Introduction

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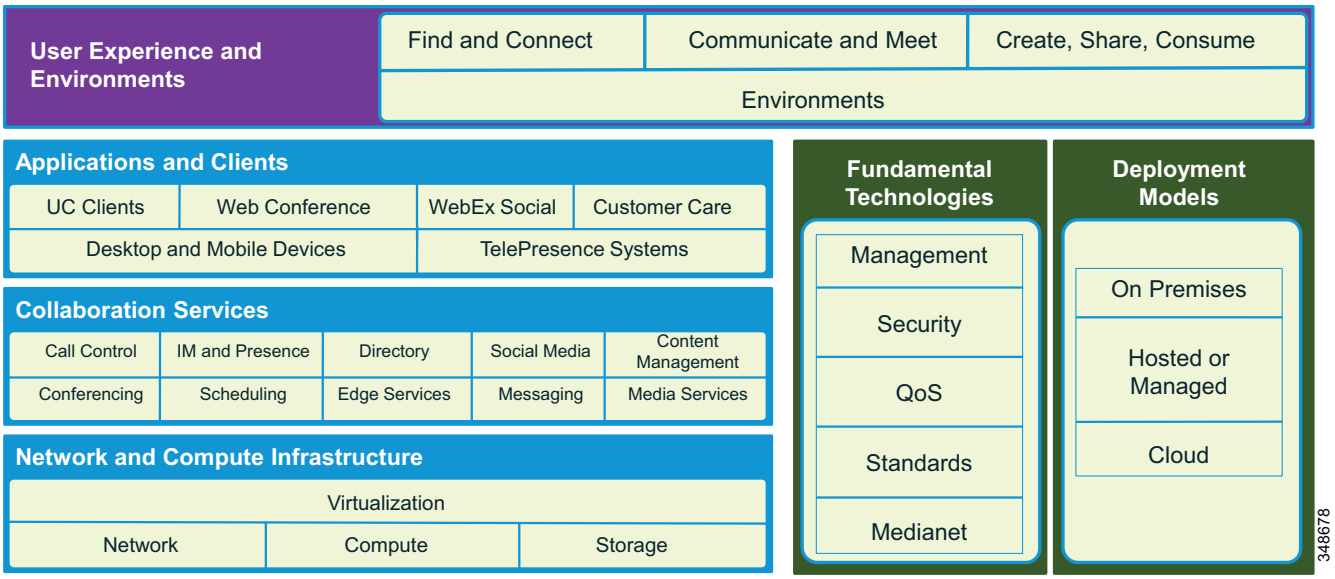
Collaboration means working together to achieve a common goal. Not very long ago, the best way for people to collaborate was for them to be in the same location at the same time so that they were in direct contact with each other. In today's globalized economy with decentralized business resources, outsourced services, and increasing costs for office facilities and travel, bringing people together in the same physical location is not the most efficient or effective way to collaborate. But with Cisco Collaboration Solutions, workers can now collaborate with each other anytime, anywhere, with a substantial savings in time and expenses.

Cisco Collaboration Solutions support the full range of voice, video, and data communications, including the latest advances in mobile communications and social media. Cisco Collaboration Solutions also provide an extensive set of applications and services that can be deployed either on premises or in the cloud.

Cisco End-to-End Collaboration Solutions

Cisco Collaboration Technology comprises an array of products to build complete end-to-end collaboration solutions for virtually any size or type of enterprise. Cisco Collaboration Solutions consists of the following main elements, illustrated in conceptual form in Figure 1-1:

Figure 1-1 Cisco Collaboration Architecture



Collaboration Infrastructure

Cisco has long been recognized as the world leader in routing and switching technology. This technology forms the core of the network infrastructure for Cisco Collaboration Solutions. The Quality of Service (QoS) mechanisms available on Cisco switches and routers ensure that the voice, video, and data communications will be of the highest quality throughout the network. In addition, Cisco gateways provide a number of methods for connecting your enterprise's internal network to an external wide area network (WAN) as well as to the public switched telephone network (PSTN) and to legacy systems such as a PBX. And for a smooth transition into the future, the Cisco Hosted Collaboration Solution (HCS) enables Cisco partners to offer customers cloud-based, hosted collaboration services that are secure, flexible, low-cost, scalable, and always current with the latest technology.

