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Systems Management Concept for CNS/ATM-1 Package

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SUMMARY

This paper considers the requirements for systems management in the ATN in the long term and for the timescale of the initial CNS/ATM-1 Package of ATN applications. It has been produced in the context of the deliverable WG1-07 Systems Management Concept Package 1.

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1. Introduction

This paper considers the requirements for systems management in the ATN in the long term and for the timescale of the initial CNS/ATM-1 Package of ATN applications. It has been produced in the context of the deliverable WG1-07 Systems Management Concept Package 1.

The paper aims to provide assumptions and rationale to support an approach to CNS/ATM-1 Package systems management. In this respect it supports the assumptions presented as Appendix A Flimsy #1 to the second meeting report of ATNP/WG2.

In addition the paper introduces draft material for the Overall Systems Management Concept in order to put the CNS/ATM-1 Package material in context.

1.1 Document Structure

Readers interested in the proposed long term concept should look at section 2.

Readers interested in the CNS/ATM-1 Package issues should look at section 3.

Section 2	Gives an outline of the long-term institutional approach to ATN Systems Management based on ATN Systems Management Concept, Issue 2.0, ATN Subgroup FANS WG1 and ATN Systems Management Analysis, Issue 1.0, ATN Subgroup FANS WG1. WG1 should review this material as a basis for future work on the Overall Systems Management Concept.
Section 3.1	Examines the Institutional framework that applies to CNS/ATM-1 Package ATN Communications, making assumptions as necessary. WG1/2/3 should review these assumptions.
Section 3.2	Examines the Transition issues that apply to CNS/ATM-1 Package ATN Communications, making assumptions as necessary. WG1/2/3 should review these assumptions.
Section 3.3	Examines the issues that apply to CNS/ATM-1 Package ATN Communications, making assumptions as necessary.
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Section 3.3.2	Examines the requirements and constraints that apply to CNS/ATM-1 Package ATN Internet making assumptions as necessary. WG2 should review these assumptions in detail.
Section 3.4	Examines the Certification issues that apply to CNS/ATM-1 Package ATN Communications, making assumptions as necessary. WG1/2/3 should review these assumptions.
Section 4	Gives recommendations to WG1/2/3.

1.2 Scope of ATN Systems Management standardisation

ATN standardisation shall only cover aspects that are necessary to the correct behaviour of ATM services based on ATN offered between organisations, across international boundaries and between the air and the ground.

Note. The structure of systems management and the associated interfaces within an organisation are not the subject of standardisation, although it may be desirable to provide guidance on these matters.

The types of organisations subject to ATN standardisation are:

- national air traffic administrations;
- international air traffic services providers;
- communications service providers;
- aircraft operators and their aircraft.

Systems management standards may be developed in the following relatively distinct areas:

- Systems Management information,
- Systems Management functions,
- Systems Management communications.

The extent to which standards need to be developed in each area is examined for the long term and for CNS/ATM-1 Package.

2. The Long-term

2.1 Institutional Objectives

This section outlines the long-term concept for ATN systems management.

2.1.1 Objectives and participants

The objectives of the ATN are to:

- Support ATM System Functions
  - ground-ground (e.g. co-ordination between ATC centres)
  - air-ground (e.g. exchange of flight profiles)
- Support AOC/AAC System Functions
  - ground-ground (e.g. co-ordination between airline offices)
  - air-ground (e.g. monitoring engine parameters)
- Support APC System Functions
  - air-ground (e.g. passenger E-mail)

ATN User Groups are:

- ATC authorities
- Aircraft operators (i.e. Airlines, including Aircraft)
- ATS service providers.

ATN Service Providers are:

- ATC administrations
- Aircraft operators (airlines)
- Commercial network service providers

2.1.2 General management requirements

Figure 1 shows the organisational elements of the ATN environment, identified above.

The users of the ATN as shown are Civil Aviation Authorities (CAAs), AIRLINES and AIRCRAFT.

AIRCRAFT operate under the authority of AIRLINES but behave autonomously in flight. All of these user types must operate ATN End Systems and ATN Intermediate Systems with which they communicate.

