



CHAPTER 4

Implement

Introduction to Implementation

The goal of implementation is to introduce the new system into the network with the least amount of disruption and the highest level of interoperability with the existing network. To minimize downtime, an essential component of this process is the implementation plan.

Before You Begin

You should understand how to implement Cisco Unified Communications. For more information, see [Cisco Unified Communications Implementation](#).

Before you begin installing components, you should have a completed implementation plan from the detailed design. Use the equipment list and site specification from the detailed design to do the following:

- Order and stage equipment
- Perform a detailed site survey
- Create site-specific installation guidelines

Your implementation plan should include:

- Deployment strategy
- Network maps and topology diagrams
- Installation and commissioning tests
- Site survey results
- List of all devices to be installed
- Installation guidelines
- Configuration worksheets
- Test and turn-up plan

When You Are Done

All components are installed and ready to configure.

Major Tasks in This Process


- [Order Equipment](#)
- [Install and Configure System Components](#)
- [Preparing Your Network for Troubleshooting and Recovery](#)

- [Conduct User Acceptance Test](#)

Order Equipment


This topic includes links to ordering guides and tools that you need to choose your ordering options.

Solution Expert Tool

[Solution Expert](#)  is a web-based tool that assists in the design, configuration, quoting, and ordering of Cisco Unified Communications products. Solution Expert is available for Cisco sales and partner systems engineers who have Cisco Unified Communications specializations.


With the Solution Expert tool, users can generate a recommended solution based on their requirements. Users can modify the recommended configuration if desired. Solution Expert validates any changes when it presents the new solution. Solution Expert also generates a bill of materials with list pricing, a Visio diagram, and other design documentation.

Quote Builder Tool

The [Quote Builder](#)  tool is a solutions quoting application for Cisco Unified Communications products. Quote Builder is available to specialized partners and Cisco employees. With Quote Builder, users can build a system quote with design documents to aid in the implementation of the solution. Quote Builder also validates designs for common deployments. Quote Builder generates a bill of materials, a network diagram, and design guides for deployment.

Ordering Guides

Ordering guides for most Cisco Unified Communications products are available for partners and Cisco employees. For information on ordering guides, go to the following URL:

http://www.cisco.com/web/partners/sell/technology/ipc/announcements/unified_communications_system_6_launch.html 

Click the “What is available for Partners” tab to view a list of the ordering guides and other marketing collaterals.

Install and Configure System Components

When implementing a new Cisco Unified Communications system, create a site-specific plan for your team. Describe what needs to be installed and configured. Your plan should list the referenced product-specific installation guides in [Table 4-1](#). [Table 4-2](#) contains products that were tested in this release and listed by technology with examples and links to configuration documents.

Your plan will help you manage timelines for implementing equipment and scheduling outages. Include an installation schedule, as well as a test plan that will verify that the operation conforms to the design objectives.

[Performing Your System Installation](#) provides guidance for the installation order of components for a Cisco Unified Communications System IPT deployment. It does not describe installation procedures for individual components. For links to the complete documentation set for each IPT system component, see the [Component Resources](#) topic on the Resource Library tab.

Performing Your System Installation

Before You Begin

See [Plan and Prepare for Your System Installation](#) on the Prepare and Plan tab to plan your overall strategy.

Install IPT Software Components

Once you have your installation plan and preparations in place, perform your system installation by following the guidelines and sequence in [Performing Your System Installation](#):

- See [Deployment Models](#) for the general installation sequence for the various components in the different deployment models.
- See [Installing Components](#) for more detailed installation information for each major installation strategy: single-stage and multistage system installation.
- See [Related Documentation](#) for links to component installation and upgrade documentation.

Component Installation and Upgrade

Using the steps from the documents listed in [Table 4-1](#), install or upgrade the required components for your network in the recommended order according to your site-specific implementation plan.

Table 4-1 *Component Installation Documentation*

Product Category	Product Technology	Documentation Title
Call Control Components	Cisco Unified Communications Manager	<ul style="list-style-type: none"> • Installing Cisco Unified Communications Manager • Replacing a Single Server or Cluster for Cisco Unified Communications Manager • Upgrading to Cisco Unified Communications Manager Release 6.1(1) from Release 5.x and Release 6.x • Upgrading to Cisco Communications Manager Release 6.1(1) from Cisco Unified CallManager 4.x Releases
	Cisco Unified Communications Manager Business Edition	<ul style="list-style-type: none"> • Overview of Mandatory Tasks for Installing a Cisco Unified Communications Manager Business Edition 6.x System • Installing Cisco Unified Communications Manager Release 6.1(1) for Cisco Unified Communications Manager Business Edition • Upgrading to Cisco Unified Communications Manager Business Edition Release 6.1(1) from Release 5.x and Release 6.x
	Cisco Unified Communications 500 Series for Small Business	<ul style="list-style-type: none"> • Getting Started Guide for Cisco Unified Communications 500 Series

Table 4-1 Component Installation Documentation (continued)

Product Category	Product Technology	Documentation Title
	Cisco Unified Communications Manager Express	<ul style="list-style-type: none"> • Cisco Unified Communications Manager Express System Administrator Guide
	Cisco Unified Survivable Remote Site Telephony (SRST)	<ul style="list-style-type: none"> • Cisco Unified SRST 4.1 System Administrator Guide: <ul style="list-style-type: none"> – Setting Up the Network – Setting Up Cisco Unified IP Phones – Setting Up Call Handling – Configuring Additional Call Features – Setting Up Secure SRST – Appendix A: Preparing SRST Support for SIP • Cisco Unified Survivable Remote Site Telephony Version 4.1 (Data Sheet)
Contact Center Components	Cisco Unified Contact Center Express\Cisco Customer Response Solutions	<ul style="list-style-type: none"> • Cisco Customer Response Solutions Installation Guide • Getting Started with Cisco Unified Contact Center Express
Application Components	Cisco Emergency Responder	<ul style="list-style-type: none"> • Cisco Emergency Responder Administration Guide 2.0, Installing Cisco Emergency Responder 2.0
	Cisco Unified Application Environment	<ul style="list-style-type: none"> • Installation Guide for the Cisco Unified Application Environment (2.4) • Upgrade Guide for the Cisco Unified Application Environment (2.4)
	Cisco Fax Server	<ul style="list-style-type: none"> • Cisco Fax Server Installation Guide • Installation Guide Supplement for Cisco Fax Server
	Cisco Unified PhoneProxy	<ul style="list-style-type: none"> • Cisco Unified PhoneProxy Installation and Quick Start Guide
	Cisco Unified Presence	<ul style="list-style-type: none"> • Installing Cisco Unified Presence Release 6.0(1)
Conferencing Components	Cisco Unified MeetingPlace	<ul style="list-style-type: none"> • System Requirements for Cisco Unified MeetingPlace Release 6.0 • Installation Order of Components for Cisco Unified MeetingPlace Release 6.x
	Cisco Unified MeetingPlace Express	<ul style="list-style-type: none"> • Installation and Upgrade Guide for Cisco Unified MeetingPlace Express Release 2.0 • Cisco Unified MeetingPlace Express 2.x information on Cisco DocWiki

