Cisco Systems

Cisco Undertakes the Largest **IP Telephony** Deployment in Industry History

Case Study: The implementation and operational processes used by Cisco to migrate its own organization to a converged, enterprise-wide network

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Foreword

IPT—The Next Frontier in the Emergence of IT

In a world where cost reduction and doing more with less have become the norm, organizations continue to seek ways of increasing efficiencies and enhancing employee productivity while sustaining ever higher standards for customer satisfaction. A tall order but one made much easier with the right tools, products, services, best practices, and methodologies all working in combination.

In a recent study sponsored by Cisco (Net Impact Study—http://business.cisco.com), it was found that Internet business solutions helped the 2,000 U.S. organizations surveyed to increase revenues by approximately US$444 billion and reduce costs by US$155 billion in the past three years. This astonishing discovery was attributed to improvements in customer care as well as back-office Internet solutions that introduced production and distribution efficiencies, reducing both logistical and labor costs.

> "Cisco has always made a practice of using its own technology and in 2000, we began migrating our existing PBX systems to a converged voice and data network to test and strengthen what we felt was a technology that would change telecommunications."
>
> John Bruno,
> Vice-President, Technology Marketing Group

Internet technology has become the greatest business enabler of our time and one that Cisco has embraced since its inception. Cisco has always made a practice of using its own technology and in 2000, we began migrating our existing PBX systems to a converged voice and data network to test and strengthen what we felt was a technology that would change telecommunications. Overlaying Internet Protocol Telephony (IPT) over an already robust system while incorporating applications such as e-learning, videoconferencing, and communications, was simply the next logical and necessary frontier.

The phased migration was rolled out worldwide to 40,000 Cisco employees. The San Jose campus—consisting of nearly 20,000 employees—was completed within just twelve months. During the course of the deployment, we learned three very fundamental lessons that led to the success of this massive project. First, we treated IPT not as a phone replacement, but as another vertical application that fit into our overall IT strategy and complemented a compliant, common infrastructure. Secondly, using mostly existing staff, we created a cross-functional implementation team that consisted of key constituents representing not only IT, but also each of our Business Units, Sales, Global Theaters, Services and Support, and others recognized as stakeholders. And finally, we focused on what's really behind the deployment—the people—and how IPT would impact them.

While the needs of every enterprise are different, some things are universal. Planning, communication, teamwork, and understanding your user's requirements are as important as technical expertise. The purpose of this paper is not to tell you how to technically architect your own network. The intent is to provide best practices learned throughout Cisco's experience with phased migration to a converged voice and data network enabled by the interoperability of Cisco's AVVID IP Telephony.

—John Bruno, Vice President, Technology Marketing Group, Cisco Systems

"Our hope is that by sharing our experience "bumps, bruises, and all" we can help our customers plan and realize the value of a converged, IP-enabled network."

Manny Rivelo,
Senior Vice-President, Worldwide Field Process and Operations

How the Cisco story benefits you

Learning from those who have already climbed the mountain makes the journey much easier for those still scaling the wall.

Integrating Cisco's own products and technologies throughout our organization underscores our commitment to the technology and enables us to help our customers with solutions that provide maximum benefit. Whether it's migrating our entire organization to an e-business strategy… implementing wireless LAN into all corporate facilities… piloting our SN5420 storage router… or installing our IP Contact Center solution into Cisco locations around the world… we have mandated that we will always be our own first and best customer.

In October 2000, an enterprise-wide deployment of IP Telephony began at the San Jose campus and within the next twelve months, 55 buildings and nearly 20,000 users spread out over a two-mile radius were converted. This was the largest deployment of LAN infrastructure and IP Telephony in industry history. The program charter was to implement our own AVVID technology solution twelve to eighteen months ahead of our external customers in order to develop business models that would demonstrate ROI, complete technology proof of concepts, and develop processes for support and deployment of IP Telephony.

Cisco's IP Telephony offers an immediate ROI by reducing total cost of network ownership through one converged network. Cost savings are even further realized through reduced equipment and infrastructure cost, increased productivity, and much easier network management. The financial impact of Cisco's internal initiative encompasses significant annual savings in competitor-leased equipment and PBX maintenance cost, to name just a few.

However, in order to extract the maximum benefit from an enterprise-wide IP Telephony initiative, careful and comprehensive planning before the actual deployment was critical. Whether the deployment involves 200 phones or 20,000 phones, planning, communication, teamwork, and knowing where the 'gotchas' are hiding will divert problems before they even occur, reducing unnecessary costs and headaches that can hinder a successful implementation.

The voices in this paper come from the experienced team of project managers, engineers, operations personnel, and support teams who completed the conversion of Cisco's San Jose, CA campus to IP Telephony. The paper focuses not on the technology, but on the planning and business processes associated with a large IPT deployment. Our hope is that by sharing our experience—bumps, bruises, and all—we can help our customers plan and realize the value of a converged, IP-enabled network.

—Manny Rivelo, Senior Vice-President, WW Field Process and Operations

Executive Summary

"Just get it done" no longer works in today's complex world—a world with limited resources where business operatives depend upon technological solutions that achieve productivity, efficiency, and customer satisfaction goals. Working smarter, not harder is the new directive.

Managing any large-scale project, especially one that impacts nearly every corner of the organization, requires a daunting combination of planning, coordination, communication, timing, and teamwork. It requires a rational, consistent, and proven process that aligns the project's goals and objectives with the resources required to get it done. And there is no better path to successful implementation than to follow in the footsteps of those who have already been there, learned what worked and what didn't work along the way, and developed a methodology that has proven successful.

The following pages tell the story of Cisco's experience migrating from a PBX circuit-switched network to IP Telephony. The phased migration of the San Jose campus was completed within twelve months and impacted nearly 20,000 employees located in 55 different buildings spread out over a two-mile radius.

The Implementation team successfully upgraded the company's entire desktop LAN infrastructure, removing 22 EPN (Expansion Port Network) PBX's and 10,000 old world phones that were counted, packaged, and returned along with 2,500 ancillary parts and components. Five CallManager clusters with eight servers each, along with 500 Cat 6K and Cat 3500 switches were installed during the upgrade.

The team knew that they would run into issues inherent with introducing any type of new technology or process change. They knew that users would experience emotions running the gamut, from anxiety and confusion to resistance and refusal. And they knew that without the right planning—including the right skillsets, tools, and processes—the initiative could quickly spiral out of control.

By taking the time upfront to plan the implementation strategy, understand the impact that the technology would have on its users, and put together a carefully chosen deployment team, the initiative was one of Cisco's greatest successes.

This case study is divided into five modules, each addressing an evolution within the process.

Module 1 discusses items that need to be addressed even before you begin the planning process. It addresses the importance of procuring executive sponsorship, discusses the elements that enabled the team to effectively manage change, provides a preliminary engineering overview, and introduces Cisco's cross-functional AVVID Tiger Team.

Module 2 is the planning process. It takes you through Cisco's experience developing the migration strategy and project plan, setting the pace and schedule for the Implementation team, the challenges and cautions of converting "Executive Row", the importance of a comprehensive communication plan, and how user training and operational policy changes were identified and addressed. This module also highlights the top ten things that can go wrong without proper planning, as well as the top ten things that will improve as a result of the retrofit.

Module 3 provides the tactical element of the implementation, including LAN infrastructure requirements, identifying wiring and cabling requirements, phone configurations, ordering circuits, and includes the Retrofit Implementation Guide as well as other helpful system admin tools that the Cisco team employed.

Module 4 is the support section. In this module, you will learn how Cisco's tiered support model provides 24/7 support, the support tools used, how the network is monitored, and what happens during the "Day 2 Handoff". In addition, this section addresses the auxiliary VLANS and power backup, managing and maintaining the network, troubleshooting tips, Support FAQs.

Module 5 is the final piece of the conversion. Here you will learn about software upgrades, disaster recovery planning, PBX lease returns, and the final retrofit clean up. Also included is a discussion on preparing your network for the future. The module wraps up with a collection of lessons learned contributed by members of the Tiger Team.

The Appendix located at the end of each module consists of tools, templates, sample documents, Website links, and other resource material Cisco used that you may find helpful in your own conversion.

The paper provides a comprehensive view of a successful IP Telephony deployment from the early planning stages through the final retrofit clean up. It has been written so that the reader can peruse the story front to back, or can choose those topics that are specifically relevant.

The purpose of any enterprise-wide initiative is to ensure that it is consistent with the goals of the organization. Doing it right and keeping those goals in sight is even more critical than adhering to a tightly orchestrated schedule with little room for flexibility.

However, the planning that is done upfront and the foundation that is put in place ahead of time will help keep the project on track, on budget, and on time.

Introduction

AVVID IP Telephony—A Converged Network

Cisco's AVVID network infrastructure is the network foundation essential for rapid and seamless deployment of emerging technologies like IP Telephony and other new 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 reality by allowing data, voice, and video to be transmitted over a single network infrastructure.

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

Organizational Benefits

From a user's standpoint, IP Telephony can increase personal and workgroup productivity, improve the ability to respond to customers, and reduce operational costs. Because the IP phone registers itself whenever it is moved, users can now 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. And because IP Telephony uses the same standards as data communications, both PCs and phones can access voice mail, check email, view video broadcasts, and enable other IP Telephony applications on the same 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 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 range up to $150 per phone—is eliminated. And 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.

Return on Investment (ROI)

One of the first and possibly most difficult questions companies face when determining whether to invest in any 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 to be performed in order for funds to be approved for any major investment.

"An important part of any ROI objective is to weigh the risks of implementing the initiative vs. not implementing it," said Lynnee Jimenez, 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 has led to renewed importance on the performance of return-on-investment (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 very general ROI expectations for technology implementations. Now, says Kozup, they're 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.

Factors that lower cost via a converged voice and data network include the reduction of wide-area facility requirements, fewer devices to manage and maintain, simpler adds, moves, and changes and a lower overhead cost associated with this simplified and converged infrastructure.

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 a number of variables during the IPT deployment to calculate ROI. Each variable was categorized by either hard or soft cost factors. Hard cost factors include areas where quantifiable 'account balance' results can be identified and measured. Soft cost factors, while not as quantifiable in measurable dollars, still have a significant impact on savings realized through efficiencies and increased productivity.

Where it All Started

Probably Cisco's greatest challenge throughout the entire IP Telephony deployment was that, at the time, the technology was new to the industry and voice was still new to Cisco. "This origi-

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

nally started out when Cisco acquired Selsius Systems, a company that provides network PBX systems for high-quality telephony over an IP network," said 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 over 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, 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 voicemail integration. Minimizing user discomfort during the migration was of utmost importance and being able to keep the user's existing phone number and voicemail was very high on the 'must have' list. "To accommodate this, we came up with an SMDI interface because we knew Selsius supported SMDI," Silva said. "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.

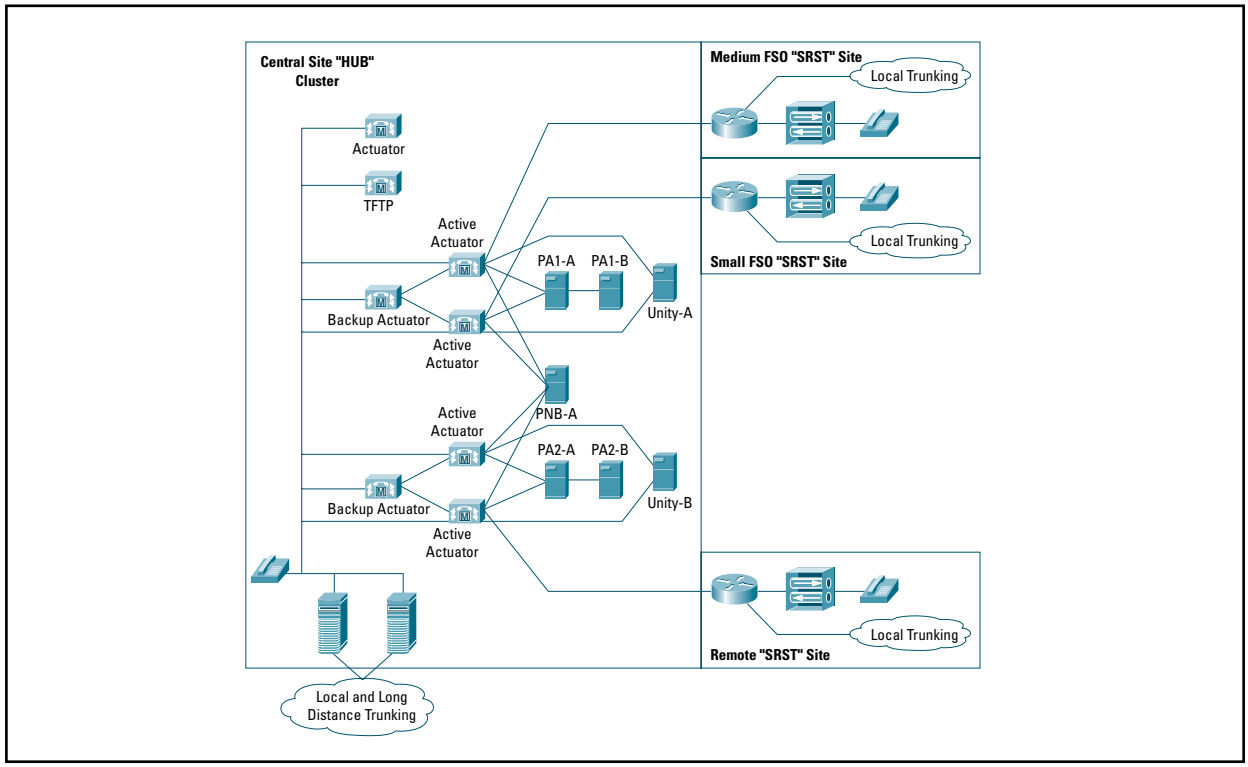
"Then we decided to put new users on the CallManager software release 2.3 and use the SDMI integration to an Octel 350, under the assumption that we were going to break this system at, say, 500 users," Silva continued. "We had a commitment from the Business Unit that we could put 500 users on there. 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."

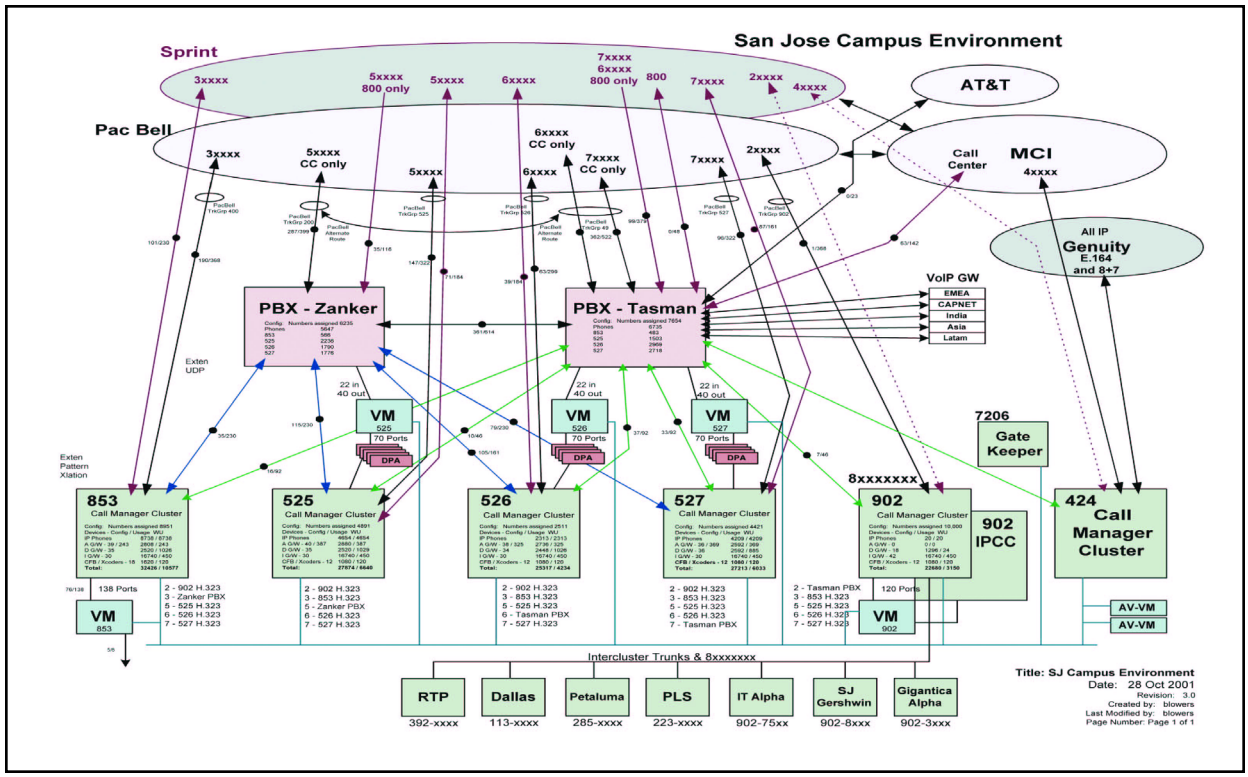
But like many 'best laid plans', that didn't happen. The rollout had begun with the first test success and by the time the team could catch their breath, they were managing 2,500 users. "It kind of got out of hand because of Cisco's rapid growth. All new employees were being given IP phones when they started," Silva said. "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

The following two diagrams represent the evolution of Cisco's architecture and the migration of the technology. The second diagram demonstrates how calls come in to the network, how they tandem through the PBX, and how voicemail and intercluster calling is performed.





Introduction

Module 1 is all about how Cisco developed a solid foundation that laid the groundwork for a smooth transition to a converged IP-enabled network. Often the most neglected part of any initiative is the pre-planning. Module 1 identifies the key elements of successful change management, offers insights on how to overcome barriers, and provides the baseline from which Cisco took the first step. Best Practices developed from Cisco's experience can be found at the end of each section.

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Importance of a Cross Functional Team

A number of components work in combination to effect a well-orchestrated migration to a new technology. However, probably the greatest contributor to the success of the initiative is a cross-functional team that represents all four corners of the organization and includes the requisite skills and technical expertise.

A cross-functional team serves the obvious purpose of ensuring the rapid delivery of initiatives that optimize a company's investments. It also serves the less obvious but equally important purpose of creating an environment that helps to build an organization where cross-functional program management is a core competency.

A cross-functional team is truly the only way to successfully implement a large initiative, especially one involving new technology. Cisco manages its voice network to a Five- Nines quality standard, which requires that the system be operational 99.999% of the time. Because it performs one function—the switching of call—a voice network alone is much easier to manage to that high quality standard. Introducing data into the picture can sometimes make it much more challenging because availability is designed into a distributed system rather than a box. Because of this multi-functionality, a cross-functional team, like Cisco's Tiger Team, armed with the proper tools and with members who understand both voice and data, becomes even more critical to sustain the high level of quality that Cisco and its customers demand.

AVVID Tiger Team

Cisco's cross-functional AVVID Tiger Team was created to lead the conversion to Voice over IP. The team members were chosen for their expertise in various disciplines and functions and to represent the users in each of the areas impacted by the deployment. For example, a representative from each of Cisco's global offices was chosen to act as Team Lead to represent the needs of that location. And the Tiger Team Lead, whose responsibility was to provide overall direction for the initiative, also managed Cisco's Voice Services operations.

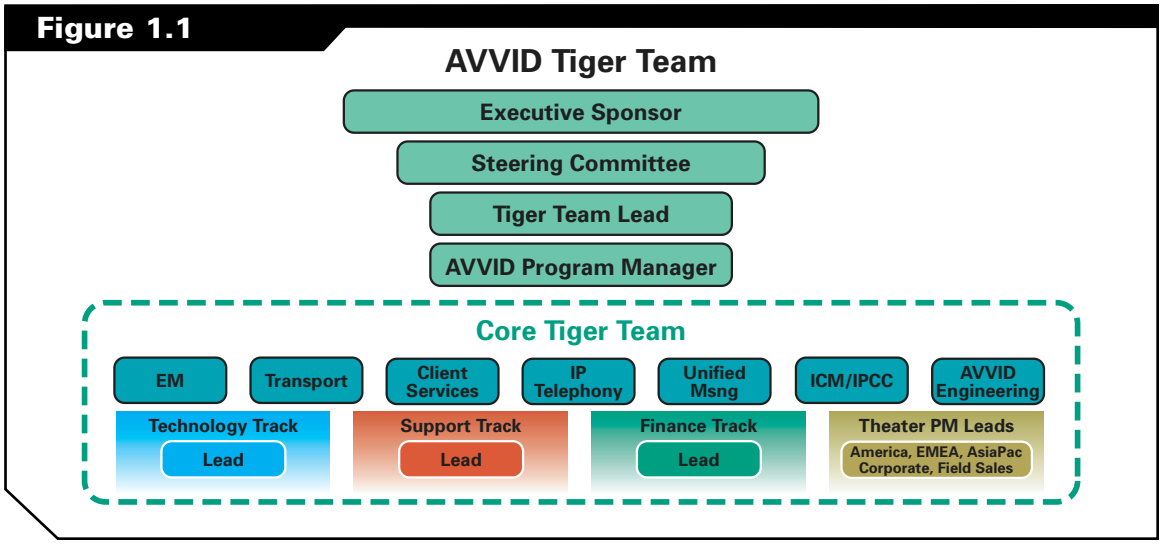
"At the time of the implementation, I held the position of Manager of Voice Services," said Graham Hosie, Tiger Team Lead and current IT Director of Strategic Program Management. "In that role, it made logical sense to also take the lead on helping to build a global cross-functional team that would allow us to step into the role of being Cisco's First, Best Customer. The AVVID Tiger Team inception was in response to the company's decision to develop and sell IP Telephony Solutions."

Once the skillsets were identified and the members of the team were chosen, the team kicked off the initiative by first clearly defining the objective and overall goal of the project and then identifying the tasks that would help them meet those goals. Change management challenges were identified and the team began to develop the components of an enterprise-wide, comprehensive communication plan. The global team then met on a weekly schedule to share status, discuss issues, and create solutions, always sharing project updates, roadblocks, and project wins with Senior Management.

Roles and Responsibilities

The AVVID Tiger Team was made up of four components—the executive sponsor, the steering committee, the team managers (consisting of a team lead and a program manager), and the core team tasked with implementing the rollout.

Figure 1.1



Executive Sponsor:
The executive sponsor is typically the highest ranking member of the organization, such as the CEO, President, or other level of authority that will help you resolve high level issues and gain buy-in from those impacted by the change. It is the executive sponsor's responsibility to communicate the vision, incorporate the objectives of the project with the goals of the company, demonstrate public support for the initiative, and commit the resources required for implementation. "As the executive sponsor of the AVVID Tiger Team," said John Chambers, Cisco CEO, "my goal was for Cisco to be our best first customer by showing worldwide leadership in the deployment of Cisco's IP Telephony." (A more indepth discussion of the importance of an executive sponsor follows this section).

Steering Committee:
The steering committee was made up of senior level executives who can influence the deployment of the project and help resolve issues that arise as a result of the conversion. Members of the AVVID Tiger Team steering committee were the vice presidents of IT, Marketing, and Sales—all individuals who had decision-making authority and helped to keep the project moving forward. The steering committee acts as the centralized customer voice and makes certain that user input is prioritized in the rollout. "Of primary importance is maintaining open and honest communication between the users and the program team," said Manny Rivelo, Senior Vice-President, WW Field Process and Operations. "The steering committee's job was to ensure that that occurred."

Team Lead:
The Tiger Team Lead was focused on building a global cross-functional team that would represent voice and data expertise, support, and all of the other disciplines required to further the initiative. "Working with Cisco's cross-functional IT departments to provide a converged support staff was a paramount concern and primary focus for the Tiger Team," Hosie said. "In stepping into the role of first customer, we partnered very closely with the Business Units to understand what our users needed, prioritize feature gaps, and identify 'Severity One' problems before the system went live."

Tiger Team Program Manager:
The primary role of the Tiger Team Program Manager was to ensure that product issues, resource issues, and client expectations were addressed and to coordinate all high level issues that could potentially jeopardize the full conversion of traditional voice to IP Telephony. "Every stage of the process was given a certain priority, depending on product availability and user readiness," said James Robshaw, Tiger Team PM. "All of that was compared to the features needed to be successful in the user's daily job."

Core Tiger Team:
The third segment of the AVVID Tiger Team was the Core Team, responsible for setting the pace for the deployment as well as carrying out the implementation. Within the core team, four tracks made up the IP Telephony deployment—technology, support, financial, and the global theaters. A Track Lead was assigned to each track and held accountable for his or her particular area of responsibility.

For an indepth discussion of each Tiger Team role, specific tasks, and responsibilities assigned to those roles, see Appendix 1-1: Tiger Team Roles & Responsibilities.

The Four Tracks

In order to provide the required level of technical expertise, ensure that all stakeholders would be represented across the organization, provide a high level of support after handoff, and keep the budget in line, the Tiger Team was segmented into four tracks.

Technology Track. The Technology Track was responsible for the architecture and design of new products being introduced into a production environment. These individuals were experts on Cisco's current infrastructure and had a view to the key feature requirements that the organization required. As gatekeepers, they determined when a product was available and ready for deployment, how its functionality would fit into Cisco's current infrastructure and provided a safe zone where new technology could be demonstrated and tested in a non-production (lab) environment. The Technology Track Team Leads were the team's direct link into the Business Units, providing feedback on how the products could be improved to better fit Cisco's business and infrastructure requirements. To ensure that the Technology Track team was well rounded and technically savvy, the eight technology track Team Leads were chosen for their solid understanding of old world PBX's, Design and Engineering, LAN infrastructure, voice dial plans, and exposure to Cisco's Voice over IP Telephony. The Technology Track worked closely with the Operations and Support Track to ensure synergy with architectural recommendations. The goal was to develop a standard template that each theater could follow, with buy-in from Design and Engineering, and Operations and Support.

Support Track. The Support Track was responsible for managing and implementing the support requirements that would ensure the ongoing stability and reliability of the network. The team consisted of representatives from Design and Engineering, Transport, LAN and WAN, the Product Business Unit and Operations, and a Cisco support partner. The LAN and WAN teams were cross-trained so that if an issue arose, there were individuals capable of determining if the problem was a LAN issue or a voice issue. "All of the team members were engaged very early in the process," said Mike Telang, Manager of Network Operations. "They were chosen because of their expertise in all areas of the network to ensure that troubleshooting would be as efficient and nondisruptive as possible." The initial challenge was bringing the consolidated team up to speed on how to troubleshoot and maintain a converged network. Because the problem could be either LAN or Voice, the team had to understand how any change to one could affect both. The Support Track was also responsible for developing the training requirements, identifying the different problem priorities, confirming the design standards dictated by the Technology Track, and developing an escalation path and a resolution grade. Cisco's Support Track ensured that the help desk systems, ticket generations, and accountability for all the problems were well documented and implemented. "We made sure that GTRC (Global Technical Response Center) was involved in the details and ensuring that support prerequisites were built and documented," said Sandy Thompson, GTRC Manager. "Their biggest contribution was acting as the client advocate and IT's support advocate, making sure both were considered during process and decision making."

Financial Track. The Tiger Team financial analyst acted as the gatekeeper of the budget and all funds spent on the project. Because Cisco is such a large organization with over 400 office buildings located around the world, it would have been difficult to avoid purchasing duplicate equipment or equipment that was not critical to the deployment which could have greatly offset the budget. The financial analyst made sure that budgetary spending stayed on track and that the goals of the deployment were in line with the goals of the company. "We built financial models and prepared an ad-hoc scenario analysis for team members to make the process easier and more streamlined," said Shelby Roshan, IT Financial Analyst. "We also prepared and consolidated standard reporting on the program which included data from each Theater on their headcount, capital, and expenses." Keeping an eye on depreciation factors, upcoming lease renewals, headcount, outside services expenditures, and equipment orders were the financial track's top priorities.

Theater Track. The Theater Track was the final track of the AVVID Core Tiger Team. The team's Project Managers were responsible for the deployment of the technology in each particular theater of Cisco's global organization. The most important role of the theater Project Managers was to ensure that the needs of their users within their designated locations were met and that everyone followed the same standards, processes, and format. Meeting weekly with all the theater PM's ensured that best practices and lessons learned were shared and provided a solid understanding of how issues are resolved within the organization and how to use the Cisco culture to drive the implementation locally.

The AVVID Tiger Team's purpose was to enable the overall conversion throughout Cisco to IP Telephony, develop global standards and support procedures, keep the budget in line and goals in sight, and ensure that participation and communication was consistent and effective. "Cisco is an amazing company when we are focused on providing a benefit to the overall organization," said James Robshaw, AVVID Tiger Team Program Manager. "Everyone rallies together to make even the most difficult times acceptable."

Best Practices: Building a Cross Functional Team

- Build and retain a strong vision to ensure that everyone is working toward a shared goal.
- Form cross-functional teams composed of key stakeholders across the organization (End users, Support, Engineering, Finance, Executive Leadership).
- Secure early buy-in from the cross-functional team. This leads to internalization, individual contributions to the goal, and helps to ensure strong individual ownership.
- Look for cross-functional dependencies and resources up front, build on them, and continually review. Utilize existing resources and count on their level of expertise to identify and deflect 'surprises'.
- Build a training program that is customized for each track of the Tiger Team to fill in any skillset gaps and increase speed to learning.
- Create organizational awareness of the project to garner broad commitment and prioritization by sharing the reasons, benefits, and goals of the project.
- Communicate each sub-team's role and who they work with to eliminate confusion, reduce duplication of effort, and enable a highly focused direction for members of the team.
- Measure results formally and informally, adjust and leverage resources based on measurements, and constantly monitor progress to keep the initiative on track.
- Establish explicit matrix management accountability and roles and responsibilities at the outset, especially between teams, to prevent gaps or overlap.
- Build a solid technical foundation for the entire team, so the organization isn't reliant on any one or two individuals.
- Include external third party partners early to ensure that they are fully in the loop, they understand your needs, and can hit the ground running.
- Build a strong communication program between users and the team to manage expectations and between the team members themselves.
- Pull in the Support team early in the process so they can understand the potential breakpoints in the hardware and software.

Best Practices: Executive Management Sponsorship

- Communicate the vision and provide a clear definition of what change must occur.
- Demonstrate public support and commitment to the transition, communicating the benefits of IP Telephony that make the change attractive.
- Meet privately with individuals or groups to convey strong personal support.
- Stay focused on the goal and reject any inconsistent or short-term action.
- Commit the resources required for successful implementation.
- Design a plan to fit your own culture and company objective.
- Understand the scope of the effort the deployment will have on the organization, the size of the group affected by the change, and be sensitive to the personal issues that major change often raises.
- Because sponsors deliver the message through their actions and words, a list of answers to frequently asked questions will help them maintain message consistency:
  - What is the purpose of this change?
  - What's in it for me?
  - How will this change affect me?
  - What's my role in the change?
  - What will I need to do differently as a result?
  - What are the benefits to the organization, customers, etc.?
  - How will the rollout take place? When? How long will it take?
  - Where can I obtain additional information concerning the new initiative?

Executive Management Sponsorship

Sponsorship from top management is key to the success of every change initiative. The level of authority that will help resolve high level issues and gain buy-in from those impacted by the change is critical. However, the lack of sponsorship or a champion at high levels in the organization will make it much more difficult to succeed.

John Chambers, Cisco's CEO, was the sponsor for the Cisco migration to a converged telephony network. The sponsor's main contribution is to set the tone for the project, visibly supporting the objectives, and encouraging the organization to get on board. Chambers took every opportunity to talk about the project at town hall meetings, as part of executive announcements, and at his own staff meetings in order to raise visibility and create buy-in. That level of visibility and support from the executive sponsor made the Tiger Team's job much easier.

The role of a sponsor is to set the example, not to be the 'doer'. But everyone, even senior management, works better if it is clear what he or she is being asked to do. The Tiger Team facilitated a session with members of the steering committee and core Tiger Team to develop the key message around the change and communicate the expected behaviors for both managers and employees. That process clearly defined what the team needed their sponsors to do and outlined the key activities that would assist in championing the change.

Managing Change

"I think it's much more than just the technology that will determine winners and losers. It's as much about business processes and culture—changing them and managing through that change—as it is the bits and bytes."

Bob Kelly, Mgr., Technical Marketing,
Enterprise Solution Design

Resistance to change is normal and should always be anticipated as a natural human behavior. Most people find it extremely uncomfortable to face situations filled with ambiguity and are attracted to familiar situations because they allow us to feel that we're in control. But the truth is that while people don't need to like the change, they do need to accept that it is taking place.

Cisco successfully managed change by taking away the mystery—by being open, honest, and providing frequent communication that was relative to the stakeholders. The team also found that the ability to be flexible, proactive, to anticipate the glitches, and constantly improve the process along the way, tailoring it to the specific needs of the stakeholders, was critical.

Flexibility and responding to stakeholders needs saved the day when the Tiger Team began to switch out the phones at the company's San Jose campus buildings. In order to create a shared-line appearance between an admin and his or her manager, the team sometimes had to give users new phone numbers. This was standard practice and most users accepted it without a problem. However, when the team switched over the Corporate Headquarters building, they ran into some unexpected pushback.

"The admin staff were seriously concerned about this," said Stephanie Carhee, IP Telephony IT Project Manager. "It meant that some of them would have to alter their phone number distribution system in order to incorporate the new number within their very streamlined, very busy office." In the end, the team allowed them to pick their own numbers, even though it was an exception to the policy and the automatic numbering system. "Sometimes you have to be sympathetic to the individual's unique business needs rather than using a cookie cutter approach with every stakeholder," Carhee said.

The team also found that meeting their stakeholders' needs might require adjusting the schedule on occasion. Conducting the conversion for a few key people on Thursday night instead of over the weekend allowed the admin staff, who handled heavy call volume to get comfortable with the new phone system before the Monday morning rush.

Reducing the discomfort that is an innate part of change ensures buy-in from the users. Because they took the time to understand their audience and identify potential resistance or issues, the Tiger Team was able to respond appropriately.

Voice of the Client Survey

Voice of the Client is a program used within Cisco that consists of client-targeted surveys and focus groups used to benchmark and track user needs and satisfaction with Cisco's IT services, products and solutions. The feedback process gauged client needs and expectations and mitigated user discomfort using design tools and processes that helped to continuously improve the quality of the technology solutions that IT provides.

The Tiger Team used the survey to solicit valuable client feedback, helping the team develop action plans to leverage the appropriate technology and applications, and manage user expectations.

"Over 6,700 employees responded to the survey from around the world," Carhee said. "And one of the things we learned through the survey was that 81% wanted to migrate to Cisco's new system as long as key features were incorporated into the change." The survey gave the Tiger Team a report card that validated what they felt were key business needs, as well as acting as a gauge to see how responsive users were to the impending change. Risk tolerance was also measured and the team learned that the majority of users would tolerate a loss of some key features for up to three months. Since the product was still in the development stage, the team used this information to determine how fast and how vast the conversion should be.

Responses to the Voice of the Client employee survey were evaluated by the Tiger Team and enabled them to successfully identify potential problems, develop workarounds, meet client expectations, and focus on turning the input into world-class solutions.

"Must Have" Features

'Must Have' features are those features that are critical to the business and enable users to do their jobs. Part of the 'Voice of the Client" survey was dedicated to making sure that those critical features were represented but identified separately from the 'nice to have' features.

Through the survey, the Tiger Team learned that keeping their existing phone numbers and voice mail was a 'must have' to some users, particularly those who worked with customers and partners. The team worked closely with Design, Engineering, and the Business Units to ensure that a plan was in place to address that concern before the conversion. "If we had conducted the conversion without listening to the concerns of our users, the project would have experienced a significant snag," said Stephanie Carhee, IP Telephony IT Project Manager. Listening carefully to what users are asking for will help make sure solutions are identified to address these basic business requirements.

"The other side of that though is to level-set the expectations right up front," said Dennis Silva, Voice Services Sr. Network Design Engineer. "Be honest about what they can realistically expect from an IP phone. You'll find that when you are upfront with people and help them create workarounds for those features—even if the features won't be the same as their 'old world' phones—they are much more adaptable to the change."

> Appendix 1-2 provides an example of the Voice of the Client survey Cisco used to determine the tolerance levels and user requirements,

Manage User Expectations

The more background you have on your users, the more surprises you take out of the picture. And the fewer surprises you have, the easier the conversion will be. Because the Tiger Team included members of Cisco's Voice Services Operations, who knew each building's infrastructure as well as the type of users in that building, they were able to identify those users who had special requirements.

"Most people don't know what their phone set-up is," said Carhee. "They just know that it works or it doesn't work, so we couldn't really rely on them to inform us of their existing phone-set-up." The team performed a dump of the PBX to review each user's set-up and to ensure that their new phones would mimic their existing phone configuration.

When the Voice Services team reviewed the results of the Executive staff conference room PBX dump, they alerted the conversion team to the special care requirements that needed to be taken to convert the Conference Room in the corporate building where shareholder conference calls were held. "There is a private phone line in that room that is separate from the rest," Carhee recalled. "If Voice Services had not told us it was there, we would have converted the room same as the others, potentially causing a public relations disaster if anything had gone wrong."

Each business will have its own set of business critical phone users. At Cisco, these include Call Center agents, who manage the multitude of customer service calls that come in from around the world each day; administrative personnel who manage multiple phones and require special set-ups; and financial analysts who require special high-speed modems for fax transmission. Not knowing where the users are located or what their special needs are can lead to disruption of business and loss of productivity.

"We ran reports that generated from the existing PBX switch, the voicemail system and the directory listing," said Mary Tsang, Service and Support Manager. "We consolidated lists and determined which users were working from home and which users would need a phone set in the office." Tsang also noted that it was important to get those lists from the vendors as early as possible. "Too many changes being made at the last minute or on first day of production makes it extremely painful for both the project manager and the end user," Tsang said.

One of the most important elements of setting expectations with customers is to help them understand exactly what they're getting. "You need to tell them what this is and what it means to them," said Dennis Silva, Voice Services Sr. Network Design Engineer. "Lay it on the table and let your user ask questions. Help them become familiar with what you're talking about." Failure to do that is a recipe for disaster.

The Tiger Team cautioned against inconsistent communication from a fragmented implementation team as well as nonstandard processes. "I think we've seen failures in various implementations because there were too many different groups claiming ownership," Tsang said. "That's why the Tiger Team approach was so successful. You need a centralized team with the ability to make decisions—working from a standardized process—so that your users aren't getting inconsistent, unreliable information."

Understand Your Organization's Culture

Corporate culture is often defined as 'the way we do things around here.' Culture builds a common language and brings people together, enabling them to work toward a shared goal. John Chambers, Cisco's CEO, consistently talks about the importance of culture, bringing it up in every meeting he holds, asking his leaders to do the same.

"As with most companies, Cisco's primary objective is to serve customers," said Stephanie Carhee, IT Project Manager. "This, of course, means that we have to deliver. An organization's culture can make or break the ability to reach that very important goal."