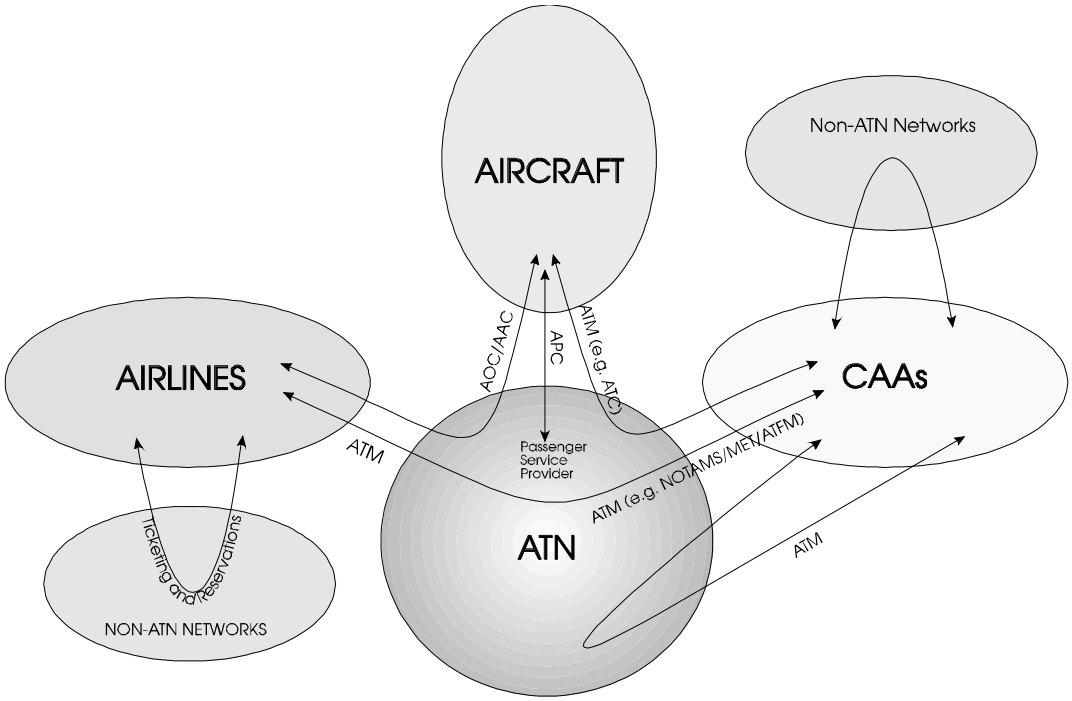


Figure 1 ATN Users and User Data

The service requirements will depend upon the traffic type being exchanged. The support of these requirements may imply a need for:

- security management;
- fault management;
- accounting management;
- performance management;
- configuration management.

The general traffic types to which the service requirements should be applied are:

- Air Traffic Communications (ATC)
- Aeronautical Administrative Communications (AAC)
- Aeronautical Operational Communications (AOC)
- Aeronautical Passenger Communications (APC).

Long-term assumption 1:The guarantee of service in the ATN can only be provided when the ATN is actively managed.

2.1.3 Administrative and Operational Management

Long-term assumption 2:There will be "Administrative" management requirements not directly related to the operation of ATN equipment, authorities may require managers to collect statistics, make statistical analysis and collate reports for accounting purposes etc.

For these purposes further classes of administrative management information and managers may be defined.

Administrative management information may present "views" of network operation to higher level management or peer managers in other institutions e.g. to:

- gather statistics for accounting purposes,
- present a filtered view of network performance statistics to a manager,
- allow the application of a particular routing policy to groups of routers,
- allow service providers to “present” their services to a user,
- implement access control between institutions.

2.1.4 Large-scale structure of the ATN

Figure 2 illustrates the possible large-scale structure of an example subset of the ATN environment.

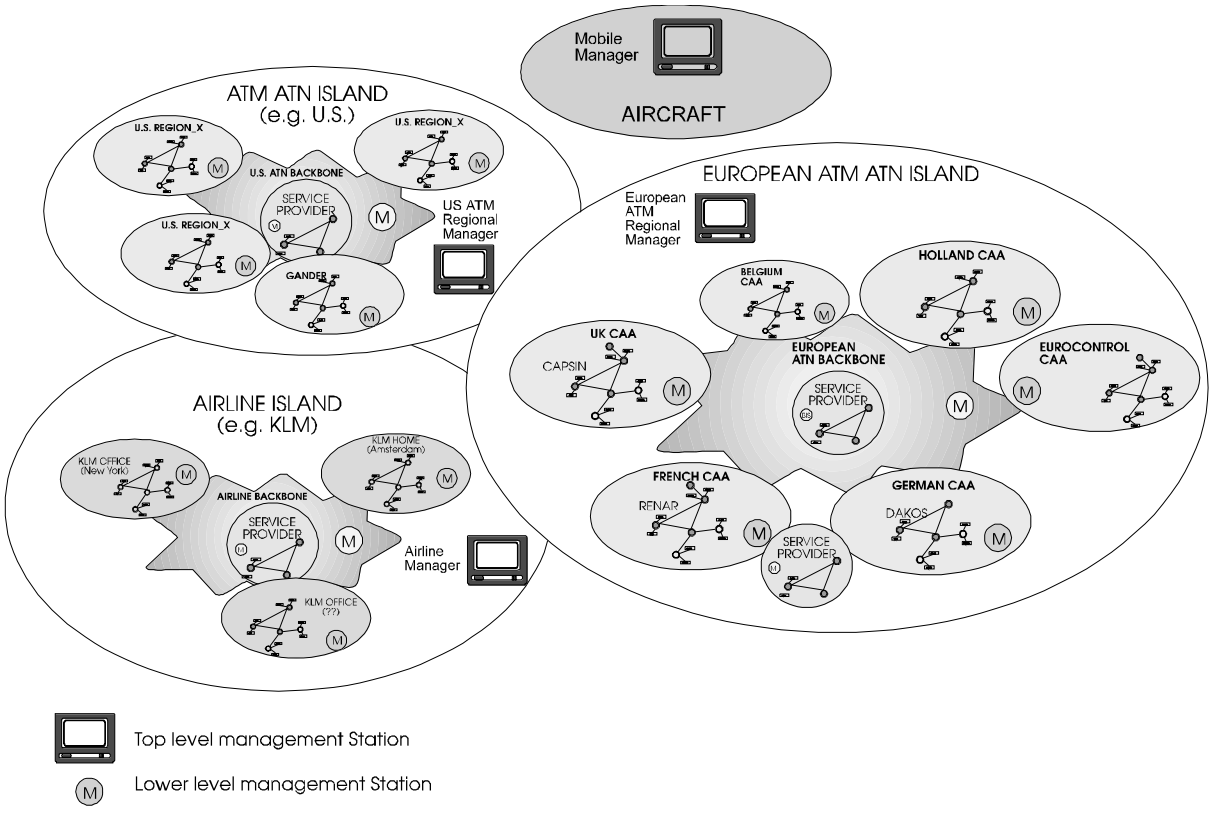


Figure 2 Large scale ATN structure

An ATN ISLAND is defined in the ATN Manual as a set of related ground routing domains (RDs) forming a routing domain confederation (RDC, as defined in ISO/IEC 10747) and containing a subset BACKBONE RDC whose RD(s) are transit RDs that will route traffic between any other RDs in the Island RDC. The concept of ATN Islands has been developed in the ATN Manual as a technique to describe regions of ATN implementation.

