



Preparing to Install the Cisco IP Phone on Your Network

Cisco IP Phones enable you to communicate using voice over a data network. To provide this capability, the IP Phones depend upon and interact with several other key Cisco IP Telephony and network components, including Cisco CallManager, DNS and DHCP servers, TFTP servers, media resources, Cisco prestandard PoE, and so on.

This chapter focuses on the interactions between the Cisco IP Phone 7970 Series and Cisco CallManager, TFTP server, and switches. For related information about other major components in a Voice over IP (VoIP) network, refer to the *Cisco IP Telephony Solution Reference Network Design (SRND) for Cisco CallManager 4.0*, which is available at this URL:

<http://www.cisco.com/go/srnd>

This chapter provides an overview of the interaction between the Cisco IP Phone 7970 Series and other key components of the Voice over IP (VoIP) network.

This chapter includes the following topics:

- [Understanding Interactions with Other Cisco IP Telephony Products, page 2-2](#)
- [Understanding the Phone Startup Process, page 2-4](#)
- [Understanding Phone Configuration Files, page 2-6](#)
- [Providing Power to the Cisco IP Phone 7970 Series, page 2-7](#)
- [Adding Phones to the Cisco CallManager Database, page 2-15](#)

Understanding Interactions with Other Cisco IP Telephony Products

To function in the IP telephony network, the Cisco IP Phone must be connected to a networking device, such as a Cisco switch. You must also register the Cisco IP Phone with a Cisco CallManager system before sending and receiving calls.

This section includes the following topics:

- [Understanding How the Cisco IP Phone Interacts with Cisco CallManager, page 2-2](#)
- [Understanding How the Cisco IP Phone Interacts with the Cisco Family of Switches, page 2-3](#)

Understanding How the Cisco IP Phone Interacts with Cisco CallManager

Cisco CallManager is an open and industry-standard call processing system. Cisco CallManager software sets up and tears down calls between phones, integrating traditional PBX functionality with the corporate IP network. Cisco CallManager manages the components of the IP telephony system—the phones, the access gateways, and the resources necessary for such features as call conferencing and route planning. Cisco CallManager also provides authentication and encryption if configured for the telephony system.

For information about configuring Cisco CallManager to work with the IP devices described in this chapter, refer to *Cisco CallManager Administration Guide*, *Cisco CallManager System Guide*, and to *Cisco IP Phone Authentication and Encryption for Cisco CallManager 4.0(1)*.

For an overview of security functionality for the Cisco IP Phone, see the “[Understanding Security Features for Cisco IP Phones](#)” section on [page 1-10](#).

**Note**

If the Cisco IP Phone model that you want to configure does not appear in the Phone Type drop-down list in Cisco CallManager Administration, go to the following URL and install the latest support patch for your version of Cisco CallManager: <http://www.cisco.com/kobayashi/sw-center/sw-voice.shtml>

Related Topic

- [Telephony Features Available for the Phone, page 5-2](#)

Understanding How the Cisco IP Phone Interacts with the Cisco Family of Switches

The Cisco IP Phone 7970 Series have an internal Ethernet switch, enabling forwarding of packets to the phone, and to the access port and the network port on the back of the phone.

If a computer is connected to the access port, the computer and the phone share the same physical link to the switch and share the same port on the switch. This shared physical link has the following implications for the VLAN configuration on the network:

- The current VLANs might be configured on an IP subnet basis. However, additional IP addresses might not be available to assign the phone to the same subnet as other devices connected to the same port.
- Data traffic on the VLAN-supported phones might affect the quality of Voice-over-IP traffic.

You can resolve these issues by isolating the voice traffic onto a separate VLAN on each of the ports connected to a phone. The switch port configured for the phone connection would have separate VLANs configured for carrying:

- Voice traffic to and from the IP phone (auxiliary VLAN)
- Data traffic to and from the PC connected to the switch through the access port of the IP phone (native VLAN)

Isolating the phones on a separate, auxiliary VLAN improves the quality of the voice traffic and allows a large number of phones to be added to an existing network where there are not enough IP addresses for each phone.