Cisco employees are accustomed to fast-paced endeavors and trying out the latest technology. "Typically, it is not necessary for us to spend a lot of time on training," Carhee said. "Using web tools (tutorials and Website links) to train employees is the Cisco way! In fact, whenever I tried to use the old method of holding live training sessions, only about 10 out of 500 people would participate. Our culture is too fast to slow down for scheduled training. Our employees prefer options that allow them to train themselves on their schedule, not the Tiger Team's schedule."

Understanding and working with your organization's culture is key to a successful deployment of new technology. Does your company encourage risk taking? Is change incorporated often and does the company embrace it? Do employees solve problems in a team environment? Is communication a top priority? Is yours a virtual company with telecommuters or employees scattered across the globe? How has change been introduced and institutionalized in the past? Was it successful or painful? All of these things are part of your organizational culture and can influence your ability to manage change.

Often when an organization considers change that impacts every employee, such as a large-scale IP Telephony deployment, the process tends to focus on hardware, software, and getting the technology up to speed as quickly as possible. However, it is important to remember that a company's infrastructure is composed not just of hardware and software, but also of its people. The conversion to Cisco's IP Telephony wasn't a question of viability or reliability. It was a combination of people, process, and organizational change.

The Communication Plan

Many failed change initiatives can be traced back to inadequate communication. Unfortunately, one of the most commonly overlooked aspects of managing any project is the communication plan. Throughout the IP Telephony deployment at Cisco, it was critical that the team leaders communicated effectively to manage quality and productivity levels, achieve the desired results of current and planned change initiatives, and to maintain and strengthen leadership credibility.

"The open and honest communication among all the team members was what made this initiative the success that it was," said Manny Rivelo, Senior Vice-President, WW Field Process and Operations. "From day one this was a Cisco effort and not an individual effort. In true Cisco fashion it was a team and it always felt that way."

Each organization and group has something to contribute. For example, Voice Services helped guide user requirements into the design and functionality of the solution. The LAN team addressed the sensitivity of voice traffic and helped provide a stable infrastructure upon which it runs. The NT/WIN2000 experts provided assistance in managing the application resources.

However, more than ever, it was critical to keep the communication flowing between the various teams. "I think our biggest challenge was when the LAN team performed their change management process, assuming that they

Best Practice: Change Management

- Build credibility and trust: Be honest and upfront—share the good, the bad, and the ugly. Return phone calls and emails quickly. Be sensitive to little things like putting the user's new phone back in the same place as the original.
- Set expectations early on.
- Clarify roles & responsibilities so that everyone knows what is expected of them.
- Lead by example. The Tiger Team was the first group to participate in the conversion, followed by Voice Services and IT.
- In the survey, ask about training options. Most Cisco employees dislike hands-on training sessions, preferring web-based tutorials, on-line documentation, and hard copy booklets left near the phone.
- Know the features critical to your users and have solutions in place ahead of time.
- Be flexible and sensitive to users with unique business needs.
- Always listen to the voices of your users to determine if you are going in the right direction.

Best Practices: Cisco's Organizational Culture

- *Empowerment.* Employees are encouraged to run with their ideas and make a difference.
- *Teamwork.* Teamwork is rated as one of the success factors against which employees are measured.
- *Trust.* Without it, no team can be effective. Team members must know that they can count on each other to succeed.
- *Driving Change.* The spirit of driving change and risk taking is rewarded in a formalized recognition program.
- *Constant Communication.* Share information openly and informally, both good news and bad. Employees are empowered to ask questions, make suggestions, raise issues, and should expect a response within 24 hours.
- *No Technology Religion.* Promoting an open systems environment keeps system maintenance costs low, enables us to take advantage of new and improved technologies, and allows us to choose the right technologies for the right scenario.
- *Frugality.* Employees are encouraged to spend Cisco's money as if it were their own. This means always being mindful of expenditures and look for opportunities to save.

weren't going to affect the telephone network," said Dennis Silva, Voice Services Senior Network Design and Engineer. "It turned out that every time they would do a route change or a recalculation, we would lose thousands of phones. It took us awhile to understand the changes they were making and how they affected the voice network."

As a solution to that challenge, the team developed a process that required any individual making a change to the network to open a Change Management Request in which core members of the Tiger Team were assigned to review and approve all requests.

Communication within the implementation team, is only one piece of the puzzle. The people who will be impacted by the change must also understand how they will be affected, especially when the change involves a relatively unknown technology. In this case, the change impacted people who had grown very comfortable with their conventional PBX telephones. IP Telephony was a relative unknown and the resulting anxiety was addressed through on-line tutorials posted on Cisco's Intranet two to three weeks before the switchover began.

Your stakeholders not only need to know what the change is, when the change is coming, and why it is being implemented, but also how it affects them and the behaviors—even the little ones—that need to be changed in order to institutionalize the change.

"In the Old World, anytime you moved your location, Voice Services had to physically move your phone for you," said Stephanie Carhee, IP Telephony IT Project Manager. "With the new IP phones, the infrastructure is in place that enables you to take your phone anywhere, plug it in, and the system knows who you are. However the new behavior that our employees had to learn was to remember to go on-line and update the employee directory database with their new locations."

Handling change and evolving your business model has become an accepted part of doing business. Your culture will dictate how fast and how vast your conversion process should be. People are often uncomfortable with change. But if you take the mystery out of it for them and help them understand the goal, how it will impact them, and teach them the required behaviors, they will more easily come to accept the importance and respond appropriately.

Module 2 provides additional information on planning and creating a comprehensive communication plan.

Best Practices: Communication

- Understand what communication-related changes need to take place, the impact of those changes on each stakeholder group and the required new behaviors.
- Ensure that there are consistent messages sent and delivered. It is critical that the senior leadership team develops the messages and provides for accountability—among themselves and with their subordinates—for delivery and actions to support the words.
- Set up communication vehicles between the cross-functional teams so that decisions aren't made in a vacuum.
- Create Web sites and communication vehicles like e-mail alias that keep users informed of your schedule, progress, and next steps.

Best Practices: Managing Expectations

- Know who your users are, how they use their phones, and how the initiative will impact them.
- Help users understand the differences between their old phones and the new IP phones.
- Generate PBX dumps, voicemail system, and directory listings early enough to allow time to design solutions to unique configurations.
- Saturate users with relevant and useful information.
- Obtain buy-in from all members of the team to reduce inconsistent communication and reinforce their commitment.

Where Do You Begin: The Engineering Story

Building the Engineering Team

As with any type of initiative, especially one that can impact an employee's ability to do his or her job, the basics need to be addressed first. You need to start with the right team, familiarize yourself with the new technology and understand how it will impact your current infrastructure. You must also understand what your users need and then manage the expectations, so they know what they're going to get.

Engineering is the cog that makes the wheel turn. Cisco made sure that there were people on the team with the appropriate experience in both voice and data technology. Also critical was having someone on the team with the appropriate NT background, who could support the servers.

As a data company, Cisco did not start out with comprehensive skillsets in voice and NT. "Although we now offer Services and Support expertise to handle all of the IP Telephony requirements for deployment, we had to learn that from scratch," said Bill Lowers, Voice Services Senior Network Design and Engineer. "When we started, we really didn't know that much about it, but we knew we'd better learn. So we sat down and read the manual from front to back—several times—becoming familiar with the CallManager, installation configuration, the admin guide, and all of the other resources that were available."

"It's necessary that you have members on the team who can learn and understand a dial plan," added Dennis Silva, Voice Services Senior Network Design and Engineer. "If they don't understand it, they can't work on a network. If you don't understand the basic infrastructure, the basic communication technology, and how a voice and data network works, it will be much more difficult to understand the components of the CallManager."

Just as critical to the success of the implementation is the appropriate level of experience in telephony, programming, voice, and alternate route selection. A basic understanding of least cost routing, modified numbering plans, and whether the UDP (Unified Dial Plans), CDP (Coordinated Dial Plans), and MDP (Modified Dial Plans) is also important.

Understand Your Infrastructure

It all starts with a single step. You need to know where you're starting from before you can know where you're going. Knowing how your users use the system today, re-examining your existing LAN infrastructure to ensure that it is ready to deploy voice, and considering whether there are multiple or remote locations is critical.

"If they're all sitting in one city, it's easier," Silva said. "But maybe they want to call New York City from San Francisco in 5 digits. Or they want to call London using a modified numbering plan. All those things need to be considered when doing the numbering plan."

As daunting and overwhelming as all that sounds, put things into perspective and remember that IP Telephony is simply a new application running on your current network, not an entirely new network. "It's a different application," Silva said. "It's just an IP device using services on an existing LAN or multi-service backbone. You're not changing the network, you're riding another application across that same infrastructure."

PBX Infrastructure

Understand Grade of Service currently being provided and engineer a solution to aggregate traffic and trunking together in order to take advantage of a more efficient, cost-effective solution. Cisco thoroughly evaluated their PBX infrastructure to help understand the organization's current voice features and functionality. This information helped them to identify the required features that their users would need as well as the PBX-to-IP Telephony connectivity requirements.

As a result of this detailed understanding of the current infrastructure, the team was able to tailor the CallManager configuration to replace the existing PBX systems. "If you look at an existing PBX and with 'X' amount of trunks, and 'X' amount of tie line trunks, and 'X' amount of local trunks for inbound, outbound access, that's exactly the number I would throw onto the CallManager," said Dennis Silva, Voice Services Senior Network Design and Engineer.

"You have to make sure you have enough facilities for people to receive phone calls and be able to call out," Silva continued. "For example, if I have 20,000 phones on the PBX side, I know how many trunks that requires. If I move a quarter of those phones over to the IP environment, then I know I'm going to need at least 25% of the available facilities on the CallManager."

AVVID Readiness Audit provides the recommended baseline information. To view or take this audit, go to http://tools.cisco.com/Assessments/jsp/welcome.jsp?asmts

Data Infrastructure

Before adding voice to their network, the data network must be designed properly. Cisco ensured the successful implementation of IP Telephony Solutions by first considering their LAN infrastructure.

The LAN team also considered the location of servers and gateways prior to implementation and identified them in the LAN infrastructure-planning phase. Considering the placement of these devices ensured that service availability would be consistent across the LAN infrastructure. "We identified gateway and server network locations for the TFTP, CNS, and DHCP servers, the firewalls, the NAT or PAT gateways, and the CallManager and Gateway locations," said Dennis Silva, Voice Services Senior Network Design and Engineer.

After locations were determined, network service availability, gateway support, and available bandwidth and scalability were investigated to ensure readiness for the IP Telephony solution.

Plan the Dial Plan

When designing Cisco's large enterprise solutions, it was critical to fully understand existing dial plan requirements and caveats that help in the transition to CallManager Routing. Dial plan requirements are very basic and encompass the ability to handle internal calls as well as external calls originating from the PSTN, applications, or other CallManager clusters. They need to be flexible enough to support abbreviated dialing, such as internal four- or five-digit extensions.

The key to any Dial Plan is finding the common denominator, which is typically the directory number (DN). The DN length must always be recognizable, routable, and unique enough for all services using those devices. A Dial Plan must be flexible enough to accommodate future applications and growth in order to reduce the cost of ownership of the installed base.

Cisco proposed a Global Dial Plan for its organization based on an underlying architecture of a seven-digit dial plan. These seven digits are broken down as a three-digit unique Site Code with a four-digit extension. "All users are assigned this unique seven-digit extension," said Gert Vanderstraeten, IT Engineer and member of the Technology Track. "But it is up to each location's

preference whether that extension appears on the IP phone's display. The default display will show the seven-digit extension." This variance, as well as local office four- or five-digit dialing is accomplished with translation patterns and voice mail field entries on the line appearance.

Applications usage is one of the key roles of a Dial Plan. Voicemail was Cisco's most widely used application and the interplay of creating and forwarding messages based on the DN was of primary importance.

"We made retention of existing four- or five-digit local dialing for phone-to-phone dialing within a site a priority," said Steven Hunter, IT Engineer. Hunter cautioned that the design of the local dial plan should always accommodate this requirement through well thought-out use of translation patterns, dialing domains, and the '#' end of dial character.

Dial Plans play another key role in the relationship of how a call is routed both internally and externally in CallManager. The standardizing of CallManager CSS/Partitions was addressed in this track, as well as part of the architecture for the Gatekeeper, Extension Mobility, and other voice applications that had an interaction with the Dial Plan.

Allowing interoperability of current systems/applications and future initiatives, the team developed the following best practices that helped set the foundation for common tools, maintenance, and monitoring. These best practices enabled users to travel from office to office without adjusting or reprogramming their portable device applications. While not all of the best practices are directly related to the dial plan, they all played a part in enabling Cisco to develop a standard, comprehensive global dial plan.

Plan for Growth

A site survey conducted within all of Cisco's locations that were targeted for the IP Telephony solution helped to determine if that office had enough growth capacity and to avoid revisiting the office in a few months. Cisco planned each of their field offices to accommodate a three-year growth capacity, using the following questions to help them determine scalability.

PBX to CallManager migration

- Does the current PBX have analog or digital interfaces? If yes, what type of analog (FXO, FXS, E&M) or digital (T1, E1, CAS, CCS) interfaces does the PBX currently have?
- What type of signaling does the PBX currently use?
- What is the FXO/FXS: loop start or ground-start?
- Is the E&M a wink-start, delay-start, immediate-start?
- Is the E&M a Type I, II, III, IV, or V?
- What is the T1: CAS, Q.931 PRI (User-Side or Network-Side), Q.SIG, DPNSS, and Proprietary d-channel (CCS) signaling scheme?
- What is the E1: CAS, R2, Q.931 PRI (User-Side or Network-Side), Q.SIG, DPNSS, and Proprietary d-channel (CCS) signaling, R2 scheme?
- What type of framing (SF/ESF/HDB3) and Encoding (B8ZS/AMI/CRC-4) do they currently use?
- Do they require passing proprietary PBX signaling? If so, which timeslot is the signaling passed on, and is it HDLC-framed?
- Will they provide clocking, or expect the router to provide clocking?
- If PRI or QSIG signaling is being used, is the PBX acting as User-Side or Network-Side

Location is Everything

When selecting a suitable location to place the CallManager servers, the AVVID Tiger Team considered environmental elements including security, UPS, power generators, availability, and network connectivity. The NOCs were considered the best site placements for the gateways due to availability, back-up power requirements, security, and access for the Telco carriers.

Environmental

- Where will you place the Call Managers? Cisco typically installs these in data centers because these rooms usually have the best environmental condition and are the most secure.
- Are there any environmental issues with the wiring closets or Telco rooms?
- Are there plenty of dedicated power circuits and correct power outlets? Not all equipment uses standard 110 volts. For example, the Catalyst switches with in-line power Ethernet blades use 208 volts.
- Are there tie cables between the Telco equipment and the new CallManager?

Best Practices: Evaluating the PBX Infrastructure

- Perform an analysis on the current traffic requirements to help migrate both DID/DOD and Voicemail.
- Study current Voicemail to determine requirements—which options are required, which are obsolete, and which are better suited in a different platform. When the team did this, they found that a current Octel "Port Assignment" was required in order to validate the PBX configuration and help move the ports as needed in the migration.
- Study current PBX trunking and analyze the current traffic requirements for T1 loading both for initial start as well as cutting over buildings during retrofit.
- Study the existing dial plans (shared and overlap) to understand the current requirements and identify what was needed to migrate to CallManager.
- Identify and understand the policy for the number plan, which is essential for developing the "master plan" of Dial Plan and number management.
- Understand the network disbursement.
- Understand feature names in CallManager vs. PBX. Many basic terms from the same system may have a completely different meaning in the other system. Cisco used the same naming/concept in PBX because standardizing across Call Managers helps in "concept" learning from one system to another.
- Examine the existing blocking factor for potential capacity issues.

Best Practices: Evaluating the Data Infrastructure

- Review the device inventory, network design, and baseline information. Links and devices should have sufficient capacity for the additional voice traffic and may require upgraded links with high peak or busy hour utilization.
- Target devices with high CPU utilization, high back plane utilization, high memory utilization, queuing drops, or buffer misses for additional inspection and potential upgrade. Peak utilization characteristics in the baseline were valuable in determining potential voice quality issues.
- Evaluate the availability requirements for the IP Telephony network, review network topology diagrams, feature capabilities, and protocol implementations.
- Review redundancy capabilities of the network to ensure it meets your availability goals with the current network design (or a new design) recommended for IP Telephony.
- Evaluate current feature capabilities of the network and device characteristics including chassis, module, and software inventory. This was useful in determining the IP Telephony feature capabilities in the existing environment.
- Evaluate the overall network capacity and impact to ensure that the network will meet overall capacity requirements and that there will be no impact on the existing network and application requirements.
- Evaluate the network baseline in terms of the impact from IP Telephony requirements.
- Perform an IP Telephony readiness audit (see Appendix 1-3) to provide the appropriate baseline information. From this audit, the team made and implemented recommendations.

Security

An IP phone is a direct connection into your network. Lobby phones or phones made available to visitors in other public areas of the organization can create a security breach if not managed properly. "If a visitor chooses to plug his or her laptop into the available IP phone, it can be a direct connect into the organization's data network," said Dennis Silva, Voice Services Design and Engineer. "We had to make certain policy changes when deploying these phones in order to ensure security."

Floor plans

The entire installation team must be provided with up-to-date layouts of the office in which the CallManager is being installed. "It's important that everyone is working off the same versions of all documentation to prevent problems," said Shawn Armstrong, IT Engineer. "Whenever possible, we assigned areas of responsibility to the installation team and made sure everyone's copies reflected those divisions."

Servers placed in diverse Data Centers on site equally balance load and fail-over redundancy. Gateways placed in main wiring closets enable diverse routing from the local and long distance providers. Also consider UPS and generator backups.

Floor plans included the user name and phone extension number, and any fax and modem numbers with the associated jack number identification. The Tiger Team worked closely with Work Place Resources and the Facilities Team to obtain current versions of employee locations and phone numbers and to request that they discontinue processing any moves at least a week before the conversion. This ensured that their data was current and reflected all existing user locations. The networking equipment and patch panels in the closet were labeled with the jack number and identification for all fax and modems. Maintaining this data will help the Support and Operations team to trouble-shoot problems in the future.

Best Practices: Plan the Dial Plan

- Establish a unique 7-digit number for personal identification dialing as well as Voicemail, Personal Assistant, and other Applications, customizable to 4 or 5 digits for office location.
- Enable a common interoffice routing access code to imply end-to-end least cost routing (8+).
- Enable a common mobile routing access code to imply end to end least cost routing—in both directions—to and from mobile phones (7+).
- Use a common PSTN routing access code (9+ or 0+).
- Use the # sign in both CallManager and Voicemail to signify end of dialing which excludes the need for region/country specific dial plans.
- Standardize on the Core Calling Search Space (CSS)/Partition.
- Standardize on the Core Route Patterns for all Application and Personal usage.
- Institute a gatekeeper for dial plan resolution for inter-office dialing.
- Use least cost routing on fully qualified E164 numbers with PSTN fail-over. The carrier for a certain source/destination is chosen independently of the dialing habits of the user.
- Keep one dialing domain for all Unity-servers within the organization.

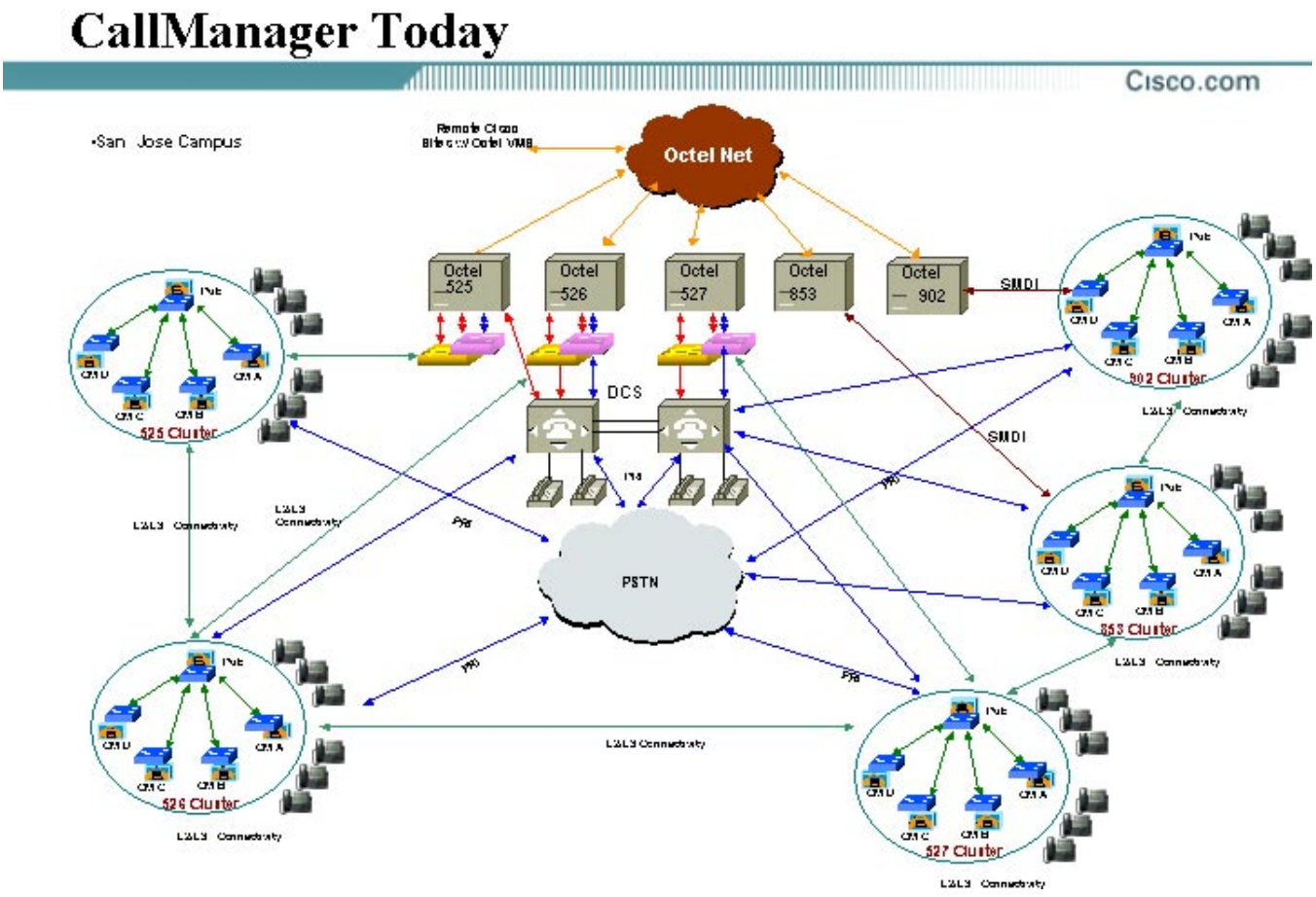
Best Practices: Location

- Each cluster should have its own TFTP server. By using an alternate TFTP Path Directory, all clusters write to a single cluster so that all DHCP scopes throughout the site can have a single entry, preventing phones from registering all over the world.
- Set option 150 on local DHCP server so that the phones will register locally and not across the network.
- Use "Rogue" with auto registration turned on to one CM cluster. This forces the "Rogue" devices to register and saves TFTP from being continuously 'hammered' by the devices originating from the DHCP.
- Reboot the CallManager servers after hours to minimize hits to the DHCP and TFTP servers.
- Establish physical security. Creating a physical boundary for critical communications equipment is a fundamental foundation in building secure networks. Network designs and software configurations cannot protect a network whose assets are not physically protected from potential malicious threats.

Call Manager Today

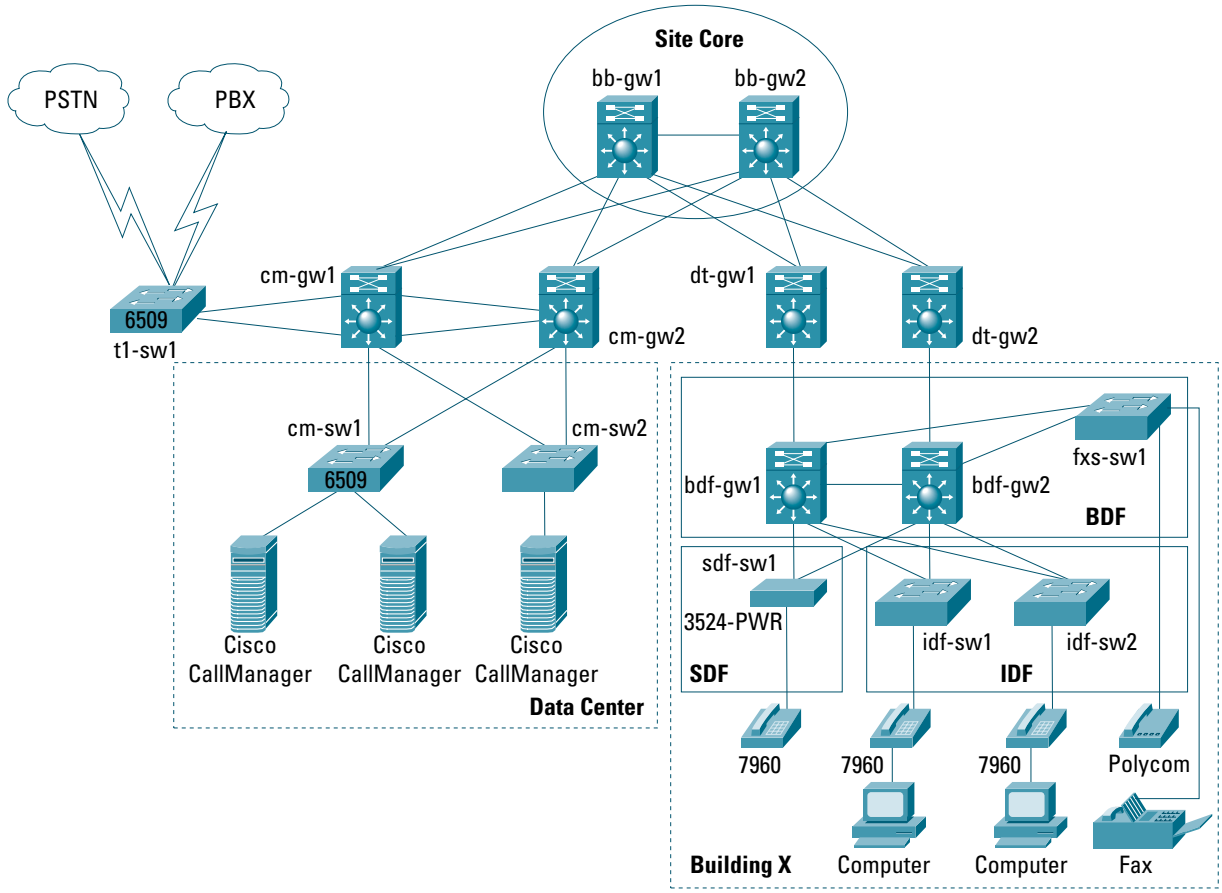
The following graphic shows the San Jose infrastructure, including the current voicemail system, the PSTN, PBX systems, and the five current CallManager clusters, as well as the call flow between them. The Octel voicemail is shared between CallManager and the PBX, allowing users to be "retrofitted" without having to change they way they interact with voicemail.

Figure 1.2



The network diagram in Fig. 1.3 below demonstrates the LAN architecture, CallManagers, and other related LAN infrastructure components, including the 6500s that support T1 and analog lines as well as the access layer switches.

Figure 1.3



Summary

The importance of the pre-planning phase cannot be overemphasized. Because the time was spent to 'plan the plan', the result was a transition where obstacles were identified and dealt with ahead of time. Considering issues that revolve around the impact the initiative will have on users ensured buy-in and greater speed-to-competency. Putting together a cross-functional team with the right expertise and accountability resulted in a much more reliable, stable network and a Support Team that has been onboard since the beginning. Following is a short summary from each section of Module 1.

Importance of a Cross Functional Team:

The AVVID Tiger Team was made up of an executive sponsor, steering committee, Team Lead and Program Manager, and a Core Team that included four tracks representing expertise in technology, support, finance, and each of Cisco's global theaters.

Executive Management Sponsorship

Executive sponsorship is instrumental to the team's ability to gain buy-in from the user community. The executive sponsor should be the highest-ranking individual within the corporation. Cisco's executive sponsor was its CEO, John Chambers. Chambers' role was to champion the initiative, communicate the vision and importance, and commit the resources required to complete the project.

Managing Change

Understanding user needs, communicating the 'who, what, where, when, and why', instilling a culture of openness to change within the organization, and managing expectations builds acceptance by the user community.

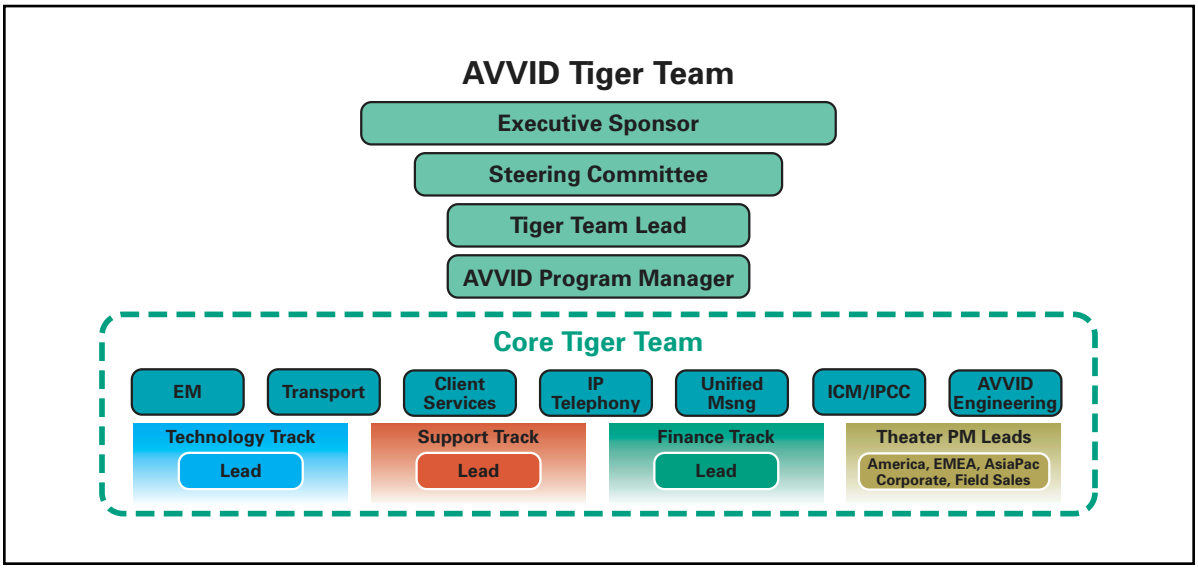
Where Do You Begin: The Engineering Story

Building the right team with experience in either voice or data helped fill the gaps, enabled a comprehensive understanding of the current infrastructure, and determined what it would take to evolve to a converged network. In addition, planning the dial plan, ensuring the ability to scale, and determining the best location for the infrastructure laid the groundwork for a successful migration.

Module 2 addresses the project plan, communication plan, training options, new operational changes and policies, and steps to help prepare for the enterprise-wide implementation.

Appendix 1-1: Tiger Team Roles & Responsibilities:

AVVID Tiger Team Roles and Responsibilities



Executive Sponsor

Expertise: CEO, President, or level of authority that will help you resolve high level issues and gain corporate buy-in from those impacted by the change.

Roles and Responsibilities:

- Communicate the vision and provide a clear definition of what change must occur.
- Demonstrate public support and commitment to the transition.
- Commit the resources required for successful implementation.

Steering Committee

Expertise: Senior level executives with decision-making authority.

Roles and Responsibilities:

- Influence the deployment of the project, keeping it focused on organizational goals.
- Help resolve issues that arise as a result of the conversion in order to keep the project moving forward.
- Act as the centralized customer voice, ensuring that user input is prioritized in the rollout.

Tiger Team Lead

Expertise: Director of Voice Services; overall management of Telecom Department. Requires an understanding of PBX telecommunications requirements, IP Telephony, Support, Operations, and Finance.

Roles and Responsibilities:

- Communicate the initiative's global deployment objectives, policies, and processes.
- Ensure that worldwide implementation standards are set and adhered to.
- Provide status reports to steering committee, executive sponsor etc.
- Establish priorities and requirements for each theater.
- Work to build teamwork and maintain business unit contacts throughout the organization.
- Help to establish objectives and metrics within each theater.
- Highlight common and theater-specific resource requirements.
- Identify and justify resources for AVVID programs.
- Track and report budget and resource allocations.

AVVID Program Manager

Expertise: Has had technology-specific training leading to a high level understanding of how to manage and drive areas of the technology development, support, operations, implementation and finance. Maintain high-level view of AVVID Technologies. Comprehensive understanding of how the organization resolves issues and completes projects

Roles and Responsibilities:

- Gather, collect, refine, and report on key process, technology, team, and coordination issues.
- Identify priorities, milestones, deadlines, and tasks of global team—both common and theater-specific.
- Conduct weekly Global Track Meetings.
- Define, maintain, track, and communicate the format and content of standard track deliverables.
- Identify key needs for resources, processes, measures, and tools for track processes.
- Provide MBO ratings to managers and individual contributors on performance.
- Communicate global technology deployment objectives and policies.
- Establish cross-functional team partnerships and strategies internally and externally.
- Create, maintain, and build relationships with Business Units, Internal Teams, Customers.
- Assess integration and deployment practices and polices for technologies.
- Provide organization structures and process models within theaters.
- Manage AVVID budget, capital, expense and resource allocations.
- Establish policies and priorities and coordination requirements for Technologies and Theaters.

Core Tiger Team

Services/Application Program Leads—(IP Telephony, Unified Messaging, ICM/IPCC, Transport, Client Services)
Expertise: Have a solid understanding and knowledge of applications and services provided through the deployment of a converged network. Be able to work with the Tiger Team to gather user requirements, resolve issues, recommend policies and support processes, and coordinate application deployment.

Roles and Responsibilities:

- Acquire assigned dedicated resources for AVVID Technology deployments and assessments.
- Establish Objectives, Metrics, Timelines, Tasks, and Deliverables for Teams, and Contributors.
- Provide MBO ratings, rewards and assessments to assigned resources, managers and individual contributors.
- Gather and organize business plans from internal and external stakeholders.
- Provide Technology Deployment Objectives to cross-functional design, implementation and operations teams that align with internal and external business plans.
- Communicate with the Business Units on Strategy, Timelines, Products and Features to be delivered, and those needed.
- Communicate with business clients and operational / implementation teams on experiences, lessons learned, must-have, nice-to-have features and functions.
- Attend all key product development and marketing briefings.
- Provide management timetable for assessment and deployment of technologies.
- Approve all technology pilots and production deployment policies, configurations and designs.
- Verify and establishes processes for installation, test, integration, architecture, design of technologies.
- Acquire, assess, and provide recommended implementation and operational support processes, methodologies and tools.
- Assess tools, methodologies and resources for implementation and support.
- Manage Technology specific AVVID budget, capital, expense and resource allocations.
- Establish priorities and coordination requirements for Technology integration and deployments.

AVVID Engineering
Expertise: Requires expertise in both voice and data as well as a solid foundation with PBX dial plans, infrastructure, trunking, traffic analysis, and an understanding of user requirements.

Roles and Responsibilities:

- Manages the development of the network designs
- Facilitate issues in the implementation phase
- Assist with testing procedures
- Monitor network reliability
- Provide back-up expertise to the Support team
- Sets design standards and templates for all applications and hardware installations
- Works close with the BU and attends all key product development and marketing briefings.
- Facilitates all software and hardware upgrades
- Provides compatibility matrices for all applications, software and hardware platforms

LAN Team

Expertise: Understands current LAN infrastructure requirements and its affect on the new converged data/voice IPT network.

Roles and Responsibilities:

- Order Catalyst Chassis, Power Supplies, 10/100 Cards, for all buildings and sites in coordination with IT-Telecom PMs. (The IT-Telecom PMs will order all FXS cards for buildings and Digital Gateway Cards for NOCs). Both teams will work together in the installation and configuration, although most of the configuration is done from the CallManager interface.
- Order sufficient capacity Slot Space and 6509 Chassis to accommodate FXS Ports analog ports to service Polycoms, Faxes, and Modems in each building.
- Provide the forecast capacity plan and management of Tie Lines, and Digital Circuits to Service Provider networks required in the Network Operations Centers.
- Order and install the Catalyst 6509 equipment (chassis, power, ports) necessary to support Digital Gateways. (The IT-Telecom Team will order the Lennon Digital Gateway Cards.) Both teams will be responsible for installation and configuration setup for the digital gateways.

Theater Implementation Managers—Corporate, Americas, Field Sales Offices, EMEA, Asia Pacific

Expertise: Requires an understanding of core business requirements for individual's specific theater.

Roles and Responsibilities:

- Communicate global technology deployment objectives and policies.
- Implement global and theater specific designs, implementation policies, operational policies.
- Provide management reporting for implementation, operations and design functions.
- Provide feedback on lessons learned, needs, and experiences for implementation, support and design teams.
- Implement methodologies and processes across theater specific teams.
- Attend weekly global program and technologies meetings.
- Assess integration and deployment practices and polices for technologies.
- Provide organization structures and process models within theaters.
- Highlight common and theater specific resource requirements.
- Acquire assigned dedicated resources for AVVID Technology deployments and assessments.
- Establish Objectives, Metrics, Timelines, Tasks, and Deliverables for Contributors within theaters.
- Provide MBO ratings, rewards and assessments to assigned resources and individual contributors.
- Gather and organize business plans and user requirements from internal clients and in-region managers.
- Assess tools, methodologies and resources for implementation and support within theater.
- Manage theater-specific AVVID budget, capital expense, and resource allocations.
- Establish priorities and coordination requirements for Theaters.
- Tracks all feature gaps and product feedback attained from user clients

Remote Field Office-Theater Implementation PM Responsibilities—Countdown to Cutover

Twelve to Ten Weeks before Cutover

- Submit Telco room requirements to Telco Carrier
- Place order to extend Telco d-marc if required
- Verify existing Telco/PBX services
- Gather user data from Client
- Review Telco drawing and approve or return for revisions
- Verify overhead paging need/status
- Review final design received from Design Team
- Provide Kick-Off documentation to Implementation Team
- Place Telco order and request Customer Service Records (CSR) and Site Survey
- Substantially complete (75%) floor plans received
- Complete cabling for secondary MPOE
- Place equipment orders

Nine to Seven Weeks before Cutover

- Statement of Work (SOW) from installation team to Project Manager
- Telco Order Confirmation and Number Assignments
- Request Voicemail Purchase Order
- Research and confirm equipment orders approved
- Sign-Off and return SOW to Installation Team
- Forward FP and Extension Information to local contact (FSAM)
- Place Voicemail order
- Receipt of Voicemail Quote

Six to Four Weeks before Cutover

- Issue Voicemail Purchase Order
- Order Sprint 8XX numbers
- Order Polycom (Operations Center phones)
- Submit Cut Sheets to Installation Partner
- Provide Cut Sheets to Voicemail Vendor
- Submit Cut Sheet to Partner
- Finalize cut date with entire project team

Three to One Week before Cutover

- Complete any disconnections or referrals (if applicable)
- Complete BDF and IDFs
- Confirm equipment delivered to the site
- Provide Partner with access to the Extranet
- Provide IP information to the Support Vendor/Organization
- Submit Pre-cutover Web Viper dates to Program Manager
- Submit Pre-cutover operations package to IT-Telecom Team
- Notify Change Management group of office down-time
- Install Call Manager and Configure LAN

Cutover Weekend

- AVVID Solution Deployment
- AVVID and UPS Testing
- Update Voicemail bill groups (new sites only)
- End to End Testing

Day Two of Operation (Cutover weekend)

- Preparation and submittal of Post-Cutover operations package
- Facilitate the inventory and ship out of old PBX
- Provide customer satisfaction report (1st day of service)
- Cancel old world PBX maintenance agreement
- Submit LAN as-built and hand-off documents to Partner
- Submit LAN as-built and hand-off documents to IT OPS

One Week after Cutover

- Forward results of customer satisfaction report to team

Support Track Lead

Expertise: Must have technical expertise and experience in both the voice and data world as well as indepth familiarity with technologies such as Call Manager, IP Phones, Personal Assistant, Soft Phone, Unified Messaging, etc. Must also be able to understand the overall implementation vision and have the ability to plan support requirements for future applications and technologies and how they would seamlessly integrate into the current AVVID infrastructure.

