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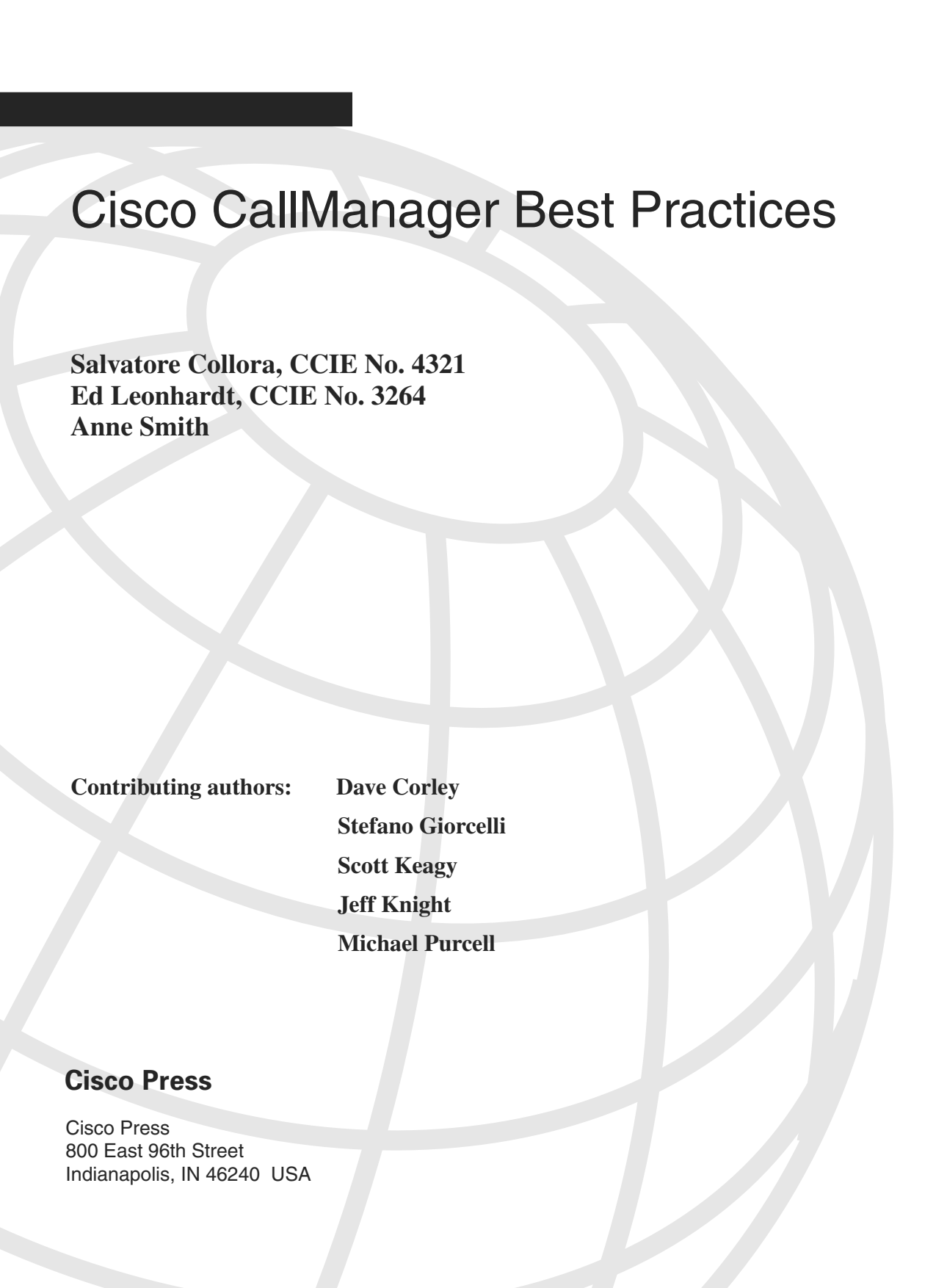
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Cisco CallManager Best Practices

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Dedications

Salvatore Collora

This book is dedicated to the loving memory of my mother, Joann Collora, who passed away during the writing of this book. She lives on through those she touched. She will always be in the hearts of my family.

Ed Leonhardt

I dedicate this book to my mom, who has encouraged me to attempt new things at every opportunity, no matter the challenge. To my faithful four-legged friend, Tasha, for being there through it all.

Anne Smith

For Herb and Vaughn.

Dave Corley

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

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Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the Cisco IOS Software Command Reference. The Command Reference describes these conventions as follows:

- **Bold** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), bold indicates commands that the user inputs (such as a **show** command).
- *Italic* indicates arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets ([]) indicate an optional element.
- Braces ({ }) indicate a required choice.
- Braces within brackets ([{ }]) indicate a required choice within an optional element.

Foreword

When I was a telecom manager in the 1980s and early 1990s, deploying a high-availability voice system was simple: You ordered a box and had your vendor bolt it down in the wiring closet. What could be easier? But those systems were expensive to acquire and maintain. You needed one in every site, and the key system you bought for a small office was completely different from the PBX you bought for a large office. The data network in those days was just a convenience for file and print sharing, not a necessity. And the pace of innovation for voice systems was incredibly slow. I still remember how thrilled my colleagues were the first time they saw the message waiting indicator on their phones light up!

Today, businesses around the world are moving more and more mission-critical services to their data network. Whether it is an enterprise financial application, a help desk program, an IP-based contact center, IP telephony services, or networked storage, these services must provide the same or better availability than the legacy systems they replace. This trend calls for a new approach to designing, implementing, and managing mission-critical converged networks—one that is based on the 3Ps principle: predictive, preventative, and proactive.

The trend toward converged systems also calls for a new kind of communications professional. It is no longer sufficient to be an expert in data only or voice only. Today, telecom and data network managers must have expertise in both data systems and voice systems. For example, data network managers must understand how to manage delay, jitter, and loss budgets for voice services on the IP network. Voice system managers must understand the importance of QoS, security, and availability on the data network. Whether you are a data professional or a voice professional, this book is designed to guide you in the best practices for building a high-quality, secure, reliable converged IP telephony solution.