Long-term assumption 3: The metaphor of ATN ISLANDS as presented in the ATN Manual is extensible such that it becomes a domain of ATN implementation that requires management.

Note. Routing structure is simply one part of an ATN ISLAND that requires management.

There are two basic types of ATN ISLAND shown in the figure:

- the AIRLINE type
- the Air Traffic Management (ATM) type.

The AIRLINE ISLANDS and ATM ISLANDS are shown in the figure as overlapping to some extent. This indicates that they are expected to exchange management information. Note that there is no such overlap with AIRCRAFT.

Long-term assumption 4: AIRCRAFT have MOBILE MANAGERs on board, but management exchanges over the air-ground link will be extremely limited and based only on paramount operational need (this is due to the limited bandwidth characteristics of this type of link).

Long-term assumption 5: In the flight deck environment, mobile managers will need to be autonomous applications requiring a minimal level of human intervention.

Long-term assumption 6: Every AIRLINE and ATM ISLAND will have a REGIONAL MANAGER which has ultimate responsibility for the operation of the ISLAND. These Managers may use lower level managers at their disposal (e.g. those in the CAA domains of responsibility).

Within ATM ISLANDS are:

- the ATM ISLAND BACKBONE
- CAAs
- commercial telecommunications SERVICE PROVIDERS.

Within AIRLINE ISLANDS are:

- the AIRLINE ISLAND BACKBONE
- AIRLINE OFFICES
- commercial telecommunications SERVICE PROVIDERS.

Long-term assumption 7: Every CAA, SERVICE PROVIDER, AIRLINE OFFICE and ISLAND BACKBONE will have an AREA MANAGER which has responsibility for its own area. These Managers may use lower level managers/agents at their disposal (e.g. managers of networks).

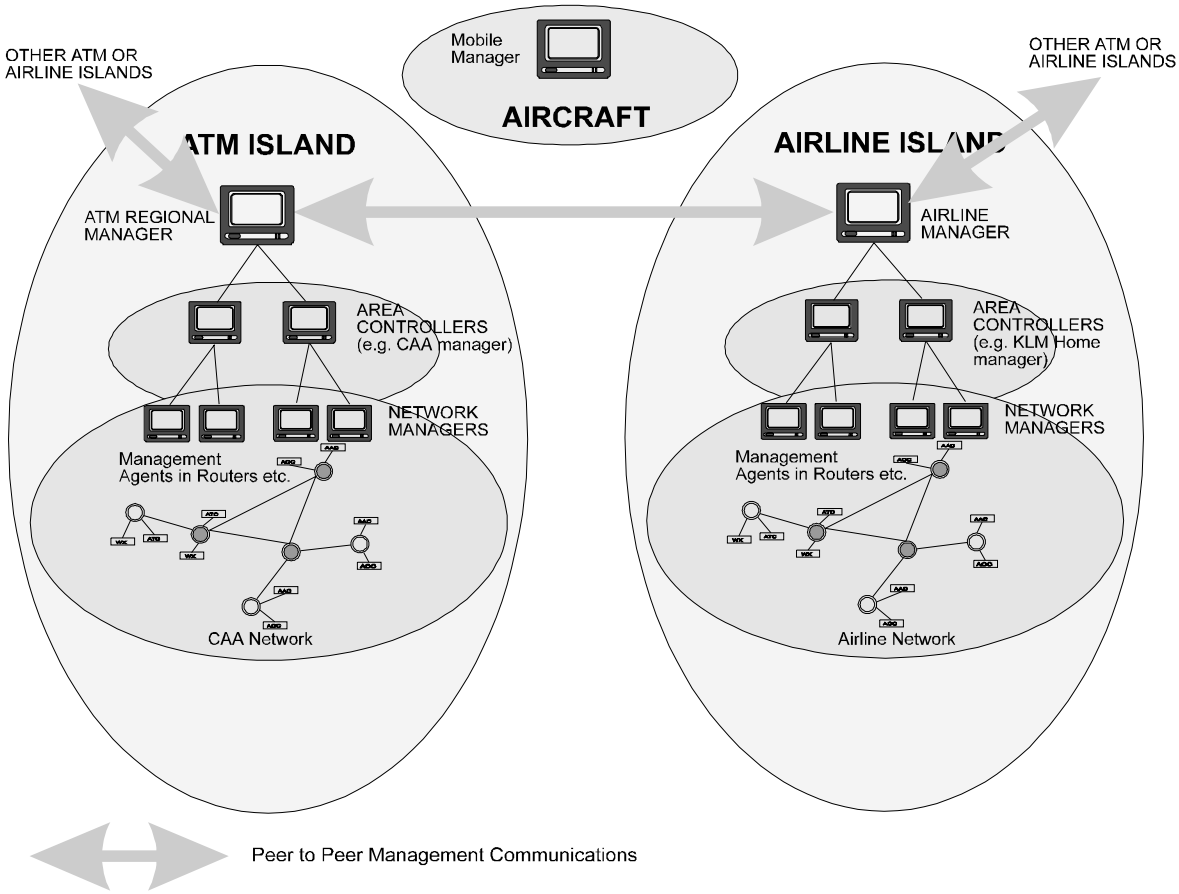
Within CAAs, AIRLINE OFFICES and SERVICE PROVIDERS are:

- NETWORKs.

