Tested Deployments and Site Models

Cisco Unified Communications Release 5.0 testing for IP telephony was designed to test the hardware and software components that work together in a multi-site distributed IP telephony deployment.

For this testing, the following site models were created. Each site model was designed to test a specific set of features and interactions. The site models can be used in various combinations to create different versions of a multi-site distributed deployment model.

- North America site models:
    - Multi-Site Centralized, Clustering over the WAN with Unified SRST
    - Very Large Campus with Clustering over the WAN
    - Large SIP Site
    - Small Site
    - Small-Campus SIP Site
    - Small-Campus H.323 Site
    - Cisco Unified CallManager Interoperability Site
    - Non-Cisco Unified CallManager Interoperability Site
    - Centralized TFTP Cluster Site
- Europe and Emerging Markets (EUEM) site models
    - Large Multi-Site Centralized with Unified SRST
    - Medium Site
    - Small Site
    - Cisco Unified CallManager Interoperability Site
    - Non-Cisco Unified CallManager Interoperability Site
    - Small Campus Multi-Site H.323

This chapter describes each site model.

For additional guidelines, recommendations, and best practices for implementing enterprise networking solutions, refer to the Cisco Solution Reference Network Design (SRND) guides and related documents, which are available at this URL:

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

For a list of the release versions of the components used in the site models, see Appendix A, "Release Versions of Components."

This topic includes the following sections:

Purpose of Solution Tests

An efficient, effective, and reliable IP telephony solution requires many interrelated hardware and software components. The site models that are described in this manual provide you with models and guidance as you implement an IP telephony system for your organization. Cisco has selected, installed, configured, and tested hardware and software designed to work together seamlessly and to provide a complete and optimized IP telephony solution.

Each site model addresses some or all of the following issues:

- End-to-end functionality
- Operability in a real-world environment
- Scalability
- Stability
- Stress
- Load
- Redundancy
- Reliability
- Usability
- Availability
- Installability
- Upgradeability
- Serviceability
- Regression

Multi-Site Distributed Deployment Options

The site models within each test group (North America and EUEM) can be implemented in various combinations to create deployment models to meet the needs of a wide range or organizations.

Figure 1-1 shows the multi-site distributed deployment that was tested for Cisco Unified Communications Release 5.0 testing for North America IP telephony.

For more detailed information about the sites used in this deployment, see the "North America Site Models" section on page 1-4.

Figure 1-1   *Multi-Site Distributed Deployment for North America IP Telephony*
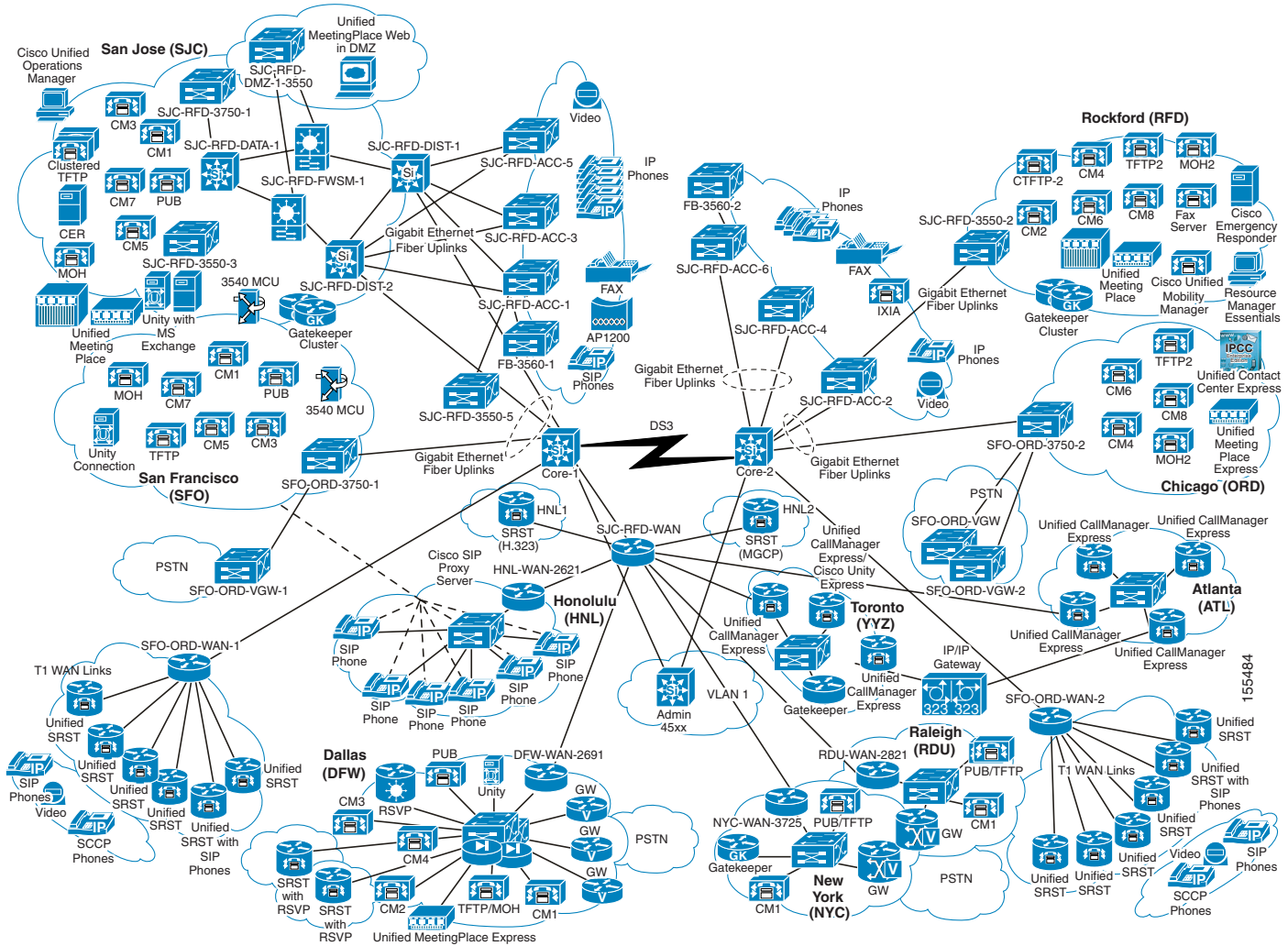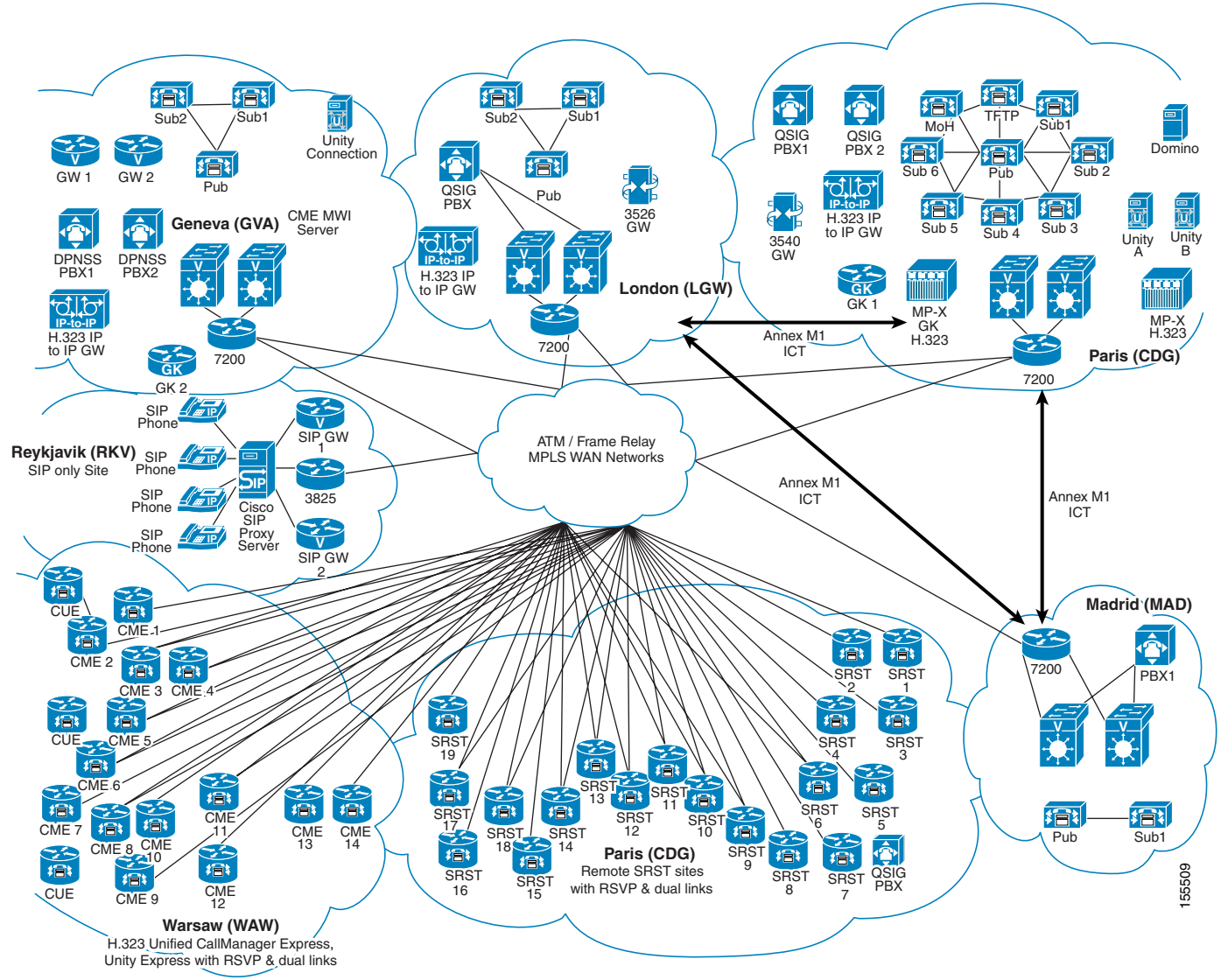

Figure 1-2 shows the multi-site distributed deployment that was tested for Cisco Unified Communications Release 5.0 testing for EUEM IP telephony.

