be thought of as a dictionary of managed objects. The containment hierarchy is similar to the inheritance hierarchy, but is more specific. The containment hierarchy shows the objects an agent contains. It represents the Management Information Base (MIB) structure. Figure 2-1 shows the RRI containment tree.

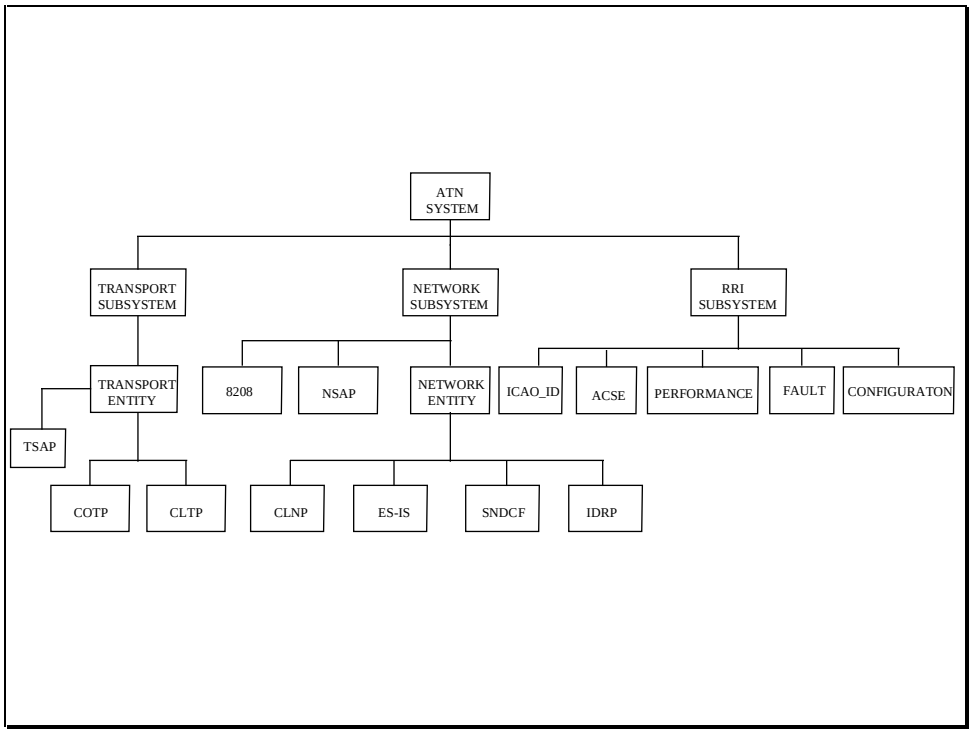

Figure 2-1

Some of the leaf nodes in the tree shown in Figure 2-1 contain subclasses. These subclasses are identified in the tables in section three. Note also that the following MO are not found in the ISO/IEC standards and have been defined for the ATN:

- RRI Subsystem and its derivatives
- SNDCF
- ES-IS
- IDRP - PIB
- IDRP - RIB
- CLNP - FIB

3. Analysis of Individual Objects

This section provides lists of all of the ATNSI RRI MO, along with their attributes and a brief description of their purpose. Those MO which are defined in ISO standards are not treated in detail.

3.1 ACSE

The ACSE provides for the establishment of peer ATN application associations, including ATN network and systems management application associations. ACSE services include A-Associate, A-Release, A-Abort, and A-P-Abort. Figure 3-1 shows the ACSE containment relationships. Note that there is one ACSE MO per ACSE connection.

