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The Definitive Guide™ To

Successful Deployment of VoIP and IP Telephony

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Chapter 5: Implementation and Migration

You have reached the phase in the IP Telephony project in which you will learn for the first time whether your combination of expectation setting, design, and project management is going to be a success. And, because you are working toward a successful deployment, this chapter will point out ways that your project could potentially go astray so that you can avoid those possible pitfalls. To ensure success during the implementation and migration, this chapter will revisit the global enterprise case study mentioned in Chapter 3 and take a closer look at how those involved actually implemented their global IP Telephony project, giving you a blueprint for your own implementation.

External Issues

External issues are those factors over which your project team is unlikely to exert much influence, as opposed to internal issues, which will be explored later. It remains to be seen in any given situation which issues will have a more profound positive or negative impact on the overall project, but both will play a role in the project's success.

Reducing Negative Impact of Implementation/Migration

There is a recurring theme that must remain in the foreground of your thinking throughout the project—your project, like any other successful endeavor, is being performed for reasons that are acceptable to management with the aim of getting results that somehow improve the business of the organization. This must be true of any project: there are business benefits and goals to be achieved and when you can compare the list of accomplishments to the list of goals and the accomplishments meet or exceed your goals, then, and only then, have you completed a successful project.

End users are a group that will often interfere with, or completely disrupt, a project's success. They can range from administrative staff to executives to network power users whose opinions matter to management. Previous chapters have discussed the importance of getting user participation and "buy in" early in the project—this consideration must continue through every step of the process.

Two of the primary areas for user uprising and resistance during IP Telephony projects are voice "quality" and the new telephone instrument. Both of these issues can be addressed early in the project by setting proper expectation levels and then, in the migration and implementation phases, by getting the user's acceptance, or sign-off, on the implementation, usually after training. By telling the user what to expect and handling or circumventing disagreements early in the project, project management—using criteria they establish, often in conjunction with user delegates—can truthfully say, "We delivered what we promised."

In the area of voice quality, the issue is rarely "quality" in any way that an end user can actually measure, but, rather, the sound of the voice is usually just different from the old phone system or other phone systems they might use, such as their cellular system. If proper expectations are set early in the project, using tools such as voice quality demos, this should become a minor issue and, in fact, might raise the confidence level of users about things they can't see, or hear. Much of the value of setting expectations comes from the confidence derived when you actually meet the expectations.

The difference between the old, reliable, beloved phone instrument and the new-fangled contraption that is now sitting on the desk after installation and migration is a potential showstopper for IP Telephony implementations. It is possible to ease the transition through training, allowing the end users to become enamored with their new phone device, to allow their opinions to be heard and their needs to be addressed, before they are forced to use the new device. Do not forget that the phone is the basic business instrument of most workers, and problems with the phone, perceived or real, can have a huge detrimental impact on organizational productivity and effectiveness. Absence of a hard "HOLD" button, which is replaced by a soft "HOLD" button that is displayed only when a call may be put on hold, for instance, creates a barrier to use. Disappearance of the buttons that light up on a traditional multi-line phone, a different sounding ringer, and similar issues will all contribute to user dissatisfaction and the potential derailing of an otherwise well-designed next-generation phone system.

Business Cycles

Businesses have natural cycles, which should be well understood and respected. This is an area in which it is useful to consult employees, especially from the IT or traditional telephony staff, regarding past failures and successes. Some things are more obvious than others. For instance, most individuals would be aware enough not to replace a phone system for a United States'-based tax accounting firm during the first two weeks of April because the U.S. Internal Revenue Service (IRS) requires individual income tax returns to be filed by April 15th. But, would a similarly aware individual be smart enough to take similar precautions for a tax accounting firm in Mumbai? They would if they understood the business of the Indian firm and realized that this company handled a lot of the tax preparation work from the U.S., which is a point that might not be so obvious.

Holidays

Holidays often seem ideal for certain upgrades and cutovers because the workers who use the data and telephone systems are absent. However, it may be equally true that support staff and Help desks are understaffed during the same timeframe, and working on holidays can make for unhappy project staff, which may translate into a higher number of mistakes than might be seen during other times. In addition, in international or multinational support situations, there may be a holiday in the country housing the Network Operations Center (NOC) while it is business as usual in the country where the installation or upgrade is being performed.

Coordination

A widely known Vice President for a major insurance company once proclaimed, from hard won personal knowledge, that any large IT project required the same skill set as a cat herder. This statement is very true of IT broadly, but especially true for next-generation telephony projects specifically. Like cats, each individual and department that may be involved in the IP Telephony project has their own agenda, likes and dislikes, priorities, and motivations. It is the true professional project manager who can align all individuals and get the desired outcome. Some of the "tips and tricks" are simple in theory but very difficult in practice. Among the tips and tricks are understanding that the IP Telephony project is only one of many activities in which participants will be engaged. Gaining positive participation involves selling the individual on the benefits they will derive by participating, identifying their role as clearly as possible, and limiting their involvement to the very minimum investment of time and effort. The list of potential participants that must be successfully coordinated includes, but is not limited to:

- User groups/departments
- IT/telephony department(s)
- Carrier(s)
- Internet Service Provider (ISP)
- Managed Service Provider(s)
- Management/executive sponsor

Another important consideration involves the extent to which the different entities need to be coordinated. Must an install tech from the carrier and a security escort from the client organization appear in exactly the same place at exactly the same time and stay together the entire time? The answer to this one is likely to be yes. Must the cable installer pull a pair of fiber, terminate, and test the connection before a new gateway can be installed? Most likely yes, but there is often some leeway as to how other tasks must be performed, and that flexibility must be built into the project plan.

