CHAPTER 3

IPv6 Support in Cisco Unified Communications Devices

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This chapter provides an introduction to the new terminology that is used with IPv6 for Cisco Unified Communications as well as a summary of the Cisco Unified Communications devices that support IPv6.

IPv4 and IPv6 Terminology and Icons

The development of IPv6 introduces new concepts for Unified Communications networks, in particular the concept of a device's IP addressing mode. Devices may now support IPv4 only, IPv6 only, or IPv4 and IPv6 addresses. This document uses the symbols (or icons) shown in Figure 3-1 to represent the IP addressing mode capabilities of devices.

Figure 3-1 Symbols Used to Represent IP Addressing Modes

IPv4 Only
This device communicates with and understands IPv4 addresses only.

IPv6 Only
This device communicates with and understands IPv6 addresses only.

Dual Stack (IPv4 and IPv6)
This device can communicate with and understand both IPv4 and IPv6 addresses.

IPv6 Aware
This device communicates with IPv4 addresses, but it can receive and understand IPv6 addresses embedded in application protocol data units (PDUs). Typically this format is used by applications that use IPv4 to transport IPv6 information (for example, Cisco Unified Provisioning Manager).

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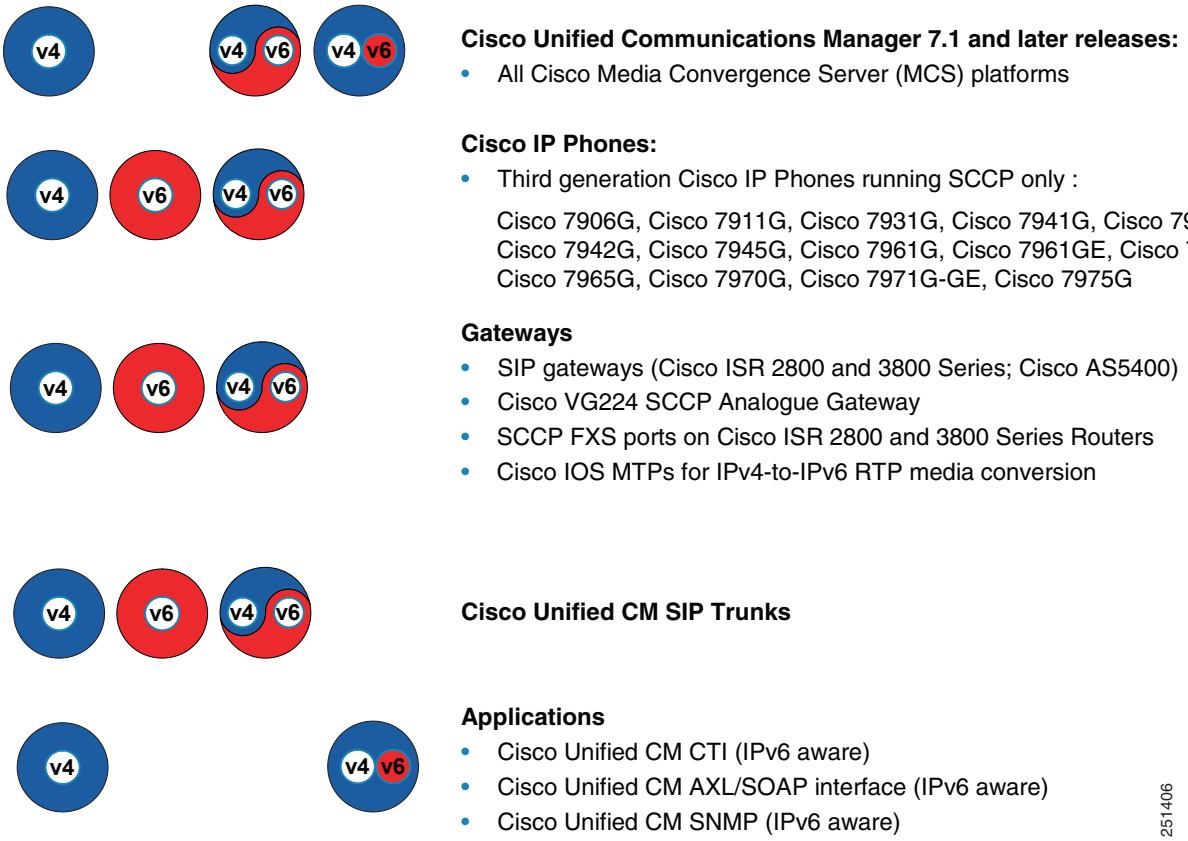
Note For dual-stack (IPv4 and IPv6) Unified Communications devices such as Cisco IP Phones, both IPv4 and IPv6 addresses are available to use for both signaling and media. For media, dual-stack devices can take full advantage of the fact that they support both IPv4 and IPv6 when they communicate to any other device. For signaling, the IP addressing mode is set to either IPv4 or IPv6 by the device configuration.

Support for IPv6 in Cisco Unified Communications Products

Figure 3-2 lists the Cisco Unified Communications products that support IPv6.

