How Cisco IT Migrated to Centralized Call Processing

Consolidation of Cisco Unified CallManager clusters improves manageability and reduces costs.

Cisco® IT Case Study / IP Telephony / CCP and SRS Telephony: This case study describes Cisco IT's internal deployment of Centralized Call Processing (CCP) and Survivable Remote Site (SRS) Telephony within the Cisco global network, a leading-edge enterprise environment that is one of the largest and most complex in the world. Cisco customers can draw on Cisco IT's real-world experience in this area to help support similar enterprise needs.

"By reducing the number of Cisco CallManager servers from 300 to 40 with centralized call processing, we're saving our systems administrators hundreds of hours a year. And we can make Cisco CallManager upgrades available to Cisco employees much much faster."

– Marc Holloman, Voice Services Manager, Americas region, Cisco

CHALLENGE

When Cisco Systems® replaced its traditional PBX systems with Cisco CallManager clusters in 2000, employees on campuses worldwide began using Cisco IP phones and Cisco IP SoftPhone software. By consolidating its separate networks for voice and data, Cisco Systems significantly reduced its IT burden. What's more, employees in certain locations gained access to productivity-enhancing IP applications such as Personal Assistant, Cisco Unity™, and Extension Mobility.

Six months later, Cisco began extending CallManager capability to remote field offices with 5 to 250 people. Cisco maintains 150 remote offices in the Americas, 59 in EMEA, and 44 in the Asia-Pacific region. "Employees in branch offices need the same business capabilities as those in main campuses, but they're often shortchanged," says Marc Holloman, voice services manager for the Americas region. "We wanted to make certain that every employee had access to the same IP telephony features, no matter what size office they happened to work in."

Initially, Cisco installed a CallManager cluster in every office—even if it supported only five people—even though a single CallManager cluster can support up to 7,500 phones. The infrastructure and support requirements of this distributed model proved prohibitive. "We soon realized that we wouldn't be able to support so many servers without increasing headcount," says Holloman. Patches for the server operating system are released frequently, and installation and rebooting require an average of 30 minutes for each server. With a two-server Cisco CallManager cluster at each of 150 field offices in the Americas, operating system upgrades alone would have consumed 150 hours per week, the efforts of nearly four full-time people. "Support challenges are high in a distributed environment," says Steve Hunter, network engineer for IT Client Services in the Asia-Pacific region. "They include not only software patches, but also configuration maintenance, troubleshooting, provisioning, and dial-plan management. Site-based telephony doesn't make sense from a cost and support perspective."

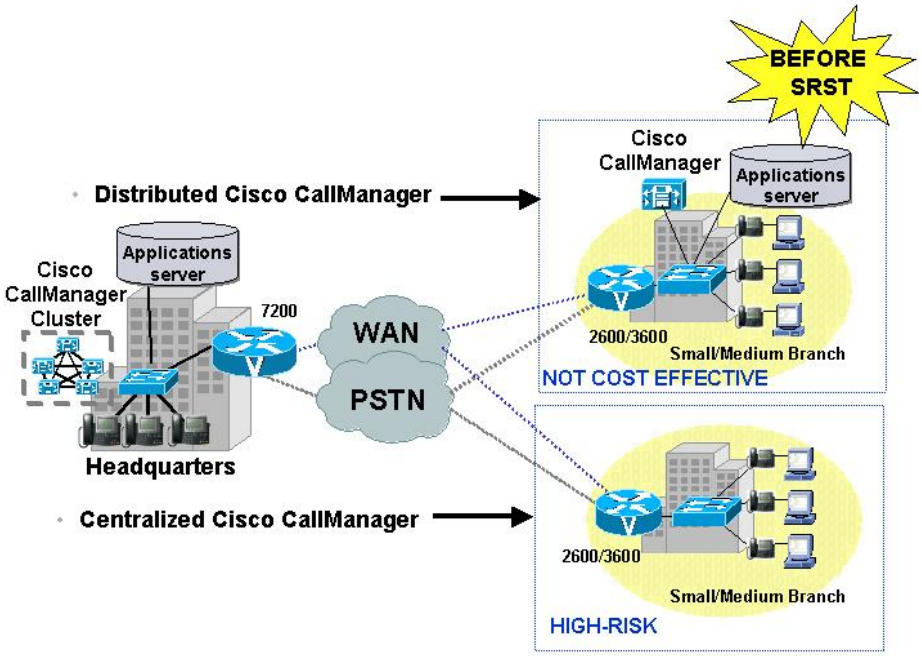
Another shortcoming of the distributed call processing architecture for Cisco was the impracticality of deploying value-added voice applications such as Personal Assistant, Cisco Conference Connection, and the Customer Response Application suite in remote offices. "It just isn't economically feasible to install a separate set of application servers in each field sales office," says Hunter.