Plans

Several inter-related plans are going to have to be put into place, desk-checked, and tested in the real world. Each of these plans will be subject to a variety of external and internal influences, as discussed throughout this chapter. As previously mentioned, internal influences are those that are, or should be, under the control of the project management team—these are easier to identify and control than external influences.

For smaller organizations, there will likely be only one variation of each plan—but there should be at least one of each plan. For larger organizations, there will likely be multiple versions of each plan that will incorporate variations for a host of factors such as organization, security level, country, and so on.

To be truly successful in your IP Telephony project, each variation of each plan must have its own ambassador—an ombudsman to speak on its behalf to ensure that it is getting its fair share of resources and to ensure its timely and on-budget completion. Each of the plans can be thought of as a part of the bigger organizational plan and, for that reason, all plans must be successfully completed for the overall project to be a success.

Plan Validation

Although it is impossible to see and avoid every problem, it is remarkably easy to identify, plan for, and avoid the major showstoppers. An important step in the creation of any plan is plan validation.

I utilize five tools to help in the plan validation process. Although it is not necessary to use all tools in every circumstance, it is useful to have these tools at your disposal and become adept at knowing when and where to apply each. The tools don't have formal names or a rigid set of rules, so I will refer to them as Visualization, Role Play, Naysayer Validation, Non-Expert Validation, and Red Teams. The tools should be applied in the order in which they are listed, and earlier tools will be applied more often than later tools in the list. Visualization, for instance, will be applied very often, informally, at the desk or sitting on the airplane, while a true Red Team is very expensive and time consuming but very often is the best way to ensure success.

Visualization

The first, and possibly the most valuable tool, is visualization. Visualization involves closing one's eyes and stepping through a process visually and thinking about each step. People who use visualization extensively find that it becomes automatic—and even subconscious—and must keep a pad and pen near the bed so that they can write down things that they come up with during the night.

You don't need to sleep at your desk—visualization can be a waking exercise and forms an important part of plan validation. If you are unknowingly visualizing and coming up with useful and meaningful project tidbits, your life will be plagued with a daunting collection of those little yellow sticky notes. The value of your visualization, however, can be greatly enhanced by keeping a project notebook, or even a voice recorder, handy to be sure that all your knowledge is captured and can be put to work.

The value of project personnel who actually know the practical side of the business, as opposed to simply the theoretical, is also clear. Practical experience can be increased and the value of designers and theoretical workers can be improved by assigning them to some lab and, preferably, field responsibilities as a helper or even an installer.

Role Play

A role play is really a visualization exercise involving two or more persons. In a role play for plan validation, for instance, visualization is performed and the steps spoken out loud, often following a plan flowchart or document. The role play is followed through until all procedures are either validated or corrected as best as it is possible to do at a desk.

Naysayer Validation

Any organization of any size has one or more naysayers—those individuals who can, and do, find fault with just about anything. Although often considered an annoyance that must be endured for purposes of intramural harmony in the organization, naysayers can represent a huge asset to the project team, as long as they are not the project manager.

After doing everything possible to ensure that there are no flaws in a plan, possibly after visualization and role play to eliminate the obvious glitches, it is time to submit the plan to naysayer validation. Invite the naysayer to identify every single possible problem scenario, regardless how far-fetched, document the problem list and possible outcomes—financial loss, user hostility, lower customer satisfaction, physical injury, security exposure—and assess the potential cost of each problem and likelihood that it will occur relative to the cost to fix or avoid the problem. This is a basic risk mitigation exercise that is a crucial part of any project but is rarely ever done as a formal part of the technical project management of an IP Telephony project.

Don't have a naysayer of your own? Go out and borrow one from another department or hire an outside naysayer/consultant. The good news is that you can return them when you are done gathering their input.

Non-Expert Validation

A desirable next step in plan validation is non-expert validation. Non-expert validation works because non-experts do not have the same biases or frames of reference that you have relative to your project. They are in a much better position to evaluate the project from a clear, unbiased perspective. A second benefit of non-expert validation is that if your non-expert can explain a concept back to you or clearly present your idea, it must be simple enough to be understood by management and the user community and will be less likely to be misunderstood. In many cases, the non-expert might be a temporary worker or a member of the target user community. Regardless of who provides the feedback, non-expert validation offers substantial value for a very small investment of time and money.

Red Teams

A Red Team is an approach in which you perform a 'dry run' of highly complex and mission-critical presentations, plans, and proposals. This idea originated in the aerospace industry in the late 1950s and early 1960s. Whenever a project team was going to make a critical presentation or proposal to management or to their client, they would assemble an impartial Red Team from among other project teams within the company. In this way, they could get the best possible practice with the least negative exposure. The team that is being evaluated is known as the Blue Team.

As project teams became less single project/single client-focused during the 1970s and 1980s, the Red Team approach all but died away and was almost entirely forgotten. That is, until the mega-projects and customer-focused teams within the telecommunications industry began to emerge in the early 1990s. The Red Team idea was revived and, although not used as widely now as it was in the 1970s and 1980s, still represents a very valuable tool for plan validation.

Implementation Plan

An overall implementation plan must be created for the project. There will be a number of subsidiary plans that must be put into place, as well, such as the training plan, test/acceptance plan, migration plan, ongoing operations plan, business/system continuity and contingency plan, and escalation procedures—all of which become part of the overall implementation plan.