Figure 3-2 Addressing Modes Supported by Cisco Unified Communications Products



Cisco Unified Communications Manager 7.1 and later releases:

- All Cisco Media Convergence Server (MCS) platforms

Cisco IP Phones:

- Third generation Cisco IP Phones running SCCP only :

  Cisco 7906G, Cisco 7911G, Cisco 7931G, Cisco 7941G, Cisco 7941GE
  Cisco 7942G, Cisco 7945G, Cisco 7961G, Cisco 7961GE, Cisco 7962G
  Cisco 7965G, Cisco 7970G, Cisco 7971G-GE, Cisco 7975G

Gateways

- SIP gateways (Cisco ISR 2800 and 3800 Series; Cisco AS5400)
- Cisco VG224 SCCP Analogue Gateway
- SCCP FXS ports on Cisco ISR 2800 and 3800 Series Routers
- Cisco IOS MTPs for IPv4-to-IPv6 RTP media conversion

Cisco Unified CM SIP Trunks

Applications

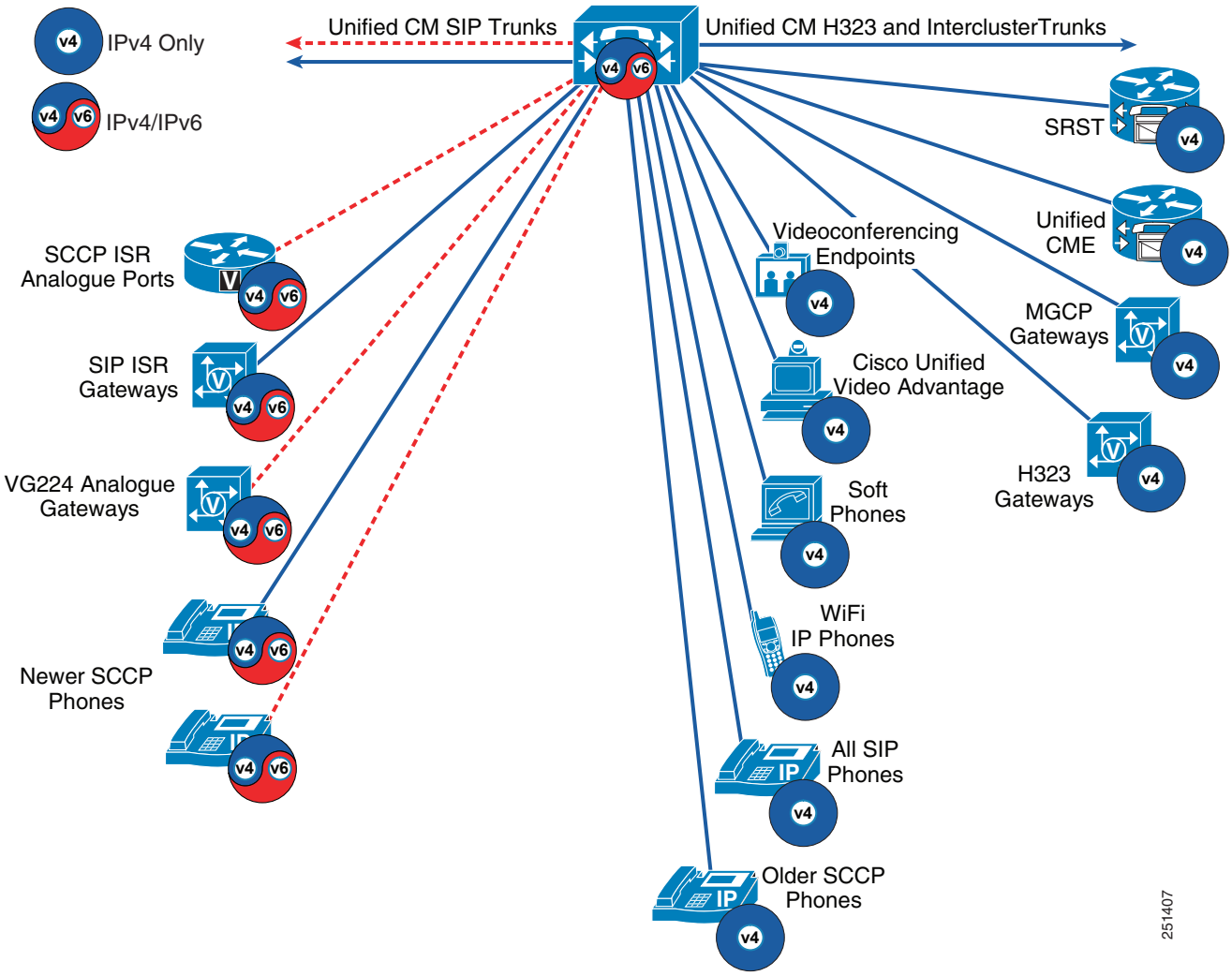
- Cisco Unified CM CTI (IPv6 aware)
- Cisco Unified CM AXL/SOAP interface (IPv6 aware)
- Cisco Unified CM SNMP (IPv6 aware)

Only the devices and applications listed in Figure 3-2 support IPv6. All other Cisco Unified Communications devices and applications support IPv4. For Unified Communications implementations, Cisco recommends that you configure all IPv6 devices and applications in dual-stack (IPv6 and IPv4) mode or IPv4-only mode. This ensures interoperability with existing IPv4-only devices and applications. Cisco IP Phones can be configured as IPv6 only, but this configuration is not recommended in production environments.