For more detailed information about the sites used in this deployment, see the "Europe and Emerging Markets Site Models" section on page 1-23

Figure 1-2   *Multi-Site Distributed Deployment for EUEM IP Telephony*

North America Site Models

Nine site models were created and tested for Cisco Unified Communications Release 5.0 testing for North America IP telephony. Each site model tested specific hardware and software components, features, functions, protocols, and related items.

A site model includes one or more sites. Each site has a three-letter name (for example, SFO, ORD, and SJC). Examples throughout this manual refer to these site names.

The following sections describe each site model in detail. Each section includes an explanation of the design characteristics of the site model, and includes a table that lists the hardware and software components used in the model. The tables contain the following information for each component:

- Component—Hardware or software component
- Description—Information such model number, release number, protocol, and hardware platform
- Qty.—Quantity of the component used in the model

Table 1-1 lists the site models and references to sections that provide detailed information.

Table 1-1   North America Site Models

Site Model and Reference	Sites Included
Multi-site Centralized, Clustering over the WAN with Unified SRST, page 1-5	San Francisco (SFO), Chicago (ORD)
Very Large Campus with Clustering over the WAN, page 1-9	San Jose (SJC), Rockford (RFD), Honolulu 1(HNL1), Honolulu 2 (HNL2)
Large SIP Site, page 1-12	Dallas (DFW)
Small Site (North America), page 1-16	Raliegh (RDU)
Small-Campus SIP Site, page 1-18	Atlanta (ATL)
Small-Campus H.323 Site, page 1-19	Toronto (YYZ)
Cisco Unified CallManager Interoperability Site (North America), page 1-20	New York (NYC)
Non-Cisco Unified CallManager Interoperability Site (North America), page 1-22	Honolulu (HNL)
Centralized TFTP Cluster Site, page 1-23	San Jose (SJC)

Multi-site Centralized, Clustering over the WAN with Unified SRST

The Multi-site Centralized, Clustering over the WAN with Unified SRST site model represents a deployment in which two sites, San Francisco (SFO) and Chicago (ORD), are used to cluster Cisco Unified CallManager over an IP WAN. In this model, half of the cluster resides in SFO and the other half in ORD. These sites provide centralized call processing to remote Cisco Unified Survivable Remote Site Telephony (Unified SRST) sites. Communications with remote sites takes place over the IP WAN.

If either the central site or the IP WAN goes down, remote sites can continue to have service through Unified SRST) running on Cisco IOS gateways. In addition, remote sites can place calls over the PSTN if the IP WAN becomes temporarily oversubscribed.

SFO and ORD sites are the hub site for remote Unified SRST sites. Unified SRST sites include H.323 and MGCP 26xx, 28xx, 37xx, 38xx and 72xx gateways. The WAN consists of T1 frame relay links.

The tested Multi-Site Centralized has the following design characteristics:

- Cisco Unified CallManager and Cisco Unity reside at the central site
- Cisco Unified CallManager clustered over the WAN
- Two Microsoft Exchange 2000 nodes for Cisco Unity
- Cisco Unity ViewMail for Outlook (VMO) in three remote sites

- Centralized dial plan and administration

- Call admission control based on locations and RSVP

- Uses encryption in SDO and ORD sites instead of infrastructure security

- 500 remote sites

- Unified SRST for remote sites

- 2,200 SIP endpoints

- 6,600 SCCP endpoints

Figure 1-3 provides an overview of the Multi-site Centralized, Clustering over the WAN with Unified SRST site model.

Figure 1-3   *Multi-site Centralized, Clustering over the WAN with Unified SRST Site Model*
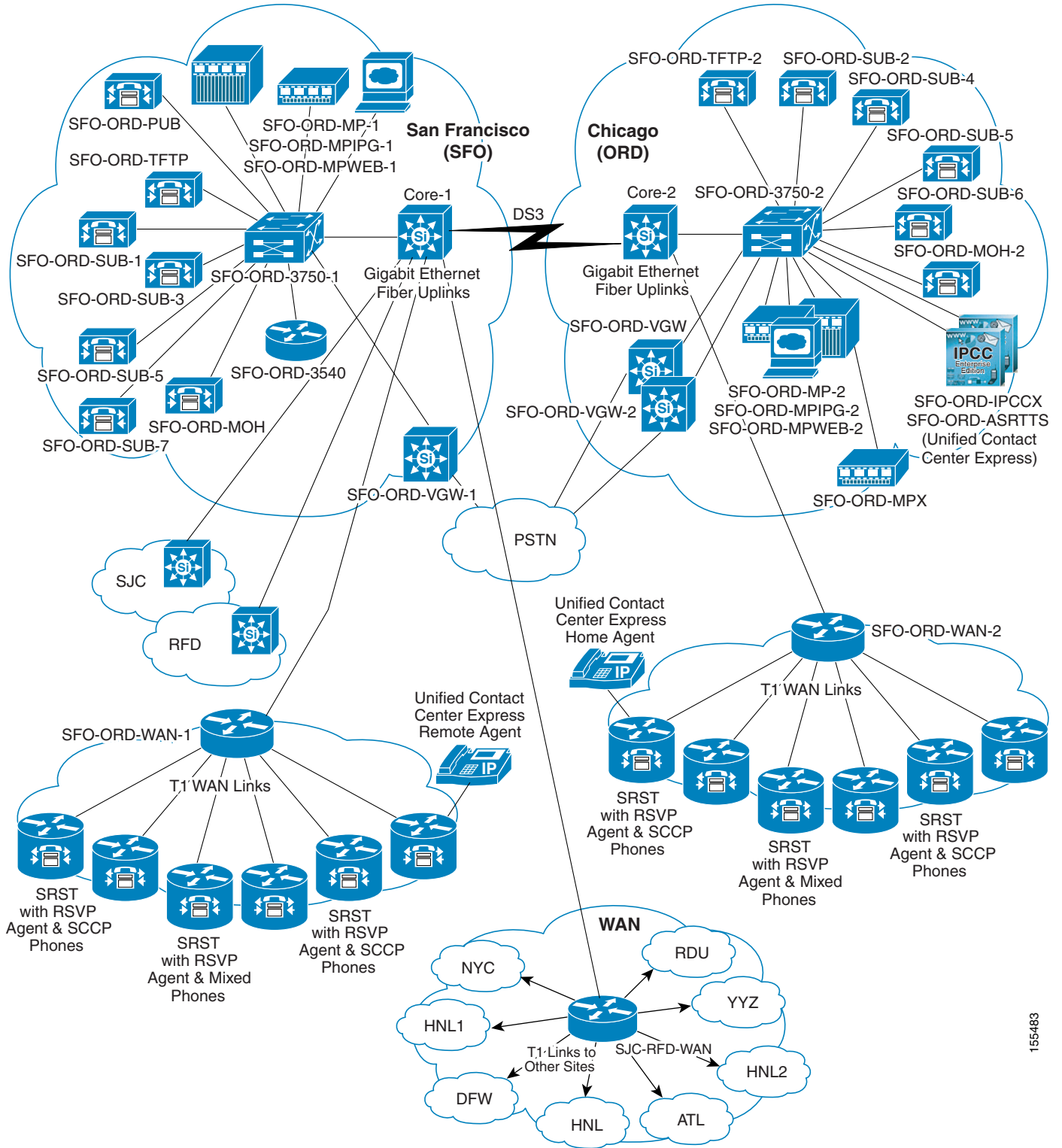
Table 1-2 lists the hardware and software components used in the Multi-site Centralized, Clustering over the WAN with Unified SRST site model.

Table 1-2   *Multi-Site Centralized, Clustering over the WAN with Unified SRST Components*

Component	Description	Qty.
Central site (SFO) components		
Catalyst Voice Gateways	Catalyst 6509 Switch with Supervisor 2	2
	Cisco 6608	3
	Cisco Communication Media Module (CMM)	7
	6-port T1 Interface Port Adaptor for CMM	21
	FlexWAN module with 2 Port Adaptor slots	2
	48-Port, RJ-45, 10/100BaseTX Ethernet with in-line power	2
Central Core Switch	Catalyst 6506 Switch with Supervisor 2	2
Cisco Unified CallManager server	Cisco MCS 7845H-2.4-EVV1 Unified CallManager Appliance	9
Cisco Unified MeetingPlace Express	Cisco MCS 7845-H1 Unified CallManager Appliance	1
Cisco Unity Connection	Cisco MCS 7845-H1-ECS1 Unified CallManager Appliance	1
MCU	IP/VC 3540 with MC10A, EMP3, and RM modules	1
Music on hold server	Cisco MCS 7845H-2.4-EVV1 Unified CallManager Appliance	2
TFTP server	Cisco MCS 7845H-2.4-EVV11 Unified CallManager Appliance	2
Central site (ORD) components		
Router	Cisco 2610XM	17
	Cisco 2611XM	10
	Cisco 2620XM	18
	Cisco 2621XM	19
	Cisco 2650XM	10
	Cisco 2651XM	10
	Cisco 2691	2
	Cisco 3725	2
	Cisco 3745	4
	Cisco 3825	2
	Cisco 3845	4
	Cisco 7206-VXR	2

Very Large Campus with Clustering over the WAN

The Very Large Campus with Clustering over the WAN site model represents a very large campus in which two sites, San Jose (SJC) and Rockford (RFD), are used to cluster Cisco Unified CallManager over an IP WAN. This site model also includes the Honolulu 1 (HNL1) and Honolulu 2 HNL2 sites, which provide Unified SRST capabilities and which are managed by the Cisco Unified CallManager cluster.

