A Cisco Evolution

IP Telephony replaces standard public switched telephone (PSTN) networks (PBX), using the Internet to send audio between two or more users in real time and allowing users to communicate via an IP telephone. Replacing conventional circuit-switched technology with a more cost-effective and efficient packet-based architecture, the Cisco Architecture for Voice, Video and Integrated Data (AVVID) transmits data, voice, and video over a single network infrastructure.

With 23 Expansion Port Network (EPN) PBXs coming up for renewal throughout the various Cisco facilities, the organization needed to make the decision whether to renew the leases or to migrate its phone system to IP Telephony. After conducting a return on investment (ROI) analysis and determining that it would be much more cost effective to migrate, Cisco began to put the team together to develop the processes that would ensure a smooth transition.

The Cisco AVVID network infrastructure is the foundation that is essential for rapid and seamless deployment of emerging technologies such as IP Telephony and other new and evolving Internet business solutions across the enterprise. Built on the Cisco AVVID network infrastructure, the AVVID IP Telephony solution brings the promise of high-quality IP voice and fully integrated communications to fruition by allowing data, voice, and video to be transmitted over a single network infrastructure.

Cisco has always been its own "first best customer," integrating its own technologies typically at least 18 months ahead of market requirements as well as using that opportunity to test and build new feature requirements.

Operational Benefits of Cisco IP Telephony

From a user's standpoint, Cisco looked to IP Telephony to increase personal and workgroup productivity, improve its ability to respond to customers, and reduce operational costs. Because the IP phone registers itself whenever it is moved, users can take their phones with them, creating a virtual office by plugging into spare data wall jacks and receiving calls regardless of their current location. They can access and self-manage their own set of phone services while maintaining one phone number. Also, because IP Telephony uses the same standards as data communications, both PCs and phones can access voice mail, check e-mail, view video broadcasts, and enable other IP Telephony applications on the same shared network.

For network managers, the process of managing a converged voice and data network becomes a much simpler task. Centralized voice services provide the ability to extend the functionality of the corporate IP voice, video, and data solutions to remote office locations without having to invest heavily in additional infrastructure and software for the remote offices. This gives the central office (CO) a greater degree of control over what is added to the network and ensures greater systems integration and security.

In addition, the cost of relocating a phone or changing phone numbers when an employee moves—a significant expense that can cost up to U.S. $90 per phone—is eliminated. Also, because IP Telephony is a software application, enhancing its capabilities in a production environment is a matter of upgrading software on the server platform, thereby avoiding expensive hardware upgrade costs.

Table 1-1 demonstrates the cost reduction and operational savings generated by the streamlined process of managing and facilitating IP telephone adds, moves, and changes.

Table 1-1   *IP Telephony Impact on Adds, Moves, and Changes: San Jose Campus IT/ Telecom Savings: Fiscal Year 2002 (August Through June)*

Type	Volume	Unit*	Savings
Project moves	3,625	$3.00	$11,244
Individual moves	784	$50.00	$6,150
Adds (new hires/configurations)	5,852	$50.00	$440,300
	5,852	$0.00	$0.00
			$457,694
WPR Savings**			
Reduction of contracted services to support MACs			
	Fiscal Year 2001	Fiscal Year 2002	
Type of Service	**Average $/Move**	**Average $/Move**	**Savings**
Disconnect/reconnect systems support	$39.38	$3.62	$153,503
(Approximately 91 percent of expense reduced)			
Other Benefits	Move process time shortened Zero downtime of phones Higher client satisfaction Integration of resources		

*Cost variance between IP and non-IP MACs
** WPR = WorkPlace Resources

Cisco calculated efficiencies in both resource and cost savings based on the following time-division multiplexing (TDM) market assumptions:

- From 250 to 10,000 phones at one site per month

- PBX maintenance—U.S. $3.50 to U.S. $2.50 per port with 33 percent ports, not phones

- Move/add/change activity—U.S. $90 per move/add/change (110 percent of phones at Cisco move each year)

- Voice mail support—U.S. $2.20 to U.S. $0.90 cents per phone

- Software upgrade support—U.S. $0.44 cents per phone

- PSTN support and coordination—U.S. $0.50 cents per phone

- LAN/WAN support—U.S. $5.00 to U.S. $0.25 cents per phone

Factoring in the preceding assumptions, the IP Telephony Remote Network Management (RNM), the service that monitors the IP Telephony network remotely, was identified as further reducing ongoing total cost of ownership due to IP Telephony eliminating support overhead and combining LAN/WAN, PSTN, and PBX support, as shown in Table 1-2.