Addressing Modes Supported by Cisco Unified Communications Devices

Figure 3-3 illustrates the addressing modes available for Cisco Unified Communications devices that support IPv6. For signaling with dual-stack (IPv4 and IPv6) devices, each device can support either IPv4 or IPv6. For media with dual-stack devices, each device can support IPv4 only, IPv6 only, or IPv4 and IPv6.

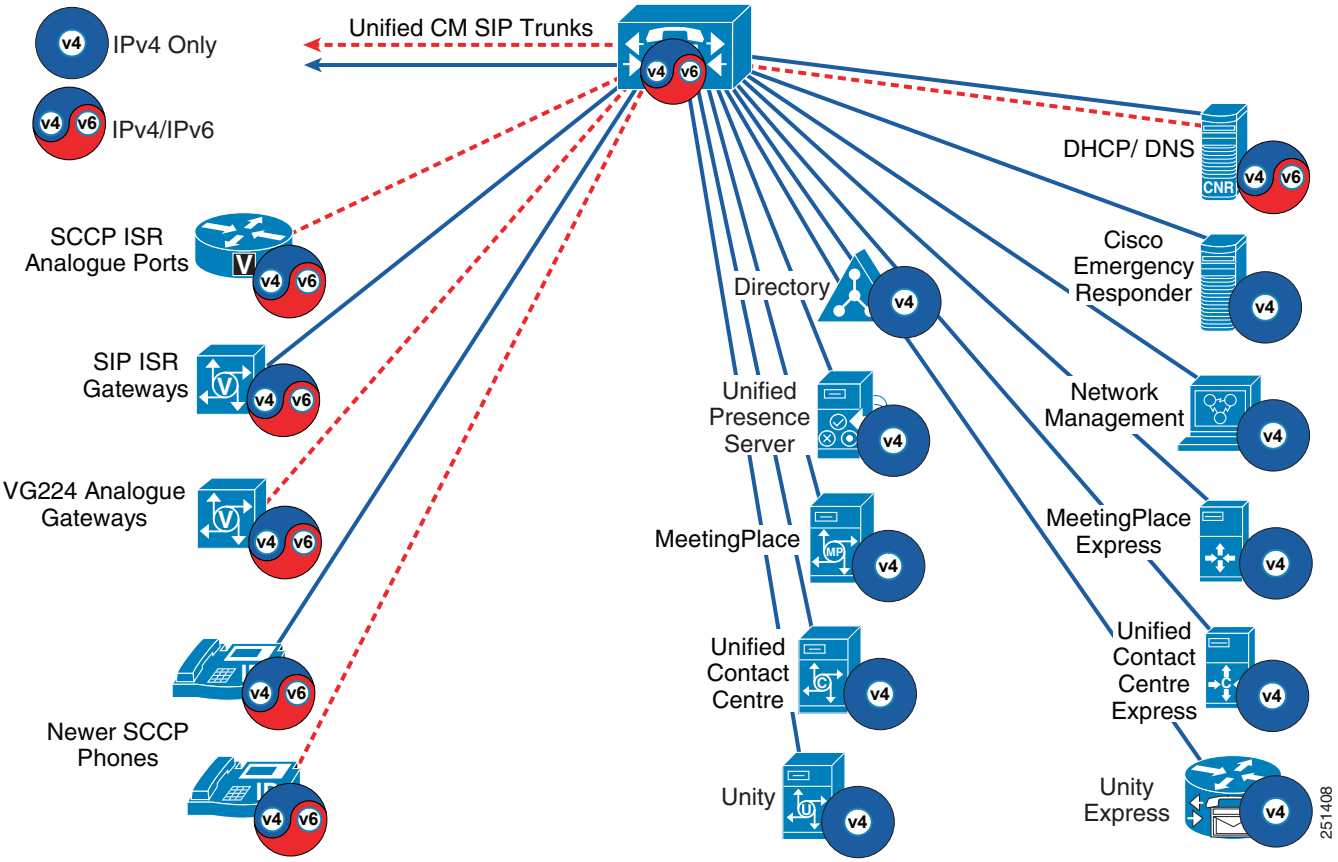
Figure 3-3 Addressing Modes for Cisco Unified Communications IPv6 Devices



Addressing Modes Supported by Cisco Unified Communications Applications

Figure 3-4 illustrates the addressing modes available for Cisco Unified Communications applications that support IPv6.

Figure 3-4 Addressing Modes for Cisco Unified Communications IPv6 Applications



IPv6 Addressing in Cisco Unified Communications Products

The previous sections discussed the various addressing modes supported by Cisco Unified Communications devices. This section describes how many IPv6 addresses each of these devices can support.

Cisco Unified Communications Manager and IPv6 Addresses

Each Cisco Media Convergence Server (MCS) can support the following addresses simultaneously:

- One IPv6 link local address (for example, FE80::987:65FF:FE01:2345)
- Either of the following:
  - One IPv6 unique local address (for example, FD00:AAAA:BBBB:CCCC:0987:65FF:FE01:2345)
  - Or one IPv6 global address (for example, 2001:0DB8:BBBB:CCCC:0987:65FF:FE01:2345)
- One IPv4 address

All IPv6 devices must have a link local address.

A unique local address is equivalent to a private address in IPv4 (for example, 10.10.10.1).

