International Civil Aviation Organization

THE SECOND MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IMPLMETATATION CO-ORDINATION GROUP OF APANPIRG

Hong Kong, China, 28 May – 1 June 2007

Agenda Item 6: **Review State's ATN Implementation/Operational activities and issues**

DESCRIPTION OF FAA AMHS PROTOCOL IMPLEMENTATION ARCHITECTURE AND BASIC OPERATION

(Presented by USA)

SUMMARY

This information paper describes the FAA' AMHS Protocol Implementation Architecture and describes its basic operation. It relates to ATNICG Strategic Objective: Efficiency Task (1) ATN Implementation Coordination.

1. FAA Operating Environment

1.1 The FAA's AFTN switch is being upgraded to include an AFTN/AMHS Gateway. The upgrade involves adding a Message Transfer and Control Unit (MTCU) and an ATN component to the AFTN switching component. See Figure 1.

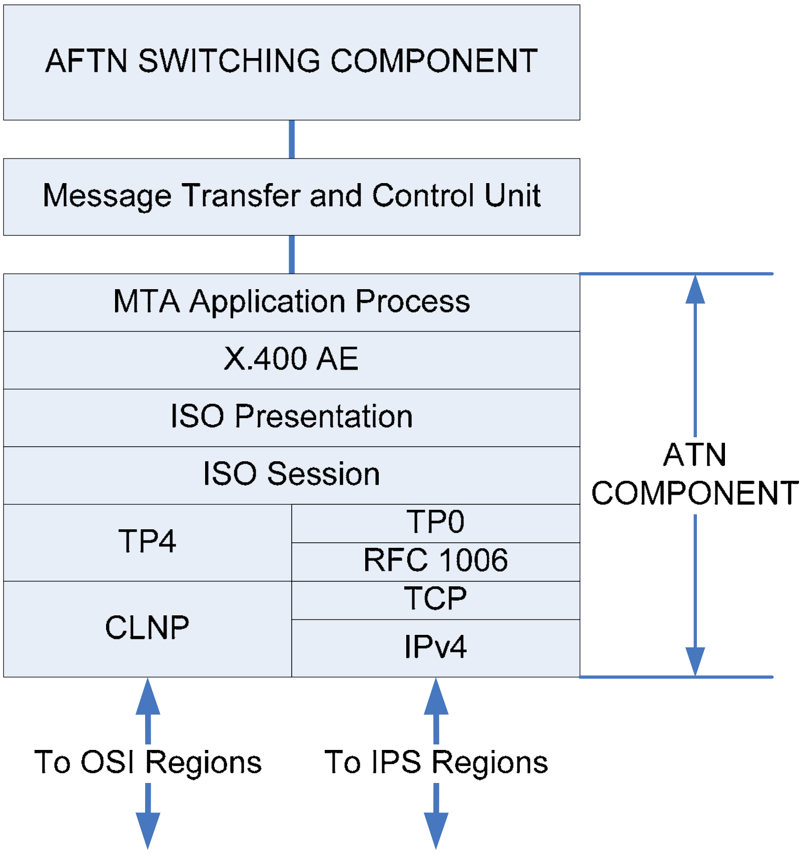

Figure 1 – FAA AMHS Protocol Stacks

1.2 The Message Transfer and Control (MTCU) Unit is an Access Unit providing a bi-directional conversion facility between the AFTN switching component and the Message Transfer Agent in the ATN component.

1.3 The ATN component consists of a Message Transfer Agent (MTA) and the AMHS OSI Upper Layers over either the standard OSI protocol suite or over the TCP/IP protocol suite. This dual stack implementation is necessary because the FAA's AMHS system interfaces to the Asia/ Pacific region using the standard ATN OSI protocol stack and interfaces to the CAR/SAM region using ATN over TCP/IP.

1.4 The standard OSI protocol stack uses the ISO Class 4 Transport service (TP4) over the Connectionless Network Protocol (CLNP). The ISO TP4 standard defines Transport Protocol Data Units (TPDUs) to establish connections, transfer data, and release connections with remote peer entities.

1.5 When running over the TCP/IP protocol suite, RFC-1006, "ISO Transport Service on top of the TCP", is used. RFC-1006 specifies how to use TP0 over TCP. As noted in RFC 1006, "a fundamental difference between the TCP and the network service expected by TP0 is that the TCP manages a continuous stream of octets, with no explicit boundaries." The TP0 expects information to be sent and delivered in discrete units. RFC-1006 uses a simple packetization scheme in order to delimit TPDUs so that the expected network service can be emulated. RFC-1006 defines a unit of transmission called a TPKT which consists of a header and a TPDU. The header contains a version number and the length of the packet. Note that TP0 is the Simple Class transport which does not provide error detection and recovery as is the case with TP4. However these functions are provided by TCP; thus, TP0 together with TCP provide the equivalent functionality of TP4 with the same service interface presented to the session layer.