Table 1-2 *Impact on Total Cost of Ownership*

PBX Support Comparison	Traditional TDM PBX Support	IP Telephony-RNM Telephony
PBX maintenance	Maintenance fees	Cisco SMARTnet
Upgrade support	Sold separately	Cisco SAS
PBX management	Dispatch or labor	Included
Move/adds/changes	Dispatch or labor	Included
PSTN management	Not included	Included
LAN management	Not included	Included
Remote site management	Not included	Included
Infrastructure changes	Not included	Priced separately

Ongoing support is made much easier with the migration to IP Telephony, and relative costs are reduced significantly. Figure 1-1 provides a view of the expected ongoing support costs for PBX versus IP Telephony.
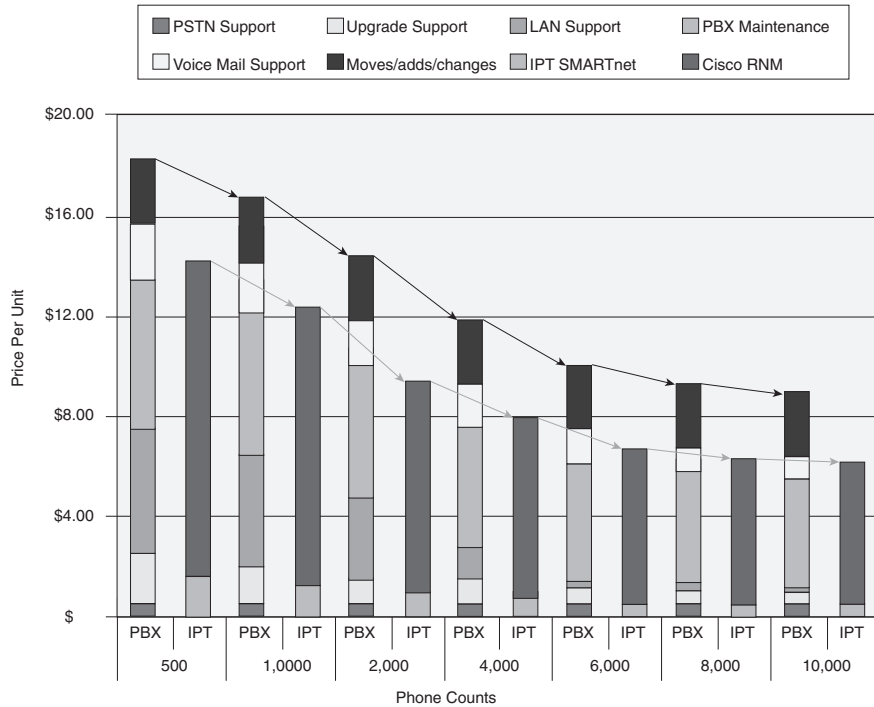

Figure 1-1 *Ongoing Support Costs for PBX and IP Telephony*

ROI

One of the first and possibly most difficult questions that companies face when determining whether to invest in a new technology is whether there will be sufficient benefits and returns for the required investment and, if so, how much impact they will have. Like most companies, Cisco requires a positive business case or financial justification for funds to be approved for any major investment.

However, ROI calculations should be only one aspect of the measurement system. Other factors, such as business, operational, and adoption impact, must be taken into consideration as well. In addition, reporting only on metrics that directly relate to the initiative's success is critical. IT organizations sometimes measure projects in ways that do not directly assess the project's contribution to business goals, making it difficult for senior management to assess the value of the initiative and provide the necessary sponsorship for its success.