A global address is a globally unique public address.

Note To route traffic from devices using unique local addresses over a public network, IPv6 NAT is required to convert unique local addresses to global addresses.

Cisco IP Phones and IPv6 Addresses

A Cisco IP Phone can support a combination of the following addresses:

- One IPv6 link local address (for example, FE80::987:65FF:FE01:2345)
- Multiple IPv6 unique local addresses (for example, FD00:AAAA:BBBB:CCCC:0987:65FF:FE01:2345)
- Multiple IPv6 global addresses (for example, 2001:0DB8:BBBB:CCCC:0987:65FF:FE01:2345)
- One IPv4 address

Cisco IP Phones must support one link local address and can support a combination of up to 20 global and/or unique local addresses. The IP phone can use only one of these global or unique local IPv6 addresses to register to Cisco Unified Communications Manager. Once registered, this IPv6 address is used for signaling and media.

The following characteristics also apply to IPv6 addresses on IP phones:

- A link local address is never sent to Cisco Unified Communications Manager as a signaling and media address.
- If the IP phone has both unique local and global addresses, the global addresses take precedence over unique local addresses.
- If the IP phone has multiple unique local addresses or multiple global addresses, the first address configured is the one used for signaling and media.

The following priority order applies to IPv6 addresses configured on an IP phone:

1. Use the IPv6 address configured manually through the phone's user interface (UI).
2. If an IPv6 address has not been configured manually on the phone, use DHCPv6 to assign an address.
3. If neither a manually configured address nor a DHCPv6 address is available, but auto-configuration (SLAAC) is enabled for the phone (in Cisco Unified Communications Manager, the SLAAC default = On), then the phone will use SLAAC to create an IPv6 address. With SLAAC, the phone uses the IPv6 network prefix advertised in the link local router's Router Advertisements (RAs) and creates the IPv6 host ID by using the phone's MAC address and the EUI-64 format for host IDs. If SLAAC is used and DHCP is disabled, a TFTP server address must be configured manually to enable the phone to register with Cisco Unified Communications Manager).

Cisco IOS Devices and IPv6 Addresses

Each interface of a Cisco IOS device can support a combination of the following addresses:

- One IPv6 link local address (for example, FE80::987:65FF:FE01:2345)
- Multiple IPv6 unique local addresses (for example, FD00:AAAA:BBBB:CCCC:0987:65FF:FE01:2345)
- Multiple IPv6 global addresses (for example, 2001:0DB8:BBBB:CCCC:0987:65FF:FE01:2345)
- Multiple IPv4 addresses

Cisco IOS media termination points (MTPs) are associated with the router's interface through the **sccp local** <*interface*> command, and they inherit the IPv4 and IPv6 addresses of the interface.

Cisco Unified Communications Configuration Parameters and Features for IPv6

This section introduces the following new features and configuration parameters in Cisco Unified Communications Manager (Unified CM) to support IPv6:

- Common device configuration for phones and trunks
  - IP addressing mode
  - IP addressing mode preference for signaling
  - Allow auto-configuration for phones
- The new role of the MTP in IPv6-enabled Unified CM clusters
- Alternative Network Address Types (ANAT) for SIP trunks
- New enterprise parameters
- MTP selection

With Unified CM 8.0, IPv6 can be enabled and configured cluster-wide and at the device level, thus allowing Unified Communications IPv6 devices to be configured to use IPv6 for signaling and/or media. The features listed above are discussed in some detail here and in greater depth in later chapters.

Common Device Configuration

Cisco Unified CM supports two IPv6 devices, IP phones and SIP trunks (to gateways or other Unified CM clusters). Rather than add IPv6 configuration parameters to specific trunks and phones, a Unified CM configuration template contains IPv6-specific configuration parameters for phones and SIP trunks. This section describes that template, which is known as the *common device configuration*.

The common device configuration profile (**Device** -> **Device Settings** -> **Common Device Configuration**) contains the following IPv6 configuration information:

- IP Addressing Mode
- IP Addressing Mode Preference for Signaling
- Allow Auto-Configuration for Phones