Cisco Collaboration Systems Release 10.*x* is deployed using virtualization with the VMware vSphere ESXi Hypervisor. The Cisco Collaboration application nodes are deployed as virtual machines that can run as single or multiple application nodes on a server. These virtualized applications can provide collaboration services for small and medium businesses, and they can scale up to handle large global enterprises such as Cisco.

In most cases you will want your collaboration sessions to be secure. That is why Cisco has developed a number of security mechanism to protect each level of the collaboration path, from the network core to the end-user devices.

Once your collaboration solution is implemented, you will want to monitor and manage it. Cisco has developed a wide variety of tools, applications, and products to assist system administrators in provisioning, operating, monitoring and maintaining their collaboration solutions. With these tools the system administrator can monitor the operational status of network components, gather and analyze statistics about the system, and generate custom reports.

Collaboration Applications and Services

Cisco Collaboration Solutions incorporate a number of advanced applications and services, including:

- **Instant messaging (IM) and presence** — The Cisco IM and Presence Service enables Cisco Jabber, Cisco Unified Communications Manager applications, and third-party applications to increase user productivity by determining the most effective form of communication to help connect collaborating partners more efficiently.
- **Collaborative conferencing** — Cisco WebEx incorporates audio, high-definition (HD) video, and real-time content sharing in a platform that provides easy setup and administration of meetings, interactive participation in the meeting, and the ability to join the meeting from any type of device such as an IP phone, a tablet device, or a desktop computer.
- **Telepresence** — Cisco TelePresence technology brings people together in real-time without the expense and delay of travel. The Cisco TelePresence portfolio of products includes an array of high-definition (HD) video endpoints ranging from individual desktop units to large multi-screen immersive video systems for conference rooms. And Cisco TelePresence products are designed to interoperate with other Cisco collaboration products such as Cisco WebEx and Cisco Unified IP Phones with video capability.
- **Voice messaging** — Cisco products provide several voice messaging options for large and small collaboration systems, as well as the ability to integrate with third-party voicemail systems using standard protocols.
- **Customer contact** — Cisco Unified Contact Center products provide intelligent contact routing, call treatment, and multichannel contact management for customer contact centers. Cisco Unified Customer Voice Portal can be installed as a standalone interactive voice recognition (IVR) system, or it can integrate transparently with the contact center to deliver personalized self-service for customers. In addition, Cisco SocialMiner is a powerful tool for engaging with customers through the social media.
- **Call recording** — Cisco MediaSense can capture, preserve, and mine conversations for business intelligence and can provide real-time monitoring of customer conversations with contact center personnel.

The Collaboration User Experience

Collaboration is all about the user experience. When users have a good experience with collaboration technology, they will use that technology more often and will achieve better results with it. That translates into a bigger return on investment (ROI) for the enterprise that has adopted the collaboration technology. And that is why Cisco has focused on making its collaboration technology easy, convenient, and beneficial to use, with particular emphasis on the following enhancements to the user experience:

- **Wide variety of collaboration endpoints** — Cisco produces a compete line of endpoint devices ranging from basic voice-only phones, to phones with video and Internet capability, and to high-resolution telepresence and immersive video devices. Cisco Collaboration Technology also provides the ability to integrated third-party endpoint devices into the collaboration solution.
- **Cisco BYOD Smart Solution** — With the Cisco Bring Your Own Device (BYOD) Smart Solution, users can work from their favorite personal device, be it a smartphone, tablet, or PC. In addition to enhancing the work experience, the Cisco BYOD Smart Solution ensures greater network security and simplifies network management by providing a single policy for wired and Wi-Fi access across your organization.