Long-term assumption 8: Every NETWORK will have a NETWORK MANAGER which has responsibility for the detailed operation of the equipment in the network. These Managers may use lower level managers at their disposal (e.g. management agents resident in physical equipment).

2.1.5 Manager Types

The following section identifies several types of manager and gives a simple example of the activities of each. When agreement on these types has been reached a detailed analysis of the functions required for each type must be conducted.



Manager Types

ATM REGIONAL MANAGER

Each ATM_ISLAND has a REGIONAL_MANAGER that the single responsible authority for establishing and maintaining the structure, integrity and internal administration of the Island as a whole. This manager also:

- co-ordinates communication policies between CAAs, AIRLINEs, SERVICE PROVIDERs and the ISLAND_BACKBONE participants that form the ATM_ISLAND,

- negotiates and administers policies for communicating with other ATN_ISLANDs and AIRCRAFT management domains external to itself.

AIRLINE MANAGER

Each AIRLINE_ISLAND has an AIRLINE_MANAGER that has the same type of responsibility as the REGIONAL_MANAGER. There will however be a difference in the communications and management policies implemented by them.

AREA CONTROLLER

Each CAA, AIRLINE HOME, AIRLINE OFFICE and ISLAND_BACKBONE has a AREA_CONTROLLER that is a manager responsible for the administration of its constituent components. These will involve the collection and organisation of data concerning operations via the NETWORK ADMIN domain. The AREA_CONTROLLER will for example:

- take action in response to the analysis of data and in response to events from NETWORK ADMIN,

- take action in response to commands from AIRLINE or REGIONAL MANAGER,

- be responsible for establishing and maintaining the RD and RDC structure and their operation via the NETWORK ADMIN domain,

- administer and maintain QOS, secure interaction and other policies common to the components of RDs and RDCs,

- switch SERVICE_PROVIDERs according to QOS required or other reasons (fault reports etc.)

NETWORK MANAGER

Each NETWORK has a NETWORK MANAGER which has access to the physical equipment. The NETWORK MANAGER collects data and administrates the Management Information Base for groups of Host Computers, Routers and Subnetwork Components according to the association rules it establishes with the "Management Agents" (see ISO/IEC 10040) resident in those systems.

MOBILE MANAGER

Each AIRCRAFT has a MOBILE MANAGER which is a responsible for the airborne NETWORK ADMIN domain. This single manager administers all the ATN Systems in the M+C domain on board the aircraft, no other manager type is mobile.

2.2 ATN Manual

The ATN Manual defines an approach to distributed systems management using the OSI Systems Management model defined by ISO/IEC 7498-4 and ISO/IEC 10040.

It makes specific requirements in the following areas, which are identified as independent aspects of a management implementation:

- management information for the ATN Internet protocols;
- management functions to be implemented in ATN systems management applications;
- an ATN Systems Management communications profile, equivalent to the international AOM12 profile, specifying the use of the ISO/IEC 9596 Common Management Information Protocol and its supporting upper layer protocols.

It requires a systems management application in the Agent role to be incorporated into each ATN BIS, and by implication recommends the provision of one or more systems management applications in the Manager role in each organisation.

Long-term assumption 9: The ATN Manual defines an approach to distributed systems management using the OSI Systems Management model defined by ISO/IEC 7498-4 and ISO/IEC 10040 and this is adopted as the long term approach to ATN Systems Management

2.3 Long Term Assumptions for Applications/Upper Layers

Long-term assumption 10: In the longer term, the managed objects for upper layers which are currently the subject of international standardisation efforts will require support in the ATN environment. As ATN applications become more sophisticated, they will also define their system management requirements for each of the management functional areas.

Note: Refer to recommendations in TULIP Standing Document 05 as distributed in at San Diego WP3/29 "Report on TULIP Activities".

3. Requirements, assumptions and constraints for CNS/ATM-1 Package

Assumption 1 Operational concepts must be defined for CNS/ATM-1 Package to enable all the following requirements, constraints and assumptions to be validated within that context.

3.1 Institutional framework assumptions for CNS/ATM-1 Package

Assumption 2 In the CNS/ATM-1 Package environment, systems management will be primarily the responsibility of each participating organisation.

Note: Even with no overall operational authority, there may be mutual benefits to groups of ATN organisations in establishing specific systems management centres, perhaps on a regional level.

Assumption 3 There will be no ICAO standardised systems management exchanges between organisations in the CNS/ATM-1 Package.

Assumption 4 Airline applications are excluded from the scope CNS/ATM-1 Package standardisation.

Assumption 5 In the absence of distributed systems management in CNS/ATM-1 Package to provide service guarantees, high reliability must be built into the network.

Assumption 6 In CNS/ATM-1 Package each organisation will operate its own network. Only NETWORK MANAGERS and MOBILE MANAGERS will be required from the Manager Types identified for the Long Term.

Assumption 7 In CNS/ATM-1 Package NETWORK MANAGERS in different organisations do not intercommunicate using ICAO standard systems management protocols.