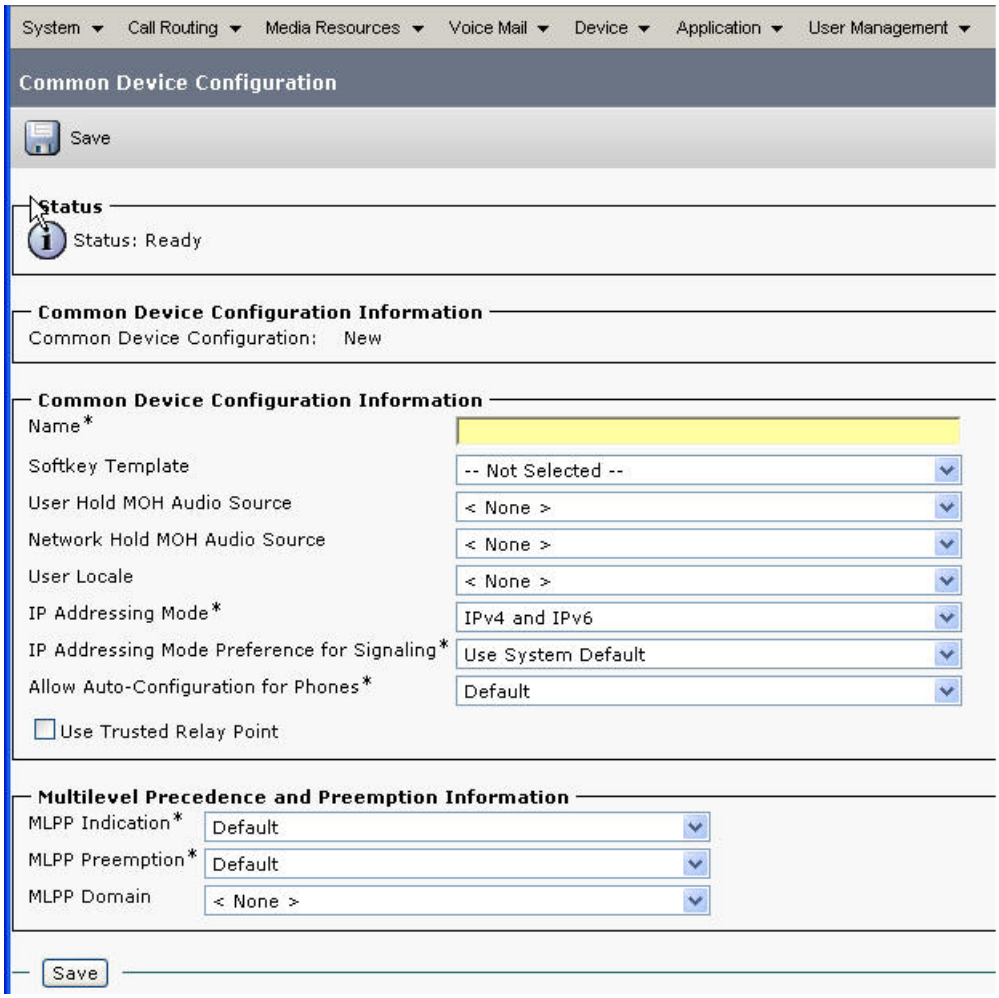
Multiple common device configuration profiles can be created and associated with devices such IP phones and SIP trunks. The following sections describe the configuration options for phones and SIP trunks.

Default Common Device Configuration

There is no default common device configuration profile, and each device is initially associated with a <None> common device configuration (see Figure 3-5). If IPv6 is enabled in the Unified CM cluster with this <None> configuration, IPv6 devices adopt the following settings:

- IP Addressing Mode = IPv4 and IPv6
- IP Addressing Mode Preference for Signaling = Use System Default
- Allow Auto-Configuration for Phones = Default

Figure 3-5 Initial Common Device Configuration Settings



Common Device Configuration for IPv6 Phones

You can configure the common device configuration profile and assign it to the phones to apply one of the following IP addressing modes to the phones (see Figure 3-6):

- IPv4 Only

  In this addressing mode, the phone will acquire and use only one IPv4 address for all signaling and media. If the phone has acquired an IPv6 address previously, it will be released.

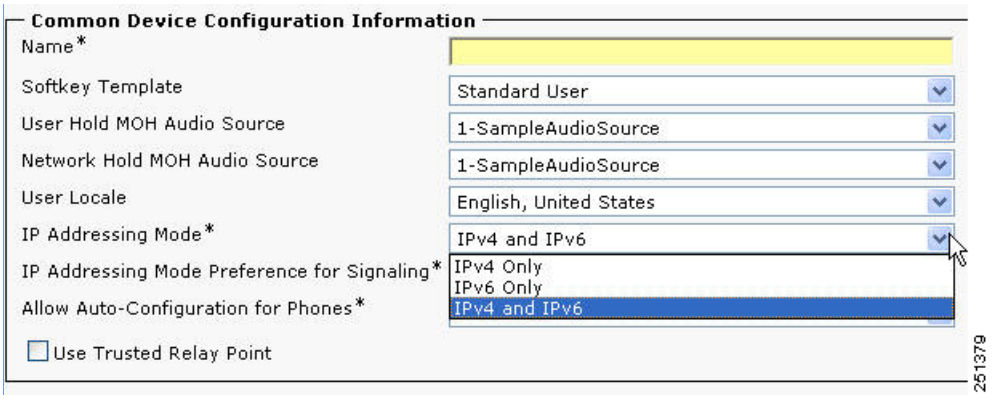
- IPv6 Only

  In this addressing mode, the phone will acquire and use only one IPv6 address for all signaling and media. If the phone has acquired an IPv4 address previously, it will be released.

- IPv4 and IPv6

  In this addressing mode, the phone will acquire and use one IPv4 address and one IPv6 address. It can use the IPv4 and the IPv6 address as required for media. It will use either the IPv4 address or the IPv6 address for call control signaling to Unified CM.

Figure 3-6 Setting the Phone IP Addressing Mode



If IPv6 is enabled in the Unified cluster, the default phone setting for IP addressing mode is IPv4 and IPv6. If the IP phone supports IPv4 and IPv6, it will adopt this setting, but all IPv4-only phones will ignore this setting.

Note Cisco recommends **IPv4 and IPv6** as the setting for the phone IP addressing mode. **IPv6 Only** is not recommended for production environments.