Cisco began investigating more cost-effective alternatives to providing IP telephony features for its remote office employees. One option was to out-task remote office support to a provider with the needed geographic reach, scale, and 24-hour operation. The other was to adopt a centralized call processing (CCP) model, in which Cisco CallManager hubs at regional hub sites would feed call processing to remote sites (see Figure 1). “We opted for the centralized call processing model because the network, after all, is our core business,” says Holloman. The CCP model would also enable application and feature parity for employees in remote offices. “With a centralized model, an application added to the hub site is typically available to the remote sites as well,” Hunter says.

But before deploying CCP, Cisco needed a way to ensure business continuity if the WAN link between the hub and the remote office went down. In the event of a WAN outage, employees would need the capability to place calls, including E911 calls, and to receive calls over the Public Switched Telephone Network (PSTN). “In converged networks, the stakes for loss of availability are higher than for data-only networks,” Holloman says. “If a WAN goes down and the result is that people can’t access the Web and network applications, the productivity loss can be overcome. But if customers or prospective customers call and hear a message that the circuit is down, the consequence can be lost sales and eroded reputation.”

A distributed Cisco CallManager network is not cost effective for extending IP telephony to small or medium-sized branch offices (Figure 1, top). A centralized Cisco CallManager solution (Figure 1, bottom) reduces capital and operational expense, but does not inherently provide backup telephony features should the WAN link fail.

Figure 1. Figure 1 Distributed vs. Centralized CallManager Architectures



SOLUTION

Cisco met the challenge by developing Survivable Remote Site Telephony (SRS Telephony), now a feature of Cisco IOS® Software. Cisco tested SRS Telephony at Canberra, Australia, in December 2001 and then in Destin, Florida, in March 2002. Following these successes, Cisco began deploying SRS Telephony to branch offices worldwide.

SRS Telephony is integrated into Cisco branch office routers. Cisco itself uses Cisco 3640 and Cisco 3745 routers, depending on the number of IP phones in the office. SRS Telephony automatically detects a failure in the WAN link to the regional hub where the Cisco CallManager cluster is located, and then uses Cisco Simple Network Automated