Assumption 8 In CNS/ATM-1 Package MOBILE MANAGERS and NETWORK MANAGERS do not intercommunicate using ICAO standard systems management protocols.

Assumption 9 In CNS/ATM-1 Package ICAO standards do not apply internally to an organisation although the implementation of standard management information in ATN equipment is encouraged in order to facilitate transition to the longer term.

Assumption 10 In CNS/ATM-1 Package distributed systems management of ATN equipment within organisations will be required but this is not subject to ICAO standards.

Note: It will obviously be impractical to have operations staff manning each piece of ATN equipment, operating it from a local interface.

Assumption 11 In CNS/ATM-1 Package administrative management information will be required by organisations (and between organisation) for report generation and accounting purposes but will not be communicated using ICAO standard mechanisms.

Assumption 12 In CNS/ATM-1 Package Service providers will typically negotiate a service level agreement with their customers and will charge accordingly, but this will not be enforced or supported by dynamically gathered data or communicated by systems management.

Assumption 13 In CNS/ATM-1 Package there is no security risk arising from the use of distributed systems management between organisations.

Note1: When organisations exchange management information in the future, specific administrative managed objects presenting a limited "view" of an organisation may provide a sufficient means for access control.

Note2. The existing provisions of the ATN Manual only define the basic MOs for use within a single administrative scope.

Note3: The exchange of standardised administrative ATN management information across organisational boundaries requires the implementation of bespoke managed objects. There are no standards for Administrative MOs. This is a significant limitation because, as described in the Appendix, while new managed objects may be implemented with relatively little effort in the managing system by means of toolkits available for use with specific management products, bespoke software is needed in the managed system to implement the managed objects' behaviours.

3.2 Transition Issues

3.2.1 The Methods for Achieving ATN Management

ATN Management could be achieved by a variety of mechanisms. The total ATN Management solution may well involve a combination the following approaches:

1. Designing the ATN network architecture and components appropriately (e.g. use fault tolerant systems).

2. Implementing operational procedures not requiring specific management functions or networking technology (e.g. voice control procedures)

3. Implementing management functions in ATN computer systems that do not communicate using the OSI systems management model as specified in the ATN Manual (e.g. using SNMP, file transfer, messaging services etc.).

4. Implementing management functions in ATN computer systems that communicate do communicate using the OSI systems management model as specified in the ATN Manual (i.e. using CMIP, standard systems management functions and managed objects)

The long term assumption is that the Provisions defined in Appendix 12 of the ATN Manual will be adopted (see above).

3.2.1.1 Use of the OSI Systems Management Model

The ATN Manual defines an approach to distributed systems management using the model defined in ISO/IEC 7498-4 and ISO/IEC 10040 and an associated communications profile using OSI protocols.

Systems management standards have been developed in the following relatively distinct areas:

- Systems Management information,
- Systems Management functions,
- Systems Management communications.

Assumption 14 The adoption of the model and Provisions defined in Appendix 12 of the ATN Manual for the definition of Systems Management information as managed objects is the minimum and most practical step in Transition towards the long term and is practical within CMS/ATM-1 Package timescales.

Note1: The adoption of common standards for systems management information will enhance inter-operability in a manner independent of management protocols.

Note2: Given the Managed Object (MO) concept, several primitive types of MO have been identified in Chapter and Appendix 12 of the ATN Manual:

- *OSI specific MOs: those defined in international standards to represent OSI protocol and system resources;*

- *OSI generic MOs: those defined in OSI Systems Management standards for use in defining specific protocol and system MOs;*

- *ATN MOs: MOs defined in ATN standards to represent ATN-specific protocol and system resources;*

- *Administrative MOs: MOs defined to represent a selection or summary of information or a modification of the behaviour available in one or more other MOs, so as to meet a specific requirement for systems management.*

Assumption 15 The adoption of the model and Provisions defined in Appendix 12 of the ATN Manual for the definition of Systems Management functions and communications can not be recommended for implementation within CMS/ATM-1 Package timescales but can be given as guidance.

Assumption 16 Systems management implementation within organisations for CNS/ATM-1 Package according to the Systems Management Provisions defined in Appendix 12 of the ATN Manual is not precluded.

Note: It may be possible for forward looking organisations to implement this within CNS/ATM-1 Package timescales some guidance is provided in Appendix B.

3.3 Requirements of CNS/ATM-1 Package ATN Communications

As stated above in the Institutional framework assumptions for CNS/ATM-1 Package:

"In CNS/ATM-1 Package distributed systems management of ATN equipment within organisations will be required but this is not subject to ICAO standards".

However:

Assumption 17 In CNS/ATM-1 Package for ATN equipment to function consistently, requirements may be placed on how systems operate or are managed locally, independent of implementation. Systems Management may be the best way to achieve results but this is a local issue.

3.3.1 Requirements of CNS/ATM-1 Package Applications and Upper Layers

3.3.1.1 Common upper layer management requirements for CNS/ATM-1 Package

The CNS/ATM-1 common upper layer profile is being defined at the time of writing. However, the details of the profile are of secondary importance here, since there is no agreement on managed object standards for the OSI common upper layer protocols (e.g., session, presentation, ACSE),

Assumption 18 Products will not support OSI distributed systems management for common upper layer protocol resources in the timescale of CNS/ATM-1 Package.

3.3.1.2 Application management requirements for CNS/ATM-1 Package

Assumption 19 There is a need for a priori information related to addressing at all relevant levels, which may have to be configured to achieve connectivity. Upper (and transport) layer addressing for CNS/ATM-1 Package will be pre-defined using a priori information.