The Cisco Unified CallManager cluster in this site model consists of the following:

- One publisher
- Eight subscribers (four in each site)
- Two music on hold servers (one in each site)
- Two TFTP servers (one in each site)
- One centralized TFTP cluster

This deployment model has the following characteristics:

- Cisco Unified CallManager clustered over a WAN for redundancy, system scaling, and disaster recovery
- Cisco Emergency Responder in redundant mode, with primary system at SJC and secondary system at RFD
- 20,000 SCCP end-points
- In line power to IP phone sets
- Single cable for connecting an IP phone and PC
- Quality of service from the desktop
- IP addressing for easy adds, moves, and changes
- Firewalls in SJC site to protect the data center

Figure 1-4 shows the topology of the Very Large Campus with Clustering over the WAN site model.

Figure 1-4   *Very Large Campus with Clustering over the WAN Site Model*
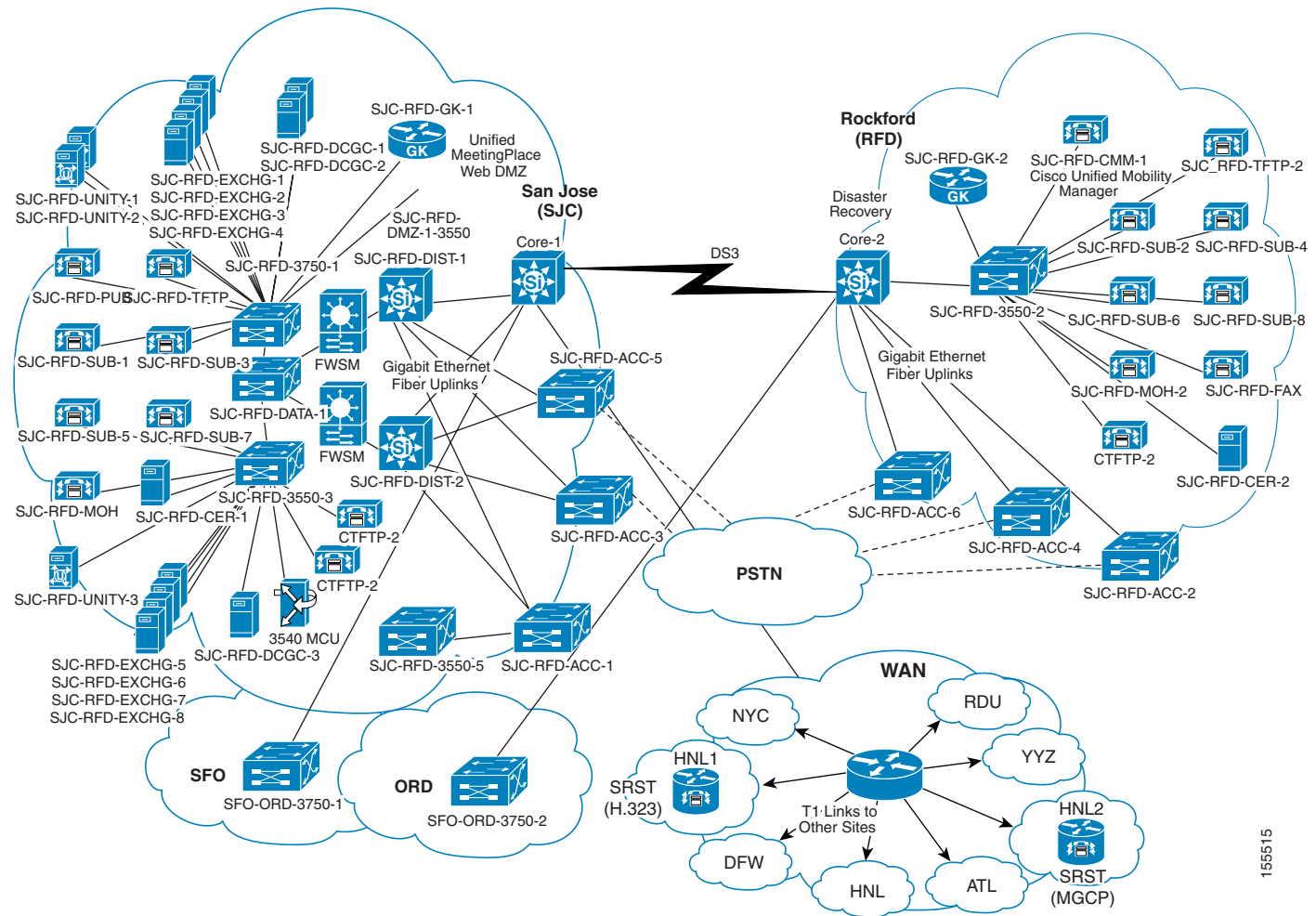
Table 1-3 lists the hardware and software components used in the Very Large Campus with Clustering over the WAN site model.

Table 1-3   *Very Large Campus with Clustering over the WAN Components*

Component	Description	Qty.
Access switch	Cisco Catalyst 6509 with dual Supervisor 2	6
	Cisco3560	2
Analog gateway	Cisco VG248	3
	Cisco VG224	1
ASR server	Cisco MCS 7845 Unified CallManager Appliance	1
Cisco Unified CallManager server	Cisco MCS 7845-H1 Unified CallManager Appliance	9
Cisco CRS server (monitoring)	Cisco MCS 7845 Unified CallManager Appliance	1

Table 1-3   Very Large Campus with Clustering over the WAN Components (continued)

Component	Description	Qty.
Cisco Emergency Responder server	Cisco MCS 7845-H1 Unified CallManager Appliance	2
Cisco Unified IP Phone	Cisco Unified IP Phone 7905G Cisco Unified IP Phone 7911G Cisco Unified IP Phone 7912G Cisco Unified IP Phone 7935 Cisco Unified IP Phone 7940G Cisco Unified IP Phone 7941G Cisco Unified IP Phone 7960G Cisco Unified IP Phone 7961G Cisco Unified IP Phone 7970G Cisco Unified IP Phone 7971G	50
Cisco Unified MeetingPlace IP GW server	Cisco MCS 7845-H1 Unified CallManager Appliance	2
Cisco Unified MeetingPlace server	Cisco MP-8112 Chassis	2
	Multi Access Blades	4
	Smart Blades	20
Cisco Unified MeetingPlace web conferencing server	Cisco MCS 7845-H1 Unified CallManager Appliance	2
Cisco Unity Unified Messaging server	Cisco MCS 7845-H1 Unified CallManager Appliance	3
Core switch	Cisco Catalyst 6506 with Supervisor 2 and 2-port DS3 module	2
Data center switch	Cisco Catalyst 6509 with Supervisor 2	1
	Cisco3750	1
	Cisco3550	4
Distribution switch with FWSM	Cisco Catalyst 6509 with SUP720	2
DNS/DHCP server	Cisco MCS 7825 Unified CallManager Appliance with 2000.4.2sr2 OS	2
Domain controller	Cisco MCS 7835 Unified CallManager Appliance	4
Exchange 2000 server	Cisco MCS-7845H-2.4-EVV1 Unified CallManager Appliance	3
	Cisco MCS-7845H-2.4-ECS2 Unified CallManager Appliance	2
Gatekeeper	Cisco 3745	2

Table 1-3   Very Large Campus with Clustering over the WAN Components (continued)

Component	Description	Qty.
Gateway	Cisco 3845 (H.323)	3
	Cisco 3725 (MGCP)	2
	Cisco 3745 (SIP)	1
IP/VC 3540 MCU	IP/VC 3540 with MC10A, EMP3, and RM modules	1
Music on hold (MOH) server	Cisco MCS 7845-H1 Unified CallManager Appliance	2
NMS server (IPCOM)	Cisco MCS 7845 Unified CallManager Appliance	1
Resource Manager Essentials	Cisco MCS 7845-H1 Unified CallManager Appliance	1
T1 gateway	Cisco Communication Media Module	6
T1 gateway	Cisco Catalyst 6608 ports	160
TFTP server	Cisco MCS 7845-H1 Unified CallManager Appliance	2
Video endpoint	Tandberg T1000 (SCCP)	1
	Tandberg T1000 (H.323)	1
	Polycom VSX-7000 (H.323)	1
	Cisco Unified Video Advantage	3
	Cisco 7985	1
WAN router	Cisco 7206 NPE400	1
Wireless infrastructure	Cisco AP1200	3
Wireless phone	Cisco Unified Wireless IP Phone 7920	10
Unified SRST site (H.323)		
Remote site switch	Cisco 3524	1
Unified SRST router	Cisco 2851	1
WAN router	Cisco 2691	1
Unified SRST site (MGCP)		
Remote site switch	Cisco 3550	1
Unified SRST router	Cisco 2691	1
WAN router	Cisco 2691	1

Large SIP Site

The Large SIP Site consists of one site called Dallas (DFW). This site includes a Cisco Unified CallManager cluster that includes the following:

- One publisher
- Four subscribers

- One MOH server

- One TFTP server

The Large SIP Site model also include EPAS (Cisco Unified Presence Server, proxy server, intermediate path performance monitoring), Unified SRST for SIP, Cisco Unity Connection for voice messaging, and Cisco Unified MeetingPlace Express for audio conferencing.