- **Mobile collaboration** — Cisco mobile collaboration solutions provide mobile workers with persistent reachability and improved productivity as they move between, and work at, a variety of locations. Cisco mobility solutions include features and capabilities such as: Extension Mobility to enable users to log onto any phone in the system and have that phone assume the user's default phone settings; Cisco Jabber to provide core collaboration capabilities for voice, video, and instant messaging to users of third-party mobile devices such as smartphones and tablets; and Single Number Reach to provide a single enterprise phone number that rings simultaneously on an individual user's desk phone and mobile phone.
- **Social networking** — Social media is not just for personal use anymore. With Cisco WebEx Social, enterprises can bring the community dynamic and real-time collaboration potential of social media into their business environment.
- **Applications and service** — As mentioned previously, Cisco has developed many advanced applications and services to enrich the collaboration experience for end users (see Collaboration Applications and Services, page 1-3). Whenever possible, Cisco strives to adhere to widely accepted industry standards in developing its collaboration technology so that you can easily integrate third-party applications and services into your collaboration solutions. In addition, the application programming interfaces available with many Cisco collaboration products enable you to develop your own custom applications.

About this Document

This document is a Solution Reference Network Design (SRND) guide for Cisco Collaboration Solutions. It presents system-level requirements, recommendations, guidelines, and best practices for designing a collaboration solution to fit your business needs.

This document has evolved from a long line of SRNDs produced by Cisco over the past decade. As Cisco's voice, video, and data communications technologies have developed and grown over time, the SRND has been revised and updated to document those technology advancements. Early versions of the SRND focused exclusively on Cisco's Voice over IP (VoIP) technology. Subsequent versions documented Cisco Unified Communications and added information on new technologies for mobile voice communications, conferencing, instant messaging (IM), presence, and video telephony. This latest version of the SRND now includes Cisco's full spectrum of collaboration technologies such as TelePresence, WebEx Social, and support for all types of end-user devices (Bring Your Own Device, or BYOD). As Cisco continues to develop and enhance collaboration technologies, this SRND will continue to evolve and be updated to provide the latest guidelines, recommendations, and best practices for designing collaboration solutions.

How to Use this Document

This document is organized into four main parts:

- System Components and Architecture

  The chapters in this part of the document describe the main components of Cisco Collaboration Technology and explain how those components work together to form a complete end-to-end collaboration solution. The main components include the network infrastructure, security, gateways, trunks, media resources, endpoints, call processing agents, deployment models, and rich media conferencing.

- Call Control and Routing

  The chapters in this part of the document explain how voice and video calls are established, routed, and managed in the collaboration system. The topics covered in this part include call admission control, dial plan, emergency services, and directory integration.

- Clients and Applications

  The chapters in this part of the document describe the collaboration clients, applications, and services that can be incorporated into your collaboration solution. The topics covered in this part include Cisco Unified Communications Manager embedded applications, voice messaging, IM and presence, collaboration clients, collaboration services, mobile collaboration, contact centers, and call recording.

- System Provisioning and Management

  The chapters in this part of the document explain how to size the components of your collaboration solution, how to migrate to that solution, and how to manage it. The topics covered in this part include sizing considerations, migration options, and network management.

For Experienced Users of this Document

Readers who are familiar with a previous version of this SRND or who are experienced at designing Unified Communications and Collaboration solutions can use this document as a reference source. You do not have to read every page or every chapter, but instead can search through this document for the particular topics you need. You should also check this document monthly for updates to the topics of interest to you.

For New Users of This Document

We realize that this document is long and that it contains an extensive amount of complex technical information. It can seem intimidating, particularly if you are a first-time reader of this document or if you do not have much experience with designing Unified Communications and Collaboration solutions. To help orient you to this document and to Collaboration technology, we recommend that you start by reading the overviews for the four main parts of this document:

- Overview of Cisco Collaboration System Components and Architecture, page 2-1
- Overview of Call Control and Routing, page 12-1
- Overview of Collaboration Clients and Applications, page 17-1
- Overview of Collaboration System Provisioning and Management, page 26-1

These overviews describe the organization of this document and they provide a high-level view of the overall architecture for Cisco Unified Communications and Collaboration solutions.

