ATNP WG2
WP 298

Aeronautical Telecommunication Network Panel (ATNP)
Working Group 2 (WG2)
Munich, Germany
June 1996

Proposed material for:
Annex 10, Volume 3, Part 1, Chapter 3, Appendix A, Section 5
Internet Standards and Recommended Practices
final WP to ATNP/2

Presented by S.Cosgrove

Sub-Volume 5 will be presented to ATNP/2 in November 1996. Version6.0 of Sub-Volume 5 will be the baseline version that will be included in Annex 10 after final ATNP/2 approval. This WP proposes a summary paper that will be presented on behalf of the entire Sub-Volume 5 at the ATNP/2 meeting in Montreal.

WG2 is asked to review the attached paper and propose any changes that would further describe the concepts of Sub-Volume 5.

References:

Flimsy 10, fifth meeting of ATNP WG3 (Brisbane), Feb. 1996

Flimsy 12, fifth meeting of ATNP WG3 (Banff), October 1995

Report of the fourth meeting of ATNP WG1 (Brisbane), February 1995

ATTACHMENT A **ATNP/2-WP/___**
11/4/96

AERONAUTICAL TELECOMMUNICATION NETWORK PANEL (ATNP)

SECOND MEETING

Montreal, 4-15 November 1996

Overview of Internet Communications Service SARPs Material

(Presented by the ATNP WG 2 Rapporteur)

WORKING PAPER

Summary

At the initial ATNP/1 meeting in 1994, three Working Groups were formed. These working groups were tasked with the development of ATN SARPs and Guidance Material for final review at ATNP/2. WG2 was formed to create the Internet SARPs and Guidance Material for the ATNP. The following is a summary of the proposed material for Sub-Volume 5.

References

1. Report of the first meeting of the Aeronautical Telecommunication Network Panel
2. Proposed ATN SARPs Sub-Volume 5

Table of Contents

1. Introduction

Three working groups were formed by ATNP/1 for the development and validation of the ATN SARPs. These working groups were tasked with the development SARPs and Guidance Material for review and final approval at ATNP/2. The groups are as follows:

- WG1 assumed responsibility for development of SARPs associated with system level requirements as well as other system level planning activities tasked by ATNP/1.
- WG2 undertook the development of SARPs for the Internet Communications Service; and
- WG3 undertook the development of SARPs for the ATN applications and upper layers.

This working paper summarizes the proposed Sub-Volume 5 of the ATN SARPs. This includes a description of the SARPs structure, a functional description of the SARPs and a discussion of the system level requirements fulfilled by the SARPs.

2. Background

The infrastructure required to support the interconnection of automated ATM (Air Traffic Management) systems is referred to as an Internet. Simply stated, an Internet comprises the interconnection of computers with gateways or routers via real subnetworks. This allows the construction of a homogeneous virtual data network in an environment of administrative and technical diversity. The internetworking infrastructure developed by ICAO for the purpose of ATM automation is the ATN.

The design of the ATN communications service provides for the incorporation of different Air/-Ground subnetworks (e.g. SSR Mode S, AMSS, VDL) and different Ground/Ground subnetworks, resulting in a common data transfer service. These two aspects are the basis for interoperability of the ATN and will provide a reliable data transfer service for all users.

The provisions designed in the ATN SARPs are capable of operating in a multinational environment with different data communication service providers. The ATN is capable of supporting Air Traffic Service Communication (ATSC) as well as Aeronautical Industry Service Communication (AINSC). This is accomplished through the interconnection of End Systems (ESs) and Intermediate Systems (ISs) using a variety of subnetwork types.

In general, Sub-Volume 5 describes the design structure of the network and transport layers of the ATN based on the ISO Open Systems Interconnection (OSI) model. This Sub-Volume also includes further description of the domain structure, routing policies and the ATN addressing scheme.

3. Discussion

3.1 Sub-Volume 5 SARPs Overview

Sub-Volume 5 defines the provisions that ATN compliant End Systems (ESs) and Intermediate Systems (ISs) must implement in order to provide the ATN SARPs compliant Internet Communications Service to the "User". This “User” is defined as the Upper Layer Architecture which is thoroughly defined in Sub-Volume 4 of the ATN SARPs produced by the ATNP. The following is a brief description of the chapters included in Sub-Volume 5.