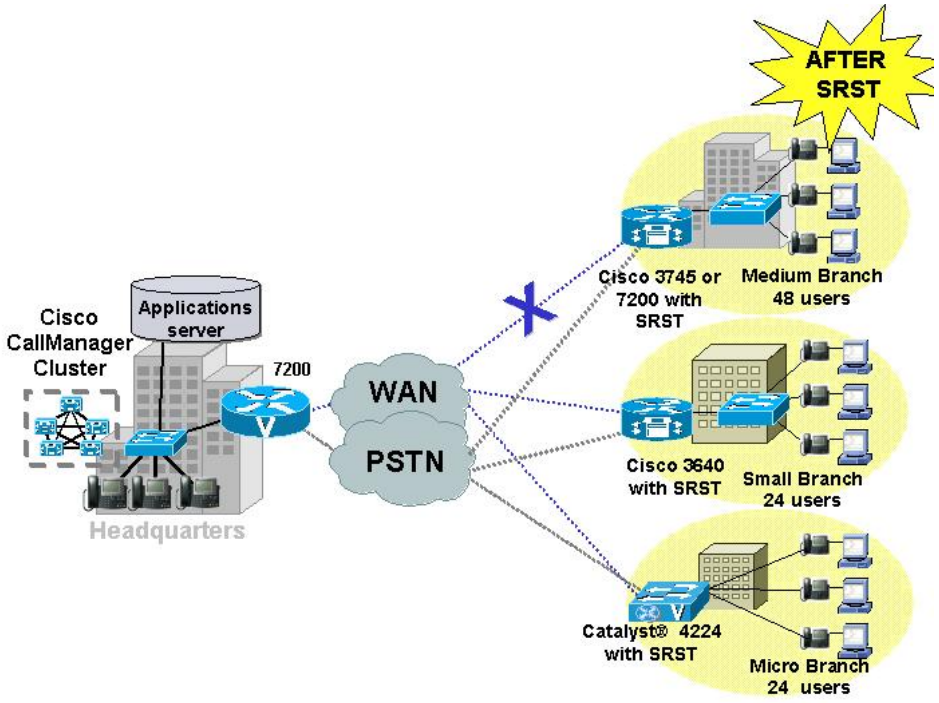
Provisioning (SNAP) capability to initiate a process to intelligently autoconfigure the router to provide call-processing backup redundancy for the IP phones in that office.

The result: Even if the WAN link to the hub site goes down, Cisco remote office employees can use their IP phones to dial out to the PSTN, receive inbound calls over the PSTN, and make station-to-station calls (see Figure 2). Callers outside of Cisco perceive no difference, and Cisco employees can use nearly all their telephony features. In fact, were it not for a message on their IP phone display, they might not even know of the fall-back operation.

When WAN connectivity is restored, SRS Telephony automatically returns call-processing functions to the primary Cisco CallManager cluster in the hub. No action is required by IT either to fall back to SRS Telephony or to return control of telephony to the CallManager cluster. “Placing a Cisco CallManager in each branch is effective but very costly from an equipment and support standpoint,” says Holloman. “Centralizing call processing is much more cost-efficient, but creates unacceptably high risk in the Cisco environment. By combining centralized call processing with SRS Telephony, we get the best of both worlds—low equipment costs, low support burden, and high availability.”

Should the WAN link fail, SRS Telephony enables remote offices connected to a central call-processing hub to continue to send and receive calls over the PSTN.