WAN connectivity is provided by a Cisco 2691 router and two SIP gateways provide connectivity to PSTN network. This site has 10,000 SIP endpoints.

Figure 1-5 shows the topology of the Large SIP Site model.

Figure 1-5   *Large Sip SiteTopology*
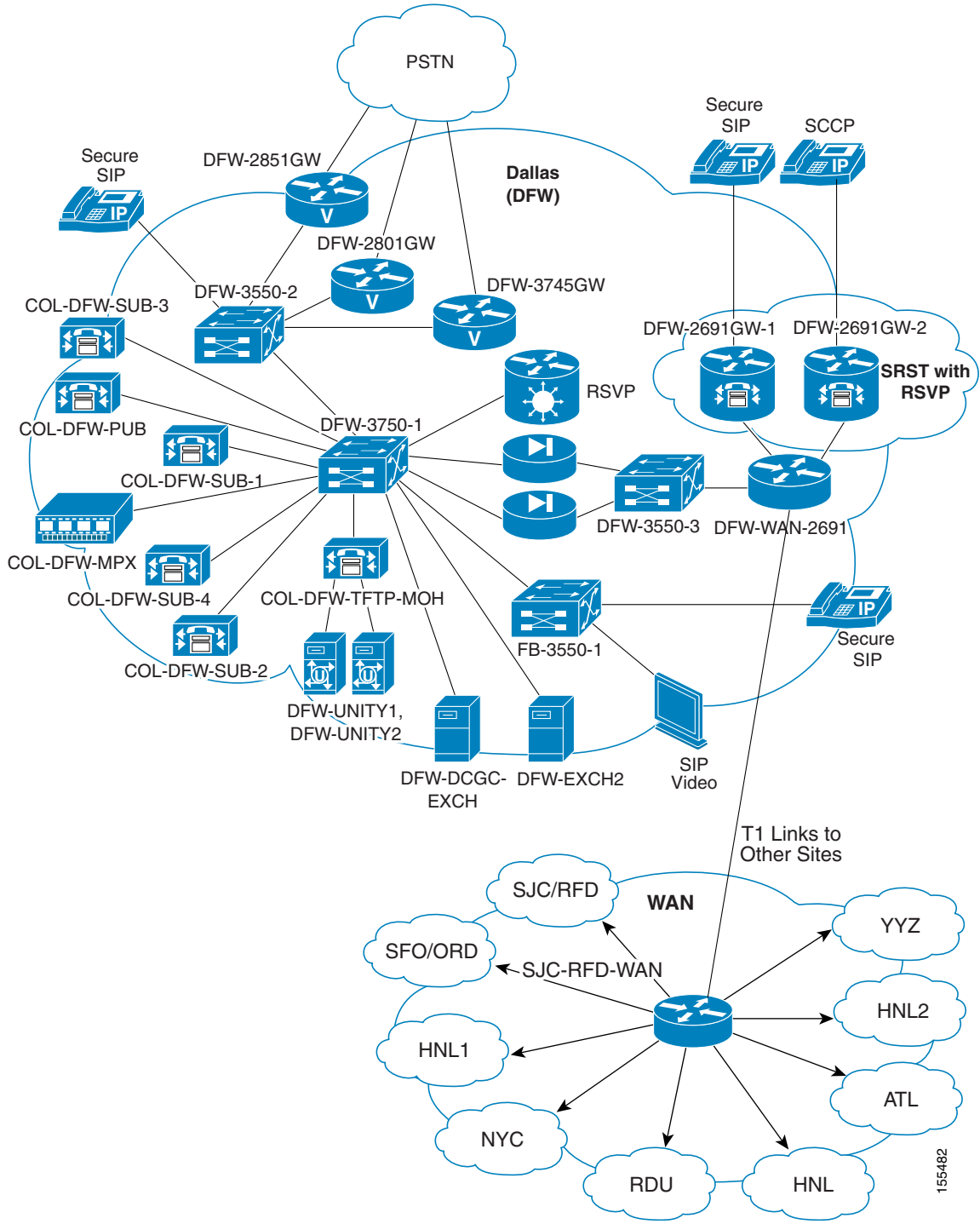
Table 1-4 lists the hardware and software components used in the Large SIP Site site model.

Table 1-4   Large SIP Site Model Components

Component	Description	Qty.
Analog gateway	Cisco VG248 (SCCP)	1
	Cisco VG224 (SCCP)	1
Cisco Unified CallManager server	Cisco MCS 7845-H1 Unified CallManager Appliance	6
Cisco Unified IP Phone	Cisco Unified IP Phone 7905G	15
	Cisco Unified IP Phone 7911G	
	Cisco Unified IP Phone 7912G	
	Cisco Unified IP Phone 7935	
	Cisco Unified IP Phone 7940G	
	Cisco Unified IP Phone 7941G	
	Cisco Unified IP Phone 7960G	
	Cisco Unified IP Phone 7961G	
	Cisco Unified IP Phone 7970G	
	Cisco Unified IP Phone 7971G	
Cisco Unified MeetingPlace Express	Cisco MCS 7825 Unified CallManager Appliance	1
Cisco Unity server	Cisco MCS 7845-H1-ECS1 Unified CallManager Appliance	2
Distribution switch	Cisco 3750	1
Distribution switch	Cisco 3550	1
DNS/DHCP server	Cisco MCS 7825 with 2000.4.2sr2 OS Unified CallManager Appliance	1
Domain controller	Cisco MCS 7845-H1-EVV1 Unified CallManager Appliance	1
Exchange server	Cisco MCS 7845-H1-ECS2 Unified CallManager Appliance	2
Firewall	PIX 535	2
Gateway	Cisco 2801 (SIP)	1
	Cisco 2851 (SIP)	1
	Cisco 3745 (SIP)	1
	Cisco 3825 (RSVP MTP)	1
	Cisco 2691 (H.323)	1
	Cisco 2691 (MGCP)	1

Table 1-4   *Large SIP Site Model Components (continued)*

Component	Description	Qty.
Video endpoint	Tandberg T1000 (SCCP)	2
	Tandberg T1000 (H.323)	1
	Polycom VSX-7000 (SIP)	2
	Cisco Unified IP Phone 7985	1
	Cisco Unified Video Advantage	2
WAN router	Cisco 2851	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	15

Small Site (North America)

The Small Site model for North America consist of one site called Raliegh (RDU). This site includes a Cisco Unified CallManager cluster that includes the following:

- One publisher
- One subscriber

The Small Site model supports 1,000 phones.

Figure 1-6 shows the topology of the Small Site model.
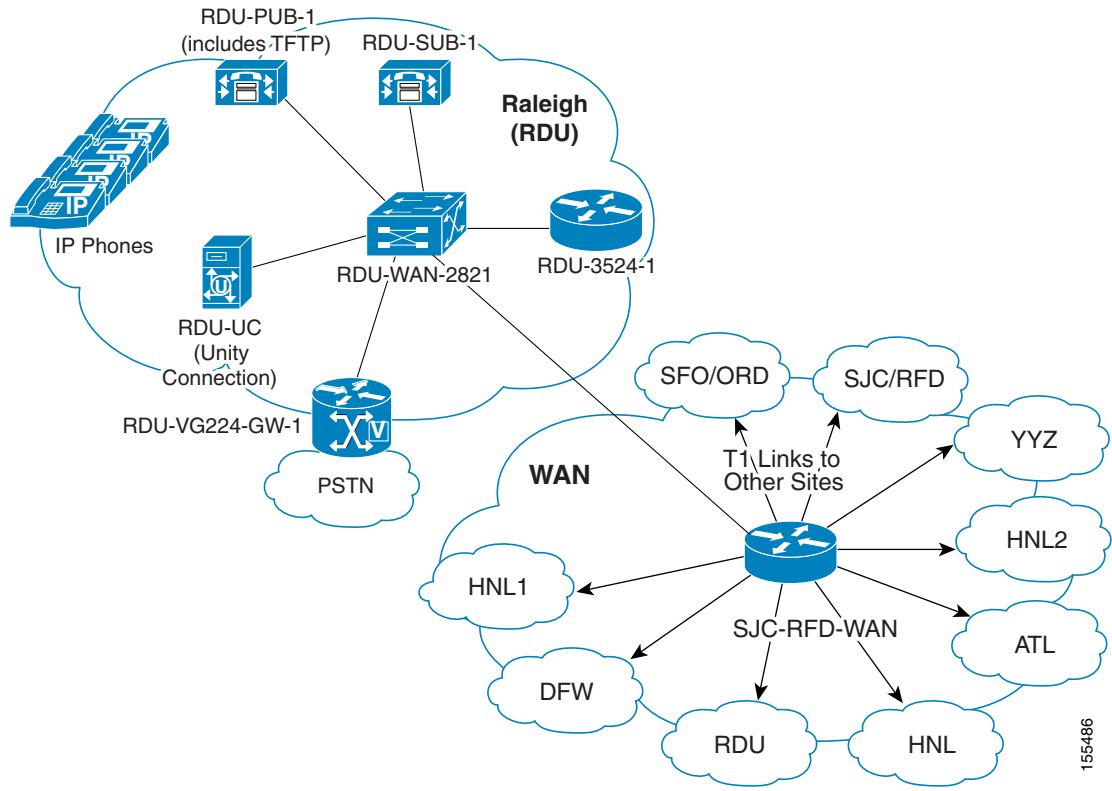
Figure 1-6   Small Site Topology

Table 1-5 lists the hardware and software components used in the Small Site model.