With the introduction of Cisco CallManager release 4.0, we have reached an important milestone in the evolution of IP telephony solutions. Incorporating the traditional calling features businesses have come to expect in legacy PBXs, standards-based protocols such as SIP and Q.SIG and innovative new features like integrated videoconferencing and media encryption, CallManager 4.0 represents a new benchmark for both employee productivity and ease of migration from existing TDM systems to new IP-based systems.

As of May 2004, Cisco has sold 3 million IP phones—more than all the IP phones sold by all other vendors combined—and we have 15,000 IP customers using our IP Telephony, unified messaging, rich-media conferencing, and customer contact solutions, including more than half of the Fortune 500.

The privileged position of Cisco in the IP telephony market means that we have learned more about what it takes to design, implement, and manage mission-critical converged networks than anyone else in the industry. *Cisco CallManager Best Practices* brings the benefit of that experience to you. The authors have spent the last five years in the trenches building IP-based voice networks, from the bleeding edge solutions of several years ago to the reliable and robust systems being used by all kinds of businesses around the world today. This book is an invaluable resource in helping communications professionals successfully manage the fundamental transition in the voice business we are experiencing today.

Donald R. Proctor
Vice President and General Manager
Voice Technology Group
Cisco Systems, Inc.

Introduction

This book describes best practices for CallManager and related IP Telephony components, such as IP phones, gateways, and applications. Detailed coverage of other elements of the Cisco IP Telephony solution is provided, including planning an implementation, installing, backing up and restoring, using services and parameters, call detail records, and much more. You will get the most from this book if you are already familiar with CallManager and the Cisco IP Telephony solution, but even if you haven't yet deployed the solution or you're just planning the deployment, you can glean valuable information. Be aware that concepts and components are not explained in detail; you can learn this information from other books in the Cisco AVVID Solution published by Cisco Press or through the Cisco IP Telephony documentation.

NOTE

Not all best practices should be deployed for every installation, so we have tried to provide an array of best practices. You should carefully consider which best practices make sense for your deployment.

The inspiration for this book was fueled by customers, who time after time would ask the same questions: How do I track things? How do I know what's going on? How do I configure intercom? How do I know when a gateway is down? The management, monitoring, provisioning, and operations capabilities of CallManager release 4.0 are a direct result of customer feedback. This book's goal is to document the best ways of taking advantage of all the capabilities CallManager offers.

The information contained in these chapters is the result of painstaking experience in the field, working with real customers, combined with time spent in the lab on a new product. Although we've tried to cover everything, there will invariably be things you don't find as you read. The reason is that every environment is different, and all customers need different things. We cast a wide net within Cisco, asking for input, and we received many suggestions. We polled systems engineers, Cisco partners, and customers. Hopefully, our experiences, put on paper in this book, will enable you to run a top-notch system and provide you with ideas you wouldn't have considered.

Target CallManager Release

This book is written to CallManager release 4.0(1). Updates to this book might be provided after publication. You should periodically check the Cisco Press website for updates and free downloads. Go to

<http://www.ciscopress.com/1587051397>

Goals and Methods

The goal of this book is to provide you with best practices in the form of small, digestible nuggets of information that make a real difference when you're running a CallManager installation. The writing style is meant to be "bursty" rather than providing long narratives and lots of screen captures. In some cases, references are made to other books in the Cisco AVVID Solution series from Cisco Press and the various release notes, tech notes, application notes, white papers, design guides, and configuration guides that are posted on Cisco.com. Rather than repeat the information you can find on Cisco.com, we reference those documents and provide links so that you can find that valuable information yourself.

Using Links

This book provides many links to Cisco.com and other websites. Over time, documents might get moved, so it's possible that some of the links referenced in this book may no longer work. You can use the search engine at Cisco.com to try to find the document. For Cisco.com documentation links (which have /univercd/cc/td/doc/ in the path), you can investigate to try to find the referenced document or a newer document that might provide the same information.

Take the following link, for example:

http://www.cisco.com/univercd/cc/td/doc/product/lan/cat6000/sw_8_1/config_gd/vtp.htm

If you try that link and find it broken, you can start removing pieces of the address from the end of the link until you find the root and perhaps a newer document. For example, this link points to a document called "Configuring VTP." Remove the **vtp.htm** portion and retry the link. You'll find the main page of links for the Catalyst 6500 Series Software Configuration Guide, version 8.1. Look for a document that might be related to VTP in that list of links.

If removing that portion of the address doesn't return a hit, try removing the next portion, **config_gd/**. The link http://www.cisco.com/univercd/cc/td/doc/product/lan/cat6000/sw_8_1 brings you to the Catalyst 6500 Series Software Documentation for version 8.1. If you are using a newer version, you might want to remove the version-specific portion of the address to see if relevant documentation for your version exists. In that case, remove **sw_8_1/** and try <http://www.cisco.com/univercd/cc/td/doc/product/lan/cat6000/>, which brings you to the root of the Catalyst 6500 Series Switches documentation.

Who Should Read This Book?

This book is intended for voice and data networking professionals who either have CallManager installed or are considering installing it. Some experience with CallManager and other Cisco IP Telephony components will result in the best understanding of all the material presented here. This book is written to be understood by the person with moderate skill levels in either voice or data networking.

Some of the concepts introduced in this book have background material associated with them, but many do not. The purpose of this book is to offer best practices, not repeat much of the basic conceptual and configuration information you can easily find in other resources. References throughout the book point you to various websites or other resources for more information. We also encourage you to read the books listed in the "Further Reading" section.

How This Book Is Organized

This book is organized as a useful guide in running a CallManager system. It should be read cover-to-cover in a linear fashion if you currently don't run CallManager. If you have a running system, feel free to jump to individual chapters of interest.