Figure 2. Figure 2 Centralized CallManager Architecture (CCP) with SRST



Geographic Distribution

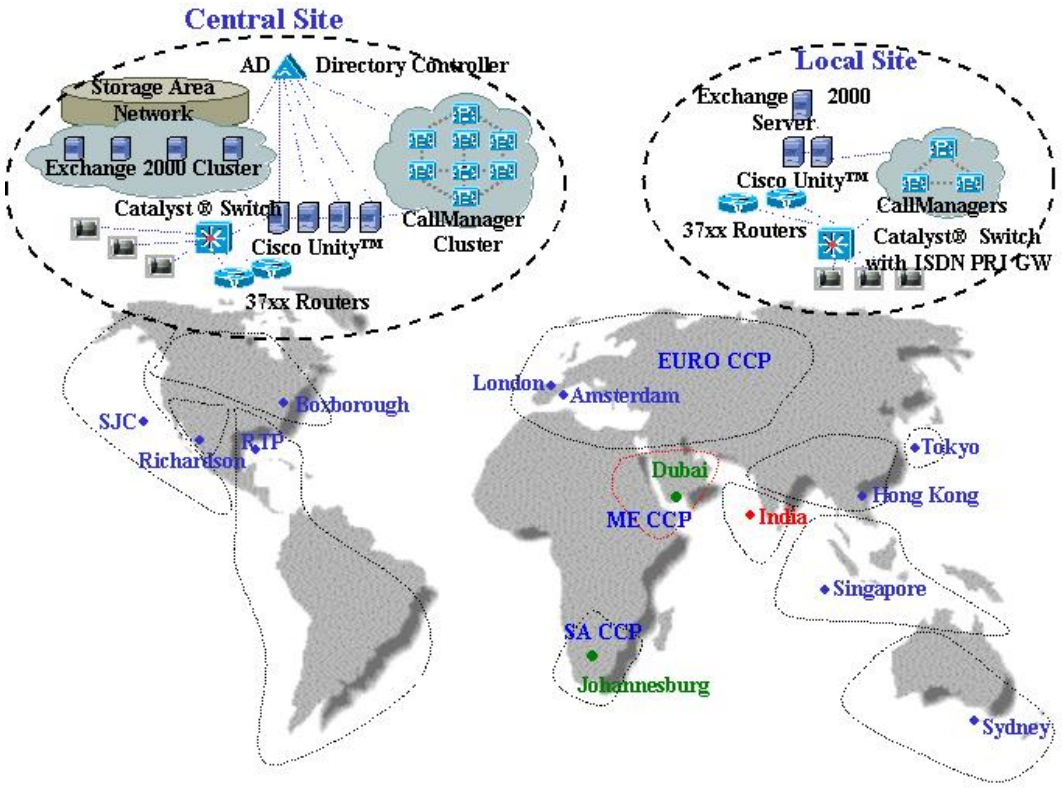
With the introduction of SRS Telephony, sites in each Cisco region were able to centralize call processing in a small number of major hubs (Table 1).

Table 1. Hub Sites for Centralized Call Processing

Americas Hubs (135 branch offices adopting CCP)	Asia-Pacific Hubs (40 branch offices)	EMEA Hubs (59 branch offices)
San Jose, California	Sydney, Australia	London-Amsterdam
Boxborough, Massachusetts	Beijing, China	Dubai, United Arab Emirates
Research Triangle Park, North Carolina	Seoul, Korea	Johannesburg, South Africa
Richardson, Texas	Tokyo, Japan	
Kanata, Canada	Singapore	

Figure 3 shows the regions for Cisco CallManager hub sites worldwide. Centralized Cisco CallManager clusters at each site manage all calling within the outlined region.