The applications for the CNS/ATM-1 Package are:

- Context Management (aircraft-ATC unit association management);
- Automatic Dependent Surveillance (contract establishment and position reporting etc.);
- Direct Controller-Pilot Communication (standardised control messages);
- ATS inter-facility data communication (inter-centre communication: co-ordination between ATC units);
- Flight Information Services (terminal information services, distribution of NOTAMs, MET data, etc);
- ATS messaging (AFTN replacement).

In case of failure, all the proposed applications except FIS and the ATS Message Service call for service restoration to be achieved within times of the order of 6-90s. This is too demanding for local management intervention; this resilience will need to be automated and so it is likely to be built into the application and its use of the ATN, rather than through distributed systems management.

Assumption 20 Resilience requirements will be met through design of the applications and the supporting networks rather than through CNS/ATM-1 Package systems management.

Assumption 21 There will be no standard system applications to provide systems and security management and naming and addressing services in CNS/ATM-1 Package.

3.3.1.2.1 CM requirements

The context management application is to be based on the application defined in (RTCA DO-223). CM is solely an air-ground application used between an aircraft and its responsible ATC unit (and possibly neighbouring ATC units), associations being initiated by the ground end systems.

No specific CNS/ATM-1 Package systems management requirements for CM have been stated. The proposed use of cryptographic authentication mechanisms (see WG1 deliverable Security Management Concept Package 1) to protect the CNS/ATM-1 Package applications implies the need for key management at least. This may be achieved through layer management protocols or through systems management protocols, or, alternatively, off-line key management procedures may be adequate.

Assumption 22 If layer security management protocols are used to establish cryptographic keys, these protocols will form part of CM, rather than being defined separately for each ATN application.

Assumption 23 There are no specific CNS/ATM-1 Package systems management requirements for CM.

3.3.1.2.2 ADS requirements

ADS is solely an air-ground application used between an aircraft and its responsible ATC unit (and possibly neighbouring ATC units).

Assumption 24 There are no specific CNS/ATM-1 Package systems management requirements for ADS.

3.3.1.2.3 CPC requirements

The direct controller-pilot communications application is to be based on the controller-pilot data link, CPC is solely an air-ground application used between an aircraft and its responsible ATC unit (and possibly neighbouring ATC units).

Assumption 25 There are no specific CNS/ATM-1 Package systems management requirements for CPC.

3.3.1.2.4 FIS requirements

The flight information services application provides for distribution of information related to air traffic management (e.g., terminal status information, NOTAMs). It is a air-ground application, in which the airborne system is able to receive on request some set of data relating to (e.g.) conditions at a destination aerodrome. The ground end system may be in a routing domain remote from the those adjacent to the airborne domain.

Assumption 26 There are no specific CNS/ATM-1 Package systems management requirements for FIS.

3.3.1.2.5 AIDC requirements

AIDC is solely a ground-ground application used between two ATC units (there is no multi-party negotiation of aircraft handover between neighbouring ATC units).

Assumption 27 There are no CNS/ATM-1 Package systems management requirements for AIDC.

3.3.1.2.6 ATS messaging service requirements

ATS messaging is solely a ground-ground application used between ATC units. It is to be implemented using OSI MHS. There will be a requirement to configure the MTA routing tables (etc.), but this can be done using local mechanisms, since (as noted earlier) the timescale for OSI-based MHS management products is beyond that for CNS/ATM-1 Package. Connectivity will presumably be maintained through diverse statically configured routes.

Assumption 28 There are no specific CNS/ATM-1 Package systems management requirements for ATS Messaging.

3.3.1.2.7 Other system application requirements

Assumption 29 There will be no standardised distributed security management applications, nor use of the Directory, in CNS/ATM-1 Package.

3.3.2 Requirements of CNS/ATM-1 Package Internet

Assumption 30 The Provisions defined in Appendix 12 of the ATN Manual for the definition of Systems Management information, functions and protocols will be profiled and amended to provide guidance material for CMS/ATM-1 Package implementations.

3.3.2.1.1 Transport protocol management requirements

The Provisions defined in Appendix 12 of the ATN Manual for the definition of Systems Management information for the transport layer are applicable as guidance.

Assumption 31 There is a requirement for management of transport layer timers. These can be given appropriate default values, or set locally (see WG1-10 QOS Management Concept Package 1).

These timers can be specified together with related transport layer QoS parameters through Initial Value MOs (IVMOs) as defined in the ATN Manual, A12.2.2.7.

3.3.2.1.2 Internetwork protocol management requirements

Layer management protocols in the form of the IDRP, IS-IS and ES-IS routing information exchange protocols are crucial to the operation of the ATN. This provides a substantial capability for automated connectivity management, independent of any other systems management facilities. In particular the Forwarding Information Base (FIB), local and adjacent routing information bases (RIBs) are available in any BIS and can be used to assist operation and fault management.

Assumption 32 The mandatory managed objects specified in ISO/IEC 10747 will be implemented.

Assumption 33 Automated local management facilities will be provided to set Routing Policy according to agreements made between organisations.

Assumption 34 Automated local management facilities will be provided to access and display the FIBs and local and adjacent RIBs in Boundary Intermediate Systems (BISs) in order to assess ATN connectivity.

Further facilities are normally needed to assist in debugging connectivity problems through packet echo and route recording. The Echo function of ISO/IEC 8473-1 (added since the second edition of the ATN Manual) must be implemented to support them.