Roles and Responsibilities:

- Develop and drive global support process and standards within IT and Customer Advocacy (CA).
- Establish metrics.

Finance Track Lead

Expertise: Must have a comprehensive understanding of the financial process, such as creating and maintaining budgets, financial close, project commit process, and performing ad-hoc financial analyses, including ROI's, scenario analysis, etc.

Roles and Responsibilities:

- Track spending against budget and support the day-to-day finances of the AVVID roll out
- Build financial models and prepare ad-hoc scenario analysis for members of the team
- Prepare and consolidate standard reporting based on data from each theater including headcount, and capital expenses
- Help the team build a lease scenario analysis for equipment returns
- Work with PM's to ensure that proper procedures for PBX equipment returns are in place to avoid additional lease fines
- Identify ROI factors and keep the team in alignment with key business drivers
- Manage depreciation factors, upcoming lease renewals, headcount, outside services expenditures, and equipment orders
- Ensure that budgetary spending stayed on track and that the goals of the deployment were in line with the goals of the company.

Appendix 1-2: Voice of the Client

AVVID Voice of the Client Survey

Voice Mail Features

Please select the area where you are located	U.S. Corp. Site	U.S. Sales Site	APAC Corp. Site	Americas Sales Site	APAC Corp. Site	EMEA Corp. Site	EMEA Sales Site
1. Ability to address a message using spell by name				Must Have		Nice to Have	Don't Care
2. Ability to mark a message as Urgent				Must Have		Nice to Have	Don't Care
3. Ability to mark a message as Private				Must Have		Nice to Have	Don't Care
4. Ability to reply to a message (Option 8 on VM)				Must Have		Nice to Have	Don't Care
5. Ability to manage Voice Mail distribution lists				Must Have		Nice to Have	Don't Care
6. Ability to maintain existing command key sequences				Must Have		Nice to Have	Don't Care
7. Ability to speed up message playback				Must Have		Nice to Have	Don't Care
8. Ability to slow down message playback				Must Have		Nice to Have	Don't Care
9. Ability to mark a message for Return Receipt Acknowledgement				Must Have		Nice to Have	Don't Care
10. Ability to slow down message playback				Must Have		Nice to Have	Don't Care
11. Ability to change message attributes (Urgent, Private, Return Receipt) per addressee				Must Have		Nice to Have	Don't Care
12. Ability to address a message either before or after recording it				Must Have		Nice to Have	Don't Care
13. Ability to have multiple greetings (On the Phone, Busy)				Must Have		Nice to Have	Don't Care
14. Ability to send a single message to a very large system distribution list				Must Have		Nice to Have	Don't Care
15. Ability to search Inbox for message from a subscriber/non-subscriber				Must Have		Nice to Have	Don't Care
16. Ability for callers to send faxes directly into your mailbox				Must Have		Nice to Have	Don't Care
17. Ability for callers to access your number by selecting your extension or using spell by name (Automatic Attendant) for after hours call processing				Must Have		Nice to Have	Don't Care
18. Which is more important to you?				Switch to Cisco's new voicemail system		Hold off on switching	Don't Care
19. How long are you willing to tolerate the lost use of feature functionality across system				1 to 3 months		1 to 4 weeks	Don't Care

Introduction

Module 2 is the pre-implementation phase and is about developing the plan. Module 2 discusses the steps taken by the Cisco team and the processes that were put in place to set the stage for the migration.

Module 2: The Migration Strategy

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The Migration

The number of employees, size of the campus, and how widely both are dispersed will have an effect on the migration strategy and the ability to manage a constantly changing landscape. Cisco, like most organizations, exists within a very dynamic environment in which users are moving constantly from one location to another and new employees are being added on a regular basis. With a population of nearly 20,000 employees located throughout a large campus environment, the Tiger Team developed new processes and procedures that took into account all of the variables that can change, alter, or otherwise affect the new converged voice and data network.

The team divided the migration into three categories: new employees; existing employees who were moving to a new location; and retrofitting each existing building one by one.

New Employees

The Tiger Team began the conversion process by issuing all new employees an IP phone with an external power supply. Working with Human Resources, Cisco's new employee checklist was changed to reflect the addition of an IP phone along with other standard equipment requirements, such as a new computer and the assignment of an office or cube location. Allocating an IP phone to all new employees right from the start helped introduce them to Cisco's technology culture and began the process of culture change from old world PBX telephony to converged voice and data.

"When I started at Cisco, the migration was in its very early pilot stage," said Stephanie Carhee, IT Project Manager. "I was given an IP phone because I had joined IT, one of the first few groups targeted to try out the new technology." Carhee noted that most new employees took it in stride because the new phone didn't require a lot of training. "New employees are already in the mode of change and so being issued an IP phone didn't really have a startling impact."

Relocations (Adds, Moves, Changes)

At any point in time, 300-600 employees are in the process of moving from one location to another within Cisco. This happens for a variety of reasons—new positions within the company, business expansion, organizational changes, etc. The second stage of the Tiger Team's migration policy mandated that employees who were still using a PBX phone would be issued a new IP phone at the time of their relocation. Employees were given instructions on how to disconnect and leave behind their old phones and a "pick-up" procedure was incorporated as part of the new policy. The team worked with Cisco's Workplace Resources and Facilities Management to ensure compliance with the new policy.

Since location changes occur often, by the time the conversion process neared completion a large percentage of employees already had an IP phone. Those individuals could move their phones themselves, making their relocations more efficient and easier for both Operations and employees and less costly for the organization. A policy change was then instituted instructing employees on how to update the company directory themselves with their new office or cube location.

Retrofit Existing Buildings

The Retrofit Process was the final stage of the migration and included the infrastructure upgrade and user conversion of all locations building by building. During the Retrofit, all users and phone lines were identified within each building, followed by a weekend conversion in which all lines were steered to the CallManager and the allocation of IP phones. "We found that conducting the conversion in this way ensured that regardless of the diverse make-up of the user groups or the prefix assignment of an employee, everyone within the building was part of the conversion," said Bill Lowers, AVVID Sr. Network Engineer.

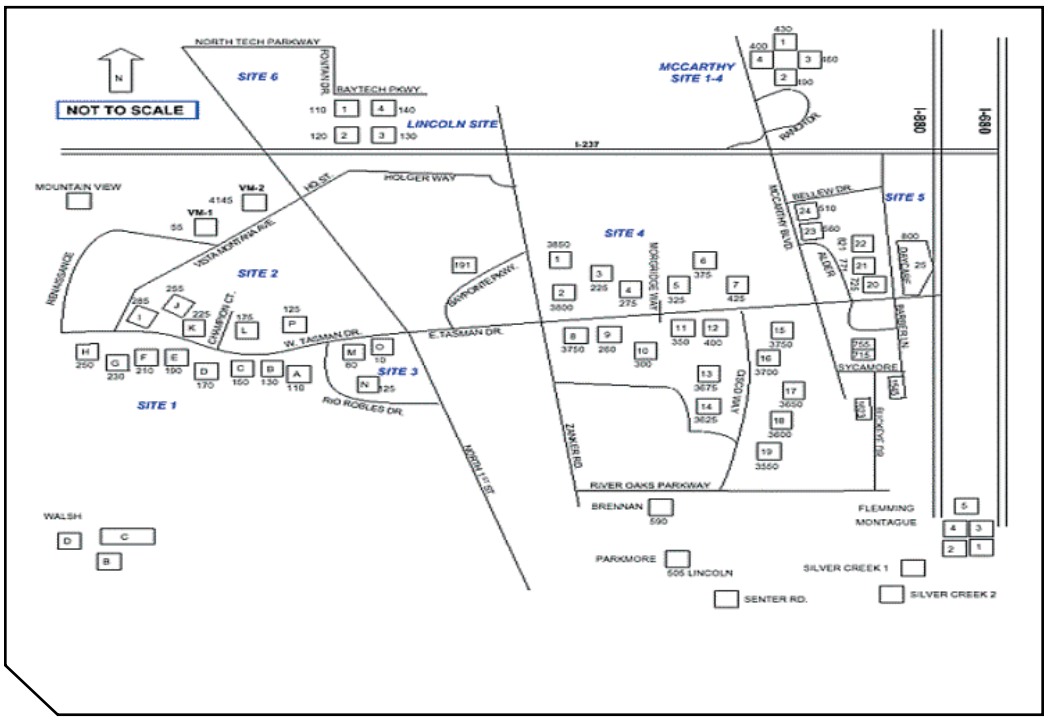
New Buildings

For new installations, such as new buildings on the San Jose campus and small branch locations, IPT was a flash cut—a single event rather than scheduled as part of the phased migration. "A parallel deployment was integrated for new buildings at the same time as the retrofit for the rest of the campus in order to allow our users to migrate slowly to the new system," said Lowers. "This was done typically on number ranges to reduce the translations between the two systems."

Best Practices: The Migration

- Conduct a pilot session with a smaller population and non-critical buildings to ensure that the plan is smooth, bugs are worked out, and a workable process is in place.
- Begin the conversion by issuing all new employees an IP phone.
- Whenever an employee moves his or her location, issue an IP phone rather than moving the old PBX phone to the new location.
- Ensure that your migration strategy covers potential changes that might affect the conversion process.
- Incorporate policy changes that encourage the conversion to the new IP phone.
- Develop a strategy that will convert all of your PBX-leased-equipment buildings first so that when leases come up for renewal, there is more flexibility during the migration process.
- Work closely with the Operations Teams responsible for Adds, Moves, and Changes to maintain a uniform policy on IP phone installation.

San Jose Campus



Assign the Project Team

A successful project team will include representation from every group within the organization impacted by the initiative. At Cisco, this included Technology, Support, Implementation, Design and Engineering, LAN Infrastructure, and Finance. The team also pulled in resources as needed from Workplace Resources, Facilities Management, and Security to further ensure the success of the deployment. With the appropriate cross-functional representation, any issues that arise can be dealt with quickly, keeping the initiative on schedule and running smoothly.

Each of Cisco's 55 San Jose campus buildings consists of two, three, and four floors and house up to 500 to 600 employees. Cisco's deployment goal was to convert the buildings at a rate of one building per week. Phone installations routinely took place during the week with cutovers scheduled for Saturdays. The project teams met weekly on the Monday before the conversion of each building to review the previous week's installation, provide status on the current one, and prepare for the next. "Because of the aggressive schedule, it was critical that all members of the team had the right expertise and a high level of commitment to the project," said Stephanie Carhee, IT Project Manager.

> For a complete description of team member roles, responsibilities, and expertise, see Module 1—Before You Begin.

Technology

Technology representation was important to the Tiger Team because they were the individuals who designed and tested the architecture—the resident experts. The Technology team not only helped to ensure that the installation was performed appropriately but—because of their day to day involvement—they were able to see first hand any issues, feature gaps, or other problems that they could resolve as the process moved forward. The Technology team attended the weekly project meetings, worked with Design/Engineering to develop workarounds for feature gaps, and stayed involved from the beginning to the end of the initiative.

LAN

The LAN team was responsible for installing and maintaining the network infrastructure that supported IPT. Because the implementation pace was so aggressive and timely, the schedule was closely coordinated with the LAN team. This ensured that the infrastructure would already be installed, tested, and operational by the time the Implementation team came in to switch out the PBX phones. The LAN Infrastructure team aligned their upgrade schedule with the implementation team and stayed one to two weeks ahead of each weekend conversion. Preparing for this in advance and reviewing the entire current infrastructure ahead of time ensured that there were no surprises.

Implementation

The Implementation team consisted of Cisco partners that had been engaged to manage the day-to-day 'plug and play' of the implementation process. They were responsible for conducting site surveys, steering new phone lines onto the CallManager, and doing the actual phone installs. They also managed the Operations Center, a designated, highly visible staging area located at each building where users could come to have issues resolved and questions answered. Members of the Implementation Team were available in the Ops Center on the Monday and Tuesday after every weekend conversion. On Wednesday, support was handed over to Cisco's GTRC (Global Technical Response Center) and TAC (Technical Assistance Center) teams, who would provide the ongoing support function.

"The Implementation team included the same Cisco partners who already managed our adds, moves, and changes," said Stephanie Carhee, IT Project Manager. "As someone already familiar with us, they were well versed on the infrastructure and the users in those buildings and knew ahead of time if there were any unique configurations we needed to be aware of."

Support

The Support team was responsible for taking over from the Implementation Team once the retrofit was complete. The Day 2 Support team included Cisco's Technical Response Center (TRC), Help Desk, and the Technical Assistance Center (TAC). Although the Support team was not directly involved in the actual implementation, the Tiger Team felt it was critical that they be involved from the beginning. The Support Team's involvement allowed them to become familiar with the technology, the architecture, infrastructure components, questions being submitted by users, and any special set-ups that were put in place to accommodate users. It also enabled the Support team to develop the support processes that would need to be in place before the Day 2 handoff.

Design and Engineering

Design and Engineering consisted of individuals who were familiar with the features of the current PBX technology as well as the IP Telephony that was being implemented. They were able to come up with ways to maximize the use of the technology as it was being rolled out and developed adjustments to the infrastructure to accommodate those cases where additional lines needed to be added.

On a weekly basis, Design and Engineering completed CallManager traffic reports and monitored trunking on the PBX and CallManager, DTMF and TDM load on PBX, and VM traffic on PBX. "Based on the traffic reports, we removed PBX trunking to PSTN as we removed PBX users," said Anthony Garcia, IT AVVID Engineer. "We added or removed PBX tie trunking based on the need and moved or managed Voice Mail facilities from the PBX to the CallManager by adding DPA ports to the CallManager." The team also managed the load on the EPNs, depending on the TDM and DTMF results and then moved the PBX tie to EPNs with low load. "One thing we learned throughout this process was the importance of Traffic reports," Garcia said.

Finance

The financial analyst was part of the core Tiger Team and acted as gatekeeper of the budget and all funds spent on the project. "Although I didn't need to attend the weekly meetings, I was able to stay current on all the issues concerning the conversion as well as the schedule through the distribution list communications," said Lynnee Jiminez, IT Finance Manager. "That way, when it was time to order equipment I was able to expedite the approval process and keep the momentum going without unnecessary delays." The Finance team also identified the buildings that were up for lease renewal, helping to determine the order in which the buildings were scheduled for the retrofit.

Ad Hoc Members

Some members of the Tiger Team participated only as the need for those resources became necessary. The ad hoc members typically did not attend the weekly project meetings but were added to the distribution list so they would receive the status reports and remain current with the process and progress of the initiative.

- WorkPlace Resources (WPR)—While not experts on the infrastructure, WPR was well versed on the individual buildings on the San Jose campus, as well as the users within those buildings. "Workplace Resources developed a floor by floor spreadsheet of all the users, their phone numbers, and their locations so that we could consolidate it with the data we pulled from the PBX report, verify the information, and identify any gaps," said Carhee. The Tiger Team also developed an automated process and worked with WPR's external moving company to ensure that as the Implementation team completed each building, the retrofit equipment was routinely relocated and ready for them when they arrived to begin the implementation on the next building.
- Facilities Management (FM)—The Tiger Team worked with FM and Operations to halt any adds, moves, and changes at least a week before the conversion so that the data used by the implementation team was current and clean.
- Security—Cisco's internal Security group worked with the Implementation team prior to each building's scheduled implementation to gain access to locked offices and other sensitive areas where the new IP phones needed to be installed. Security was included on the distribution list to receive updates on where the team would be working on a week-by-week basis. This ensured that the implementation team would have access to each of these areas as needed without having to halt the process to wait for the proper authorization.

Best Practices: Assign the Project Team

- Ensure that a representative from each group within the organization impacted by the retrofit participates on the team.
- Technology representation—Design and Engineering, Voice Services, LAN and WAN will ensure that problems are resolved as they arise and workarounds for feature gaps are addressed.
- Involve Support early in the process to familiarize them with the technology.
- Finance participation will ensure that the budget stays on track and can expedite approvals when necessary.
- Facilities, Workplace Resources, Security, etc., can work with the team to make the implementation a smoother experience.

Develop the Project Plan

The Project Manager worked with the project team members to develop a project plan that would meet the goals of the initiative, communicate what was expected of each member of the team, and identify the deliverables and dependencies. Commitment to the project plan was essential because failure to get buy in and agreement to dates would seriously jeopardize the success of the project. Under the direction of the Project Manager, the team used the project plan as a roadmap, ensuring that all processes were standardized and all deliverables were completed on time.

Project Pace and Schedule

Most initiatives burst out of the gate with enthusiasm and good intentions, but many times things can happen to slow down that momentum. In order to complete the initiative within the timeline, Cisco created a schedule that established the project's pace, kept things on track, and identified and removed the roadblocks.

Establish milestones

A large scale IP Telephony deployment is an evolving initiative and keeping the migration team focused on the goal for more than a year would be a challenge. To address this, the Project Manager identified milestones to guide the team and demonstrate to senior management that they were making progress. This helped to keep the momentum going and the motivation level high. The milestones can be instrumental in determining the project pace but only if they are relevant, provide value, and are aligned with company goals.

One of the milestones used in the Cisco deployment was the impending PBX leases that were coming up for renewal. The goals established by senior management required that no leases were to be renewed past the renewal deadline. Tying that goal to the deployment objectives was a great opportunity for the Project Manager to drive the Project Team for measurable results. In all, twenty-two PBX EPN leases were coming up for renewal within a six-month period. "We did a lot of massaging on the schedule to accommodate the lease deadline," said Stephanie Carhee, IT Project Manager. "Some buildings were converted earlier and some later to coincide with the lease agreements."

That strategy enabled the Implementation team to disconnect all relevant PBX's (except for the main PBX switch leases that supported Call Centers) in time to avoid extending any of the lease agreements. This satisfied the senior management directive of no lease renewals and met a measurable and important milestone.

Work closely with the LAN, Implementation, and Engineering teams

Joining forces and working closely with the LAN Team helped Cisco to ensure that the implementation schedule remained on track. The Implementation Team stayed at least two to three weeks behind the LAN upgrade team to allow time to put the appropriate infrastructure in place and to solve problems that might negatively impact the project. For example, in the very early stages of the implementation, power supplies had to be installed with each phone in those areas where the infrastructure was not yet in place. Once the team had installed the desktop LAN switches and retrofitted the rest of the infrastructure, inline power was available for the phones and the Implementation Team no longer had to spend precious time working around that critical need.

The Engineering team helped to maintain the pace of the project as well. Due to the sheer volume of users impacted by the migration, a number of unique phone set-ups had to be accommodated. Engineering helped find workarounds for those situations and other special configurations that required additional assistance, time, and attention. "On one occasion, we found that one of the lines we had to convert was a 'hot line' for customer critical calls," said Stephanie Carhee, IT Project Manager. "The phone needed to ring on multiple desks to enable several people the ability to pick up that call. Engineering was able to jump in and help us work through that issue to keep us moving on schedule."

Best Practices: Develop the Project Plan

- An experienced Implementation team and Support team who intimately know the history of the telecommunications system can identify nonstandard phone set-ups.
- Automation and organizational representation concerning every process change can ensure that little things won't become big things.
  - Post deployment status and schedule on the IPT Website (see next section).
  - Automate all equipment deliveries, pick-up, and storage.
  - Automate Operations Center reservations for each building.
- Conduct early PBX audits, identify all business critical lines and unique set-ups, and perform continuous traffic studies.
- Ensure that there is prolific communication between Operations, Implementation, Engineering, Support, Security, Workplace Resources, Call Center, LAN Infrastructure, and Security Services.
- Assign a room in each building to be used as the Operations Center and issue an IP phone that can travel with the team.
- Provide excellent and cost effective support during the transition by taking advantage of the power and flexibility of the IP Telephony infrastructure.
- Minimize disruption by planning the IP transition to follow the LAN infrastructure upgrades by a few weeks. This allows LAN infrastructure deployment, testing, and stabilization before cutover to the new voice infrastructure.

Remove obstacles

Removing obstacles from the path of the Implementation team not only kept the project on track, but also kept the team motivated because they were able to spend more time moving forward and less time fighting fires. "The last thing we wanted was for the Implementation team to show up only to find that the equipment wasn't there or the Operations Room, where we kept the equipment, was locked and they couldn't get in," Carhee said. "The Implementation team members were Cisco partners and having them stand around idle while waiting for equipment to show up could have quickly caused the schedule to slip and costs to spiral out of control."

Develop vendor relationships

Although some of the vendors and partners Cisco worked with were not involved at the beginning of the initiative, the Tiger Team brought them in early enough to ensure that they knew the scope of the project and the process. This also made them understand that they were a vital part of the team. "We found that because we had engaged the partners early, on more than one occasion they were willing and able to jump in and help us resolve issues that came up periodically," said Doug McQueen, Manager, Strategic Program Management.

Operations Center

At the heart of the implementation was the Operations Center, a room in each building that was designated to serve as the Implementation team's center of operations. Because the schedule called for converting a building a week over a period of twelve months, it was imperative that when the Implementation Team arrived, everything was ready to roll. Equipment used in the installation process was delivered to the Operations Center the Wednesday before the team arrived, along with all necessary tools, diagrams, reports, and other incidentals that they required to perform the retrofit.

To make updates quick and easy, the Issue Log was posted on whiteboards in the Operations Center so that as members of the team entered the room, they could immediately see what the outstanding issues were and what needed to be done.

And finally, a designated IP phone was issued to the Operations Center that team members could take with them as they traveled from one building to another. The phone provided consistency for the Implementation Team and enabled support calls from users in the current building as well as users from the building just completed to follow the Implementation Team as they moved between buildings. The IP phone ensured that someone was always available to answer the phone during those hours, even if they weren't actually in the Operations Center.

The Operations Center also served as a centralized location where users could come to ask questions, see a demo, get training, and pick up accessories. The Operations Center was open and staffed from 7am—5pm. For before or after hours, users had access to the Implementation team's voicemail and email alias.

The Communication Plan

In Module 1, the importance of a well thought out and comprehensive communication plan was discussed. No change initiative can be successful unless all of the stakeholders –the implementation team as well as the users—know what to expect. Users need to know what the change is, what they need to do about it, when it is coming, the reasons behind it, how it will affect them, and what behaviors will need to change. And the implementation team must work toward shared goals, implementing the initiative in an effective manner, and maintaining consistency throughout the initiative.

The Tiger Team Project Manager was responsible for developing and managing the communication plan and to maintain consistency, all communication was filtered through her. "We used a variety of communication vehicles to ensure that the message was consistent, accurate, and highly relevant to each user," said Stephanie Carhee, IT Project Manager. "We utilized tools that made the support process easy for both the team and for the user and included e-mail, Web postings, Video on Demand, eAlerts (targeted emails) pointing to news on the Website, and eCommunities (on-line discussion boards)."

Develop the Strategy

The Project Manager was responsible for developing the specific plan to achieve the communications objectives of the project, which included ownership, development and delivery timeframes, ordering all equipment, and proposed communication vehicles. The plan also sought to discover who the stakeholders are, what they need to know, how to identify resistance, and how to respond.

"The first step we undertook was to decide what our communication approach would be for the change initiative and create a strategy around how we planned to achieve it," Carhee said. The team identified the following four elements that were used throughout the deployment to measure and provide an objective for the overall communication plan.

1. Content and Information: Provide people with the right information so they can continue to be effective in their jobs and contribute to the success of the deployment. Make sure that the content is relevant to users and post only useful or interesting information that will encourage use of the communication vehicles.
2. Strategic context: Ensure that the information is relevant to the user's own situation and help them understand how it fits into the organization's strategic direction.
3. Leadership Alignment: Align the team's actions with leaders' words, ensuring consistency in messages and sponsoring communication.
4. Listening and Feedback: Ensure that a process for two-way communication has been enabled and translate the feedback into action.

Project Website

A Project Website was created on Cisco Employee Connection (CEC), Cisco's internal employee Intranet. The Website served as a central source for anyone who wanted information on the project. As the initiative unfolded, the information posted was available for the entire company and served as an effective way to relay summary information quickly and provide a map to the more detailed information if needed. "We put our project's Web address in our .sig (email signatures) file so that every email we sent pointed people directly to it," Carhee said.

The Project Website was the most effective way for the user community to see when their buildings were scheduled to be converted, and identified the cross-functional team members who would be conducting the implementation and providing assistance. The site provided status information including which buildings had already been converted and how many remained on the schedule as well as a link to the PBX return status so that users could see which PBX would be disconnected, where it was, and what time it would happen. The Website communicated access to the online user guide, tutorial, and supplemental documentation in lieu of physical training. Employees could even use the Website to order accessories, such as headsets, for their new IP phone.

The Project Website was also used as a consolidated place for all communication relative to the project team members. Templates, such as the IP Phone Test Procedure, templates for signage and box labels, and many more were posted on the Website. The project team list was available to identify the Design Lead, Install Lead, Workplace Resources representative, and a full team roster with roles and responsibilities. In addition, the Project Manager posted a weekly summary of the rollout and updated the Website on a weekly basis.

The most highly accessed information on the Project Website was the following:

- Deployment status report, which provided the percentage of users currently on the system, with a rising graph indicating the conversion rate.
- "IP Phone Tip of the Week".
- General information, such as environmental diagrams, timelines, project scope, FAQs, project information folders, and project goals.
- Online IP Phone tutorials, user guides, demos, and documentation on advanced IP phone features.

Email Aliases

In order to develop communication outlets that enabled users to voice concerns, ask questions, and request specialized training, the communications team developed a number of Email aliases to make the process as easy as possible for both users and Tiger Team members. An Email alias creates a distribution list of recipients so that relevant information can be targeted to specific individuals and groups.

Customer case alias

The customer case alias was developed to enable users to send questions and comments directly to the Implementation and Support team. Two weeks before the conversion, an announcement was distributed detailing the deployment and how users could communicate with the retrofit team. "We got a lot of great feedback from the user community on this tool," Carhee said. "And our policy was that every email was reviewed and a response sent within 24 hours." All members of the Implementation team were added to the customer case alias distribution list to provide them with frontline visibility to the issues, concerns, and questions that were being raised. The Project Manager and her assigned backup handled all responses in order to ensure consistency and adherence to protocol. "Some of the questions were repetitive but we were able to point those to our Website, which helped to keep the number of responses manageable," Carhee said.

Best Practices: Communication Plan

- State the vision in terms that employees can understand, describing the change from their frame of reference, and articulating the impact on behaviors and tasks.
- Communicate the reasons for the change, make a strong case for why that change is necessary, and explain how the organization will differ as a result.
- Ensure that communication is behavioral as well as verbal. Management must demonstrate sponsorship behaviors that reinforce the verbal communication of change.
- Communicate how the change is grounded in the organization's existing values and commitments. If a change in culture is required to implement the change, make a strong case and begin the process of culture change with the IPT initiative.
- Consistently communicate the vision statement down through the organizational hierarchy to ensure a cascading network of communication and sponsorship.
- Enable opportunities for two-way communication. Enlist employee ideas and suggestions for how the vision can be made a reality and act on those ideas.
- Develop a project website that users can go to for more information concerning the schedule, FAQ's, training, etc.
- Develop an Email alias targeted for each specific group so that everyone isn't overloaded with on information that isn't relative to them and limit communication to important messages only. Most employees are bombarded with emails and you don't want your message to get lost.

Project team alias

The project team alias was a vehicle for all members of the project team to receive timely updates on the conversion, such as which buildings were coming online, when, and highlighting any special configurations or issues that they may need to be aware of. During the weekly status meetings, all cross-functional team members were invited to discuss issues that might cause the project to slow. And for those members who were unable to attend a meeting, the project team alias was a way for them to catch up on what they missed, provide critical information to the rest of the team, and prevent unnecessary two-way information gaps.

Implementation team alias

The Implementation team alias enabled those individuals to receive specific and focused communications that the rest of the team did not need to receive. It prevented an overload of information to everyone else and kept the installers up to speed on special setups, unique situations, or other issues they needed to be aware of.

Building notifications alias

Even before the IPT initiative began, Workplace Resources routinely used a building email alias to communicate with residents of each particular building. Residents included those who telecommuted from home but were a part of a workgroup located in that particular building. The Tiger Team capitalized on that alias to send out an announcement two weeks before each building conversion, providing indepth information about the schedule, what to expect, how to inform the team about special configurations or business critical phone lines, and how they could request additional information. Because the migration strategy involved a phased approach, deploying IP Telephony one building at a time, the building alias enabled the team to focus their communication on the needs of the individuals in that building for the seven days it took to convert it.

Appendix 2-1: Sample user conversion notice

Identify Business Critical Phone Users

Everyone uses his or her phone differently. Some may require only occasional use for two-way voice conversations. Others need high-speed fax capability. Some administrative assistants may support multiple managers and need separate lines for each manager. Understanding the usage pattern and the business requirements of each department and group before scheduling their migration enabled the Tiger Team to avoid action that could severely impact the users' ability to do his or her job.

Reports generated from the existing PBX switch, the voicemail system, and the directory listing provided Cisco with critical information about its existing phone population. "These consolidated lists helped us to determine which users were working from home and which users would need a phone set in the office," said Mary Tsang, Service and Support Manager. The lists are available from the PBX and should be obtained as early as possible to avoid unnecessary changes at the last minute or, even worse, on the first day of production. "Those kinds of changes make it extremely painful for both the project manager and the end user," Tsang said.

Business critical phone users include the following:

- Call Center agents and their back-ups
- Modem lines used by Call Center agents
- Lobby Receptionist configured with a Call Center set-up
- Call Center agents that support callers over the weekend and require uninterrupted service
- Call Center agents tied to the leased PBX and scheduled for disconnect
- Modem lines used for high speed financial transmissions or for other critical and timely transactions
- Support teams who troubleshoot live customer calls
- Senior management private lines where sensitive information is shared
- 1MB lines tied directly to the Telco carrier rather than the production network
- TV studio where live feeds are broadcast
- Administrative assistant with unique configurations
- Administrative assistants who support more than one manager or support managers across different CallManager clusters
- Hotlines that are designated "drop everything and answer"
- Engineering labs with special modem lines
- Test labs that tie directly into the PBX
- Emergency phones such as those located in the elevators or parking lots

Call Center agents are Cisco's most business critical phone users. These are the individuals who act as the front line to the customer on a variety of issues—from the routine to a Priority One urgency. The Tiger Team made the decision that the Call Centers would not be cut over to IP until Internet Protocol Call Center (IPCC) features became available that would enable the agents to provide customers with equal or better service than PBX.

IPCC features combine voice and data technologies, facilitate customer interaction that originates from multiple sources, such as IP voice, TDM voice, Web, Email, and fax to empower a true multimedia customer contact center. Because IPCC was not yet available at the time of the Cisco IPT deployment, the Implementation team conducted only a partial retrofit of all protected buildings—those areas where Call Center agents, backup agents, and analog devices requiring special consideration were located. This type of partial retrofit enabled Voice Services to place approximately 5,000 lines on the IP network and eliminate those lines off the PBX. "This was a big win and huge cost savings for Cisco," said Shelby Roshan, IT Financial Analyst. "The partial retrofit of our ten protected buildings allowed us to complete the campus conversion and leave the non-leased PBX EPNs until IPCC became available."

The Implementation team worked closely with the Contact Center team to ensure that all Call Center lines were flagged as "Do Not Touch" and removed from the retrofit cut sheets. The teams then continued to work together to investigate the IPCC solution, which provides Call Center Agents with the IP functionality but without the use of an PBX EPN.

Cisco's contact centers handle more than 100,000 calls per week in addition to a multitude of e-mails and Web requests. Global Call Center (GCC), Cisco's most complex call center, acts as the "frontline" for the Technical Assistance Center (TAC), answering calls, creating TAC cases, and dispatching the Technical Response teams. The GCC will be the first to use this solution to manage the more than 20,000 calls that they receive monthly. At the time of this writing, IPCC was successfully being implemented into the GCC.

Business Critical Phone Users

- Know who your business critical phone line users are and have a solution in place in advance of the conversion.
- Don't rely on users to tell you their configurations. Verify their understanding of their configuration with a PBX dump.
- Configuration mistakes are serious. Do the homework and use the Operations Team to help flush out "special configurations".
- If critical features are not available, conduct a partial retrofit of everyone except for users dependent upon those features so that you can still convert the building.
- Call Center agents are critical. Ensure that you have a strong check and balance policy to ensure 100% voice access.
- Customer service is key to a smooth transition. Ensure that the Implementation Team abides by a 24 hour or less response time to all user inquiries.
- Use the communication vehicles thoughtfully. Users are already bombarded with emails so you want your message to be relevant, timely and useful.

Converting "Executive Row"

Executive Row is the nickname used by Cisco employees to describe the building and the floors where the organization's senior staff resides. While the needs of all of the organization's users are important and received the team's undivided attention, Executive Row is one of the most publicly visible and is another example of a business critical user group. It has the highest use of administrative assistant staff, highest need for special configuration, and has a greater sensitivity for getting it right the first time.

Executive Row consists of Cisco's CEO and senior executives who routinely speak to government officials, customers, the media, and other highly visible organizations. The availability of their phones and the phones of the admin staff who support them is critical. Their jobs often revolve around the availability and quality of their phones. The team soon learned that if they could get the admin staff through the conversion, migrating the executive staff itself to the IP phones would be a much smoother process.

Simple courtesies and exceptions to policies when necessary proved to be very effective here as well as they did in other special needs situations with the general Cisco user population. "The dynamics of Executive Row is fast paced and process-driven. Being sensitive to their needs and maintaining some flexibility in operational policy to get issues resolved quickly for them was necessary," said Marisa Chancellor, Director of Voice Services

When Executive Row was scheduled for conversion, the first thing the team's executive sponsor, CEO John Chambers, did was to send a private message to his staff about the impending conversion, requesting their cooperation. Because of heavy workload and total dependency on phone availability, this group was understandably apprehensive about the conversion. However, Chambers' message eliminated potential pushback from both the executives and the admin staff because they understood how critical this initiative was to the organization.

For starters, the team prepared a list from the Directory of all those identified with an admin title. Once a reliable list was identified, the team met personally with each one to understand their current phone set-up, how they used their phone, and which features were most important to them.

The team anticipated, however, that most users aren't well versed on their phone set-up. Therefore, they had also taken the time to pre-identify all private lines, emergency phone lines, and unique configurations. Identifying key phone users and cross referencing their understanding of the set-up with that of the data dumped from the PBX ensured that there would be no surprises after the cutover. The team also reviewed the senior executives' existing configurations culled from the PBX review to ensure that their new set-up would be the same as well.

After the interviews were completed, the team provided the admin staff with a visual confirmation template of their new phone configuration. (See Appendix 2-2) Because most admins support multiple managers and multiple phone lines, missing a single phone line configuration would be detrimental and special care was taken to avoid that possibility. To ensure that expectations were met from the admin's perspective as well as from the Implementation Team, the Project Manager created a picture of the front of the IP Phone with its buttons visible and arrows drawn to indicate the new button set-up. Presenting this confirmation document before the conversion provided the users and Implementation team time to agree to the set-up or make changes.

The Implementation team then selected a few key phone users to migrate on the Thursday night before the weekend conversion so that they could get comfortable with their phones on Friday, typically a lighter call volume day. This early conversion lessened the impact of the senior admin personnel having to manage typically heavy Monday call volume on a new phone system. The team also facilitated additional training sessions, carefully walking the admin staff through the conversion. Because admins use their phones differently from standard users, these special training opportunities ensure their understanding of the IP phone features that are most frequently used by support personnel

Once the weekend conversion was complete, voicemail distribution lists and directories were updated and all new phone number changes were communicated to the entire admin staff. "This was an important point," said Doug McQueen, Manager, Strategic Program Management. "These individuals use distribution lists heavily and special directories daily. Forgetting to update this list will cause a major snag in their distribution system. The last thing you want is someone missing an important message because the distribution list wasn't updated with the new phone number."

Because of the sensitivity of Executive Row and the larger number of special configurations, the team reserved a conference room nearby for the entire first week to provide additional support to the staff. Floor monitors were assigned to walk the floors and offer immediate resolution to problems or questions. Speed to learning for this particular segment of our audience was critical, therefore the more support that was available to them, the smoother the conversion would be. In about ten days, the support

hotline stopped ringing with questions and concerns and at that point, the team felt confident that they could close that building's Operations Center.

The final step to converting Executive Row was to incorporate a "Red Carpet" system which gave the Executive Admins an immediate vehicle to resolve issues. Executive Row houses the most highly visible people in the organization and therefore requires the extra attention to detail to ensure that the transition is smooth and problems are resolved quickly.

"I was a little nervous about the impending conversion and really didn't want my PBX phone to leave my desk," said Debbie Gross, Chief Executive Assistant to the President. "But I knew I had to jump in with both feet. The IT project team was absolutely fantastic in terms of being 'on call' and available, helping us learn how to use the phones, solving problems, and in general holding our hands."

Gross admitted that it was difficult at first to get used to the phone. "We had to pay attention to things like pictures of 'off-hook' phones that told us we had a call coming in and envelopes flashing telling us we had voicemail. But it really didn't take that long to train the ear and the eye in terms of what to watch for and after I got used to it, I really began to like the phone," Gross continued.