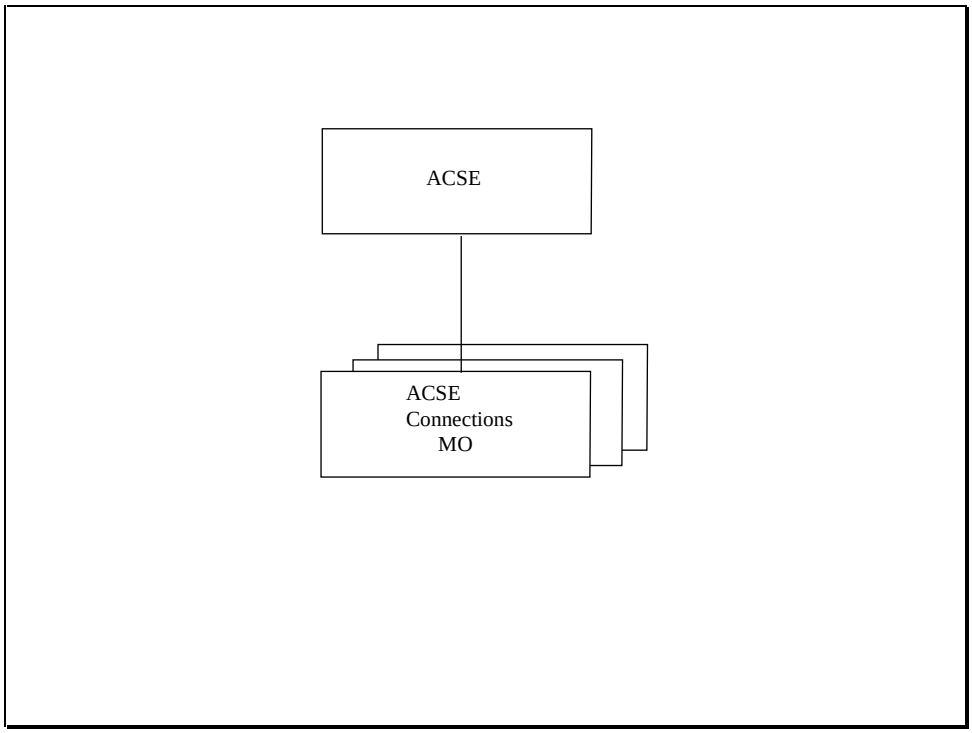

Figure 3-1

The ATN ACSE MO attributes (and contained MO) are listed in Table 3-1.

MO/*Attribute*	**Description**
ACSE MO	Defined by ATNSI
Total_bit_count	Counter: Total ACSE bit count
Total_queue_count	Counter: Total ACSE queue counts
Total_message_count	Counter: Total ACSE Message Count
ACSE_connections MO	One for each ACSE connection
ACSE_connections_AETs	Per connection origin and destination AET
Total_connection_bit_count	Per connection Total bit count
Overhead_bit_count	Counter: Per ACSE connection bit count for overhead bits
Data_bit_count	Counter: Per ACSE connection bit count for data bits
Message_counts	Counter: Per connection message count (data only)
Queue_counts	Counter: Per connection queue count

Table 3-1

3.2 TRANSPORT PROTOCOL

The ATNSI RRI requires the Transport MO as defined in ISO 10737. This MO should provide support for the following:

- All Transport connections origin/destination TSAP/NSAP and associated priority
- Bit counts (both overhead and data) by Transport connection
- Aggregate for all bit counts for all connections
- PDU size and number counts (both overhead and data) by Transport connection

- Aggregate for all PDU size and number counts for all connections
- Queue counts by transport connection
- Aggregate queue counts

Figure 3-2 illustrates the Transport Subsystem Containment Hierarchy as defined in ISO 10733.