Table 1-5   Small SIte Components

Component	Description	Qty.
Analog gateway	Cisco VG224	1
Cisco Unified CallManager server	Cisco MCS 7835-H1 Unified CallManager Appliance	2
Cisco Unified IP Phone	Cisco Unified IP Phone 7940G	6
	Cisco Unified IP Phone 7960G	
	Cisco Unified IP Phone 7970G	
Cisco Unity Connection	Cisco MCS 7845-H1-ECS1 Unified CallManager Appliance	1
Distribution switch	Cisco 3524	1
Gateway	Cisco 2851 (MGCP)	1
	Cisco 3725 (DSP Resources)	1
	Cisco 3725 (H.323)	1
WAN router	Cisco 2821	1

Small-Campus SIP Site

The Small-Campus SIP Site model consists of one site called Atlanta (ATL). This site includes:

- Four Cisco Unified CallManager Express routers
- Four hundred SIP endpoints
- On Cisco Unity Express

This site communicates with Cisco Unified CallManager clusters in other sites using a SIP trunk through an IP-to-IP gateway.

Figure 1-7 shows the topology of the Small-Campus SIP Site model.

Figure 1-7   ***Small -Campus SIP Site Topology***

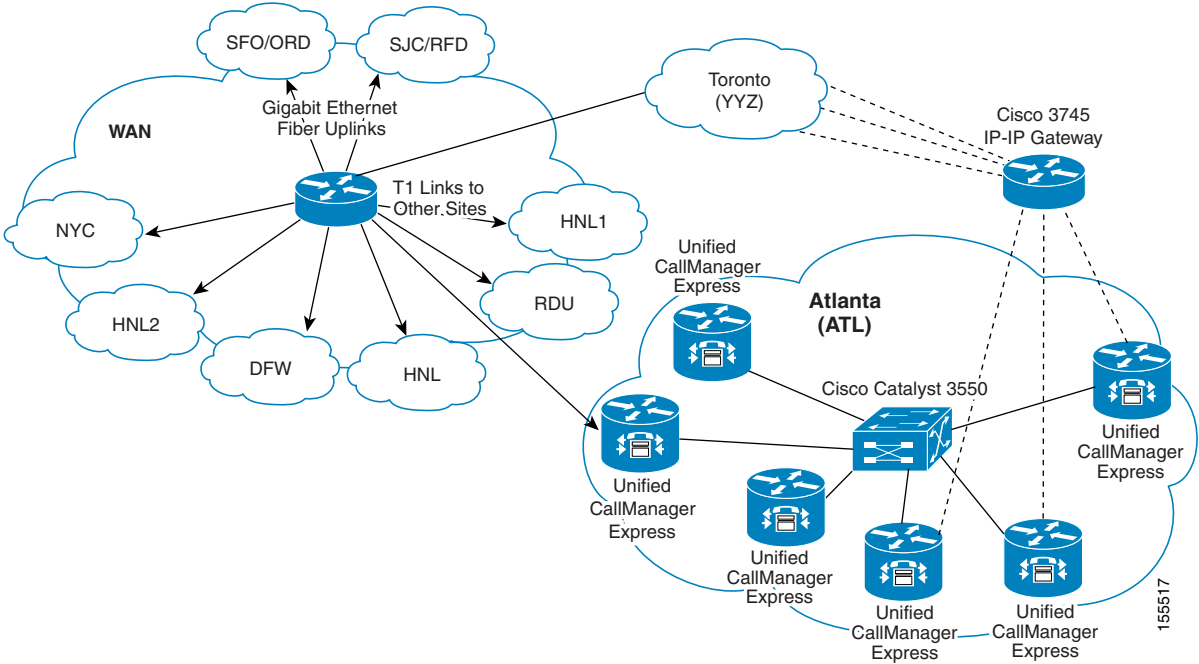Table 1-6 lists the hardware and software components used in the Small-Campus SIP Site model.

Table 1-6   ***Small-Campus SIP Site Components***

Component	Description	Qty.
Cisco Unified CallManager Express	Cisco 3725	1
	Cisco 2611	1
	Cisco 2651	1
Cisco Unified CallManager Express with advanced integration module AIM-CUE	Cisco 3845	1

Table 1-6   Small-Campus SIP Site Components (continued)

Component	Description	Qty.
Cisco Unified IP Phone	Cisco Unified IP Phone 7905G	12
	Cisco Unified IP Phone 7912G	
	Cisco Unified IP Phone 7940G	
	Cisco Unified IP Phone 7960G	
Site Switch (shared by all sites)	Cisco Catalyst 3550	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	2

Small-Campus H.323 Site

The Small-Campus H.323 Site model consists of one site called Toronto (YYZ). This site includes:

- Four Cisco Unified CallManager Express routers
- Once Cisco Unity Express
- One H.323 gatekeeper.

The Cisco Unified CallManager Express routers connect to MP 5.3 via the H.323 gatekeeper.

This site has four hundred SCCP endpoints. An IP-to-IP gateway between YYZ and ATL provides connectivity between Cisco Unified CallManager Express routers and Cisco Unified CallManager clusters. The H.323 gatekeeper provides connectivity between Cisco Unified CallManager Express routers and Cisco Unified CallManager clusters.

Figure 1-8 shows the topology of the Small-Campus H.323 Site model.
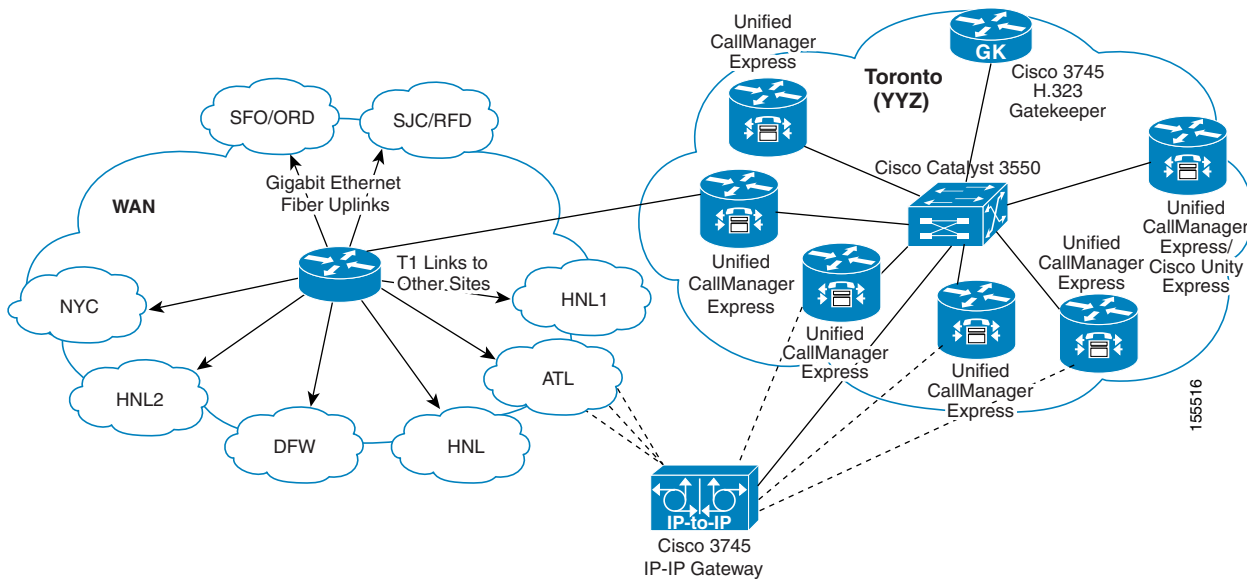
Figure 1-8   Small-Campus H.323 Site Topology

Table 1-7 lists the hardware and software components used in the Small-Campus H.323 Site model.

Table 1-7   Small-Campus H.323 Site Components

Component	Description	Qty.
Cisco Unified CallManager Express	Cisco 2801	1
	Cisco 3745	1
	Cisco 2691	1
	Cisco 2851	1
Gatekeeper	Cisco 3745	1
IP-to-IP gateway	Cisco 3745	1
Site switch (shared by all sites)	Cisco 3550	1

Cisco Unified CallManager Interoperability Site (North America)

The Cisco Unified CallManager Interoperability Site model for North America consists of one site called New York (NYC). This site was designed to test interoperability between Cisco Unified CallManager 4.1(3) SR1and Cisco Unified CallManager 5.0.

This site includes a Cisco Unified CallManager cluster that includes the following:

- One Publisher/TFTP server
- One subscriber

This site also has one Cisco Emergency Responder server, one VG224 with 24 analog phones, sic SCCP phones, and 600 simulated SCCP phones.

Figure 1-9 shows the topology of the Cisco Unified CallManager Interoperability Site model.

Figure 1-9   Cisco Unified CallManager Interoperability Site Topology

Table 1-8 lists the hardware and software components used in the Cisco Unified CallManager Interoperability Site.