Training Plan

One of the first questions often heard during implementation planning is, "Training for a phone?," which is usually followed by the aside, "You pick it up, you get dial tone, and you dial." Although user, and management, skepticism of the need for training is widespread, training is mandatory if your organization is to get the desired benefits from the new system; this is one of the elements that should be addressed in setting proper expectations early in the project. The training plan must be divided into two parts: operations training and user training.

Operations training involves training on the actual guts of the system and what is needed to keep it running. Training is often under-appreciated and under-budgeted because point-and-click Graphical User Interfaces (GUIs) make a system look like anyone off the street could use them—anything but the truth. In fact, GUIs alleviate the need to learn complex and arcane commands but still require operator intelligence and knowledge to keep a system up and running. In the case that the sophisticated, and often finicky, GUI system is down, operations training will ensure that staff can use an old-fashioned dial-in modem and a command line; it is always advisable to have this skillset on staff and readily available.

In situations where operations are outsourced to a carrier, ISP, or Managed Service Provider, training is still needed, but the focus is somewhat different. In a "do-it-yourself" situation, the organization must understand trouble reporting, troubleshooting, and problem resolution for upwards of 90 percent of problems they are likely to encounter. The organization's personnel must be at least as capable in operation, upgrade, and repair of the system as the vendor or manufacturer's field personnel.

In an outsourced (or partially outsourced) situation, an organization's staff, though smaller and more streamlined, must be experts in problem diagnosis and trouble reporting. Although there will be an initial inclination on the part of the service provider's staff to waste a lot of time retracing the steps of the organization's own people and redoing tests that have already been done, after the outsource organization is comfortable and confident, time will be saved and problems will be solved more quickly because the early diagnostic steps of the customer organization will be relied upon.

Test/Acceptance Plan

Based upon a combination of the list of end-user and management requirements for the new phone system and work done in the lab and in early field trials, it will be possible to put together a series of test and user acceptance plans. Regardless of the actual content, each plan, or segment of the plan must be written in such a way that a person of sufficient authority can sign off on the plan. More than one critical delivery has been botched because the person in the office at the time of the delivery said "I don't have the authority to sign for that." This situation must be avoided.

In large, distributed organizations, one approach that works well is to have special training, possibly via a Webinar or online training session, for the individuals authorized to sign-off on the test plans. If the new voice system is going into a branch bank and the branch manager is the designated person to accept the system, an alternate person should be designated and both persons should receive training to assure that someone is trained on the acceptance criteria and procedures. Training a primary and backup person will increase the likelihood of a timely acceptance of the system and avoid delays in the schedule.

The training, very simply, might include an overview of the project: why the bank is doing it and the objectives. Although overall organizational benefits are important, any training or briefing should also address benefits for the branch bank. Possible problems, fallback procedures, and contingency plans should be clearly documented, as should the test acceptance criteria, which should be as easy to verify as possible. Although a bank branch manager can be asked to ensure that a SIP Invite packet is issued to the SIP server, it is a far better idea to make "dial tone" and "ability to dial in-branch, main branch, and outside local calls" as four separate acceptance criteria.

It is also possible to do remote acceptance testing, such as calling to a certain central location from the remote branch to validate a certain set of procedures. In this case, the branch manager's role might simply be to sign off on the amount of time the tech was on site, or there may not be a role for the branch manager. Experience has shown, however, that project success is greatly increased if local personnel, especially non-technical management, are involved in acceptance. Besides being good manners, it can often create a knowledgeable on-site contact at no additional cost.

Migration Plan

After the design has been modified and tested prior to deployment, a migration plan must be put into place and be rolled out with discipline and precision. Rarely is a new technology rollout as visible, or subject to such across-the-board resistance, as with telephony. The migration plan is a combination of technical changes, user expectation setting, and user satisfaction exercises and must be executed flawlessly to avoid a negative impact on overall organizational effectiveness.

Ongoing Operations Plan

After the new system is implemented, and after the users have been migrated, it is time to put ongoing operational plans into place; however, the plans should be developed, refined, and validated well before they are needed. Ongoing operations plans should take into account all aspects of the life cycle of the system. For instance, assume as a starting point that the system has been properly installed and accepted, the following questions might arise:

- How will the operational status quo be maintained?
- How will the IP phones be updated and upgraded?
- Can new software revisions be downloaded transparently? Automatically?
- What if a service or feature does not work? Is there a back-rev plan?
- Are there problems in a network with mixed versions of software?
- What about hardware refresh?
- How often and by whose request or approval may IP phones or VoIP over WiFi devices be replaced or upgraded to newer models?
- How is bandwidth utilization monitored and managed for applications whose usage is growing, such as video?
- How do ongoing operations plans tie back to the Service Level Agreement (SLA)?
- What software tools are available to automatically monitor SLA compliance?
- When SLA breaches occur, are there software tools available to provide alerting, troubleshooting, optimization, utilization measurement and capacity planning?
- How are SLA breaches handled within the organization's Help desk and reported to management?

All of these topics and more must be addressed in the ongoing operations plan.

Contingency and Business/System Continuity Plan

A contingency plan as well as business and system continuity plans should always be a part of any project—especially one of the visibility and potential impact on an organization as a IP Telephony project. Having these plans in place, even if they are never put into play, will impress management and users with the scope of planning and give them confidence that all possibilities have been considered. In addition, the plans will be available when and if needed. Periodic drills and reviews should be performed to ensure that the plans will work if put into action.