Assumption 35 Basic physical connectivity testing will be provided through the Echo Request/Response function and the Partial Route Recording option of CLNP.

Assumption 36 There is a need for a priori information related to addressing, which will have to be configured by local management to achieve and control connectivity.

3.3.2.1.3 Route initiation requirements

Route Initiations requirements are specified in the ATN Manual Appendix 6 and further explained in WG2/WP-68, Proposed Guidance Material in Support of Route Initiation.

Assumption 37 Automated local management is required to support route initiation between ground-based BISs.

Assumption 38 To support air-ground route initiation between airborne and ground-based BISs, an automated local systems management facility is required. In the case of event driven route initiation the local management facility must co-ordinate events between the BIS and the subnetwork equipment.

Assumption 39 There is currently no generic specification of management information in support of route initiation or mobile circuits, guidance material will be provided for CNS/ATM-1 Package.

Note:. Two mechanisms are specified for link establishment: In the event-driven case, the air-ground subnetwork automatically notifies the IS of changes in connectivity (Join Event), while, in the polled case, one IS cycles through a list of known remote ISs attempting to establish a link.

3.3.2.1.4 Subnetwork management requirements

Standardised management information is defined for the probable ground subnetwork protocols (eg, ISO/IEC 8208, ISO/IEC 7776) and called up in the ATN Manual, A12. There is currently no generic specification of management information to support mobile subnetworks.

Assumption 40 Management information will be defined as guidance material for CNS/ATM-1 Package

Assumption 41 Local systems management facilities will be provided to manage subnetworks

3.4 Certification issues

Assumption 42 All ATN equipment will be subject to safety certification as defined by the relevant national administration. This follows from the fact that the ATN will carry data related to aircraft safety.

Assumption 43 Within an organisation or aircraft any local ATN systems management implementations will need to be certified (whether or not it is compliant with ATN Manual Appendix 12).

Assumption 44 Different levels of certification will apply to airborne and ground-based systems.

Assumption 45 The use of off-the-shelf products for local ATN systems management may be limited by the availability of data to support certification, such as internal design documentation.

Assumption 46 Certification requirements will prevent the use of commercially available distributed systems management products in airborne systems for CNS/ATM-1 Package.

3.5 Off-the-shelf products

Assumption 47 Several capable MANAGER products are available: e.g., Hewlett-Packard's OpenView, IBM's NetView. Typically these will support a variety of management protocols, including SNMP and CMIP.

Assumption 48 Products are available now supporting the Systems Management Functions, Protocols and standard MO definitions specified in the ATN Manual Appendix 12 but these have not been widely incorporated into commercially available communications equipment with OSI MANAGER/AGENT facilities.

Note: There is no support in current or near-term profiles or products for the use of encodings other than BER with CMIP.

Assumption 49 The implementation of a new MO (e.g. ATN specific MO) in a managed system may require a significant programming effort. This factor also places an inherent constraint on the timescales for the support of new managed object specifications by managed system products.

Note: See Appendix B for more information.

4. Recommendations

WG1 is invited to consider the Long Term sections of this document as candidate material for deliverableWG1-08 - Overall Systems Management Concept.

The WG1 Systems Management special interest group is invited to comment on this document in detail and also on the ATN Systems Management Concept, Issue 2.0, ATN Subgroup FANS WG1 and ATN Systems Management Analysis, Issue 1.0, ATN Subgroup FANS WG1.

In WG2 the provisions defined in Appendix 12 of the ATN Manual (or elsewhere) for the definition of Systems Management information, functions and protocols should be profiled and amended to provide guidance material for CMS/ATM-1 Package implementations.

WG2 and 3 is invited to comment on the requirements, assumptions and constraints for CNS/ATM-1 Package in the form of flimsies (WG1 meets after WG2/3).

Appendix A - Flimsy #2: Assumptions Regarding ATN CNS/ATM-1 Package Systems Management from WG2-2

1. Introduction

This flimsy proposes high-level assumptions regarding the support of System Management functions for CNS/ATM package 1 .

These assumptions were developed from principles agreed at the WG2-25 Task Force meeting held on 15 December 1995 at the DNA "Direction de la Navigation Aérienne" premises in Paris, France.

2. Assumptions regarding ATN System Management for CNS/ATM package 1

Participants of the meeting agreed that:

Given the current lack of well identified operational requirements regarding Systems Management for the ATN internet , the definition and implementation of a global ATN Systems Management solution cannot be achieved within the timeframe foreseen for the package 1 SARP acceptance. Consequently , within this timeframe:

1. No exchange of Systems Management information will be required between routers of different administrative domains .

2. No exchange of System Management information will be required by means of a management protocol over the air/ground links. This does not preclude the exchange of routing information, by means of routing information exchange protocols.

3. The exchange of System Management information within an administrative domain is considered a local matter and can be achieved by any means deemed appropriate.

Nevertheless, it is desirable that:

a) An ATN Management Information Model (i.e. set of Managed Objects) be defined for package 1 in order to allow the support of local Management functions as well as the development of a future global ATN Systems Management solution.

b) The exchange of Systems Management information across administrative domain boundaries be possible as long as it does not compromise the safety and regularity of flight.