IP Addressing Modes for Media Streams Between Devices, and the New Role of the MTP for IPv6

As described previously, you can configure IPv6 devices to support a single IPv4 address, a single IPv6 address, or both an IPv4 address and an IPv6 address (also known as dual stack configuration). Furthermore, devices that do support both an IPv4 address and an IPv6 address can choose to use either their IPv4 addresses or their IPv6 addresses to transport RTP voice streams between the devices. The selection of IPv4 or IPv6 for media is determined by the Unified CM cluster-wide setting of **IP Addressing Mode Preference for Media**. (For details, see Cluster-Wide Configuration (Enterprise Parameters), page 3-13.)

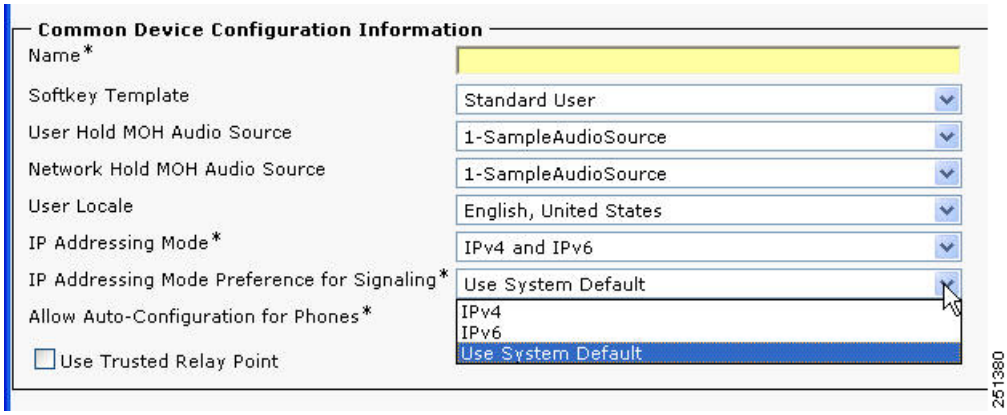
For two devices (such as phones) that support mismatched addressing modes, an IP addressing version incompatibility exists when a device with an IPv4 address wants to establish a RTP voice stream with a device with an IPv6 address. To resolve this IP addressing incompatibility for media, Unified CM dynamically inserts a media termination point (MTP) to convert the media stream from IPv4 to IPv6, and vice versa. For more information on how and when MTPs are used for IPv6 calls, see the chapter on Media Resources and Music on Hold, page 8-1.

IP Addressing Mode Preference for Signaling for Phones

The phone IP Addressing Mode Preference for Signaling has three settings (see Figure 3-7):

- IPv4 — If the phone has an IPv4 address, it will use that address for call control signaling to Unified CM.
- IPv6 — If the phone has an IPv6 address, it will use that address for call control signaling to Unified CM.
- Use System Default — The phone will use the configured cluster-wide enterprise parameter value for its IP Addressing Mode for Signaling, if it has an address of that type.

Figure 3-7 Setting the Phone IP Addressing Preference for Signaling



If IPv6 is enabled in the Unified CM cluster, the default phone setting for IP Addressing Mode for Signaling is **Use System Default**. If the IP phone supports either IPv6 only or IPv4 and IPv6, it will adopt the cluster-wide setting for IP Addressing Mode for Signaling, but all IPv4 phones will ignore this setting.

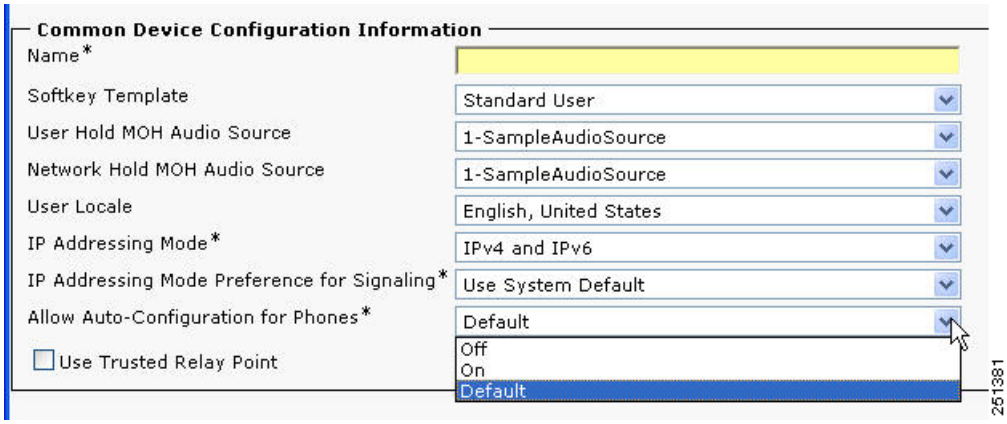
Allow Auto-Configuration for Phones

The parameter to Allow Auto-Configuration for Phones has three settings (see Figure 3-8):

- On — The Phone is allowed to use Stateless Auto Address Configuration (SLAAC) to acquire an IPv6 address. Whether or not the phone will use SLAAC depends on the link local router's configuration of the O bit and M bit in Router Advertisements (RAs):
  - If the O bit is set in the router's RAs, the phone will use SLAAC to acquire its IP address and will use the DHCP server to acquire other information (such as the TFTP server address and DNS server address). This is known as stateless DHCP.
  - If the M bit is set in the router's RAs, the phone will not use SLAAC but will use the DHCP server to acquire its IP address and other information. This is known as stateful DHCP.
  - If neither the M bit nor the O bit is set, the phone will use SLAAC to acquire an IP address but will not use DHCP for other information. The phone will also require a TFTP server address to download its configuration file and register to Unified CM. This TFTP server address can be configured manually though the phone's user interface (UI).
- Off — The phone will not use Stateless Auto Address Configuration (SLAAC) to acquire an IPv6 address. In this case the phone can either be configured manually or use stateful DHCPv6 to acquire an IPv6 address and TFTP server address.

