



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

Components are configured and ready to test:

- For basic standalone operation
- For interoperability in your applications
- Acceptance Test Plan is completed


Major Tasks in This Process

- [Order Equipment](#)
- [Install and Configure System Components](#)
- [Prepare 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.

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 installation plan for your team. Describe what needs to be installed and configured. Your plan should reference product-specific installation and configuration guides that can be used during the implementation process.

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 contact center deployment. It does not describe installation procedures for individual components. For links to the complete documentation set for each contact center system component, see the [Component Resources Documentation](#) topic in the Resource Library.

The following topics provide additional information for installing and configuring individual contact center products:

- [Component Installation and Configuration Guides](#) provides a complete list of components and links to related installation and configuration documents.
- [Installation and Configuration Checklists](#) provides checklists for installing and configuring some of your contact center components.
- [Component Compatibility and Interoperability](#) provides links to information about compatibility between Cisco products and with third-party systems or a hardware platform.

For a list of links to information on components that are used in the contact center environment, see the [Component Resources Documentation](#) topic in the Resource Library.

Performing Your System Installation

Before You Begin

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

Install Contact Center 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. For a description of deployment models, see [Test Deployment Models and Sites](#).
- 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 compatibility, installation, and upgrade documentation.

Component Installation and Configuration Guides

This topic provides references to installation and configuration documents for the software and hardware components that are part of the Cisco Unified Communications system family of products. This information includes component names and related documentation.

Table 4-1 Component Installation and Configuration Documentation

Product Category	Product Technology	Components	Documentation Title
IP Telephony	Cisco Unified Communications Manager	<ul style="list-style-type: none"> • Cisco Unified Communications Manager • Cisco Real-Time Monitoring Tool • Music on Hold • Cisco Security Agent (only as a standalone agent) • Third-party Antivirus 	<ul style="list-style-type: none"> • Installing Cisco Unified Communications Manager • Upgrading to Cisco Unified Communications Manager Release 6.1(1) from Cisco Unified Communications Manager Release 5.x and Release 6.x • Upgrading to Cisco Unified Communications Manager from Cisco Unified Communications Manager 4.x Releases • Cisco Unified Communications Manager Administration Guide • Cisco Unified Serviceability Administration Guide for Cisco Unified Communications Manager • Cisco Unified Communications Manager System Guide • Cisco Unified Communications Manager Bulk Administration Guide
	Cisco Unified Presence	<ul style="list-style-type: none"> • Cisco Unified Presence 	<ul style="list-style-type: none"> • Installing Cisco Unified Presence • Cisco Unified Presence Administration Guide • Cisco Unified Serviceability Administration Guide for Cisco Unified Presence
	Cisco Unified IP Phones	<ul style="list-style-type: none"> • Cisco Unified IP Phones (SIP) 7941G, 7961G, 7970, 7971G • Cisco Unified IP Phones (SCCP) 7940, 7941G, 7960, 7961G, 7970, 7971G • Cisco Unified IP Phone 7921G (Wireless) 	<ul style="list-style-type: none"> • Cisco 7900 Series IP Phones Install and Upgrade Guides • Cisco 7900 Series IP Phones End-User Guides • Cisco 7900 Series IP Phones Maintain and Operate Guides

Table 4-1 Component Installation and Configuration Documentation (continued)

Product Category	Product Technology	Components	Documentation Title
Customer Contact	Cisco Unified Intelligent Contact Management	<ul style="list-style-type: none"> • Cisco Unified Intelligent Contact Management Enterprise • Cisco Unified Contact Center Enterprise • Cisco Unified System Contact Center • Progger (Peripheral Gateway, CallRouter, and Logger) • Rogger (CallRouter and Logger) • Generic Peripheral Gateway • Cisco Unified Contact Center Gateway Enterprise • Cisco Unified Contact Center System Gateway • Media Routing PG • CTI Server • Real-Time Admin Workstation (RTAW) • Historical Data Server • WebView • Cisco Unified Outbound Dialer • Cisco Unified Mobile Agent • Cisco Security Agent • Windows 2003 Active Directory • Third-party Antivirus 	<ul style="list-style-type: none"> • Pre-installation Planning Guide for Cisco ICM Enterprise and Hosted Editions • Installation Guide for Cisco ICM/IPCC Enterprise & Hosted Editions • ICM Configuration Guide for Cisco ICM Enterprise Edition • Installation Guide for Cisco ICM/IPCC Enterprise and Hosted Editions • Cisco IPCC Gateway Deployment Guide for Unified ICME, Unified CCE, and Unified CCX, Enterprise and Express • System IPCC Enterprise Installation and Configuration Guide • IPCC Administration Guide for Cisco IPCC Enterprise Edition • WebView Installation and Administration Guide for Cisco ICM/IPCC Enterprise & Hosted Editions • Outbound Option Setup and Configuration Guide for Cisco ICM/IPCC Enterprise & IPCC Hosted Editions • Mobile Agent Guide for Cisco Unified CC Enterprise & Hosted • Cisco Security Agent Installation/Deployment Guide for Cisco ICM/IPCC Enterprise & Hosted Editions • Hardware and System Software Specification (Bill of Materials) for Cisco ICM/Unified Contact Center Enterprise & Hosted Editions • Security Best Practices for ICM/Contact Center Enterprise & Hosted Editions • Staging Guide for Cisco ICM/Contact Center Enterprise & Hosted Editions

