

DHCP and DDNS

The following topics explain DHCP and DDNS services and how to configure them on Threat Defense devices.

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About DHCP and DDNS services

This topic describes the DHCP server, DHCP relay agent, and DDNS update.

DHCPv4 servers

A DHCPv4 server provides network configuration parameters, such as IP addresses, to DHCP clients.

- delivers configuration parameters directly to DHCP clients attached to Firewall Threat Defense device interfaces, and
- uses UDP port communication for client-server messaging.

DHCPv4 server communication details

The DHCP communication uses specific network protocols and port assignments:

- IPv4 DHCP client: Uses broadcast rather than multicast address to reach the server and listens for messages on UDP port 68
- DHCP server: Listens for messages on UDP port 67

The DHCP server for IPv6 is not supported; you can, however, enable DHCP relay for IPv6 traffic.

DHCP options

DHCP provides a framework for passing configuration information to hosts on a TCP/IP network. The configuration parameters are carried in tagged items that are stored in the Options field of the DHCP message

and the data are also called options. Vendor information is also stored in Options, and all of the vendor information extensions can be used as DHCP options.

Common DHCP options

Cisco IP Phones download their configuration from a TFTP server. When a Cisco IP Phone starts, if it does not have both the IP address and TFTP server IP address preconfigured, it sends a request with option 150 or 66 to the DHCP server to obtain this information.

- DHCP option 150 provides the IP addresses of a list of TFTP servers.
- DHCP option 66 gives the IP address or the hostname of a single TFTP server.
- DHCP option 3 sets the default route.

A single request might include both options 150 and 66. In this case, the DHCP server provides values for both options in the response if they are already configured on the Firewall Threat Defense.

You can use advanced DHCP options to provide DNS, WINS, and domain name parameters to DHCP clients. DHCP option 15 is used for the DNS domain suffix. You can also use the DHCP automatic configuration setting to obtain these values or define them manually. When you use more than one method to define this information, it is passed to DHCP clients in the following sequence:

1. Manually configured settings.
2. Advanced DHCP options settings.
3. DHCP automatic configuration settings.

Domain name configuration precedence

You can manually define the domain name that you want the DHCP clients to receive and then enable DHCP automatic configuration. Although DHCP automatic configuration discovers the domain together with the DNS and WINS servers, the manually defined domain name is passed to DHCP clients with the discovered DNS and WINS server names, because the domain name discovered by the DHCP automatic configuration process is superseded by the manually defined domain name.

DHCP relay agents

A DHCP relay agent forwards DHCP requests received on an interface to one or more DHCP servers.

DHCP relay agent operation

DHCP clients use UDP broadcasts to send their initial DHCPDISCOVER messages because they do not have information about the network to which they are attached. If the client is on a network segment that does not include a server, UDP broadcasts normally are not forwarded by the Firewall Threat Defense device because it does not forward broadcast traffic. The DHCP relay agent lets you configure the interface of the Firewall Threat Defense device that is receiving the broadcasts to forward DHCP requests to a DHCP server on another device.

Requirements and prerequisites for DHCP and DDNS

This reference provides the model support and user role requirements necessary for configuring DHCP and DDNS functionality.

Model support

Firewall Threat Defense

User roles

- Admin
- Access Admin
- Network Admin

Guidelines for DHCP and DDNS services

Context mode restrictions

DHCPv6 stateless server is not supported in multiple context mode.

Firewall mode restrictions

Consider these firewall mode limitations when configuring DHCP and DDNS services:

- DHCP Relay is not supported in transparent firewall mode or in routed mode on the BVI or bridge group member interface.
- DHCP Server is supported in transparent firewall mode on a bridge group member interface. In routed mode, the DHCP server is supported on the BVI interface, not the bridge group member interface. The BVI must have a name for the DHCP server to operate.
- DDNS is not supported in transparent firewall mode or in routed mode on the BVI or bridge group member interface.

Clustering limitations

DHCPv6 stateless server is not supported with clustering.

IPv6 support

Does not support IPv6 for DHCP server; IPv6 for DHCP relay is supported.

