CHAPTER 1

Introduction

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Cisco has taken a leading role in the definition and implementation of the IPv6 architecture within the Internet Engineering Task Force (IETF) and continues to lead the industry in IPv6 development and standardization.

This document describes Cisco's implementation of IPv6 for its Unified Communications products, and it discusses how to design Unified Communications networks to use IPv6 in a dual-stack (IPv4 and IPv6) environment. This document does not discuss the implementation of IPv6 in the campus and WAN in detail because these topics are discussed in other Cisco documents (which are referenced in this document). For those who are unfamiliar with IPv6, this document also provides a brief introduction to IPv6 architecture and functionality. Recommendations for further reading on IPv6 are also made in this document.

The primary focus of this document is on new IPv6 functionality for Cisco Unified Communications networks. The co-existence of IPv4 and IPv6 devices is considered throughout this document. However, Cisco strongly recommends that you use this document in conjunction with the *Cisco Unified Communications SRND*, available at

http://www.cisco.com/go/ucsrnd

The *Cisco Unified Communications SRND* provides in-depth guidance on Unified Communications deployments using IPv4

The deployment of IPv6-only devices is discussed in this document, but emphasis is given to the deployment of dual-stack (IPv4 and IPv6) devices, which offer a greater degree of functionality and interoperability with existing IPv4-only devices.

Note The scope of this document is limited to the solutions that have been tested and approved by Cisco. Supported IPv4 applications are limited to those stated in this document. It is assumed that devices running in dual-stack mode (IPv4 and IPv6) will work with all other IPv4 applications; however, those applications that have not been tested by Cisco are not supported by Cisco Technical Assistance Center (TAC).

Deployment Recommendations

Cisco recommends that you deploy IPv6 in a dual-stack Cisco Unified Communications Manager (Unified CM) cluster with approved dual-stack devices (phones, gateways, and so forth). This approach is recommended to avoid IPv6-only deployments, which are not currently supported in production environments. Single-site call processing deployments, multiple-site distributed call processing deployments, and multiple-site deployments with centralized call processing are supported.

To maximize IPv6 traffic in the Unified Communications network, IPv6-capable phones, SIP gateways, and SIP trunks should be configured as dual-stack devices and use IPv6 signaling and IPv6 media. SIP trunks should also be configured to use Alternative Network Address Types (ANAT).

IPv6-only Unified Communications clusters in which no IPv4 addresses are assigned to any Unified Communications components, are not supported. If IPv6-only functionality is configured, it extends to IPv6-only SIP trunks and IPv6-only IP phones (where only basic voice services are supported).

Comparison of IPv4 and IPv6

This section provides a brief description of the motivation behind deploying IPv6, as well as a summary comparison of IPv4 and IPv6.

Why Deploy IPv6?

The deployment of IPv6 is primarily driven by IPv4 address space exhaustion. As the worldwide usage of IP networks increases, the number of applications, devices, and services requiring IP addresses is rapidly increasing. Current estimates by the Internet Assigned Numbers Authority (IANA) and Regional Internet Registries (such as ARIN, LACNIC, and APNIC) indicate that their pools of unallocated IPv4 addresses will be exhausted sometime between Q4 2011 and Q2+ 2012.

Because the current IPv4 address space is unable to satisfy the potential huge increase in the number of users and the geographical needs of the Internet expansion, many companies are either migrating to or planning their migration to IPv6, which offers a virtually unlimited supply of IP addresses.

The process of transforming the Internet from IPv4 to IPv6 is likely to take several years. During this period, IPv4 will co-exist with and then gradually be replaced by IPv6.

Some countries such as Japan are aggressively adopting IPv6 today. Others, such as those in the European Union, are moving toward IPv6, while China is considering building pure IPv6 networks from the ground up. Even in North America, where Internet addresses are abundant, the U.S. Department of Defense mandated that as of October 1, 2003, all new equipment purchased must be IPv6-capable. As these examples illustrate, IPv6 enjoys strong momentum.

Advantages of IPv6 Over IPv4

As a new version of the Internet Protocol, IPv6 provides the following advantages over IPv4:

- Larger address space

  The main feature of IPv6 that is driving adoption today is the larger address space. Addresses in IPv6 are 128 bits long compared to 32 bits in IPv4. The larger address space avoids the potential exhaustion of the IPv4 address space without the need for network address translation (NAT) or

other devices that break the end-to-end nature of Internet traffic. By avoiding the need for complex sub-netting schemes, IPv6 addressing schemes are easier to understand, making administration of medium and large networks simpler.

- Address scopes

  IPv6 introduces the concept of address scopes. An address scope defines the region, or span, where an address can be defined as a unique identifier of an interface. These spans are the link, the site network, and the global network, corresponding to link-local, site-local (or unique local unicast), and global addresses.

- Stateless Address Auto-Configuration (SLAAC)

  IPv6 hosts can be configured automatically when connected to a routed IPv6 network using ICMPv6 router discovery messages. Address reconfiguration is also simplified. If IPv6 auto-configuration is not suitable, a host can use stateful configuration (DHCPv6) or can be configured manually.

- Multicast

  Multicast is part of the base specifications in IPv6, unlike IPv4, where it was introduced later. Like IPv6 unicast addresses, the IPv6 multicast address range is much larger than that of IPv4. IPv6 does not have a link-local broadcast facility; the same effect can be achieved by multicasting to the all-hosts group address (FF02::1).

- Streamlined header format and flow identification

  The IPv6 header format reduces router processing overhead by using a fixed header length, performing fragmentation on hosts instead of routers, and using an improved header extension method and a new flow label to identify traffic flows requiring special treatment.

- Mobile IPv6

  Mobile IPv6 allows a mobile node to change its locations and addresses, while maintaining a connection to a specific address that is always assigned to the mobile node and through which the mobile node is always reachable. Mobile IPv6 provides transport layer connection survivability when a node moves from one link to another by performing address maintenance for mobile nodes at the Internet layer. Mobile IPv6 is not supported by Cisco IP Phones or other Unified Communications components.

- Network-layer security

  IPSec, the protocol for IP network-layer encryption and authentication, is an integral part of the base protocol suite in IPv6. This is unlike IPv4, where IPsec is optional. Because of its reduced payload and performance overhead, Cisco IPv6 Unified Communications products use TLS and SRTP for authentication and encryption.

Table 1-1 summarizes the differences between IPv4 and IPv6.

Table 1-1 A Comparison of IPv6 and IPv4 Services

IP Service	IPv4 Feature	IPv6 Feature
Address range	32-bit, Network Address Translation (NAT)	128-bit, multiple scopes
Auto-configuration	DHCP	Stateless, Easy Reconfiguration, DHCP
Routing	RIP, OSPFv2, IS-IS, EIGRP, MP-BGP	RIPng, OSPFv3, IS-IS, EIGRP, MP-BGP
IP Security	IPSec	IPSec
Mobility	Mobile IP	Mobile IP with direct routing

Table 1-1 A Comparison of IPv6 and IPv4 Services (continued)

IP Service	IPv4 Feature	IPv6 Feature
Quality of Service (QoS)	Differentiated Service, Integrated Service	Differentiated Service, Integrated Service
IP multicast	IGMP, PIM, and Multicast BGP	MLD, PIM, and Multicast BGP; Scope Identifier