Table 4-1 Component Installation and Configuration Documentation (continued)

Product Category	Product Technology	Components	Documentation Title
	Cisco Customer Response Solutions	<ul style="list-style-type: none"> • Cisco Customer Response Solutions (CRS) • Cisco Security Agent • Third-party Antivirus 	<ul style="list-style-type: none"> • Getting Started with Cisco Unified IP IVR Customer Response Solutions • Cisco Customer Response Solutions Installation Guide • Cisco Customer Response Solutions Administration Guide • Installing Cisco Security Agent for Cisco Customer Response Solutions
	Cisco Unified Customer Voice Portal	<ul style="list-style-type: none"> • Cisco Unified Customer Voice Portal • Unified CVP Call Servers • Cisco Unified CVP Reporting Server • Cisco Unified CVP Operations Console • HTTP Media Server/Web Server • Cisco Unified Customer Voice Portal Studio • Nuance OSR • Nuance OSMS • Cisco Security Agent • Third-party Antivirus 	<ul style="list-style-type: none"> • Installation and Upgrade Guide for Cisco Unified Customer Voice Portal • Configuration and Administration Guide for Cisco Unified Customer Voice Portal • Cisco Security Agent Installation/Deployment Guide for Cisco Customer Voice Portal • Reporting Guide for Cisco Unified Voice Portal
	Cisco Agent Desktop Server	<ul style="list-style-type: none"> • Cisco Agent Desktop Server • Cisco Supervisor Desktop • CAD Agent Desktop • Cisco Security Agent (on desktop) • Voice over IP (VoIP) Monitor Server 	<ul style="list-style-type: none"> • Cisco CAD Installation Guide • Cisco Desktop Administrator User Guide • Cisco Supervisor Desktop User Guide • Cisco Agent Desktop User Guide

Table 4-1 *Component Installation and Configuration Documentation (continued)*

Product Category	Product Technology	Components	Documentation Title
	Cisco Telephony Integration Object Server	<ul style="list-style-type: none"> • Cisco Telephony Integration Object Server • Cisco Supervisor Desktop • CTI OS Agent Desktop • Cisco Security Agent (on desktop) 	<ul style="list-style-type: none"> • CTI OS System Manager's Guide for Cisco ICM/IPCC Enterprise & Hosted Editions • CTI OS Supervisor Desktop User Guide for Cisco Unified Contact Center Enterprise & Hosted • CTI OS Agent Desktop User Guide for Cisco Unified ICM/CC Enterprise & Hosted Editions • Hardware and System Software Specification (Bill of Materials) for Cisco ICM/Unified Contact Center Enterprise & Hosted Editions
Unified Communications Applications	Cisco Unity Connection	<ul style="list-style-type: none"> • Cisco Unity Connection 	<ul style="list-style-type: none"> • Installation Guide for Cisco Unity Connection • Supported Hardware and Software, and Support Policies for Cisco Unity Connection • Cisco Communications Manager Integration Guides for Cisco Unity Connection • Cisco SIP Proxy Server Integration Guide for Cisco Unity Connection
Security Management	Firewall and Appliance Services	<ul style="list-style-type: none"> • Cisco Catalyst 6500 Series Switch Firewall Services Module (FWSM) • Cisco Adaptive Security Appliance (ASA) 5540 Services 	<ul style="list-style-type: none"> • Catalyst 6500 Series Firewall Services Module Guides • Cisco ASA 5500 Series Adaptive Security Appliance Install and Configuration Guides
	CiscoWorks Management Center for Cisco Security Agent and Cisco Security Agent	<ul style="list-style-type: none"> • CiscoWorks Management Center for Cisco Security Agents • Cisco Security Agents 	<ul style="list-style-type: none"> • Installing Management Center for Cisco Security Agents • Using Management Center for Cisco Security Agents
Voice Network Management	Cisco Unified Operations Manager	<ul style="list-style-type: none"> • Cisco Unified Operations Manager 	<ul style="list-style-type: none"> • Quick Start Guide for Cisco Unified Operations Manager • Installation Guide for Cisco Unified Operations Manager
Communications Infrastructure	Cisco 7800 Series Media Convergence Servers	<ul style="list-style-type: none"> • Cisco 7800 Series Media Convergence Servers 	<ul style="list-style-type: none"> • Cisco 7800 Series Media Convergence Servers Install and Upgrade Guides