DHCPv4 server guidelines

Follow these guidelines when configuring DHCPv4 server:

- The maximum available DHCP pool is 256 addresses.
- You can configure a DHCP server on any interface with a name and IP address, such as a physical interface, a subinterface, or a BVI in routed mode.

- Do not select an interface that uses DHCP or PPPoE to obtain it's address as a DHCP server interface.
- You can configure only one DHCP server on each interface. Each interface can have its own pool of addresses to use. However the other DHCP settings, such as DNS servers, domain name, options, ping timeout, and WINS servers, are configured globally and used by the DHCP server on all interfaces.
- You cannot configure an interface as a DHCP client if that interface also has DHCP server enabled; you must use a static IP address.
- You cannot configure both a DHCP server and DHCP relay on the same device, even if you want to enable them on different interfaces; you can only configure one type of service.
- The Firewall Threat Defense does not support DHCP clients behind DHCP relay servers; the client must be directly connected to the Firewall Threat Defense.
- The DHCP server does not support BOOTP requests.

DHCPv6 server guidelines

Consider these guidelines when configuring DHCPv6 server:

DHCP relay guidelines

Follow these guidelines when configuring DHCP relay:

- You can configure a maximum of 10 DHCPv4 relay servers per virtual router, global (VRF) and interface-specific servers combined, with a maximum of 4 servers per interface.
- You can configure a maximum of 10 DHCPv6 relay servers per virtual router. Interface-specific servers for IPv6 are not supported.
- You cannot configure both a DHCP server and DHCP relay on the same device, even if you want to enable them on different interfaces; you can only configure one type of service.
- Do not select an interface that uses DHCP or PPPoE to obtain it's address as a DHCP relay interface.
- DHCP relay services are not available in transparent firewall mode or in routed mode on the BVI or bridge group member interface. You can, however, allow DHCP traffic through using an access rule. To allow DHCP requests and replies through the Firewall Threat Defense, you need to configure two access rules, one that allows DCHP requests from the inside interface to the outside (UDP destination port 67), and one that allows the replies from the server in the other direction (UDP destination port 68).
- For IPv4, clients must be directly-connected to the Firewall Threat Defense and cannot send requests through another relay agent or a router. For IPv6, the Firewall Threat Defense supports packets from another relay server.
- The DHCP clients must be on different interfaces from the DHCP servers to which the Firewall Threat Defense relays requests.
- You cannot enable DHCP Relay on an interface in a traffic zone.

DDNS service configuration

The firewall's DDNS supports only DynDNS service. Hence, ensure that the DDNS is configured with update URL in the following syntax:

https://*username***:***password***@***provider-domain*/*path***?hostname=<h>&myip=<a>**.

Configure the DHCPv4 server

Configure a DHCPv4 server to automatically assign IP addresses, DNS servers, domain names, and other network configuration parameters to DHCP clients on your network.

The DHCPv4 server provides dynamic IP address allocation and network configuration to clients. You can configure global server settings, interface-specific pools, and advanced DHCP options to customize the service for your network requirements.

Before you begin

Follow these steps to configure the DHCPv4 server:

Procedure

Step 1 Choose **Devices** > **Device Management**, and edit the Firewall Threat Defense device.

Step 2 Select **DHCP > DHCP Server**.

Step 3 Configure these DHCP server options:

- **Ping Timeout**—The amount of time in milliseconds that Firewall Threat Defense device waits to time out a DHCP ping attempt. Valid values range from 10 to 10000 milliseconds. The default value is 50 milliseconds.

  To avoid address conflicts, the Firewall Threat Defense device sends two ICMP ping packets to an address before assigning that address to a DHCP client.

- **Lease Length**—The amount of time in seconds that the client may use its allocated IP address before the lease expires. Valid values range from 300 to 1048575 seconds. The default value is 3600 seconds (1 hour).

- (Routed mode) **Auto-configuration**—Enables DHCP auto configuration on the Firewall Threat Defense device. Auto-configuration enables the DHCP server to provide the DHCP clients with the DNS server, domain name, and WINS server information obtained from a DHCP client running on the specified interface. Otherwise, you can disable auto configuration and add the values yourself in Step 4.

