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- Agenda Item 3: Assessment of development of regional air navigation and security infrastructure**
3.6 Report of the ATM/CNS/SG/5 Meeting

DRAFT CAR/SAM IP IMPLEMENTATION APPROACH

(Presented by the CNS ATN Task Force Coordinator)

SUMMARY

This Information paper proposes an approach to implementation of an Internet Protocol (IP) network in the Caribbean and South American regions. The proposed approach is to initially implement IP version 4 (IPv4) within the regions and IP version 6 (IPv6) for inter-regional connectivity. A transition phase is proposed using a dual stack transition mechanism where both IPv4 and IPv6 are implemented in routers and Hosts (i.e., AMHS systems). This will lead to an eventual all IPv6 network.

1. Introduction

1.1 The CAR/SAM ATN Task Force, which met in November 2006, presented an AMHS Implementation Plan to the CNS/ATM SG. The AMHS Implementation Plan proposed using the Internet Protocol Version 6 (IPv6) as the network protocol. Further analysis, however, indicates that the AMHS applications do not yet support IPv6 internally in their communication stacks. Since many Member States have either procured or implemented the AMHS, the ATN Task Force recommends initial use of the Internet Protocol Version 4 (IPv4) to expedite the implementation of AMHS service in the region.

1.2 IPv4 is recommended during the initial period within the CAR/SAM region and IPv6 is recommended for inter-regional connectivity. A transition phase is proposed using a dual stack transition mechanism where both IPv4 and IPv6 are implemented in all of the Routers and incrementally in Hosts (i.e., AMHS systems). This will lead to an eventual all-IPv6 network where all Routers and Hosts are only IPv6 based and IPv4 is disabled.

2. Considerations

- The Technical Manual for the IPS will not be finalized by the Aeronautical Communication Panel (ACP) before 2008
- The associated Guidance Material has not been developed by the ACP
- Initial implementations in the ICAO European Region are using AMHS over IPv4 in separate sub-regions. Two of these sub-regions are interconnected via

IPv6 using a network address and protocol translation technique whereby IPv4 messages are converted to IPv6 across the interface and then back to IPv4.

- The aeronautical communication industry (i.e., AMHS system providers) has not fully developed the MTA to support IPv6
- Many CAR/SAM Member States have either already implemented the AMHS or need to replace the AFTN service in the near future

3. Discussion

3.1 *Protocol Stacks for Current AMHS Applications –*

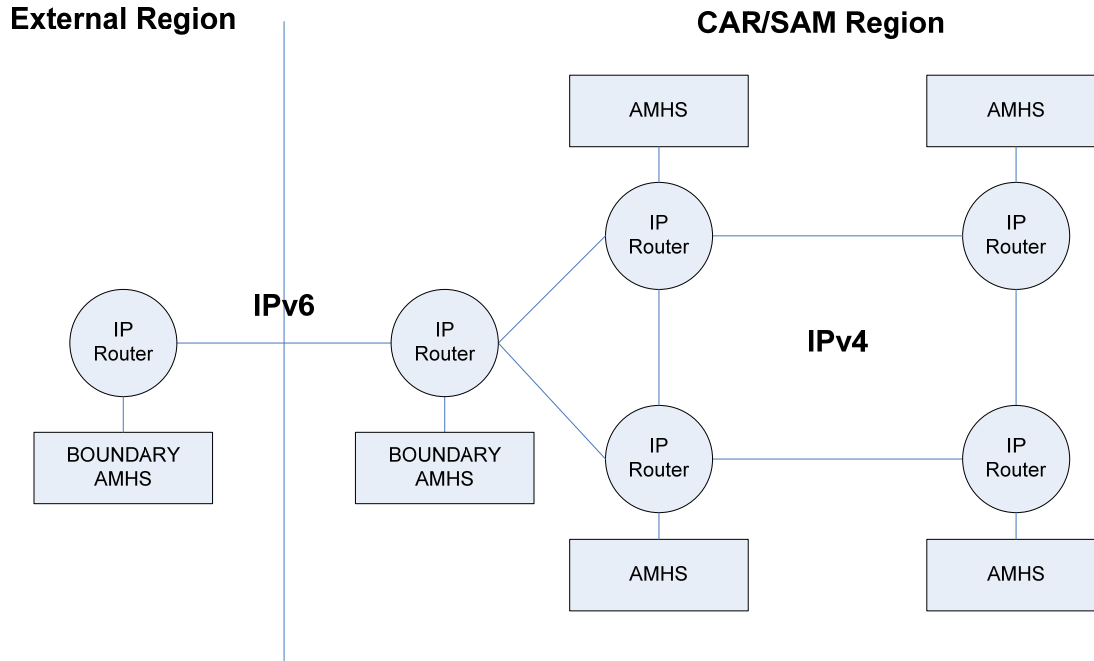
3.1.1 Figure 3.1 shows the protocol stacks that are supported in current AMHS applications. These applications support a full OSI stack with the OSI upper layers (application, session, and presentation) over the OSI Class 4 Transport Protocol (TP4), which in turn runs over the OSI Connectionless Network Layer Protocol (CLNP). The current applications will also run over the Transport Control Protocol (TCP) and IPv4. In this case a method is needed to converge the upper layers over TCP. This is accomplished using RFC 1006. RFC 1006 defines a method for adapting an OSI transport protocol (i.e., the Class 0 Transport Protocol (TP0)) to run over TCP in an IPv4 environment.