Contingency Plan

Retreat, though not a savory choice, must always be kept as a viable option. A well-planned retreat has saved many a project and rescued the very valuable "political capital" needed for credibility within an organization. A contingency plan for terrestrial wired telephony might be as simple as using cell phones as a fallback if the new IP phones aren't working, but the procedures should be clearly spelled out, including details such as access to voicemail during the transition—from the cell phones if needed.

A fall-back plan for IP Telephony should also include a lab-tested and field-verified approach for recovering the system to the last-known good configuration as well as a timetable for making a go/no-go decision for various milestones within the rollout. If, for instance, a system is to be operational at 8:00 am on Monday morning and the rollback procedure, conservatively, takes 2 hours to execute, a go/no-go decision point should be scheduled no later than 4:00 am on Monday morning if the new or upgraded system has not yet passed acceptance testing.

Note that the 4:00 am decision point is actually 4 hours, not 2 hours, earlier than the 8:00 am operational time. The extra time allows for some assessment to be done at 4:00 am and extra time in case the estimated time for the rollback is off, and to validate proper operation after the rollback procedure. In any case, an operational phone system is online at 8:00 am.

Business/System Continuity Plan

Overall business and system continuity plans are inextricably interwoven with the business and system continuity plans for specific systems or subsystems. An organization, for instance, may have a plan, and hardware, in place to ensure that a building has backup electrical power via a generator, for instance, in case of loss of primary power. This alleviates the IP Telephony project team from responsibility for purchasing and maintaining such a system, but this does not alleviate responsibility for ensuring access to such a system and for participation in periodic testing. As an example, power outlets that have Uninterruptible Power Supplies (UPS) and/or generator backup are often orange. In this example, IP Telephony project procedures should ensure that all IP phones, or equipment racks providing POE, are plugged into the orange outlets. Beyond that, procedures should ensure that no additional, non-essential equipment, such as personal radios or space heaters, are plugged into the designated outlets. The IP Telephony project team must also ensure that the backup power system can accommodate the load put on the system by their equipment and participate in periodic testing.

The Value of Reliability

What is the actual cost of an outage or other problem, per event, regardless of duration? What is the actual cost related to the length of the outage or problem? Are there thresholds at which the cost rises? And, what are the other impacts, both actual and intangible, that result from an outage?

Every outage, regardless of duration, has a cost simply because it happened. The cost may be employee confidence in the system, customers who are lost because they switch to a new service, or stock prices being negatively influenced by accompanying bad press. In addition to one-time costs, the cost may accumulate over time. As an example, having to pay overtime to get time-sensitive transactions entered after a computer network is back "on the air" or having to pay overtime, or miss the window of opportunity, for making telemarketing calls to homeowners during the early evening hours. Or, as is often the case in financial transactions, mind-boggling sums might be lost if a transaction cannot be performed. Numbers into the millions of dollars per minute are not uncommon for certain financial systems. Only by knowing the true cost of a service-impacting outage can you assess the true cost and true value of reliability.

Escalation Procedure

To ensure that escalation is applied in a positive way to the IP Telephony project, you must be certain that escalation timetables are clearly documented, locked in, formal, and automatic. That is to say that the Tech I who is onsite installing the soft switch knows that if he or she is not done within 4 hours of starting, or by 6:00 pm, or whatever, they are to immediately call and notify the Tech Manager and to get reinforcements. It is also incumbent upon the organization to ensure that the reinforcements are available and are aware of their trigger points for automatic escalation. An underlying consideration is to set a bigger penalty for not performing an escalation than for performing one, and that the blame game be played only after numerous similar failures on the part of the individual. And, even then, only in a positive manner aimed at solving the shortcoming, even though the solution might involve training, retraining, re-assignment, or termination.

Internal Issues

Now that you have a hint as to the range of potentially project-impacting issues over which you will have limited, or no, control, let's turn attention to those items over which you should be able to exert more control. We can then dive into our case study for a greater appreciation of how these elements can impact an actual implementation.

Creation of Baseline and User Profiles

During the process of determining the needs and objectives of management and users, a set of criteria emerged that were the basis for system development and validation and, most likely, have been incorporated at this point into the SLA. From those requirements, additional input from management, and a review of any applicable security and/or acceptable use policies, a baseline user profile and specific profiles for classes of users must be developed. The specifics will differ based upon your exact system but will include a range of capabilities:

- Permission to use outbound long-distance and international calling
- Applications that are accessible from different platforms
- Amount of system memory and processor capability
- Number of calls that may be stored in voicemail
- Delivery of voicemail via email
- Whether voicemails should be retained on the server

Bringing All Users to Baseline

After the organizational, or departmental, baselines have been established, it is important to upgrade any users who do not meet the baseline profile and train them to be sure they are getting the most benefits from the new service. In some instances, system users may have capabilities or administrative rights that they will not retain when moving into the new system. The housecleaning aspect of a move to a new system is important, as users and their privileges can morph over time, usually gaining capabilities rather than losing them. One thing that should not be done is to migrate users wholesale while maintaining users' old rights and privileges. For a variety of reasons, mostly operational and security related, there should be a minimum number of possible user profiles and very, very few exceptions. The politics may be tricky and the battles might go to the highest levels, which is why a policy of minimum number of user profiles with users receiving the minimum number of rights that will allow them to accomplish their jobs, should be established from the very beginning.