- Default — The phone will use the cluster-wide enterprise parameter configuration value for **Allow Auto-Configuration for Phones**.

Figure 3-8 Setting the Parameter to Allow Auto-Configuration for Phones



If IPv6 is enabled in the Unified CM cluster, the phone's default setting for Allow Auto-Configuration for Phones setting is **Default**. If the IP phone supports either IPv6 only or IPv4 and IPv6, it will adopt the cluster-wide setting for Allow Auto-Configuration for Phones, but all IPv4 phones will ignore this setting.

Common Device Profile Configuration for Unified CM SIP Trunks

You can apply SIP trunk configuration settings either through the Common Device Configuration profile that you create and assign to the SIP trunk (IP Addressing Mode and IP Addressing Mode Preference for Signaling) or through the SIP profile configuration you assign to the SIP trunk (Enable ANAT).

With IPv6 enabled and with an IPv6 and IPv4 address defined on the Unified CM server, you can configure the SIP trunk to use either of these addresses as its source IP address for SIP signaling. The SIP trunk also listens for incoming SIP signaling on the configured incoming port number of the server's IPv4 and IPv6 address.

IP Addressing Mode

The SIP trunk IP addressing mode has three settings:

- IPv4 only — The SIP trunk will use the Unified CM IPv4 address for signaling and either an MTP IPv4 address or a phone IPv4 address for media.
- IPv6 only — The SIP trunk will use the IPv6 address for signaling and either an MTP or phone IPv6 address for media.
- IPv4 and IPv6 — For signaling, the SIP trunk will use either the Unified CM IPv4 address or the Unified CM IPv6 address. For media, the SIP trunk will use either an MTP IPv4 and/or IPv6 address or the phone IPv4 and/or IPv6 address.

For more information on these SIP trunk IP addressing modes, see SIP Trunks Using Delayed Offer, page 7-14.

If IPv6 is enabled in the Unified CM cluster, the default SIP trunk setting for the IP Addressing mode is **IPv4 and IPv6**. All IPv4 trunks (H.323 and MGCP) will ignore this setting.

Cisco recommends setting the IP addressing mode for IPv6 SIP trunks to **IPv4 and IPv6**. The **IPv6 Only** setting is not recommended and should not be used in production environments.

IP Addressing Mode Preference for Signaling

The SIP trunk IP Addressing Mode Preference for Signaling has three settings:

- IPv4 — The SIP trunk will use the Unified CM IPv4 address as its source address for SIP signaling.
- IPv6 — The SIP trunk will use the Unified CM IPv6 address as its source address for SIP signaling.
- Use System Default — The SIP trunk will use the cluster-wide enterprise parameter configuration value for its IP Addressing Mode for Signaling.

If IPv6 is enabled in the Unified CM cluster, the default SIP trunk setting for IP Addressing Mode Preference for Signaling is **Use System Default**. With this setting the SIP trunk will adopt the cluster-wide setting for IP Addressing Mode Preference for Signaling. All IPv4 trunks will ignore this setting.

The SIP trunk IP Addressing Mode Preference for Signaling is used only for outbound calls. Unified CM will listen for incoming SIP signaling on the configured incoming port number of the server's IPv4 and IPv6 address.

Allow Auto-Configuration for Phones

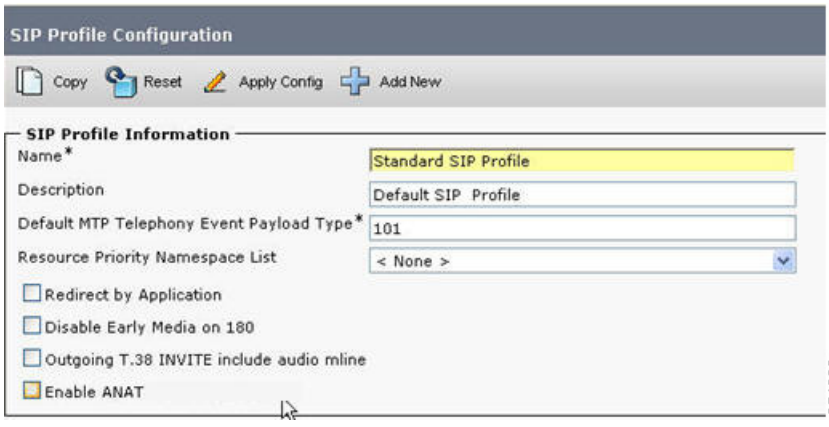
The parameter to Allow Auto-Configuration for Phones is not used by SIP trunks.

