*International Civil Aviation Organization*
CAR/SAM Regional Planning Implementation Group (GREPECAS)
**CNS/ATM Subgroup**
**Coordination meeting of the ATN ground-ground and ground-air applications project**
(Lima, Peru, 19 to 20 May 2010)

**Agenda Item 1**: **Review of the ATN CAR/SAM planning / implementation activities**

**c) IP CAR/SAM Regional Plan**

# IPv6 Addressing Plan

(Presented by the United States of America)

This paper proposes an IPv6 addressing plan for the CAR/SAM Aeronautical Telecommunication Network (ATN). The plan is consistent with the addressing strategy specified in ICAO Doc 9896 and uses the identifiers already assigned in the CAR/SAM IPv4 Addressing Plan

## 1 Introduction

### 1.1 Background

1.1.1 1.1.1 The CAR/SAM CNS ATN Task Force has already developed an Internet Protocol version 4 (IPv4) addressing plan for implementing ATN applications throughout the region. This specification proposes a Internet Protocol version 6 (IPv6) addressing plan for the region that is an extension to the IPv4 plan.

### 1.2 Objective

1.2.1 In support of the strategy to use IPv6 for Inter-Regional connectivity and the possible long term transition to IPv6 within the region, this document proposes an address format for IPv6 addresses.

### 1.3 Scope

1.3.1 This document is limited to describing IPv6 addresses to be used initially for connectivity with other regions and eventually within the region.

### 1.4 References

| | | |
|---|---|---|
| [1] | ATM/CNS/SG/6 | CAR/SAM IPv4 Addressing Plan |
| [2] | COMT33_WP09 | EUROCONTROL IPV6 Address Management |
| [3] | ICAO Doc 9896 | Manual for the ATN using IPS Standards and Protocols |

| | | |
|---|---|---|
| [4] | IEEE EIU-64 | IEEE Guidelines for 64-bit Global Identifier (EIU-64) Registration Authority |
| [5] | RFC 791 | Internet Protocol |
| [6] | RFC 1918 | Address Allocation for Private Internets |
| [7] | RFC 3177 | IAB/IESG Recommendations on IPv6 Address Allocations to Sites |
| [8] | RFC 3513 | Internet Protocol Version 6 (IPv6) Addressing Architecture |
| [9] | RFC 3879 | Deprecating Site Local Addresses |
| [10] | www.lacnic.net/en/registro | Latin American and Caribbean Internet Address Registry |

## 2 IP Addressing Background

### 2.1 IPv4 Addresses

2.1.1 In the Internet Protocol (IP) [5] a distinction is made between names, addresses, and routes. A name indicates what we seek. An address indicates where it is. A route indicates how to get there. It is the task of higher level protocols to make the mapping from names to IPv4 addresses, for example using a domain name service (DNS). IP deals primarily with addresses in that its main task is to forward packets of data to a particular destination address. IPv4 Addresses are a fixed length of four octets (32 bits). An address begins with a Network ID, followed by a Host ID as depicted in Figure 2-1.

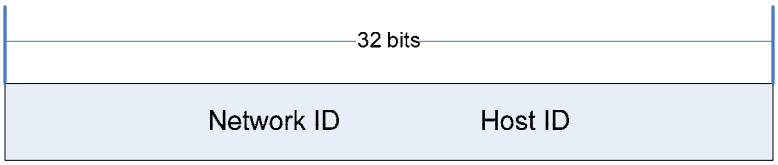


**Figure 2-1. IPv4 Address Format**

2.1.2 The original IP addressing scheme divided the Network ID from the Host ID along octet boundaries. In this scheme the main classes of addresses were differentiated based on how many octets were used for the Network ID. This method is called classful addressing. Classful addressing was subsequently modified to so that the Host ID could be split into Subnet ID and (sub-)Host ID. This was accomplished using a subnet mask which defined the Subnet ID and Host ID boundary and the method is called classful addressing with subnetting. This approach eventually evolved into classless addressing where the division between the Network ID and Host ID can occur at an arbitrary point, not just on octet boundaries. With classless addressing the dividing point is indicated by a slash (/) followed the number of bits used for the Network ID. This value is called the prefix length of the address and the address value up to that point is called the network prefix.