After you read the main overviews, we recommend that you read and become familiar with the sections of this document that are essential for the design of any and all Unified Communications and Collaboration solutions. The following list provides links to those sections that apply to all designs, and they are listed here in the order we recommend reading them:

Network Infrastructure

- LAN Infrastructure
  - Power over Ethernet (PoE), page 3-13
  - LAN Quality of Service (QoS), page 3-15
  - QoS Design Considerations for Video, page 3-22
  - Network Services, page 3-23
- WAN Infrastructure
  - WAN Quality of Service (QoS), page 3-37
  - Bandwidth Provisioning, page 3-44
- Wireless LAN Infrastructure
  - Design Considerations for Voice and Video over WLAN, page 3-59
  - WLAN Quality of Service (QoS), page 3-65

Cisco Collaboration Security

- Access Security, page 4-6

Gateways, page 5-1

- All sections

Cisco Unified CM Trunks

- Unified CM Trunks Solution Architecture, page 6-3
- A Comparison of SIP and H.323 Trunks, page 6-4
- SIP Trunks Overview, page 6-6
- Session Initiation Protocol (SIP) Operation, page 6-7
- Unified CM SIP Trunk Features and Operation, page 6-15
- Unified CM Session Management Edition, page 6-39
- IP PSTN and IP Trunks to Service Provider Networks, page 6-53
- Cisco Unified Border Element, page 6-53

Media Resources

- Media Resources Architecture, page 7-2
- Annunciator, page 7-17
- Music on Hold, page 7-19
- Design Considerations for Media Resources, page 7-37

Call Processing

- Call Processing Architecture
  - Call Processing Hardware, page 9-4
  - Unified CM Cluster Services, page 9-5
- Design Considerations for Call Processing, page 9-30

Collaboration Deployment Models

- Deploying Unified Communications and Collaboration, page 10-2
- Deployment Model Architecture, page 10-3
- Common Design Criteria, page 10-5
- Campus Deployments, page 10-9
- Multisite Deployments with Centralized Call Processing, page 10-11
- Multisite with Distributed Call Processing
  - Best Practices for the Distributed Call Processing Model, page 10-24
  - Leaf Unified Communications Systems for the Distributed Call Processing Model, page 10-24

Cisco Rich Media Conferencing

- Types of Conferences, page 11-2
- Cisco Rich Media Conferencing Architecture, page 11-4
- Design Considerations for Cisco Rich Media Conferencing, page 11-42

Dial Plan

- Dial Plan Fundamentals, page 14-3
- Dial Plan Elements
  - Cisco Unified Communications Manager, page 14-13
- Recommended Design
  - Globalized Dial Plan Approach on Unified CM, page 14-55

LDAP Directory Integration

- What is Directory Integration?, page 16-3
- Directory Access for Unified Communications Endpoints, page 16-4
- Directory Integration with Unified CM
  - Cisco Unified Communications Directory Architecture, page 16-7
  - LDAP Synchronization, page 16-10
  - LDAP Authentication, page 16-21

Cisco Voice Messaging

- Voice Messaging Portfolio, page 19-2
- Messaging Deployment Models, page 19-4
- Messaging and Unified CM Deployment Model Combinations
  - Cisco Unity Connection Messaging and Unified CM Deployment Models

    Centralized Messaging and Centralized Call Processing, page 19-7

    Cisco Unity Connection Survivable Remote Site Voicemail, page 19-8

    Distributed Messaging with Centralized Call Processing, page 19-11

    Combined Messaging Deployment Models, page 19-14
  - Messaging Redundancy

    Cisco Unity Connection, page 19-18

    Centralized Messaging with Distributed Unified CM Clusters, page 19-22
- Best Practices for Voice Messaging
  - Best Practices for Deploying Cisco Unity Connection with Unified CM

    Managing Bandwidth, page 19-32

    Native Transcoding Operation, page 19-33

    Cisco Unity Connection Operation, page 19-34

    Integration with Cisco Unified CM, page 19-35

After you have read the chapters and sections listed above, you can begin exploring other sections of this document that contain more details relevant to your particular solution design.

Where to Find Additional Information

Because this document covers a wide spectrum of Cisco Collaboration products and possible solution designs, it cannot provide all the details of individual products, features, or configurations. For that type of detailed information, refer to the specific product documentation available at

http://www.cisco.com

This document provides general guidance on how to design your own collaboration solutions using Cisco Collaboration technology. Cisco has also developed, tested, and documented specific solutions for certain applications, and has made those solutions available for customers to copy and deploy. They are part of the Cisco Validated Design program described and documented at

http://www.cisco.com/go/designzone