- (Routed mode) **Interface**—Specifies the interface to be used for auto configuration. For a device with virtual routing capability, this interface can only be a global virtual router interface.

Step 4 To override auto-configured settings, do the following:

- Enter the domain name of the interface. For example, your device may be in the Your_Company domain.

- From the drop-down list, choose the DNS servers (primary and secondary) configured for the interface. To add a new DNS server, see Create a network object.

- From the drop-down list, choose the WINS servers (primary and secondary) configured for the interface. To add a new WINS server, see Create a network object.

Step 5 Select **Server**, click **Add**, and configure the following options:

- **Interface**—Choose the interface from the drop-down list. In transparent mode, specify a named bridge group member interface. In routed mode, specify a named routed interface or a named BVI; do not specify

the bridge group member interface. Note that each bridge group member interface for the BVI must also be named for the DHCP server to operate.

- **Address Pool**—The range of IP addresses from lowest to highest that is used by the DHCP server. The range of IP addresses must be on the same subnet as the selected interface and cannot include the IP address of the interface itself.
- **Enable DHCP Server**—Enables the DHCP server on the selected interface.

Step 6 Click **OK** to save the DHCP server configuration.

Step 7 (Optional) Select **Advanced**, click **Add**, and specify the type of information you want the option to return to the DHCP client:

- **Option Code**—The Firewall Threat Defense device supports the DHCP options listed in RFC 2132, RFC 2562, and RFC 5510 to send information. All DHCP options (1 through 255) are supported except for 1, 12, 50–54, 58–59, 61, 67, and 82. See DHCPv4 servers, on page 1for more information on DHCP option codes.

  Note
  The Firewall Threat Defense device does not verify that the option type and value that you provide match the expected type and value for the option code, as defined in RFC 2132. For more information about option codes and their associated types and expected values, see RFC 2132.

- **Type**—DHCP option type. Available options include **IP**, **ASCII**, and **HEX**. If you chose IP, you must add IP addresses in the IP Address fields. If you chose ASCII, you must add the ASCII value in the ASCII field. If you chose HEX, you must add the HEX value in the HEX field.
- **IP Address 1** and **IP Address 2**—The IP address(es) to be returned with this option code. To add a new IP address, see Create a network object.
- **ASCII**—The ASCII value that is returned to the DHCP client. The string cannot include spaces.
- **HEX**—The HEX value that is returned to the DHCP client. The string must have an even number of digits and no spaces. You do not need to use a 0x prefix.

Step 8 Click **OK** to save the option code configuration.

Step 9 Click **Save** on the DHCP page to save your changes.

a) To view DHCP bindings, use **show dhcpd binding**.

Example:

```
> show dhcpd binding
IP Address Client-id         Lease Expiration  Type
10.0.1.100 0100.a0c9.868e.43 84985 seconds     automatic
```

Configure the DHCP relay agent

Configure a DHCP relay agent to forward DHCP requests received on an interface to one or more DHCP servers when DHCP clients and servers are on different network segments.

You can configure a DHCP relay agent to forward DHCP requests received on an interface to one or more DHCP servers. DHCP clients use UDP broadcasts to send their initial DHCPDISCOVER messages because they do not have information about the network to which they are attached. If the client is on a network segment that does not include a server, UDP broadcasts normally are not forwarded by the Firewall Threat Defense device because it does not forward broadcast traffic.

You can remedy this situation by configuring the interface of the Firewall Threat Defense device that is receiving the broadcasts to forward DHCP requests to a DHCP server on another interface.

Note DHCP Relay is not supported in transparent firewall mode.

Procedure

Step 1 Choose **Devices** > **Device Management**, and edit the Firewall Threat Defense device.

Step 2 Select **DHCP** > **DHCP Relay**.

Step 3 In the **IPv4 Relay Timeout** and **IPv6 Relay Timeout** fields, enter the amount of time in seconds that the Firewall Threat Defense device waits to time out the DHCP relay agent. Valid values range from 1 to 3600 seconds. The default value is 60 seconds.