Additional Capabilities by User Profile

Once baselines are established, additional user capabilities and permissions may be granted for specific user profiles. A common user profile that meets the needs of a certain class of user is always preferable to personal profiles that must be maintained and administered resulting in a nightmarish and unmanageable maize of profiles and permissions.

Security Issues

We must also consider the security of our system and not forget that attackers will find combinations of capabilities and permissions that give them access and allow them to compromise the system. For this reason, profiles should be established and reviewed before being implemented and should be audited and reviewed periodically.

Security of IP Telephony systems is particularly difficult because IP Telephony systems are susceptible to all of the security vulnerabilities of the systems upon which they run as well as new vulnerabilities related to IP Telephony generally and manufacturer's implementations specifically. For instance, a Denial of Service (DoS) attack that exploits the SYN exchange that begins each TCP session and is aimed at a server running IP Telephony is not a IP Telephony security problem, per se, but will, albeit indirectly put IP Telephony out of service. On the other hand, IP Telephony may be attacked directly, for instance, by exploiting weaknesses in the way that Uniform Resource Identifiers are parsed, which will compromise the IP Telephony service but will not impact underlying protocol layers or other services running on the same server.

Security is so important that it should be carefully considered at each step of planning and deployment in conjunction with the internal security department and, as needed, outside security professionals and consultants.

Liaison with Security Department

It is important early-on to establish a liaison with the internal and/or service provider security departments, to seek their input, guidance, and collaboration and to keep them aware of what you are doing. Very often, folks from the security department have as much knowledge about your needs and applications as you do about their responsibilities. For this reason, it is a good idea to start any meetings with a briefing about what you are trying to accomplish and why and to request and expect a similar briefing from the security people. When working with the security people, you can increase the likelihood of success (that is, that your efforts will not be blocked or thwarted in any meaningful way) by gently reminding the security folks charged with your protection that they are in the role of providing a valuable service to you and that you are the customer, not the other way around. In many cases, the very best security people have spent at least a part of their careers in situations in which running the show has had real and serious consequences in terms of financial loss or national security. It is a bit different in the commercial world, but the security viewpoint should always be considered and, in the case of a tie, a debate can be held to allow an upper-level manager to make a policy decision.

Firewalls and Proxy Server Issues

Firewalls, proxy servers, intrusion detection systems (IDSs), and similar tools are the stock-in-trade of the security business, and the value of properly implemented security systems cannot be overstated. However, two issues come into play when discussing security as it relates to your IP Telephony project. The first issue is improperly implemented systems that degrade, disrupt, or outright stop VoIP services. The second issue is with properly implemented systems that do not allow VoIP.

In the case of firewalls, for instance, most firewalls today do not make simple “pass/no pass” decisions based upon simple criteria such as source and destination IP addresses. Today’s firewalls often perform sophisticated analyses called heuristics, which protect against as-yet-unknown problems, or stateful inspection, which does sophisticated analysis of the interplay of multiple levels, or layers, of protocols. In the best case, this process only adds some delay, but in the worst case, these systems might cause sessions to be dropped or blocked entirely.

Proxy servers are another type of system that can often get in the way of VoIP. A proxy server acts on behalf of a user. To protect a user from attack and maintain anonymity, a user’s browser, for instance, might make a request of a proxy server to do some action on its behalf, to retrieve a Web page, for instance. In this case, the user connects to the proxy server, and the proxy server connects to the Web server. Each of the Web sessions requires additional resources on the proxy server, and most proxy servers are sized and configured based upon the number of simultaneous sessions. If, in your new VoIP service, VoIP calls were to replace browser sessions on a 1-to-1 basis, you would probably be OK, proxy-server wise. But it is likely that the sum of simultaneous browser and VoIP sessions will be greater than browser sessions only before implementation of the new system; thus, you run the risk, especially during the busiest times, of overloading the proxy servers. Security systems—be they firewalls, proxy servers, or IDSs—should always be a part of system testing.

IP Addresses and Port Numbers

Most prevalent applications on IP networks, such as browsers, file transfer, and email, use well-known port numbers to communicate and, therefore, may be readily identified by firewalls and other security systems. IDSs and stateful inspection services can also determine fairly easily whether the behaviors of these applications are proper. A problem with VoIP is that it does not use well-known port numbers, but rather, registered port numbers, and requires special configurations on firewalls and other security systems to handle different "flavors" of VoIP. By different flavors, I mean VoIP originated from different manufacturers. This is especially problematic in environments in which VoIP from multiple manufacturers might be employed, such as an environment where employees choose the VoIP system they will use, or a system that is shared with clients. This is far less problematic in a controlled environment where the organization controls all the parameters, but it is possible to have both situations.

IP Addresses, Port Numbers, Sockets, and VoIP

IP addresses plus Layer 4 (TCP/UDP) port numbers equal socket numbers. Sockets uniquely identify the endpoint of a connection in the network at a moment in time. If you think about a street addressing analogy, IP addresses get you to the building (that is, server or other IP host, such as a user PC), and the port number actually gets you to the office in the building (the application). All port numbers fall into one of three categories: well-known, registered, or ethereal, which means temporary. Most widely used applications have well-known port numbers, which makes life easier for administrative and security use. If a widely used application is authorized for the system, its well-known port identified by its well-known port number is either left "open" or opened provisionally for information packets to flow through. If a given application is not authorized, or not authorized for the IP addresses, or some other criteria, then it is closed and any attempt to go through that port is seen as a potential security violation. The problem with VoIP is that it was not originally included in the list of common, prevalent applications and, therefore, does not have a well-known port number. It is too late to retrofit it into IPv4, the current version of IP being used most widely in the US today. VoIP applications, therefore, must use registered port numbers, which vary by manufacturer, protocol, and software publisher.