Appendix 2-2: Phone Configuration Template
Appendix 2-3: Executive Row Checklist

Best Practices: Converting Executive Row

- Take extra care to prepare and prioritize the cutover effort for Executive Row.
- Provide a secondary IP phone to accommodate multiple offices, private phone lines, and private conference rooms. Allocate multiple phone numbers to the same user only when a private line is imperative. However, this should be an exception to the rule and not a standard option.
- To lessen the anxiety of having to change one's phone number, whenever possible let the user select his or her own phone number from the available list.
- Install Cisco's 7914 expansion modules to accommodate additional line appearances, heavy speed-dial users, and administrative assistants who support more than one manager.
- Never disconnect unidentified modem lines in Executive Row until you find the owner to provide authorization.
- Continue to use 1MB lines for critical transmissions (i.e.: Live TV studio phone lines, fast speed financial transactions, emergency lines, etc.)
- Provide adequate number of support staff to man the Operations Center and assign floor monitors to offer quick response for user questions and problems.
- Request the on-site assistance of an Operations Senior Staff Manager to remain in the Operations Center to approve requests that fall outside the normal procedure.
- Incorporate a "Red Carpet" Support Team for the Executive Row Day 2 Handoff to manage IP phone support issues for Senior Management and their admin staff. Be prepared to keep the building's Operations Center open if a longer transition time is needed.
- Define a Boss/Admin configuration that optimally supports the objectives of the administrative assistants and work with Engineering to define a Boss/Admin shared line appearance template so that all set-ups from both the Operations and Implementation teams are configured the same.
- Interview the administrative assistants to identify their special needs and create a visual confirmation document that confirms your understanding of their set-up. Then conduct a PBX dump to verify each Admin configuration.
- Give the administrative assistants prototypes of the phone setup so they can provide feedback and acclimate to their new phones before the cutover.
- Design a training program that provides individual or small group training sessions.
- Work with the Senior Executive Admin to identify all the heavy phone users and individuals that may require special assistance and then convert them on Thursday to lessen anxiety and give them time to learn the new phone set-up.

User Training

In a large campus environment such as Cisco's, it was very important that a training method was selected that was scalable yet effective for the various levels of experience. Selecting a method that is not scalable will slow the pace of the project and may cause unnecessary delays. You will find that basic phone users will require no (or very little) training, while others may take longer to achieve an acceptable level of comfort.

The most effective tool for training a large campus environment is the IP Telephony communication Website. Utilizing Website links, on-line tutorials, streaming video, and Video on Demand will allow users to select their own training tools and—more importantly—allow users to decide when it is convenient for them to obtain training.

For those "techies" who want more indepth information, such as product release notes or advanced product features, provide Weblink access to that information.

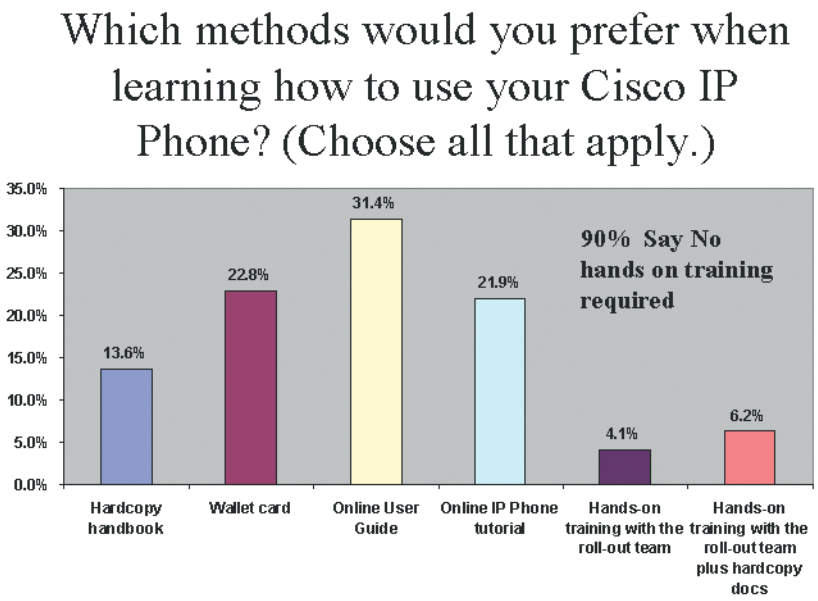
As part of the communication plan, the Tiger Team distributed an announcement to all users (See Appendix 2-1) outlining the changes users should expect as well as the various links to training tools. "We did have a couple of instances where users requested a special training session," said Del Hays, AVVID Support Manager. "So we put together a 10-15 minute overview of key phone features followed by a Q & A session. And of course, it's always a good idea to have a working phone on display to show real world examples of how to use the phone."

Very early in the conversion process, the IP Phone was an anomaly and users wanted to spend more time understanding the features. "We held Town Hall meetings early on to introduce the phone, share advanced features, and give users an opportunity to ask questions," said Stephanie Carhee, IT Project Manager. "We distributed copies of the user guide, directed them to the on-line tutorial link and FAQs (see Appendix 2-4), and had several working phones on display to encourage users to play with them." The team also reassured users that in most cases you would not have to change your phone number and that no existing or archived voice mail would be lost.

Once the IP phone became part of the culture user training was no longer necessary. But for those who did request training, a 10-minute IP phone overview was usually sufficient. The Implementation /Support Team used the Operation Center as a training room and set it up on the Monday and Tuesday after each weekend conversion so that users could drop by and obtain hands on training.

The Operations Center added a level of comfort to users because they knew that support was readily available if they needed it. Interestingly though, the team found that only a small percentage of users actually stopped in for training support or assistance. "Most of the users' frequently asked questions included information about the headset, phone cords, and how to use the more advanced features of the phone," Hays said.

The Operations Center enabled the ability to offer user training and demos and gave users the flexibility of contacting the team using the medium that was most convenient to them—physically coming to the Operations Center, calling on the phone, or sending an email.



For an example of Cisco's User "Frequently Asked Questions", see Appendix 2-4.

Best Practices: User Training

- Develop a Support FAQ document for the Support Team in order to ensure uniformity within Operational Policy. (See Module 4)
- Provide a variety of training methods so users can choose the ones that best fit their needs and make those options available via the Web.
- Hold Town Hall meetings early to introduce the phone to your users and help reduce the 'fear factor'. Communicate with your users so they know when their migration is coming, expected behavior changes, and identify where they can find training.
- Communicate the Support team 'hotline' phone number, location of the training room, and the Email alias.
- Allocate an IP phone to the Support team so that they can take the phone with them and answer questions wherever they are in the building.
- Use the Operations Center as a training room too so that users have one place to go for answers to questions and for training.
- Setup the building Email distribution lists or alias as a communications vehicle to introduce the various training options.
- In the beginning users will want more training because the IP Phone is unfamiliar. Once it becomes part of the culture, five to ten minutes per user will suffice.
- Admin personnel use the phone differently than other users. Expect to provide additional training for them. Once they become familiar with it, they will serve as advocates for the phone, as well as an additional outlet users can go to get answers on IP phone features.
- Be flexible in your training options because most people will want alternatives to hands-on user training.

Identify Operational Policy Changes

IP Telephony is a new model and as such requires that new operational support be designed and instituted throughout the organization. Because IPT provides a level of flexibility that was not available before, the team found that it was necessary to institute new operational policies.

Modem/Analog Policy

Cisco's Information Security Group (InfoSec) already had an established policy on the use of modem lines—who was authorized to have one and how to get authorized if an employee needed one. As part of the building notification process, the Tiger Team sent out a Web link to all users in that facility that pointed them to InfoSec's modem policy. "The modem/analog policy was something we took very seriously," Carhee said. "Since the success of the initiative depended upon following the appropriate security guidelines developed by InfoSec, we wanted to make sure we followed it closely."

Users were asked to respond within one week if they were authorized to use a modem/analog line so that the implementation team could make arrangements to migrate those lines to the CallManager. If the existing lines were not identified within that timeframe, the team disconnected them so that unused or rogue analog lines were not part of the implementation. "With the number of lines we were dealing with—up to 600 lines at a time—it made more sense for us to disconnect those unidentified or unclaimed, non-critical modem lines," Carhee said. "We could then easily reconnect them if someone came to us later claiming ownership."

Bill's "Clean Network" Theory

The modem/analog policy tied in neatly with "Bill's Clean Network Theory." Bill Lowers, Senior Network Engineer at Cisco, had convinced the team that migrating from PBX systems to a converged voice and data network was the perfect time to clean house. With up to 3,000 analog lines located throughout Cisco's San Jose Campus buildings, it was likely that many of those lines were unused, forgotten, or unassigned. Rather than blindly moving those unnecessary lines over to the CallManager, the Team took that opportunity to trace and disconnect all non-critical lines that were unidentified or unassigned.

Best Practices: Security

- Protect the Network Elements. Routers, Ethernet switches and VoIP gateways define network boundaries and act as gateway interfaces to all networks. Securing these vital pieces of voice and data networks is a requirement for securing the data, voice, and video application running across the infrastructure.
- Design the IP Network. Understanding and following sound IP network design principles not only allows the network to scale and perform, but also increases the security of all attached devices.
- Secure the CallManager server. Securing the actual voice call processing platform and installed applications is the most vital step in providing security to IP Telephony networks.

Best Practices: Operational Policy Changes

- Because users can take their phones from location to location, Cisco's policy was that one phone was issued per employee.
- Incorporate the auto numbering tool to automatically disperse numbers for multiple clusters. This will prevent one cluster from being top heavy and requiring the use of additional infrastructure. Ensure that all DID numbers are equally distributed between all clusters in order to adequately manage traffic.
- Review all circuit ID's to ensure that tags and owners are identified. Clearly labeling the owner's building and cube or office location identifies the line as a critical user or regular use line.

"Obviously you have to take care when you're in a building with critical phone users, such as our Call Center agents who troubleshoot problems for customers," said Lowers. "But building as much integrity into the system as possible prevents having to purchase additional infrastructure to support lines you don't even use." (See Module 5 for more information on Retrofit Clean-up).

Security Policy

Security involves technology and practice. Cisco technologies like VPN, Firewalls, Access Control Lists, etc., need to be matched with strong security policies. Therefore, the first step in any security implementation is to establish a security policy. Common security practices include physically restricting access to wiring closets and data centers to authorized staff only, using keyed or electronic locks on doors, installing IP video surveillance equipment, and alarming capabilities.

An IP phone is a direct connection into your network. Lobby phones or phones made available to visitors in other public areas of the organization can create a security breach if not managed properly. "If a visitor chooses to plug his or her laptop into the public IP phone, it can be a direct connection into the organization's data network," said Paul Molyski, IT LAN Project Manager. "We had to make certain policy changes when deploying these phones in order to ensure security." After each building conversion, Molyski was given a list of all public phones that required LAN network restrictions.

Additional information on securing an IP Telephony network can be found in the IP Telephony Solutions Guide. In addition, an online seminar—'How To Make Your Network SAFE for E-Business'—is available on Cisco's Website that describes the essentials of Cisco security and VPN solutions.

IPT Solutions Guide: http://www.cisco.com/warp/public/788/solution_guideSAFE:

http://wwwin.cisco.com/ent/vsec/programs/seminar/index.shtml

Emergency Phone Lines

Emergency phones were set up on analog FXS boards with separate partitions within the calling search space that were set up to route the call to the correct destination. The implementation team added these lines to the CallManager, just as they did any analog circuit, and then changed the calling search space for the correct routing. "The calling search space tells the call where to go on an outbound call," said Del Hays, AVVID Support Manager. "In this case, all calls were directed to go straight to Security. These partitions were set up by the Design Engineers prior to the line being installed." Analog installation is a manual task and requires that all information for each line be added one by one.

"Emergency phones can be configured to place the call," Hays said. "Some of the emergency phones on the San Jose campus were configured to route to Security instead of the CallManager. In this case, we only supplied a normal analog line to the phone. The programming was then done on the phone itself for the routing to Security."

The Good, the Bad, and the Ugly

Managing a change as large in scope as an enterprise-wide IP Telephony deployment takes special care, attention to detail, and adherence to policy. A lot could go wrong if it isn't managed properly but with the appropriate planning, the initiative can go smoothly and successfully. Below are a list of the top ten things to watch out for and the top ten things that a smooth implementation will enable.

Top Ten Things That Can Go Wrong During the Retrofit

1. IPCC was not yet available at the time of Cisco's conversion and removing a Call Center agent from the PBX too soon could have been a critical mistake. Obtain a resource from the Call Center team to attend project status meetings and to provide a list of all Center Agents located in the scheduled building as well as back-up support agents. The list should be provided to the IPCC Deployment Team that will convert the Call Center agents to the call center application later.

2. Disconnection and removal of critical phones that are unidentified or unassigned can backfire. *Analog Lines:* Announce the impending removal of these lines so that users who rely on these lines have the opportunity to come forward and prove ownership. *Modem Lines:* If unassigned modem lines are located in a building housing the Call Center Team, it's better to just leave them. Adherence to corporate policy on the use of modem lines for non-Contact Center buildings will help with the clean up. *1MB (Measured Business) Line*s are assigned when the users want an additional level of redundancy and removal could cause a major problem during an emergency. Identify the owner and building location on all circuit orders and termination points and conduct a periodic audit of these lines to continually assess their viability.

3. IP phones carry the same potential for abuse as PBX phones, including enabling call forwarding to a secondary number, as well as unauthorized Long Distance charges. Take steps to ensure that all lobby phones and other courtesy phones have restricted features.

4. Because IP phones run off the data network, they can create a security breach if access is unrestricted on public phones, allowing visitors to download sensitive data from the corporate Intranet. Ensure that public phones are secured against fraud.

5. If not properly anticipated, resistance to change can create havoc. Gain acceptance by taking away the mystery. An executive sponsor and senior management support is key.

6. Not taking the time to manage expectations can cause user dissatisfaction. Develop a comprehensive communication plan, identify "must have" features, and set the right expectations up front.

7. If software upgrades aren't carefully choreographed, the conversion could result in delays and unnecessary issues. Cross-functional communication is critical and using the Engineering Lab to test all CallManager software upgrades will prevent painful problems.

8. Incorporate new policies and processes that support and improve current organizational procedures. For example, giving users more than one phone could distort network and CallManager capacity planning. Emphasize the benefits of CallManager and IPT that eliminate almost any need for a second line, supporting the organization's need for multiple extensions per person but with only one phone per employee.

9. If a virus can affect the data network, it can now also affect the new converged IP network. Ensure that systems are in place to address viruses and protect the network.

10. Cross-train and combine the LAN teams with the Data Teams so that network troubleshooting is easier and adverse network changes aren't made.

Top Ten Things That Will Improve as a Result of the Retrofit

1. After the successful conversion of several buildings, the Implementation Team will have developed a level of confidence, knowledge, and experience to tackle almost every building configuration for future technology deployments.
2. Once the first few users have been converted and the process has been proven, users will move from dreading the move to eager anticipation.
3. Users will find the mobility of the phone useful. For example, Lab Technicians that have both a primary desk and a lab cube will find it useful to be able to take their phones with them to either location.
4. Users will find the IP Phone Logs effective in identifying callers, prioritizing phone calls, and enabling the user to decide whether to check voicemail immediately or wait until a more convenient time.
5. Users will become very efficient at using the IP Phone and will begin to offer suggestions on how to make the new IP phone system better, offering more creative and efficient suggestions on how to increase employee productivity. For example, as a result of user input, Cisco has deployed various enterprise information services to the Cisco 7960 phone sets, such as directory look-ups and stock lookups.
6. The new infrastructure sets the groundwork for the new applications that will follow (i.e. Call Center Applications, Personal Assistant, SoftPhone and Unified Messaging).
7. Adds, Moves, and Changes will be conducted with ease, simplicity, and less cost. Operations will be able to close cases faster and accommodate the large number of changes that a large campus endures.
8. New buildings will be able to take advantage of the installation of a single cable, eliminating the necessity for both network cables and telecommunications cables.
9. The conversion to a "clean network" is possible. Taking this opportunity to disconnect the thousands of analog, modem, and other lines that are no longer being used, but are still being billed, streamlines the campus numbering system and adds new numbers to the recycled number availability list. And instituting a new policy change will ensure that no unverified lines will be placed onto the CallManager.
10. PBX's that are up for renewal now have an additional option. They can be removed and converted to a more flexible VoIP solution or they can co-exist with old world and new world.

Summary

Planning the plan will result in a smoother migration with fewer bumps and no surprises. Module 2 focuses on the various elements that prepare the initiative for success—from pulling together the right team to communicating with users to identifying necessary operational changes.

The Migration

Dividing the retrofit into logical segments and manageable chunks ensures that the retrofit will be easier to implement. The migration was segmented by new employees, adds/moves/changes, and then completed building by building.

Assign the Project Team

Every group who will be impacted by the initiative is represented on the team, including Technology, Support, Implementation, Design and Engineering, LAN, WAN, and Finance. Others such as Workplace Resources, Facilities Management, and Security are added as needed.

Develop the Project Plan

Set goals and establish milestones to keep the project moving and show progress. Create a schedule so that the LAN team stays two to three weeks ahead of the implementation team to ensure infrastructure is in place. Set up an Operations Center in each building being converted to act as Ground Zero for both users and the implementation team.

The Communication Plan

Determine who your users are, how you can best facilitate two way communication with them, and what they need to know. Use email, a project Website, Email alias, and other media to keep communication consistent, relevant, and useful.

Identify Critical Users

From high-speed fax capability to separate lines for admin personnel to Call Centers and Help Desks, everyone uses his or her phone differently. Identify users with special configurations and ensure that their new phone set-up meets their needs.

Converting Executive Row

Executive Row, including senior executives and their admin staffs, is populated with high volume phone users who cannot afford to be without communication, even for a short time, and cannot take a lot of time to learn how to use the IP phone's new features. Take the extra time to make their transition easier and problem-free.

User Training

Provide different training options and let your users choose what best fits their needs. Options can include Web-based training, demos, user guides, and facilitated sessions among others.

Identify Operational Changes

New support models, attention to security issues, different handling of modem lines, and restrictions on migrating unused lines are considerations of the new converged voice and data network. Revisiting operational policies will ensure a smooth migration and keep the new system clean.

The Good, the Bad, and the Ugly

The section lists the top ten things that will improve as a result of the new IP Telephony network and the top ten things that could go wrong without proper planning.

Module 3 addresses the Day 2 handoff to the Support team. Topics addressed include network management, power backup, monitoring and troubleshooting, serviceability, and the importance of back-up support.

Appendix 2-1: Sample Users Conversion Notice

TO: All Building Employees
FROM: Cisco IT AVVID Tiger Team

Our plan is to convert all users on the San Jose Campus to the Cisco IP Phone. Your location is scheduled for conversion on Saturday _____ Exceptions to this include all Call Center Agents and Lobby Receptionists that are part of the Contact Center Operators Group. There are three areas of sensitivity for us; Modems, Boss Admin Support and Oryx System users.

Modems: Cisco's Corporate Security Policy states that Modems are not approved nor supported for use. The exceptions would include those areas where customer-facing support is provided. To ensure that your approved modem has been identified, please send an email it to retrofit-case@cisco.com. If you would like to obtain the necessary approval for a modem, the procedures can be found at: Office Analog / ISDN Line Security Policy: http://wwwin.cisco.com/infosec/policies/analog_isdn_fax_security.html; Modem Access and Authentication Policy http://wwwin.cisco.com/infosec/policies/modem.html; Dial-out modems for customer network access from a centralized Cisco access server http://eman.cisco.com/NETWORKING/tech_ref/access_dialin_dialout_info.html

Oryx Priority Call Management System: Oryx is not a supported feature with the Cisco IP Phone and will eventually be replaced with Cisco's Personal Assistant product. Other options to consider in managing your priority calls include: configuring your IP Phone to forward your calls to your cell phone or alternate phone number, or utilize the pager notification system available on your voicemail system to alert you when you have received an urgent, private or regular voicemail.

Boss Admin Support: The Cisco IP Phone has a 6-line admin share support feature. Users who have other extensions appear or ring on their phone may face a challenge transitioning from the legacy PBX system to the AVVID CallManager phone system. AVVID presently supports the feature however; the primary users' number and any additional number must have the same prefix. Example: If an Admin user has a 525 prefix and wishes to have a Managers line appear/ring on the same phone, the Managers number must also have a 525 prefix.. Mixing prefix numbers such as 525 and 526/527 or 853 prefixes will not function at this time within the AVVID Call Manager. If you and your manager have a different prefix, and / or would like your IP Phone provisioned to manage the calls of your manager, please email us at retrofit-case@cisco.com

Facsimile Machines: Cutover support for Faxing should not be an issue. However, we would encourage all Admin. and Support Centers to inform of us of any special applications by sending an email to retrofit-case@cisco.com

During this transition we understand that you may have questions and concerns: We ask that you reference our FAQ site at: http://wwwin.cisco.com/support/library/ip-phone/faqs.shtml

Additional useful links designed to answer your questions:

Using Your Cisco IP Phone 7960
http://lbj.cisco.com/push_targets1/ucdit/cc/td/doc/product/voice/c_ipphon/get_star/ipp60get.htm

Cisco IP Phone Tutorial
http://www.cisco.com/warp/public/779/largeent/avvid/products/7960/read_me.htm

Release Notes for the Cisco IP Phone 7960
http://lbj.cisco.com/push_targets1/ucdit/cc/td/doc/product/voice/c_ipphon/ip_7960/ipprnote.htm

Cisco IP Phone 7960 Quick Start
http://eman.cisco.com/dashboards/technology/avvid/ip_phone_qrg.pdf

Ordering an IP Phone Compatible Headset
http://wwwin.cisco.com/ent/voice/news/headset9-18-00.shtml

How to use the Octel Voicemail System
http://eman.cisco.com/TELECOM/help_desk/tele_voicemail.html

Thank you for your support
Cisco IT AVVID Tiger Team

Appendix 2-2: Phone Configuration Template

Building 10 Boss/admin IP Phone Configuration

Name: Ann Giluso – Ext. 64805 cube: E6-9 4th flr.

Service Request: Sidecar (7914) & Shared Line set-up

Your new IP Phone Configuration is outlined above for Oct. 13th. Please contact us immediately at retrofit-case@cisco.com or at ext 68096 if the settings we have planned for you are not correct.

Appendix 2-3: Executive Row Checklist

Executive Row Checklist

_____ Check spell by name on all number changes within voice mail and in the local and global directory.

_____ Ask senior managers which phones they want to keep and which ones can be removed. Verify with PBX dump so that you know which numbers are already assigned to them.

_____ Remind users to update their VM distribution list when number changes occur.

_____ Identify users who have more than one number and ask if they prefer a separate voicemail for each or if they want multiple lines to roll into one voicemail.

_____ Submit Global Directory updates.

_____ Follow up with Engineering to ensure that Global Directory is updated for all CallManagers.

_____ Ask if additional phones are required in public areas where there were none previously.

_____ Identify how many admins will require the 7914 Expansion Modules and pre-order them to accommodate each one's needs.

_____ Verify that all voicemail boxes for shared line appearance confirms that voicemails are being directed to the right user. Press the 'messages' button to conduct a quick test.

_____ Identify number of rings preferred by each admin and their manager.
(Preferences will vary).

_____ For all senior executive conference rooms, ask if the silent ring option is required. Some VP's don't want the disruption of a second phone ringing while they are in a meeting.

_____ Senior executive offices often have heavy call volume and may have ACD functionality that will route callers to a secondary office or number (i.e. prompt to allow callers to press one for shareholder info, press 2 for media questions, etc.). If this is the case, work with Telecom to route these calls appropriately on the IP phone. A simple phone swap-out does not automatically continue this feature.

_____ Test for understanding and make sure all admins know how to transfer calls directly into voicemail. This is a common function and is conducted differently on an IP phone.

_____ Provide a visual confirmation of all phone changes so that both the Implementation team and the administrative staff agrees to the new phone configuration.

Appendix 2-4: User Frequently Asked Questions

IP Phone Support Information

Frequently Asked Questions

- General Questions
- Using IP Phones
- Troubleshooting

General Questions

- AVVID IP Phones
- When will I get an IP Phone?
- Why are we using the Cisco IP Phone?
- How can I get an IP Phone for my house?
- How can I order the appropriate headset/cord for my IP Phone.
- How do I request or suggest features for IP Phones?

Using IP Phones

- How do I drop or end a call?
- How do I forward all my calls?
- How do I program my speed dial?
- How do I use the directories?
- How do I adjust the ringer volume?
- How do I change the Ring sound?
- How do I connect two IP Phones with only one phone jack?
- How do I adjust/save speaker volume levels?
- How do I transfer a call?
- How do I place a conference call?

IT Internal Technical Support Library FAQs:
http://wwwin.cisco.com/support/library/ip-phone/faqs.shtml

Troubleshooting

- How to report problems with your IP Phone.
- Message waiting indicator (MWI) is not working.
- What to do if your IP Phone appears “dead”.
- What to do if your IP Phone appears to be in configuration mode or registering mode.
- What to do if your IP Phone is stuck in configuring mode.

Module 3: Implementation

Introduction

Module 3 is where the pedal meets the metal. All of the planning and preparations discussed in Modules 1 and 2 have paved the way for a smooth transition from PBX-based phones to IP phones and it is in this stage that it all comes together. In Module 3, you will learn how the LAN and WAN were prepared for the convergence of voice and data; the importance of conducting a thorough site survey of each building; and the implementation techniques used by the retrofit team. The Appendix will provide you with templates, samples, checklists, and other tools used by the retrofit team to make the process more efficient and consistent.

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LAN Infrastructure Requirements

A successful implementation of Cisco IP Telephony Solutions requires the LAN infrastructure to provide a stable voice-capable platform. Before adding voice to the network, the LAN team took the time to ensure that the data network was configured properly. "To prepare for the Cisco IP Telephony retrofit, we rebuilt the desktop LAN infrastructure," said Paul Molyski, IT LAN Project Manager. Although that upgrade was already in the planning stages, the decision to deploy IPT throughout Cisco accelerated the process.

At the time, much of Cisco's existing LAN infrastructure was older technology. Several of our buildings were still running the same network equipment that was installed when the buildings were constructed several years ago. In addition, two separate networks were running—one for IT and one for Engineering. The goal was to replace the existing infrastructure with a combined network and with current hardware. Since the timing for that goal happened to coincide with the IPT deployment, the decision was made to accelerate the LAN retrofit to avoid deploying IPT with a mix of new LAN infrastructure equipment (in-line power) and old LAN infrastructure equipment (no in-line power and outdated LAN equipment).

Standardization

Cisco's LAN had been constructed over a number of years, growing as Cisco grew, and resulting in a non-homogeneous architecture that was difficult to support. In 2000 a new LAN architecture standard was developed for the San Jose campus. The first step toward integrating the new standard was to upgrade the various campus site and inter-site backbone portions of the LAN for the new converged network.

This was during a time of rapid growth for Cisco and to keep the LAN upgrade consistent throughout the organization, all new buildings that came on-line during this process were fitted with the new LAN architecture. As part of the IPT deployment, a new LAN segment was created, which was similar in design to a Data Center LAN segment. Meant to contain the CallManagers as well as the CAT 6000 switches that terminated the Public Switched Telephone Network (PSTN) connections, it would also contain future telephony servers, such as those for Interactive Voice Response (IVR), Unity, and Personal Assistant applications.

After the site and backbone portions were rebuilt, the retrofit of the desktop LAN was begun later that same year. "The goal was to maintain consistency by strictly adhering to the new LAN architecture," said Molyski. "Since we would end up with over five hundred CAT 6000 switches and a hundred smaller switches in the desktop LAN, ongoing support and the higher availability requirement would be a problem if consistency was not maintained."

Before the deployment of IP Telephony, LAN availability and QoS was less of an issue—Three 9's (99.9%) availability was acceptable for most services on a data-only network. Now however, Five 9's (99.999%) is the standard for telephony. "Today, the LAN has an uptime of 99.99%, but we believe that it's higher than that for the portions that support IPT," Molyski said. "The side effect of this is that we ended up with a much better LAN for all the services that rely on it. In a nutshell, installing a LAN that was suitable for IPT resulted in better service for all LAN applications."

For a technical summary of how QoS was implemented at Cisco, see Appendix 3-7.

In-Line Power

Integrating IP Telephony support added some requirements to the overall LAN design. "Most noteworthy was the use of in-line power for the desktop Ethernet connections," Molyski said. "This required that we configure CAT 6K's with the 2500 Watt power supplies and the wiring closets (IDFs) with 208V, 20 AMP UPS power."

Although not every installation required the use of 2500-Watt power supplies, the LAN team used that standard throughout the network. "The CAT 6K's provide excellent real time power consumption information that can be used to determine the exact power requirements on a switch-by-switch basis," Molyski added. "With Cisco's ever-changing requirements, standardizing on 2500-Watt power supplies was the way to go for us."

The LAN team installed CAT 3524-PWR switches in locations where IP phones were deployed, but where desktop network services were not provided. The standard for desktop Ethernet service was to provide two 10/100 patches to each CAT5 wall plate. "The intent was that the IP phone would use one live jack and a PC would then be connected to the IP phone," Molyski said. This left the second live jack available for another device and resulted in a noticeable decrease in the number of requests for additional connections, reducing overall support costs.

CAT 6Ks with FXS blades were then deployed to support analog telephone connections, including modems, FAXs and Polycoms. These FXS switches were a part of the desktop LAN and were installed where the CAT3 cabling system terminated in each

Best Practices: LAN

- Standardize on the LAN architecture to maintain consistency and reduce support costs.
- Integrate in-line power for the desktop Ethernet connections and remove any IP phone power adapters.
- Allow only the voice VLAN to pass traffic on public access phones to prevent security breaches.
- Do not connect devices that produce heavy data traffic, such as NFS workstations, to IP phones. The internal switch in the phone may drop packets in this situation.
- Implement change management practices that encourage processes for the data infrastructure to complement those for voice services.

building's main wiring closet. Analog devices that had been connected to the PBX were then reconnected to the FXS CAT6Ks via this cable plant.

"In cubes, offices, and conference rooms, converting PBX phones to IP phones was not a problem because CAT5 was readily available in those locations for use by the IP phones," Molyski added. "However in locations where wall phones were implemented with a single CAT3 jack, we were stuck with using the CAT3 cable." In these instances, in-line power proved to be the only way to conveniently power those phones. The CAT3 runs were rewired to the desktop CAT 6Ks.

Security

In some instances, such as lobby phones and other public access areas, the team had to provide IP phone service but needed to restrict it to voice-only service to prevent unauthorized access to the desktop network. This was accomplished by allowing only the voice VLAN to pass traffic. "This was simple to do because auxiliary VLANs were used to carry voice traffic," Molyski recalled. As a result, any PC connected to that phone would be unable to gain access to Cisco's internal network.

Although many of the cable paths from the desktop wiring closets (IDFs) to the phone locations in the Labs far exceeded the 100m CAT5 cable spec, the solution was to place 3524-PWR switches in secondary wiring closets (SDFs) within the Lab areas and connect these back to the desktop network. "Even after implementing this practice we still had some cable runs which exceeded the 100m spec," Molyski said. Because running at 10 Mbit over CAT5 allows that to happen, the team configured the 3524's for 10Mbps Ethernet with the data VLAN blocked, knowing that if the IP phone was able to power up using the in-line power, it would operate satisfactorily.

The Results

"I can't say enough about the advantages of in-line power," Molyski said. "The convenience of not having to use an external power adapter should not be under-estimated. During the installation, our test phones went through hundreds of power cycles with no problems." The in-line power feature was later used to power the Access Points for the wireless network, which provided an added bonus of having implemented in-line power.

"Adding voice traffic to our LAN demanded a higher availability standard than what is acceptable for data only," concluded Molyski. "The additional cost for this was not that great and we ended up with a better LAN not only for voice, but for data and video as well. The net result was that we had a LAN that was more reliable and required less effort to support."

The concepts and implementation techniques used by Cisco's LAN team are valid regardless of whether the retrofit involves a headquarters with tens of thousands of users or a small branch with fewer than a hundred users. However, the size of the network determines the actual components and platforms and the details that determine the scalability, availability, and functionality of the network.

For LAN upgrade test procedures, see Appendix 3-1.

WAN Infrastructure Requirements

IP Telephony WAN deployments require significant planning. For multiservice traffic to travel across a converged wide-area network (WAN), the network must support and supply the prerequisite Quality of Service (QoS) features. The design and dimensioning of the WAN must also be compatible with the traffic profiles, business requirements, and circuit tariffs.

The Cisco WAN was built using a hierarchical model in order to enable the most cost-effective platforms to be provisioned at the edge. The hierarchical model is a tiered architecture that provides several layers of network devices from the edge to the core, strategically moving certain 'work' functions to those devices, and enabling routing decisions to be made closer to the core.

"Because so much processing and memory power is required, the devices in the core tend to be higher-end devices," said Amy Rogers, IT Engineer. "That process allows us to put lower end devices toward the edge because that alleviates the routing decision process. All they do is grab the packet coming in and forward it to the core for distribution. This reduces cost on the edge and provides a more manageable and predictable network topology because it's more controlled in the core."

Bandwidth

In addition to the design philosophy, the WAN bandwidth requirements must be adequately provisioned. As the requirements for data traffic outstrip those of voice, the percentage of the wide area bandwidth required for voice decreases, lowering costs at the same time. The WAN links must be provisioned to support the minimum requirements for data, as well as the bandwidth required for voice and video traffic. When other applications are inactive, the bandwidth is then available for data.

"Originally, when we first began to put VoIP on the WAN, we had some areas of bandwidth constraints that wouldn't allow us to put a large amount of voice traffic on the link," Rogers said. "For instance, the WAN links to Europe and Asia Pacific were quite saturated just with data on them. When we implemented VoIP using the AS5300 platforms, we then used a QoS feature called rate limiting which enabled us to carve out some bandwidth for a limited number of calls."

Cisco's WAN backbone then went through a large upgrade where the existing backbone circuits were replaced with greater bandwidth and more redundancy. "In some cases, we pulled off 999% increase in bandwidth—almost 1000 times the bandwidth we originally had," Rogers said. "So, once the new backbone was in place, the issues of bandwidth constraint disappeared. Today, we have no bandwidth constraint issues in our AVVID deployment over the WAN."

Software and Hardware Upgrades

In the days of the AS5300 when the PBXs were still in place, hardware, firmware, and software upgrades were often needed. However, this was the result of a still developing technology. "When we encountered some bugs, we had to upgrade to a d/e code," Rogers said. "But at Cisco, we have always had the luxury of maxing out our boxes with the highest processors, memory, DSP chips, etc."

The testing procedures then followed the process of any typical hardware/software upgrade. "This meant getting on the phone with someone at the other end of the call while having debugs enabled on both ends of the routers," Rogers said. "The Telecom group watched the activity on the PBX or CallManager and then we would place calls, watch that call in the debug, analyze the problem if one occurred and work through it with the configuration parameters on either the routers or the PBXs until it was fixed."

Best Practices: WAN

- In order to analyze the gaps between existing bandwidth and device requirements, several categories of information need to be collected, including the existing WAN topology, device information, and resource utilization.
- Voice bandwidth requirements depend on a number of parameters, such as the sampling rate, codec, link type, header compression techniques, and the number of simultaneous voice calls.
- Analyze upgrade requirements for hardware, software, and WAN connectivity. Hardware upgrades were needed to ensure adequate processing power; software upgrades were implemented to support IPT features; and WAN upgrades were implemented to support the additional traffic load.
- Prior to voice deployment, all upgrades were performed on centralized call processing, WAN, and LAN. This enabled the solution to be tested prior to live voice traffic.
- A combination of assessment methods was used including live testing, Internet Performance Manager, and Cisco VoIP Readiness Net Audit.
- Define the operational turnover and production/support of the WAN. Prior to bringing the system on line, the team verified that all systems were 'go', that support personnel had been trained, and that all new support processes were approved and in place.

For more information on WAN requirements, see "IP Telephony Solution Guide" at:
http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/solution/5_implem.htm

For Cisco VoIP Readiness Net Audit:
http://www.cisco.com/warp/public/cc/serv/mkt/sup/ent/avvid/nadit_ds.htm

Technology Infrastructure Guidelines for Campus Networks
http://www.cisco.com/warp/public/cc/so/cuso/epso/entdes/cndsn_wp.htm

Network Provisioning

CAT 5/CAT 3 Wiring, Cabling Requirements

At the time of the IPT rollout, Cisco's San Jose campus cabling configuration consisted of four Category 5 and two Category 3 cables per standard wallplate. Several new buildings were going up on campus and to prepare them for the IPT deployment, the first decision was to eliminate the CAT3 cables since they would not be needed for the IP phones. Because Internet Telephony runs on existing IT data network infrastructure, the user's personal computer (PC) plugs directly into the IP phone, requiring only one port to support both the phone and PC, eliminating the need for additional cable. This had the added advantage of leaving three CAT5 cables open in each office. "This configuration helped us attain significant cost savings," said Al Valcour, RCCD, Construction Planning Project Manager. "It meant that we didn't need to install extra cables to each office."

The next area of business was to address the riser cable within each building. The riser cable ran from the Building Distribution Frame (BDF) to the Intermediate Distribution Frame (IDF). "We have one BDF per building and at least one IDF per floor, although in most cases there are two IDFs," Valcour continued. Since there was no longer a PBX in the BDF, it reduced the amount of riser cabling in each building from 900 pairs of copper running to each IDF, down to just 100 pairs. "Although we still have the extra cable in our existing buildings, we have substantially reduced its usage," Valcour said.

Cable Distance and Wall Phones

The primary challenge the team experienced during the retrofit was cable distance on existing wall phone installations. While PBX phones could be run close to 3000 ft. on CAT3, IP phones are limited to 330 ft. (100 meters). "We knew that distance might be a problem in some locations, but we found that it made more sense to use the existing cable that was there and then replace it if there was a problem," Valcour said. "We ran into a few situations where CAT3 cable was beyond the 100 meters and wouldn't retain the connection, so in those cases we had to install new cable to a new, closer location. And since we were replacing cable anyway, we upgraded to CAT5 which is a voice and data grade cable."

In cases where distance was a factor and Cisco upgraded to CAT5, Valcour retained a Cisco vendor/partner to do the installa-

tion. "We also used the cabling vendor to install all of the wall mounts required for the wall phones," said Valcour. "We had them test all wall phones for connectivity to ensure that we had full functionality and to give us time—at least three to five days—if we needed to upgrade the cabling before the retrofit."

Valcour added that in most cases today, and with the new industry standards in place calling for CAT5E, new cabling will be maintained at the 90 meter wiring closet to wall plate CAT5 standard. CAT3 cabling is limited to 10 Mbit, while CAT5 will provide up to 100 Mbit. Although both maintain the same distance limitations, they have vastly different data rate capabilities. "As long as the total CAT3 cable length is within 100 meters, it will function properly," Valcour said. "But the new industry standard minimum is CAT5E, which is what we're currently installing here at Cisco. The advantage is that regardless of the service (voice, data, video), CAT5E will support the service and enables scalability and growth potential."

Wall phones are also considerations and—depending on routing and where the cabling is running to—may require an extended length of cabling. To enable the required access from the wall field to the racks where the new IP phone connectivity was mounted on the wall, Valcour and his team ran tie cables from the wall to the racks within each IDF.

A Simplified Process

IP Telephony has made life simpler for Valcour. "In the past, we'd have large riser cables that we had to design to distribute voice, separate wall fields, and a separate voice component," said Valcour. "With integration, we now design the cabling to support the network and it supports whatever applications ride on it." Currently, Cisco is in the process of installing CAT5E. The next migration will be to CAT6, which is under review for certification and provides a higher bandwidth—up to 1 Gb Ethernet.

Power, Rack space, and Ordering circuits

Because Cisco was implementing a large IPT deployment, an important component of the migration was making sure there would be adequate rack space to fit all of the servers that would be needed and adequate power requirements to keep them running. Once that has been verified or adjusted to meet the requirements of the new converged network, not only will the implementation progress smoothly, the organization will also have the flexibility to scale in the future.