The timeout is for address negotiation through the local DHCP Relay agent.

Step 4 (Optional) Check **Trust All Information** to set all client interfaces as trusted.

You can configure interfaces as trusted interfaces to preserve DHCP Option 82. DHCP Option 82 is used by downstream switches and routers for DHCP snooping and IP Source Guard. Normally, if the Firewall Threat Defense DHCP relay agent receives a DHCP packet with Option 82 already set, but the giaddr field (which specifies the DHCP relay agent address that is set by the relay agent before it forwards the packet to the server) is set to 0, then the Firewall Threat Defense will drop that packet by default. You can preserve Option 82 and forward the packet by identifying an interface as a trusted interface.

Step 5 On **DHCP Relay Agent**, click **Add**, and configure these options:

- **Interface**—The interface connected to the DHCP clients.
- **Enable IPv4 Relay**—Enables IPv4 DHCP Relay for this interface.
- **Set Route**—(For IPv4) Changes the default gateway address in the DHCP message from the server to that of the Firewall Threat Defense device interface that is closest to the DHCP client, which relayed the original DHCP request. This action allows the client to set its default route to point to the Firewall Threat Defense device even if the DHCP server specifies a different router. If there is no default router option in the packet, the Firewall Threat Defense device adds one containing the interface address.
- **Enable IPv6 Relay**—Enables IPv6 DHCP Relay for this interface.

Step 6 Click **OK** to save the DHCP relay agent changes.

Step 7 On **DHCP Servers**, click **Add**, and configure these options:

Add the IPv4 and IPv6 server addresses as separate entries, even if they belong to the same server.

- **Server**—The IP address of the DHCP server. Chose an IP address from the drop-down list. To add a new one, see Create a network object
- **Interface**—The interface to which the specified DHCP server is attached. The DHCP Relay agent and the DHCP server cannot be configured on the same interface.

Step 8 Click **OK** to save the DHCP server changes.

Step 9 Click **Save** on the DHCP page to save your changes.

Configure Dynamic DNS

When an interface uses DHCP IP addressing, the assigned IP address can change when the DHCP lease is renewed. When the interface needs to be reachable using a fully qualified domain name (FQDN), the IP address change can cause the DNS server resource records (RRs) to become stale. Dynamic DNS (DDNS) provides a mechanism to update DNS RRs whenever the IP address or hostname changes. You can also use DDNS for static or PPPoE IP addressing.

DDNS updates these RRs on the DNS server: the A RR includes the name-to-IP address mapping, while the PTR RR maps addresses to names.

The Firewall Threat Defense supports these DDNS update methods:

- Standard DDNS—The standard DDNS update method is defined by RFC 2136.

  With this method, the Firewall Threat Defense and the DHCP server use DNS requests to update the DNS RRs. The Firewall Threat Defense or DHCP server sends a DNS request to its local DNS server for information about the hostname and, based on the response, determines the main DNS server that owns the RRs. The Firewall Threat Defense or DHCP server then sends an update request directly to the main DNS server. See these typical scenarios.

  - The Firewall Threat Defense updates the A RR, and the DHCP server updates the PTR RR.

    Typically, the Firewall Threat Defense "owns" the A RR, while the DHCP server "owns" the PTR RR, so both entities need to request updates separately. When the IP address or hostname changes, the Firewall Threat Defense sends a DHCP request (including the FQDN option) to the DHCP server to inform it that it needs to request a PTR RR update.

  - The DHCP server updates both the A and PTR RR.

    Use this scenario if the Firewall Threat Defense does not have the authority to update the A RR. When the IP address or hostname changes, the Firewall Threat Defense sends a DHCP request (including the FQDN option) to the DHCP server to inform it that it needs to request an A and PTR RR update.

  You can configure different ownership depending on your security needs and the requirements of the main DNS server. For example, for a static address, the Firewall Threat Defense should own the updates for both records.

- Web—The Web update method uses the DynDNS Remote API specification (https://help.dyn.com/remote-access-api/).

  With this method when the IP address or hostname changes, the Firewall Threat Defense sends an HTTP request directly to a DNS provider with which you have an account.