Consider, for instance, a situation in which a large hotel chain provides an IP network that is used by both guests and employees. In this case, the IP network should be segregated for security and performance reasons because employees will use the carefully chosen and implemented VoIP solution internally and hotel guests will use anything they want in an ad hoc fashion and may, or may not, get the voice quality they need in the open, "best effort" world of the dynamically shared private intranet/public Internet connection.

NAT and Internal and External IP Addresses

IP addresses come in two basic flavors—registered and unregistered. The registration process ensures that no two user organizations will have the same IP addresses on the Internet because the registration process provides unique sets, or blocks, of IP addresses. This does not mean that organizations cannot use their own IP address assignments on their own, private IP networks: they can. In addition, there is not a problem with this situation as long as the private IP network, with its own set of IP addresses, is not connected to the Internet. If it is desirable to connect the two networks with conflicting IP addresses, this must be accomplished using a device, such as a router, that performs a special translation function of the internal, potentially duplicate, IP addresses to external, unique IP addresses. This function is called Network Address Translation (NAT). In many cases, internal users do not need access to the Internet, and there are many more internal users than those crossing the NAT boundary. The importance of NAT is clear, but the reason why it deserves special consideration in VoIP systems is that the use of NAT often causes a disconnect in the mapping of the underlying IP address to the higher-level phone number or User Resource Identifier (URI) used by VoIP.

The solution to the NAT problem lies in either ensuring that all "internal" IP addresses are registered, or using a separate IP network internally for VoIP. Assuring that all addresses are registered eliminates NAT, which is not practical for many organizations; Using a separate IP network internally for VoIP simplifies the issues of managing VoIP but raises costs and network complexity and completely kills the multimedia, triple play network concept. It is also possible to place servers, such as VoIP or SIP proxy servers, strategically on the Internet/registered side of the NAT function so that remapping is done after the relationship between the IP address and phone number or URI is not crucial. Another approach is to "bury" the IP address relationships within lower-layer transport systems, such as Virtual LANS (VLANS) or Virtual Private Networks (VPNs).

Internal and External Phone Number Mapping

The foregoing discussion of the use of internal IP addresses that were assigned without reference to standards or registered assignment and the potential to encounter duplicate numbers is not limited to IP addresses. Many organizations, especially the world's largest, have the same issue with traditional telephone numbers. The problem is solved in much the same way as IP addresses, where internal phone numbers are used internally but are mapped to external numbers either through PBXs, IP PBXs, or some other gateway function, on their way into the public switched telephone network (PSTN). This is a large issue and should be part of a serious discussion prior to implementation.

Flash Cut vs. Parallel Operation

The next consideration of migration is whether a system should be flash cut—always, of course, with a rollback plan in place to return to prior operational levels should a disaster of some type occur during the cutover—or allowed to operate in parallel for some period of time. The flash cut can be a bit of a bold move and disconcerting for the end users, but operationally, it is usually a lot cleaner than having two systems in place for any period of time. A happy middle ground is to do a phased operation, possibly in two or three steps, in which an individual phone user is flash cut, gaining their new IP-based phone and losing their old phone all in one fluid motion, but there will still be old phones in the office area for some period of time until the final set of users are cut over. If users are properly prepared and trained, this type of phased implementation can provide a psychological safety net for the users but keep costs and the complexity of the interim network operations under control.

Migration Priority and Order

The order in which migration will occur and the priority of users within the list should be the cause of much debate. Invariably, management will either want the highest ranking people to go first because they are the most important and should get these shiny new tools before the masses, or they will want the highest ranking people to go last because any problems in implementing the new technology will have the biggest negative impact on them. There is rarely a middle ground. What might make more sense is to migrate users who have been involved in system selection and implementation in the first wave. These "friendlies" are more likely to provide insightful commentary and useful observations in the early phases as opposed to creating political firefights that must be fought before migration progresses.

The earliest migrations should be as close geographically to the source of technical support as possible and, furthermore, capable of receiving overnight packages. This may mean the headquarters office, but it does not mean that the CEO's office should be migrated first.

Involvement of End Users in Acceptance

The importance of involvement of the end users in the implementation and migration of the IP Telephony system has been stressed throughout the project. It is no more or less important at the implementation and migration phase. Continue to work with the end-user community, generate good "word of mouth," work to address all issues quickly and thoroughly, and be aware that the performance of your network very well might begin to change as more and more packet telephony users are added to the network. For this reason, keep your feelers out in the user community, get early insight into possible problems, and use your friendlies to detect problems early, before they are fatal.

IP Telephony Implementation and Migration Case Study

At this point, you know a lot. When you combine the previous four chapters with this chapter and your own broad personal knowledge gained from reading, learning, and, quite possibly, your own experiences at designing, implementing, and using packet voice, it adds up to a lot of knowledge. The question becomes: "How can you customize your knowledge to your specific needs to allow you to directly apply what you know to ensure the success of your IP Telephony initiative?". The reality is that level of customization requires a lot of interaction and collaboration that is not possible in the current medium. So, let's do the next best thing—explore how the many hundreds of different factors that have already been discussed were combined to create an implementation and migration architecture—a blueprint—for a global company. The hope is that you will see patterns and approaches that will be helpful to you and that in this way, you can start down the road of applying the theoretical to the practical. Hopefully, this case study will give you more insight and food for thought.