For more information, refer to the documentation included with a Cisco switch. You can also access related documentation at this URL:

<http://www.cisco.com/univercd/cc/td/doc/product/lan/index.htm>

Related Topics

- [Understanding the Phone Startup Process, page 2-4](#)
- [Network Configuration Menu, page 4-6](#)

Understanding the Phone Startup Process

When connecting to the VoIP network, the Cisco IP Phone goes through a standard startup process that is composed of several steps, as described in [Table 2-1](#). Depending on your specific network configuration, not all of these steps may occur on your Cisco IP Phone.

Table 2-1 Cisco IP Phone Startup Process

Step	Description	Related Topics
1. Obtaining Power from the Switch.	<p>You can connect the Cisco IP Phone to a Cisco switch with one of the modules that provides power to the phone.</p> <p>In this optional configuration, the switch determines whether the phone requires power. If the phone does require power, the switch applies power. If the phone can support different power levels, the phone may come up in full-power mode.</p>	<ul style="list-style-type: none"> • Providing Power to the Cisco IP Phone 7970 Series, page 2-7. • Resolving Startup Problems, page 9-2.
2. Loading the Stored Phone Image.	The Cisco IP Phone has non-volatile Flash memory in which it stores firmware images and user-defined preferences. At startup, the phone runs a bootstrap loader that loads a phone image stored in Flash memory. Using this image, the phone initializes its software and hardware.	Resolving Startup Problems, page 9-2.
3. Configuring VLAN.	If the Cisco IP Phone is connected to a Cisco switch, the switch next informs the phone of the voice VLAN defined on the switch. The phone needs to know its VLAN membership before it can proceed with the Dynamic Host Configuration Protocol (DHCP) request for an IP address.	<ul style="list-style-type: none"> • Network Configuration Menu, page 4-6. • Resolving Startup Problems, page 9-2.
4. Obtaining an IP Address.	If the Cisco IP Phone is using DHCP to obtain an IP address, the phone queries the DHCP server to obtain one. If you are not using DHCP in your network, you must assign static IP addresses to each phone locally.	<ul style="list-style-type: none"> • Network Configuration Menu, page 4-6. • Resolving Startup Problems, page 9-2.

Table 2-1 Cisco IP Phone Startup Process (continued)

Step	Description	Related Topics
<p>5. Accessing a TFTP Server.</p>	<p>In addition to assigning an IP address, the DHCP server directs the Cisco IP Phone to a TFTP Server. If the phone has a statically-defined IP address, you must configure the TFTP server locally on the phone; the phone then contacts the TFTP server directly.</p> <p>Note You can also assign an alternative TFTP server to use instead of the one assigned by DHCP.</p>	<ul style="list-style-type: none"> • Network Configuration Menu, page 4-6. • Resolving Startup Problems, page 9-2.
<p>6. Requesting the CTL file.</p>	<p>The TFTP server stores the certificate trust list (CTL) file. This file contains a list of Cisco CallManagers and TFTP servers that the phone is authorized to connect to. It also contains the certificates necessary for establishing a secure connection between the phone and Cisco CallManager.</p>	<p>For more information, refer to <i>Cisco IP Phone Authentication and Encryption for Cisco CallManager 4.0(1)</i></p>

Table 2-1 Cisco IP Phone Startup Process (continued)

Step	Description	Related Topics
7. Requesting the Configuration File.	The TFTP server has configuration files, which define parameters for connecting to Cisco CallManager and other information for the phone.	<ul style="list-style-type: none"> • Understanding Phone Configuration Files, page 2-6 • Resolving Startup Problems, page 9-2.
8. Contacting Cisco CallManager.	<p>The configuration file defines how the Cisco IP Phone communicates with Cisco CallManager. After obtaining the file from the TFTP server, the phone attempts to make a connection to the highest priority Cisco CallManager on the list. If security is implemented, the phone makes a TLS connection. Otherwise, it makes a non-secure TCP connection.</p> <p>If the phone was manually added to the database, Cisco CallManager identifies the phone. If the phone was not manually added to the database and auto-registration is enabled in Cisco CallManager, the phone attempts to auto-register itself in the Cisco CallManager database.</p> <p>Note Auto-registration must be disabled if security is implemented.</p> <p>The configuration file provides a phone with its load ID.</p>	Resolving Startup Problems, page 9-2.