The **DDNS** page also supports setting DHCP server settings relating to DDNS.

Note DDNS is not supported on the BVI or bridge group member interfaces.

Before you begin

- Configure a DNS server group on **Objects** > **Object Management** > **DNS Server Group**, and then enable the group for the interface on **Devices** > **Platform Settings**, create or edit a Threat Defense policy and click **DNS**. See Configure DNS server settings.
- Configure the device hostname. You can configure the hostname when you perform the Firewall Threat Defense initial setup, or by using the **configure network hostname** command. If you do not specify the hostname per interface, then the device hostname is used.

Procedure

Step 1 Choose **Devices** > **Device Management**, and edit the Firewall Threat Defense device.

Step 2 Choose **DHCP** > **DDNS**.

Step 3 Standard DDNS method: Configure a DDNS update method to enable DNS requests from the Firewall Threat Defense.

You do not need to configure a DDNS update method if the DHCP server will perform all requests.

a) On **DDNS Update Methods**, click **Add**.
b) Set the **Method Name**.
c) Click **DDNS**.
d) (Optional) Configure the **Update Interval** between DNS requests. By default when all values are set to 0, update requests are sent whenever the IP address or hostname changes. To send requests regularly, set the **Days** (0-364), **Hours**, **Minutes**, and **Seconds**.
e) Set the **Update Records** you want the Firewall Threat Defense to update.

This setting only affects the records you want to update directly from the Firewall Threat Defense; to determine the records you want the DHCP server to update, configure the DHCP client settings per interface or globally. See, Step 5, on page 10.

- **Not Defined**—Disables DNS updates from the Firewall Threat Defense.
- **Both A and PTR Records**—Sets the Firewall Threat Defense to update both A and PTR RRs. Use this option for static or PPPoE IP addressing.
- **A Records**—Sets the Firewall Threat Defense to update the A RR only. Use this option if you want the DHCP server to update the PTR RR.

f) Click **OK**.
g) Assign this method to the interface in Step 5, on page 10.

Step 4 Web method: Configure a DDNS update method to enable HTTP update requests from the Firewall Threat Defense.

a) On **DDNS Update Methods**, click **Add**.

b) Set the **Method Name**.
c) Click **Web**.
d) Set the **Web Update Type** to update IPv4, IPv6, or both types of addresses.
e) Set the **Web URL**. Specify the update URL. Check with your DNS provider for the URL required.

Use this syntax:

https://*username***:***password***@***provider-domain***/***path***?hostname=<h>&myip=<a>**

Example:

https://jcrichton:pa$$w0rd17@domains.example.com/nic/update?hostname=<h>&myip=<a>

f) (Optional) Configure the **Update Interval** between DNS requests. By default when all values are set to 0, update requests are sent whenever the IP address or hostname changes. To send requests regularly, set the **Days** (0-364), **Hours**, **Minutes**, and **Seconds**.
g) Click **OK**.
h) Assign this method to the interface in Step 5, on page 10.
i) The web type method for DDNS also requires you to identify the DDNS server root CA to validate the DDNS server certificate for the HTTPS connection. See, Step 9, on page 12.

Step 5 Configure interface settings for DDNS, including setting the update method, DHCP client settings, and the hostname for this interface.

a) On **DDNS Interface Settings**, click **Add**.
b) Choose the **Interface** from the drop-down list.
c) Choose the **Method Name** that you created on the **DDNS Update Methods** page.

(Standard DDNS method) You do not need to assign a method if you want the DHCP server to perform all updates.

d) Set the **Host Name** for this interface.

If you do not set the hostname, the device hostname is used. If you do not specify an FQDN, then the default domain from the DNS server group is appended (for static or PPPoE IP addressing) or the domain name from the DHCP server is appended (for DHCP IP addressing).

e) Standard DDNS method: Configure the **DHCP Client requests DHCP server to update requests** to determine which records you want the DHCP server to update.

The Firewall Threat Defense sends DHCP client requests to the DHCP server. Note that the DHCP server must also be configured to support DDNS. The server can be configured to honor the client requests, or it can override the client (in which case, it will reply to the client so the client does not also try to perform updates that the server is performing).