- **Chapter 1, “Planning the CallManager Implementation,”** details planning considerations such as assessing the current infrastructure and voice environment, choosing the right equipment, establishing the rollout plan, and providing training.
- **Chapter 2, “Planning Centralized Call Processing Deployments,”** addresses the best practices to follow when you initially deploy CallManager. This chapter focuses on wide-area network deployments, optimizing voice quality, and surviving outages with minimal user disruption.
- **Chapter 3, “Installing CallManager,”** describes preinstallation, installation, and post-installation best practices to ensure the smoothest possible installation and the maximum amount of uptime after the software is installed.
- **Chapter 4, “Backing Up and Restoring the Environment,”** helps you plan a backup strategy, back up the environment, restore the environment, and troubleshoot typical backup problems.
- **Chapter 5, “Upgrading and Patching CallManager,”** continues where Chapter 3 left off. This chapter addresses the best way of upgrading and patching the system so that you experience the least downtime, yet stay current.
- **Chapter 6, “Securing the Environment,”** describes a set of best practices to mitigate security threats, including account and password management, OS hardening, security considerations for remote administration, secure endpoint provisioning, and a variety of infrastructure prevention and detection mechanisms that operate at layers 2 through 7.
- **Chapter 7, “Configuring CallManager and IP Telephony Components,”** provides best practices and configuration tips for the CallManager system and features such as music on hold, extension mobility, intercom, video, system and group speed dials, IP phones, gateways, dial plan components, toll fraud prevention, tools, and applications such as IPMA, SoftPhone/Communicator, BAT, and Attendant Console.
- **Chapter 8, “Managing Services and Parameters,”** describes best practices for CallManager-related services and highlights some of the pertinent service and enterprise parameters. It also provides several recommendations for which services should be activated on each server in a cluster, based on the size of your deployment.
- **Chapter 9, “Using Multilevel Administration,”** details best practices associated with the MLA feature in CallManager, including monitoring the Access log, creating custom groups, and maintaining security.
- **Chapter 10, “Mastering Directory Integration,”** addresses the main design principles for integrating CallManager with a corporate LDAP directory, and summarizes design considerations for providing IP phones with access to a corporate LDAP directory.

- **Chapter 11, “Administering Call Detail Records,”** details best practices associated with the use of call detail records and call management records in CallManager, including troubleshooting, using CAR, and using third-party CDR applications.
- **Chapter 12, “Managing and Monitoring the System,”** provides best practices for the various facilities available within the CallManager environment for management and monitoring. These include things such as authentication, authorization, and accounting, Simple Network Management Protocol (SNMP), Microsoft Performance, and syslog.
- **Chapter 13, “Using Real-Time Monitoring Tool,”** details the most important aspects of running RTMT. This chapter addresses how to set alerts and provides points of focus.
- The **Appendix, “CallManager 4.0 New Feature Description,”** briefly describes the new features in CallManager release 4.0. It is not a substitute for formal product documentation, but it can help you understand the basics of the new features.
- The **Glossary** defines terms and acronyms used in this book.

Comments for the Authors

The authors are interested in your comments and suggestions about this book. Please send feedback to ccmbestpractices@external.cisco.com

Updates and Free Downloads

Check the Cisco Press website for updates to chapters and free downloads, such as a starter spreadsheet for interviewing users to develop user classes (FeatureInventory.xls, as discussed in Chapter 1), and a sample dial plan document in Visio format (Sample-Dial-Plan.vsd, as discussed in Chapter 1). Check the following link regularly

<http://www.ciscopress.com/1587051397>

Further Reading

The authors recommend the following resources for more information. You can find the books mentioned here at a technical bookseller near you or at an online bookseller.

Cisco Documentation

You should be familiar with and regularly using the documentation that is provided with the Cisco IP Telephony system to supplement the information in this book.

You can find Cisco IP Telephony documentation by searching for a specific product on Cisco.com or by starting at the following link

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

Cisco CallManager Fundamentals: A Cisco AVVID Solution

You'll find detailed information about CallManager's inner workings in the book *Cisco CallManager Fundamentals* (ISBN 1-58705-008-0). You can examine this book at a technical bookseller near you or at an online bookseller.

Troubleshooting Cisco IP Telephony: A Cisco AVVID Solution

You can find extensive troubleshooting information and methodology in the book *Troubleshooting Cisco IP Telephony* (ISBN 1-58705-075-7). You can examine this book at a technical bookseller near you or at an online bookseller.

Developing Cisco IP Phone Services: A Cisco AVVID Solution

You can find instructions and tools for creating custom phone services and directories for Cisco IP Phones in the book *Developing Cisco IP Phone Services* (ISBN 1-58705-060-9). You can examine this book at a technical bookseller near you or at an online bookseller.

Cisco IP Telephony

You can find installation, configuration, and maintenance information for Cisco IP Telephony networks in the book *Cisco IP Telephony* (ISBN 1-58705-050-1). You can examine this book at a technical bookseller near you or at an online bookseller.