Understanding Phone Configuration Files

Configuration files for a phone are stored on the TFTP server and define parameters for connecting to Cisco CallManager. In general, any time you make a change in Cisco CallManager that requires the phone to be reset, a change is made to the phone's configuration file automatically.

Configuration files also contain information about which image load the phone should be running. If this image load differs from the one currently loaded on a phone, the phone contacts the TFTP server to request the required .loads and .sbn files. (These files are digitally signed to ensure the authenticity of the files' source.)

In addition, if the device security mode in the configuration file is set to Authenticated and the CTL file on the phone has a valid certificate for Cisco CallManager, the phone establishes a TLS connection to Cisco CallManager. Otherwise, the phone establishes a TCP connection.

A phone requests a configuration file whenever it resets and registers with Cisco CallManager.

A phone accesses a default configuration file named XmlDefault.cnf.xml from the TFTP server when the following conditions exist:

- You have enabled auto-registration in Cisco CallManager
- The phone has not been added to the Cisco CallManager Database
- The phone is registering for the first time

**Note**

If security is implemented, a phone will not access the XmlDefault.cnf.xml configuration file.

All other times, a phone accesses a .cnf.xml file corresponding to its device name.

Providing Power to the Cisco IP Phone 7970 Series

With a backlit color display and touchscreen, the Cisco IP Phone 7970 Series require more power than other Cisco IP Phones. This section provides information about power for the Cisco IP Phone 7970 Series.

For related information, refer to the documents shown in [Table 2-2](#). These document provide information about the following topics:

- Cisco switches that work with the Cisco IP Phone 7970 Series and that support IEEE 802.3af when a phone is in full-power mode
- The Cisco IOS releases that support bidirectional CDP power negotiation
- Other requirements and restrictions regarding power

Table 2-2 Related Documentation for Power

Document Topics	URL
PoE Solutions	http://www.cisco.com/en/US/netsol/ns340/ns394/ns147/ns412/networking_solutions_package.html
Cisco Catalyst Switches	http://www.cisco.com/univercd/cc/td/doc/product/lan/index.htm
Integrated Service Routers	http://www.cisco.com/en/US/products/hw/routers/index.html
Cisco IOS Software	http://www.cisco.com/en/US/products/sw/iosswrel/products_ios_cisco_ios_software_category_home.html
Catalyst 6500 Series Software Release 8.x Release Notes	http://www.cisco.com/en/US/partner/products/hw/switches/ps708/prod_release_note09186a008019d7f0.html

This section includes these topics:

- [Power Requirements, page 2-8](#)
- [Power Modes, page 2-11](#)
- [Cisco Switches, Modules, and Cards that can Provide In-Line Power to the Cisco IP Phone 7971G-GE, page 2-13](#)

Power Requirements

The following guidelines regarding power apply to the Cisco IP Phone 7900 Series:

- A Cisco IP Phone 7971G-GE cannot power up using Cisco prestandard PoE or IEEE 802.3af Class 2 or lower. A Cisco IP Phone 7971G-GE will only power up when connected to a switch that supports IEEE 802.3af Class 3 (15.4 W in-line power at the switch port).

- The Cisco IP Phone cannot use an older external power supply (CP-CUBE-PWR).

The Cisco IP Phone uses a new power supply, CP-PWR-CUBE-2 (341-0081-01). The older power supply, CP-PWR-CUBE= (34-1537-01), does not provide sufficient power to the Cisco IP Phone and will not connect to the phone. You can also use this new power supply with other Cisco IP Phones.

- The Cisco IP Phone cannot use the inline power patch panel WS-PWR-PANEL. This power source is not compatible with the Cisco IP Phone.
- The Cisco IP Phone 7971G-GE is not compatible with switches that are not IEEE 802.3af-compliant.
- Any changes to the phone's current power source may cause the phone to restart.

If the phone starts up using in-line power and is then connected to an external power supply, the phone may restart. If the phone starts up using an external power supply but loses that connection and switches to in-line power, the phone may restart.