"We walked every building, entered each BDF or the location chosen to house the FXS switch, the CallManager server, and the DPA's to make sure there was adequate rack space for the different switches and the circuit installation," said Dennis Silva, Sr. Network Engineer. "We reserved rack space and verified that the necessary power was in place. If it wasn't, then we worked with Workplace Resources to get power installed there."

Every business has unique networking needs and access to different facilities. For the T1 CAT 6K's, Cisco used the ten NOCs (Network Operations Centers) located throughout the San Jose campus because of their UPS power and generator capability as well as multiple SONET rings to multiple vendors. "What that means is that your single point of failure is eliminated," Silva said. "If we lost one NOC, it would be just a blip on the screen. Nobody would even know the difference."

This strategy afforded the greatest protection to the network. "The buildings all have multiple entrances," Silva continued. "So, for instance, if someone on the facility grounds staff is out there with a backhoe and digs up one of our cables coming in from PacBel, Sprint, AT&T, or MCI, it won't effect the service because it's on a ring. The other entrance, which is on the other side of the building, will just become activated and take over." All of Cisco's NOCs have multiple entrances and multiple SONETs and have adequate UPS and generators for power backup. "They're pretty bullet proof," Silva said. "And because we're located on a flood plain, they're never on the ground floor."

Best Practices: Network Provisioning

- Like Cisco, most organizations do not have in-house expertise for cable installation. When choosing a partner, ensure that they are certified in the equipment being installed.
- Have a full understanding of the existing infrastructure before starting the retrofit. Know how your current cabling system is set up, whether there are wall fields or patch panels, and whether the existing cabling is CAT3 or CAT5.
- Make sure there is appropriate rack space to fit all of the additional servers and that the existing power configuration is adequate.

Provisioning the VLAN

In Cisco's converged network architecture, one set of IP addresses (VLAN) is used for data while another set (VVLAN or Auxiliary VLAN) is used for voice. Both coexist on each desktop switch port enabling the connection of an IP phone to the switch port and a PC connection to the phone while using different VLANs. Each IP phone requires an IP address, along with associated information such as subnet mask, default gateway, etc. This means that the need for IP addresses will double as IP phones are assigned to users. The information can be configured statically on the IP phone or it can be provided by a Dynamic Host Configuration Protocol (DHCP) server.

There are three methods of assigning IP addresses to the IP phones:

1. Assigning IP addresses using the same subnet as the data devices.

2. Modifying the IP addressing plan.

3. Creating a separate IP subnet for IP phones.

"We used the method that enabled us to create a separate IP subnet for IP phones," said Paul Molyski, IT LAN Project Manager. The new subnet was positioned in a private address space—network 10.0.0.0. Using this scheme, the PC was placed on a subnet reserved for data devices and the phone was on a subnet reserved for voice. "Having the phone learn its IP configuration dynamically eliminated our having to manually configure the IP phone," Molyski said. "So when the IP phone powers up, it gets its voice VLAN number automatically, then sends a DHCP request on that subnet for an IP address.

The automated mechanism by which the IP phone gets its voice subnet was provided through enhancements to the Cisco Discovery Protocol (CDP). "IP addresses are a valuable commodity," Molyski said. "Using private IP addresses for the IP phone system avoids 'burning up' any valuable registered IP addresses."

Connecting to Voice Mail

Depending on an organization's needs and existing network architecture, connecting to Voice Mail will depend upon whether the migration entails putting in a new voicemail system or integrating to an existing voicemail system. "We did both," Garcia said. "We put in a new voicemail system and we integrated it with our existing system." Because Cisco opted to share voicemail systems, it was critical that they performed the traffic analysis up front in order to identify how many ports were actually being utilized.

Best Practices: Provisioning the VLAN

- Use the IP Telephony deployment as an opportunity to review your entire IP address space allocation scheme, making re-assignments and re-addressing changes that will benefit the organization.
- Align the data and voice address block assignments so that they are the same size. This will make the network design easier to follow and aid in troubleshooting.
- For large installations, take advantage of the auxiliary VLAN feature of Cisco switches because it preserves registered IP address space.

"When you've got 5,000 users on a voicemail system and you're using 100 ports during your peak time, the PBX's can queue the phone calls," said Dennis Silva, Voice Services Senior Network Design and Engineer. "CallManager works a little differently. If you have 110 calls going to that box all at the same time but only 100 ports, those last ten people are just going to hear ringing until a port frees up and the system drops them into that port." The CallManager can accept as many calls as there are ports. Therefore, a careful traffic analysis done ahead of time to identify how many calls are typically expected during peak times will eliminate that potential problem.

Site Survey

Site readiness is crucial to rapid deployment since site deficiencies will most likely delay the implementation. The Implementation team used the Site Survey to ensure readiness by collecting key information highlighting the gap between what currently existed at the site and what would be required to implement the solution. "The survey team was probably the most important piece of the entire retrofit process and the reason why it went so smoothly," said Del Hays, AVVID Support Manager.

The survey team was responsible for surveying every telecom service in the building, including fax machines, modems, regular phones, and those users needing special configurations, such as the Boss/Admin feature. "They identified every service that was in the building and verified whether that service was currently working," said Chad Ormondroyd, Implementation Team Lead. This saved the team hundreds of hours when they performed the weekend uploads because problems were identified and corrected ahead of time.

The survey team consisted of up to four Tier One technicians, depending on the size and population of the building. On Monday and Tuesday of the week prior to the weekend conversion, the survey team walked through the building, verified the

information, and then created a spreadsheet with the updated data. On Wednesday, the spreadsheet was given to the retrofit team who then used it as the final cut sheet for the upload.

The site survey was instrumental in helping to clean up the network as well. "If there was a modem or a fax line that was supposed to be in a particular location, the survey team would find it and test it to see if it was working," Ormondroyd said. "If it wasn't, then we didn't include it in the retrofit. That helped us clean out the old data at the same time we were installing the new system."

See Appendix 3-2 for Cisco Site Survey Tables. For additional detail, go to: http://www.cisco.com/warp/public/788/solution_guide/forms/index.html#ss

The Implementation

Properly preparing for the implementation was crucial to the success of Cisco's IPT deployment and each building scheduled for migration was readied for equipment installation prior to the Implementation team's arrival. This process included checking power rails, air conditioning, and circuit installation. In addition, the live circuits that connected to the equipment were fully tested to ensure that they were suitable to carry network traffic.

Once those steps were in place and the survey team had conducted the walk through, it was time to begin the retrofit and cutover to the new system. "We gave ourselves two to three days to prep the cut sheet and identify those who needed the boss/admin configuration, who needed number changes, where phones might be missing etc.," Hays said. "Then we contacted each group to get number changes set up, voicemail boxes built, and make any other necessary preparations."

The next step was to set up the BAT tools, scan the phones, and label the boxes with the locations, separating everything by floors. Once the phones were scanned, the team waited until after hours—typically after 5 p.m. on weekdays—to upload them into the system. When the upload was complete, the team began to install the new phones and remove the old PBX translations. After the installation, the Implementation team went back and tested the phones to make sure that everything was in agreement with the worksheet and to address any discrepancies. Although testing was a manual process, as the team gained experience the process became more efficient and required less time to complete.

Best Practices: Site Survey

- Identify every service in each building to ensure a complete database upload to the CallManager.
- Conduct the survey on the Monday and Tuesday of the week prior to the conversion to ensure that the retrofit team has time to prepare the cut sheet and to create solutions for unique configurations.
- Delete non-working and unidentified modems and fax lines from the spreadsheet to ensure a clean network. (The exceptions are those buildings with business mission-critical users).
- Use an experienced survey team composed of Tier 1 technicians already familiar with the existing set-ups.

For an implementation checklist, see Appendix 3-3.
For Retrofit Implementation Procedures, see Appendix 3-6.

Boss/Admin Phone Configurations

The IP Telephony Boss/Admin feature enables admin personnel to answer other users' phone lines, such as a manager or anyone else in the admin's call group. In order to configure the appropriate phones, the survey team had to identify which users needed that feature. (See Module 2 "Converting Executive Row"). Following is a sample template that the survey team used to collect that information.

After the retrofit for that building was complete, each administrative assistant was interviewed to ensure that they were comfortable with the IP phones and to address any problems they may be having. The following script was used during the interviews:

- Does your phone work appropriately? Is the configuration correct?
- If you could change anything about the phone, what would it be?
- Have you found any IP phone feature gaps to be disruptive?
- Do you know how to transfer a call directly into voicemail without making the phone ring? (If no, provide instructions)
- Provide Telecom Help Desk info and make sure everyone is familiar with the Day 2 support process.

System Admin Tools

Preparing for the implementation required a concise combination of planning, procedures, processes, and tools. To aid the process and ensure this smooth transition from the PBX environment to the new IP Telephony application, system admin tools and procedures were used throughout each stage of the implementation. Following is a description of each tool. At the end of this Module are several templates, samples, and other helpful tools used by the Implementation team during the retrofit process.

Export Stations

Telecommuting is a large part of Cisco's organizational culture. Enabling users to work and maintain productivity from remote locations was a critical "must have" feature.

Export stations provide the ability for users to access voice mail and other features remotely, from home or other locations. Simple Network Management Protocol (SNMP) features for the CallManager enable network management applications to retrieve data from the server in a standard fashion.

Examples of the exported data include:

- Cisco CallManager group tables
- Region tables
- Time zone group tables
- Device pool tables
- Phone detail tables
- Gateway information tables and status traps
- CDR host log table, and performance counters

Although export stations are typically easy to enable, the team did run into a challenge that caused an otherwise avoidable delay. "One of the problems that we had in the very early stages of the implementation was an errant comma in the exported data file," Hays said. "Because someone had entered an extra comma at the end of the script, it wouldn't upload." Hays cautioned that when entering information in the hardware address that identifies the user's phone, the information must be entered in a specific sequence. "If you just scatter or throw in any kind of MAC address, it will be rejected, saying it's already in use." The MAC address must be a 12-digit number using character 0-9 or A-F. For people with no phones (i.e. VM only), a MAC address of '000000000001', '000000000002', etc. was set up to ensure that they didn't conflict.

BAT Tool/Scanner

Collecting the data and entering it manually into the new system could have been a long and cumbersome process, fraught with human error. To save time, reduce errors, and simplify the process of entering all of the data into the exported data file, the Implementation team used an automated collection process. Scanning the phone's UPC bar code—located on the outside of the box—into an Excel spreadsheet and converting it with a BAT tool, the team was able to populate the template in batches of 250 phones. The data was then segmented by which phones were going to be uploaded into which CallManager. "Utilizing the BAT tool took us only about three hours vs. the two days it would have taken had we entered the data manually. It also saved us from having to troubleshoot manual errors," Ormondroyd said.

To view a sample of the BAT tool, see Attachment 3-A.

Test Phone Procedures

Once the phones were installed, they were tested to ensure that calls were accurately routed for inbound calls, outbound calls, and for voicemail. The test procedure for IP phones was similar to the test procedure for PBX phones. "To double check that everything was working correctly, we used a manual procedure in addition to the software reports that indicated whether the calls were being steered correctly," Hays said. "Basically we picked up each phone and dialed out to test outbound calls, performed inbound dialing to ensure that it rang to the right phone, and then tested it to see if it went to voicemail appropriately."

The handset, speaker, and accessories were also tested and other external devices and parts were checked visually to ensure that none were missing or broken. "The goal was to have 100% of the phones up and working by the time the user came in to try it out," Ormondroyd said. On average, only about two to three percent of phones experienced problems steering or bad LAN connections when installing. The typical causes ranged from incorrect MAC address to misspelled names.

To see Cisco's fully detailed IP Phone Test Procedure, refer to Appendix 3-4.

Removal of Port/stations from PBX

Once all the data had been downloaded onto the CallManager, the last thing the Implementation team needed to do was delete the data from the PBX. After retrofitting those lines into the new system using the BAT tool and scanner, phone numbers were removed from the PBX database and steered onto the uniform dialing plan on the CallManager. "The most important point of this step is that in order for the phone to ring in one system, it must be completely removed from the other," said Hays. The team verified that this step was complete by running a script in the PBX to test that all extensions had been removed properly, followed by a manual test in the UDP tables to correct any problem found with individual extensions.

Adds, Moves, and Changes

All adds, moves, and changes in the building scheduled to be retrofitted were halted at least a week before the Implementation team arrived. The team worked closely with Workplace Resources (WPR) and Facility Management (FM) to ensure that this process was followed. WPR also provided a list of all users, their cube locations, and the phone numbers of everyone in the building. This information was used by the team to build the final cut sheet and enabled them to conduct an accurate dump of the PBX database to see what lines were on that PBX switch, who they belonged to, and how they were configured.

"The survey team went in ahead of us and surveyed the entire building to make sure everybody was in the location they were supposed to be in and that the PBX dump was current and accurate." Once the information was compiled and verified, the Implementation team was able to upload the data into the CallManager.

Retrofit Implementation Guide

The Retrofit Implementation Guide details the process used by the Implementation team to ensure consistency and standardization of the retrofit. The guide provides comprehensive information relative to each step in the process and includes the following topics:

- General phone information, including main prefixes, associated CallManager server names, and Voice Mail numbers.
- Cut Sheet Requirements, such as naming standards and call restriction standards for common area phones.
- Operations Retrofit Process
- Add IP Phone; Add Analog Phone
- Phone Tests
- IP Phone Spreadsheet Creation Procedures
- BAT Import Procedures
- Restricted Phone Configuration Procedures
- Miscellaneous Phone Installation Notes
- Floor Walk-Through Checklist
- Wall Phone and Wiring Punchdown
- Headset Support
- Boss/Admin Configurations; Voicemail Only Configurations for telecommuters
- Troubleshooting Phones
- Operations Room FAQ

Retrofit Implementation Guide: See Appendix 3-6.

Staffing Required for Retrofit Team

The plug and play part of the retrofit was outsourced to a Cisco partner who was already familiar with Cisco's internal telephony network and didn't have to learn everything from the ground up. The Tiger Team Project Manager designed a matrix to help ensure that the Implementation team was becoming progressively more efficient after each building's retrofit. "We multiplied the number of phones being converted by how long the retrofit took to ensure that our Partner was becoming faster and more efficient," said Stephanie Carhee, IT Project Manager. As the project moved forward and the process became more streamlined, fewer people were needed to maintain the momentum (see sample efficiency report in Appendix 3-6)

Move Team

All weekly moves required the change-out of a PBX phone to an IP phone. Weekly moves were estimated to average 250 per week, 75% of which would be PBX phones. Moves due to levitations (cube resizing) averaged 120 per week. During the period of September through May, one new building opened each month, resulting in an additional 500 to 1,000 moves per month. Staffing requirements included a project manager and six field technical engineers (FTE).

Work to be performed:

- Manage inventory control
- Identify phones to be converted
- Prepare the master spreadsheet
- Notify users of change
- Program IP phones
- Program PBX changes into batch loading tool, including removal of stations as well as steering changes
- Secure phones, assigning MAC to individuals/locations listed, writing MAC address and name on box
- Deliver the equipment to the appropriate IDF, if required
- Install and test phones

Retrofit Team

Project uplifted one building per week and averaged 500 to 600 phones per building, requiring three telecom representatives consisting of one team lead and two FTE's.

Work to be performed:

- *Day One:* Secure floor plans for buildings to be converted that week. Conduct PBX dump for the building to be converted. Secure spreadsheets from Call Centers outlining all agents and extensions to be exempt from the conversion. Provide communication to the building (i.e. e-mails, posting notices, etc.) regarding work to be performed that week. Clean up from prior week. Begin identifying all building analog lines.
- *Day Two:* Perform walkthrough of the building during business hours to collect the following: Extension and type of PBX phone, user name, building number, floor, and cube. Identify and record information for conference rooms, lobbies, breakrooms, etc. Continue identifying analog lines.

- *Day Three:* Consolidate written information gathered by walkthrough into master spreadsheet and floor plan. Compile move information for that week. Consolidate Call Center info with walkthrough info. Complete all analog line info.
- *Day Four*: Send email to users advising that telephone services will be unavailable Friday after 5:30 p.m. Consolidate written information outlining MAC assignments into master spreadsheet. Deliver spreadsheet to Implementation team to perform batch upload of info into the CM database and provide copy to Project Manager for archive and for Ops Team.

Early in the retrofit process, when the Implementation team was getting comfortable with the process, staffing consisted of up to fifteen technicians. However, that number was reduced to eight technicians by the end of the retrofit installing up to 300 phones per weekend.

For IPT Retrofit Project Gantt Chart, see Appendix 3-5.

Implementation Schedule

Monday–Tuesday:	Answer conversion questions; provide user training
Wednesday:	No activity—team's day off
Thursday:	Equipment scanning
Friday:	After 5 p.m., steer all phones to the CM. Prepare equipment and move it to identified locations. Configure special set-ups. Load phone information with BAT into CallManager.
Saturday:	Phone placement "plug and play". Begin installation.
Sunday:	Fallback day if the previous day's conversion requires extra time to execute.

Project Risk Assessment

Because of the rapid pace of the implementation, the goal was to put the processes in place that would get it done quickly and most efficiently. In order to effect a smooth, risk-free conversion, the Implementation team worked with Design/Engineering, the Support team, and the Business Unit to identify the project's severity points. Project risk factors put a stake in the ground that identified thresholds where a decision must be made whether to stop and take a step back or continue to move forward. The Implementation team needed to understand where those hot zones were that could potentially affect the project and how to react to them.

"We identified the risk factors by talking to the Engineering and Support teams," said Stephanie Carhee, IT Project Manager. "We looked at where the vulnerable areas were that could cause problems to our users, to the network, and to the overall serviceability of the system."

Without this level of planning, the implementation would be like a row of dominos—one misstep could cause everything behind it to fall as well. A risk assessment provides an 'instruction manual' that identifies what could happen, what should be done to prevent it, what to do if it does happen, and then what action to take.

See Appendix 3-6, p. 3-36 Contingency Metric: Project Risk Assessment Table.

Best Practices: Implementation

- The implementation should start off slow and build momentum. Define the schedule according to the experience of the Implementation team rather than by dates. Going too fast or too slow can have disastrous consequences. Ensure that the weekly schedule outlines key tasks.
- Be sensitive to potential "burn out". Because the Implementation team will need to work every weekend, ensure that one day off during the week is enforced. Schedule time off or retrofit clean-up time for the Implementation team during software upgrades to provide additional breaks or lighter work loads.
- Make sure that all equipment is in place before the weekend.
- Do a "Find and Replace" for any commas with spaces in the BAT phone description to prevent problems in the script.
- Use the BAT Tool/Scanner to create the exported data file to save time and reduce human error.
- Conduct manual and visual phone tests in addition to the software reports.
- Halt all Adds, Moves and Changes a week before the retrofit.
- Design an installation schedule that outlines all tasks for each day. Keep Sunday free as Plan B if more time is needed in case something goes wrong.
- Use experienced teams to conduct the site surveys, preferably technicians that know the current set-ups.
- Consider beginning the retrofit with a larger Implementation team until they become more efficient. Design a performance matrix to determine how well and fast the team is conducting the conversion. Once the team becomes more proficient, consider reducing the number of staff required to conduct the plug and play functions.

Customer Service

After six months, the Tiger Team was midway through the Cisco campus conversion. Things had gone relatively smoothly and once the team had converted a significant number of buildings without incident, it was no longer a big deal. It had transitioned to an expectation that things would continue in that mode. "After the twentieth building, our process had become very smooth," said Graham Hosie, Tiger Team Lead and Director of IT Strategic Program Management. "We had not experienced any escalations, problems or issues, and the project had become a non-event. If we continued to maintain our commitment to customer service, we knew the rest of it would proceed equally as uneventfully."

However, while the Implementation team was now comfortable and familiar with the technology, the conversion still loomed over the heads of those users who had yet to be converted. The Implementation team had to remain sensitized to the apprehension experienced by those individuals and remember that this was brand new to them. Maintaining the consistency of customer service was just as critical to the project at that point as it was in the very beginning when they retrofitted the first building.

"We found that unhappy users typically had no problem escalating their concerns," said Stephanie Carhee, IT Project Manager. "So we constantly reinforced the importance of customer service to the Project Team, specifically the Implementation and Support teams because at that point, they were the most visible."

Carhee found it helpful to design customer service rules that the team should follow as a benchmark. "For example, we mandated that all questions from users must be answered within 24 hours," she said. The team also maintained a log so that user requests and concerns didn't get lost in the shuffle. The entire Implementation team was added to the Customer Care alias to ensure that everyone knew what was going well and what needed attention.

As the initiative's Project Manager, Carhee handled all initial escalations with the Tiger Team Lead, who acted as the point of contact for all next level escalations. The Team Lead handled these escalations by applying the same rules followed by the PM and Installation team. "Flip flopping the rules and making exceptions were very rare," Carhee said. "Consistency not only made my job easier, it also enabled the team to maintain credibility when dealing with unhappy users who wanted us to bend the rules."

The team knew that complacency was not their friend. "Completing the campus conversion within one year had become the gold star we used to continue the momentum after the mid-

Best Practices: Customer Service

- Workplace Resources or Facilities Management should be a member of the Implementation team because they are familiar with the building, its layout, and those who work there.
- A survey team provides the additional checks and balances that will make the retrofit proceed much more smoothly. Verification with the site survey and PBX dump ensures additional checks and balances and integrity of data.
- Involving a representative from the company's telecom group will add another level of expertise because they will know the set-ups and unique configurations of the users.
- During the midpoint of the project, customer service can get harder to consistently maintain. Instill the importance of Customer Service to the Implementation team and be mindful of the little things that are important to users.

way point," said James Robshaw, Tiger Team Program Manager. "Raising the expectation that we needed to complete the campus and convert all 20,000 users within that timeframe became an incredible motivation."

Even though the first six months of the implementation had gone well, the Tiger Team didn't make the mistake of resting on its laurels. Consistent review of the PBX dumps enabled them to anticipate potential problems and helped to keep the project moving forward. "Nothing stops a project faster than realizing at the last minute that a special phone configuration doesn't have a timely solution in place," Carhee said. Process reviews were conducted every quarter to analyze what was working well and what improvements needed to be made. With the rapid pace of the schedule, it would be easy to make the same mistake over and over again.

A good rule of thumb to measure user satisfaction is when user phone calls switch from callers complaining about the impending change to callers wanting to influence the schedule to get their new IP phone sooner. "That swing in customer acceptance was a key measurement for us that the conversion was going well," Carhee said.

Resources

Appendix 3-1: LAN Upgrade Test Procedure

Appendix 3-2: Cisco Site Survey Tables

Appendix 3-3: Retrofit Implementation Checklist

Appendix 3-4: IP Phone Test Procedure

Appendix 3-5: Retrofit Project Gantt Chart

Appendix 3-6: Retrofit Implementation Guide

Attachment: 3-A: BAT Tool

Site Survey Tables: http://www.cisco.com/warp/public/788/solution_guide/forms/index.html#ss

Cisco IP Telephony Network Design Guide:
http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/network/index.htm

Cisco VoIP Readiness Net Audit: http://www.cisco.com/warp/public/cc/serv/mkt/sup/ent/avvid/nadit_ds.htm

"Improving Security on Cisco Routers" technical notes: http://www.cisco.com/warp/public/707/21.html.

Summary

With the right process, procedures, and tools, the implementation phase can roll out smoothly, efficiently, and on schedule. Preparing the LAN and WAN for a converged voice and data network is a critical first step, followed by provisioning the network for proper cabling, access to in-line power, and enabling the appropriate class of service. The cutover can be expedited with system admin tools and a thorough site survey that provides critical user information. Following is a short summary from each section:

LAN Infrastructure Requirements

Standardizing on the organization's LAN maintains consistency, increases network stability, and reduces support costs.

WAN Infrastructure Requirements

WAN links must be provisioned to support the minimum requirements for data, plus the additional bandwidth required for converged voice and data traffic.

Network Provisioning

IP Telephony greatly reduces the number of riser cables required at each site. However, cable distance must be addressed to ensure proper functionality.

Provisioning the VLAN

In a converged network architecture, one set of IP addresses (VLAN) is used for data, while another set (VVLAN or Auxiliary VLAN) is used for voice. Cisco created a separate private IP subnet for IP phones.

Connecting to Voicemail

By performing a careful and comprehensive traffic analysis up front, Cisco was able to integrate with its existing voicemail system.

The Implementation

The site survey collects key information about every user, service, and special configurations in the building. System admin tools increase productivity and reduce errors by automating the data gathering process. Outsourced staffing requirements should decrease during the course of the implementation, as they become more efficient with experience.

Customer Service

Ongoing sensitivity to user apprehension about the new technology must continue to be addressed, even in later stages of the implementation when things have been proceeding without incident for the Implementation team. Reinforce the importance of customer service to reduce escalations and offer users a sense of comfort with their new phones.

Module 4 addresses the Day 2 handoff to the Operations and Support team. Topics addressed include network management, power backup, monitoring and troubleshooting, serviceability, and the importance of back-up support.

Appendix 3-1: LAN Upgrade Test Procedures

1. Test at least one port in each CAT 6K 10/100 blade for data and voice traffic. Connect an IP phone and make sure it powers up and registers with the CallManager. Connect a laptop to the IP phone and make sure the laptop is able to access the network.
2. You can display the configuration of the IP phone by pressing "settings_3" and scrolling through the various configuration parameters. The parameter settings, or lack of settings, will give an indication of how far the phone registration has progressed.
3. Even if the phone does not register, the Ethernet switch portion of the phone will be operational, allowing data from an attached PC to pass through the IP phone.
4. After disconnecting an IP phone from an in-line power source, wait 10 seconds before connecting another device. The in-line power does not drop to zero immediately after a disconnect and could possibly damage another device.
5. After the CAT 6K is put into production and the IP phones have been deployed, verify available power in the CAT 6Ks by issuing the "show env power" command.

Appendix 3-2: Site Survey Tables

Gathering Site Information

General Site	Record the following general site information during the initial survey.
Site Groups	Associate random groups of sites with a site group name. This allows a group of sites to be referred to by one name. These site group names can then be associated (in the tables) to other entities such as contact people. Use this table to create your own site groups as needed.
Project Contacts	Capture information about people who will need to be contacted during the course of the project for information or assistance.
Rooms	Record office, meeting, or equipment space rooms. The phone information is for capturing information on phones that may be replaced with IP phones, in a potential project meeting space, or near equipment to be worked on during the project.
Telephones	Capture existing telephone information.
IP Addresses	Record the IP address ranges in use at—or allocated to—the site.
Documentation	Record any documentation captured from the customer or during the site survey.
Individual Equipment	Capture information on communication devices related to the deployment of the Cisco IP Telephony solution. This information should be captured during the site surveys and should include the following component types: routers, LAN switches, WAN switches, PBXs, voice mail systems, ACDs, IVRs, CSU/DSUs, multiplexers, and so forth.
User Services Equipment	List and describe all existing features to maintain under the Cisco IP Telephony solution. This information should be gathered during the initial survey and site survey.
Inter-site Communications	Capture information on circuits (physical communications path) and links (virtual circuit that is carried over a physical circuit). In most cases, there are no virtual circuits for leased lines. The majority of this information should be collected during the site survey.
Service Organizations	Store information concerning outside organizations that provide services to the customer on a site or site group basis. This information should be gathered during the initial survey.
Site Survey Notes	Enter notes that clarify any ambiguous information in the site survey. Record information that is needed but not listed in any of the above mentioned tables.
Documentation	List all types of documentation, such as floor plans and diagrams that relate to the site.

Each of the site survey tables described above are available at the following location: http://www.cisco.com/warp/public/788/solution_guide/forms/index.html#ss.

Appendix 3-3: Implementation Checklist

Implementation Checklist

_____ Unpack the Equipment

_____ Verify Cabinet Power Feeds, Rails, and Earthing

_____ Physically Install Equipment in Cabinet

_____ Record Equipment Serial Numbers

_____ Verify Equipment Slot Allocations

_____ Install Intra-Cabinet Power Cables

_____ Install Intra- and Inter-Cabinet Communications Cables

_____ Verify Circuit Termination in Customer Patch Panel

_____ Power Up Cisco Equipment

_____ Verify and Load System Software and Firmware

_____ Configure the Equipment

_____ Implement the Dial Plan

_____ Dial Plan Architecture

_____ Dial Plan Configuration

_____ Configuring E-911

_____ Dial Plan

_____ Gateway Selection

_____ Gateway Interfaces

_____ Critical E-911 Considerations for All IP Telephony Deployment Models

_____ Critical E-911 Considerations for Single Site Deployment Models

_____ Conduct Installation Tests

_____ Add Equipment to Network

_____ Conduct Solution Acceptance Tests

Appendix 3-4: Phone Test Procedure

CISCO IP PHONE TEST PROCEDURE

Floor: _____ Cubicle ID: _____ Phone #: _____ Installer_____

	1. Plug the Ethernet cable into the YELLOW JACK marked 10/100SW on the back of the IP Phone.
	2. Plug the long side of the handset cord into the jack on the bottom left side of the phone with handset picture. Plug the other end into the handset itself.
	3. Plug the other end of the Ethernet cable into the YELLOW or GREEN JACK on the wall or floor.
	4. Verify the phone is receiving power by observing the front of the IP phone. Is it getting power? If not first check the connections on the Ethernet cable, then call for help from a team leader or contact the Operations Center.
	5. After approximately 2 minutes, the phone should display a number. Does this number match your list and the old phone it is replacing? If not, call for help from a team leader or contact the Operations Center.
	6. Test the phone by dialing the following numbers and verifying that you can hear using the handset and the speaker. Dial the number listed that matches the first number of the phone you are testing.
	7. Test the phone dialout capability to verify that you can hear a 1000 Hz tone.
	8. Test the phone by dialing another IP phone and verifying that you can talk with and hear the other person using the speaker and handset.
	9. Test calling the new phone from another phone to ensure steering is correct.
	10. Using the same person you called in step 8, have them call your number (**DO NOT ANSWER**) to verify that the phone rolls to voice-mail after several rings. Does the phone roll to voice-mail? If not, call for help from a team leader or contact the Operations Center.
	11. Call their number to repeat the process for their phone. Does the phone roll to voice-mail? If not then call for help from a team leader or contact the Operations Center. Notice ring volume for phone being tested and ensure that it is at moderate level, then adjust and save the new settings.
	12. Place the Getting Started manual, Quick Reference Guide along with the Operations Contact Center sheet under the phone.
	13. Place all packing material you removed from the box when unpacking the new phone back into the box and place it into the trash can in the cube or office.
	14. Unplug the old phone, wrap the cord around it and take it to the designated drop-off.
	15. Sign this sheet and place it in the designated drop-off location at the Ops Center.

Appendix 3-5: IPT Retrofit Weekly Project Gantt Chart

Day	Time	Task	Assigned To
	3 weeks before	• Reserve Ops Center and staging areas • Schedule wall phone jack brackets and wiring	PM PM
	2 weeks before	Send out building notification to users	PM
		• Request security escort for access to locked room on Saturday • Identify Escalation contact	PM
	2 weeks before, prior to 3pm Monday's Go-No Go meeting	Walk buildings, floors, and staging area Verify: • All FXS cards are installed in the BDF • Cabling is in place from the FXS cards to the punch-down block • Wall cabling is installed • Ethernet switches are installed in lab • Analog cards are ready • IP phones are available • Building is ready (from walk through) • Work areas are reserved • Security issues are identified	Retrofit Team
	1 week before, at 3pm Monday meeting	• Send out notification to users • Weekly retrofit meeting. Check off: • WPR Wiring & wall bracket ready • LAN Readiness • Analog cards ready • IP Phones available • Building Ready (from walkthrough) • Work areas reserved • Security issues identified • LAN support secured • Locks installed in Ops/staging room • IS staff on call • Carts secured for phone movement • Required cross connect wire secured	PM WPR IS LAN Telecom Eng PM PS team PM PM PM PM PM PM PM PS PS PS
Monday	8am	IS starts walk-through to produce Cut sheets Verify Ops Center is reserved	Retrofit Team PM
Tuesday	8am to 5pm	Continue cut sheet production Move patch cables/punch down jumpers into IDFs as required	Retrofit Team PS
	12am	Determine # and type of existing phones	PM
	By 5 p.m.	IP phones brought to secure staging area Cut sheet delivered from Telecom to PS	PM Telecom Ops

IPT Retrofit Weekly Project Gantt Chart (continued)

Day	Time	Task	Assigned To
	All Day	Make available multiple length LAN patch cables in BDFs as required	IS LAN
	By End of Day	Cleanup and sort cut sheet by type and cluster.	Retrofit Team
	By End of Day	Verify analog cards are programmed correctly	Retrofit Team
	By End of Day	Determine # phones required & provide info to Inventory Manager	Retrofit Team
	By End of Day	Distribute copies of cut sheet to Project Manager and others with 'need to know'	Retrofit Team
	By End of Day	Order three e-containers per floor	PM
Wednesday	8 am to 12 pm	Scan MAC address into batch	PS
	12:00 AM	Create phone placement spread sheet Print floor maps	PS PS
	5pm	Schedule phone pickup for delivery to staging area.	PM
Thursday	8am to 12pm	Scan MAC address into batch input	Retrofit Team
	8am to 5pm	Verify Analog device cut sheet Convert IP Phone Cut sheet to batch input	Retrofit Team PS PE
	9:00 AM	Set up Ops Center Activate 3 LAN ports in Ops Center	PS PE IS LAN
	2pm	Final Building Review • Review special admin configurations • Verify WPR status (wire and wall mount) • Verify WR and Staging room • Final review of cut sheet (adds & changes) • Determine if additional admin meeting is required • Final retrofit reminder	Project team
	By 5pm	Materials prep • Sort and print cut sheets for IP phone placement • Print floor maps • Print PBX collection documents • User problem reporting instruction • War room announcement update & make copies • Place sign on Ops Center door • Place three signs on e-container – "Do not remove" – Equipment count sheets – "Deliver to…"	Retrofit Team
	Start at 5pm	Analog cut starts, one floor at a time • Data entry to CM • Redirect extensions to CM • Cross connect devices	Retrofit Team
	Start at 5pm	IP wall phone cross connects	Retrofit Team

IPT Retrofit Weekly Project Gantt Chart (continued)

Day	Time	Task	Assigned To
	By End of Day	Inform Lab owners of switch installation	LAN team
	8pm	Verify e-containers availability. Notify PS if missing	Retrofit Team
Friday	9am	Move IP phones to each floor (elevator vestibule)	PS
	5:00 PM	Deliver trouble reporting communique to PS Identify test phones and analog devices Key analog input Start cross connecting analog devices to CM port in in BDF—at least one per exchange	PM PM PS PM
	5pm-12pm	IS Staff on call	PM
	Start at 5pm	Complete prep of batch data and run batch programs	Retrofit Team
	Start at 5pm	Resolve user ID conflicts from BAT run	Retrofit Team
	Start at 5pm	Restrict dialing of lobby and common area phones and lobby phone access to the directory	Retrofit Team
	Start at 5pm	Complete analog devices cut from Thursday	Retrofit Team
	Start at 5pm	Redirect extension to CM	Retrofit Team
	Start at 5pm	Install IP wall phones	Retrofit Team
	6pm	Verify batch run	PS PE
	Start at 8pm	Spot check IP Phone and analog devices, one phone per cluster	Retrofit Team
	End of Day	Verify DHCP scope for building	Retrofit Team
Saturday	Beginning of day	Review miscellaneous installation notes with temporary worker.	Temp leads
	All day	Set all IP Phones** • Place user guide & User trouble reporting instructions with each phone • Test each (see Test Phone Procedures)	Retrofit Team
		Test phone and technical leads, correcting problems as they are found.	Retrofit Team
		Disconnect PBX phone*** Place PBX phone in provided box located in elevator vestibule. Record number of phones placed in box.	Retrofit Team
		Test lobby phone and common area dialing restrictions	Retrofit Team
		Cross connect analog devices to CM port in BDF	PS
		Test each Fax, Polycom and 2500	PS
	By End of Day	Building cleanup all floors: • Collect all loose phones, locate to Ops Ctr • Close any secured door • Identify duplicate IP phones • Identify missed PBX phones • Secure phones not installed	Retrofit Team

IPT Retrofit Weekly Project Gantt Chart (continued)

Day	Time	Task	Assigned To
	Last thing Saturday	E-page Proj. Mgr. with status message. If other than ALL-OK, additionally send email with supporting detail.	Retrofit Team
Sunday	All Day	Correct problems reported on Saturday E-page PM with status message	PS, PE PS
Monday	7:30am – 5pm	Receive trouble calls and resolve problems****	Retrofit Team
	8am	Send out speed dialing announcement to building users	PM
	3pm meeting	Attend meeting directly or by conf. call Discuss both Lessons Learned & issues log	Project team Retrofit Team
	By End of Day	Move staging room stuff to Ops Ctr and cleanup	Retrofit Team
Tuesday	7:30am – 5pm	Receive trouble calls and resolve problems****	Retrofit Team
	5pm	Provide updated IP phone count, PBX phone count, and total hours worked.	Retrofit Team
	5pm	e-mail to 'avvid-docs@cisco.com' • Retrofit activity report • Retrofit Lessons Learned.doc • IP Phones 12-5.xls • Analog 12-5.xls • Forward building cut sheets to CM Database Administrator	PM
	12am	Forward lobby IP phone ports addresses to LAN group requesting them to be restricted	Retrofit Team
	By End of Day	Schedule pickup of PBX phone boxes	PM
	By End of Day	Send Ops Ctr location to Move Team, Workplace Resources and Security	PM
	By End of Day	Move Ops Ctr equipment to new location	Retrofit Team
	By End of Day	Confirm the removal of Ops Center locks Close Ops Center and enable voicemail to answer user calls until re-open scheduled for Thursday	PS
	12am	Distribute reports	PM
2 weeks after WR close		Conduct final dump of PBX to ensure all users are off the PBX	PM
		Remove Cross connects	Retrofit Team

* Completion of AVVID Infrastructure readiness audit is a prerequisite for this project

** IP phone packing material to be placed in work area trash

*** PBX telephones to be placed in provided containers

**** IS Technical staff on call to support problem resolution

Appendix 3-6: IPT Retrofit Implementation Guide

1. GENERAL PHONE INFORMATION

sjclstr1a – 853	Voice Mail: 36555
sjclstr2a – 525	Voice Mail: 52222
sjclstr3a – 526	Voice Mail: 68800
sjclstr4a – 527	Voice Mail: 74800

Speed Dial: http://sjclstr?a/ccmuser

Login to server with username 'cisco_main\username' and your NT password.