2.1.3 A network may be set up with IP addresses to form a private or public network. On a private network a single organization controls address assignment for all nodes. On a public network there must be some conventions to assure that organizations do not use overlapping addresses. In the Internet this function is performed by the Internet Assigned Numbers Authority (IANA) which delegates authority to Regional Internet Registries (RIR). For the CAR/SAM region the RIR is the Latin American and Caribbean Internet Address Registry (LACNIC) [10].

2.1.4 Private Addressing is defined in RFC 1918 [6]. IANA has reserved the following three blocks of the IP address space for private internets:

10.0.0.0 - 10.255.255.255 (10/8 prefix)
172.16.0.0 - 172.31.255.255 (172.16/12 prefix)
192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

2.1.5 Because of the number of bits available to users, these blocks are referred to as a "24-bit block", a "20-bit block", and a "16-bit" block. An enterprise that decides to use IP addresses within the private address space defined by RFC 1918 can do so without any coordination with IANA or an Internet registry. Addresses in this private address space will only be unique within an enterprise or a group of enterprises (e.g., an ICAO region) which choose to cooperate over this space so they may communicate with each other in their own private internet.

## 2.2 IPv6 Addresses

2.2.1 IP Version 6 (IPv6) unicast addresses as defined in RFC 3513 [8] are 128-bit addresses consisting of a Global Routing Prefix followed by a Subnet ID followed by an Interface ID.

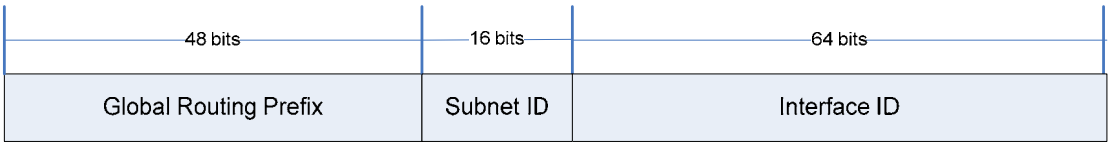


**Figure 2-2. IPv6 Global Unicast Address Format**

2.2.2 The Global Routing Prefix is a typically hierarchically-structured value assigned to a site (a cluster of subnets/links). The Subnet ID is an identifier of a link within the site, and the Interface ID is typically equivalent to an IPv4 MAC address that is 64-bits long in IEEE EUI-64 format [5]. RFC 3177 [7] recommends that a /48 be assigned to individual sites, which leaves 16-bits for the Subnet ID.

# 3 CAR/SAM Addressing

## 3.1 CAR/SAM IPv4 Addressing

3.1.1 Because of the limited availability of public IPv4 addresses, the CAR/SAM Region is using a 24-bit block IPv4 private address space [1].

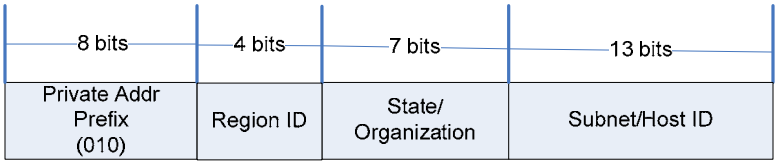


**Figure 3-1. CAR/SAM IPv4 Address Format**

3.1.2 The CAR/SAM IPv4 address format is depicted in Figure 3-1. The first byte of the address contains the fixed decimal value 10. The next 4 bits of the address are used to identify the ICAO Office for region.

