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Centralized Address Space Management(CASM) Problems and Use cases
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Abstract

The organisations use IP Address Space Management (IPAM) tools to manage their IP address space, often with proprietary database and interfaces. This document describes evolution of IPAM into a standardized interfaces for centralized management of IP addresses.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on August 2, 2017.

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1. Introduction

The address space management is an intergral part of any network management solution. The network may be based on legacy design or a more modern private and public cloud, the network may be big or small but every network operator need to manage the addressing needs of network elements. Typically, network operators write proprietary scripts or use cheat sheets to manage the addressing requirements. In recent trends, open source communities have developed tools to manage available IP addreess space.

The open source or proprietray tools and scripts are collectively known as Internet Protocol Address Management (IPAM) system. The organizations use IPAM system to manage their IP address space, often with proprietary database and interfaces. One of the biggest challenges with IPAM systems, is lack of standardized interface for allocation, storing and retrieving information.

This document describes a diverse set of use cases for a IPAM system and the probelms identfied with current IPAM approach. The problems identifed here should become the basis for a new vision defined as Centralized Address Space Management (CSAM).

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Terminology

CASM: Centralized Address Space Management

IPAM: IP Address Management

4. Address Space Management Use cases

The address space management is an intergral part of any network management solution. Every device in the network be it a physical or virtual, needs an IP address for communication with other devices in the network. There is an absolute requirement that a network operator must find a way to assign address to these devices.

The address management could be as simple as having one address pool from where addresses are allocated or may a much more complex scheme based on various requirements and nature of the network. This section is going to identfiy few top uses cases of address management.

4.1. DHCP server pool

One of the most common method to assign an IP address to a device or function is DHCP. A device may request one or more IP addresses. The DHCP server on network handles all the DHCP requests and assign IP addresses. These addresses are allocated from a pre-defined address pool.

A DHCP server might need multiple address pools if it manages DHCP request on multiple network segments. An address management system may be used to initialize these address pools on DHCP servers or could also be configured statically. But the static assigment is prone to misconfiguration and if the DHCP server is ever replaced, the new server must be configured with the same old pool.

4.2. Static address configuration

Some devices or functions do not rely on DHCP protocols to obtain an IP address. This could be due to lack of DHCP client functionality or lack of DHCP server avaialable in the network segement for whatever reason. In such situations, an IP address may be configured statically but static IP address assignment is prone to errors as

mentioned earlier. The better way is to use an address management system for configuring devices without DHCP support.

4.3. Public IP address pool

The public IPv4 addresses are very precious resources and should be used very carefully. A given organization may have a small number of these addresses, so it must find a way to allocate and free these resources effectively. The manual configuration mechanism may not be the best way to manage this resource.

4.4. Multicast IP address pool

The multicast addresses are used for distributing broadcast contents. The multicast content distributor must be assigned an address and the content consumer must somehow figure out that address. This is usually configured manually or throgh proprietary mechanisms.

4.5. SDN controllers

In order to build private or public clouds, address management of virtual machines, virtual functions and overlay networks is a very important task. In addition, the network operator also need to manage addressing of undelay network elements. The SDN controllers and underlay management systems must coordinate addressing schemes to ensure smooth operation. There is need for one address management system that would meet the requirements of such a network deployment.

In order to create overlay networks and virtual workloads, the SDN controller also manage MAC addresses to assign to virtual network interfaces. But this is typically not handled by IPAM systems.

5. Legacy address space management (IPAM) systems

As mentioned earlier, address management is a central component of every network management system. Organizations small or large deploy different ways of achieving this; some write their own scripts or use cheat sheets, and others use open source tools.

These systems may not be suitable for all kind of uses cases due to lack of functionality and moreover the interfaces to these systems are closed which makes migration from one system to other difficult.

Although, the functionality of IPAM systems vary from vendor to vendor but in general as a whole, following drawbacks exists:

- Lack of common set of standard interfaces across IPAM system vendors

- Address usually allocated with very little or no context
- Lacks ability to annotate requests with user-defined attributes as private or public address
- Lacks capability to manage both unicast and multicast addresses
- MAC address and network segment (VLAN) does not given enough information about user or usages
- Lack of built-in multi-tetancy into interfaces
- Lack of information about address requester such as virtual or physical device
- Lack of integration with name services such as DNS
- Lack of integration with DHCP server to get address records
- Lack of integration with address translation services such as NAT44 and NAT64

The purpose is not to show a laudry list of deficiencies in the available IPAM system but to show a need to develop a new system that can meet the address allocation requirements of modern network architectures that gives consumers a portable way to use these systems.

6. Acknowledgements

This document started from a slide deck authored by Rakesh Kumar and Anil Lohiya.

7. IANA Considerations

This memo includes no request to IANA.

8. Security Considerations

TBD

9. Informative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

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