Table 4-1 Component Installation and Configuration Documentation (continued)

Product Category	Product Technology	Components	Documentation Title
	Catalyst 3500 Series	<ul style="list-style-type: none"> • Cisco Catalyst 3550 multilayer switch 	<ul style="list-style-type: none"> • Cisco Catalyst 3550 Series Switches Install and Upgrade Guides • Cisco Catalyst 3550 Series Switches Configuration Guides
	Catalyst 6500 Series	<ul style="list-style-type: none"> • Cisco Catalyst 6506, 6509 • Cisco Catalyst 6506, 6509 (MSFC) • Cisco Catalyst 6506, 6509 (Communications Media Module) 	<ul style="list-style-type: none"> • Cisco Catalyst 6500 Series Switches Install and Upgrade Guides • Cisco Catalyst 6500 Series Switches Configuration Guides
	Gateways/Gatekeepers	<ul style="list-style-type: none"> • Unified CVP, VXML Voice/data, H.323, SIP, and MGCP Gateways: Cisco 3725, 3745, 3825 and 3845 • Unified CVP, VXML voice, H.323, and PSTN Gateways: AS5400, HPX/AS5400XM • PSTN and voice gateways: AS5850 • Cluster Gatekeeper: Cisco 3745 • RSVP Agent: Cisco 37xx and Cisco 38xx Platforms 	<ul style="list-style-type: none"> • Cisco AS5400 Series Universal Gateways • Cisco AS5800 Series Universal Gateways • Cisco 3700 Series Multiservice Access Routers • Cisco 3800 Series Integrated Services Routers
	Routers	<ul style="list-style-type: none"> • Cisco 7206 • Cisco 871 router (teleworker access router) 	<ul style="list-style-type: none"> • Loading Cisco IOS Software Quick Start Guide • Cisco IOS Software Releases 12.4 T Configuration Guides • Cisco 7206 Installation and Configuration Guide • Cisco 850 Series and Cisco 870 Series Access Routers Cabling and Setup Quick Start Guide • Cisco Easy VPN Remote
Data Center Application Services	Cisco Content Services Switch	<ul style="list-style-type: none"> • Cisco 11500 Content Services Switch • WebNS 	<ul style="list-style-type: none"> • Cisco CSS 11000 Series Content Services Switches Install and Upgrade Guides • Cisco CSS 11000 Series Content Services Switches Configuration Guides • Cisco CSS 11000 Series Content Services Switches Maintain and Operate Guides

Installation and Configuration Checklists

Use the checklists from the following documents to install and configure the required components for your applications.

**Note**

The order in which you install components depends on your site. Follow the order recommended in your site-specific implementation plan.

- [Installing Cisco Unified Communications Manager Release 6.1\(1\)](#)
- [IPCC Installation and Configuration Guide for Cisco IPCC Enterprise Edition](#)
- [System IPCC Enterprise Installation and Configuration Guide](#)
- [Cisco IPCC Gateway Deployment Guide for Unified ICME, Unified CCE, and Unified CCX, Enterprise and Express](#)
- [Customer Response Solutions \(Unified IP IVR\)](#)
 - [Getting Started with Cisco IP IVR Cisco Customer Response Solutions](#)
 - [Cisco Customer Response Solutions Installation Guide](#)
- [Configuration and Administration Guide for Cisco Unified Customer Voice Portal](#)

Component Compatibility and Interoperability

Use the following links to access commonly used interoperability and compatibility information for Cisco products with each other, with a third-party system, or with a computer hardware platform.