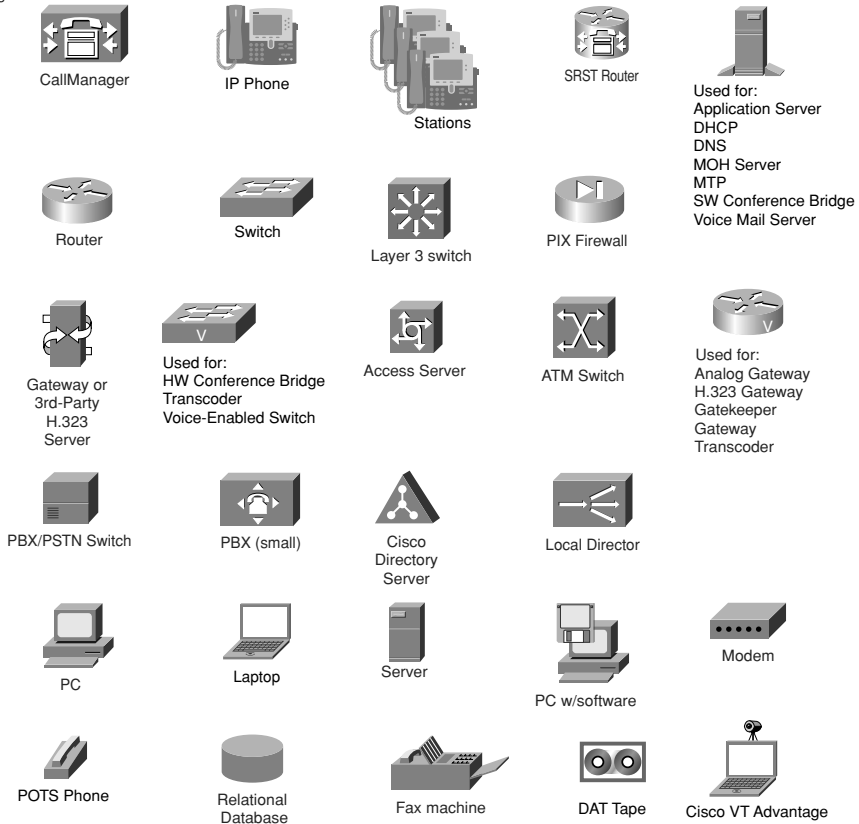
Integrating Voice and Data Networks

You can find information on how to integrate and configure packetized voice networks in the book *Integrating Voice and Data Networks* (ISBN 1-57870-196-1). You can examine this book at a technical bookseller near you or at an online bookseller.

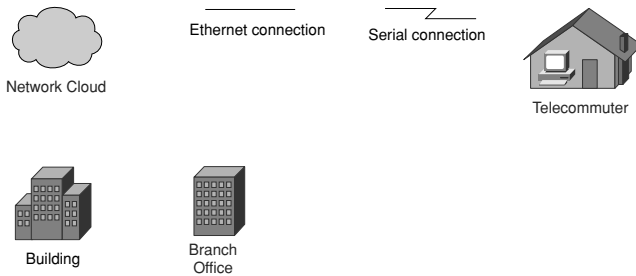
Icons Used in This Book

Throughout this book, you will see a number of icons used to designate Cisco-specific and general networking devices, peripherals, and other items. The following icon legend explains what these icons represent.

Network Device Icons



Media/Building Icons







Installing CallManager

This chapter discusses the best practices for Cisco CallManager installation. Fortunately, the installation routine is automated, but a few possible pitfalls still must be avoided.

The purpose of this chapter is to ensure the smoothest possible installation and the maximum amount of uptime after the software is installed. At first glance, some of the advice given in this chapter could be perceived as dictatorial; however, the instructions are based on lessons learned the hard way by many engineers over the course of many CallManager installations. The authors consulted the Cisco Technical Assistance Center (TAC) teams that support CallManager for their view of the most common causes of failed installations. In addition, the authors consolidated the experiences of several integrators.

Following the recommendations in this chapter will support the success of your installations.

Before the Installation

Chapter 1, “Planning the CallManager Implementation,” explored the planning necessary before installing CallManager. Before you turn on the Media Convergence Server (MCS) or the Cisco-certified server to install CallManager, you should consider the following steps, which smooth out the installation process:

- Determining the installation logistics
- Preparing the installation checklist
- Preparing the installation media
- Verifying network connectivity
- Verifying power, basic input/output system (BIOS) settings, and hardware compatibility
- Using only supported third-party hardware
- Using dual network interface cards (NICs)
- Having your Cisco SmartNet contract number or system serial number on hand
- Reading the release notes

Determine the Installation Logistics

Before performing any kind of installation, be sure you thoroughly organize all the installation logistics. The checklist shown in Table 3-1 highlights some of the most important items. Use it to track completion of the necessary tasks and place a check mark in the first column when you have completed the task.

Table 3-1 *Partial Installation Checklist for Logistics*

Logistics Installation Checklist	
Task	Comments
☐ Rack space available	
☐ Rack-mounting hardware available	
☐ Power outlets sufficient	
☐ Uninterruptible power supply (UPS) available	
☐ Network connectivity in place	
☐ Date and time of installation communicated to interested parties	
☐ Network drop available in the correct VLAN	

In general, it's best to perform CallManager installations in a test environment that is configured to mimic the production network topology. Working first in a test environment affords the time needed to perform all installation, testing, and documentation tasks without the time pressure of an outage window. It also provides time for the logistics mentioned in Table 3-1 to be addressed.

NOTE

CallManager is so flexible that it really does not need to be installed on site. Often, network integrators who are certified in IP Telephony perform most, if not all, of the phases of the installation and configuration off-premises. They often arrive on the day of installation with a fully configured server. This is normal and to be expected. Be sure to ask for full installation documentation if you are the customer, and be sure to provide it if you are the integrator. If issues arise, proper documentation eases interactions with TAC. Table 3-2 provides a means for you to document the current server characteristics.

If you follow the best practices described in this chapter, such as recommendations against joining Windows domains, CallManager servers do not interfere with any other network components. Therefore, if you cannot perform the installation in a lab environment, you can safely do it on the production network, subject to your company's policy on new server introduction.

Check with your server administrators for their checklists of steps necessary to add servers to the production network.

Prepare the Installation Checklist

Before beginning an installation, you should document the characteristics of each server by using a document similar to that shown in Table 3-2. This table supplies the minimal information necessary for troubleshooting. Use it to document the servers prior to installation and place a check mark in the first column when you have documented the information.