> 🕮 To fully understand the case study, take a look at the Request for Proposal (RFP) used by the company that is the subject of this case study. You might even find the document useful as a starting point from which you may add, change, and delete to create your own RFP. A generalized version of the RFP, which has been modified to be more general as well as to hide the identity of the company is available from at http://nexus.realtimepublishers.com/content/DGSDVIP_RFP.doc.

The following case study will have many elements that can be applied to you, or at least, using your imagination, you can put yourself in the action. If you are not a global giant, you might not need to consider the legal and regulatory environment in many countries—simply in your own country. If you are a carrier or service provider, maybe you can forego the selection of the transport network and use your own, or maybe you should consider using the transport services of another company for your off-net calls. Maybe you don't want to manage your old gear as a part of your plan; then don't, but at least take a look and see how things came together in this real-life scenario.

The Three Tracks

There is an oft-told story about three blind people and their description of an elephant. The story goes something like this: Three blind people go to the zoo and are given the opportunity to touch an elephant. Having never seen an elephant, as all of them were blind from birth, they didn't really know what to expect, but having felt many other things, they thought they did have a basis for their observations of the elephant. After they had all had a chance to touch the elephant, they were asked to describe the beast. One person, having felt the trunk, said that an elephant was much like a snake, only much bigger. The second person, having grasped the tail, described the elephant as being like a huge broom, swishing this way and that. The third impression was as a result of handling the elephant's leg; the third person described an elephant as being much like a large tree.

The reason for pausing at this point to share this story is that it illustrates a common situation with IP Telephony projects—although most folks have never encountered this IP Telephony animal before, they all bring prior conceptions, often misconceptions, about it, and they all tend to view it from their own perspective. The participants in your project will often see what they see based upon their experience and job status. It will be the job of the project manager to make this specialization work for you, as was the case in the following case study.

Three different groups are involved in the implementation of the global IP Telephony project: they are the business group, the technical group, and the legal and regulatory group. The business group sees the business benefits and pitfalls of the global IP Telephony project; they confirm the Return on Investment (ROI) calculation and the tax ramifications of equipment depreciation and worry about factors such as Moore's Law. The technical group is concerned about the protocols, devices, and deployment. They concern themselves with considerations such as Quality of Service (QoS) in a multimedia network, network security, and survivability of systems in often harsh field conditions. The legal department is worried about all things legal and regulatory: contracts, local regulation, corporate governance, and similar worries.

Instead of re-educating everyone in new ways of doing things, the decision was made early-on to harness the natural order of things and design the project blueprint around three tracks: business, technical, and legal/regulatory, and to closely manage the points of interaction between the tracks. Although it is the job of the overall project managers to see the 50,000-foot view, the workers are best focused on their own area of specialty. Let's explore the project based upon these three tracks as identified in Figure 5.1.