Cisco developed a simple ROI measurement system that enabled IT to assess the viability of the IP Telepohony implementation. The measurement system included the following factors:

- **Financial**—Reduction of wide-area facility requirements; fewer devices to manage and maintain; simpler adds, moves, and changes; and lowered overhead cost associated with simplified and converged infrastructure

- **Operational metrics**—Availability, performance, and error rates

- **Business metrics**—Cost savings, satisfaction, cycle-time acceleration, transaction response times, availability, and error rates

- **Adoption metrics**—Adoption rates and overall employee satisfaction with the new system

"An important part of any ROI objective is to weigh the risks of implementing the initiative versus not implementing it," said Lynnee Jimenez, Cisco IT finance manager. "We weighed the benefits—strategic and financial—and asked ourselves what the overall justifications were versus the alternatives we considered."

This necessary emphasis on frugality leads to renewed importance on the performance of ROI calculations. Chris Kozup, a senior research analyst for Meta Group, points out that in the generous economic environment of past years, executives would cite general ROI expectations for technology implementations. Now, says Kozup, executives are pressed to pinpoint more specific ROI targets, such as those for a 12-month or 24-month period, with a clearly stated "time to ROI" target.

In an effort to identify specific ROI factors, Cisco began by committing all new building openings to one set of wiring standards. All upcoming PBX leases were terminated when they came up for renewal, and all new employees were issued an IP phone right from the start.

Cisco addressed several variables during the IP Telepohony deployment to calculate ROI. Each variable was categorized by either hard or soft cost factors. Hard cost factors included areas where quantifiable "account balance" results could be identified and measured. Soft cost factors, although not as quantifiable in measurable dollars, still impact savings realized through efficiencies and increased productivity. Table 1-3 documents the hard and soft cost factors identified during and after the migration.

Table 1-3 *Hard Cost Factors and Soft Cost Factors for IP Telephony Deployment*

Hard Cost Factors	Soft Cost Factors
Drastically reduces cabling requirements for new site openings.	Increased proficiencies—Adds, moves, and changes are simple, quick, and efficient.
Incurs less cost and time to perform adds, moves, and changes, as well as fewer personnel to support.	New employee IP phone allocations are efficient and easy to manage, despite enormous growth.
Eliminates PBX maintenance cost.	Increased productivity—Employees use the technology to be more self-sufficient.
Eliminates leased equipment cost.	Increased mobility—Workplace sharing ratio enables employees to plug in and work wherever they happen to be—at home, in multiple offices, in conference rooms, and so on.
Eliminates PBX system cost (phones, line cards, trunk cards, system software, user licenses, and so on).	Leveraged resources—Both voice and data staff provide IP Telephony support.
Reduces toll-bypass and network carrier costs.	
Eliminates costly hardware PBX expansion port cost to accompany fast growth.	
Encourages virtual office space design because of maximum use of real estate space.	

You can use the Cisco ROI calculator to calculate the ROI for your Cisco IPT solution. You can find the calculator at http://www.cisco.com/warp/public/779/video/iptv/roicalc/.

Where It All Started

The greatest challenge for Cisco throughout the entire IP Telephony deployment was probably that the technology at that time was new to the industry, and voice running over the data network was still new to Cisco. "This originally started out when Cisco acquired Selsius Systems, a company that provides network PBX systems for high-quality telephony over an IP network," says Dennis Silva, voice services senior network design and engineer. "The scariest thing for us back then was that, not only was it new to us, there had never been an IP Telephony deployment that involved more than 50 phones in production anywhere in the world. The technology was still in development, and most of the Selsius deployments had all taken place in a lab environment."

Silva and his team were tasked with learning the technology quickly and then conducting a pilot within Cisco. "We tested the technology and then deployed about 100 phones within the IT department to run a carefully monitored trial for a period of time."

Cisco Architecture in the Beginning

The first challenge the team identified was the lack of voice mail integration. Minimizing user discomfort during the migration was of utmost importance, and being able to keep the user's existing phone number and voice mail was high on the "must have" list. "To accommodate this, we came up with a Simple Message Desktop Interface (SMDI) because we knew Selsius supported SMDI," Silva says. "Although they had never used SMDI and had never integrated with Octel, they did have that particular type of interface. So we purchased an Octel 350, dedicated it with a CallManager, and assigned all new employees to this dedicated CallManager." This prevented the necessity of integrating with the PBX and Octel systems.