For static or PPPoE IP addressing, these settings are ignored.

Note
You can also set these values globally for all interfaces on the **DDNS** page. The per-interface settings take precedence over the global settings.

- **Not Selected**—Disables DDNS requests to the DHCP server. Even if the client does not request DDNS updates, the DHCP server can be configured to send updates anyway.
- **No Update**—Requests the DHCP server not to perform updates. This setting works in conjunction with a DDNS update method with **Both A and PTR Records** enabled.

- **Only PTR**—Requests that the DHCP server perform the PTR RR update. This setting works in conjunction with a DDNS update method with **A Records** enabled. Use this setting to enable DHCP option 81.
- **Both A and PTR Records**—Requests that the DHCP server perform both A and PTR RR updates. This setting does not require a DDNS update method to be associated with the interface.

f) Click **OK**.

Note
The **Dynamic DNS Update** settings relate to DHCP server settings when you enable a DHCP server on the Firewall Threat Defense. See, Step 6, on page 11 for more information.

Step 6 If you enable the DHCP server on an Firewall Threat Defense, you can configure DHCP server settings for DDNS.

To enable the DHCP server, see Configure the DHCPv4 server, on page 5). You can configure the server behavior when DHCP clients use the standard DDNS update method. If the server performs any updates, then if the client lease expires (and is not renewed), the server will request that the DNS server remove the RRs for which it was responsible.

a) You can configure server settings globally or per interface. For global settings, refer to the main **DDNS** page. For per-interface settings, refer to the **DDNS Interface Settings** page. Interface settings take precedence over global settings.
b) Configure which DNS RRs you want the DHCP server to update under **Dynamic DNS Update**.
   - **Not Selected**—DDNS updates are disabled, even if the client requests them.
   - **Only PTR**—Enables DDNS updates. If you enable the **Override DHCP Client Requests** setting, then the server will only update the PTR RR. Otherwise, the server will update RRs that the client requests. If the client does not send an update request with the FQDN option, the server will request an update for both A and PTR RRs using the hostname discovered in DHCP option 12.
   - **Both A and PTR Records**—Enables DDNS updates. If you enable the **Override DHCP Client Requests** setting, then the server will update both the A and PTR RRs. Otherwise, the server will update RRs that the client requests. If the client does not send an update request with the FQDN option, the server will request an update for both A and PTR RRs using the hostname discovered in DHCP option 12.
c) To override the update actions requested by the DHCP client, check **Override DHCP Client Requests**.

   The server will reply to the client that the request was overridden, so the client does not also try to perform updates that the server is performing.

Step 7 (Optional) Configure general DHCP client settings. These settings are not related to DDNS, but are related to how the DHCP client behaves.

a) On the **DDNS** page, check **Enable DHCP Client Broadcast** to request that the DHCP server broadcast the DHCP reply (DHCP option 1).
b) To force a MAC address to be stored inside a DHCP request packet for option 61 instead of the default internally generated string, on **DDNS** > **DHCP Client ID Interface**, choose the interface from the **Available Interfaces** list, and then click **Add** to move it to the **Selected Interfaces** list.

Some ISPs expect option 61 to be the interface MAC address. If the MAC address is not included in the DHCP request packet, then an IP address will not be assigned. This setting does not directly relate to DDNS, but is a general DHCP client setting.

Step 8 Click **Save** on the Device page to save your changes.

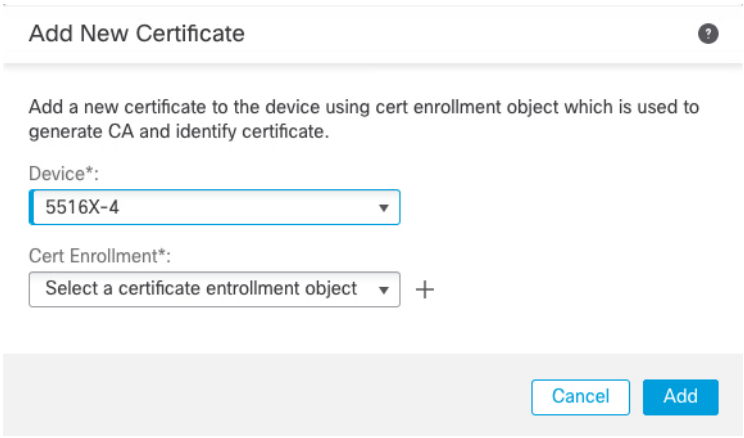
Step 9 The Web method for DDNS also requires you to identify the DDNS server root CA to validate the DDNS server certificate for the HTTPS connection.