Table 3-2 *Pre-Installation Server Characteristics*

Pre-Installation Server Characteristics	
	Item Description
☐	Host name
☐	Windows operating system (OS) version
☐	Windows OS patch level
☐	CallManager version
☐	CallManager patch level
☐	Workgroup name
☐	IP address
☐	IP subnet mask
☐	IP default gateway
☐	IP DNS servers
☐	Publisher or Subscriber
☐	sa password (CallManager 3.3 and below)
☐	Password key (CallManager 4.0 and above)
☐	DC Directory Manager password

continues

Table 3-2 *Pre-Installation Server Characteristics (Continued)*

Pre-Installation Server Characteristics	
Item	Description
☐	Administrator password
☐	Backup server or target
☐	Location of backup
☐	LMHOSTS file entries
☐	NIC speed and duplex

Be sure to place the information in Table 3-2 where the operations team can find it. You would be surprised how much useful documentation often remains inaccessible in locked desks just when needed. If you keep the documentation in printed form, be sure to either black out password information or store passwords in accordance with your company’s policy on documents that contain sensitive information. In addition to the server information, it’s important that an updated network topology diagram be kept in the folder for aid in troubleshooting. If the documentation is kept in electronic form, it’s best to password-protect it.

TIP Whenever you make changes on the server, be sure to update your documentation.

Prepare the Installation Media

This might seem obvious, but it’s important to have all the media available at the time of installation. Depending on the server you are using, you will use CD or DVD media for the installation.

The CD/DVD pack from the factory has Windows OS CD/DVDs and CallManager application software CDs. Depending on the type of server you use, Hewlett-Packard (HP) might include SmartStart CDs in the package. CallManager definitely does not use these HP CDs, although HP provides them in the standard server package.

NOTE In rare cases, the media shipped with your server are incorrect for your system. Be sure to read the release notes to ensure that the labels on your media match the supported versions of the hardware. If you find that your media are incorrect, contact the Cisco Technical Assistance Center at 1-800-553-2447 or <http://www.cisco.com/tac>.

Verify Network Connectivity

Before performing an installation, be sure the system is connected to a network. Even if the system is not connected to the production network at the time of installation, ensuring Ethernet connectivity with the correct speed and duplex settings speeds up the boot sequences during installation.

If the network is unavailable, the CallManager service fails to start, causing errors on the screen that could result in confusion. In addition, the timeout values for the various services make the machine slow and unresponsive.

Verify That Both Power Plugs Are Connected

CallManager 4.0 still supports several older MCS platforms that have dual power supplies, such as the MCS-7835-1266. By default, if both power supplies are not connected, the system does not boot unless you press the F1 key. The default can be changed through the BIOS, but this is not recommended, because it's possible that future upgrades will disable it. See the next section for BIOS information.

The point of the boot interruption is to remind you to replace a bad power supply so that you'll have a way of knowing something is wrong.

Do Not Modify the Original BIOS Settings

Do not change any of the BIOS settings before installation. It's important to leave the computer in the pristine state in which it arrived from the factory. Changing settings without approval from Cisco TAC only makes troubleshooting more difficult should you encounter a problem.

In addition, changing the BIOS settings might cause the installation to fail or cause Windows to behave abnormally. Cisco strongly recommends that you leave the factory default settings as they are. Although many savvy server technicians might be able to make perceived performance improvements by changing the BIOS settings, all the testing of CallManager and the underlying Windows OS is done with the BIOS settings shipped from the factory.

Do Not Add Unsupported Third-Party Hardware

Do not under any circumstances add any third-party hardware that is not supported. Unsupported hardware includes

- Unsupported sound cards
- RAID controllers

- Fibre Channel host/bus adapters
- Tape drives
- Unsupported hard disks
- USB devices
- Memory

These devices are not recognized by the installation routine and therefore can potentially cause the installation to fail. In addition, if an unsupported third-party device is installed in the machine, TAC asks you to remove it before troubleshooting.

Use Dual Network Interface Cards (Adapter Teaming)

Several MCS platforms have two NICs onboard. Adapter teaming is supported starting with CallManager 3.2 and Windows OS 2000.2.4. *Adapter teaming* provides a way for an MCS server to have two connections to the network to provide continuous connectivity in the event of network switch failure.

The following servers currently support the adapter teaming driver:

- Cisco MCS-7825H-2.2-EVV1
- Cisco MCS-7835H-2.4-EVV1
- Cisco MCS-7845H-2.4-EVV1
- Cisco MCS-7835-1266
- Cisco-verified, customer-provided HP DL380 G2 server
- Cisco-verified, customer-provided HP DL380 G3 server, including single and dual processors
- Cisco-verified, customer-provided HP DL320 G2 server

Before you install the adapter teaming driver, Cisco requires that you have installed the Cisco-provided OS version 2000.2.4 or later.

To install the driver, it's crucial that you follow the Installing the Cisco Media Convergence Server Network Teaming Driver instructions on Cisco.com at

http://www.cisco.com/en/US/products/hw/voiceapp/ps378_prod_installation_guide09186a008015a131.html

Using adapter teaming is not a requirement for fault tolerance. Fault tolerance is also achieved using CallManager SQL-based clustering. It's important that you connect your CallManager Publisher and Subscriber servers to different switches in the network to provide fault tolerance in the event of a switch outage.

Locate Your Cisco SmartNet Contract Number or System Serial Number

Before starting any installation or upgrade, it's a good idea to have your contract number in hand. When you call TAC, the operator first requests your contract number. If you have a new machine and have not received your contract number, the serial number of the MCS server will work.

Read the Release Notes

It's absolutely critical to read the release notes for the version of CallManager and the Windows OS you will install. The Achilles' heel of most installations is the failure of the installer to read the release notes thoroughly, which causes him or her to miss something during the setup.

Windows OS Version

As mentioned, you should not assume that you should use the Windows OS CDs that shipped with your product. Which Windows OS you should install depends on the version of CallManager you are installing. Read the section "Check the Compatibility Matrix" in Chapter 1, "Planning the CallManager Implementation" for more information. The release notes list the various OS versions and patch levels that have been tested with each version of CallManager. Install the OS that correlates to the version of CallManager you are installing. If your server did not ship with the proper OS, open a case with TAC to obtain the proper installation media.