Figure 3. Centralized Cisco CallManager Clusters

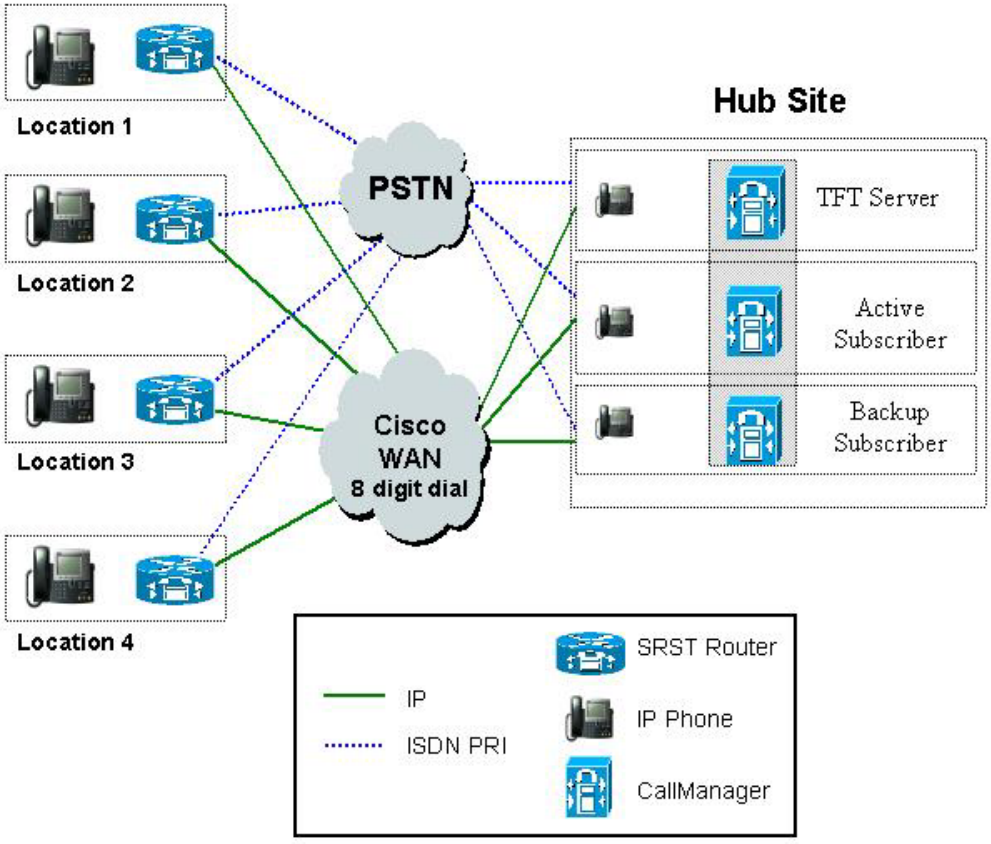


Cluster Architecture

A typical Cisco CallManager cluster includes three servers: a TFTP publisher, active subscriber, and backup subscriber (Figure 4). Branches in Asia-Pacific and EMEA sites typically use multiple active and backup subscribers.

In Figure 4, the hub, shown at right, comprises a TFTP publishing server, an active subscriber, and a backup subscriber. It also provides application servers; for example, for Personal Assistant or Cisco Unity software. The Cisco router in the remote office provides access to the PSTN and delivers basic IP telephony features in the event the WAN fails.

Figure 4. Centralized Call Processing Architecture



When designing the centralized call processing model, Holloman followed the model of the Cisco WAN infrastructure; that is, if a remote branch office WAN link terminated in Research Triangle Park, so too did its Cisco CallManager connection. “This design approach minimized delay by ensuring that voice packets could traverse the minimum number of hops,” Holloman says.

Offices with fewer than 72 people use the Cisco 3640 Router. Offices with 73 to 240 people were upgraded to Cisco 3745 routers because they support more phones in fall-back mode should the WAN link go down. “Each time we upgrade the SRS Telephony feature, it supports more phones,” says Holloman. For the most current information about the number of telephones supported by different Cisco routers, refer to the Cisco SRS Telephony Overview document on Cisco.com
http://www.cisco.com/en/US/products/sw/iosswrel/ps1839/products_feature_guide_chapter09186a008011616f.html

Asia Pacific Deployment

Cisco Systems’ Asia-Pacific region spans 44 sites in 12 countries, with about 5000 employees. The head office is located in Singapore, and regional head offices are located in Sydney, Beijing, and Bangalore. Each regional head office serves as a hub site for Cisco CallManager, and supports 6 to 10 smaller field sales offices as spoke sites. All offices in Australia, China, Southeast Asia, and Japan have been converted to centralized call processing with SRS Telephony.

When the Asia-Pacific region centralized call processing, Cisco IT also implemented a revised dial plan that enables Least Cost Routing by providing comprehensive voice-over-IP coverage for intra-office calls, as well as tail-end hop off to the PSTN.

EMEA Deployment

The European centralized call processing cluster consists of 13 servers, split between Amsterdam and London using clustering over the MPLS IP-VPN WAN. The cluster currently supports 3,000 employees working at the three core campus sites in Amsterdam, London, and Brussels as well as remote sites in Bucharest, Sofia, and Luxembourg, which use SRS Telephony. EMEA plans to add another 3000 users across 36 remote sites in early 2004. “We’re looking forward to the reduced cost of ownership we’ll achieve by reducing our server count from 150 to 13,” says Ian Pudney, IP telephony program manager for EMEA.