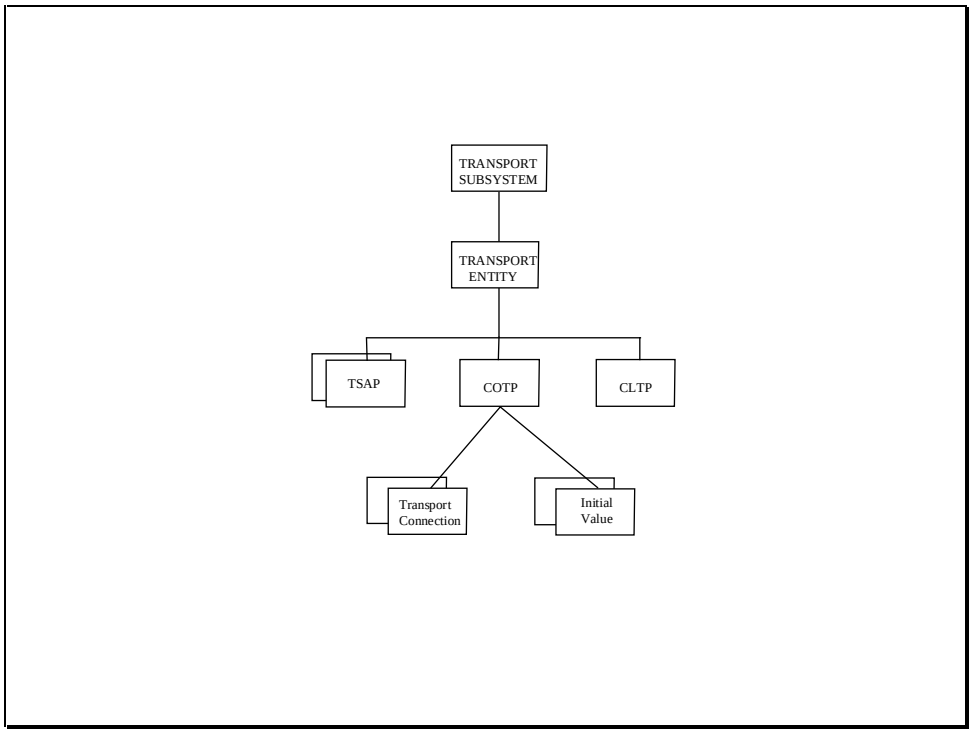

Figure 3-2

Table 3-2 lists the Transport MO as defined by 10737.

MO/*Attribute*	**Description**
Transport Entity MO	Defined in ISO10733 (Container Object)
Transport Subsystem MO	Defined in ISO10733 (Container Object)
Connection Oriented TP MO	Defined in ISO10733
Connection-less TP MO	Defined in ISO10733

Table 3-2

3.3 IDRP MO REQUIREMENTS

The MO classes idrp_config and adjacentBIS are supported, as defined in ISO 10747. Additional MO classes to those specified in ISO 10747 have been defined. These are a Policy Information Base (PIB) MO class, and Routing Information Base (RIB) MO classes. Over all, the RRI IDRP MO should provide the following functionality:

- All router connections (origin/destination Data Terminal Equipment (DTE))
- Aggregate for all router connections
- IDRP traffic (inbound and outbound, bit count and packets) on every router connection
- Aggregate IDRP traffic
- Policy Information Bases (PIB)
- Routing Information Bases (RIBs), for the Adj-Rib-In, Adj-Rib-Out and Loc-RIB.

Note: The Forwarding Information Base (FIB) MO is considered to be part of CLNP.

Figure 3-3 illustrates the containment hierarchy starting at the IDRP Configuration MO.

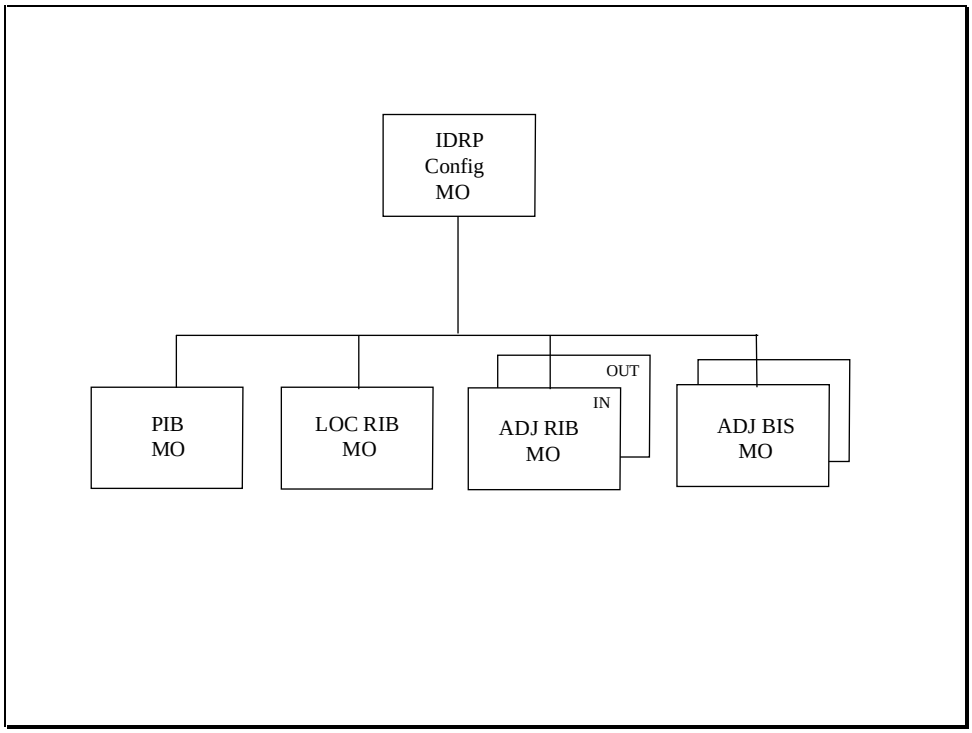

Figure 3-3

Table 3-3 lists the IDRP MO as defined in ISO 10747, as well as the PIB MO and RIB MO, which have been defined by ATNSI.