CallManager Version

Do not assume that the CallManager CDs that shipped with your server are the most recent or those you should actually install. As the software changes, the various Cisco distribution channels are populated with servers and CDs. It's quite possible that the server you ordered came from a warehouse that had not yet been refreshed.

It's key to determine the version of CallManager you want to run. After you do this, be sure to check Cisco.com to find the latest patches available. Patches generally contain bug fixes that keep your system running smoothly.

Read the release notes for the main CallManager version as well as the patches. The release notes generally list all the bugs that the patch fixes.

For the latest CallManager release and service releases, check the Software Center at <http://www.cisco.com/kobayashi/sw-center/>. You need a Cisco.com login ID and password to access the Software Center. To ensure smooth installation, read the release notes for the version you will install. For example, you might think that the latest Windows OS version

posted on Cisco.com would be the right OS to use in every case. This is not true. In every set of release notes, whether they are for CallManager or the Windows OS, a matrix lists what has been tested and what is recommended. It's essential to the success of your installation that you follow the guidelines in the release notes.

Hardware Compatibility

CallManager 4.0 does not support MCS-7820, MCS-7822, MCS-7830, IBM X330, or IBMX340 servers. Be sure to check the release notes for hardware compatibility.

During the Installation

Whereas the preceding section focused on what you should do before starting the installation process, this section discusses the best practices to use during the installation itself by covering the following topics:

- Locating key directories and files
- Avoiding Windows domain participation
- Updating the LMHOSTS file
- Using consistent passwords across servers

The installation process has two stages—the Windows OS installation and the CallManager installation. The Hardware Detection CD/DVD is used during the Windows OS phase.

Locate Key Directories and Files

After the Windows OS installation is completed, you are prompted for the CallManager installation media. The CallManager media contains Microsoft SQL Server 2000, DC Directory, and CallManager.

When installing CallManager, it's useful to know the key directories and files and their locations, as shown in Table 3-3. Knowing where these files are located makes troubleshooting easier and contributes to better overall knowledge of the environment.

Table 3-3 Important File Locations

Directory	Files that the Directory Contains
C:\CiscoPlugins	CallManager plugins listed under Applications > Install Plug-Ins in Cisco CallManager Administration
C:\CiscoWebs	CallManager Administration web pages

Table 3-3 *Important File Locations (Continued)*

Directory	Files that the Directory Contains
C:\program files\cisco\bin	CallManager application binary files and tools such as CCM.EXE
C:\program files\cisco\CallDetail	Call detail record (CDR) files
C:\program files\cisco\CallManagerAttendant	Cisco CallManager Attendant Console files
C:\program files\cisco\common	Files common to many CallManager services
C:\program files\cisco\EM	Cisco Extension Mobility service
C:\program files\cisco\JRE	Java Runtime Engine
C:\program files\cisco\MA	Cisco IP Manager/Assistant application
C:\program files\cisco\MOH	Music on Hold service
C:\program files\cisco\QRT	Quality Reporting Tool
C:\program files\cisco\TFTPPath	Path from which IP phones and gateways get their configuration files
C:\program files\cisco\trace	CallManager trace files
C:\program files\cisco\users	CallManager Attendant Console that users share
C:\program files\cisco\xntp	XTNP Time Server, used to keep CallManager server clocks synchronized
C:\utils\	Windows 2000 utilities such as KILL and SHUTDOWN
C:\utils\vnc	Virtual Network Computing, which can be used instead of Terminal Services; upgrades can be made using VNC
C:\dcdsrvr	DC Directory
C:\program files\common files\cisco\logs	Common installation log folder for OS and CallManager installation and upgrades
C:\utils\DualNIC	HP adapter teaming driver

Avoid Windows Domain Participation

One question often asked is, “Should I have CallManager servers participate in our Windows domain?” The best practice is to create a workgroup instead of using the Windows domain structure. Although it’s true that adding a CallManager server to the Windows domain allows for the use of existing groups and passwords, issues with domain participation arise during installations or upgrades.

Most of the issues revolve around domain policies, such as password aging and system access policies. For example, if the domain policy is to change passwords every 30 days, and in this cycle the administrator password is changed, it’s very possible that the CallManager services will not start on a reboot.

Although it’s possible to have CallManager in a domain, having it there is a potential detriment that can cause difficulties.

Update the LMHOSTS File

The installation routine gives you the option of adding hosts and IP addresses to an LMHOSTS file. It’s critical that you add the host names and IP addresses of all the servers in your cluster to the LMHOSTS file on every server. Microsoft SQL replication depends on NetBIOS name resolution, which is accomplished by the LMHOSTS file. If you do not add the servers to the LMHOSTS file, Subscriber installations might experience problems with database replication, which causes CallManager to be nonfunctional.

Sometimes the installation routine does not prompt you to add the servers, so you must manually edit the file. All CallManager systems come with two files on the system:

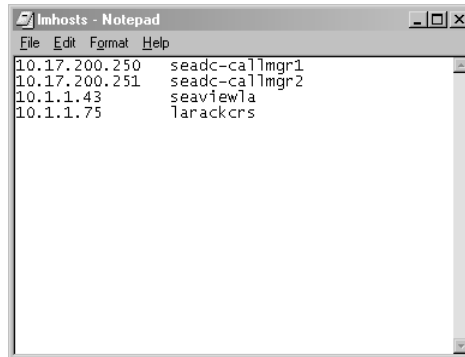
```
C:\winnt\system32\drivers\etc\hosts  
C:\winnt\system32\drivers\etc\lmhosts.sam
```

The latter is a sample LMHOSTS file provided by Microsoft as an example of the file’s syntax. If the installation routine fails to prompt you, rather than editing that file, use the following procedure to manually create a valid LMHOSTS file. Perform this procedure after the OS installation and before CallManager installation.