Table 4-1 Component Installation Documentation (continued)

Product Category	Product Technology	Documentation Title
	Cisco Unified Videoconferencing	<ul style="list-style-type: none"> Installation and Upgrade Guide for Cisco Unified Videoconferencing 3545 MCU Release 5.1 Installation and Upgrade Guide for Cisco Unified Videoconferencing 3515 MCU12 and MCU24 Release 5.1X
Voice Mail and Messaging Components	Cisco Unity	<ul style="list-style-type: none"> Supported Hardware and Software, and Support Policies for Cisco Unity Release 5.x Use the Installation Guide That Matches the Cisco Unity 5.x Configuration Installation Guide for Cisco Unity Release 5.x in a Unified Messaging Configuration with Microsoft Exchange (With Failover Configured) Installation Guide for Cisco Unity Release 5.x in a Unified Messaging Configuration with Microsoft Exchange (Without Failover) Installation Guide for Cisco Unity Release 5.x in a Voice Messaging Configuration with Microsoft Exchange (With Failover Configured) Installation Guide for Cisco Unity Release 5.x in a Voice Messaging Configuration with Microsoft Exchange (Without Failover) Installation Guide for Cisco Unity Release 5.x with IBM Lotus Domino (With Failover Configured) Installation Guide for Cisco Unity Release 5.x with IBM Lotus Domino (Without Failover) Reconfiguration and Upgrade Guide for Cisco Unity Release 5.x (With IBM Lotus Domino) Reconfiguration and Upgrade Guide for Cisco Unity Release 5.x (With Microsoft Exchange)
	Cisco Unity Connection	<ul style="list-style-type: none"> System Requirements for Cisco Unity Connection/ System Requirements for Cisco Unity Connection in Cisco Unified CMBE System Requirements for Cisco Unity Connection Release 2.0 Installation Guide for Cisco Unity Connection Release 2.x
	Cisco Unity Express	<ul style="list-style-type: none"> Cisco Unity Express 3.1 Installation and Upgrade Guide
Endpoints and Clients Components	Cisco Unified 79xx IP Phones	<ul style="list-style-type: none"> Cisco Unified 7900 Series IP Phones

Table 4-1 Component Installation Documentation (continued)

Product Category	Product Technology	Documentation Title
	Cisco IP Communicator	<ul style="list-style-type: none"> Cisco IP Communicator, Data Sheet Deploying and Updating Cisco IP Communicator
	Cisco Unified Personal Communicator	<ul style="list-style-type: none"> Installation Guide for Cisco Unified Personal Communicator, Release 1.2
	Cisco Unified Video Advantage	<ul style="list-style-type: none"> Installation and Troubleshooting Guide for Cisco Unified Video Advantage Release 2.0
Wireless and Mobility Components	Cisco Unified Mobile Communicator	<ul style="list-style-type: none"> Cisco Unified Mobile Communicator End User Guides
	Cisco Unified Mobility Advantage	<ul style="list-style-type: none"> Cisco Unified Mobility Advantage Installation Guide
	Aironet Wireless Access Points	<ul style="list-style-type: none"> Quick Start Guide Cisco Aironet 1200 Series Access Points Running Cisco IOS Software Cisco Aironet 1200 Series Access Point Hardware Installation Guide Cisco Aironet 1200 Series Access Point Radio Upgrade Instructions
Security Components	Cisco Advanced Security Appliance (ASA) 5500 Series	<ul style="list-style-type: none"> Cisco ASA 5500 Getting Started Guide, Software Version 8.0(1)
	Cisco Catalyst 6500 Series Switch Firewall Service Modules (FWSM)	<ul style="list-style-type: none"> Catalyst 6500 Series Switch and Cisco 7600 Series Router Firewall Services Module Installation and Verification Note Upgrading the Catalyst 6500 Series Switch and Cisco 7600 Series Router Firewall Services Module from Release 2.x to Release 3.1
	Cisco Catalyst 6500 Series Intrusion Detection System (IDSM-2) Module	<ul style="list-style-type: none"> Integrate Cisco Service Modules with Cisco Catalyst 6500 Virtual Switching System 1440 Upgrading the Intrusion Detection System Module
	Cisco Intrusion Prevention System Appliance IPS-4200	<ul style="list-style-type: none"> Installing Cisco Intrusion Prevention System Appliances and Modules 6.0
	Management Center for Cisco Security Agents	<ul style="list-style-type: none"> Installing Management Center for Cisco Security Agents 5.2
	Cisco Security Agent for CRS	<ul style="list-style-type: none"> Installing Cisco Security Agent for Cisco Customer Response Solutions
	Cisco NAC Appliance (Clean Access)	<ul style="list-style-type: none"> Supported Hardware and System Requirements for Cisco NAC Appliance (Cisco Clean Access) Cisco NAC Appliance Hardware Installation Quick Start Guide, Release 4.1
Network Management Components	Cisco Unified Operations Manager	<ul style="list-style-type: none"> Quick Start Guide for Cisco Unified Operations Manager 2.0
	Cisco Unified Service Monitor	<ul style="list-style-type: none"> Quick Start Guide for Cisco Unified Service Monitor 2.0.1 Quick Start Guide for Cisco 1040 Sensor

Table 4-1 Component Installation Documentation (continued)