Alternative Network Address Types (ANAT)

Alternative Network Address Types (ANAT) is used in the SIP Offer and Answer exchange by dual-stack SIP trunks. ANAT allows these SIP devices to send both IPv4 and IPv6 addresses in the Session Description Protocol (SDP) body of a SIP Offer, and to return in the SDP body of the SIP Answer a preferred IP address (IPv4 or IPv6) with which to establish a voice connection.

Cisco supports ANAT over dual-stack (IPv4 and IPv4) SIP trunks. ANAT must be supported by both ends of the SIP trunk. You can enable ANAT by checking the **Enable ANAT** check box on the SIP profile associated with the SIP trunk (see Figure 3-9). ANAT can be used with both Early Offer and Delayed Offer calls.

Figure 3-9 SIP Trunk Profile Configuration



For more information on ANAT, see Alternative Network Address Types (ANAT), page 7-10.

Note Enable ANAT only on SIP trunks with an IP addressing mode setting of **IPv4 and IPv6**.

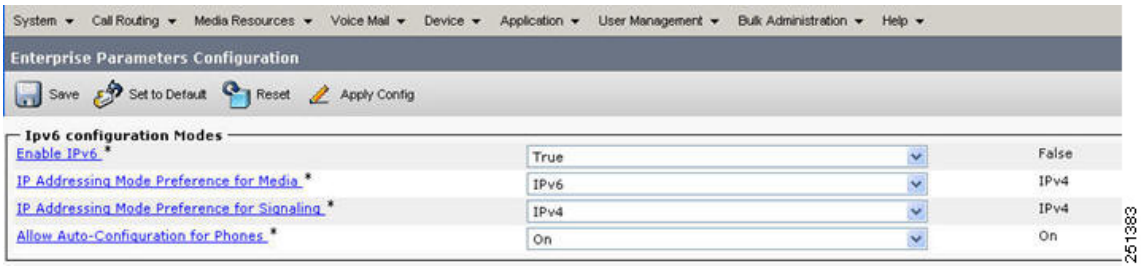
Cluster-Wide Configuration (Enterprise Parameters)

Before configuring the cluster-wide parameters in Unified CM, you must configure each server with an IPv6 address. For details on Unified CM IPv6 address configuration, see Configuring IPv6 in Cisco Unified CM, page A-1.

In the Unified CM Administration interface, select **Enterprise Parameters -> IPv6 Configuration Modes** to configure the following cluster-wide IPv6 settings for each Unified CM server (see Figure 3-10):

- Enable IPv6
- IP Addressing Mode Preference for Media
- IP Addressing Mode Preference for Signaling
- Allow Auto-Configuration for Phones

Figure 3-10 Cluster-Wide IPv6 Configuration Modes



Enable IPv6

Set this parameter to True to enable IPv6. The default setting is False.

IP Addressing Mode Preference for Media

IP Addressing Mode Preference for Media has two setting options:

- IPv4 (default)
- IPv6

The cluster-wide IP Addressing Mode Preference for Media is different than the device-level IP addressing mode. The cluster-wide IP Addressing Mode Preference for Media serves two purposes:

- The IP Addressing Mode Preference for Media is used to select which IP addressing version will be used for media when a call is made between two dual-stack devices.
- The IP Addressing Mode Preference for Media is also used when there is a mismatch in supported IP addressing versions between two devices. For example, if an IPv6-only device calls an IPv4-only device, an MTP must be inserted into the media path to convert from IPv4 to IPv6, and vice versa.

Typically both devices will have MTP media resources available to them in their media resource group (MRG). The IP Addressing Mode Preference for Media is used to select which device's MTP is used to convert from IPv4 to IPv6 (and vice versa) for the call, as follows:

- If the IP Addressing Mode Preference for Media is set to IPv4, the MTP associated with the IPv6-only device will be selected, so that the longest call leg between the device and the MTP uses IPv4.
- If the IP Addressing Mode Preference for Media is set to IPv6, the MTP associated with the IPv4-only device will be selected, so that the longest call leg between the device and the MTP uses IPv6.
- If the preferred device's MTP is not available, the other device's MTP will be used.
- If no MTPs are available, the call will fail.

MTP resource allocation is discussed in detail in the chapter on Media Resources and Music on Hold, page 8-1.

IP Addressing Mode Preference for Signaling

The cluster-wide setting for the IP Addressing Mode Preference for Signaling is used by devices whose IP Addressing Mode Preference for Signaling is set to **Use System Default**.

The IP Addressing Mode Preference for Signaling has two setting options:

- IPv4 (default)
- IPv6

Allow Auto-Configuration for Phones

The cluster-wide setting to Allow Auto-Configuration for Phones is used by phones whose Allow Auto-Configuration for Phones parameter is set to **Default**.

The parameter to Allow Auto-Configuration for Phones has two setting options:

- On (default)
- Off

IPv6 Address Configuration for Unified CM

Once you have configured an IPv6 address for the Unified CM server (see Configuring IPv6 in Cisco Unified CM, page A-1), you must also configure this address in the Unified CM Administration graphical user interface (see Figure 3-11). This IPv6 address is used in the device configuration files stored on the cluster's TFTP server(s). IPv6 devices can use this address to register with Unified CM. A server name can also be used, but an IPv6 DNS server is required to resolve this name to an IPv6 address.

Figure 3-11 IPv6 Address Configuration for Unified CM