MO/*Attribute*	**Description**
IDRP Configuration MO	Define in ISO 10747 (Container Object)
Adjacent BIS MO	Defined in ISO 10747
PIB MO	One per BIS
PIB ID	String identifier
PIB contents	Complete contents of PIB table
Adj-RIB MO	Two per BIS: Adj-RIB-In & Adj-RIB-Out Records
Adj_RIB ID	String identifier
Adj_RIB contents	Contents of Adjacent RIB In/Out Records
Loc-RIB MO	One per BIS
RIB ID	String identifier
RIB contents	Complete contents of RIB table
RRI-IDRP_Stats MO	

Table 3-3

3.4 CLNP MO REQUIREMENTS

The RRI CLNP MO is specified as defined in ISO 10733. An additional MO shall be defined for the Forwarding Information Base (FIB). There is one FIB MO per ATN Intermediate System (IS).

In addition to the management data supplied by the CLNP MO as defined in 10733 there is a requirement for the ability to track relay transit times through the RRI for Benchmark purposes. This requirement will be met with an ATNSI defined Relay Transit Time MO.

Figure 3-4 contains an illustration of the CLNS containment hierarchy, including that portion defined in ISO 10733 as well as the ATNSI defined portion.

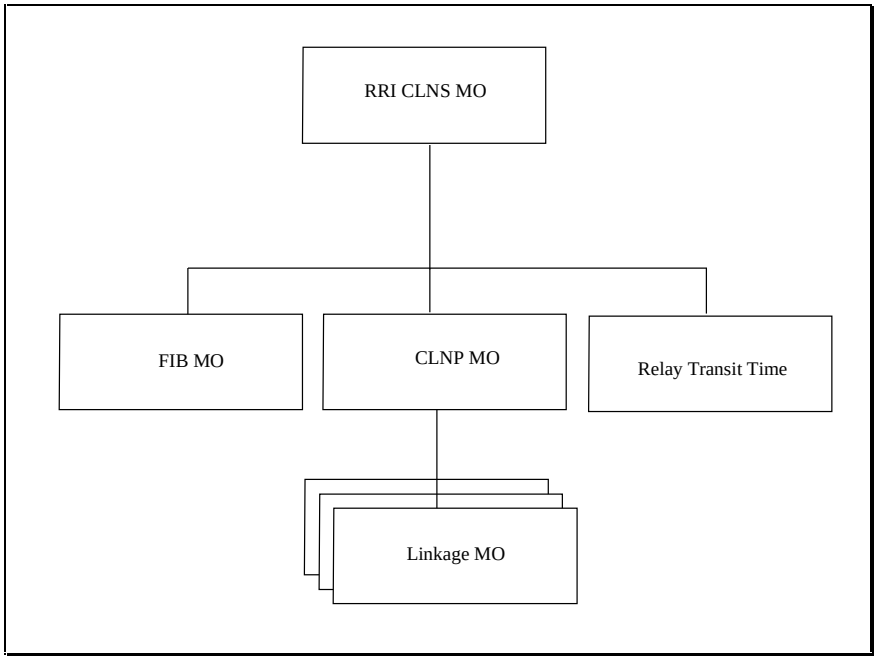

Figure 3-4

The ISO defined MO and attributes, along with the additional transit time attribute and FIB MO are summarized in Table 3-4.