Product Category	Product Technology	Documentation Title
	Cisco netManager Unified Communications	<ul style="list-style-type: none"> Quick Start Guide for Cisco netManager - Unified Communications 1.0
	Cisco Unified Provisioning Manager	<ul style="list-style-type: none"> Installation Guide for Cisco Unified Provisioning Manager, 1.1
	Cisco Unified Service Statistics Manager	<ul style="list-style-type: none"> Quick Start Guide for Cisco Unified Service Statistics Manager 1.0
	Cisco Monitor Manager	<ul style="list-style-type: none"> Quick Start Guide for Cisco Monitor Manager 1.1.2
	Cisco Monitor Director	<ul style="list-style-type: none"> Quick Start Guide for Cisco Monitor Director 1.1.2
Infrastructure Components	Routers, Gateways, and Gatekeepers (H.323 and MGCP)	<ul style="list-style-type: none"> Cisco 2600 Series Routers Cisco 2800 Series Routers Cisco 3700 Series Routers, Voice Gateways and Gatekeepers Cisco 3800 Series Routers Cisco 7200 Series Voice Gateways Cisco VG200 Voice Gateways
	Switches	<ul style="list-style-type: none"> Cisco Catalyst 3550 Series Switches Cisco Catalyst 3750 Series Switches Cisco Catalyst 4500 Series Switches Cisco Catalyst 6500 Series Switches
	Cisco Unified Border Element	<ul style="list-style-type: none"> Cisco Unified Border Element Configuration Guide

Software Versions and System Caveats

For specific information on the product software versions used, system limitations, and known caveats, see the [System Release Notes for IP Telephony: Cisco Unified Communications System, Release 6.1\(1\)](#).

Component Reference Configurations

[Table 4-2](#) lists the types of IPT components that were tested in Cisco Unified Communications System Test Release 6.1(1) and provides a brief description of each. The component type in the table is linked to information that describes how the components were configured during system-level testing.

Table 4-2 **Component Types and Descriptions**

Type	Description
Call Control Components	<p>Call control components extend enterprise telephony features and capabilities to packet telephony network devices such as IP phones, media processing devices, voice over IP (VoIP) gateways, and multimedia applications. Additional services, such as unified messaging, multimedia conferencing, collaborative contact centers, and interactive multimedia response systems, are made possible through open telephony APIs.</p> <p>Some examples of these components are Unified Communications Manager and Cisco Unified Presence.</p>
Application Components	<p>Application components are customized applications that help you streamline business processes and drive productivity through Internet Protocol (IP)-based Unified Communications. These components enable the rapid development, reliable execution and automated management of applications that integrate voice and video with enterprise applications and data.</p> <p>Some examples of these components are Cisco Emergency Responder and Cisco Unified Application Environment.</p>
Conferencing Components	<p>Conferencing components provide integrated voice, video, and Web conferencing capabilities to enable remote meetings that are natural and effective with face-to-face quality, such as meetings, training sessions, and presentations.</p> <p>Some examples of these components are Cisco Unified MeetingPlace and Cisco Unified Videoconferencing.</p>
Voice Mail and Unified Messaging Components	<p>Voice mail and unified messaging components deliver powerful voice, integrated, and unified messaging options that transparently integrate with Microsoft Exchange, Lotus Domino, and Novell GroupWise. They scale to meet the needs of large, multisite organizations and offers extensive personalization options, a broad range of productivity enhancing features, and powerful migration tools, including:</p> <ul style="list-style-type: none"> • Interoperability with existing voice messaging and telephony systems • Custom keypad mapping of the telephony interfaces • Integrated context-sensitive help <p>Some examples of these components are Cisco Unity and Cisco Unity Connection.</p>
Endpoints and Clients Components	<p>Endpoint and client components integrate the management capabilities of IP-based networks with phones, pagers, and computers and use these for signaling, voice communications, and data communications.</p> <p>Some examples of these components are Cisco IP Communicator, Cisco Unified Personal Communicator, and Cisco Unified 79xx IP Phones.</p>
Wireless and Mobility Components	<p>Wireless and mobility components provide services that enable secure, scalable, methods to real-time access to instant messaging, e-mail, and network resources. You can also access real-time simultaneous tracking of thousands of Wi-Fi devices for location-based security, high-value asset tracking, and business policy enforcement.</p> <p>Some examples of these components are Cisco Unified Mobile Communicator and Aironet Wireless Access Points.</p>

Table 4-2 **Component Types and Descriptions (continued)**

Type	Description
Security Components	<p>Security components are processes and technologies designed to quickly adapt to new threats to your network by using proactive, automated, real-time threat management.</p> <p>Some examples of these components are Cisco Advanced Services Appliance ASA 5500 Series, Firewall Services Modules, and Cisco Intrusion Prevention System Appliance IPS-4200.</p>
Network Management Components	<p>Network management components provide an integrated view of the entire Cisco Unified Communications system and present the current operational status of each element of the IP communications network. In addition these components provide a low-cost, reliable method of monitoring and evaluating the quality of calls and diagnosing issues.</p> <p>Some examples of these components are Cisco Unified Operations Manager, Cisco Unified Service Monitor, and Cisco netManager Unified Communications.</p>
Infrastructure Components	<p>Infrastructure components are network routers, switches, software, and other standards-based networking components that provide reliable connectivity that is more resilient and enables all the latest network services.</p> <p>Some examples of these components are Cisco Series Routers, Cisco Catalyst Series Switches, and Cisco Voice Gateways.</p>

Introduction to Troubleshooting

This topic describes how to develop a system-level troubleshooting methodology as you install and configure a Cisco Unified Communications network for the first time. It also provides recommendations for preparing and documenting the network that may assist you in diagnosing and isolating problems when they occur. This topic contains the following sections:

- [System Troubleshooting Methodology](#)
- [Preparing Your Network for Troubleshooting and Recovery](#)

System Troubleshooting Methodology

The Implementation phase of your network deployment is an excellent time to develop a methodology for troubleshooting the network as a whole. Troubleshooting networking equipment at a system level requires solid detective skills. When a problem occurs, the list of potential suspects is long. You must collect detailed information and systematically narrow the list of potential causes to determine the root problem. This topic does not provide step-by-instructions for resolving problems that occur during network installation. Instead, this topic describes sound methods for troubleshooting your network using the following general steps:

1. [Gather Information on the Problem.](#)
2. [Isolate Point\(s\) of Failure.](#)
3. [Apply Tools to Determine the Problem's Root Cause.](#)

Gather Information on the Problem

In a IP telephony network, problems are typically discovered and reported by one of the following types of users:

- External users trying to reach employees within your company
- Internal users using phones to call employees in other company locations or PSTN destinations, and perform basic actions such as call transfers and dialing into conferences.