Table 1-8   Cisco Unified CallManager Interoperability Site Components

Component	Description	Qty.
Analog gateway	Cisco VG224	1
Cisco Unified CallManager server	Cisco MCS 7835-H1 Unified CallManager Appliance	2
Cisco Unified IP Phone	Cisco Unified IP Phone 7940G Cisco Unified IP Phone 7960G Cisco Unified IP Phone 7970G	6
Gatekeeper	Cisco 3725	1
Gateway	Cisco 3725 (H.323)	1
Site switch	Cisco 3550	1
WAN router	Cisco 3725	1

Non-Cisco Unified CallManager Interoperability Site (North America)

The Non-Cisco Unified CallManager Interoperability Site model for North America consists of one site called Honolulu (HNL). This site connects to a SIP network through CSPS. Voice mail connectivity to Cisco Unity Exchange and Cisco Unity Connection is provided via CSPS and SIP.

This site includes 13 SIP endpoints.

Figure 1-10 shows the topology of the Non-Cisco Unified CallManager Interoperability Site model.

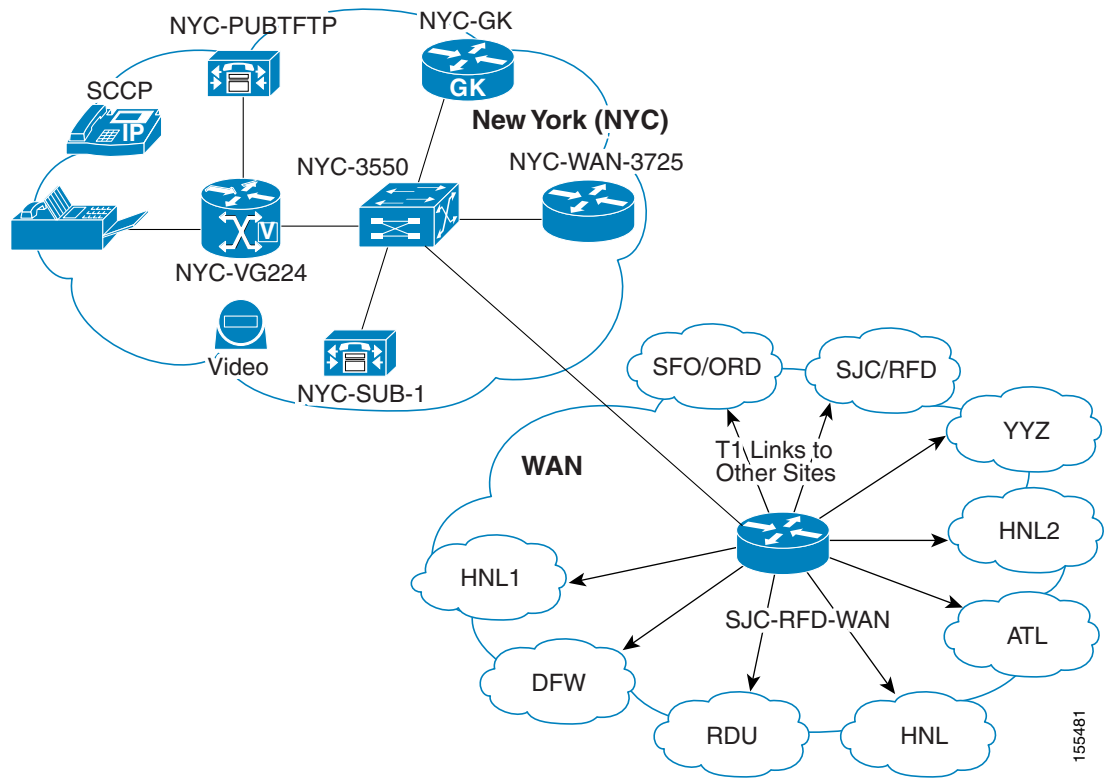*Figure 1-10   Non-Cisco Unified CallManager Interoperability Site Topology*

Table 1-9 lists the hardware and software components used in the Non-Cisco Unified CallManager Interoperability Site model.

Table 1-9   Non-Cisco Unified CallManager Interoperability Site Components
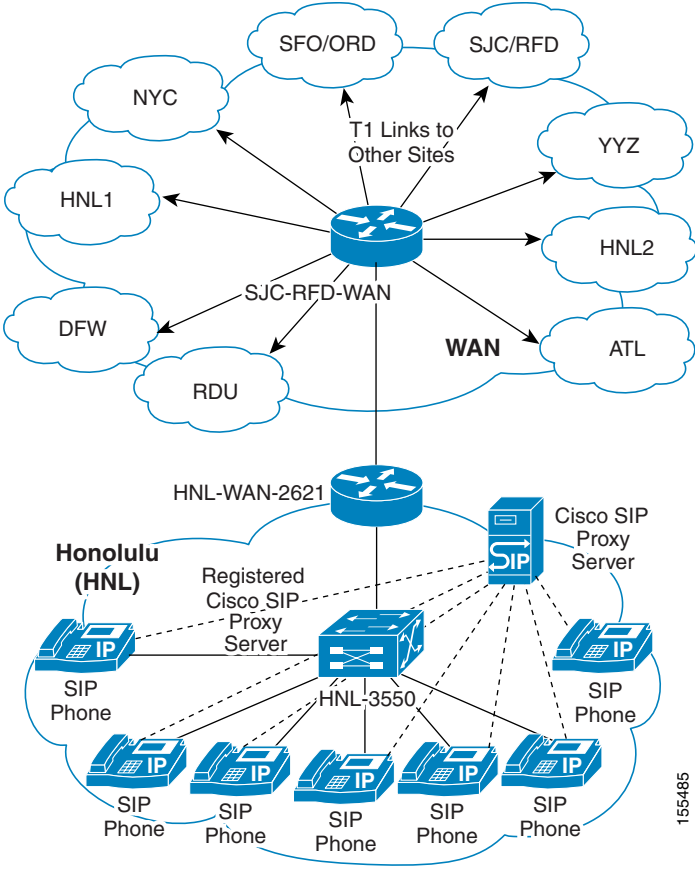
Component	Description	Qty.
Cisco Unified IP Phone	Cisco Unified IP Phone 7940G	6
	Cisco Unified IP Phone 7960G	
Cisco SIP Proxy server	Cisco MCS 7835 Unified CallManager Appliance	1

Table 1-9   Non-Cisco Unified CallManager Interoperability Site Components (continued)

Component	Description	Qty.
Remote site switch	Cisco 3550	1
WAN router	Cisco 2691	1

Centralized TFTP Cluster Site

The Centralized TFTP Cluster Site model consists of a site called San Jose (SJC). This site was used to test centralized TFTP servers.

Table 1-10 lists the hardware and software components used in the Centralized TFRP Cluster Site model.

Table 1-10   Centralized TFTP Cluster Site Components

Component	Description	Qty.
Cisco Unified CallManager server	Cisco MCS 7845H-2.4-EVV1 Unified CallManager Appliance	2
Cisco Emergency Responder	Cisco MCS 7845-H1-ECS1 Unified CallManager Appliance	1

Europe and Emerging Markets Site Models

Six site models were created and tested for Cisco Unified Communications Release 5.0 testing for Europe and Emerging Markets (EUEM) IP telephony. Each site model tested specific hardware and software components, features, functions, protocols, and related items.

A site model includes a site with a three-letter name (for example, CDG, GVA, and MAD). Examples throughout this manual refer to these site names.

The following sections describe each site model in detail. Each section includes an explanation of the design characteristics of the site model, and includes a table that lists the hardware and software components used in the model. The tables contain the following information for each component:

- Component—Hardware or software component
- Description—Information such model number, release number, protocol, and hardware platform
- Qty.—Quantity of the component used in the model

Table 1-11 lists the site models and references to sections that provide detailed information.

Table 1-11   EUEM Site Models

Site Model and Reference	Sites Included
Large Multi-Site Centralized with Unified SRST, page 1-24	Paris (CDG)
Medium Site, page 1-26	Geneva (GVA)
Small Site (EUEM), page 1-28	Madrid (MAD)
Cisco Unified CallManager Interoperability Site (Europe and Emerging Markets), page 1-29	London (LGW)

Table 1-11   EUEM Site Models (continued)

Site Model and Reference	Sites Included
Non-Cisco Unified CallManager Interoperability Site (EUEM), page 1-31	Reykjavik (RKV)
Small Campus Multi-Site H.323, page 1-32	Warsaw (WAW)

For an illustration showing how these site models were deployed for testing, see Figure 1-2 on page 1-4.

Large Multi-Site Centralized with Unified SRST

The Large Multi-Site Centralized with Unified SRST site model consists of one site called Paris (CDG). This site model represents an international deployment with up to 100 remote sites deployed across various countries. In includes Cisco Unity, Cisco Unified MeetingPlace Express, and third-party components. Cisco Unified CallManager uses QSIG, H.323, and SIP to interoperate between sites. Remote sites are interconnected through the WAN and all are RSVP-enabled to the central site.

In this model, a Cisco Unified CallManager cluster serves 6000 phone in local and remote locations, with all endpoints and gateways fully encrypted (RTP and signalling). PBXs that support the QSIG ISO variant connect to this cluster through direct QSIG links. The Cluster connects to the rest of the network through legacy ATM/frame relay and MPLS WAN networks.

Calls between the CDG site, the LGW site, and the MAD site are provided by Annex M1 intercluster trunks. Cisco Unity (with failover capabilities) provides voice messaging. Lotus Domino is used for unified messaging. PBX users access voice messaging features through the QSIG trunks to Cisco Unified CallManager.