Step 1 Click **Start > Run**.

Step 2 Enter **notepad c:\winnt\system32\drivers\etc\lmhosts**. (Be sure to include the period.)

Step 3 After Notepad is loaded, enter your information as shown in Figure 3-1.

Figure 3-1 *LMHOSTS File Syntax Using Notepad*

Use Consistent Passwords Across Servers

Before CallManager 4.0, you had to specify passwords for the Directory Manager, the SQL Server 2000 sa, and CallManager Administrator.

CallManager 4.0 forces SQL 2000 to use Windows Authentication mode. This mode has no internal SQL Server 2000 usernames and passwords to be specified. For security reasons, however, the CallManager 4.0 installation still prompts for and sets the sa account password.

Although it's not mandatory that all three passwords be the same, it is important that all the passwords be the same across servers. In other words, the Publisher and all Subscribers must use the same Directory Manager, sa, and Administrator passwords. If these passwords are not the same, synchronization does not occur, and you are forced to use the CCM Password Changer tool. To access the CCM Password Changer tool, open a DOS window (**Start > Run > type cmd**), enter **CCMPwdChanger**, and press **Enter**.

Many installations complete unsuccessfully because of password issues. You will save yourself much grief by making the passwords consistent.

TIP

Many keyboard, video, and mouse (KVM) switches inadvertently change the Caps Lock status when switching between systems. Be sure to double-check that the Caps Lock is OFF before entering any passwords.

After the Installation

This section describes tasks to perform after the installation of CallManager is completed:

- Double-check the items from your pre-installation checklists in Tables 3-1 and 3-2.
- Do not add unauthorized software to CallManager servers.
- Do not change OS parameters.
- Do not create other accounts on the system.
- Do not add Microsoft software updates.
- Verify database synchronization.
- Ensure that the NIC is set to 100/Full.
- Add the Cisco Security Agent.
- Add approved virus protection software.

Double-Check Your Pre-Installation Checklist

Whether you print the installation guide and check off the steps one by one, or you use the checklist provided at the beginning of this chapter, be sure that your installation routine is documented.

There are two main reasons for documentation: to verify that the appropriate steps were taken, and to enable the replication of the procedure by other teams.

TIP

If possible, perform a dry run through the CallManager installation in a lab environment to make sure your processes and procedures are sound.

Dry runs are useful for troubleshooting. If you encounter a problem during the installation, TAC can review your procedure to ensure its validity.

Do Not Add Unsupported Software to CallManager Servers

Under no circumstances should any unapproved software be added to any CallManager system. Unapproved software includes items such as backup utilities and unsupported antivirus programs. CallManager is tested and supported by Cisco “as is” without any unapproved modifications to the OS or hardware.

Adding unapproved software can expose issues in the underlying OS and can adversely affect CallManager operation. Utilities such as backup and virus protection can severely affect a server's CPU load, which can cause performance degradation that negatively affects phone service. In addition, TAC cannot support any system on which unsupported applications have been installed.

WARNING Your CallManager installation will not be supported by TAC if it has unapproved software installed. This cannot be overemphasized. Cisco thoroughly tests the system's performance and cannot support any unauthorized software. Third-party software vendors must go through a rigorous testing procedure to gain approval for the use of their products on a CallManager server.

Backing up the system is always a concern, and that is addressed in Chapter 4, "Backing Up and Restoring the Environment." In addition, security and management are concerns. Table 3-4 lists the various third-party applications that are supported on CallManager.

Table 3-4 *Supported Third-Party Applications*

Application	Category	Vendor
Prognosis	Management	Integrated Research
Vivinet	Management	NetIQ
Norton AntiVirus	Security	Symantec
McAfee Netshield	Security	Network Associates
Cisco Security Agent	Security	Cisco Systems

Do Not Change OS Parameters

Many customers have an information technology (IT) checklist that must be completed before a Windows 2000 system is allowed to be on the network. Although these policies exist for good reason, sometimes one or more steps on the checklist should be skipped. If you are challenged for skipping a step on the checklist, explain that this system should be treated as a closed system even though it uses Windows 2000 as the OS, Microsoft SQL Server 2000 as the database, and Internet Information Server (IIS) as the web server.

Cisco has gone to great lengths to harden the OS, thus obviating the need for further lockdown. In addition, Cisco includes Cisco Security Agent (CSA) free with each CallManager license. CSA protects the system from many types of network attacks. See Chapter 6, "Securing the Environment," for more information on security.

In addition, any and all OS and IIS changes are wiped out during some types of upgrades because the upgrades use a standard image. For example, the upgrade to version 3.3 from versions 3.1 and 3.2 requires a complete server rebuild, and no OS changes are preserved. It's not practical to be required to repeat the changes for each server after each upgrade.

Do Not Create Other Accounts on the System

Several customers have a policy by which the local "administrator" account is disabled, and other accounts with administrative privilege are created and used in day-to-day system operation. This kind of policy is analogous to the types of post-installation tasks covered in the preceding section.

You should avoid modifying or disabling the local administrator account at all costs. CallManager upgrades use this account for various installation tasks, and the password change prompt is presented at the end of every installation. Creating other accounts with administrator privileges is not a problem, but disabling the local administrator account causes many problems during upgrades.

Use Only Microsoft Patches and Updates That You Download from Cisco.com

Under no circumstances should you ever install any Microsoft update or patch directly from the Microsoft website. Do not enable the Windows 2000 Auto Update feature either, because doing so would result in a system that is unstable and unsupported by TAC.

Patches and updates are supplied by Cisco at the Software Center on Cisco.com at <http://www.cisco.com/kobayashi/sw-center/>. You must be logged in with a valid Cisco.com account to access CallManager software. You must install only patches approved by Cisco. Cisco performs regression testing on all patches, which ensures compatibility with all applications.