Telecom Help Desk xxxxx Option 3

2. CUT SHEET REQUIREMENTS

The following information is required from IT Telecom:

ANALOG PHONES

For all analog phones the retrofit team requires:

1. Extension
2. Floor
3. Location/Cube #
4. Type: Polycom or Fax (Modem information will be provided by the approved modem user list)
5. Description as per naming standards.
6. IDF
7. Jack Number and Color (White or Gray)

IP PHONES

For all User IP phones the retrofit team requires:

1. Extension
2. Floor
3. Location/Cube #
4. Employee Last Name
5. Employee First Name
6. Employee UserID

For all Wall Phone and Lobby IP phones (Jack #99x)the retrofit team requires:

1. IDF
2. Jack Number

For all IP phones the retrofit team requires to be specified:

1. Which are Wall Phones
2. Which phones are to have Restricted Campus Only Access

3. STANDARDS

IP PHONE NAMING STANDARDS

The following are the IP phone naming standards that appear to be used:

	Description Example	Display Example
User Phones	NAME: SJC10/5/537	Joe Smith
Conference Room Phones	Cf Hang Ten SJC16/2/252	Cf Hang Ten
IDF/BDF Phones	IDF SJC XVI SJC16/2/217	IDF SJC XVI
Break Room Phones	Break Room SJC XVI 16/1/118	Break Room SJC XVI
Copy Room Phones	Copy Room SJC XVI SJC16/3/318	Copy Room SJC XVI
Lobby Phones	Lobby SJC XVI SJC16/1/100	Lobby SJC XVI
Reception Phone	Reception SJC XVI SJC16/1/100	Reception SJC XVI

ANALOG PHONE NAMING STANDARDS

The following are the analog phone naming standards that appear to be used:

	Display Example
Polycoms	Py,Light House SJC16/4/401
Faxes	Fx,RAPD 53936 SJC16/4/G5-11
Modems	Md,Chambers SJC16/4/G5-11

CALL RESTRICTION STANDARDS

The following types of phone should be restricted for Local-Only Access which allows calling within the Campus, local, and toll-free numbers.

1. Lobby Phones
2. Break Room Phones
3. Copy Room Phones

4. OPERATIONS RETROFIT PROCESS

DOCUMENTS PRIOR TO WALK THROUGH

1. Request document with all building occupants and locations from WPR.
   a. Remove all occupants that are currently assigned IP phones with an 853 extension.
   b. Format list into order requested by Professional Services.

2. Download all of the extensions residing in the PBX EPN.
   a. Separate all analog lines from the list.
   b. Separate all common area phones from the list.
   c. Separate all lab phones from the list.

WALK THROUGH

1. Walk through all common areas.
    a. Verify room name and/or number.
    b. Verify extensions.
    c. Obtain jack numbers.
2. Walk through all conference rooms.
    a. Verify room name and/or number.
    b. Verify extension of digital phone.
        1. If wall phone, obtain and/or verify jack number.
    c. Verify whether or not room has Polycom.
        1. Verify extension.
        2. Obtain jack number.
3. Fax machines.
    a. Obtain correct locations for fax machines.
    b. Verify extensions.
    c. Obtain jack numbers.
    d. If fax is not found in building, verify through EMAN who the Fax belongs to.
        1. If not in EMAN, send a fax to machine requesting the client to respond and call for verification.
4. Walk through all cubes and offices.
    a. Verify if cube has a PBX phone.
        1. Verify client from list.
            a. Verify extension belongs to client by pressing the voice mail button.
        2. If cube only has a phone, and is not on the client list verify PBX extension by calling a display phone.
            a. Verify if this is a guest phone in the switch, and/or through EMAN.
            b. If phone is dead or has a fast busy tone, bring back to building 2 for reclaim.
        3. If there are two phones in cube:
            a. Verify which has voice mail.
            b. Reclaim second number, phone, and send to Operations.
5. Lab Phones
    a. Gain access to lab through Security.
    b. Walk through lab, capture all extensions and jack numbers.
    c. Obtain room and card reader numbers, report to Professional Services.

SPREADSHEET CLEANUP

1. Common area phones.
    a. Insert correct room numbers.
    b. Insert jack numbers for wall phones.
2. Analog lines (faxes and Polycom's)
    a. Insert locations.
    b. Insert jack numbers.
3. Client phones
    a. Insert correct locations.
    b. Insert correct extensions
4. Lab phones
    a. Create list from walk through.
    b. Insert extensions.
    c. Insert jack numbers.

FRIDAY SWITCH WORK

1. Tasman Switch
    a. Change UDP table to EPN 6 for all extensions to be uplifted.
2. Zanker switch
    a. Remove all extensions to be uplifted from switch.
    b. Change UDP to correct AAR Code for each extension.

PBX CLEANUP

1. List stations still residing on EPN.
    a. Remove all stations.
    b. Change UDP tables in switch to reflect removal.
2. Create spreadsheet.
    a. Submit spreadsheet with all remaining extensions to Operations.

5. ADD IP PHONE

It may be necessary to manually add IP phones to the system. Use the following procedures:

1. Enter **MAC Address** column on the Spreadsheet
2. Enter **Description** as per naming standards
3. Select **Device Pool** as per the Spreadsheet
4. Enter Calling Search Space = **Unlimited Access** (**853=CSS_SJAllServices**)
5. Select Button Template **Default 7960**
6. Select **Insert**
7. Select **Line 1**
8. Enter Directory Number as per the **Emptel** column on the Spreadsheet
9. Select Partition = **San Jose Campus** (**853=Cisco**)
10. Enter Calling Search Space = **Unlimited Access** (**853=CSS_SJAllServices**)
11. Select Call Waiting = **ON**
12. Enter **Forward Busy** Destination = Voice Mail Numbers as per Section 1.
13. Enter Calling Search Space = **Unlimited Access** (**853=CSS_SJAllServices**)
14. Enter **Forward No Answer** Destination = Voice Mail Numbers as per Section 1.
15. Enter Calling Search Space = **Unlimited Access** (**853=CSS_SJAllServices**)
16. Enter Display as per Naming Standards in Section 2.
17. Select 'Insert and Close'
18. Reset Phone

To add User Directory information do the following:

1. Enter **First Name** as per the Spreadsheet
2. Enter **Last Name** as per the Spreadsheet
3. Enter **User ID** as per the Spreadsheet
4. Enter Password = **abcd**
5. Enter Confirm Password = **abcd**
6. Enter Telephone Number = **Emptel** column on the Spreadsheet.
7. Select 'Associate Devices'
8. Search for the associated phone.
9. Select 'Check Box' and 'Radio Button' to select as a Primary Extension.
10. Select 'Insert'

6. ADD ANALOG PHONE

1. Select the proper gateway card.
2. Choose the next available port and select 'Add DN'
3. Enter Directory Number = '**Ext.**' column on Spreadsheet
4. Enter Partition = **San Jose Campus** (**853=Cisco**)
5. Enter Calling Search Space = **Unlimited Access without VM** (**853=CSS_SJAllServicesNoVoiceMail**)
6. Enter Display = '**Display**' column on Spreadsheet
7. Select 'Insert and Close'
8. Once all ports are added, do a Reset; then Restart on the gateway for changes to take effect.

7. PHONE TESTS

OUTGOING CALL TESTS

1. Test dialing Voice Mail numbers: xXXXX, xXXXX, xXXXX, xXXXX
2. Test calling PacBell 1000Hz test number: 9-727-0020

INCOMING CALL TESTS

1. Test calling the new phone from another phone by dialing the 5-digit extension, and let ring to ensure Voice Mail picks up (Voice Mail is on all phones except for Analog and Guest phones).
2. Test calling the new phone from another phone (9-xxx-xxxx) to ensure the steering is correct.

8. IP PHONE SPREADSHEET CREATION PROCEDURES

CUT SHEET CLEAN-UP

1. Start with the template IP phones spreadsheet.
2. Set column to do a =PROPER() function on the First and Last names to set Users case properly.
3. Do Paste Special Value, in Users, Labs, Common Areas, and Guest phones into a single IP Phone spreadsheet
4. Spot check the 'BAT Phones' worksheet and ensure it is displaying correct data.
5. Do a Find and Replace for any commas with spaces in the BAT phones description.
6. Ensure Reception Phone has a generic name and not the username of the receptionist.

BAT USERS WORKSHEET CREATION

1. Sort IP phones by "User ID"
2. Copy individual columns using (with Paste Special, then Values) of EMPFIRST, EMPLAST, USERID, MAC ADDRESS, and EXT. to "BAT Users" Worksheet.
3. Delete excess rows in "BAT Users" for phones that don't have User ID's
4. Resort the main "IP Phones" worksheet by FLR and SPID

BAT PHONES WORKSHEET CREATION

The "BAT Phones" worksheet is created automatically as it is referencing the "IP Phones" worksheet.

**NOTE: NEVER do a sort on the "BAT Phones" worksheet. Always do sorts on the "IP Phones" worksheet and it will automatically sort the "BAT Phones" worksheet. The "BAT Users" worksheet can be resorted without any problems.

9. BAT IMPORT PROCEDURES

CREATE BAT PHONE IMPORT FILES

1. See last page for sample template to create bat tool spreadsheet
2. Load the "IP Phone" spreadsheet and "BAT.XLT" spreadsheet into Excel.
3. Sort the "IP Phones" worksheet by the EMPTEL column

   (*** **NOTE: Be sure to select all columns when sorting!!!**).
4. Switch to the "BAT Phones" worksheet and select from Column A to G a group of phones for a single Device Pool, then select Copy.
5. Switch to the "BAT.XLT" spreadsheet, "Phones" worksheet, and do a 'Paste Special'; then 'Values'.
6. Select the 'Export to BAT' button and enter a filename to save the .txt files.

Example Name: c:\bat\ph525bdh.txt

7. Delete data that was copied to the BAT.XLT spreadsheet.
8. Repeat steps 3-6 for all device pools in all clusters.
9. **Once finished creating all text files. Check the beginning and end users in the text file against the spreadsheet that was used to scan the MAC addresses to ensure the files are correct!**

USER BAT PHONE IMPORT FILES

1. Sort the "BAT Users" worksheet by the EXT column
2. Select from Column A to F all the phones for a given cluster, then select Copy.
3. Switch to the "BAT.XLT" spreadsheet, "Users" worksheet, and do a 'Paste Special'; then 'Values'.
4. Select the 'Export to BAT' button and enter a filename to save the .txt files.
5. Example Name: c:\bat\users525.txt
6. Delete data that was copied to the BAT.XLT spreadsheet.
7. Repeat steps 2-6 for all user in all 4 clusters.
8. **Once finished creating all text files. Check the beginning and end users in the text file against the spreadsheet that was used to scan the MAC addresses to ensure the files are correct!**

RUNNING BAT

1. Select 'Application' then 'BAT' from Call Manager.
2. Select 'Configure', 'Phones'.
3. Enter the filename. Example: c:\bat\ph525bdh.txt
4. Select the correct template **and double-check it against the filename entered.**
5. Select 'Insert' and view the resulting log file.
6. Record any errors or conflicts.
7. Repeat steps 3-6 for all device pools in a cluster.
8. Select 'Configure', 'Users'.
9. Enter the filename. Example: c:\bat\users525.txt
10. Select 'Insert' and view the resulting log file.
11. Record any errors or conflicts.
12. Repeat steps 1-11 for all clusters.

10. RESTRICTED PHONE CONFIGURATION PROCEDURES

1. Select phone to be configured.
2. Change Calling Search Space to **Local without VM (853=Local)**
3. Select Line 1
4. Change Calling Search Space to **Local without VM (853=Local)**
5. Select 'Update and Close'
6. Reset Phone

11. MISCELLANEOUS PHONE INSTALLATION NOTES

1. Plug the IP phone into an available Yellow or Green Jack.
2. If Yellow and Green jacks are both in use, connect the phone to the PC and ensure cable is plugged properly and you hear a click!
3. Leave documentation only at user desks, not in Common Areas
4. For Wall Phones, loosely screw in bottom black screw into the wall plate to secure the phone.
5. Identify any Rogue (extensions with 4xxxx) phone Extensions and Location Information.
6. Identify any locations where we swap a phone that they appear to already have an IP phone.
7. Identify any locations with headsets.
8. Place the new phone in the same location as the old phone. If necessary, use a longer patch cable.

FLOOR WALK-THROUGH CHECKLIST

1. Identify cube and phone number for any remaining PBX phones that give a test tone when dialing 9-727-0020.
2. Identify cube and phone number for any 'Rogue Phones', i.e. Phones with extension 4xxxx
3. Pick-up any remaining PBX and white IP Selsius phones.
4. Ensure all office doors are locked and IDF/BDF's closed.
5. Cleanup any garbage that may have been missed.

12. WALL PHONE WIRING PUNCHDOWN

Punch down the 110 block in the following manner:

White 110 Block (to RJ-45 Patch Panel

3	4	5	6
|	|	|	|
3	4	5	6

Wall Phone 99x 110 Block

13. HEADSET SUPPORT

The following procedures should be used with the different models of headsets:

HEADSET MODEL	PROCEDURES
Plantronics	1. Remove Block and leave at desk. 2. Plug the headset directly into the 7960 headset jack
Telelink—SoftTalk Communications	Can't be used. Highlight web address on user page.

14. BOSS/ADMIN PHONE CONFIGURATIONS

Examples: Boss Ext.: xxxxx

Following is a sample template used to collect Boss/Admin information.

Retrofit Administrative Assistant Identification Form

To identify all administrative assistants within Building XX and to ensure no disruption of service, all call coverage information must be identified for every admin located on Floors X and X.

No.	Name	Ext.	Cube Location	Supporting Manager(s)	Supports Call Coverage/ Name & Ext.

To ensure uniformity and consistency between the various support groups, the implementation team used the following template to standardize all of the boss/admin configurations.

Boss/Admin Configuration Template

	Boss X79551		Admin X75339		
Line 1 79551	Partition CSS FWDB FWDNA Call Wait	4th line unlimited 74800 unlimited 74800 unlimited On	Line 1 75339	Partition CSS FWDB FWDNA Call Wait	San Jose Campus 2nd line 75339 2nd line 74800 unlimited On
Line 2 79551	Partition CSS FWDB FWDNA Call Wait	3rd line 4th line 79551 4th line 74800 unlimited Off	Line 2 75339	Partition CSS FWDB FWDNA Call Wait	2nd line 3rd line 75339 3rd line 74800 unlimited Off
Line 3 79551	Partition CSS FWDB FWDNA Call Wait	2nd line 3rd line 79551 3rd line 74800 unlimited Off	Line 3 75339	Partition CSS FWDB FWDNA Call Wait	3rd line Unlimited Access 74800 unlimited 74800 unlimited Off
Line 4 79551	Partition CSS FWDB FWDNA Call Wait	San Jose Campus 2nd line 79551 2nd line 79551 2nd line Off	Line 4 79551	Partition CSS FWDB FWDNA Call Wait	3rd line 4th line 79551 4th line 74800 unlimited Off
			Line 5 79551	Partition CSS FWDB FWDNA Call Wait	2nd line 3rd line 79551 3rd line 74800 unlimited Off
			Line 6 79551	Partition CSS FWDB FWDNA Call Wait	San Jose Campus 2nd line 2nd line 79551 2nd line

STANDARD BOSS/ADMIN: 2 PHONES WITH 1 LINE RINGING ON BOTH PHONES

The following procedures should be used to configure a standard Boss/Admin setup:

1. On the Boss Phone make the following changes:

   a) Line 1: xxxxx in Partition=**2nd Line**
   b) with Calling Search Space in Unlimited
   c) with Forward Busy to xxxxx in Calling Search Space Unlimited
   d) with Forward No Answer to xxxxx in Calling Search Space Unlimited

   a) Line 2: xxxxx in Partition=**San Jose Campus (853=Cisco)**
   b) Call Waiting Off
   c) with Calling Search Space in 2nd Line
   d) with Forward Busy to xxxxx in Calling Search Space 2nd Line
   e) with Forward No Answer to xxxxx in Calling Search Space 2nd Line

2. On the Admin Phone make the following changes:

   a) Line 2: xxxxx in Partition=San Jose Campus (853=Cisco)
   b) Call Waiting Off
   c) with Calling Search Space in 2nd Line
   d) with Forward Busy to xxxxx in Calling Search Space 2nd Line
   e) with Forward No Answer to xxxxx in Calling Search Space 2nd Line

STANDARD BOSS/ADMIN IN TWO LOCATIONS (FOUR PHONES TOTAL)

Repeat Standard Boss/Admin steps above for two new phones.

KNOWN BOSS/ADMIN FEATURE LIMITATIONS

The following are known feature limitations with the Boss/Admin configuration and should be communicated to the end-users:

1. The Message Waiting Indicator does not display on the Boss' phone, and instead you have to look for the Envelope symbol on the display beside the Boss extension to determine if they have a Voice Mail.
2. To check Voice Mail on the Admin phone they need to select their line first, then press the Message button. Just pressing Messages may take them to the Boss' Voice Mail.
3. If the Boss is using their first line this is not displayed as in-use on the Admin. phone. If the Boss is using their 2nd line, it is displayed as in-use on the Admins phone.

15. VOICE-MAIL ONLY CONFIGURATIONS

The following procedures should be used to set up users with Voice Mail only and no phone:

1. Search for '0000000' in the appropriate phone cluster.
2. Assign the MAC address of the phone to the next available sequential number.
3. The phone may then be re-assigned.

16. TROUBLESHOOTING PHONES

#	PROBLEM	RESOLUTION
1	Rogue Phones (Extension 4xxxx) on the cutsheet	1. Verify MAC address of the phone is configured in the correct cluster. 2. Disconnect phone from the network 3. Delete phone from the CM 853 cluster 4. Attach the phone to the network and test.
2	Rogue Phones not on the cutsheet	1. Check if MAC address of the phone is configured for a location in any of the 4 clusters. 2. If the MAC is configured in a cluster correct the phone as per Problem #1. 3. If the phone is not configured anywhere, identify the phone location and include in report.
3	Duplicate User Error when loading BAT	Go to the user's cube to see if an IP phone already exists. If so, don't install a new phone and delete the new phone out of Call Manager. If a PBX phone exists go to the User Directory and associate the UserID with the new phone.
4	Mis-pulled PACBell line in the BDF	Contact Team Lead with jack information
5	Phone won't boot.	Stuck on screen "Opening x.x.x.x" 1. Ping IP address of phone and disconnect from network to ensure it's getting an IP address. 2. If not getting an IP and DHCP is disabled on the phone, do '**#' at the phone to unlock the configuration so you can enable DHCP.
6	Analog Ports Don't Work	1. Verify the wiring. 2. Problems can occur if extensions on ports are changed on an FXS card where a reset from the Call Manager doesn't work. Contact Team Lead to get the FXS card reset from the Catalyst switch.

17. WAR ROOM FAQ

#	PROBLEM	RESOLUTION
1	I moved buildings and my phone doesn't work.	This is supported by the move team Telecom Help Desk. Call xxxxx Option #3.
2	Will Phones work with Oryx?	Oryx is not supported at the time. Future enhancements to Cisco IP phones will provide all the features of Oryx.
3	The time is off on the phones	This is a known problem and is being working on by IT Engineering.

18. RETROFIT PROJECT FAQ

1. Once a Building is fully retrofitted and the EPN disconnected, no PBX phones will work in the building.
2. The Retrofit Project will eventually convert all phones on the San Jose Campus. The deployment schedule can be found on the AVVID Retrofit Link Page.
3. All faxes and polycoms will functions as usual with no disruption in service.
4. The same prefix is required for shared lines. (ie Boss and Admin both need 525-xxxx phones)
5. If an Admin wishes to change their phone number to support their manager, 48-72 hours are required to request the new phone number to support this configuration.
6. Boss/Admin Shared lined configurations are not automatic and must be requested.
7. Unapproved Modem lines will be terminated.
8. If you have an extra PBX phone, contact the Ops Center at xxxxxx for pickup.
9. Most headsets will work on the IP phone. If not, a new order will have to be placed through the vendor.
10. Your IP phone will be able to use Speed Dial once retrofitted. Password will be 'xxxx', or 'yyyy', or 'ciscoxxx'.
11. The ability to use shared line appearances across different prefixes is under 'Priority' development by the EVVBU.
12. The call forward feature can be used to forward to internal and external numbers. However, it's not recommended to be used for Admin call coverage.
13. Oryx is not a supported feature on the IP phone. In a future IP phone release, a comparable IP phone solution (Personal Assistant) for single number reach will be made available.
14. Admin configurations for shared line appearances will be able to use up to two lines.
15. The same model of IP phone will be deployed to all users.
16. All Voice Mail functionality and passwords will remain unchanged.
17. If you want to use the IP phone on-line tutorial go to: http://avvid
18. Other AVVID web sites: http://avvid
19. The Retrofit Ops Center team can be contacted at xxxxx. Help Desk cases will not be opened during the first 48 hours after a building has been retrofitted. All user questions and concerns can be sent to retrofit-case@cisco.com

19. SAMPLE RETROFIT REPORTS

Trouble Log

CALLER NAME	EMP TEL	FLR/CUBE	PROBLEM	RESOLUTION
User A	x-xxxx	2-J6-7	Phone installed in wrong cube	Moved phone to right cube
User B	x-xxxx	4-G5-7	Cable too short/Headset not working	Replaced cable; Fixed headset
User C	x-xxxx	2-C7-6	Cable too short	Replaced cable

Sample Efficiency Metrics:

IP Telephony Retrofit Efficiency Report

Building	Total CM Devices Installed	Total Hours Worked	Total time per Phone	Total Partner Billable	Devices per Billable Hour	IP Phone Installer Hours	IP Phones Installed	IP Phones Installed per Temp Hour
A	133	314.5	2.3647	191.5	0.6945	29.5	107	3.6271
B	433	393.5	0.9088	285	1.5193	89.5	399	4.4581
C	279	345.75	1.2392	281.75	0.9902	86	238	2.7674
D	465	383	0.8237	325.5	1.4286	136.5	404	2.9597
E	359	264	0.7354	256	1.4023	80	294	3.675
F	383	323	1.1857	323	1.1857	82	339	4.134
G	285	238	0.835	238	1.0877	70	262	3.7914
H	278	260	1.0692	260	1.0692	90	262	2.9111
I	417	267	1.5617	267	1.5617	75	382	5.0933

Contingency Metric

Project Risk Assessment Table

Problem	Preventive Action	Contingency Action	Trigger	Owner
Analog cards not installed and/or programmed	Monitor installation schedule and site inspection	Postpone analog device retrofit	(Go-No Go)=no	Cisco IS
IP phones not available	Monitor stock and order early	Continue with analog upgrade	(Go-No Go) = no	Cisco IS
Power line cards not available	Monitor installation schedule and site inspection	Install with 110 power supplies	(Go-No Go) = no	Cisco IS
LAN Infrastructure failure	Capacity monitoring	Back out of building retrofit	Technical issues arise during installation relating to LAN	Cisco IS
CM Load related failures	Monitor NT	Back out of building retrofit	Technical issues arise during installation related to LAN	Cisco IS
Batch configuration Program fail	Test	Call off that week's retrofit	Friday nights processing fails	Cisco PS
PE resource issues	Meet with Partner early and often. Have a trial run before first weekend cut.	Postpone first building retrofit	Trial run is unsuccessful	Cisco PS
Multiple resources managing project	Define responsibilities, deliverables, and customer expectations.	Implement conflict management techniques	Partner and Customer personnel unclear of "go to" resource for issue resolution	Cisco PS
Partner lacks resources with required skillset to successfully install system	Meet with Customer Meet with Solutions Delivery Manager to determine skillset of Partner. Meet with Partner to define responsibilities.	Customer resources to assist in trouble-shooting problems.	Technical issues arise during deployment that prevents successful install.	Cisco PS

For a Sample Bat Tool Excel Spreadsheet
http://wwwin.cisco.com/it/client/at_work/ipt_case_study.shtml

Appendix 3-7: QoS on the Cisco IT Network

The implementation of IP Telephony throughout Cisco was the driving factor in the development of a Quality of Service (QoS) strategy on the Cisco IT global network. "Cisco's QoS solution had to provide the necessary special handling requirements by certain traffic types," said Craig Huegen, Chief Network Architect. "Cisco's desire was to build QoS end-to-end across the entire global network, with pre-defined classes of service that will permit any application to ride over the network with appropriate Quality of Service levels."

Cisco IT had been using QoS features of IOS for several years, leveraging Priority Queuing (PQ), Custom Queuing (CQ), and Weighted Fair Queuing (WFQ) features in IOS to give some priority to business-critical applications across the WAN. However, these features were typically applied only to WAN links on an ad-hoc basis, usually when utilization was running high. They were not part of a global QoS strategy.

The introduction of the Voice over IP (VoIP) modules for the 3600 series routers spurred Cisco's first requirements for a more consistent, global QoS policy. "At this time, Cisco was beta-testing a new QoS mechanism called Class-Based Weighted Fair Queuing (CBWFQ), and Cisco IT participated in the test," recalls Huegen. CBWFQ provided us the ability to lump types of traffic together into classes, then give certain amounts of bandwidth to each particular class. The addition of the priority queuing to CBWFQ allows for Low-Latency Queuing (LLQ), which was necessary for carrying real-time applications across the IT network. LAN switches like the Catalyst 6500 series were introduced with multiple queues and thresholds, enabling us to extend QoS into the LAN for IP Telephony.

"Now that we had the functionality in IOS allowing us to give priority service to real-time applications such as voice, we wanted to put together an end-to-end QoS strategy," said Huegen. The process was outlined in three significant steps.

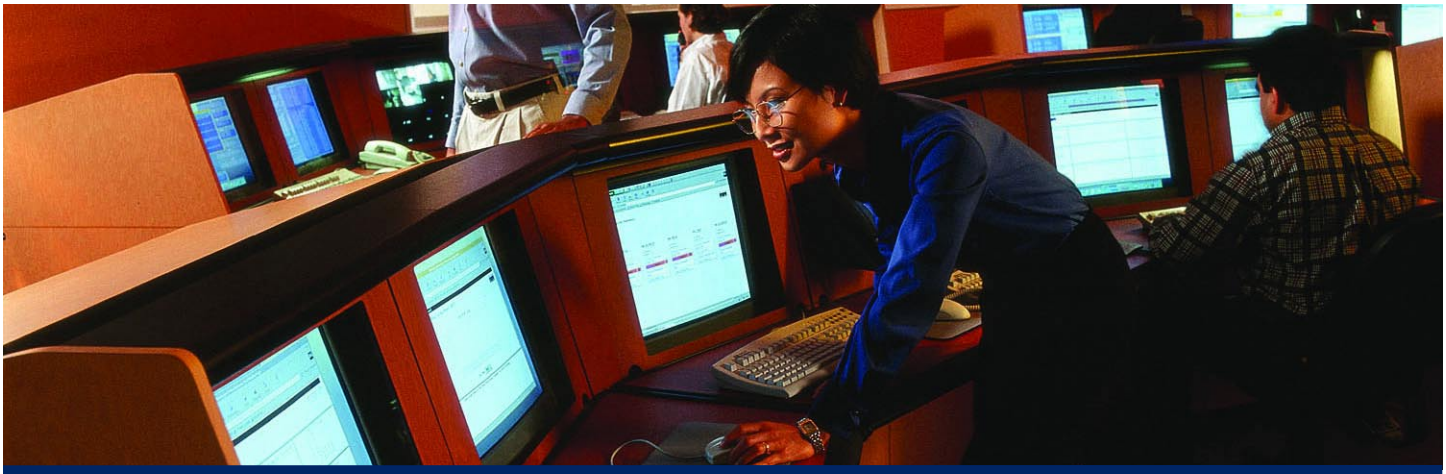
"First, we elected to use a Diffserv-based QoS strategy. We established our five major classes of service that we were to use for the global networks' voice, video, signaling and high-priority data, normal/default data, and batch traffic. We also identified the requirement for a "trusted edge" — that is, we wanted the edge of the network controlled by IT to ensure traffic was marked at the appropriate Diffserv levels."

"Next, a classification and marking strategy was built. We leveraged the auxiliary VLAN feature of the IP telephony solution to identify voice traffic from IP telephones. The Catalyst switches' capabilities to remark traffic to appropriate Diffserv levels were also used," said Huegen. "Finally, the necessary configurations to the LAN switches and WAN routers were enabled globally giving us the appropriate level of service to the traffic that had been marked at the edge."

In summary, Cisco took advantage of the QoS features inherent within its' products to implement an effective end-to-end QoS solution for not only voice but for other types of real-time traffic as well.

QoS Reference sites include:
http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/avvidqos/avvid.pdf

More information on Cisco's AVVID IP Telephony solutions (including AVVID infrastructure, deployment models, dial plans, etc.) can be found at:
http://www.cisco.com/warp/public/779/largeent/avvid_sol/cani.html
http://wwwin.cisco.com/ent/ese/solutions/voice/
http://www.cisco.com/partner/WWChannels/technologies/IPT/index.html



Introduction

Without a comprehensive, well thought out support plan, the celebration of a successful implementation will be short-lived. Module 4 discusses the elements of Cisco's IPT support plan from staffing and training to network management and monitoring tools to troubleshooting and support processes.

Module 4: Day 2 Handoff and Support

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Introduction

In the Old World, voice networks, data networks, and servers were managed independently and administrators could differentiate service issues fairly easily.

Separate groups typically managed operational processes without a great deal of interaction and often, each group had its own independent support plan with its own unique goals or service requirements to meet existing needs.

With a converged voice and data network, organizations now need to rethink that support policy. The IP Telephony solution requires groups or individuals that have historically not interacted with one another to work more closely together. New support processes that meet specific IP Telephony requirements to improve availability for voice traffic may be needed. And if not already in place, new roles and responsibilities to ensure support at each level for all areas of the solution may also be required.

The three critical components required to enable efficient operation and support of the new voice and data converged network are the processes, tools, and support team. All three components are interactive elements that must blend and coexist in order to provide effective and responsive support to the new world of VoIP.

Cisco's Support Team in Action

Sometimes, even when prolific planning has been done, schedules have been created, and processes are in place, the unexpected can still happen. The following story is an example of how a well-defined support plan saved the day during the retrofit of Cisco's Executive Row—the building that houses the company's senior executive team and their staffs.

"When we went into Executive Row to do that conversion, it was decided that we would also upgrade the CallManager to the latest release," said Stephanie Carhee, IT Project Manager. "Although we typically didn't like to plan upgrades at the same time as a retrofit, the users in this building needed features that only this upgrade could provide."

Executive Row's numerous administrative assistants support multiple managers, which meant that they were heavy phone users as well as heavy speed dial users. Their configuration required the 7914 Sidecar Expansion Module. "The upgrade was done to all of the five CallManager clusters at the same time that we were retrofitting that building and steering users to the CallManager," Carhee said.

Although the conversion typically occurred on a weekend, the decision was made to convert a limited number of phones on the previous Thursday. This gave key administrative assistants time to become familiar and comfortable with their phones before Monday, which was their heaviest call volume day. "The Thursday upgrade wasn't causing us any problems at all," Carhee said. "In fact, on Friday everything was fine and so on Saturday morning we were ready to convert the rest of the building."

However, when the Implementation team came in on Saturday morning to begin the retrofit, they found that those on Clusters 525 and 526 were not steering correctly to the CallManager. "The upgrade caused a lot of failures in the phones—they were not recognizing the CallManager," said Del Hayes, AVVID Support Manager. "We would plug a phone in but it would not initialize!" The Implementation team, a Cisco partner who also provides Tier 1 support, performed some rudimentary tests and tried some fixes, but when that didn't work, they immediately called Cisco's Tier 2 Support team.

"We came in and first performed the same steps as the Tier 1 team did," said Mike Telang, Manager, Network Operations. "Then we started looking at Trace files to see what other logs were being generated. We found that it was a bug in the software and that was when we escalated it to Tier 3." Since Cisco is also an early adaptor of its own technology, they found that the newly released software had caused some unforeseen problems.

Tier 3 Support consists of members from the original design and development team who intimately know the ins and outs of the IP Telephony network, architecture, and newly released software. "Tier 3 came in immediately and then worked overnight to find the bug, write a patch, and re-install the software to get everything up and running again," Telang said.

Although the team knew that performing upgrades was risky during the retrofit, they knew that in this case it was also necessary. "Ideally, the system should be allowed to settle for a time so glitches can be discovered," Hays said. "But we avoided a large disaster with this building because we already had a support system in place that was set up to respond to emergency issues such as this one."

Cisco's support process involves a true team effort. "From a Tier 1 support team that is on the ground with its users to our Tier 2 team who steps in to handle more complex cases to our Tier 3 technology experts, everyone did their part in the overall effort," said Carhee. "By Monday morning, no one even knew there had been a problem."

The Support Team

The key to a successful handoff from the implementation stage is a support model that is simple and scalable, and a support team that has been involved since the beginning of the initiative. Module 1 discussed the importance of developing a Tiger Team with representation from all phases of the initiative, who would remain involved throughout the duration. This continuity ensured that when it was time for the handoff from the Implementation team to the Operations/Support team, they were fully versed on the CallManager functionality, issues that arose during the deployment, the upgrade schedule, and the impact on support processes and staff.

Cisco's support team is comprised of three levels of increasing responsibility, expertise, training, and capability.

Tier 1:

Supported by Cisco's Client Services organization, Tier 1 is the customer-facing arm of the Support team. Tier 1 consists of the Help Desk who takes the initial user call for assistance, opens a support ticket, and routes the call to one of the appropriate Global Technical Response Center (GTRC) technicians on call at that time. GTRC performs first-line testing and can normally solve about 40% of incoming calls without escalation. Tier 1 support is typically outsourced to one of Cisco's long-time partners.

Cisco's four GTRC help desks are strategically located across the globe and follow one operating model to provide real time follow-the-sun user support worldwide. After IP Telephony was deployed throughout the San Jose campus, the GTRC acted as the organization's point guard to answer questions, respond to requests for help, and became the centralized point of contact for user support.

"Although our support processes didn't change, the first thing we did to prepare for IPT support was to reorganize ourselves and streamline the support process," said Tracey Mercer, San Jose Corporate GTRC Manager. "We did this by consolidating the Voice Services help desk into the GTRC so that users didn't have to call Voice Services for telephony assistance and then the GTRC for desktop or network assistance."

Integrating IP Telephony into their support processes barely caused a ripple at the GTRC, who typically learn new technology by first integrating it into their own team. "We learn by doing," Mercer said. "We were some of the first pilot users of the new technology, so we had actually used the phones before they were rolled out to the rest of the organization." GTRC also had representatives on the core Tiger Team and worked closely with the team to identify issues, recommend training, and report back to the GTRC as the initiative progressed.

"The Tiger Team came into our staff meetings and gave us regular updates on the deployment," Mercer said. "They showed us the topology, infrastructure, discussed the global deployment, and then when it was time to begin the conversion, they gave our Call Center agents personalized, one-on-one, desk-side training." FAQs, escalation contacts, best practices, and other documentation was developed to help the team further prepare for the Day 2 Handoff.

Although the processes, tools, and staff were ready for the conversion to the new technology, change itself is always a challenge because best practices are still being developed and bugs are still being worked out. "In the initial implementation, the voice quality wasn't yet up to par—but that's the whole point of being Cisco's first and best customer and we are always willing to take that on," Mercer said. Call Center agents kept both their old PBX and the new IP phones on their desks initially, and as the technology matured, they continued to give feedback, helped build the documentation, and gained the necessary history and experience with it.

"At the end of the day, support is still all about trending the problem, finding ways to resolve as much of the call as possible, and then building escalation contacts," Mercer said. "And although troubleshooting IP Telephony is different because you're troubleshooting for a desktop problem, the support process and case flow is the same."

Tier 2:
For those cases where GTRC is unable to reach a solution for the user or customer, the problem is escalated to Tier 2, Cisco's Transport team. Tier 2 consists of experts in voice services, LAN, and data and has been certified on one of three levels—entry level Network Associate; Network Professional; or Cisco Certified Internetwork Expert.

Tier 2 is staffed 24 hours a day with a rotating staff. The Tier 2 contact is paged via the on-call duty pager regarding high priority IP Telephony trouble tickets or issues that cannot otherwise be resolved by Tier 1. During slack time, Tier 2 will review the IP Telephony queue for lower priority problems and assist wherever possible and practical. If Tier 2 support is unable to resolve any issue, they will then escalate the issue to Tier 3, Cisco's Technical Assistance Center (TAC), for consultation on the problem. However, Tier 2 maintains responsibility for the ticket until the case is closed.

To resolve the problem before escalating to TAC, Tier 2 coordinates with other resources, including LAN, WAN Operation, NT Operations, and On Site Support (OSS) for server or hardware problems. Tier 2 training consists of the following:

- All Help Desk training
- Review and remote hands-on trial of all CallManager commands in the Tier 1 script
- Review and remote hands-on trials of the known bugs and fixes
- Review of all materials found on the resources Web sites
- Hands-on experience setting up new IP phones on site and new phone records in CallManager
- Overview class on IP phone and CallManager features
- CCN Installation, Support and Maintenance class

Tier 3:
The highest level of escalation begins and ends with Cisco's Design Engineers and members of the organization's Business Units. These are the design and engineer teams who were involved in the original design and adaptation of the technology and its applications. Tier 3 is Cisco's Worldwide Technical Assistance Center (TAC) and is responsible for working with the Tier 2 team to resolve the more difficult problems.

When IP Telephony issues need to be escalated to Tier 3, Tier 2 maintains ownership of the existing trouble ticket. To ensure consistency and follow through, however, a separate ticket is also opened in TAC's ticketing system as well. If no solution is available for the problem, Tier 2 support will work with TAC to ensure that the problem is listed as a bug report in Cisco's Corporate Defect Tracking System (DDTS) and escalated within the Business Unit's Development Engineering team.

Although the three levels of support enable Cisco's IPT users to get even difficult to diagnose issues resolved, users only have to make one phone call to get the ball rolling.

Support Manager

To ensure that the support program effectively managed network needs and met Cisco's current and future business goals, a Service and Support Manager (SSM) was appointed. The SSM serves as a dedicated focal point for not only Cisco's own internal users, but also for Cisco's major strategic Enterprise accounts. The SSM's responsibilities are to:

- Be the customer focal point for support issues
- Develop a comprehensive "high touch" support model
- Ensure successful delivery of all support and services
- Drive support improvements at Cisco
- Build relationships and function as a bridge to other Business Units
- Ensure customer success

"The Service and Support Manager (SSM) function is a critical element in Cisco's ability to support its users," said Graham Hosie, Tiger Team Lead and Director of IT Strategic Program Management. "The SSM is an integral member of the team as well as both our internal and external customer advocate."

Training

Early Involvement

The Tiger Team met early and often with representatives from Cisco's Support Team to ensure that as each building's retrofit was completed, the Support team was familiar with the application and was able to take on the support. Working together, they identified the current issues as well as users' needs and challenges, defined what constituted a problem area and developed a problem statement in order to match solutions and alternatives to known issues. The team recommended additional tools, training, and resources, and developed User and Support FAQs during the pilot phase to assist in the support development process.

"The Support team was engaged in all of the IPT pilot programs so they could become familiar with the new technology," said Stephanie Carhee, IT Project Manager. "The most effective way to increase speed to learning was to just give it to them and let them use it so they could see it from the users' perspective."

Certification

There are three levels of certification for any support team who is responsible for maintaining and supporting AVVID technologies.

- Cisco Certified Network Associate (CCNA)—an associate level certification in networking foundations.
- Cisco Certified Network Professional (CCNP)—a professional level certification in networking foundations.
- Cisco Certified Internetwork Expert (CCIE)—an expert level certification that leads to the highest level of achievement for network professionals.

The certification levels focus on Cisco technologies and solutions, such as cable, Internet solutions, security, SNA/IP and more.

