



## Configuring IPv6

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Prime Cable Provisioning supports the CableLabs DOCSIS standard: DOCSIS 3.0 and 3.1. The DOCSIS 3.0 and 3.1 standards introduces key new features that build on previous DOCSIS standards. These features include:

- Provisioning of IPv6 devices, which include:
  - DOCSIS-compliant cable modems and CMTS
  - PacketCable 2.0
  - Computers
  - Any STB compliant with CableLabs OpenCable Application Platform
  - eRouter 1.0
  - Variants of eSAFE (embedded Service/Application Functional Entities) devices such as E-CM or E-DVA.

Prime Cable Provisioning provides services required to provision IPv6 devices, such as IPv6 support for TFTP and ToD services. It also processes configuration files for IPv6 devices.

- Expanded addressability

The main benefit of IPv6 is its expanded addressing capability. IPv6 addresses increase the address space from 32 to 128 bits, providing for a virtually unlimited number of networks and systems.

- IPv6 provisioning and management of cable modems. This provisioning flow includes:
  - Supported IP modes— provisions DOCSIS cable modems (except CableHome WAN-MAN) in IPv4, IPv6 and dual stack mode. See [Dual Stack Support](#) for more information about dual stack.



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**Note** Cable modems can forward IPv4 and IPv6 traffic regardless of the IP provisioning mode.

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- DHCPv6—The DOCSIS provisioning flow specifies the use of DHCP for IPv6, also known as DHCPv6. For details on the DHCPv6 provisioning flow in DOCSIS, see [DOCSIS DHCPv6 Workflow](#).
- [Enabling IPv6, on page 2](#)

- [IPv6 Addressing, on page 3](#)
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## Enabling IPv6

Before you enable to provision devices in IPv6, ensure that you enable IPv6 on your system. To enable your machine to support IPv6:

### On Linux:

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**Step 1** Log in as *root*.

**Step 2** Modify the configuration file of the kernel module loader, */etc/modules.conf* or */etc/conf.modules*, to include the following statement:

```
alias net-pf-10 ipv6 # automatically load IPv6 module on demand
```

**Step 3** Test the IPv6 configuration using the following command:

```
# ifconfig
```

If `inet6 addr: 2001:e30:1400:1:208:c7ff:fe9d0a/64 Scope:Global` string is displayed in the result, IPv6 is successfully enabled.

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You must enable IPv6 provisioning group capabilities in Prime Cable Provisioning to provision IPv6 devices. To enable the provisioning group capabilities, you need to enable the corresponding IPv6 interface and services in the DPE. See the following sections of [Cisco Prime Cable Provisioning 6.1.1 DPE CLI Reference Guide](#) for additional information.

- [interface ip provisioning](#) to configure IPv6 interface
- [service tftp](#) to enable IPv6 TFTP service in DPE
- [service tod](#) to enable IPv6 TOD service in DPE

Other concepts related to IPv6:

- [IPv6 Addressing, on page 3](#)
- [Single Stack versus Dual Stack, on page 4](#)
- [DHCP Options for IPv6, on page 5](#)
- [Configuration Workflows for IPv6, on page 5](#)

# IPv6 Addressing

IPv6 addresses are 128 bits long and are represented as a series of 16-bit hexadecimal fields separated by colons (:). The A, B, C, D, E, and F in hexadecimal are case-insensitive. For example:

```
2031:0000:130f:0000:0000:09c0:876a:130b
```

A few shortcuts to this addressing are:

- Leading zeros in a field are optional, so that 09c0 can be written 9c0, and 0000 as 0.
- Successive fields of zeros (any number of them) are represented as ::, but only once in an address (because if used more than once, the address parser has no way of identifying the size of each block of zeros). So, the previous address can be written:

```
2031:0:130f::09c0:876a:130b
```

The use of the double-colon abbreviation makes many addresses small, for example ff01:0:0:0:0:0:1 becomes ff01::1.

Link-local addresses have a scope limited to the link, and use the prefix fe80::/10. Loopback addresses have the address ::1. Multicast addresses are identified by the prefix ff00::/8 (there are no broadcast addresses in IPv6).

The IPv4-compatible addresses in IPv6 are the IPv4 decimal quad addresses prefixed by ::. For example, an IPv4 address that would be interpreted as ::c0a8:1e01 can be written as ::192.168.30.1.