As the network administrator, you must collect sufficient information from these users to allow you to isolate the problem. Detailed, accurate information will make this task easier. Table 4-3 lists recommended questions to ask users when they report a problem. As you turn up your network, you may consider putting these questions in an on-line form. A form will encourage users to provide more details about the problem and also put them into the habit of looking for particular error messages and indicators. Capturing the information electronically will also permit you to retrieve and re-examine this information in the future, should the problem repeat itself.

Table 4-3 Questions to Ask Users When They Report Problems

Ask this Question...	To Determine...
Did something fail or did it simply perform poorly?	Whether the issue relates to system degradation or a connectivity failure. An example of a failure is when a user dials a phone number and hears fast busy tone. An example of a performance problem is when a user dials into a conference call and hears “choppy” audio when other parties speak. Quality of service or performance issues require a different approach than connectivity or operational problems. You must still isolate the potential sources of the problem, but you will typically use performance management tools instead of log files.
What device were you trying to use?	The device type, model and version of software installed. It is also critical to capture the IP address assigned to the device, as well as its MAC address. In the case of IP phones, determining the phone’s active Cisco Unified Communications Manager server is also important. On Cisco Unified IP phones, these important network values can be displayed by pressing the Settings button and choosing the Network Configuration option from the menu.
Did it ever work?	If a device was recently installed and the problem occurred while making it work for the first time, or if the device was operating normally before the problem occurred. If the device was newly installed, the problem is most likely due to improper configuration or wiring of that particular device. Problems with devices that are already up and running can typically be traced back to one of two causes: (a) the user modifying their device, such as changing their configuration or upgrading software, or (b) a change or failure elsewhere in the network.
Exactly what action(s) did you perform?	The steps that led up to the problem, including which buttons were pressed and in which order. Capturing this information in detail is important so that you can consistently reproduce the problem.

Table 4-3 Questions to Ask Users When They Report Problems (continued)

Ask this Question...	To Determine...
What error message(s) appeared or announcements did you hear?	The visual and audio indicators of the problem. Ask users to provide the exact text that appears and any error codes in either an E-mail or on-line form. If the error indication was audible, ask the user to write down the announcement they heard, the last menu option they were able to successfully choose or the tone they heard when the call failed.
What time did the problem occur?	The date and time to compare against entries in log files. If the problem occurred on a Cisco Unified IP phone, make certain the user provides the timestamp that appears on their phone's display. Several Cisco components in a network may capture the same problem event in separate log files, with different ID values. In order to correlate log entries written by different components, you must compare the timestamps to find messages for the same event. Cisco Unified IP phones synchronize their date and time with their active Cisco Unified Communications Manager server. If all Cisco components in the network use Network Time Protocol (NTP) to synchronize with the same source, then the timestamps for the same problem messages will match in every log file.
What is the number of the phone you used and what was the phone number you called?	If the problem relates to a WAN or PTSN link, or a Cisco Unified Communications Manager dial plan issue. Ask the user the phone number he or she dialed (called number) and determine if the destination was within his or her site, another site within the corporate network, or a PSTN destination. Because the calling number (the number of the phone used) also affects call routing in some cases, capture this number as well.
Did you try to perform any special actions, such as a transfer, forward, call park, call pickup, or meet-me conference? Is the phone set up to automatically perform any of these actions?	If the problem is not directly related to the calling number or called number but rather to the supplementary service setup on Unified Communications Manager or the problem is at the destination phone the user tried to reach by transferring or forwarding the call.
Did you attempt the same action on another device?	If the problem is isolated to that user's device or represents a more widespread network problem. If the user cannot make a call from his or her phone, ask the user to place a call to the same destination using a phone in a nearby office.

Isolate Point(s) of Failure

After collecting information on the symptoms and behavior of the problem, to narrow the focus of your efforts you should:

- Identify the specific devices involved in the problem.
- Check the version of software running on each device.
- Determine if something has changed in the network.
- Verify the integrity of the IP network.

Identify Devices Involved in the Problem

In large- to medium-sized networks, it is crucial to identify the specific phones, routers, switches, servers and other devices that were involved in a reported problem. Isolating these devices allows you to rule out the vast majority of equipment within the network and focus your time and energy on suspect devices. To help you isolate which devices were involved in a problem, two types of information can prove invaluable:

- **Network topology diagrams:** It is strongly recommended that you have one or more diagrams that show the arrangement of all Cisco Unified Communications products in your network. These diagrams illustrate how these devices are connected and also capture each device's IP address and name (you may want to also have a spreadsheet or database of the latter information). This information can help you visualize the situation and focus on the devices that may be contributing to the reported problem. See [Network Topology Diagrams](#) for recommendations on how to prepare these diagrams.
- **Call flow diagrams:** Cisco equipment, including Unified Communications Manager servers, typically provide detailed debug and call trace log files. To interpret these log files, however, it is useful to understand the signaling that occurs between devices as calls are set up and disconnected. Using the network topology and call flow diagrams in conjunction with the log files, you can trace how far a call progressed before it failed and identify which device reported the problem. Examples of using call flow diagrams for problem isolation are shown in [Troubleshooting Daily Operations](#).

Check Software Release Versions for Compatibility

After you have identified which devices may be involved in the problem, verify that the version of software running on each device is compatible with the software running on every other device. As part of Cisco Unified Communications Release 6.0(1) verification, Cisco Systems has performed interoperability and load testing on simulated network environments running specific software versions. The [Release Matrix](#) lists the combination of software releases that were tested.

However, if the combination of releases installed in your network does not match the values in the Release Matrix, it does not necessarily mean the combination is invalid. To check interoperability for a specific device and software release, locate and review its Release Notes. Release Notes contain up-to-date information on compatibility between the product and various releases of other products. This document also describes open caveats, known issues that may cause unexpected behavior. Before beginning extensive troubleshooting work, examine the Release Notes to determine if you are experiencing a known problem that has an available workaround.