Chapter 5.1
This Chapter contains introductory material to the remainder of the Sub-Volume.

Chapter 5.2
This Chapter contains pertinent definitions of the Internet Routing Architecture and components. It also contains system provisions related to communications protocol support for ATN End Systems and Intermediate Systems, and SARPs related to security and priority handling within the ATN Internet.

Chapter 5.3
This Chapter contains provisions related to the deployment of ATN components within the ATN Internet. It also highlights the use of routing information, the definition of routing policies, and the procedures for initiating the exchange of routing information.

Chapter 5.4
This Chapter contains provisions related to the ATN Internet addressing architecture and responsibilities related to the definition and allocation of ATN Internet address fields.

Chapter 5.5
This Chapter contains the Transport Layer provisions applicable to ATN End Systems. The provisions for the ISO Connection Oriented Transport Protocol (Class 4) and the Connectionless Transport Protocol are also defined.

Chapter 5.6
This Chapter contains the Inter-Network Layer provisions, based on the ISO Connectionless Network Protocol (CLNP), applicable to ATN End Systems and ATN Intermediate Systems.

Chapter 5.7
This Chapter contains provisions related to the use of the various candidate Ground/Ground and Air/Ground subnetworks of the ATN. The provisions ensure successful inter-operation of ATN Intermediate Systems and the subnetworks to which they are attached. Compression techniques are also defined to enable the efficient use of the limited bandwidth available over such Air/Ground subnetworks.

Chapter 5.8
This Chapter contains provisions related to the exchange of routing information between ATN Intermediate Systems using the Inter Domain Routing Information Exchange Protocol (IDRP) and specific features of the ES-IS protocol.

Chapter 5.9
This Chapter contains a recommendation regarding the implementation of Internet Systems Management. The technical details regarding this implementation issue is to be determined.

3.2 Functional Description

The functional description will outline the capabilities and relationships of the ATN components as defined in Sub-Volume 5:

3.2.1 General

The basic structure of the ATN is comprised of a collection of various components. The description of these components illustrate the overall functionality provided by Sub-Volume 5. These points are as follows:

- The main infrastructure components of the ATN are the subnetworks, the ATN Routers (Intermediate Systems) and the End Systems;
- A subnetwork is not an ATN element in the strict sense but is defined as an independent communication network based on a particular communication technology (e.g., X.25 Packet Switch Network) which is used as the physical means of transferring information between ATN systems. A variety of ground-ground as well as air-ground subnetworks provide the possibility of multiple data paths (each application may require different path attributes) between end systems;
- The ATN Routers are responsible for connecting various types of subnetworks together and to route messages (i.e. data packets) across these subnetworks based on the requested class of service and on the current availability of the network infrastructure (e.g. suitable routes to the destination system);
- ATN End Systems host the application services as well as the upper layer protocol stack and communicate with peer end systems.

3.2.2 End Systems

An ATN End System is a realisation of the OSI End System architectural entity. The End System supports one or more ATN Applications and their communication over the ATN by providing either the connection mode transport service, or the connectionless mode transport service, or both.

3.2.3 ATN Routers

The Routers are Intermediate Systems comprising the lower 3 layers of the OSI reference model and include, according to their type, the appropriate set of routing protocols. The Routers are responsible for forwarding each packet containing the user data via the appropriate paths towards its destination, taking into account the particular service requirements encapsulated in the header of the packet. The choice of the appropriate subnetwork to be used, when forwarding data packets through the ATN, is based on connectivity, security and quality of service considerations and can be influenced by the application services. Furthermore ATN Routers exchange routing information (i.e. information about available routes, their characteristics, and the End Systems reachable via these routes) with other adjacent Routers.
The ATN distinguishes different types of Routers with increasing number of protocols supported:

a) static or dynamic intra-domain Routers (IS, Intermediate System);

b) inter-domain Routers (BIS, Boundary Intermediate System).