In addition, various tools such as C:\utils\mcsvr.exe and the Details button on CallManager Administration (**Help > About Cisco CallManager**) use the information contained in the Cisco-packaged updates to maintain the integrity of that data. If you install a Microsoft patch and then you need assistance from TAC, the version of software that you give the customer support engineer could easily be incorrect, which could lead to unplanned downtime.

More information about patching and updates is provided in Chapter 5, "Upgrading and Patching CallManager."

Verify Database Synchronization

When you install a Subscriber server, the Microsoft SQL 2000 Database Pull Subscriptions are created automatically. However, it's important to double-check the subscription's integrity.

To double-check subscriptions, follow this procedure on the Subscriber:

Step 1 Click **Start > Programs > Microsoft SQL Server > Enterprise Manager**.

Step 2 Double-click **Microsoft SQL Servers**.

Step 3 Double-click **SQL Server Group**.

Step 4 Double-click the Subscriber server.

Step 5 Double-click **Databases**.

Step 6 Double-click the CCMXXXX database with the highest value of XXXX.

Step 7 Click **Pull Subscriptions**.

Be sure the status of the subscription is set to Running. If the database status is not Running, follow the procedure outlined in "Using DBLHelper to Reestablish a Broken Cisco CallManager Cluster SQL Subscription," Document ID 46082 at the following link:

http://www.cisco.com/en/US/products/sw/voicesw/ps556/products_tech_note09186a00801e7ddf.shtml

Set the NIC to the Highest Link Speed and Full Duplex

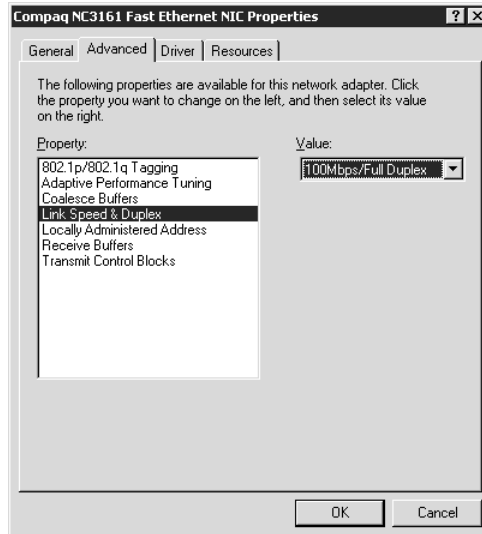
Set the NIC to the highest speed supported by both the server and the switch. Also, be sure to set the duplex to Full. A sample is shown in Figure 3-2. If this is left on auto-detect, which is the default, problems can occur, such as signaling delays, voice cut-through, poor Music on Hold quality, and poor quality on software-based conferences. The NIC is often the last thing you check, but setting the NIC speed and duplex immediately after installation helps you avoid problems related to speed and duplex mismatches.

Do not leave the switch port to which CallManager is connected in auto-negotiate mode. Leaving the port in auto-negotiate mode creates speed and duplex mismatches. Instead, set the port to match the server's speed and duplex.

Follow these steps to change the switch port settings:

Step 1 Click **Start > Settings > Network and Dialup Connections**.

Step 2 Double-click **Local Area Connection**.

Figure 3-2 *Setting the NIC Settings to 100/Full*

Step 3 Click **Properties**.

Step 4 Click **Configure**.

Step 5 Click the **Advanced** tab.

At this point, each server provides a different way to set the speed and duplex. As soon as you are at the screen described in Step 5, it should be an intuitive operation to set the speed and duplex. If you have trouble finding the right settings, contact your server support team.

On CatOS-based Cisco switches, run these commands:

```
set port speed x/y 100
set port duplex x/y full
```

On Cisco IOS software-based Cisco switches, the commands to apply at the interface level are

```
speed 100
duplex full
```

NOTE

When you perform an upgrade to CallManager or the OS, checking speed and duplex should be part of the post-installation procedure, because the installation routine could reset these settings.

Use the Cisco Security Agent

Cisco Security Agent (CSA) provides protection against many kinds of malicious code, including Trojan horses, worms, denial of service attacks, and buffer overflows.

CSA software is provided free with each license of CallManager. Download it from: <http://www.cisco.com/cgi-bin/tablebuild.pl/cmva-3des>. You must be logged in with a valid Cisco.com account to access CSA software.

Add Cisco-Supported Virus Protection Software

Although Cisco provides a headless license of Cisco Security Agent free of charge, you may still want to install approved virus protection software on CallManager servers. Search Cisco.com using keywords such as “virus protection CallManager” and check for Cisco CallManager Bulletins at the following link for virus protection software that has been approved by Cisco. Do not, under any circumstances, install a product that is not specifically supported by Cisco. You may impair the operation of CallManager by doing so.

http://www.cisco.com/en/US/products/sw/voicesw/ps556/prod_bulletins_list.html

Summary

The best practices for installation, which are detailed in this chapter, ensure that you have a clean CallManager system ready to be configured. The system documentation you have prepared as part of performing the installation will be useful when you upgrade the system.

The major steps for installation include the following:

- Before installation
 - Determine the installation logistics.
 - Prepare the installation checklist.
 - Prepare the installation media.
 - Verify network connectivity.
 - Verify that both power plugs are connected.
 - Do not modify the original BIOS settings.
 - Do not add unsupported third-party hardware.
 - Use dual NICs (adapter teaming).
 - Locate your Cisco Smartnet contract number or system serial number.
 - Read the release notes.

- During the installation
 - Locate key directories and files.
 - Avoid Windows domain participation.
 - Update the LMHOSTS file.
 - Use consistent passwords across servers.
- After the installation
 - Double-check your preinstallation checklist.
 - Do not add unsupported software to CallManager servers.
 - Do not change OS parameters.
 - Do not create other accounts on the system.
 - Use only Microsoft patches and updates that you download from Cisco.com.
 - Verify database synchronization.
 - Set the NIC to the highest link speed and full duplex.
 - Use the Cisco Security Agent.
 - Add Cisco-supported virus protection software.

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