2. FAA's AMHS Implementation Architecture

2.1 Figure 2 depictes the FAA's AMHS Protocol Architecture. As is shown in Figure 2, an AFTN/AMHS gateway with a TCP/IP protocol stack has been added to the FAA's current AFTN switching system.

2.2 The FAA's ATN router has been upgraded to contain an "RFC-1006 Gateway". The RFC-1006 gateway uses the TCP/IP function provided by the Router Operating System and adds both a TP4 and TP0 transport, an RFC-1006 adaptation layer (which adds or deletes TPKT packet headers) and a TP4-TP0 Interworking function which translates TP0 TPDUs to TP4 TPDUs and vice versa. The TP4-TP0 Interworking function manages connections in each direction and performs address mapping using pre-configured addresses.

2.3 The pre-configured addresses are an ATN TSAP address (i.e., a 20-byte NSAP address and a T-Selector value of 1 to 4 bytes), a local IPv4 address, and a local port number (2001). Note that because the RFC-1006 gateway and the ATN router reside on the same platform, the NSAP used for the gateway and the router NET address are the same except for the selector value. The AFTN/AMHS has a distinct IPv4 address and uses the well-known port 102 as specified in RFC-1006.

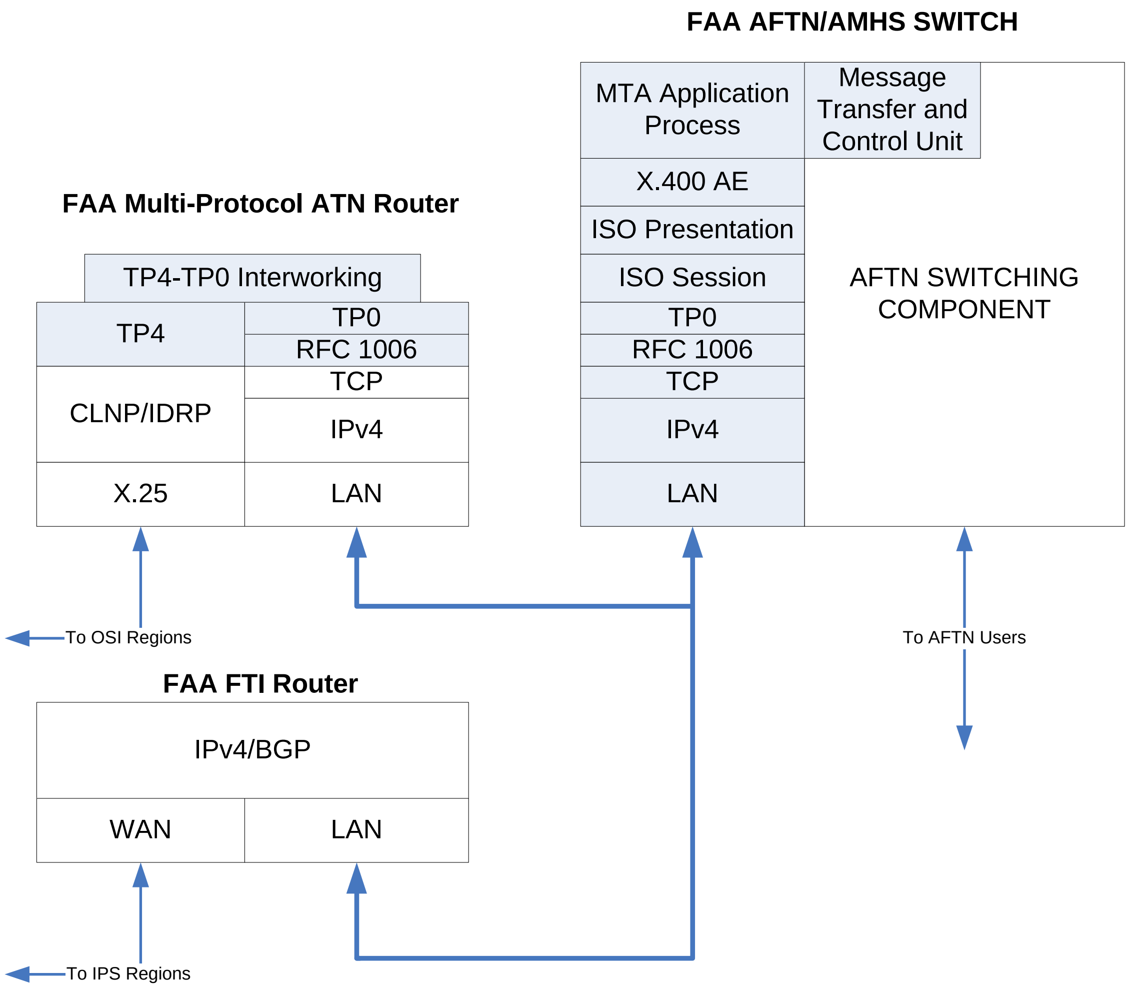

Figure 1 – FAA AMHS Protocol Architecture

3. FAA's AMHS Basic Operation

3.1 Locally Initiated Transfers

3.1.1 When the local AMHS has data to deliver to the remote AMHS system it must first establish a TCP connection with the RFC-1006 Gateway Function. This is accomplished by performing the normal TCP connection establishment process to port "**2001**" of the FAA Multi-Protocol ATN Router. Once a connection is established, a TP0 Connect message (with a TPKT header and CR TPDU) is generated and delivered to the Gateway Function over the TCP connection.

3.1.2 Upon receipt of the TP0 connect message, the RFC-1006 Gateway Function validates that the destination AMHS system is a valid peer (i.e. there is a pre-configured address) and that a connection does not already exist to the remote AMHS system.

3.1.3 If validation is successful, then the RFC-1006 Gateway Function translates the TP0 connect request into a TP4 connect request and sends the message using the standard ATN Protocol stack. If validation fails, then the gateway sends a TP0 disconnect message back to the local AMHS over the associated TCP connection.

3.1.4 When the remote AMHS receives the TP4 connect request it can either accept or reject the connection. If the connection is accepted, a TP4 connect confirm message is returned to the RFC-1006 Gateway Function. The RFC-1006 Gateway Function generates a TP0 connect confirm message and sends it to the local AMHS over the associated TCP connection. This successfully completes the connection establishment process.

3.1.5 Once established, the local AMHS can transfer Data Messages by generating a TP0 data request message and sending it to the RFC-1006 Gateway Function. The RFC-1006 Gateway Function translates the TP0 data request into a TP4 data request and sends the message to the remote AMHS.

3.1.6 If the connection is rejected by the remote AMHS, then a TP4 disconnect indication is received by the RFC-1006 Gateway Function. Receipt of this message causes a TP0 disconnect message to be sent back to the local AMHS over the associated TCP connection.