This example shows how to add a DDNS server's CA as a trustpoint.

a) Obtain the DDNS server CA certificate. This procedure shows a manual import using PEM format, but you can also use PKCS12.

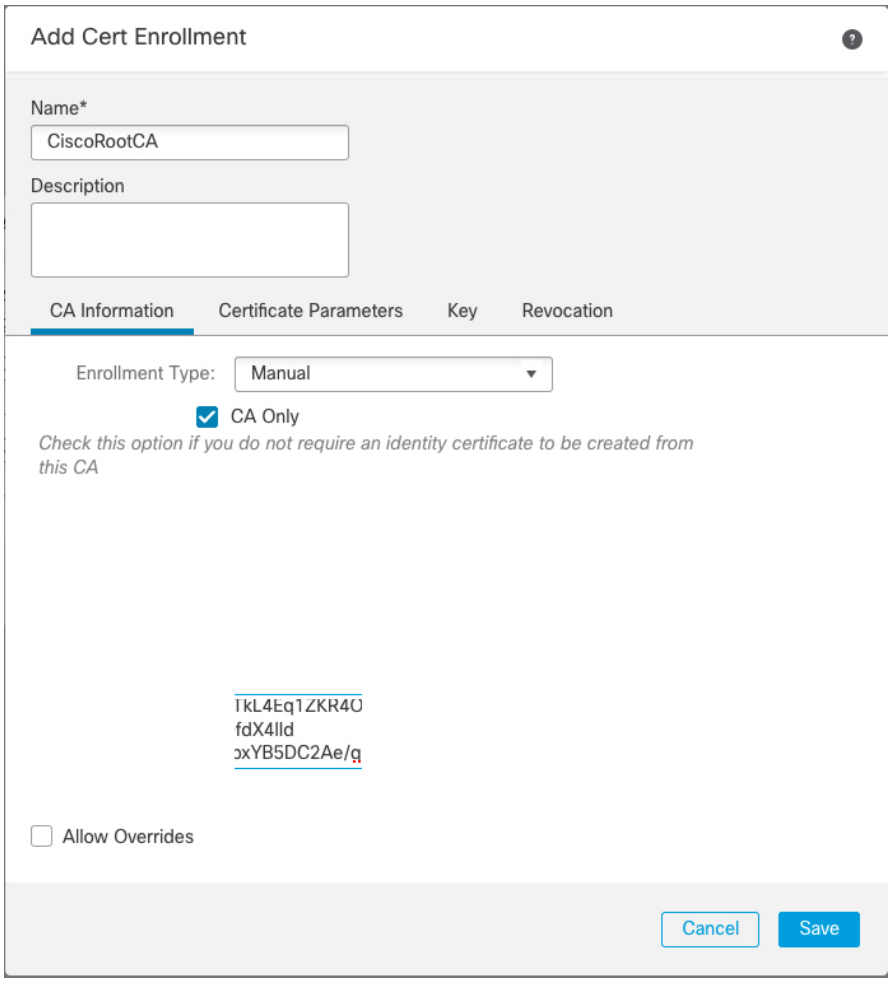
b) In Firewall Management Center, choose **Devices** > **Certificates**, and click **Add**.

c) Select a **Device**, and click **Add** (+).



The **Add Cert Enrollment** dialog box appears.

d) Enter these fields, and click **Save**:



- Enter a **Name**.
- Choose **Enrollment Type** > **Manual**.
- Click **CA Only**.
- Paste in the CA text from step 9.a, on page 12.

e) Click **Save**.