AMHS APPLICATION (Message Transfer Agent)	
Presentation Layer	
Session Layer	
TP4	TP0
	RFC 1006
	TCP
CLNP	IPv4

Figure 3.1 Protocol Stacks for Current AMHS Applications

3.2 *Initial Implementation of IP*

3.2.1 Figure 3.2 depicts the proposed initial implementation of IP for CAR/SAM.



*Figure 3.2 Initial Phase
IPv4 Intra-Regional and IPv6 to External ICAO Regions*

3.2.2 For the initial phase AMHS applications will use the currently available IPv4 protocol stack described in section 3.1. Routers within the region will operate IPv4. For interfacing to external regions IPv6 is proposed. This may be accomplished using Network Address Translation – Protocol Translation (NAT-PT) specified in RFC 2766.

3.2.3 Figure 3.2 depicts a “Boundary AMHS” system. This AMHS system provides gateway MTA access to external regions. It is anticipated that other AMHS systems in the region will not connect directly to AMHS systems in other regions, but rather will forward message traffic to the Boundary AMHS, which in turn will forward message traffic to a corresponding Boundary AMHS in the external region.

3.3 *Transition to IPv6 within CAR/SAM*

3.3.1 Figure 3.3 depicts the transition phase implementation of IP for CAR/SAM.

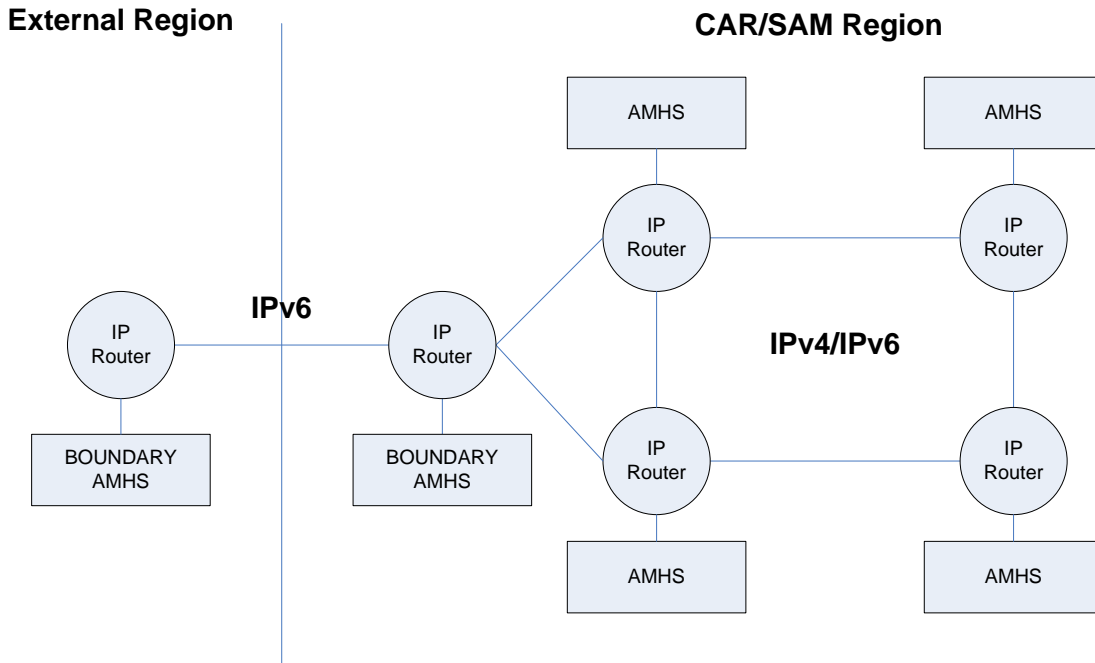


Figure 3.3 Transition Phase
IPv4 and IPv6 Intra-Regional, and IPv6 to External ICAO Regions

3.3.2 In this phase it is proposed that AMHS applications support dual stack operation with both IPv4 and IPv6 as depicted in Figure 3.4. Note that RFC 2126 is now invoked since it defines a method for adapting an OSI transport protocol to run over TCP in an IPv6 environment.