Tip

The Bug Toolkit requires that you are a Cisco partner or a registered Cisco.com user with a Cisco service contract. Using the Bug Toolkit, you can find caveats for any release. To access the Bug Toolkit, go to the <http://tools.cisco.com/Support/BugToolkit/>.

Determine if Network Changes Have Occurred

Before focusing on the particular device or site where the problem occurred, it may be useful to determine if a change was made to surrounding devices. If something has been added, reconfigured or removed from elsewhere in the network, that change may be the source of the problem. It is recommended that you track changes to the IP telephony network such as:

- New user phones added
- Modifications to Cisco Unified Communications Manager call routing settings, such as new directory numbers, route patterns and dial rules to support new sites or devices

- Changes to port configurations on switches, routers or gateways (new equipment, wiring changes or new port activation)
- Changes to IP addressing schemes (such as adding new subnets) that may have affected route tables

Verify the IP Network Integrity

Always remember that Cisco Unified Communications equipment relies on a backbone IP network. Many connectivity problems are not caused by configuration errors or operational failures on Cisco devices, but rather by the IP network that interconnects them. Problems such as poor voice quality are typically due to IP network congestion, while call failures between locations may be the result of network outages due to disconnected cables or improperly configured IP route tables.

Before assuming that call processing problems result from Cisco Unified Communications devices themselves, check the integrity of the backbone IP network. Keep the OSI model in mind as you perform these checks. Start from the bottom, at the physical layer, by checking that end-to-end cabling. Then verify the status of Layer 2 switches, looking for any port errors. Move from there to confirm that the Layer 3 routers are running and contain correct routing tables. Continue up the OSI stack to Layer 7, the application layer. To resolve problems occurring at the top levels of the stack, a protocol analyzer (or “sniffer”) may be useful. You can use sniffer to examine the IP traffic passing between devices and also decode the packets. Sniffers are particularly useful for troubleshooting errors between devices that communicate using Media Gateway Control Protocol (MGCP) or Session Initiation Protocol (SIP).

Apply Tools to Determine the Problem’s Root Cause

After you have eliminated the IP network as the source of the problem and you have isolated the specific Cisco Unified Communications components involved, you can start applying the many diagnostic tools provided by Cisco components.

[Table 4-4](#) lists the diagnostic tools and supporting troubleshooting documentation available for most components in an IP telephony network. Note that this summary table is provided for reference only. The procedures in [Troubleshooting Daily Operations](#) specify when to use each tool and provide links to the troubleshooting instructions in each component’s documentation where appropriate.

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation

Category	Component	Diagnostic Tools Available	Information Available In...
Call Control	Cisco Unified Communications Manager	Serviceability System tools: <ul style="list-style-type: none"> Alarms Real-Time Monitoring Tool window Trace log files <ul style="list-style-type: none"> Communications Manager trace log SDL trace log (under TAC direction) 	Troubleshooting Guide for Cisco Unified Communications Manager Cisco Unified Communications Manager Real-Time Monitoring Tool Administration Guide Cisco Unified Serviceability Administration Guide Cisco Unified Communications Manager CDR Analysis and Reporting Administration Guide for Cisco Unified Communications Manager Disaster Recovery System Administration Guide Troubleshooting TechNotes
	Cisco Unified Communications Manager Business Edition	Serviceability System tools: <ul style="list-style-type: none"> Alarms Real-Time Monitoring Tool window Trace log files: <ul style="list-style-type: none"> Communications Manager trace log SDL trace log (under TAC direction) 	Troubleshooting Guide for Cisco Unified Communications Manager Cisco Unified Communications Manager Real-Time Monitoring Tool for Cisco Unified Communications Manager Business Edition Cisco Unified Serviceability Administration Guide for Cisco Unified Communications Manager Business Edition Cisco Unified Communications Manager CDR Analysis and Reporting Administration Guide for Cisco Unified Communications Manager Business Edition Disaster Recovery System Administration Guide
	Cisco Unified Communications Manager Express	IOS command line tools (such as Show commands and Debug trace utilities)	Troubleshooting Guides Troubleshooting TechNotes
	Cisco Unified Survivable Remote Site Telephony	IOS command line tools (such as Show commands and Debug trace utilities)	Cisco Unified SRST System Administrator Guide, “Monitoring and Maintaining Cisco Unified SRST” chapter
	Cisco Unified Communications 500 Series for Small Business	IOS command line tools (such as Show commands and Debug trace utilities) SNMP alarms/events	User Guide for the Catalyst Express 520 Switches, “Troubleshooting the Switch” chapter Cisco Unity Express GUI Administrator Guide, “Troubleshooting Cisco Unity Express” chapter Cisco Unity Express Voice-Mail and Auto-Attendant CLI Administrator Guide, “Troubleshooting” chapter

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Contact Center	Cisco Customer Response Solutions (Cisco Unified Contact Center Express)	Log files Alarms	Cisco Customer Response Solutions Servicing and Troubleshooting Guide, “Part II Troubleshooting” Troubleshooting TechNotes
Application	Cisco Emergency Responder	E-mail alerts sent to administrator ERL Debug tool Cisco ER Admin Utility tool Call history logs SYSLOG collector tool that generates trace and debug files Windows Event Viewer	Cisco Emergency Responder Administration Guide, “Troubleshooting Cisco Emergency Responder” chapter Troubleshooting Guides
	Cisco Unified Application Environment	AppServer log files	Administration Guide for the Cisco Unified Application Environment, “Maintaining the Cisco Unified Application Environment” chapter
	Cisco Unified PhoneProxy	System log files: <ul style="list-style-type: none"> • Shell.log • Update.log • Phoneproxy.log 	Cisco Unified PhoneProxy Administration Guide, “Troubleshooting” chapter
	Cisco Unified Presence	Configuration Troubleshooter Trace log files Alarms	Cisco Unified Presence Administration Guide, “Configuration Troubleshooter” section Cisco Unified Serviceability Administration Guide for Cisco Unified Presence, “Troubleshooting Trace Setting Configuration” section System Error Messages for Cisco Unified Presence Cisco IP Phone Messenger User Guide for Cisco Unified Presence, “Troubleshooting” section Disaster Recovery System Administration Guide for Cisco Unified Presence