Routers of group a) above are for use only within an ATN Routing Domain and are a local matter, whereas those of group b) are required to provide ATN-compliant, standardised communication service to adjacent routing domains and other Routers of the same type (i.e. BISs) within their own routing domain. If a group b) Router encompasses in addition the functionality of an intra-domain Router (i.e. group a) Router), then this portion of its functionality is a local matter

Clearly, as an aircraft moves, the path through the network which must be taken to reach that aircraft will change. The ATN supports a dynamic routing process which allows the route information possessed by each Router to be updated, both as a result of the movement of the aircraft and as a result of other changes in the network topology due to failures, maintenance activities etc.

3.2.4 Subnetworks

Subnetworks may be distinguished as either Ground/Ground (fixed), Air/Ground (mobile) or Airborne subnetworks. They can be separated into LANs (Local Area Networks) and WANs (Wide Area Networks), whereby typically LANs are used to interconnect ESs and (B)ISs, e.g. within an ATC centre or within an aircraft. It should be recognised that a subnetwork does not possess any ATN specific functionality. i.e., the subnetwork simply carries data units from one point to another without any regard given to the contents of those messages. The ATN router adapts the data packets to the specifics of the subnetwork for transfer between adjacent ATN systems. This concept of subnetwork dependent convergence of packets and protocol functions is essential to the versatility of the ATN.

Existing fixed and mobile data networks may be used as subnetworks within the ATN, thereby having the potential to significantly reduce the initial set-up cost of the ATN infrastructure, provided they meet certain minimum criteria like byte and code independence. In any case, the use of a certain subnetwork on one path does not impose a restriction to using a different subnetwork on another path.

The provisions for the use of protocols, are specified in a tabular fashion in the Sub-Volume under the title of ATN Protocol Requirements Lists (APRLs). The method used to read the APRLS is explained in Sub-Volume 1 of the ATN SARPs.

3.3 Specific Components of Sub-Volume 5

This Sub-Volume of the SARPs addresses the technical and policy issues regarding the designated ATN Routing Domain (RD). RDs are further divided into fixed and mobile with

3.3.1 Network Layer

ATN End Systems shall implement:

a) The End System provisions of ISO/IEC 8473 as the Subnetwork Independent Convergence Function (SNICF).
b) a Subnetwork Access Protocol (SNAcP) suitable for each underlying subnetwork.
c) a Subnetwork Dependent Convergence Facility (SNDCF) providing byte and code independent service to the SNICF (i.e. ISO/IEC 8473) via the appropriate Subnetwork Access Protocol.

3.3.2 Transport Layer

Depending on the requirements of the application and its supporting upper-layer protocols, ATN End Systems shall implement either one or both of the following:

a) ISO/IEC 8073 as specified in Sub-Volume 5.
b) ISO/IEC 8602 as specified in Sub-Volume 5.

3.3.3 Quality of Service

3.3.4 Priority

3.4 System Level Requirements Satisfied by Sub-Volume 5

The following are the Requirements designated in Sub-Volume 1 from the ANC operational panels that Sub-Volume 5 specifically contributes to satisfying the specific requirement:

1. The ATN shall use the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) standards.
2. ATN shall provide a means to facilitate migration from initial implementations to future versions.

3. ATN shall enable data communications to be carried only over authorized paths for the type of traffic specified by the user.
4. ATN shall provide a means to unambiguously address all ATN End and Intermediate systems.
5. ATN addressing plan shall permit States and organisations to assign addresses within their own administrative domains.
6. ATN shall enable exchange of application address information.
7. ATN shall employ policy based routing.
8. ATN shall employ ATSC traffic classes in accordance with specified criteria.
9. ATN shall enable communication priorities.
10. ATN shall support fixed and mobile systems.
11. ATN shall enable an aircraft Intermediate System to be connected to a ground Intermediate System via concurrent mobile subnetworks.
12. ATN shall accommodate ICAO standardized mobile subnetworks.
13. ATN shall enable an aircraft Intermediate System to be connected to multiple ground Intermediate Systems.
14. ATN shall enable the transition of existing AFTN users and systems into the ATN architecture.

4. Recommendations

It is recommended that the ATN Panel accept the proposed Sub-Volume 5 material for inclusion in the ATN SARPs.