AMHS APPLICATION (Message Transfer Agent)	
Presentation Layer	
Session Layer	
TP0	TP0
RFC 1006	RFC 2126
TCP	TCP
IPv4	IPv6

Figure 3.4 Protocol Stacks for Transition-Phase AMHS Applications

3.3.3 Routers within the region will operate both IPv4 and IPv6, thereby providing “dual IP layer operation” described in RFC 4213, Basic IPv6 Transition Mechanisms. AMHS systems within the region will be incrementally updated to support dual IP layer operation.

3.3.4 For interfacing to external regions it is expected that message traffic will continue to pass through the Boundary AMHS system and IPv6 communication is maintained at the network layer. However, once the Boundary AMHS is updated to dual stack, NAT-PT may be removed and IPv6 used without translation.

3.4 End State full IPv6 within CAR/SAM

3.4.1 Figure 3.5 depicts the end-state implementation of IP for CAR/SAM. Once all of the AMHS systems have been upgraded, IPv4 operation may be disabled leaving just IPv6 operation in the region.

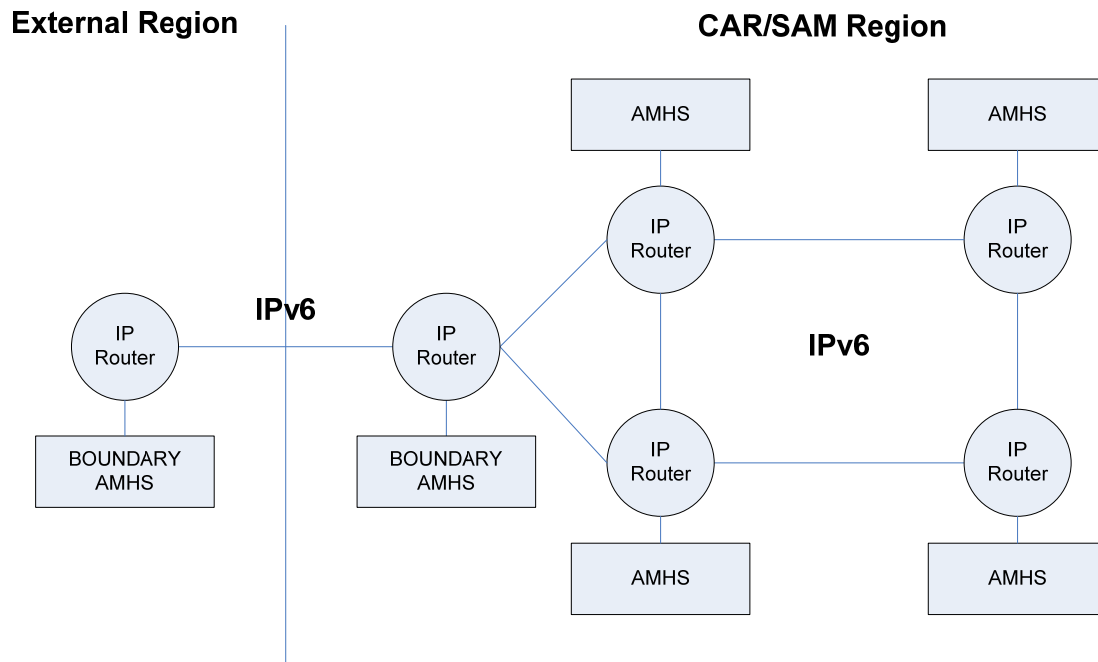


Figure 3.5 End State
IPv6 for Intra-region and Inter-region

4. Conclusion

4.1 This paper has outlined an IPv6 transition strategy for the Caribbean and South American regions. The goal is for the regions to fully implement IPv6 in accordance with the ICAO ACP specification once it is adopted. The implementation will be for both intra-regional and inter-regional communication when the IPv6-based applications become available. CAR/SAM States are invited to review this approach and plan their individual implementation accordingly.