- To ensure uninterruptible operation of a phone, use in-line power and make sure that the switch has a backup power supply.
- When the Cisco IP Phone 7970G starts up with inline power, it starts in low-power mode. It then attempts to negotiate for full power using CDP. If the switch supports the new power negotiation feature, which may be a part of CDP version 2, and grants the phone enough power, the phone will go to full-power mode. If the switch does not support CDP power negotiation, the phone will stay in low power mode.

- [Table 2-3](#) describes the PoE discovery methods that the phones support.

Table 2-3 PoE Discovery Methods for the Cisco IP Phone 7970 Series

Model	Discovery Method
Cisco IP Phone 7970G	<ul style="list-style-type: none"> • Cisco prestandard PoE or IEEE 802.3af, when receiving power over the data pair • IEEE 802.3af, when receiving power over the spare pair <p>Note Cisco prestandard PoE over the spare pair is not supported</p>
Cisco IP Phone 7971G-GE	IEEE 802.3af over the data pair or the spare pair

- [Table 2-4](#) shows the maximum power required from a switch for the Cisco IP Phone 7970 Series. These values include power losses in the cable that connects the phone to the switch.

Table 2-4 Maximum Power From a Switch

Phone Model and Power Mode	Maximum Power Consumed	LCD Brightness
Cisco IP Phone 7970G in low-power mode	6.3 W	Approximately 1/2
Cisco IP Phone 7970G in full-power mode	10.25 W	Full
Cisco IP Phone 7971G-GE in low-power mode	15.4 W	Near full
Cisco IP Phone 7971G-GE in low-power mode	Requires Cisco-approved external power supply	Full

Power Modes

Depending on how a Cisco IP Phone 7900 Series is powered, the phone may operate in low-power mode or in full-power mode. In low-power mode:

- The brightness of the LCD screen on the Cisco IP Phone 7970 will appear at about half its full brightness
- The brightness of the LCD screen of the Cisco IP Phone 7971G-GE will appear almost at full brightness
- The Brightness control on a phone (**Settings > User Preferences > Brightness**) will not allow you to set the brightness to the maximum value

[Table 2-5](#) describes the Cisco and third-party switch configurations that determine the power mode in which a phone operates.



Note

The power negotiation feature that is described in this table is optional and may be available in a Cisco switch as part of CDP Version 2.

Table 2-5 Cisco IP Phone 7970 Series Power Modes

Mode	Cisco Switch Configurations	Third-Party Switch Configurations
Cisco IP Phone 7970G— low-power mode	<ul style="list-style-type: none"> • IEEE 802.3af in-line power from a Cisco switch that does not support the power negotiation feature or on which the power negotiation feature is disabled • Cisco prestandard PoE from a Cisco Switch that supports a maximum of 7 W in-line power per port • Cisco prestandard PoE from a Cisco Switch that supports 7 W or 15.4 W in-line power per port, and that does not support the power negotiation feature or on which the power negotiation feature is disabled 	<ul style="list-style-type: none"> • IEEE 802.3af in-line power
Cisco IP Phone 7970G— full-power mode	<ul style="list-style-type: none"> • Cisco-approved external power supply • IEEE 802.3af in-line power from a Cisco switch on which the power negotiation feature is enabled • Cisco prestandard PoE from a Cisco Switch that supports 15.4 W in-line power per port, and on which the power negotiation feature is enabled 	<ul style="list-style-type: none"> • Cisco-approved external power supply
Cisco IP Phone 7971G-GE— low-power mode	<ul style="list-style-type: none"> • IEEE 802.3af in-line power from a Cisco switch, regardless of whether the power negotiation feature is enabled 	<ul style="list-style-type: none"> • IEEE 802.3af in-line power
Cisco IP Phone 7971G-GE— full-power mode	<ul style="list-style-type: none"> • Cisco-approved external power supply 	<ul style="list-style-type: none"> • Cisco-approved external power supply

Cisco Switches, Modules, and Cards that can Provide In-Line Power to the Cisco IP Phone 7971G-GE

Table 2-6 shows lists of some of Cisco switches, modules, and cards that can support IEEE 802.3af Class 3 power and provide in-line power to the Cisco IP Phone 7971G-GE.