A chief advantage of centralized call processing for EMEA is desk-sharing over a larger geographical area. Each of the 71 sites in EMEA encourages desk sharing by mobile employees, to minimize real estate costs. The Cisco CallManager Extension Mobility feature enables desk sharing because employees can log on to their own telephone extensions from any IP phone served by a single CallManager cluster. “The single most requested feature from our mobile workforce in EMEA was the ability to log on to IP phones at different sites—even different countries,” reports Ian Pudney, IP telephony program manager for the EMEA theatre. “We were able to grant this request when we deployed centralized call processing. Now employees can log on to any IP phone served by the cluster. This is a great example of IP telephony as an enabler for productivity-increasing applications.”

RESULTS

Assured Business Continuity

If the WAN link between a Cisco CallManager hub and a remote office goes down, the Cisco router takes over IP telephony functions. Callers do not notice any difference, and Cisco employees generally can’t tell the difference except for an advisory displayed on the IP phone. When the WAN link comes up again, the centralized Cisco CallManager cluster automatically resumes control.

Dramatically Reduced Support Requirements

Now Cisco can apply patches and upgrades to many fewer servers: In the Americas region, the support burden has dropped from 150 Cisco CallManager clusters (300 servers) to 5 CallManager clusters (15 servers), plus an additional 25 servers at sites too large to participate in the distributed architecture. "The time savings are enormous," says Holloman. Service releases and patches can come from Cisco or from Microsoft, and each software upgrade requires systems administration time. Upgrade times can vary significantly depending on the complexity of the CallManager architecture, since the complexity of ensuring data backup and integrity, disaster preparation, and verifying the system is fully functional after the upgrade is complete becomes much more complex as we serve more sites and more phones with fewer clusters. A smaller, two-CallManager hub can take a few person-hours to upgrade; Cisco San Jose's complex twelve-CallManager cluster can take over a hundred person-hours for combined OS and CallManager upgrades. "By reducing the number of Cisco CallManager servers from 300 to 40 with centralized call processing, we're saving our systems administrators hundreds of hours a year. And we can make Cisco CallManager upgrades available to Cisco employees much much faster," says Holloman.

Estimates for time savings in Cisco have been varied. Reducing the number of CallManagers by 85% has significantly reduced systems administrator workload, but the increase in CallManager hub complexity has made the savings less than 85%; estimates of cost savings within Cisco IT range from 25% to 75%. A customer migrating from a similar "CallManager cluster in every site" to a CCP CallManager hub environment is likely to experience cost savings; the actual amount would depend upon the size and complexity of the clusters in the new CCP environment.

Case in point: In Latin America, upgrading 15 Cisco CallManager sites required 20 days of work for four people. In the United States, one person upgraded CallManager capability for 40 offices in one night, because a single CallManager hub served all sites. “Centralized call processing creates huge time savings,” says Holloman. “As a

result, Cisco support staff can focus less on day-to-day maintenance and more on delivering new technology and products."

Other Cost Savings

Centralized call processing not only eliminated the need to increase headcount for Cisco, it created these additional cost savings:

- Decreased capital expense by reducing the number of Cisco CallManager server platforms; for example, from 300 to 40 in the Americas.
- CCP simplified implementation of VoIP by making dial plan administration less complex. This enabled dial-plan savings by improving least-cost routing—Cisco CallManager forces on-net routing when possible. As a result, the Singapore office is saving about US$13,000 per month in calls to Australia, the United States, Thailand, and Malaysia, compared to before the office centralized call processing. "We anticipate international direct dial (IDD) savings of up to US$1 million annually," says Hunter.
- Reduced telecommunications costs for mobile workers. The Extension Mobility feature of Cisco CallManager enables employees to log on to any IP phone served by a single cluster to retrieve their own telephone extension. When used in a single Cisco location with a desk-sharing policy, Extension Mobility reduces real estate and furniture costs. "In a centralized call processing environment, Extension Mobility can operate over multiple sites and countries," says Pudney. "This allows our highly mobile workforce to stay in touch with their home country, clients, and customers in a very cost-effective way that avoids expensive mobile phone international roaming costs."