## Dual Stack Support

Prime Cable Provisioning supports provisioning of CableLabs devices in dual stack mode. By default, dual stack mode is disabled and in such a case, the DPE cache stores these configurations using either MAC address (for IPv4 mode CM) or DUID address (for IPv6 mode CM). When a CM transitions from one IP mode to another IP mode, the previous IP mode configuration is deleted from the DPE cache and replaced with the new IP mode configuration generated from the RDU. So if the CM transitions from IPv4 to IPv6 mode, the IPv4 configuration cache is removed from the DPE, and is replaced with the IPv6 configuration details.

When dual stack is enabled, DPE caches both IPv4 and IPv6 configuration details. The IPv4 configuration is stored using the MAC address and the IPv6 is stored using its DUID and none of the configuration details are deleted. You can view both the configuration details using the `show device-config` command.

You can enable or disable dual stack provisioning either from the Admin UI or using the API without restarting the RDU. Dual stack provisioning can be specified at any acceptable point in the property hierarchy. You can use the Device, Provisioning Group, Class of Service, DHCP Criteria, and Technology Defaults properties to accomplish this. To enable dual stack from the Admin UI at CoS, DHCP Criteria, and Device level, set the property `/dualStack/provisioning/mode/enable` to `true`. The API constant is

```
PolicyKeys.DUAL_STACK_PROVISIONING_MODE_ENABLE.
```

## Dual Stack Device Disruption Behavior



**Note** Prime Cable provisioning can disrupt only CableLabs DOCSIS, PacketCable and eRouter devices.

In single stack mode, when device disruption is initiated, Prime Cable Provisioning uses either IPv4 or IPv6 address to disrupt the device, based on the discovered data that is stored on the device (i.e., DHCPv4 or DHCPv6).

Once dual stack mode is enabled, the device disruption behavior depends on the value set for the property *dualStack/disruption/pref/mode*. This property can take the following values:

- *Dual-stack*—This is the default value set for this property. In this case, Prime Cable Provisioning sends two device disruption requests, one each for IPv4 and IPv6 address to disrupt the device.
- *IPv4*—In this case, IPv4 address is used to disrupt the device and the devices that have only IPv6 address are ignored.
- *IPv6*—In this case, IPv6 address is used to disrupt the device and the devices that have only IPv4 address are ignored.

The API constant for this property is `PolicyKeys.DUAL_STACK_DISRUPTION_PREF_MODE`. You can specify this property at any acceptable point in the property hierarchy.

## Single Stack versus Dual Stack

RFC 4213 defines dual stack as a technique to provide complete support for both Internet protocols—IPv4 and IPv6—in hosts and routers. Any network stack that supports both IPv4 and IPv6 is called a dual stack, and a host implementing a dual stack is called a dual-stack host.

Prime Cable Provisioning provisions cable modems in the following IP modes:

- *IPv4 only*—In this mode, the cable modem requests a DHCPv4 server for an IPv4 address and related operational parameters.
- *IPv6 only*—In this mode, the cable modem requests a DHCPv6 server for an IPv6 address and related operational parameters. The modem uses the IPv6 address to obtain the current time-of-day and a configuration file.
- *Dual stack*—In this mode, the cable modem acquires both IPv6 and IPv4 addresses and parameters through DHCPv6 and DHCPv4 almost simultaneously, prioritizing the use of the IPv6 address to acquire time-of-day and a configuration file.

While provisioning in the IPv4 and IPv6 modes, the cable modem operates with only one IP address type (v4 or v6) at any given time. For this reason, the IPv4 and IPv6 modes of provisioning are called single stack modes. In single stack mode, Prime Cable Provisioning saves discovered data only for the most recent IP mode that a cable modem is provisioned in. So, if a dual stack device boots in IPv4 mode, then in IPv6 mode, only IPv6 data is discovered and stored.

In the dual stack mode, you can manage the cable modem via IPv4 and IPv6 addresses simultaneously. In this mode, the modem acquires a second IP address after it is operational. Using this feature, you can provide streamlined migration from IPv4 to IPv6 in DOCSIS networks.

## DHCP Options for IPv6

The DOCSIS 3.0 standard defines several new options for DHCPv4 and DHCPv6. DHCPv6 options do not use any DHCPv4 options; they are unique and separate. For the list of DHCPv6 options that Prime Cable Provisioning also supports, see the [Cisco Prime Network Registrar End-User Guides](#).

## Configuration Workflows for IPv6

Configuring Prime Cable Provisioning to support IPv6 involves two distinct workflows:

- Configuring the DPEs in the provisioning group.
- Configuring the Cisco Prime Network Registrar servers in your network.