"Then we decided to put new users on the CallManager software release 2.3 and use the SMDI integration to an Octel 350, under the assumption that we were going to break this system at, say, 500 users," Silva continues. "We had a commitment from the business unit that we could put 500 users on there. However, by the time we got to 500 users, no doubt we'd be on CallManager 3.0, which was the latest software upgrade; we'd have an Octel solution, and all of our problems would be solved."

But like many best-laid plans, that did not happen. The rollout had begun with the first test success, and by the time the team could catch its breath, it was managing 2500 users. "It kind of got out of hand because of Cisco's rapid growth. All new employees were being given IP phones when they started," Silva says. "So here we were with a new system that had never been tested for more than 200 people, and now we had over ten times that."

However, the development team was able to work through the challenges, and with careful monitoring and management of software releases, the initiative to deploy an IP Telephony solution throughout Cisco hit the ground running and never looked back.

Cisco Architecture Evolution

Figures 1-2 and 1-3 represent the evolution of the Cisco architecture and the migration of the technology. Figure 1-2 provides a view of how the network architecture looked in 2001 at the beginning of the migration. Figure 1-3 demonstrates how calls come in to the network, how they tandem through the PBX, and how voice mail and intercluster calling are performed.
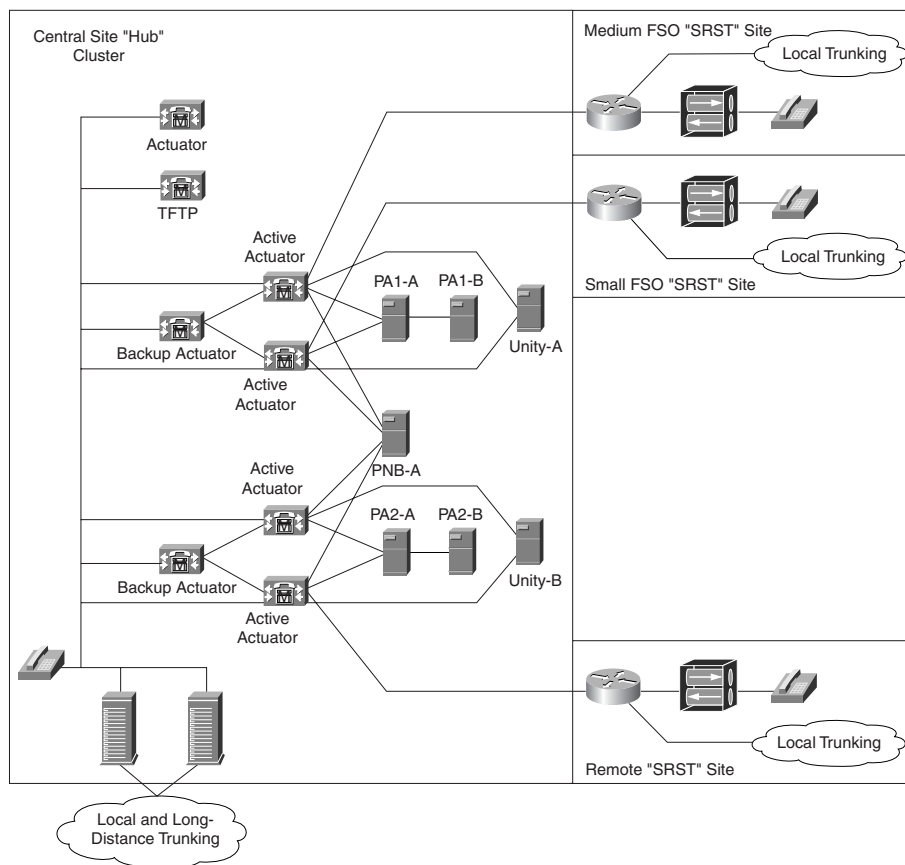
Figure 1-2 *Traffic Flow Example of Voice Mail and Intercluster Calling*

Summary

This chapter provided the background on why Cisco decided to migrate to an all IP network, included a discussion on ROI, and described the architectural evolution from the beginning of the migration to IP Telephony. The chapters that follow will provide you with the knowledge and tools to plan, design, implement, operate, and optimize your IP network.

Figure 1-3   Cisco 2001 San Jose Campus Environment