MO/*Attribute*	**Description**
RRI CLNP MO	Defined by ATNSI; Container Object
CLNP MO	Defined in ISO 10733
Standard attributes	Defined in ISO 10733
Relay Transit Times MO	Defined by ATNSI
Most_recent_time	Defined by ATNSI; Most recent recorded transit time
Max_time	Defined by ATNSI; Longest recorded transit time
Min_time	Defined by ATNSI; Shortest recorded transit time
FIB MO	Defined by ATNSI; One per IS
FIB_Id	String Identifier
FIB_Content	Complete contents of FIB table

Table 3-4

3.5 ES-IS MO REQUIREMENTS

The following are the functional requirements for RRI ES-IS management:

- Adjacent End System Count
- Adjacent Intermediate System Count
- Per Adjacent System Information
- System Address (NSAP)
- Subnetwork Name
- Subnetwork Point of Attachment
- ES-IS PDU and Byte Counts - Received and Transmitted Each
- ISH PDU
- ESH PDU
- RD PDU
- Totals per Adjacent System
- Historical ES-IS Information Totals

These requirements can be met by defining the RRI ES-IS MO. The containment hierarchy for the ES-IS MO is provided in Figure 3-5 below.

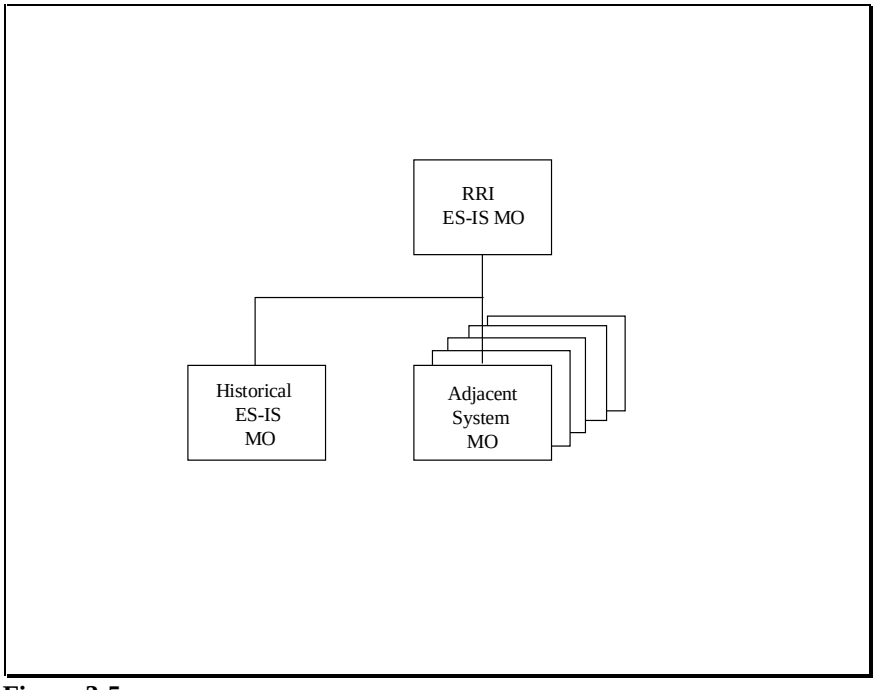

Figure 3-5

The attributes of this object are listed in Table 3-5.

MO/*Attributes*	**Description**
RRI ES-IS MO	Defined by ATNSI; One for every ATN ES/IS supporting ISO
Total_ES_count	Total number of adjacent ES
Total_Adj_IS count	Total number of adjacent IS
Adjacent_System MO	One MO per adjacent system
NSAP	System address (NSAP)
Subnetwork_name	Subnetwork Name
Subnetwork_point_of_attachment	Subnetwork Point of Attachment
Num_ISH_PDU__recd	Total number of ISH PDU received
Num_ISH_PDU_trans	Total number of ISH PDU transmitted
Num_ISH_bytes_recd	Total number of ISH bytes received
Num_ISH_bytes_trans	Total number of ISH bytes transmitted
Num_ESH_PDU_recd	Total number of ESH PDU received
Num_ESH_PDU_trans	Total number of ESH PDU transmitted
Num_ESH_bytes_recd	Total number of ESH bytes received
Num_ESH_bytes_trans	Total number of ESH bytes transmitted
Num_RD_PDU_recd	Total number of RD PDU received
Num_RD_PDU_trans	Total number of RD PDU transmitted
Num_RD_bytes_recd	Total number of RD bytes received
Num_RD_bytes_trans	Total number of RD bytes transmitted
Total_PDU_received	Total number PDU received per adjacent system
Total_PDU_trans	Total number PDU transmitted per adjacent system
Total_bytes_recd	Total number bytes received per adjacent system
Total_bytes_trans	Total number bytes transmitted per adjacent system
Historical ES-IS MO	Historical ES-IS information Totals
Note: The attributes of this MO are TBD; It could include attributes which reflect totals of the attributes listed above for specific periods of time, e.g. Total RD PDU for past week.	Attributes reflecting historical data