Cisco's Certification Process: http://www.cisco.com/warp/public/10/wwtraining/

AVVID Boot Camp

Cisco Network Deployment boot camps and workshops alleviate the complexity of learning how to deploy and implement a solution for emerging technologies. Cisco's networking experts with the most up to date integration and deployment practices for the technology solution conduct these courses. Attendees will be able to successfully design, implement, operate and handle the integration aspects of a particular solution and will also receive mentoring and guidance on using Cisco's deployment Best Practices. The boot camps focus on mentoring a student to deploy and operate a complex network solution by providing intensive hands-on lab sessions that include various tasks such as network connectivity from a known network design, configuring devices, and troubleshooting.

Cisco's AVVID Boot Camp: http://www.cisco.com/warp/public/cc/serv/mkt/sup/advsv/kmntf/ntinmt/

Smooth Day 2 Handoff

The Day 2 handoff from the Implementation team to the Support team is also very critical and all documentation, potential issues, and other relevant information must be provided to the Support team. "At the time of the handoff, our team gave the Operations and Support team our cut sheet, which was a spreadsheet listing all of the lines we had cut over," said Chad Ormondroyd, IT Implementation Team Lead. "We also gave them a list of the lines that were not cut over so they could be returned to the pool of extensions assigned for future use."

Documentation

The following documentation can be found at: www.cisco.com/univercd/cc/td/doc/product/voice/c_ipphon/ip_clmgr/english/index.htm

- Cisco IP Phone Administration Guide for Cisco CallManager
- Find Your Phone Guide on the Web
- Cisco IP Phone 7960 and 7940 Series At a Glance
- Cisco IP Phone Models 7960 and 7940 User Guide
- Getting Started with the Cisco IP Phone 7910
- Quick Reference for the Cisco IP Phone 7910
- Quick Reference Cisco IP Phone 7910
- Release Notes for the IP Phone 7960/7940/7910
- Installing the Wall Mount Kit for the Cisco IP Phone
- Quick Reference Cisco IP Phone 12 SP+
- Quick Reference Cisco IP Phone 30 VIP
- Cisco IP Phone 7914 Expansion Module
- Cisco IP Conference Station 7935
- Regulatory Compliance and Safety Information for the Cisco IP Phone 7960, 7940, and 7910 Series
- Cisco IP SoftPhone
- Quick Reference Cisco IP Phone 7960/7940

Best Practices: The Support Team

- Ensure Operations and Support team involvement early and consistently throughout the planning and implementation process.
- Supplement existing staff with external experts where appropriate.
- Ensure that training is provided to meet the needs of each technical level.
- Assign ownership and develop standardization of hand-over process and documentation between Implementation and Operations/Support.

The Support Model

A big mistake that is often made whenever new technology is implemented is the temptation to completely reinvent the support model with each new application. Although the IP Telephony support model created the necessity for multiple groups to work closely together to help resolve user issues, it still took advantage of much of Cisco's existing support processes. The newly converged support model was then streamlined so that it could continue to support whatever new application was deployed throughout the organization in the future.

The tiered support model already in use at Cisco was modified to include expertise in the new technology. The tiered model was cost effective and enabled the resolution of easy to solve or repetitive issues, such as phone resets and user access passwords to be handled by Tier 1. Tier 2 tackled the more complex problems such as software issues, LAN support, and data problems. And Tier 3 required the involvement of those individuals responsible for the design and engineering of the technology solutions.

Tiered Support

Support Tier	Responsibility	Goal
Tier 1 Help Desk/GTRC	Full time help desk support. Answer support calls, place trouble tickets, work on problem up to 15 minutes. Document ticket and escalate to Tier 2 support.	Resolve 40% of incoming calls
Tier 2 Transport Team	Queue monitoring, network management station monitoring. Place trouble tickets for software problems. Provide implementation support. Take calls from Tier 1, vendor, and Tier 3 escalation Retain ownership of call until resolved.	Maintain ownership of escalated issues until resolution
Tier 3 TAC/Business Unit/ Design & Engineering	Provide immediate support to Tier 2 for all priority 1 issues. Agree to help with all problems unresolved by Tier 2 within SLA resolution period.	No direct problem ownership

With input from Design/Engineering and the Business Unit, the Support Team then designated a severity code (priority level) for each type of issue and directs the request for help accordingly. Severity codes define response times and escalation paths.

Response Times

Severity	Definition	Action	Response	Resolution or Workaround
1	25% or more of phones down or functionality severely degraded.	Immediate escalation to Tier Two.	Tier Two 5 minutes	4 hours
2	15% or more of phones down or functionality somewhat degraded.	Immediate escalation to Tier Two.	Tier Two 1 hour	8 hours
3	Single phone outage or service affecting problem.	Tier 1 tries to re-solve. If unable within 15 minutes, escalate to Tier Two.	Tier Two 1 hour	1 business day
4	New hire request for installation.	Tier One responds and resolves.	2 hours	2 business days
5	Request for phone upgrade or new feature.	Tier One responds and resolves.	24 hours	5 business days

Best Practices: The Support Model

- Develop a support model that best utilizes existing resources and supplements existing staff with external experts when appropriate.
- A tiered support model will most effectively match severity levels with the appropriate technical response staff.
- Ensure a system of checks and balances within the network to increase and sustain network architecture.
- Develop Priority 1 and 2 weekly reports and review with the Implementation and Support teams. Reports should include issues, action, and status.
- Capture and summarize lessons learned from trouble tickets and problem cases in order to provide the information to the Implementation and Support teams.
- Plan quarterly case summary meetings to discuss the number of cases, number and type of Return Material Authorizations (RMA's), failure analysis information, and other priorities to enable continuous improvement.

Network Management

Five functional areas of the network are managed to ensure the highest level of availability—fault, configuration, accounting, performance, and security.

Fault Management

Fault management detects hardware or software problems on network elements in the infrastructure that can lead to disruption or degradation of network services. A properly configured network element is capable of forwarding system messages and notifications to a management system, which can then take the appropriate action to minimize the impact on network availability based on the severity of faults reported. Fault management must be implemented properly to ensure the effectiveness of fault detection and the timely resolution of network-related issues.

Configuration Management

Configuration management manages configuration files, software, addresses, and detailed inventory information of network elements. An up-to-date configuration management system can significantly reduce the amount of time spent troubleshooting network activities. Complete and detailed inventory information also provides tremendous value in the planning and budget allocation stages of a network rollout.

Accounting Management

With increasing user and application traffic in the network, Cisco tracks the use of its network resources on the Call Manager. A thorough understanding of traffic profiles allows network planners to prioritize and allocate sufficient bandwidth for different applications. Critical and delay-sensitive applications should receive a higher priority over regular user traffic to satisfy their time and bandwidth requirements. Accounting data collected from network elements typically ranges from simple to detailed records on traffic statistics. This data can be used for planning, or as an input to the billing system for enterprises that need to implement chargeback to internal and external entities.

Performance Management

Performance management measures the performance levels of different components of an IT infrastructure. Satisfactory performance levels are dependent on network, system, and application components of the overall infrastructure. Measuring the performance of different components is crucial and can be accomplished by first defining specific metrics and then collecting them on a regular basis.

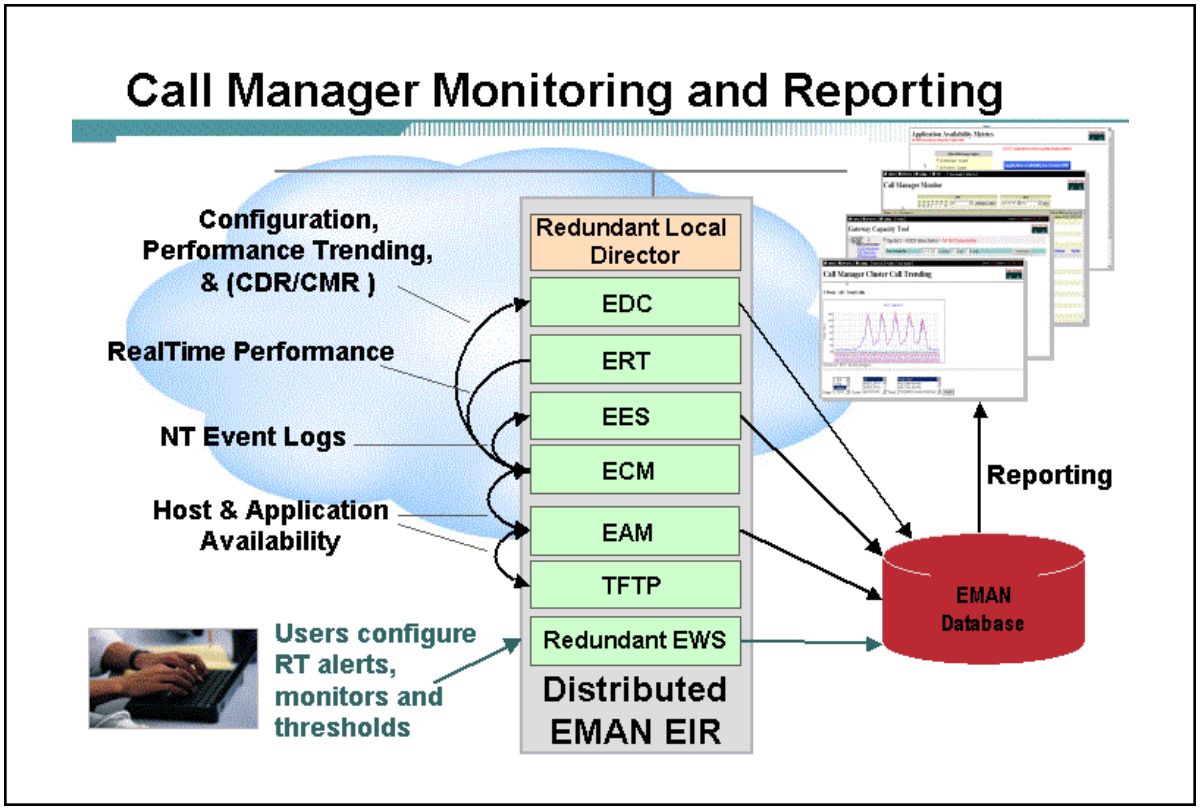
The collected performance data can be measured against performance objectives or a service level agreement (SLA) established within the organization. Historical performance data also serves as a baseline of normal operating characteristics and utilization of network elements and end systems. Performance data gathered on an ongoing basis provides network engineering with the ability to effectively plan for growth in the infrastructure.

Security Management

Security management involves the various aspects of controlling access to resources in the infrastructure. Security measures ensure that only authorized users have access to network platforms, systems, and sensitive business information. Cisco's security policy requires that the network devices are handled by the Terminal Access Controller Access Control System (TACACS). "TACACS provides a way to validate every user on an individual basis before they can gain access to the router or communication server," said Shawn Armstrong, IT Engineer. "TACACS is used by Cisco to allow finer control over who can access the router in non-privileged and privileged mode. Windows 2000 and CallManager Administration is managed with approved NT accounts and domain memberships."

Additional information can be found in IP Telephony Operations Support and Planning: http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/solution/6_operat.htm

The Support Tools



Case Reporting

Cisco uses a service/contact management system that enables multiple, global support organizations to track, manage, and report on customer service and support issues. The issues are tracked by client/contact problem submissions and support requests that are received into GTRC's Help Desk via the phone, Web, and chat sessions used in the early stages of Cisco's IT strategy. However the solution did not scale and had reached a point where it could not be upgraded for global collaboration, reporting, and integration with Cisco technology, such as EMAN, IPCC, and other applications.

A cross-functional team consisting of GTRC, Voice Services, Data Center Operations, and others, was brought together to research an IT Service/Contact Management solution. Following a four-month test and trial of several top contenders, a solution was found to replace the case reporting solution.

The solution rated high among contenders in out-of-the-box usability, integration capability, ROI, vendor reputation, track record, and product line. The results will be a smoother case flow, automation of several labor intensive activities, a Web interface that takes the place of a local installation, better tools for root cause analysis, and a more flexible and robust reporting structure. "The decision to integrate this solution will allow IT to streamline business processes, integrate Cisco technologies, fully capture and report on service levels, leverage industry best-practices, and prepare us to develop the tools necessary to evolve our service organization to new heights," said John Bruno, Vice President, Technology Marketing

The implementation will be one of the first programs to utilize the Internal Contact Center (ICCIT) Business model, which is focused on the ability to track and resolve issues, reduce time to resolution of problems, improve productivity, and reduce the cost of support.

CallManager Monitoring/EMAN

Many organizations develop their own monitoring tools that meet unique business needs for availability and quality. The EMAN (Enterprise Management) tool was developed by Cisco's IT team to further ensure that the new converged network met Cisco's exacting standards. EMAN monitors the CallManager and other related IP telephony equipment for availability and alarms, collecting historical data for proactive problem identification, trending, capacity planning, and statistical analysis.

"EMAN is our enterprise monitoring tool that monitors all devices on the network," said Anthony Garcia, IT AVVID Engineer. "It checks for heartbeat and every 15 seconds, it pings the device to make to sure it's still online. If one of the systems fails to respond within a pre-set number of pings, the Tier 2 Support staff will be automatically paged."

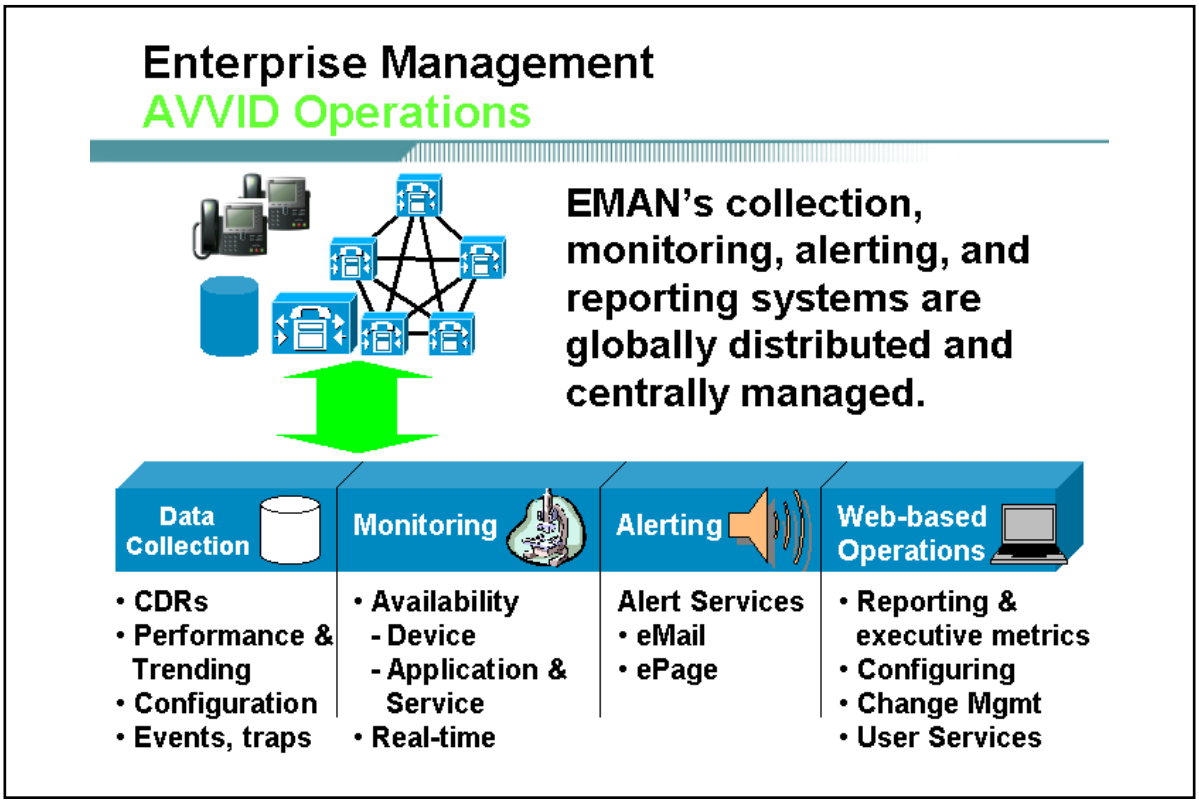
EMAN collects availability statistics from both the Cisco CallManager and from any IP addressable adjunct equipment, including the TFTP server, the DHCP server, and the Digital gateway or Analog gateway devices.

However, EMAN does more than just monitor the IP telephony infrastructure. The Call Detail Record (CDR) provides information on who is calling whom, from what extension the call is being made, whether the call went through, and the voice quality of the call.

"My team is the development organization that works closely with the Business Unit to influence product strategy and develop tools that will enhance Cisco's product solutions," said Patricia Justusson, EMAN IT Infrastructure Senior Manager. "Monitoring, availability, and alert services are just one of the functional areas we are responsible for. We also develop products that help lower infrastructure costs and improve operational systems support—including Change Management, Disaster Recovery tools, SLA tools, and a variety of others that help manage availability and improve efficiency."

Justusson's team is looking ahead to enhancing the support process. "What's really exciting is how we can auto provision these solutions," Justusson said. Currently, CallManagers are separate clusters located regionally around the world. Every Cisco site around the globe has its own set of people responsible for managing those clusters. "We're looking at how to scale Operating Support System (OSS) cost over clusters and we're working on an appliance-size model where we can lock down the servers—going down the stack—and standardize on one box."

The new tool will also host an application called the Telephony Member Management (TMM) that will track and manage all of Cisco's phone numbers enterprise-wide." This will enable everyone to use one tool to manage all of their phone numbers," Justusson said. "For example, the tool will track phone number availability and when people move or leave, it will automatically relinquish that number to the pool of re-usable extensions. And it is a granular entitlement—it gives people control only over their own set of phone numbers."



Monitoring Tools

Microsoft Performance Monitor®

Performance Monitor is a Windows 2000 application that displays the activities and status of Cisco CallManager system and reports both general and specific information in real time. "It takes certain values on the server, such as the heartbeat, system uptime, the number of phones and gateways, memory and processor load on the machine, etc.," Garcia said. "It also monitors the number of calls in progress at any time and the number of calls currently passing through a specific gateway. We want to make sure that if there's any problem with the IP phone service, we know about it as soon as the first user is aware of it."

Performance Monitor collects and displays system and device statistics for any Cisco CallManager installation and administrative tool and enables a full understanding of a system without studying the operation of each of its components. After adding the Cisco CallManager parameters, the support team defined the terms under which Cisco CallManager displays statistics generated by the system. Performance Monitor shows both general and Cisco CallManager-specific status information in real-time.

Microsoft Event Viewer®

Microsoft Event Viewer is a Windows NT Server application that displays system, security, and application events (including Cisco CallManager) for the Windows NT Server. "Most of the time, we use that tool after the fact to see what the root cause of the problem was," Garcia said. "When there's a problem, it is listed in the Event Viewer. For example, if you tried to log into our server and you didn't have authorization, it would give you three tries and then kick you out. I could look in Event Viewer to see what happened in the last hour and it would show me that your user name tried to log in unsuccessfully three times."

CallManager® Trace

CallManager traces are local log files. The IP address, TCP handle, device name, or the time stamp can be used when reviewing the CallManager trace to monitor the occurrence or the disposition of a request. "Within the CallManager is a database that stores traces of everything that happens in the system," Garcia said. "Whenever there is a problem, we look through these traces that include CCM traces, SDL traces, CTI traces, etc."

Sniffer® Trace

A sniffer is a software application that monitors IP traffic on a network and provides information—such as quantity and type of network traffic—in the form of a trace. Sniffer traces can also help identify high levels of broadcast traffic that could result in voice audio problems or dropped calls. "For example, say we're having problems with our PacBell circuit number one," said Dennis Silva, Voice Services Senior Network Design and Engineer. "We'll get a sniffer on it and see what's happening and do some test calls over it. It analyzes at the packet level and we get the results immediately."

Troubleshooting

Cisco's manual, "Operating the IP Telephony Network", addresses some common problem categories that may occur with Cisco CallManager and related devices. Each problem category suggests troubleshooting tools that can be used to help isolate and troubleshoot problems. Although not an exhaustive list, some of the more common problem categories are presented below:

Problem Category	Description
Voice Quality	Lost or distorted audio during phone calls.
Phone Resets	Phones will power cycle or reset due to one of the following: • TCP failure connecting to Cisco CallManager, or • Failure to receive an acknowledgement to the phone's KeepAlive messages.
Dropped Calls	Occur when a call is prematurely terminated.
Cisco CM Feature Issues	Caused by configuration errors or a lack of resources: these issues may include Conference Bridge or Media Termination Point.
Slow Server Response	Mismatched duples, screen savers (that consume all of the CPU when active), and third party software.
Reorder Tone Through Gateways	Occurs when users try to make a restricted call, call a number that has been blocked, call a number that is out of service, or if the PSTN has an equipment or service problem.
Gatekeeper Registration Problems	Sometimes occurs when IP connectivity is lost within the network

"When the GTRC encounters a problem they cannot resolve using the troubleshooting tools and utilities, they call us for assistance," said Mike Telang, Manager, Network Operations. "They provide us with CallManager Administration Details, plus any diagnostic information that they were able to gather, and we take it from there."

Power Backup

Power backup provides UPS power and is typically either installed to support IP Telephony devices or has already been installed to support critical network devices and servers located in data centers. All CAT 6K's and Call Manager servers that support IP Telephony at Cisco are on UPS power. However, smaller devices, such as the 3524-PWR switches, are generally located in secondary wiring closets (SDF's) and are not on UPS power. "A minimum of two hours of UPS battery back up is supplied to support the phones in a power outage," said Al Valcour, Construction Planning Project Manager. "The CallManagers are located in the Network Operating Center and have both UPS and generator back up, while the 6509 switches require 24 watt power supplies to provide power for the phones."

Power Matrix

	Reliable Networks	High Availability Networks	Non-stop Networks
IP Phones	Inline Power™ with surge protection and eight hour UPS battery backup recommended.	Inline Power™ with surge protection and eight hour UPS battery backup recommended.	Inline Power™ with surge protection and eight hour UPS battery backup recommended.
CallManager and Gateways Data Center Internetworking Infrastructure	• 30 minute UPS battery backup recommended • Equipment BTU determination and environmental provisioning process recommended • Power provisioning process recommended	• One hour UPS battery backup recommended • Equipment BTU determination and environmental provisioning process recommended • Power provisioning process recommended • UPS SNMP management process required	• Eight hour UPS battery and generator backup recommended for CM and Gateway; Four hour for Data Center and Internetworking Infrastructure • Equipment BTU determination and environmental provisioning process required • Power provisioning process required • UPS SNMP management process required

Serviceability—Five Nines

Availability and performance standards set the service expectations for Cisco's support team and help to define service and support requirements for the IPT network. Service goals were identified for availability and performance. "We included performance factors such as delay, jitter, maximum throughput, and bandwidth commitments," Telang said. "Availability for a converged network includes IP Telephony and gateway availability, in addition to overall network availability."

Cisco developed performance goals based on IP Telephony or VoIP requirements and created availability goals based on business requirements, keeping in mind relevant technical constraints and cost. The following areas determine the potential availability of the IP Telephony solution:

- Hardware path MTBF (mean time between failure) and MTTR (mean time to repair)
- Software reliability
- Power/Environment availability, including disaster preparedness
- Carrier or link availability
- Network design, including redundancy and convergence capabilities
- User error or process considerations, including the time it takes to isolate and resolve technical problems

"Once we defined the service areas and service parameters, we built a matrix of service standards," Telang said. "We also defined areas we thought could be confusing. For example, maximum response time will be very different for a round-trip ping than what users may experience on a voice call." Availability was based on expected availability defined by investigating each of areas listed above and the expected support capabilities.

Availability Target for Data-Only Network

Network Area	Availability Target	Measurement Method	Average Network Response Time Target	Maximum Response Time Accepted	Maximum Jitter Accepted
LAN	99.99%	Ping monitoring	Under 50 ms (round trip ping)	250 ms	20 ms
WAN	99.9%	Ping monitoring	Under 100 ms (round trip ping)	250 ms	20 ms

Availability Target for Voice and Data Converged Network

Network Area	Availability Target	Measurement Method	Average Network Response Time Target	Maximum Response Time Accepted	Maximum Jitter Accepted
LAN	99.99%	Ping monitoring	Under 50 ms (round trip ping)	250 ms	20 ms
WAN	99.99%	Ping monitoring	Under 100 ms (round trip ping)	250 ms	20 ms

Note: Ping does not always accurately measure the response time for RTP or voice traffic due to QOS configurations for RTP and ping process priority for many platforms. Instead, RTP traffic performance is measured with Cisco's Internet Performance Monitor (IPM), which is bundled with CiscoWorks2000.

Backup Support and Recovery

Device File Backups and Recovery

The potential always exists for device file corruption or loss due to hardware problems. Cisco prepared for this by developing a defined process for backing up network devices and CallManager systems. Most network devices including IOS gateways and MGCP gateway devices support TFTP for configuration file backups. DT-24 gateways keep their configuration on the CallManager so if a new one is required, a new MAC address is configured on the CallManager. "The CallManager system may require a system software load, as well as a set of configuration files for recovery, so these should be on hand in case of a needed recovery," Telang said. CallManager backups can be done using a supported tape drive backup or network backup to another system.

Part of Cisco's support policy included defining when backups should occur, who will perform the backup, where the backup tape or directory can be found, and who is responsible for recovery. The following matrix shows Cisco's file backup and recovery plan:

Device	Backup Method	Backup Responsibility	Backup Period	Recovery Responsibility
Call Manager (CM)	Network-CM utility to back up server XX	Tier 2 NT operations (no remote CMs backed up)	Full backup daily at 6:00 a.m.	Tier 2 NT operations
IOS gateway	Network TFTP	Data network Tier 2 operations	After configuration changes	Tier 2 data network operations
IP phone	None—information stored on CM	N/A	N/A	N/A
DT-24 gateway	None-information stored on CM	N/A	N/A	N/A
Other network devices	Network TFTP	Data network tier 2 operations	After configuration changes	Tier 2 data network operations

Because the CallManager is an NT device, Cisco's NT server administration group was assigned the responsibility for managing CallManager configuration and change. This includes the following:

- Track, manage, and archive all CallManager change control logs
- Maintain CallManager configuration consistency
- Maintain CallManager software consistency, including versions and patches
- Backup schedule
- Backup recovery procedure

Resources

Cisco Certification Process: http://www.cisco.com/warp/public/10/wwtraining/

Cisco AVVID Boot Camps: http://www.cisco.com/warp/public/cc/serv/mkt/sup/advsv/kmntf/ntinmt/

IP Telephony Operations Support and Planning: http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/solution/6_operat.htm

Support documentation: www.cisco.com/univercd/cc/td/doc/product/voice/c_ipphon/ip_clmgr/english/index.htm

Cisco's IT Change Management process: wwwin.cisco.com/CustAdv/InfoSys/Ops/DataCenter/ops_manual/change_management.pdf

IP Telephony FAQs: http://wwwin.cisco.com/support/library/ip-phone/faqs.shtml

Summary

A carefully thought out support plan will keep the new IPT network running smoothly and any problems resolved quickly. Cisco's support model includes a combination of tiered technical expertise and response processes, network monitoring, network back up and recovery, and an effective Change Management model.

The Support Team

Early engagement of the Operations and Support team will ensure familiarity with the new technology and converged network as well as issues and special configurations. Three tiers of response should be staffed with increasing expertise and ability to solve routine to complex problems.

The Support Model

Whenever possible, the support model already in existence served as Cisco's baseline for IPT support. Cisco's model includes tiered support, escalating priority designations, and associated response times. The Network Management model covers fault, configuration, accounting, performance, and security.

The Support Tools

EMAN (Enterprise Management) monitors the CallManager and other IPT equipment for availability and alarms, collecting historical data for problem identification, trending, capacity planning, and statistical analysis. Determine service thresholds and use an automatic paging system for all alerts. Other monitoring tools include Performance Monitor, Event Viewer, CallManager Trace, and Sniffer Trace.

Power Backup

All CAT 6K's and Call Manager servers that support IP telephony at Cisco are on UPS power. However, smaller devices, such as the 3524-PWR switches, are generally located in secondary wiring closets (SDF's) and are not on UPS power.

Serviceability

Availability goals are based on business requirements. Cisco's CallManager availability standards are currently set for 99.99% LAN and 99.9% WAN based on MTBF, MTTR, software, power/environment, carrier/link availability, redundancy, and fault isolation.

Backup Support and Recovery

Most IPT network devices, including IOS gateway and MGCP gateway devices, support TFTP for configuration file backups.

Module 5 is the final piece of the conversion and covers the retrofit cleanup, PBX lease returns, software upgrades, disaster recovery, and network planning for the future.

Appendix 4-1: Support FAQ

Where can I purchase an IP phone?

How can I get a sidecar?

How do I request an analog line?

Where can I get a head set for my IP phone?

I cannot receive calls from external callers?

I cannot make calls to a specific area code, why?

I am unable to transfer/hold/conference multiple calls, why?

When I am on phone calls are going into my Voice Mail?

My phone does not show up under the drop down menu at the URL for speed dial?

My Caller ID is not working on phone?

How many people can be conference called on an IP Phone?

How do I disable a Conference Call on an IP?

What if Avaya calls with IP connectivity and modem access issues?

Voice quality. There is static/distortion/popping noises on the phone line.

The guest phone in the cube is not displaying x-xxxx.

There is a new person starting in my department. He/she needs a phone and voicemail

I have downloaded softphone and would like support in setting it up.

For more information on IP Telephony FAQs, go to:
http://wwwin.cisco.com/support/library/ip-phone/faqs.shtml

For a copy of Cisco's IPT Support and Operations Solutions Guide for Day 2, go to:
http://wwwin.cisco.com/it/client/at_work/ipt_case_study.shtml

Introduction

You've almost arrived. You can see your destination and it is a fully converged voice and data network with all users migrated to IP Telephony. But there are still a few more things that need to be addressed before the celebration can begin. Module 5 discusses how Cisco manages changes to the network, implements software upgrades, and takes steps to ensure continuous and uninterrupted service on the new network. This section also discusses the PBX disconnects and returns, disposal of Cisco-owned equipment, the final clean-up effort, and how IT is preparing the network for future applications and new technologies.

Module 5: Final Piece of the Conversion

But We're Not Done Yet **5–2**

Change Management **5–3**

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Certificate

Congratulations to the
San Jose IP Telephony Retrofit Project Team

For Above & Beyond/Customer Service

The San Jose Retrofit Project Team has just completed the largest deployment of LAN Infrastructure and IP Telephony in industry history. At a Herculean pace of a building a week, the Project Team completed the entire upgrade and conversion of the San Jose campus, with its 55 buildings and nearly 20,000 users. As the PBX leases came up for renewal, the team successfully rebuilt the entire desktop LAN infrastructure, retrofitting the entire San Jose campus in just one year. The financial impact resulted in $2.5M annual savings in competitor-leased equipment and $425K annual savings in PBX Maintenance cost.

The Implementation team installed over 500 CAT6K and CAT3500 switches during the upgrade. The Project Team counted, packaged and returned 10,000 PBX legacy phones; physically removed 22 leased PBX's and 2,500 ancillary parts and components - all within the lease deadline.

When the exploration of IPT began in 1999, IP Telephony technology was still in its infancy. As part of a combined cross-functional project team effort, customer solutions, best practice principles, product workarounds, and system fixes were developed to ensure that an immature product would be a viable solution in a large campus environment. The Project Team worked closely with the Business Unit to identify bugs, fixes, and solutions that ultimately resulted in the evolution of today's Cisco IPT solution.

Today, 2002, The San Jose Retrofit Project Team has set the standard for a multi-cluster CallManager implementation and how to successfully migrate to cutting edge technology. Not only were they the first to do it on such a large scale, they also did it with minimal customer impact.

The Committee for IT Quarterly Award for Excellence
For Above and Beyond Customer Service
February 2002

But We're Not Done Yet

Cisco has come a long way since 1999 when the IP Technology exploration process first began. And the Tiger Team had come a long way from their first meeting when they met to decide on the goals, processes, and plans that would result in Cisco's year long migration to a new voice and data converged network. But the team wasn't done yet—there was still work to do. To complete the conversion, they still needed to conduct a final clean up of analog and modem lines, package and return the remaining leased PBX equipment, implement new processes that would keep the network clean and stable, and leverage VoIP into the organization's disaster recovery plans. And never one to stand still, Cisco was already looking ahead and preparing the new network for future innovations, new technologies, and new applications like Personal Assistant, Softphone, Conference Connection, Extension Mobility, and Unified Messaging. Although the LAN and WAN had been upgraded for IP Telephony, the IP phones had been installed, and the support plan was in place, the initiative wouldn't be complete until those final steps had been taken.

Change Management

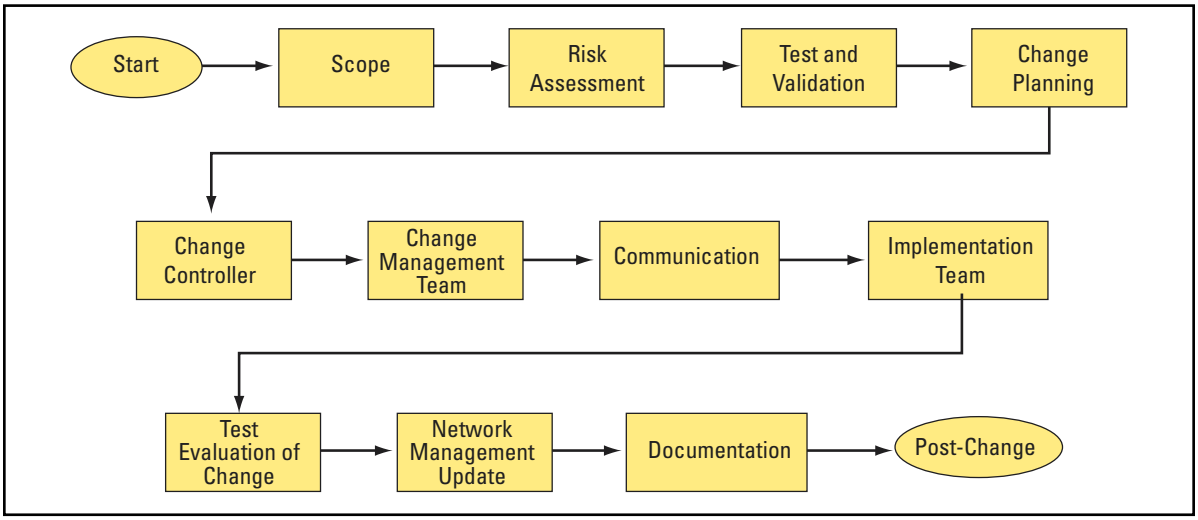
An IT network is a constantly changing landscape with software upgrades, bug fixes, new applications, and other changes continuously being introduced. To keep the network stable in the midst of constant change, a process must be implemented that provides a level of control, authorization, accountability, and monitoring of each change request.

A Change Management process helps to ensure that changes to the network do not result in negative impact. When a change to the network is needed, requestors must follow Cisco's internal Change Management process to maintain network integrity. The process is controlled and managed by Cisco's Network Operations Center's (NOC) Change Management Committee, who reviews the request, identifies the impact to the network, and determines the fit and timing with other changes and upgrades already in the funnel. Cisco identified the process for change management as follows:

1. Change controllers facilitate change management review meetings, receive and review change requests, manage change process improvements, and act as a liaison for user groups.
2. Periodic change review meetings bring together system administrators, application developers, network operations staff, and facilities groups, as well as general users.
3. Change input requirements identify the change owner, business impact, risk level, reason for change, success factors, backout plan, and testing requirements.
4. Change output requirements document updates to Domain Name Service (DNS), network map, template, IP addressing, circuit management, and network management.
5. A change approval process verifies validation steps for higher-risk change.
6. Postmortem meetings are held to review unsuccessful changes and to determine the root-cause of the change failure.

Following is a flowchart that demonstrates the process of change management and each step along the way from submitting a request to the Change Management committee to acceptance and implementation of the change.

Change Management Process Flow Chart



For more information on Change Management, refer to the Change Management Best Practices White Paper at http://www.cisco.com/warp/public/126/chmgmt.shtml

Best Practices: Change Management

- Emergency change requests that involve work to be completed before the next Change Management meeting will require the approval of the requestor's Manager and Director, the Operations Duty Manager, and the Sr. Director of Enterprise Operations and Hosting.
- Consult with Management regarding changes being planned and how those changes will be affected by the business financial quarter end freeze period.
- If a change is being made to an IS system within the Freeze period, written approval must be obtained from the IT Director or above in advance of the Change Management meeting.
- The Sr. Director of Enterprise Operations and Hosting, or his designee, will review all Change Management Requests submitted for work during the Quarter End Freeze.
- Be sensitive to those buildings that incur heavy activity during quarter end freeze and try not to conduct phone swap out of those buildings during that time.
- Prepare for quarter end freeze in the project schedule and plan the migration schedule around it.

Quarter End Freeze

Change to the network must always be carefully monitored and managed, but system stability is especially critical during a fiscal quarter end close. Because change inherently induces risk, which reduces system stability, it's important to put a process in place that minimizes the number of changes being made to the network at that point in time. If not carefully planned, the impact to the network and other systems in preparation for fiscal quarter end processing can cause a devastating slowdown or halt to those critical business activities.

"Change is fundamental to staying current and providing the best service to our business," said Stephanie Carhee, IT Project Manager. "The quarter end freeze policy is designed to allow some leeway for as long as possible prior to the close. But we never want to allow last minute changes to the network immediately prior to the Freeze start date." Although changing out phones was considered a low risk project, the team was sensitive to those buildings that required 100% reliability during quarter end freeze, such as those whose users performed financial or accounting activities. Altering the schedule to retrofit only those buildings less affected by the quarter end freeze ensured that the retrofit could continue to move forward while minimizing risk to those business critical buildings.

Cisco's Change Management committee considers the impact of all requested changes and identifies in advance all affected systems and users who will be impacted. Representation at the Change Management Meeting is mandatory for all change requests submitted and the policy mandates that changes affected by the Quarter End Freeze will ONLY be approved as a result of discussion in the Change Management Meeting.

Software Upgrades

To accommodate the massive, enterprise-wide IPT deployment, Cisco created a program, called Strategic Program Management (SPM), which became the model for large implementations. The program was focused on a chain release of software upgrades and the team faced the challenge of trying to get everything synchronized in terms of all the versions that were currently active. SPM provides a process of managing multiple projects across different disciplines and assigns a project manager who is responsible for coordinating all of the projects.

According to Doug McQueen, Manager, SPM, "Waves of new applications at Cisco are frequent because we're a technology-driven company and these new technologies often come with frequent change/upgrade cycles. You have to time the various activities so that you can make progress deploying the current upgrade before getting hit with a new release. Ideally, you want to have plenty of time to lab test the upgrades before they enter production."

After conducting a thorough review of the new software load and reviewing the new architectural design, the team reviewed the release notes and selected the smallest CallManager cluster to test in a lab environment. When the new load was stable and viable, the remaining CallManager clusters were then scheduled for upgrade.