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Conferencing	Cisco Unified MeetingPlace	Log files: <ul style="list-style-type: none"> Gateway SIM event log Error log gwcptrace CLI command	<p>Administrator's Guide for Cisco Unified MeetingPlace Audio Server, "Troubleshooting the Cisco Unified MeetingPlace Audio Server System" chapter for voice/audio issues</p> <p>Installation and Upgrade Guide for Cisco Unified MeetingPlace Audio Server, "Troubleshooting the Cisco Unified MeetingPlace Audio Server System Installation" chapter for audio server installation issues</p> <p>Configuration Guide for Cisco Unified MeetingPlace Audio Server, "Troubleshooting the Cisco Unified MeetingPlace System Configuration" chapter for T1/E1 port and general MeetingPlace issues</p> <p>Configuration Guide for Cisco Unified MeetingPlace Web Conferencing, "Troubleshooting Cisco Unified MeetingPlace Web Conferencing" chapter for Web conferencing issues</p> <p>Administrator's Guide for Cisco Unified MeetingPlace Video Integration, "Troubleshooting" chapter for videoconferencing problems</p> <p>Administration Guide for Cisco Unified MeetingPlace for Microsoft Outlook, "Troubleshooting" chapter for Microsoft Outlook integration issues</p> <p>Administration Guide for Cisco Unified MeetingPlace Directory Services, "Troubleshooting Cisco Unified MeetingPlace Directory Services" chapter for directory services issues</p> <p>Troubleshooting TechNotes</p>
	Cisco Unified MeetingPlace Express	System logs Alarms	<p>Configuration and Maintenance Guide for Cisco Unified MeetingPlace Express, "Troubleshooting Cisco Unified MeetingPlace Express" chapter</p> <p>User Guide for Cisco Unified MeetingPlace Express, "Troubleshooting and Getting Help" chapter</p>

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Conferencing (video)	Cisco Unified Video-conferencing Video Gateway 3521, 3522, 3526, 3527, 3545	BRI/PRI link LEDs on front and rear panels BRI/PRI link LEDs viewable remotely using Gateway interface Gateway statistics	Administrator Guide for Cisco Unified Videoconferencing 3527 PRI Gateway and 3522 BRI Gateway , “ Troubleshooting the Cisco Unified Videoconferencing 3500 Gateway ” chapter Administrator Guide for Cisco Unified Videoconferencing 3545 PRI Gateway and 3545 Serial Gateway , “ Troubleshooting the Cisco Unified Videoconferencing 3545 Gateway ” chapter
	Video MCU 3515, 3540, 3545	LEDs Command line interface	Administrator Guide for Cisco Unified Videoconferencing 3515 MCU12 and MCU24 , “ Troubleshooting the MCU ” chapter Administrator Guide for Cisco Unified Videoconferencing 3545 MCU , “ Troubleshooting the MCU ” chapter Troubleshooting Guide for Cisco Unified Videoconferencing 3500 MCU

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Voice Mail and Unified Messaging	Cisco Unity	Event log Cisco Unity Diagnostic Tool (UDT): <ul style="list-style-type: none"> • Macro trace logs • Micro trace logs Voice Connector trace logs Tools Depot utilities: <ul style="list-style-type: none"> • Integration Monitor • Call Viewer • Port Status Monitor Dialogic tools (for systems equipped with Dialogic voice cards only): <ul style="list-style-type: none"> • TSP trace logs • Universal Dialogic Diagnostics Utility Dr. Watson logs for underlying Windows 2000 server platform	Troubleshooting Guide for Cisco Unity Release 5.x (With Microsoft Exchange) Troubleshooting Guide for Cisco Unity Release 5.x (With IBM Lotus Domino) Troubleshooting TechNotes
	Cisco Unity Connection	Serviceability System tools: <ul style="list-style-type: none"> • Alarms • Real-Time Monitoring Tool window Cisco Unity Diagnostic Tool (UDT): <ul style="list-style-type: none"> • Macro trace logs • Micro trace logs CuVrt service verbose logging	Real-Time Monitoring Tool Administration Guide for Cisco Unity Connection Administration Guide for Cisco Unity Connection Serviceability Cisco Unified Serviceability Administration Guide for Cisco Unity Connection Disaster Recovery System Administration Guide for Cisco Unity Connection Troubleshooting TechNotes
	Cisco Unity Express	CLI commands for status checking and performance monitoring SNMP alarms/events	Cisco Unity Express GUI Administrator Guide, “Troubleshooting Cisco Unity Express” chapter Cisco Unity Express Voice-Mail and Auto-Attendant CLI Administrator Guide, “Troubleshooting” chapter Troubleshooting TechNotes



Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Endpoints and Clients	Cisco Unified IP phones	Network configuration, status and phone model information on Settings menu	End-User Guides Cisco Unified IP Phone Administration Guides for Cisco Unified Communications Manager, “Troubleshooting and Maintenance” chapters Error Message Decoder  Output Interpreter  Troubleshooting TechNotes
	Cisco IP Communicator	Quality Report Tool (QRT) Error Reporting Tool	Cisco IP Communicator Administration Guide, “Troubleshooting Cisco IP Communicator” chapter User Guide for Cisco IP Communicator, “Troubleshooting Cisco IP Communicator” chapter Troubleshooting TechNotes
	Cisco Unified Personal Communicator	Cisco Unified Problem Reporting Tool (Windows version only)	Troubleshooting Guide for Cisco Unified Personal Communicator User Guide for Cisco Unified Personal Communicator for Windows, “Troubleshooting” chapter for Windows version User Guide for Cisco Unified Personal Communicator for Macintosh, “Troubleshooting” chapter for Macintosh version
	Cisco Unified Video Advantage	Diagnostics Tool AutoUpdate Status Viewer CAST Viewer CDP Viewer Trace Tool Error Reporting Tool	Installation and Troubleshooting Guide for Cisco Unified Video Advantage, “Troubleshooting Cisco Unified Video Advantage” chapter Cisco Unified Video Advantage User Guide, “Troubleshooting Cisco Unified Video Advantage” chapter Troubleshooting TechNotes
Network Management	Cisco Unified Operations Manager	Alarms and events appearing in Dashboard displays Phone status tests Synthetic test Node-to-node tests	User Guide for Cisco Unified Operations Manager, “Administering Operations Manager” chapter
	Cisco Unified Service Monitor		User Guide for Cisco Unified Service Monitor, “Administering the System and Managing Data” chapter