Appendix B - ATN systems management implementation

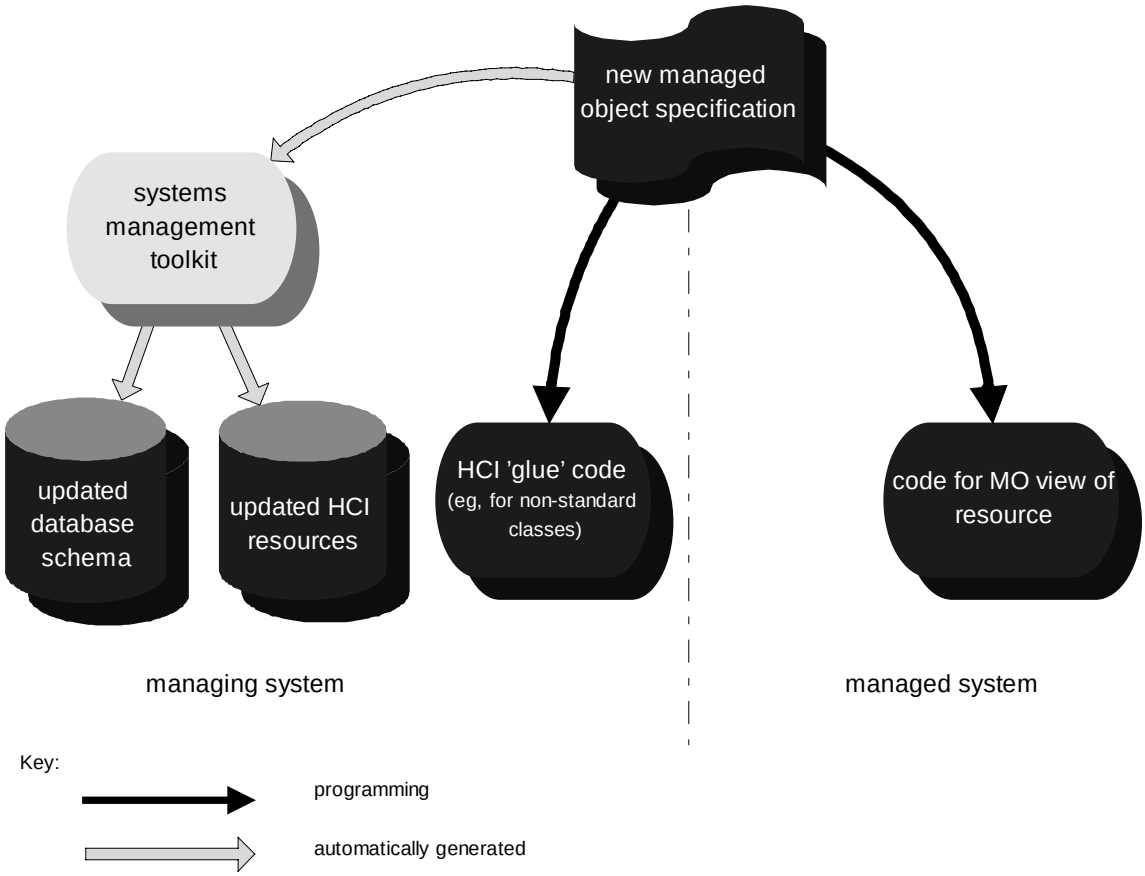
1. Implementing access control

OSI systems management standards do not at present (hence certainly not within the timescale of CNS/ATM-1 Package) support the detailed access control of systems management operations that is necessary for interorganisational systems management.

To implement access controls within the current framework of OSI management standards, the most practical approach is to define and implement a new set of managed objects that provides the view of the organisation's systems management data that is desired to be exported; if the organisation has different types of relationships with other organisations, several different sets of managed objects may be needed to define corresponding interaction types. It may be necessary to define a completely new managed object to export a management capability for a combination of resources that are managed locally through separate managed objects. However, the usual case will be that there is a local managed object (eg, as specified in the ATN Manual A12) that embodies the maximum management capability for each resource, and this specification will have to be specialised to export a subset capability.

2. Implementing managing systems

Current systems management application products take advantage of the concept of an object-structured management information base to allow fairly easy extensibility of the allowed set of manageable resources, using toolkits. The figure below illustrates the process of defining new resources to such systems; in principle, the only programming needed is to define the behaviour of newly defined attribute types (ie, attributes whose behaviour is not directly inherited from standard attribute types).



Defining a new managed object

Programming is needed to implement ATN-specific attributes and classes, and to customise the HCI.

3. Implementing managed systems

The figure above also illustrates the greater complexity of the agent side of the implementation, although some assistance can be had from toolkits here as well. Programming is necessary to map the attributes and behaviours of the MO specification to the real managed resource. In addition, the communications stack has to be provided.

In the context of ATN interorganisational management, the complexity of such an implementation may be limited because view managed objects will be best implemented in one or more managing systems of the managed organisation, rather than in the managed resources themselves; this avoids possible problems (eg, capacity limits, need to modify ROM code) involved in programming the managed resources themselves, but introduces an indirection that may be a point of failure or a cause of delay. Another approach that is particularly appropriate for view MOs is to adapt the new managed object from the local managed object with full management capability in the managed resource; but this may not be feasible, for instance, if the source code is not available.

4. Evolution of distributed systems management

Although there are several current technologies for distributed systems management, they share the concept of an object-oriented information base mediated by simple primitives. This similarity leads to the possibility of interoperation between such technologies.

OMNI*Point* has defined interoperability mechanisms between CMIP, SNMP and object-oriented systems management facilities using CORBA: hence the ability to support CMIP-based systems management would allow for interoperability, if required, not only with other CMIP systems but with the other technical approaches that are likely to be adopted now and in the longer term.