0000 SAM: South American Office.
0001 NACC: North American, American Power station and Caribbean Office.
0010 APAC: Asia and Pacific Office.
0011 MID: Middle East Office.
0100 WACAF: Western and Central African Office.
0101 ESAF: Eastern and Southern African Office.
0110 EUR/NAT: European and North Atlantic Office.

3.1.3 The next 7 bits indicate the State or Organization within the region. Refer to the CAR/SAM IPv4 addressing plan [1] for assigned values of this field.

3.1.4 The final 13 bits of the address are partitioned by local policy depending on the number of subnets and individual hosts in the State or Organization.

## 3.2 CAR/SAM Proposed IPv6 Addressing

3.2.1 The proposed CAR/SAM IPv6 address format is depicted in Figure 4-1.

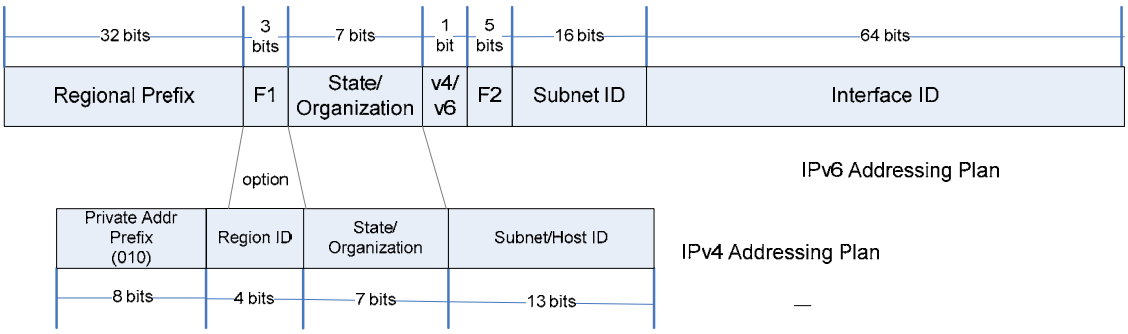


**Figure 4-1. CAR/SAM IPv6 Address Format**

3.2.2 This address format is intended to follow ICAO requirements for IPv6 addressing as specified in Doc 9896 [3] and build on the CAR/SAM IPv4 addressing plan [1]. In addition, the proposed CAR/SAM IPv6 address format follows the IPv6 addressing scheme for EUROCONTROL [2].

3.2.3 The first 32 bits of the address shall designate the Regional Prefix for the CAR/SAM region. ICAO Doc 9896 [3] specifies that Administrative Domains obtain a /32 prefix allocation from their Regional Internet Registry (RIR). Accordingly the CAR/SAM regional office may obtain its own /32 address block for the region from the Latin American and Caribbean Internet Address Registry (LACNIC) [12].

3.2.4 The next three bits (F1) of the prefix can be optionally used in two ways:

a) If Regions obtain their own Regional Prefix from an RIR, these bits can be reserved for future use following [2].

b) If Regions combine and share a Regional Prefix, the F1 field could be used for partitioning the address space on a sub-regional basis, for example, using the Region ID assignments following [1] as defined in section 3. Note that only 3 bits are required to designate all regions.

3.2.5 The next 7 bits of the prefix shall be used for identification of the State or Organization within an ICAO region. The CAR/SAM State/Organization Identifiers are as specified in the CAR/SAM IPv4 Addressing Plan [1].

3.2.6 The next bit of the prefix indicates whether IPv4/IPv6 address translation is required at a network border following [2].

3.2.7 The next five bits (F2) of the prefix are also reserved for future use following [2].

3.2.8 The last two bytes of the prefix shall designate the Subnet ID in accordance with RFC 3177 [7].

3.2.9 The lower 64 bits of the address shall be used as the Interface ID which is the MAC address in IEEE EUI-64 format [4].

## 4 Suggested Actions

4.1 The Meeting is invited to:

a) Take note of the information presented in this paper.

b) Review whether shared or individual Regional Prefixes are to be used, and

c) Provide comment or input.

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