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Communications Infrastructure	VG224 Analog Voice Gateway	IOS command line tools	VG224 Analog Phone Gateway Software Configuration Guide, “Using the ROM Monitor” chapter Troubleshooting Guides Output Interpreter  Troubleshooting TechNotes
	Cisco Catalyst 3550 Access Switch	IOS command line tools (such as Show commands and Debug trace utilities)	Catalyst 3550 Multilayer Switch Software Configuration Guide, “Troubleshooting” chapter Error Message Decoder  Output Interpreter  Troubleshooting Tech Notes
	Cisco Catalyst 3560 Access Switch	IOS command line tools (such as Show commands and Debug trace utilities)	Catalyst 3560 Switch Software Configuration Guide, “Troubleshooting” chapter Catalyst 3560 Switch System Message Guide, “Catalyst 3560 Switch Debug Commands” chapter Error Message Decoder  Output Interpreter  Troubleshooting Tech Notes
	Cisco Catalyst 3750 Access Switch	IOS command line tools (such as Show commands and Debug trace utilities)	Catalyst 3750 Switch Software Configuration Guide, “Troubleshooting” chapter Catalyst 3750 Switch System Message Guide, “Catalyst 3750 Switch Debug Commands” chapter Error Message Decoder  Output Interpreter  Troubleshooting Tech Notes
	Cisco Catalyst 4506 Access Switch	IOS command line tools (such as Show and Debug commands)	Catalyst 4500 Series Installation Guide, “Troubleshooting the Installation” chapter Catalyst 4500 Series Switch Cisco IOS System Message Guide Error Message Decoder  Output Interpreter  Troubleshooting TechNotes

Table 4-4 IP Telephony Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Communications Infrastructure (continued)	Cisco Catalyst 6506, 6509 including Firewall Services Module (FWSM) and Communications Media Module (CMM)	IOS command line tools (such as Show commands and Debug trace utilities)	Catalyst 6500 Series Switch Installation Guide, “Troubleshooting” chapter Catalyst 6500 Series Error and System Message Guides Catalyst 6500 Series Switch and Cisco 7600 Series Router Firewall Services Module Command Reference for FWSM logging configuration and system log messages Error Message Decoder  Output Interpreter  Troubleshooting TechNotes

Preparing Your Network for Troubleshooting and Recovery

Before your network becomes operational, you can take several proactive steps to make troubleshooting easier, including:

- Produce network topology diagrams to help you isolate potential sources of problems.
- Synchronize the date and time on all servers.
- Set trace/logging levels on key devices so that diagnostic information is available when problems occur.

Network Topology Diagrams

One of the first lines of defense is possessing current topology information. One of the most important pieces of topology information is a detailed network diagram (usually created using Microsoft Visio or a similar application). At a minimum, your network topology diagrams should include the following information:

- The name assigned to each major device (typically the DNS name)
- IP addresses for all devices in the network
 - Addresses for each router, core and access switch
 - Addresses for all telephony and application servers, including the IP address for each server in a Cisco Unified Communications Manager cluster
 - DHCP address range for addresses assigned to endpoints such as IP phones and agent workstations
- Phone extension number ranges assigned to sets of agents or users, as well as the main inbound dial-up numbers for each location. This information is useful in resolving dial plan configuration errors.
- WAN IP and PSTN links between sites.

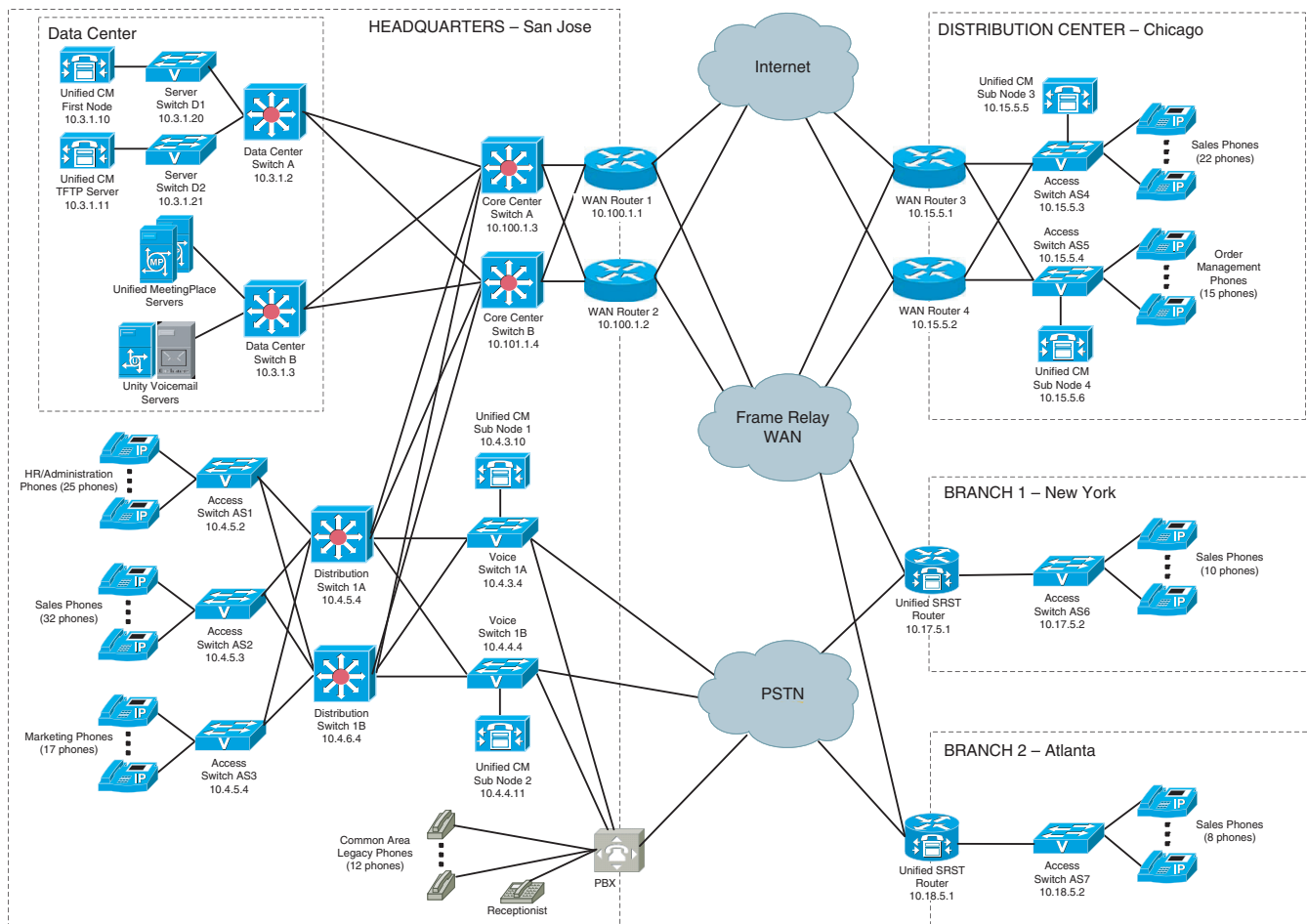
This information is critical for isolating which components are involved in a particular problem. For medium- to large-sized networks, you may want to take a “layered” approach in your diagrams. Create a high-level diagram that illustrates the overall physical layout of your network, including all sites and the links between them. Then for each site create additional diagrams that show detailed addressing information, port numbers and dial plan configurations.