- [Cisco Unified Communications Compatibility Tool](#)
- [Cisco IP Contact Center Enterprise Edition Software Compatibility Guide](#)
- [Cisco Unified Contact Center Express \(Cisco Unified CCX\) Software and Hardware Compatibility Guide](#)
- [CTI Compatibility Matrix](#)
- [Cisco Interoperability Portal](#)
- [Hardware and System Software Specification \(Bill of Materials\) for Cisco Unified ICM/Unified CC Enterprise & Hosted Editions, Release 7.2\(1\)](#)
- [Hardware and System Software Specification for Cisco Unified Customer Voice Portal \(Unified CVP\), Release 4.0\(1\), Release 4.0\(1\) SR1, Release 4.0\(2\)](#)

Software Versions and System Caveats

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

Call Flow Configuration Commands

Sample configuration commands for components that are involved in the call flows are in downloadable zip files for all test bed components in [Configuration Command Files](#) in the Resource Library.

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 contact center network, problems are typically discovered and reported by one of the following types of users:

- External customers dialing into a call center to order products, obtain customer service, and so forth.
- Internal agents receiving incoming calls from a call queue or initiating outbound collection calls to customers.
- Internal users using administrative 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 4-2](#) 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 4-2 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.
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.

Table 4-2 Questions to Ask Users When They Report Problems (continued)

Ask this Question...	To Determine...
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 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 contact center network such as:

- New agent 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 4-3](#) lists the diagnostic tools and supporting troubleshooting documentation available for most components in a contact center 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 where appropriate.

Table 4-3 Contact Center 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

Table 4-3 Contact Center Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Contact Center	Cisco Unified Intelligent Contact Management Enterprise	Distributed Diagnostics and Services Network (DDSN) Support Tools Dashboard (requires additional software)	ICM Administration Guide for Cisco ICM/IPCC Enterprise & Hosted Editions Cisco Support Tools User Guide for Cisco Unified Software Troubleshooting TechNotes
	Cisco Unified Contact Center Enterprise	Log files: <ul style="list-style-type: none"> • Error/event logs • Agent desktop activity logs • Debugging logs Test programs: <ul style="list-style-type: none"> • Chat Service test program • Enterprise Service test program • IP Phone Agent Service test program • Packet Capture Driver test program • Recording and Statistics Service test program • Sniffing Adapter Update Utility • Voice Over IP Monitor service test program 	Mobile Agent Guide for Cisco Unified CC Enterprise & Hosted, “Configuration and Troubleshooting Appendix for Remote Agent” appendix Troubleshooting Guide for Cisco Unified Contact Center Management Portal Troubleshooting TechNotes
	Cisco Customer Response Solutions (Unified IP IVR)	Log files Alarms	Cisco Customer Response Solutions Servicing and Troubleshooting Guide, “Part II Troubleshooting” Troubleshooting TechNotes
	Cisco Unified Customer Voice Portal	Error messages Alarms Support Tools Dashboard (requires additional software)	Troubleshooting Guide for Cisco Unified Customer Voice Portal Installation and Upgrade Guide for Cisco Unified Customer Voice Portal, “Troubleshooting Unified CVP Software Installation” chapter Cisco Support Tools User Guide for Cisco Unified Software Troubleshooting TechNotes

Table 4-3 Contact Center Component Troubleshooting Tools and Documentation (continued)

Category	Component	Diagnostic Tools Available	Information Available In...
Contact Center (continued)	CTI Object Server (CTIOS)	Log files: <ul style="list-style-type: none"> • CTI OS Server logs • CTI Toolkit logs Error messages in the CTI OS Server console window Support Tools Dashboard (requires additional software)	CTI OS Troubleshooting Guide for Cisco ICM/IPCC Enterprise and Hosted Editions Cisco Support Tools User Guide for Cisco Unified Software Troubleshooting TechNotes
	Cisco Agent Desktop (CAD)	Log files: <ul style="list-style-type: none"> • Error/event logs • Agent desktop activity logs • Debugging logs Test programs: <ul style="list-style-type: none"> • IP Phone Agent Service test program • Voice Over IP Monitor service test program Support Tools Dashboard (requires additional software)	Cisco Support Tools User Guide for Cisco Unified Software Troubleshooting TechNotes
Applications	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
Voice Mail and Unified Messaging	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

Table 4-3 Contact Center 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
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
Communications Infrastructure	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 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.
- Create IVR flowcharts that illustrate how calls are routed between agents and sites.