Table 3-5

3.6 SNDCF MO REQUIREMENTS

The management data required for the management of the RRI SNDCF can be summarized as follows:

- Queue counts by subnetwork
- Aggregate queue counts
- All router connections (origin/destination Data Terminal Equipment (DTE))
- Aggregate for all router connections

For Mobile subnetworks there is an additional requirement for data related to the following:

- Count of Join/Leave events by subnetwork
- Aggregate on join/leave events

The SNDCF MO provides access to the required data. Figure 3-6 illustrates the containment hierarchy for the SNDCF MO.

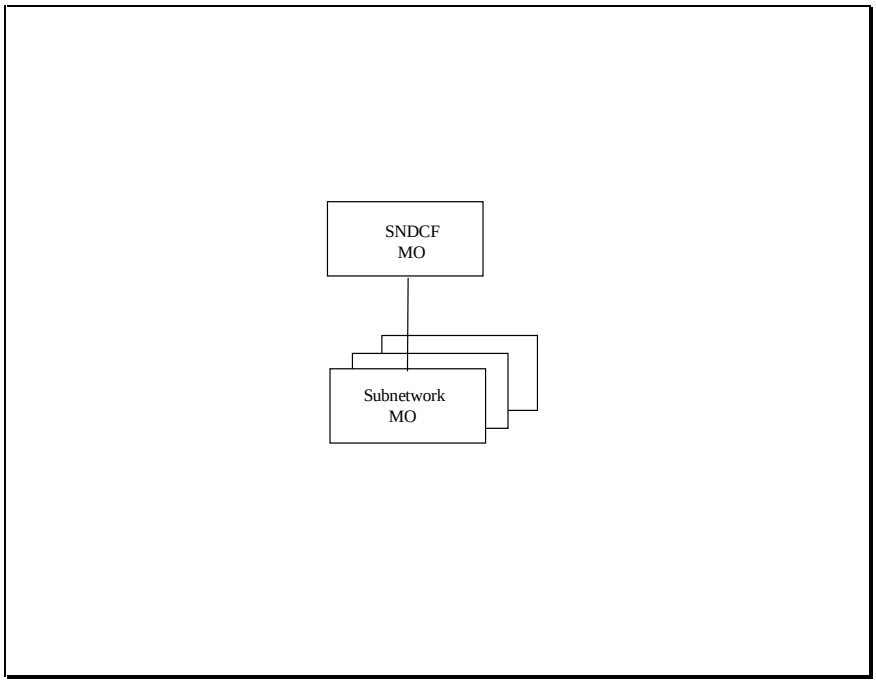

Figure 3-6

The attributes for this MO are listed in Table 3-6.

MO/*Attribute*	**Description**
SNDCF MO	Defined by ATNSI; One per ATN system
Total_router connections	Aggregate for all router connections
Total_queue count	Aggregate queue counts
Total_join_events	Aggregate on join events
Total_leave_events	Aggregate on leave events
Subnetwork MO	One MO per subnetwork
Queue_count	Queue counts by subnetwork
Router_connections	All router connections (origin/destination Data Terminal Equipment (DTE))
Number_join_events	Count of Join event for subnetwork
Number_leave_events	Count of Leave events for subnetwork

Table 3-6

3.7 ATNSI RRI SPECIFIC MO REQUIREMENTS

The ATNSI RRI requires the following additional management data:

- Processing time through the RRI based on first bit in, last bit out (benchmark/exceptions)
- ICAO 24-bit ID, hardware part number, software part number (one MO for each, and one aggregate MO for all three)
- Fault Management
- Error counts
- Retransmit counts
- Support for Ping and Traceroute initiation and reporting
- Threshholding
- Configuration Management
- Policy Downloading
- Configuration Downloading

To provide access and support for this management data the following MO have been defined specifically for the ATNSI RRI:

1. RRI Subsystem MO
2. ICAO_ID MO
3. RRI_Fault MO
4. RRI_Performance MO
5. RRI_Configuration MO

The containment relationships are depicted in Figure 3-7.