Because the technology was new and the deployment schedule was aggressive, the team had to come up with a way to make the process workable and manageable. "Every upgrade is a different process and involves multiple steps," said Anthony Garcia, IT AVVID Engineer.

Dennis Silva, Voice Services Senior Network Design and Engineer, agreed. "Some upgrades are more complex than others, like OS upgrades, patches, etc.," Silva said. "So this is actually the first time we've ever had to put something together that documents each step that needs to be done, in what order it needs to be done, and provides checks and balances along the way." A maintenance upgrade or a maintenance patch is simpler, according to Silva. "Basically, you just click on it and off it goes. You restart the system and then supply it—it's one step. But a major upgrade is much more complex."

The Voice Services Design and Engineering team created a checklist that provides high-level steps that help to ensure the release process goes smoothly and helps to prevent or minimize business disruption. (See Appendix 5-1).

Communication is also critical in this stage. The Implementation team was on the email alias for all change management requests so that they were kept in the loop on all network changes including new software loads. "What you don't want to have happen is to find that the network is off limits during a scheduled conversion," said Stephanie Carhee, IT Project Manager. "Communication between the Engineering team, Change Management, and Implementation team will ensure a smoother transition during any change." The team also kept the Change Management Committee apprised of building conversions by submitting a change management request along with their deployment schedule.

To track known software bugs and associated release notes, go to: http://wwwin-metrics.cisco.com/FAQ.html

Best Practices: Software Upgrades

- Make sure the upgrade team represents expertise in both voice and data. The overall value will be a simplified network and ultimately a simplified organization.
- Training is essential. Find out where the gaps are and make sure the team has access to the appropriate training.
- Try to control the number of upgrades occurring at the same time. Testing too many at once means that you will lose track of what you're trying to achieve and that you may complicate diagnostics if multiple upgrades don't go as planned.
- Don't conduct an exhaustive test of everything. Monitor it, decide where the time will be most wisely spent, and focus on doing that well.
- Never introduce a new software load on the production network first. Use the Lab to conduct a thorough preliminary test.
- Ensure that the Implementation team is on the email alias for all change management requests.
- Try to mimic the production environment in the testing lab. If your new network will accommodate 300 phones, test that same number of devices in the lab. Cutting corners now will increase the chances of unhappy surprises later.

Disaster Recovery

A Disaster Recovery (DR) plan covers the hardware, software, and processes required to run critical business applications that enable business continuity in the case of a disaster. The IP Telephony application created new implications for Disaster Recovery since the voice and data network are converged.

Every organization has different needs and different views for an appropriate Disaster Recovery plan. For example, finance-based companies are required by law to have a hot standby site while the retail industry is more focused on inventory protection. “Our focus has been to identify IP Telephony-based solutions for several scenarios,” said Jayne McKelvie, IT Project Manager. “Although some of these are still in the pilot stage, we’ve taken advantage of the IP phones’ ability to reconnect and create a virtual office wherever the user happens to be.”

If a single key building is unsafe, Cisco’s DR Plan calls for moving Call Center agents to another building on campus by taking advantage of the flexibility of the CallManager to "plug and play" phones anywhere on the LAN. “In case we can't retrieve the regular phone sets, we have spares available in secure locations” McKelvie added. If the campus is unsafe but the CallManager is still operational, DR leverages the IP Telephony telecommuting tools—such as VPN and SoftPhone—and instructs employees to use their IP phones at home if they can continue working.

For example, during the September 11 crisis, many employees chose to work at home, using Cisco’s VoIP network to conduct business. In addition, Cisco identified those employees who were traveling, determined if any of them were unable to make connections to get home, and then ensured that they had access to IP Telephony tools to keep them in constant communication. In an emergency situation, the ability to communicate is critical and IP Telephony plays a vital role at Cisco.

If the campus is unsafe and the CallManager is unavailable, those same telecommuting tools can be used but can be redirected to a different CallManager. “We’ll be piloting this variation soon for IT Ops' application and using 800-number rerouting to get calls to the group, wherever they might be located,” McKelvie said. “The most important elements addressed for the new Disaster Recovery plan were flexibility and maintaining communications within the DR and IT Ops teams during an outage. Because if they can't talk to each other, we can't react to a disaster.”

No matter how many scenarios the Disaster Recovery team can envision, actual disasters can be a surprise that can encompass anything from virus attacks to natural disasters. However, with the conversion of IP Telephony technology within the San Jose campus, ensuring LAN, WAN, and Internet network security and availability has become extremely important. “The technology and products are still evolving and we're always on the lookout for new products and new ways to use existing products,” McKelvie said.

Resiliency and backup services form a key part of disaster recovery and require diligent reviews to meet the criteria for business continuity. A high availability design is very often the foundation for disaster recovery. Key tasks for resiliency planning and backup services include an assessment of the current situation and a review of existing backup support services. Vendor Support Services can also add a strong value to Disaster Recovery planning—for example, specific managed "hot standby sites" or on-site services with rapid response times. Cisco’s IPT disaster recovery plan is still a work in process, however the following preliminary best practices have been identified as critical to its success:

Best Practices: Disaster Recovery

- Identify and make a list of the top ten potential disaster types and the impact on the business. Review the list with senior management, build management awareness, and obtain signoff from management for disaster recovery planning process and funding.
- Establish a Disaster Recovery planning group to perform risk assessments and audits, establish priorities for network and applications, develop recovery strategies, create up-to-date inventory, document the plan, develop verification criteria and procedures, and prepare an implementation strategy.
- Ensure that members of the IP Telephony team are part of the Disaster Recovery team and leverage their expertise and knowledge of the VoIP Network.
- Conduct system backups on a daily basis Monday through Saturday. Hold overnight backup tapes onsite; weekly backups offsite for 35 days; and monthly backups for seven years. In a disaster situation, tapes would be used for recovery at an alternate mirror site.
- Look at disaster recovery from the new IP Telephony perspective and ensure that the disaster recovery elements traditionally found on a data network (viruses, etc.) are addressed.
- Include IP Telephony's features in disaster recovery plans, as they will provide new levels of flexibility and increased uptime.
- Continually identify new potential disaster scenarios and how to address them.
- Ensure that your back-up plans allow for you to provide two-way backup exchange to the alternate site or systems offering you back-up. Redundancy can be a two-way process.

Operating the IP Telephony Network document: www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/solution/6_operat.htm#xtocid9

PBX Lease Returns

Twenty-two of Cisco's 55 EPN PBXs were leased, which meant that the IP Telephony implementation schedule was largely dictated by the PBX lease return dates. To keep the massive effort of returning the large quantity of leased equipment organized and on schedule, the Team Leader responsible for the retrofit clean-up effort entered all of Cisco's PBX leases onto a spreadsheet and developed a Microsoft project plan to keep the returns on track. The initiative involved returning each leased PBX, along with its ancillary parts, throughout the San Jose campus. Currently only the two main leased PBXs remain on lease extension until the final clean-up is complete and the Cisco IP Contact Center solution has been deployed.

"Getting the equipment out of the buildings was the easy part," said Reid Bourdet, SPM IT Project Manager and Team Lead responsible for returning all of Cisco leased legacy PBX equipment. Like a lot of large enterprises, Cisco had taken each lease agreement and allocated that lease to various buildings. "Because of the sheer size of the deployment, what we had to do then was to pull all of the equipment back together to rebuild the original lease, ensuring that it was all there and matched the original equipment list before we returned it," Bourdet said.

The other challenge was ensuring that when the PBX de-installs were conducted, care was taken to prevent creating alarms from the equipment that remained. Cisco developed a procedure that entailed first removing the software, removing all of the trunks—the lines coming into the PBX—and then removing the cabinet from the CPU. "You have to tell the CPU that the cabinets are no longer there. If you don't, the CPU is always looking for it and will alarm the system," Bourdet cautioned.

Each PBX hardware de-install took about one working day, while the software removal required an additional three to four hours. Staffing involved four technicians who were familiar with the PBX network and knowledgeable on trunking technology. An additional telecom administrator removed the phone sets from the software configuration. "It's really important that the individuals doing the actual de-installs are qualified and familiar with this type of network," Bourdet said. "We were fortunate enough to have the necessary resources on staff. If we didn't, we would have outsourced that part of the initiative to PBX-certified individuals."

Although the equipment disconnection and retrieval went smoothly for the team, they did experience a problem reconciling their equipment list with the vendor's. "We followed the lessors' instructions to the letter, but we still ended up with disagreements about the quantities of equipment that we returned," Bourdet said. The leasing company did not inventory the equipment when it arrived at their facility, instead turning it over to a secondary market vendor. "The secondary vendor then either miscounted it or things got lost between here and there, because our records and their records did not match. If I had it to do over, I would have gone an additional step that included a box level inventory of the equipment, rather than a consolidated list," Bourdet added.

Results of PBX Lease Return Initiative

STATUS:

- 99.9% of all leased equipment up for renewal was returned.
- Over US$3.5 million dollars (market value) of equipment was returned, including 22 EPNs and 10,000 phones.
- US$128,888 per month saved in leased equipment cost.
- All final leftover equipment will be inventoried and identified for Lab testing use or reselling opportunities.

RESULTS:

- Except for Call Center agents, the San Jose Campus is now 100% retrofit. At the time of this writing, Cisco's IP Contact Center product (IPCC) is currently being deployed into the Call Centers.

Best Practices: PBX Lease Returns

- Enter all PBX lease renewal dates and associated equipment onto a spreadsheet for tracking purposes and build a project plan that schedules the de-installs and returns.
- Develop a process that prevents alarms when removing the cabinets from the PBX.
- Ensure that only PBX-certified technicians are involved in the de-installation.
- Carefully match the equipment list on the original lease agreement to the inventory being returned, create a box-level inventory list, and get a signed receiving list from the vendor.

Vendor Rules of Engagement

Maintaining a good relationship with the PBX vendor is especially critical at this point of the process. While the fact that you are discontinuing the lease arrangements, returning the equipment, and migrating to new technology isn't good news for them, honesty, trust, integrity, and continuing to treat them as valued members of the team will enable the process to go as smoothly as possible.

"We shared our deployment schedule with them and kept them up to date monthly," said Fran McBrearty, IT Project Manager. "Before the deployment began, we always had weekly project meetings and were working with them on several different projects in terms of growth, management of systems, Call Center issues, etc. So when we started doing the PBX disconnects, the same process continued."

By the time the retrofit was complete and the team began to disconnect the PBXs, the vendor had already reassigned its resources to other customers. "As the team shrank, we had to learn how to deal with the right people at the right time in order to keep the initiative moving forward," McBrearty said.

Cisco understood that the vendor couldn't keep its project managers, software engineers, and technicians assigned to them because the level of business was being substantially reduced. At this point, it's important to understand the contract requirements. The team reviewed the original service level agreements they had signed with the vendor, and while they were flexible about allowing the vendor to begin pulling and reallocating resources they had dedicated to Cisco, the Cisco team leveraged the maintenance contract to obtain the support they needed from those vendor resources that remained.

"We used the same PBX vendor to do the disconnects," said Reid Bourdet, SPM IT Project Manager. "But we made sure that we had a mutually agreed upon scope of work and negotiated the pricing on disconnects for a one-time charge rather than on an as-needed basis. We gave them the schedule, the scope of work, and then negotiated the price."

Due to the massive size of the enterprise-wide initiative, Cisco had decided to perform the IP Telephony rollout in phases. "Many companies will opt to do the cutovers as a flashcut," McBrearty said. "Basically, the PBX is here on Friday, gone on Monday. That scenario is not going to require the vendor to keep existing resources on staff throughout the implementation." But whether the retrofit is conducted in phases or flashcut in a single event, honesty, integrity, and adherence to the contract will help to maintain a good relationship on both sides.

Best Practices: Vendor Rules of Engagement

- When disconnecting the PBXs, discontinuing the lease arrangements, and returning the equipment, continue to treat the vendor with honesty, trust, integrity, and as valued members and partners of the team.
- Understand the existing service agreement before you begin the migration and ensure that the resources you need to assist with the migration are consistent with the terms of the agreement.
- If the PBX vendor is contracted to assist with the disconnects, make sure there is a mutually acceptable and agreed-upon scope of work and schedule.
- Negotiate the disconnect price as a one-time charge rather than on an as-needed basis to keep costs down.

Non-leased Equipment Disposal

Not all of the equipment replaced by the IP Telephony migration was leased. For the non-leased equipment, Cisco made the decision to either sell the equipment, transfer it internally to other locations and engineering labs inside the organization, or to discard it and write it off. Following is the procedure used by the Tiger Team's financial representatives to collect, mark, and dispose of the non-leased equipment.

For WRITE-OFFS: (Equipment not able to be redeployed or sold)

I. Information which MUST be provided to financial analyst:

   A. Serial number of the asset OR asset tracking number OR tag number OR department number where original asset was purchased (at least 1 of 4 must be provided)

   B. Current location of the asset (state, city, building)

   C. Brief asset description

II. Provide other information if known:

   A. Approximate cost of asset when originally purchased

   B. Approximate date of original purchase

   C. Department number where original asset was purchased

III. Send asset to the System Resource Center once written off.

For SALE OF ASSET:

I. See section I. A, B, C above for required information to be sent to financial analyst.

II. Customer should be notified to send the check payment to:

   Cisco Systems, Inc.
   Attn: PBX Equipment Disposal Financial Analyst
   Room XXX
   170 West Tasman Drive
   San Jose, CA 95134-1706

III. Purchaser must write asset number on the check so that Fixed Asset Accounting can apply the proceeds to the original department charged with the depreciation expense. Contact your financial analyst if you do not know the asset number.

For TRANSFER OF ASSET within Cisco: (ie. Equipment redeployed to a lab)

I. See section I. A, B, C above for required information to be sent to financial analyst.

II. Provide financial analyst with the department number that the asset will be transferred to and email confirmation from the transferee department accepting the on-going depreciation charges.

Retrofit Clean-up

When the Implementation team began the conversion to IPT, an IP Call Center solution was not yet in place. The decision was made to remove as many lines off the PBX as possible, conduct a partial retrofit, and convert everyone except for Call Center agents, their back ups, and any business critical analog lines. The team conducted a final clean-up at the end of the conversion to ensure that the Implementation team would have ample time to carefully review all analog lines housed in the same buildings as Call Center agents.

"It would have been detrimental to the Implementation team if we had accidentally removed a business critical phone line used by our Call Center team," said Stephanie Carhee, IT Project Manager. "Because we were careful in our decision to remove only those lines that were traced and identified, we are proud of the fact that we did not bring down any Call Center agents or their designated analog lines during the retrofit."

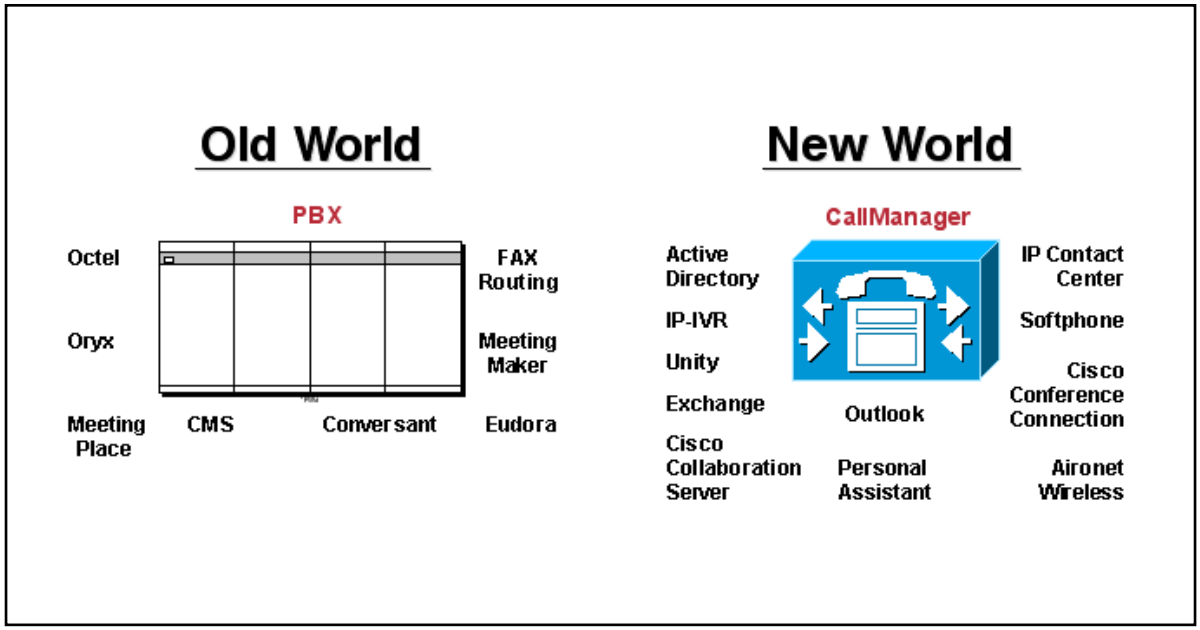
Once the retrofit was over however and the dust settled, the cleanup phase began. "We had to examine each situation separately and make the decision, for example, whether to pull out an analog line or replace it with CallManager," Bourdet said. "If a line was designated 'critical use', we replaced it with an outside line." Other situations included engineering lab applications with call-in numbers for product demos and high-speed modem lines.

The clean up ensures that all lines removed and disconnected from the PBX are not business critical and provides ample time to carefully review all of the "unidentified" analog lines and trace them in an attempt to find owners. By doing this, the Implementation team was able to carefully remove nearly 17,000 ports from the PBX—3,000 of which were analog lines. Most enterprise companies like Cisco have thousands of lines that, through the years, have either been forgotten about or are simply unused. By being mindful of this extra step, Cisco's clean-up effort eliminated thousands of unused lines and resulted in annual cost savings of up to US$42,000.

In addition, because of the accelerated pace of the project, it is possible that a guest phone might be functioning incorrectly, or a legacy phone or missed wall bracket might get lost in the shuffle. The clean-up effort provides an opportunity to walk the floor once more to ensure a clean 100% campus conversion.

"One of the things that made it much easier for us was that the Implementation team gave us a printout of what was remaining in the PBX," Bourdet said. "We started working with that and then went through a period of discovery with the users to determine what was the best course of action to take." Paying close attention to the applications that were left running through the PBX and working with users to determine what their needs were allowed the clean-up team to tailor a solution that fit the needs of the user and of the organization.

Using the same individuals for the clean-up effort as for the PBX lease returns, the team conducted the clean-up building by building, concentrating on Cisco-owned equipment only after the lease return efforts were completed. As of April 2001, San Jose still had over 22,000 ports remaining on the PBX. One year later, those ports have been reduced to less than 2,000, with mid 2002 the final target date for 100% completion.



Preparing Your Network for the Future

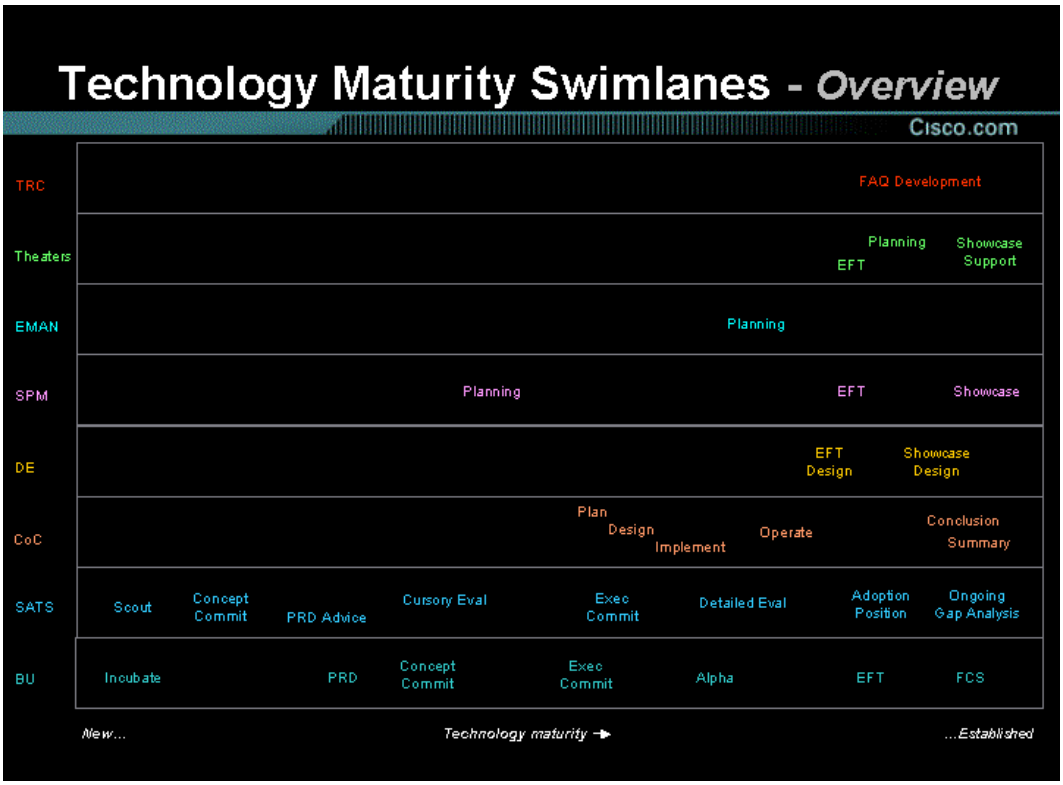
Utopia (or "PBX-free in 2003") is the unofficial name of an official project at Cisco. The project involves decommissioning all of the legacy phone equipment, migrating the entire organization across the globe to IP Telephony, and planning for growth, scalability, and the integration of future applications.

"Of course, it's not as simple as that," cautioned Paul Molyski, IT LAN Project Manager. "We have to have the solutions in place and 'Utopia' is our plan for doing that." The following graphic represents Cisco's Old World network applications and the new network that demonstrates the capability of a converged voice and data network with applications either currently in place or those in the implementation plan.

As new technology evolves, so should the systems or processes that manage them. As Cisco prepares for the "Utopia" stage, team members are developing a system that will analyze the new IP Technology for applicability, test it for feasibility, provide an adoption position, and ensure that all impacted teams are involved and in agreement.

Cisco's business philosophy has always been based on a first to market strategy. However, business decisions are driven more by what meets the needs of the organization than by dates or schedules. "Certain technologies need to scale to meet our global 40,000+ user community and because of that, we needed to take our time and complete the final IPT conversion right the first time," said Stephanie Carhee, IT Project Manager. Once the San Jose campus conversion was complete, the team identified many components that still hung off the PBX. "Therefore, instead of focusing on removing the PBX in 2003, we will ensure that every possible solution is in place to lessen the need for it until we are indeed PBX free."

The following chart outlines all the cross-functional teams affected by the rollout of new applications and identifies an interception point that the product development stage will need to evolve to before the applications are ready for deployment. New technologies are designed to provide employees with even more flexibility and productivity than ever before. As a result, the chart provides a method of determining at which point each application is ready for deployment, without creating silos and duplication of work between cross functional teams. The chart demonstrates how applications are integrated and developed into the new IP-enabled network.



With the flexibility of IPT, the floodgates to many new applications are opened. Looking at how quickly these applications can be integrated and yet maintain compatibility between hardware and software versions is the challenge. Cisco's technology experts work closely with its Business Units to determine compatibility requirements, as well as feature requirements. Understanding the needs of the various cross-functional teams will enable the team to continue to identify innovative product development requirements, adoption positions, and timing for implementation. Cisco will always be its Best First Customer and piloting these new applications will always be a primary directive.

Lessons Learned

A long-term, complex deployment of new technology that involves multiple groups and a tightly controlled schedule is a learning experience where bumps, bruises, and mistakes are turned into lessons learned and documented to enable others to benefit from the experience. Cisco's IPT deployment was no exception. Following is a consolidation of the lessons learned throughout each stage of the initiative, contributed by members of the Tiger Team who were front and center from beginning to end.

Communication

- Without Senior Management support and sponsorship, the integration and acceptance of New World Technology will be harder to reach and may inhibit an earlier user adoption curve.
- Decisions made in a vacuum will not be easily integrated. Maintain consistent communication between Design, Implementation, and Support.
- Communication is fundamental to enabling the rapid introduction of new technologies. Use the Web to communicate with users and team members and to manage all processes and procedures in order to maintain the project pace and schedule.
- Change is always difficult. Users will be less likely to commit to the project if they don't know who, what, when, and why. Set clear expectations within the user community to ensure a smoother migration.
- Beware of terminology differences—overlapping terms and acronyms from different technology tracks have different meanings. Develop a glossary of terms and consistently check for understanding.

The Team/Relationships

- Those involved in the original design and engineering of the new solution know the technology intimately. Involve Engineering when making strategic implementation decisions to leverage their expertise for unique configurations and workarounds.
- Cisco's LAN was upgraded in preparation for the new converged voice and data network. Work closely with LAN Infrastructure Team to ensure that your infrastructure is in place before the Implementation team is ready to begin the retrofit.
- The Implementation team was made up of Cisco partners who managed the company's old world telephony network. Having core members of the Implementation team who best know the existing network makes the process more efficient and helps maintain the pace and schedule of the project.
- Depreciation variables, lack of monitored budget control, and the potential for over-ordering equipment are sure ways to invite out-of-control costs. Assign a financial analyst to monitor the entire project and work with you to keep the financial aspect on track.
- Cross-functional training between the Transport and Voice teams is a must to ensure effective troubleshooting and reduce adverse changes made in the network
- Understand the value that each cross-functional team brings to the initiative. Involve Voice Services to help guide and educate customer requirements into the design and functionality; LAN to help monitor the sensitivity of voice traffic and help provide a stable infrastructure; and NT/WIN2000 to provide guidance in management of application resources.

Planning/Strategic

- Starting the implementation before you know the 'must have' features and configurations identified and ready can cause an immediate slow-down while fixes are developed and put into place. Know your users and identify the product features that are 'must have' vs 'nice to have' before you begin.
- Administrative assistants use their phone very differently from most users. Understand their special needs, the Boss/Admin relationship, and work with them to ensure that their IPT setup accommodates those needs.
- Because Senior Management and their Admin Support team are heavy phone users and often hold highly visible or customer critical positions, they may require a different procedure, or support plan than that used for the rest of the organization.
- To make the process more efficient and manageable, define your migration strategy (i.e.: by organization, by user, by building, etc.) and incorporate the new technology three ways: new hires, moves/changes, by building.
- Determine which elements will drive the project pace (PBX leases, new building openings) and design the schedule to accommodate those variables.
- Know your business critical phone users and their "critical lines" within your network so that the Implementation team is prepared to take special care not to disrupt their business operations. This includes Call Centers, modem lines, 1MB lines, analog lines, etc.
- Software upgrades are a fact of life and, in Cisco's case, were sometimes deployed at the same time as the IPT retrofit. Ensure that the project schedule allows time for routine software upgrades. Select areas with less than critical applications to retrofit while the upgrade is underway.
- Introducing new software releases on the production network before first testing the software in a lab environment can create negative impact to the network.
- Because the IP phones uses a new pair of wires on the CAT 3 cable, have wiring experts on call to correct the cabling in case you run into wall phone wiring/jack problems. Have someone from the LAN team on-site for the lab cabling.
- Ensure that security access to locked offices is authorized before the Implementation team arrives to begin the retrofit to prevent avoidable delays.

Strategic Placement of Equipment

- Place servers in diverse Data Centers on campus, equally balancing the load and failover redundancy. Ensure adequate UPS and generator backup.
- Place gateways on Network Operations Centers for diverse routing from the local and long distance providers. Ensure UPS and generator backup.
- Each part of the IP phone has been designed to work optimally when set up correctly. The phone cord will curl and knot if installed incorrectly or backward. Pay close attention even to the small details.

Understand Current Environment

- Each department and group uses telephony differently. Study customer usage for usage patterns and requirements of the business.
- Understand voicemail requirements to identify which options are required, which are obsolete, and which are best suited in a different platform.
- Understand Grade of Service being provided. Engineer a solution to aggregate traffic and trunking together to take advantage of more efficient and cost effective solutions.
- Study dial plans to fully understand existing requirements.
- Understand network infrastructure to ensure it is ready to deploy voice.
- Standardize across CallManagers. In a multi-cluster environment, standardization between systems helps in administration, troubleshooting, and problem resolution.

Technology

- The standard for desktop Ethernet service provides two 10/100 patches to each CAT5 wall plate—one live jack for the IP phone with the PC connecting to the phone.
- The convenience of not having to use an external power adapter should not be underestimated.
- Beware of PC/workstation interruptions when those devices are plugged into the phone. Create a standardized process for the Implementation team to ensure that this is done properly (i.e. standard jacks they should always use).
- Cut Sheets should include jack numbers, should be scanned for duplicate phone numbers, and sorted so offices and cubes are grouped together for greater efficiency.
- Problems with calls not going to Voice Mail may require that all the servers must be rebooted once the upgrade is completed.
- Contact the lab administrators ahead of time to verify jack #'s for the lab phones. Provide lab admins with the new jack #'s and phone #'s after the conversion. Provide the lab team with documentation for how new LAN switches are connected and cabled.

Operations

- Use the “clean network” philosophy when defining your Implementation Guidelines. The retrofit is a perfect opportunity to start out with a clean network. Operational policies will accommodate the new voice and data converged network and keep it clean and stable.
- Create configuration and speed dial backups for key admin personnel in case someone’s phone is accidentally deleted and needs to be recreated.

Resources

Change Management Best Practices White Paper: http://www.cisco.com/warp/public/126/chmgmt.shtml

Operating the IP Telephony Network document:
www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/solution/6_operat.htm#xtocid9

QDDTs FAQ (Software release notes): http://wwwin-metrics.cisco.com/FAQ.html

Summary

Change Management

In order to maintain the integrity of the network, requestors follow Cisco's internal change management process whenever a change to the network is required. Change requests are reviewed for impact to the network, fit, timing, and upgrades already in the funnel.

Software Upgrades

Cisco created a Call Manager software upgrade checklist focused on managing a chain release of software upgrades in order to keep upgrades synchronized with all the versions that were currently active.

Disaster Recovery

A Disaster Recovery plan covers the hardware and software required to run business critical applications. The IP Telephony application created new and positive implications for Disaster Recovery, providing a level of flexibility that was not readily available within the legacy systems.

PBX Lease Returns

The IP Telephony implementation schedule was largely dictated by the PBX lease return dates. The initiative involved returning 55 PBXs, each containing 35 different cabinets throughout the San Jose campus.

Vendor Rules of Engagement

Discontinuing the lease arrangements, returning the equipment, and migrating to new technology will change the relationship with the vendor. However, honesty, trust, integrity, and continuing to treat them as partner and valued member of the team will enable the process to go more smoothly.

Non-leased Equipment Disposal

For the non-leased (Cisco-owned) equipment, the decision was made to either sell the equipment, transfer it internally to other locations and use it inside the organization, or to discard it and write it off.

Retrofit Clean up

Once the retrofit was over, the cleanup phase began and decisions were made whether to disconnect the remaining modem and analog lines or to steer them onto the CallManager.

Preparing Your Network for the Future

Preparing for the future means that as new IPT applications become available, a system must be in place that analyzes the technology for applicability, tests it for feasibility, provides an adoption position, and ensures that all teams are involved and in agreement

Lessons Learned

Planning and scheduling is critical to the success of any large initiative, but trial and error is a large part of implementing any new technology. Lessons were learned and documented by the team throughout the entire implementation for use in future deployments.

Appendix 5-1: CM 3.2 Software Upgrade Checklist

The following is a sample of a software upgrade checklist created by Anthony Garcia, AVVID Network Design Engineer. Columns A-H represent the servers being upgraded. Placing a check in the boxes below A-H demonstrates that the tasks in the "Upgrade Tasks" column have been completed.

A	B	C	D	E	F	G	H		Upgrade Tasks
■	■	■	■	■	■	■	■	1	Put new device loads in TFTPPath
■								2	Configure DCD on subscribers and tftp.
								3	Disable Trend Micro Service (Stop then Disable)
	■	■	■	■	■	■	■	4	Dump CDRs: This process can take a long time.
	■	■	■	■	■	■	■	5	Reduce msdb/dbo.sysreplication alerts
	■	■	■	■	■	■	■	6	Run Backup and verify completed
								7	Turn off perfmon alerts
■					■			8	Get current gateway, phone counters, and TFTP File Count
								9	Clean up diskspace. Trace files, c:\temp, perf logs, empty trash AND copy upgrade files to servers
								10	Upgrade RIB Firmware (details attached): Done via web browser
■	■	■	■	■	■	■	■	11	Reboot Process Guidelines
								12	Fix RIB configuration (details attached): Done at console and via web browser
								13	PC BIOS, RAID Firmware CD#2
								14	OS Update (win-OS-Upgrade.2000-1-3.exe)
■					■			15	Stop CM
								16	Microsoft SQL Service Pack 3
								17	Run QCHAIN
								18	RIB Driver for W2K
								19	Set win32time on each server. Run this command: net time /setsntp:ntp02
								20	Disk Swap Routine
								21	Log on as Administrator
	■	■	■	■	■	■	■	22	Upgrade Publisher, reboot at end.
	■	■	■	■	■	■	■	23	Verify db tables and stored procedures
■	■	■	■	■		■	■	24	Upgrade TFTP
■	■	■	■	■		■	■	25	Change CMTFTP log in name in Services
■	■	■	■	■		■	■	26	Reboot TFTP
■	■	■	■	■		■	■	27	Verify TFTP File Generation and Verify CM TFTP Log in name correct
	■	■	■	■	■	■	■	28	Disable Rogue via Web browser
■			■		■		■	29	Upgrade Primaries, DO NOT reboot. Stagger every 5 minutes
■			■		■		■	30	Simultaneously Reboot Primaries AND.....
■	■	■		■	■	■		31	Simultaneously stop CallManager service on backups
■			■		■		■	32	Verify CM Heartbeat, tables and stored procedures DB totals on Primaries
■	■	■		■	■	■		33	Upgrade Backups, reboot at end.
■	■	■		■	■	■		34	Verify CM Heartbeat, tables and stored procedures DB totals on Backups
								35	Change SQLSvc & Administrator Passwords
	■	■	■	■	■	■	■	36	Verify stiBack logging in as "Local system account"
	■	■	■	■	■	■	■	37	Edit Voicemail MWI configuration
								38	Full cluster reboot (Pub, TFTP, Primaries THEN Backups)
								39	Verify Auditing
								40	Disable Telnet service
	■	■	■	■	■	■	■	41	Remove Software MTPs, Conf Bridges, and MOH, that were built with Hawkbill
	■	■	■	■	■	■	■	42	Enable Rogue via Web Browser
								43	Enable Trend Micro Service
	■	■	■	■	■	■	■	44	Reset IIS Security
	■	■	■	■	■	■	■	45	Check IP Services(On phone, services button)
	■	■	■	■	■	■	■	46	Reset Gateways, DPA's, VG200's
	■	■	■	■	■	■	■	47	Test Calls
								48	Test Voice Mail
								49	Test PA (If installed)
								50	Verify and Enable Perfmon Alerts
								51	Verify 'cisco_main\domain admins' is in the local administrators group
	■	■	■	■	■	■	■	52	Verify DCD Search and update functionality

Green = PreUpgrade
Blue = Upgrade
Red = Post Upgrade

The IP Telephony Case Study can be found on Cisco's internal website at:
http://wwwin.cisco.com/it/technology/at_work/ipt_case_study.shtml

Glossary of Terms

AVVID	Architecture for Voice, Video and Integrated Data
BAT	Bulk Administration Tool
BDF	Building Distribution Frame
CDP	Cisco Discovery Protocol
CDR	Call Detail Records
CM	CallManager
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
DTS	Defect Tracking System
EPN	Expansion Port Network
IDF	Intermediate Distribution Frame
IPT	Internet Protocol Telephony
LAN	Local Area Network
MAC	Moves/Adds/Changes (can also mean IP address)
Mbit	Megabit Ethernet
MGCP	Media Gateway Control Protocol
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NAT	Network Address Translation
NOC	Network Operating Center
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network (PBX)
ROI	Return on Investment
RTP	Real Time Transport
SNMP	Simple Network Management Protocol
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Ptorocol
VLAN	Virtual LAN
VoIP	Voice over Internet Protocol
WAN	Wide Area Network

For a comprehensive list of IP Telephony terms and definitions, go to:
http://www.cisco.com/univercd/cc/td/doc/product/voice/evbugl4.htm#xtocid18819

CUSTOMER CONCERNS FAQ

The IP Telephony case study was developed in direct response to customer concerns of complexity, resources, timing, implementation, training, support, and other issues relative to deploying an enterprise-wide IPT solution throughout the organization. The case study addresses a majority of concerns and questions that have been voiced by customers attending EBCs (Executive Briefing Center) and via other methods of collecting feedback. The following is a matrix that identifies some of the concerns and where they are addressed in the case study.

Issue	Location
How do I get my organization on board with the impending conversion to IP Telephony?	Module 1: Executive Sponsorship
How do you manage accountability without sufficient resources, teams, and decision-making authority? How about insufficient coordination and teamwork?	Module 1: Importance of a Cross Functional Team
Lack of communication.	Module 2: The Communication Plan
User acceptance and integration.	Module 1: Managing Change
Lack of formal identification and prioritization of issues, problems, and dependencies. No tracking mechanism. Managing project scope creep.	Module 2: Develop the Project Plan
How to balance current projects vs IPT rollout requirements.	Module 1: AVVID Tiger Team Module 3: Staffing Required for the Implementation Team
Why did you convert your San Jose campus in a phased migration rather than a flash cut? How did you determine the Migration Strategy?	Module 2: The Migration Strategy
Preparing current network for IPT. Changing network designs, objectives, and policies.	Module 1: Understand Your Infrastructure Module 2: Identify Operational Policy Changes Module 3: LAN and WAN Infrastructure Requirements
Managing Support of the new network.	Module 4: The Support Team, Model & Tools
How to work with the current legacy equipment vendor to return equipment and maintain relationship.	Module 5: Vendor Rules of Engagement
How did Cisco manage QoS?	Module 3: QoS on the Cisco IT Network
Limited resources and team bench strength.	Module 3: Staffing Required for the Implementation Team
Planning for growth and scalability.	Module 5: Preparing Your Network for the Future
ROI planning and justification.	Introduction: Return on Investment
Requirements for cleaning up analog devices.	Module 2: Modem/Analog Policy Module 3: Site Survey Module 5: Retrofit Cleanup
How did you manage User Training?	Module 2: User Training
Managing PBX lease returns. How to find out about bug fixes and software upgrades.	Module 5: PBX Lease Returns Module 5: Software Upgrades
How do I manage employee expectations?	Module 1: Managing Change
Are there special requirements when converting the Senior Management Staff?	Module 2: Converting Executive Row
Is there a guide the Implementation Team used during the Implementation phase?	Module 3: The Implementation Guide
What are the Top 10 Things that can go Wrong during the Retrofit?	Module 2: The Good, The Bad & The Ugly
What are the Top 10 Things that will Improve as a Result of the Retrofit?	Module 2: The Good, The Bad & The Ugly
What were the lessons learned by the Team?	Module 5: Lessons Learned

May 2002 Version 2.0

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LW3212/SC/DPC/05.02
Printed in the USA