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.

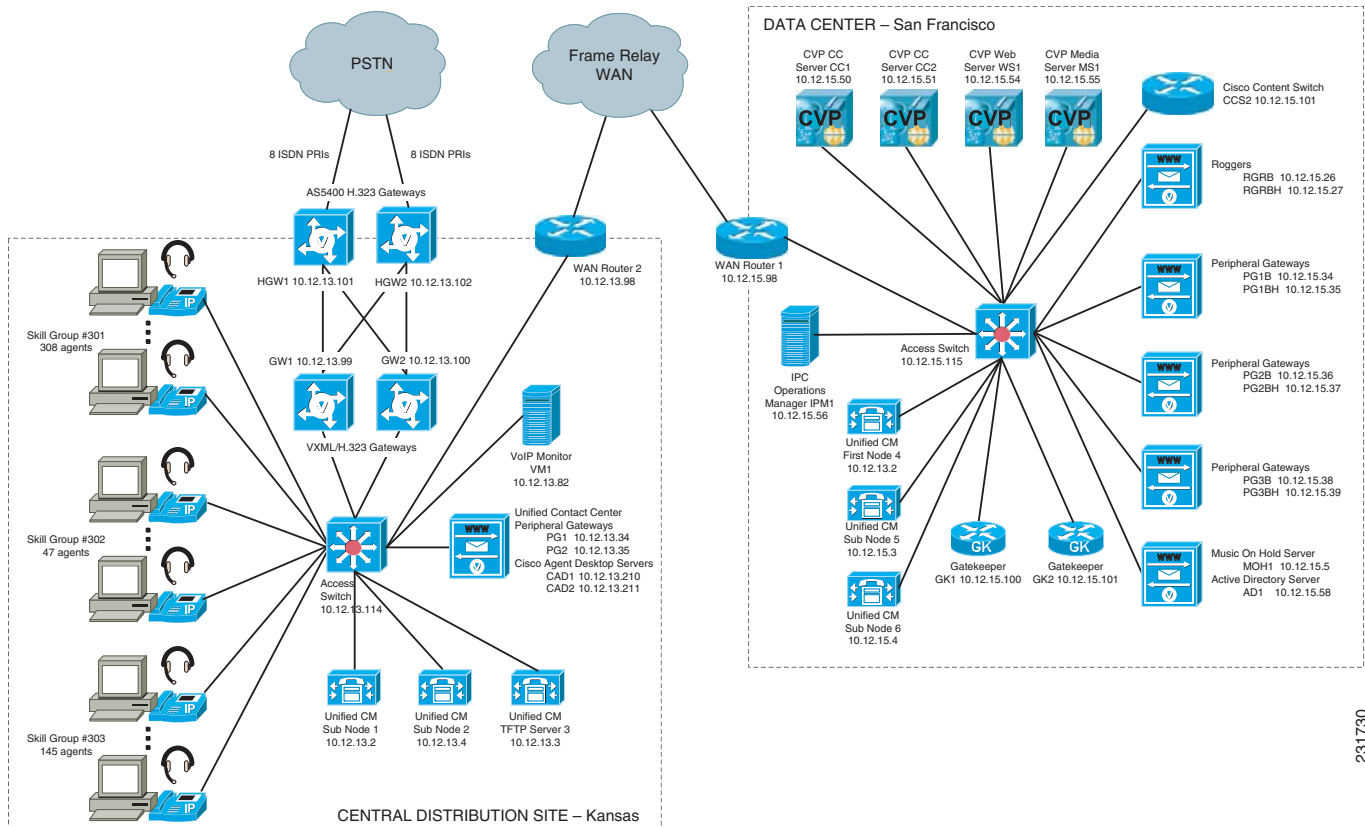


Tip

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 two sites in a contact center network. Agents accepting calls from customers are located in a central distribution site in Kansas, while the equipment supporting interactive voice is located in a data center in San Francisco.

Figure 4-1 Contact Center 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.