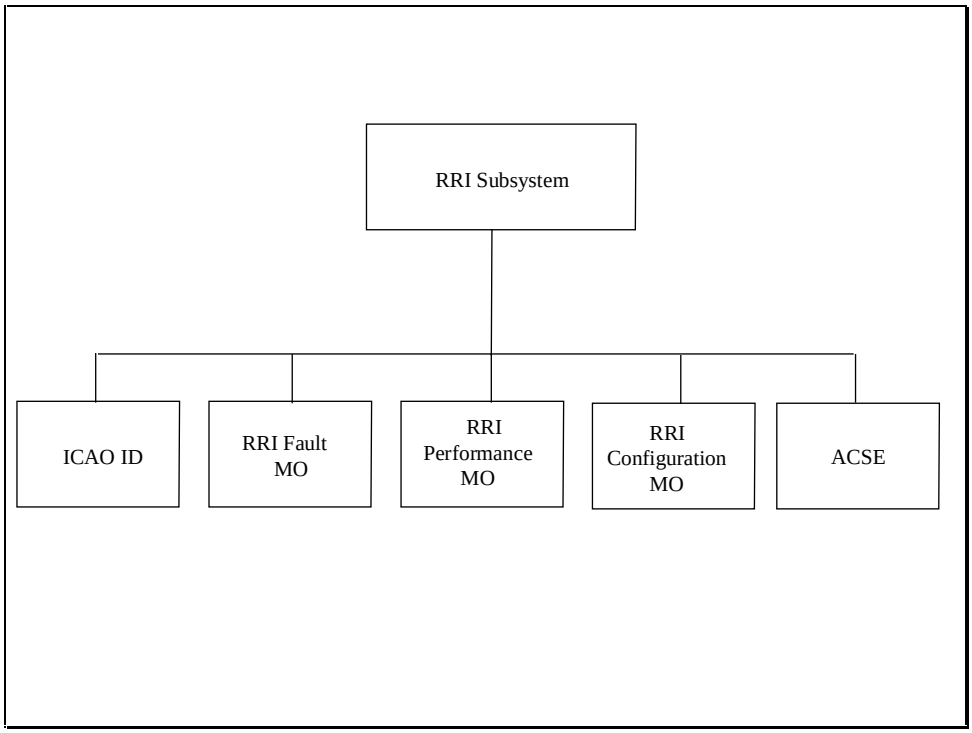

Figure 3-7

These MO are listed, with their attributes and descriptions, in Table 3-7.

MO/*Attribute*	**Description**
RRI Subsystem MO	Container Object
ICAO_ID MO	Container Object
24_bit_ID	Address String: ICAO 24 bit ID
Hardware_part_number	Integer: Hardware number
Software_part_number	Integer: Software number
RRI_Performance MO	Container Object
Processing_time	Processing time through the RRI based on first bit in, last bit out (benchmark/exceptions)
RRI_Configuration MO	Container Object
Get_Policy	Operation: Download a policy table
Get_Configuration	Operation: Download a routing table or other configuration table

Table 3-7

4. Notes

Note 1: There are several MO which have been defined in the international standards that are not included in this document. These include the TSAP MO (shown in Figure 1-1), the NSAP MO (not shown), and the ISO 8208 MO and its derivatives. These MO may be required for the ATNSI RRI management system. In this case, the standard definitions for these MO will serve as a baseline for the corresponding RRI MO implementations.

Note 2: The original requirement for an individual ICAO 24-bit ID MO, a hardware part number MO and a software part number MO has been modified in this document. A single ICAO ID MO is defined, with a 24-bit ID attribute, a hardware part number attribute, and a software part number attribute.

5. Summary

The MO described in this document make up the ATNSI RRI MIB. Taken as a whole, the MO which have been defined in ISO standards, along with the MO defined specifically for the ATNSI RRI provide a large data set which serves as an initial implementation of an ATN Router management system. A considerable amount of performance, fault and configuration management statistics can be obtained either directly and through derivation, using the currently defined MIB. Operational experience will provide the opportunity for extending and refining the MIB.

References

1. Exhibit F3: ATNSI Network Management Subsystem Specification, Version 4.0, October, 1996.
2. Exhibit F1: ATNSI Router Reference Implementation Specification, Version 4.0, October, 1996.
3. Chapter 12, Systems Management Guidance, ATN Manual, 2nd Edition, 1993.