3.1.7 When the local AMHS determines that the data transfer process is complete it issues a TP0 disconnect to the RFC-1006 Gateway Function. This message is translated into a TP4 disconnect message and sent to the remote AMHS.

3.2 Remote Initiated Transfers

3.2.1 When a remote AMHS has data to deliver to the local AMHS system it must first establish a TP4 connection. This is accomplished by generating a TP4 connect request message and sending it to the TSAP of the RFC-1006 Gateway Function. Note that from the remote systems perspective the TSAP is the address of the local AMHS system.

3.2.2 Upon receipt of the TP4 connect request message, the RFC-1006 Gateway Function validates that the remote AMHS system is a valid peer (i.e. there is a pre-configured address) and that a connection does not already exist with this remote AMHS system.

3.2.3 If validation is successful, then the RFC-1006 Gateway Function translates the TP4 connect request into a TP0 connect request. If a TCP connection is not active then the RFC-1006 Gateway Function creates a TCP connection to the local AMHS and forwards the TP0 connect request to the local AMHS.

3.2.4 The local AMHS can either accept of reject the connection. If the connection is accepted then the local AMHS sends a TP0 connect confirm to the RFC-1006 Gateway Function over the associated TCP connection. The RFC-1006 Gateway Function translates the TP0 connect confirm into a TP4 connect confirm and sends the message back to the remote AMHS.

3.2.5 The remote AMHS can then transfer the AMHS message data by generating a TP4 data request. When the RFC-1006 Gateway receives a TP4 data request it generates a TP0 data request and sends it to the local AMHS system using the associated TCP connection.

3.2.6 If the connection is rejected then the local AMHS sends a TP0 disconnect message to the RFC-1006 Gateway Function over the associated TCP connection. The RFC-1006 Gateway Function translates the TP0 disconnect message into a TP4 disconnect request message that is sent to the remote AMHS system.

3.2.6 When the remote AMHS determines that the data transfer process is complete it issues a TP4 disconnect message to the RFC-1006 Gateway Function. This message is translated into a TP0 disconnect message and sent to the local AMHS.

4. Considerations with the FAA's AMHS Implementation and Operation

4.1 In general the FAA's implementation architecture should be transparent to a remote MTA. That is, the remote MTA is not aware of the use of the RFC 1006 Gateway; but, rather operates as if the Protocol Stack were actually the AMHS Upper Layers over TP4/CLNP.

As was noted above, one consequence of the architecture is that the ATN Router and End System address are the same except for the selector.

A second consequence of the architecture and method of operation is that the FAA AMHS will operate a single TP4 connection in each direction. If a new TP4 connection request is received while there is an active TP4 connection with the same peer, it will be rejected until the active connection times out or is otherwise disconnected.

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