Access to the PSTN for normal off-net calls is provided by ten E1 ETSI PRI links to the PSTN. Remote sites have either centralized breakout to the PSTN or local PSTN breakout using E1 PRI, BRI, or FXO connections. PSTN access is controlled by Cisco Unified CallManager using MGCP, H.323, or SIP. Unified SRST is used in each remote site.

This site model includes two Cisco Unified MeetingPlace Express servers. One is connects to Cisco Unified CallManager through a direct H.323 link. The other connect to Cisco Unified CallManager through an H.323 gatekeeper. Both Cisco Unified MeetingPlace Express servers can receive and make calls from local and remote sites.

Access to the SIP network is provided through a SIP trunk to a remote Cisco SIP Proxy Server (CSPS). Access to third-party services such as operator console, billing, and voice recording, if available, is provided locally. Some of sites will also have video endpoints and Cisco Unified Videoconferencing Gateways, and remote QSIG PBXs.

The Large Multi-site Centralized with Unified SRST site model has these design characteristics:

- Cisco Unified CallManager cluster for redundancy and system scaling
- Inline power to IP phones
- Encryption of RTP, SIP, SCCP, and H.323 where available.
- SIP and SCCP phones
- Quality of service from the desktop
- Video phones, MCUs, and Cisco Unified Videoconferencing H.320 Gateways in local and remote sites
- Locally connected third-party applications for attendant console, billing, and voice recording

- Remote access through H.323 gatekeepers to Cisco Unified MeetingPlace Express networks and other remote connected clusters

- Cisco Unified MeetingPlace Express locally connected through H.323

- Cisco Unity failover with Domino, connected through an SCCP link to Cisco Unified CallManager

- PBX connectivity to Cisco Unified CallManager and Cisco Unity through Cisco Unified CallManager using a direct QSIG trunks

- QSIG feature transparency between PBXs to PBX, PBX to Cisco Unified CallManager, Cisco Unified CallManager to PBX, and Cisco Unified CallManager to Cisco Unified CallManager clusters

- Central and remote PSTN breakout for remote sites with MGCP PRI, BRI, and FXO backhaul, and SIP and H.323 control

- Cisco RSVP Agent

Table 1-12 lists the hardware and software components used in the Multi-site Centralized, Clustering over the WAN with Unified SRST site model.

Table 1-12   Large Multi-site Centralized with Unified SRST Site Model Components

Component	Description	Qty.
Access Catalyst switch	WS-C6509-E	3
Analog gateway	Cisco VG248	5
	Cisco ATA 188 Analog Telephone Adaptor	5
Cisco Unified CallManager server	Cisco MCS 7835-H1-IPC1 Unified CallManager Appliance	11
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	10
	Cisco Unified IP Phone 7970G	10
	Cisco Unified IP Phone 7960G	20
	Cisco Unified IP Phone 7940G	10
	Cisco Unified IP Phone 7912G	10
	Cisco Unified IP Phone 7905G	10
	Cisco Unified IP Phone 7902G	6
	Cisco Unified IP Phone 7936	4
	Cisco Unified IP Phone 7961G/7961G-GE	5
	Cisco Unified IP Phone 7941G/7941G-GE	5
	Cisco Unified IP Phone 7911G	10
Cisco Unified MeetingPlace Express	MCS-Cisco MCS 7845-H1-IPC1 Unified CallManager Appliance	2
Cisco Unity Server	Cisco MCS 7835-H1-ECS1 Unified CallManager Appliance	2
CMM analog module	WS-SVC-CMM-24FXS	3
CMM conference module	WS-SVC-CMM-ACT	3
Core Catalyst chassis	WS-C6506-E	2
E1 gateway card	WS-X6608-E1	1

Table 1-12   Large Multi-site Centralized with Unified SRST Site Model Components (continued)

Component	Description	Qty.
E1 interface module	WS-SVC-CMM-6E1	3
Expansion module for Cisco Unified IP Phone	Cisco Unified IP Phone Expansion Module 7914	10
Gateway	Cisco 1760-V	2
	Cisco 2611XM	1
	Cisco 2621XM	1
	Cisco 2651XM	1
	Cisco 2691	1
	Cisco 2801	2
	Cisco 2811	2
	Cisco 2821	2
	Cisco 2851	2
	Cisco 3725	1
	Cisco 3745	1
	Cisco 3825	2
	Cisco 3845	2
Gateway Card	WS-SVC-CMM	3
Inline power IU switch	WS-C3550-24PWR-SMI	3
	WS-C3750-24PS-S	3
	WS-C3750-48PS-S	2
Router	Cisco 7206-VXR	1
Video conferencing	Cisco Unified Videoconferencing MCU 3511 EMP	2
Video endpoint	Cisco Unified Video Advantage	4
	Cisco 7985	5
Video H.320 Gateway BRI	IPVC-3521-GW-4B	2
Video H.320 Gateway PRI	IPVC-3526-GW-1P	2
Video MCU and Gateway	IPVC-3544-CHAS	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	5

Medium Site

The Medium Site model consists of one site called Geneva (GVA). In this model, a Cisco Unified CallManager cluster serves 2000 phones. The Cisco Unified CallManager cluster connects to the rest of the network through legacy ATM / Frame Relay and MPLS WAN networks.

A local Cisco Unity Connection provides voice messaging services for local PBX and Cisco Unified CallManager users. Access to the PSTN for normal off-net calls is provided by five E1 RTSI PRI links to the PSTN. Access to other sites and to services such as Cisco Unified MeetingPlace Express is

provided by H.323 gatekeeper controlled trunks and an IP-to-IP gateway. Access to the SIP network is through a SIP trunk to a remotely located CSPS. Third-party operator consoles are provided on Cisco Unified CallManager to serve local phones and to provide backup to the operator console in the CDG site.

The Medium Site model has these design characteristics:

- Cisco Unified CallManager cluster for redundancy and system scaling
- Inline power to IP phones
- SIP and SCCP phones
- Quality of service from the desktop
- Locally connected third-party applications for attendant console, billing, and voice recording, if available
- Local Cisco Unity connection with SCCP connections to local cluster, LGW cluster, and Cisco Unified MeetingPlace Express through Tandem IP-to-IP gateways and through EGW via SIP
- Remote access through H.323 gatekeepers to Cisco Unified MeetingPlace Express networks and to other clusters that are not connected directly
- Cisco Unified MeetingPlace Express remote access through H.323 gatekeeper

Table 1-13 lists the hardware and software components used in the Medium Site model.

Table 1-13   Medium Site Model Components

Component	Description	Qty.
Access Catalyst switch	WS-C6509-E	2
Analog gateway	Cisco VG248	2
	Cisco ATA 188 Analog Telephone Adaptor	1
Analog gateway card	WS-X6624-FXS	1
Cisco Unified CallManager server	Cisco MCS 7835-H1-IPC1 Unified CallManager Appliance	3
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	2
	Cisco Unified IP Phone 7970G	2
	Cisco Unified IP Phone 7960G	2
	Cisco Unified IP Phone 7940G	2
	Cisco Unified IP Phone 7912G	2
	Cisco Unified IP Phone 7905G	2
	Cisco Unified IP Phone 7902G	2
	Cisco Unified IP Phone 7936	1
	Cisco Unified IP Phone 7961G/7961G-GE	2
	Cisco Unified IP Phone 7941G/79461G-GE	2
	Cisco Unified IP Phone 7911G	2
Cisco Unity Connection	Cisco MCS 7845-H1-ECS1 Unified CallManager Appliance	1
CMM analog module	WS-SVC-CMM-24FXS	2
CMM conference module	WS-SVC-CMM-ACT	2

Table 1-13   Medium Site Model Components (continued)

Component	Description	Qty.
E1 gateway card	WS-X6608-E1	1
E1 interface module	WS-SVC-CMM-6E1	2
Gateway	Cisco 2651XM	1
	Cisco 2691	1
Gateway card	WS-SVC-CMM	2
Inline power IU switch	WS-C3550-24PWR-SMI	1
	WS-C3750-48PS-S	1
Router	Cisco 7206-VXR	1
Video conferencing	Cisco Unified Videoconferencing MCU 3511 EMP	2
Video endpoint	Cisco Unified Video Advantage	1
	Cisco 7985	1
Video H.320 Gateway PRI	IPVC-3526-GW-1P	2
Wireless phone	Cisco Unified Wireless IP Phone 7920	2

Small Site (EUEM)

The Small Site model for Europe and Emerging Markets consists of one site called Madrid (MAD). In this model, a Cisco Unified CallManager cluster serves 750 phones in a single campus. A PBX that supports the ISO QSIG variant connects to this cluster through direct QSIG links.

Cisco Unity Connection connects to the cluster through the QSIG-enabled intercloster trunk via the LGW site and provide voice messaging functions to PBX users and to Cisco Unified CallManager users. PBX users have access to Cisco Unified CallManager through a QSIG trunk.

The Cluster connects to the rest of the network through legacy ATM/frame relay and MPLS WAN networks. Calls between this site and other sites in the network are made through the WAN with two Annex M1 intercluster trunks to the CDG and LGW sites.

Access to the PSTN as a backup route to other sites and for normal off-net calls is provided by two E1 ETSI PRI links to the PSTN. Access to services such as Cisco Unified MeetingPlace Express, and operator consoles also is provided through the Annex M1 intercluster trunk to the Large Multi-Site Centralized with Unified SRST site.