Table 2-6 Cisco Products that Power the Cisco IP Phone 7971G-GE— Partial List

Product	Model	Description
Cisco Catalyst 3550 Series switch	WS-3550-24 PWR	24 ports 10/100 with PoE, 2 GBIC, stackable
Cisco Catalyst 3560 Series switch	WS-3560-48PS	48 ports 10/100 with PoE, 4 SFP
	WS-3560-24PS	24 ports 10/100 with PoE, 2 SFP
	WS-3560G-48PS	8 ports 10/100/1000 with PoE, 4 SFP
	WS-3560G-24PS	24 ports 10/100/1000 with PoE, 4 SFP
Cisco Catalyst 3750 Series switch	WS-3750-48PS	48 ports 10/100 w/ PoE, 4 SFP, stackable
	WS-3750-24PS	24 ports 10/100 w/ PoE, 2 SFP, stackable
	WS-3750G-48PS	48 ports 10/100/1000 w/ PoE, 4 SFP, stackable
	WS-3750G-24PS	24 ports 10/100/1000 w/ PoE, 4 SFP, stackable
Catalyst 4500 Series PoE line cards	Catalyst 4500 PoE 802.3af 10/100, 48-Port(RJ45) line card	—
	Catalyst 4500 PoE 802.3af 10/100, 48-Port(RJ21) line card	—
	Catalyst 4500 PoE 802.3af 10/100/1000, 48-Port(RJ45) line card	—

Table 2-6 Cisco Products that Power the Cisco IP Phone 7971G-GE— Partial List (continued)

Product	Model	Description
Cisco Catalyst 6500 Series 96-port 10/100 Module	WS-X6148X2-RJ-45	96-port 10/100 classic module, RJ-45, upgradeable to PoE
Note The 96-port 10/100 module comes in data and PoE versions. Consistent with the Catalyst 6500 pay-as-you-grow architecture model, the data version can be upgraded to support IEEE 802.3af PoE via the addition of a daughter card later for maximum investment protection. This PoE module can support up to 48 Class 3 devices (15.4W) simultaneously or up to 96 Class 1 or Class 2 devices	WS-X6148X2-45AF	96-port 10/100 802.3af PoE classic module, RJ-45
Cisco Catalyst 6500 Series 48-port 10/100/1000 and 10/100 PoE Modules	WS-X6148-GE-45AF	48-port 10/100/1000 802.3af PoE classic module, RJ-45
	WS-X6548-GE-45AF	48-port 10/100/1000 802.3af PoE CEF256 module, RJ-45
	WS-X6148-45AF	48-port 10/100 802.3af PoE classic module, RJ-45
	WS-X6148-21AF	48-port 10/100 802.3af PoE classic module, RJ-21
Catalyst 6500 Series daughter cards	WS-F6K-GE48-AF=	802.3af PoE daughter card for the WS-X6148-GE-TX and WSX6548-GE-TX modules
	WS-F6K-FE48X2-AF=	802.3af PoE daughter card for the WS-X6148X2-RJ-45 module

Adding Phones to the Cisco CallManager Database

Before installing the Cisco IP phone, you must choose a method for adding phones to the Cisco CallManager database. The following sections describe these methods:

- [Adding Phones with Auto-Registration, page 2-16](#)
- [Adding Phones with Auto-Registration and TAPS, page 2-17](#)
- [Adding Phones with Cisco CallManager Administration, page 2-18](#)
- [Adding Phones with BAT, page 2-18](#)

[Table 2-7](#) provides an overview of these methods for adding phones to the Cisco CallManager database.

Table 2-7 *Methods for Adding Phones to the Cisco CallManager Database*

Method	Requires MAC Address?	Notes
Auto-registration	No	Results in automatic assignment of directory numbers
Auto-registration with TAPS	No	Requires auto-registration and the Bulk Administration Tool (BAT); updates information in the Cisco IP Phone and in Cisco CallManager Administration
Using the Cisco CallManager Administration	Yes	Requires phones to be added individually
Using BAT	Yes	Allows for simultaneous registration of multiple phones

Adding Phones with Auto-Registration

You can add phones with auto-registration without first gathering MAC addresses from the phones.

**Note**

Cisco recommends you use auto-registration to add less than 100 phones to your network. To add more than 100 phones to your network, use the Bulk Administration Tool (BAT).