Feature Parity for Remote Offices

With centralized call processing, employees in Cisco branch offices have access to the same IP telephony features, capabilities, and applications as employees who work on campuses. "Centralized call processing enables us to provide Cisco employees in even the smallest offices with productivity-enhancing applications such as Follow-Me services, Personal Assistant, and Cisco Unity," says Holloman. "This corrects a major shortcoming of legacy PBX services, which usually provide a subset of features to branch office employees."

More Rapid Application Deployment

Because IP telephony applications can now be deployed in fewer sites—5 sites instead of 150 in the Americas—centralized call processing enables Cisco to deploy more applications, to more people, at less expense. For example, when the Americas region centralized call processing, Cisco was able to reduce the number of servers for Personal Assistant from 100 to 8. The other 92 servers have been redeployed for other applications. Similarly, when the Asia-Pacific region deploys Cisco Unity software in Australia and New Zealand, deployment will take one-eighth the time it would have before centralization, because the hub site serves seven spoke sites that now will not need their own servers.

"Before we adopted centralized call processing, Cisco employees could take advantage of value-added IP voice applications only if the application was deployed on a server at their location," says Holloman. "Now, with centralized call processing, we can deploy the application on a single Cisco CallManager cluster and make it available to employees in all offices connected to that hub site. We're providing better service to Cisco employees even as we save equipment and application costs—and the benefit will increase with each new voice service we deploy." What's more, applications have the same look and feel of those in headquarters, simplifying training and facilitating inter-office mobility.

LESSONS LEARNED

Hunter says that an essential first step in deploying CCP and SRS Telephony is for the company to understand the extent of its reliance on the network. "Our last unplanned downtime due to system failure was at Sydney in August

2000, due to routing errors at the campus core," he says. "The first impact to employees was the telephone system. That sold us on the importance of SRS Telephony to ensure that the telephone system could continue operating even if the data network went down." Hunter also encourages companies that adopt a centralized call processing model—or any IP telephony—to be vigilant regarding network and host security. Diligent patching, backup, virus scanning, and use of host intrusion detection systems (IDSs) are essential, he says.

NEXT STEPS

Based on the success of centralized Cisco CallManager in hub locations, Cisco is planning to centralize its Cisco Unity servers, as well.

Longer-term, Cisco plans to further consolidate its Cisco CallManager hub sites. The Americas region, for example, will consolidate from four to two sites. This will augment the time savings for upgrading and maintaining clusters. To facilitate disaster recovery, Holloman will begin distributing CallManager clusters across the WAN—for example, deploying the active subscriber server in San Jose and the backup subscriber in Research Triangle Park. "Distributing clustering across the WAN will provide redundancy in the event of a major disaster in one city," Holloman adds.

As SRS Telephony is enhanced to support more IP phones in fall-back mode, Cisco will connect very large branch offices to the CCP architecture, which will further reduce management costs. The office in Petaluma, California, for example, has 1000 employees.

"Centralized call processing makes it cost-efficient to extend IP telephony across the enterprise to any size office, even the smallest," says Holloman. "And SRS Telephony removes the risk. Cisco is experiencing ongoing benefits from reduced capital costs, reduced operational burden, and feature parity for remote office employees, ensuring that every employee has access to the same productivity-enhancing IP applications. Everyone wins."

CONTACTS

For more information about AVVID production deployment, start a conversation with the IT subject matter experts in Cisco@Work IP Telephony forum at:

http://iforums.cisco.com/iforum/servlet/SCom?page=scom&folderID=caw&CommCmd=MB?cmd=display_messages&mode=new&location=.ee77364

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