The Small Site model has these design characteristics:

* Cisco Unified CallManager cluster for redundancy and system scaling
* Inline power to IP phone sets
* SIP and SCCP phones
* Quality of service from the desktop
* Remote access through AnnexM1 intercluster trunk to third-party applications for attendant console and billing
* Remote access through Annex M1 intercluster trunk to Cisco Unified MeetingPlace Express SIP and H.323 Networks

- Cisco Unity Connection, with the server located remotely and connected through QSIG and intercluster trunk to Cisco Unified CallManager

- PBX connectivity to Cisco Unified CallManager, Cisco Unity Connection, and the rest of the network through Cisco Unified CallManager using a direct QSIG trunks

- QSIG feature transparency between PBXs to PBX, PBX to Cisco Unified CallManager, Cisco Unified CallManager to PBX, and Cisco Unified CallManager to Cisco Unified CallManager clusters.

Table 1-14 lists the hardware and software components used in the Small Site model.

Table 1-14   ***Small Site Model Components***

Component	Description	Qty.
Access Catalyst switch	WS-C4506	2
Analog gateway	Cisco VG248	2
Cisco Unified CallManager server	Cisco MCS 7825H-3.0-IPC1 Unified CallManager Appliance	1
	Cisco MCS 7835-H1-IPC1 Unified CallManager Appliance	1
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	2
	Cisco Unified IP Phone 7970G	2
	Cisco Unified IP Phone 7960G	2
	Cisco Unified IP Phone 7940G	2
	Cisco Unified IP Phone 7912G	2
	Cisco Unified IP Phone 7905G	2
	Cisco Unified IP Phone 7902G	2
	Cisco Unified IP Phone 7936	1
	Cisco Unified IP Phone 7961G/7961G-GE	2
	Cisco Unified IP Phone 7941G/7941G-GE	3
	Cisco Unified IP Phone 7911G	2
Gateway	Cisco 3845	1
Inline power IU switch	WS-C3550-24PWR-SMI	1
	WS-C3750-24PS-S	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	2

Cisco Unified CallManager Interoperability Site (Europe and Emerging Markets)

The Cisco Unified CallManager Interoperability Site model for EUEM consists of one site called London (LGW). In this model, a Cisco Unified CallManager cluster serves 2,000 phones in a single campus. A PBX that supports the ISO QSIG variant connects to this cluster through direct QSIG links.

The Cluster connects to the rest of the network through legacy ATM/frame relay and MPLS WAN networks. Calls between this site and other sites in the network are made through the WAN with two Annex M1 intercluster trunks to the CDG and MAD sites.

Some PBX and Cisco Unified CallManager users have voice messaging services provided by Cisco Unity Connection, which is connected to the cluster through an SCCP link. The PBX user access voice messages through QSIG trunks to Cisco Unified CallManager.

Other PBX and CCM users have access to Unified messaging with Unity and Domino located in the CDG Site via the Annex M1 Inter Cluster Trunk. MWI events and message store and retrieval for both the connected PBX and the CCM users is all passed Annex M1 between the sites.

Access to the PSTN as a backup route to other sites and for normal off-net calls is provided by 5 E1 ETSI PRI links to the PSTN. Access to Cisco Unified MeetingPlace Express, the Cisco Unified CallManager network, and any non-directly connected clusters is provide through remotely located H.323 gatekeepers. Access to the SIP network is provided through a SIP trunk to a remotely located CSPS. Operator console services are provided in the CDG site through the Annex M1 intercluster trunk.

The Cisco Unified CallManager Interoperability Site model has these design characteristics:

- Cisco Unified CallManager cluster for redundancy and system scaling
- Inline power to IP phones
- Quality of service from the desktop
- Video phones, MCUs, and Cisco Unified Video Conferencing H.320 gateways
- Remote access through AnnexM1 intercluster trunk to third-party applications for attendant console
- Remote access through H.323 gatekeepers to Cisco Unified MeetingPlace Express networks and to other clusters that are not directly connected
- Cisco Unity Connection, with the server located remotely and connected through an SCCP link to Cisco Unified CallManager
- Cisco Unity with Domino unified messaging located remotely, with access provided through Annex M1 intercluster trunk from the Large Multi-Site Centralized with Unified SRST cluster
- PBX connectivity to Cisco Unified CallManager and to Cisco Unity through Cisco Unified CallManager using a direct QSIG trunks
- QSIG Feature transparency between PBXs to PBX, PBX to Cisco Unified CallManager, Cisco Unified CallManager to PBX, and Cisco Unified CallManager to Cisco Unified CallManager clusters.

Table 1-15 lists the hardware and software components used in the Cisco Unified CallManager Interoperability Site model.

Table 1-15   Cisco Unified CallManager Interoperability Site Model Components

Component	Description	Qty.
Access Catalyst switch	WS-C6509-E	2
Analog gateway	Cisco VG248	2
Cisco Unified CallManager server	Cisco MCS 7835-H1-IPC1 Unified CallManager Appliance	3

Table 1-15   Cisco Unified CallManager Interoperability Site Model Components (continued)

Component	Description	Qty.
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	2
	Cisco Unified IP Phone 7970G	2
	Cisco Unified IP Phone 7960G	2
	Cisco Unified IP Phone 7940G	2
	Cisco Unified IP Phone 7912G	2
	Cisco Unified IP Phone 7905G	2
	Cisco Unified IP Phone 7902G	2
	Cisco Unified IP Phone 7936	1
CMM analog module	WS-SVC-CMM-24FXS	2
CMM conference module	WS-SVC-CMM-ACT	2
E1 gateway card	WS-X6608-E1	1
E1 interface module	WS-SVC-CMM-6E1	2
Gateway card	WS-SVC-CMM	2
Inline power IU switch	WS-C3550-24PWR-SMI	1
	WS-C3750-48PS-S	1
Router	Cisco 7206-VXR	1
Video conferencing	Cisco Unified Videoconferencing MCU 3511 EMP	1
Video endpoint	Cisco Unified Video Advantage	1
	Cisco 7985	1
Video H.320 Gateway PRI	IPVC-3526-GW-1P	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	2

Non-Cisco Unified CallManager Interoperability Site (EUEM)

The Non-Cisco Unified CallManager Interoperability Site model for EUEM consists of one site called Reykjavik (RKV). This site model is designed to test interoperability of all components in the other models with CSPS controlled endpoints.

The Non-Cisco Unified CallManager Interoperability Site model includes a Cisco SIP Proxy Server (CSPS), and SIP phones and PSTN gateways connected to the CSPS. Each Cisco Unified CallManager cluster also has connectivity to the CSPS for interoperability.

Table 1-16 lists the hardware and software components used in the Non-Cisco Unified CallManager Interoperability Site model.

Table 1-16   Non-Cisco Unified CallManager Interoperability Site Model Components

Component	Description	Qty.
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	2
	Cisco Unified IP Phone 7970G	2
	Cisco Unified IP Phone 7960G	2
	Cisco Unified IP Phone 7940G	2
	Cisco Unified IP Phone 7912G	2
	Cisco Unified IP Phone 7905G	2
	Cisco Unified IP Phone 7961G/7961G-GE	2
	Cisco Unified IP Phone 7941G/7941G-GE	2
	Cisco Unified IP Phone 7911G	2
Gateway	Cisco 2891	1
	Cisco 2851	1
Inline power IU switch	WS-C3550-24PWR-SMI	1
	WS-C3750-24PS-S	1
Router	Cisco 7206-VXR	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	2

Small Campus Multi-Site H.323

The Small Campus Multi-Site H.323 site model consists of one site called Warsaw (WAW). This model includes 13 Cisco Unified CallManager Express sites connected to each other and to the rest of the network through H.323 gatekeepers. Each Cisco Unified CallManager cluster uses an IP-to-IP gateway and MTP to communicate with the Cisco Unified CallManager Express systems in this site, and with the Cisco Unified MeetingPlace Express system located in the CDG site.

Each Cisco Unified CallManager Express system has either Cisco Unity Express installed locally installed, or will access Cisco Unity Connection through an MWI relay gateway that is located in the GVA site.

The Small Campus Multi-Site H.323 model has these design characteristics:

- Inline power to IP phones
- Quality of service from the desktop
- Cisco Unity Connection, connected through MWI relay gateway
- Remote access through H.323 gatekeepers to other Cisco Unified Express clusters and Cisco Unified Meeting Place Express servers

Table 1-17 lists the hardware and software components used in the Small Campus Multi-Site H.323 model.

Table 1-17   Small Campus Multi-Site H.323 Model Components

Component	Description	Qty.
Analog gateway	Cisco VG248	2
Cisco Unified IP Phone	Cisco Unified IP Phone 7971G-GE	4
	Cisco Unified IP Phone 7970G	4
	Cisco Unified IP Phone 7960G	10
	Cisco Unified IP Phone 7940G	10
	Cisco Unified IP Phone 7912G	10
	Cisco Unified IP Phone 7905G	6
	Cisco Unified IP Phone 7902G	6
	Cisco Unified IP Phone 7936	2
Gateway	Cisco 1760-V	1
	Cisco 2611XM	1
	Cisco 2621XM	1
	Cisco 2651XM	1
	Cisco 2691	1
	Cisco 2801	1
	Cisco 2811	1
	Cisco 2821	2
	Cisco 2851	1
	Cisco 3725	1
	Cisco 3745	1
	Cisco 3825	5
	Cisco 3845	2
Inline power IU switch	WS-C3550-24PWR-SMI	2
	WS-C3750-24PS-S	1
	WS-C3750-48PS-S	1
Wireless phone	Cisco Unified Wireless IP Phone 7920	2