When auto-registration is enabled, Cisco CallManager begins the automatic startup process to obtain a directory number. During auto-registration, Cisco CallManager automatically assigns the next available sequential directory number to the phone.

When you use this method, Cisco CallManager automatically assigns directory numbers to new phones as they register with Cisco CallManager.

You can use auto-registration to quickly enter phones into the Cisco CallManager database. You can then modify any settings, such as the directory numbers, from Cisco CallManager. Additionally, you can move auto-registered phones to new locations and assign them to different device pools without affecting their directory numbers.

Auto-registration is disabled by default.

For information about enabling and configuring auto-registration, refer to *Cisco CallManager Administration Guide*.

**Note**

When you configure the cluster for mixed mode through the Cisco CTL client, auto-registration is automatically disabled. When you configure the cluster for non-secure mode through the Cisco CTL client, auto-registration is automatically enabled.

Related Topics

- [Adding Phones with Auto-Registration and TAPS, page 2-17](#)
- [Adding Phones with Cisco CallManager Administration, page 2-18](#)
- [Adding Phones with BAT, page 2-18](#)

Adding Phones with Auto-Registration and TAPS

You can add phones with auto-registration and TAPS without first gathering MAC addresses from phones.

**Note**

Cisco recommends you use auto-registration and TAPS to add less than 100 phones to your network. To add more than 100 phones to your network, use the Bulk Administration Tool (BAT).

TAPS, the Tool for Auto-Registered Phones Support, works with the Bulk Administration Tool (BAT) to update phones that were already added to the Cisco CallManager database with dummy MAC addresses. Use TAPS to update MAC addresses and download pre-defined configurations for phones.

To implement TAPS, you or the end-user dial a TAPS directory number and follow voice prompts. When the process is complete, the phone will have downloaded its directory number and other settings, and the phone will be updated in Cisco CallManager Administration with the correct MAC address.

You must make sure that Auto-registration is enabled in Cisco CallManager Administration (System > Cisco CallManager) for TAPS to function.

**Note**

When you configure the cluster for mixed mode through the Cisco CTL client, auto-registration is automatically disabled. When you configure the cluster for non-secure mode through the Cisco CTL client, auto-registration is automatically enabled.

Refer to *Bulk Administration Tool User Guide for Cisco CallManager* for detailed instructions about BAT and about TAPS.

Related Topics

- [Adding Phones with Auto-Registration, page 2-16](#)
- [Adding Phones with Cisco CallManager Administration, page 2-18](#)
- [Adding Phones with BAT, page 2-18](#)

Adding Phones with Cisco CallManager Administration

You can add phones individually to the Cisco CallManager database using Cisco CallManager Administration. To do so, you first need to obtain the MAC address for each phone.

For information about determining a MAC address, see the [“Determining the MAC Address of a Cisco IP Phone”](#) section on page 1-17.

After you have collected MAC addresses, choose **Device > Add a New Device** in Cisco CallManager Administration to begin.

For complete instructions and conceptual information about Cisco CallManager, refer to *Cisco CallManager Administration Guide* and to *Cisco CallManager System Guide*.

Related Topics

- [Adding Phones with Auto-Registration, page 2-16](#)
- [Adding Phones with Auto-Registration and TAPS, page 2-17](#)
- [Adding Phones with BAT, page 2-18](#)

Adding Phones with BAT

The Cisco Bulk Administration Tool (BAT) is a plug-in application for Cisco CallManager that enables you to perform batch operations, including registration, on multiple phones.

To add phones using BAT only (not in conjunction with TAPS), you first need to obtain the appropriate MAC address for each phone.

For information about determining a MAC address, see the [“Determining the MAC Address of a Cisco IP Phone”](#) section on page 1-17.

For detailed instructions about using BAT, refer to *Cisco CallManager Administration Guide* and to *Bulk Administration Tool User Guide for Cisco CallManager*.

Related Topics

- [Adding Phones with Auto-Registration, page 2-16](#)
- [Adding Phones with Auto-Registration and TAPS, page 2-17](#)
- [Adding Phones with Cisco CallManager Administration, page 2-18](#)