**Tip**

Frequent adds, changes and upgrades to your network can quickly make these diagrams out-of-date. Inaccurate diagrams slow down the troubleshooting process and may lead to misdiagnosing the problem. Remember to keep these diagrams as current as possible.

Figure 4-1 shows a typical high-level topology diagram for a medium-sized enterprise IP telephony network. Note that only device names and IP addresses are listed in the diagram.

Figure 4-1 IP Telephony Network Topology Diagram Example



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Synchronizing Server Date and Time

The best resources for diagnosing problems within your network are the debug and trace log files produced by individual Cisco devices. Tracing can be enabled on multiple devices and the log file output compared to isolate problems. In order to correlate messages for the same activity in different log files,

you must compare the message timestamps and the source device MAC and IP addresses (there is no universal call ID value shared between Cisco devices). You should synchronize every device to the same date and time source so that the timestamps match. To accomplish this synchronization, set each device to obtain its date and time from the same Network Time Protocol (NTP) source.

For Cisco IOS-based devices (switches, routers or voice gateways), you can configure each device to act as a NTP client and periodically poll a master NTP source using the following command:

```
ntp server ip-address [version number] [key keyid] [source interface] [prefer]
```

Additional IOS commands are available to establish a device as a NTP peer (operating as the master source for other devices), as well as setting up NTP broadcasting instead of polling. See the [Cisco IOS Configuration Fundamentals Command Reference](#) for details on these IOS commands.

Recommended Trace/Logging Settings

In order to have diagnostic information available when you begin to research problems, you must configure devices in your network to capture signaling, processing and other activity in log files.

Cisco Unified Communications Manager Trace Settings

Trace settings for Cisco Unified Communications Manager servers are maintained using the Cisco Communications Manager Serviceability graphical interface. There are two ways to set trace logging levels for Unified Communications Manager services:

- **Customize trace levels for individual parameters:** This approach offers a high-degree of control and flexibility over the trace output. However, in order to use this approach you should understand not only the significance of each parameter, but also the impact of tracing on Unified Communications Manager server performance. For example, setting trace levels to “Error” has a minimal impact to CPU cycles while leaving the “Detail” level set for long periods of time may impact call processing. For instructions on setting individual trace levels, see the [Cisco Unified Serviceability Administration Guide for Cisco Unified Communications Manager, “Configuring Trace”](#) chapter.
- **Apply predefined trace levels:** This approach allows you to quickly enable and disable tracing for each Unified Communications Manager service based on predefined levels. You can also use these default troubleshooting trace settings in combination with customized settings to temporarily override the your custom settings. For instructions on using the Troubleshooting Trace Settings option in the Cisco Unified Communications Manager Serviceability interface, see the [Cisco Unified Serviceability Administration Guide for Cisco Unified Communications Manager, “Configuring Troubleshooting Trace Setting Configuration”](#) chapter.

Debug Trace Settings for CRS and IP IVR JTAPI Client

If you encounter any problems with CRS, activate the following debug trace settings to generate debug logs:

- For CRS issues: SS_TEL, SS_ICM, and LIB_ICM.
- For JTAPI Client issues: Enable all Trace Levels and select all debug levels except MISC_DEBUGGING.

However, deactivate the above trace settings if you experience any degradation in performance during heavy load situations.

Conduct User Acceptance Test

After the components are configured and integrated with other Cisco IPT applications, the field engineer prepares the system for the user acceptance test. Test scripts are run and compared against expected results. Any variability in network performance is noted and addressed before the user acceptance test.

Testing the customer solution involves the following tasks:


- Determine the user acceptance test parameters and deliverables and record these in the user acceptance test plan.
- Conduct a prelaunch test. Using an incremental approach, test the solution against the system design in a low-risk environment with limited users. If the system is stable, the rollout pace is increased until the full implementation is operational.
- The customer signs the Ready-for-Use Acceptance Letter acknowledging that the acceptance test yielded satisfactory results.

Train End Users

The final stage of the Implement phase is to help ensure that the customer's system administration team and end users are trained to take over management of the new system.

Cisco Systems offers several training and certification programs for customers to maximize the usage of their newly adopted systems. See the [Training Library](#) for more information on Cisco training websites and videos on demand (VODs).

Additional Sites and Services

Steps to Success is a Cisco methodology that outlines the tasks required to complete a successful customer engagement. Registered users can visit the [Steps to Success](#)  resource site for Cisco Unified Communications process flows.

Cisco Unified Communications Services is a Cisco service offering that provides engineering expertise and best practices.

- Registered users can visit the [Cisco Unified Communications Services](#)  partner site.
- Nonregistered users can visit the [Cisco Unified Communications Services](#) site.