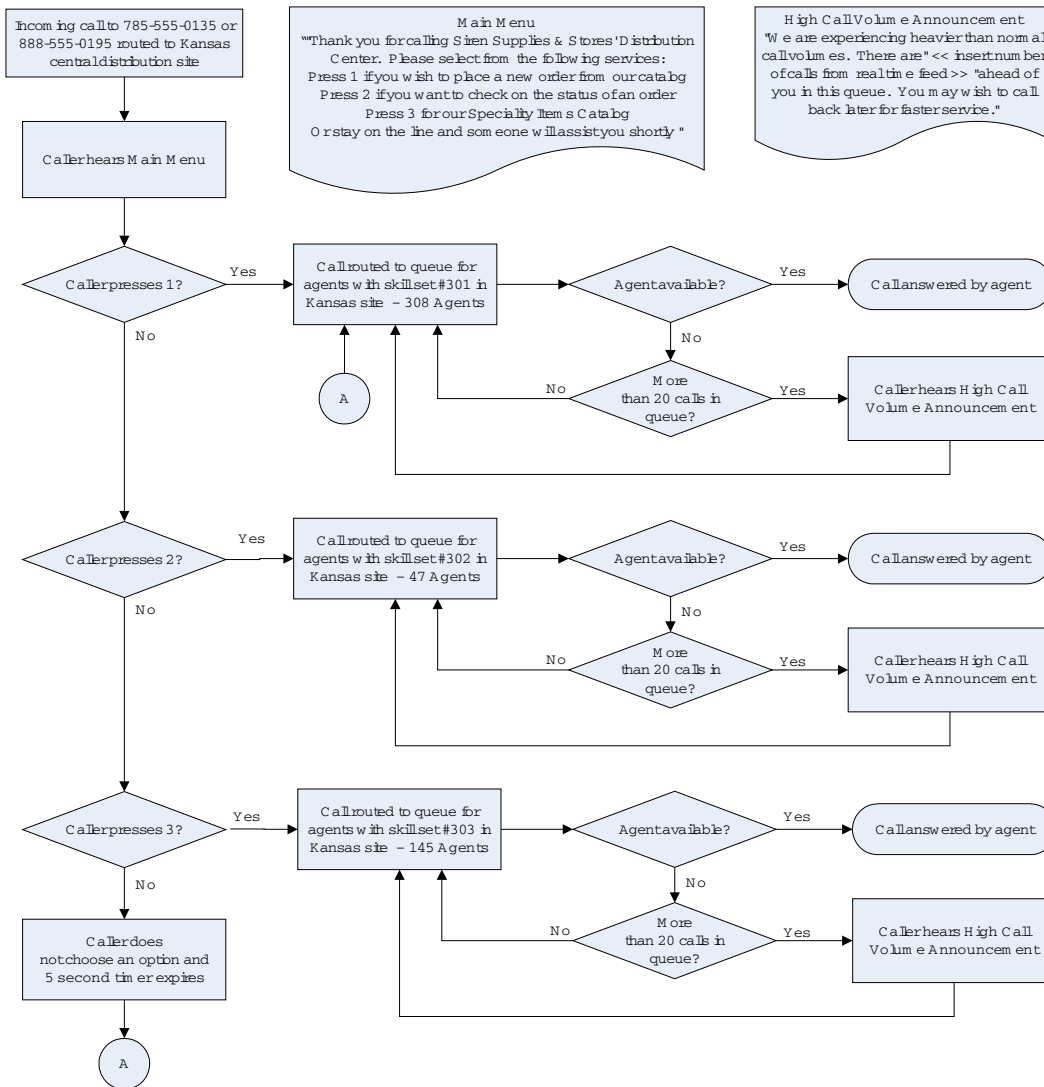
IVR Flowcharts

In a contact center environment, another tool that can help you troubleshoot call processing problems is a flowchart that traces the call routing process based on the interactive voice response (IVR) menu choices that callers make. [Figure 4-2](#) traces the processing of an incoming call received by a central distribution site. The call receives a voice treatment prompting the call to select between three menu options or hold for an agent. The flowchart indicates which set of agents receives the call based on the menu option selected, as well as describing the capacity (number of agents) in the particular skill set group.

For calls received during high traffic periods, with more than 20 calls queued up for agents, the flowchart indicates the announcements played to the callers and how the calls are routed. This type of flowchart is useful for troubleshooting problems reported by external users (customers). While [Figure 4-2](#) shows a fairly simple example, where calls stay within a particular site, some contact center applications may

overflow calls to other sites. In those cases, the overflow calls may traverse an IP WAN to a secondary site and may be handled by additional devices. In situations like that, you need to also view a network topology diagram for the secondary site to trace the call processing.

Figure 4-2 Interactive Voice Response Flowchart Example



Conduct User Acceptance Test

After the components are configured and integrated with other Cisco contact center 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.