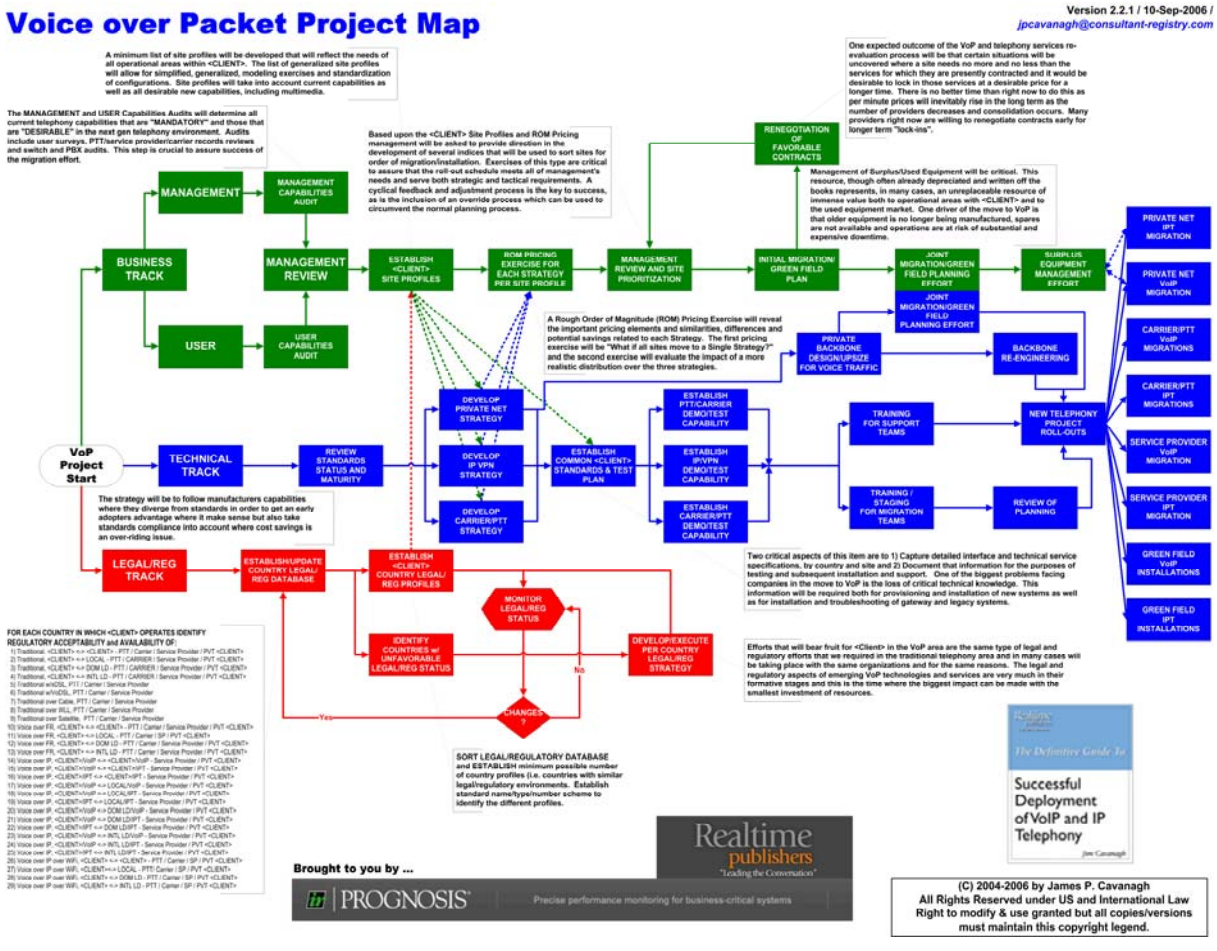

Figure 5.1: IP Telephony project roadmap.

A kickoff meeting was held with representatives of all groups present to allow project participants to meet each other and to get a sense of the "big picture," which was, literally, a big picture. Each group received a master E-size copy of their organization's master project map (see Figure 5.1), measuring nearly 3 feet by 4 feet. It was agreed that the master blueprint would remain unchanged, but it was the job of each track to define the specific, detailed, approach for each of the boxes represented on the master project map. The project map, and all subsequent detailed drawings from the tracks, are done in Visio and each track was allowed to use any other tools of their own choice for managing their part of the project, but Visio was the common way of representing project relationships, eventually yielding several hundred detailed diagrams.

Business

The initial job of the business team was to assess management's and user's needs and desires for the new system—both in terms of actual functionality and business impact. In many organizations, this task would have been relegated to the technical team, but management in this case did not want their new telephony initiative to be based upon what was technically possible but rather wanted to apply available and immediately emerging technology to specific business needs and business outcomes.

The management and user capabilities audit determined all current telephony capabilities that were mandatory and those that were desirable in the next-generation telephony project. Audits included user surveys, Postal Telephone & Telegraph (PTT), carrier and service provider record audits and billing reviews, and switch and PBX audits.

One noteworthy outcome of the audit process was a realization of how much attrition of expertise about the older systems there had been. In some cases, retired employees were brought back as consultants to gather configuration details and call detail record information from older vintage switches and Private Branch Exchanges (PBXs)—functions rarely performed on some of the older gear in the network. This realization, in and of its self, was a wake up call for management.

ROI and TCO

An important consideration in the management review was the financial aspects of the project. Although the details are confidential, it is possible to share some broad observations. For instance, since the mid-1990s, the company had been realizing approximately 20 percent year-over-year savings in their voice and data networking areas with increasing costs in their telemetry and video areas. The savings represents two factors: the first factor is riding an aging investment in voice and data infrastructure on the back side of its depreciation curve and the second factor is demanding cost concessions from vendors and service providers until there was almost no margin left. It was clear that the new IP Telephony initiative was going to put voice and data infrastructure into the increasing cost area, at least for the foreseeable future, and that vendors and service providers could give little more in discounts.

In the first case, all benefits of the new network needed to be clearly identified to upper management and metrics devised to show progress. This was accomplished by a senior telecom and networking management taskforce who approached the task as if their survival depended upon it—and it did. Spending more without producing tangible results was out of the question. In fact, the senior vice president in charge of the taskforce commented that "there is no such thing as strategic in our world: it is purely tactical. Tactical means that you can show hard cost savings or other benefits and strategic means that you can't. We have become purely tactical."

The second area was addressed by taking a different approach to vendors and service providers. The relationships were redefined to foster a more collaborative engagement, which allowed the company to get more value from a relationship with fewer key vendors, carriers, and service providers, and to pay a bit more money to each. This approach also leveraged the relationships to reduce headcount, especially in very remote areas, in what might be called a very closely managed near-outsourcing arrangement.

In terms of actual ROI and Total Cost of Ownership (TCO) targets, the ROI and TCO in this case study represent nearly unrealistic goals for most companies. Most companies cannot purchase products and services on the scale of the case study company. One of the reasons that scale matters is that very high costs in certain areas can be averaged out by lower costs in other areas. This averaging effect is easier with tens of thousands of users. On the other side of the coin, however, even slightly higher across the board costs will soon spiral out of control if not contained.

The typical ROI for the company is 12 months, but because of the scale of the changes that needed to occur, the ROI was calculated at nearly 14 months—considered good by many organizations. TCO, not including incidental expenses incurred on an individual basis such as Internet access service charges at hotels for traveling employees, is around $38/person/month for the VoIP portion of the network only. The network includes other IP Telephony technologies, such as Voice over ATM and Voice over Frame Relay, with higher TCOs. The company is migrating away from aging traditional and non-VoIP systems as quickly as possible, convinced of the financial and operational benefits of a single IP infrastructure company-wide.

Establish Site Profiles

The broad user and management capabilities audits were combined for management review and the result was a master set of capabilities and target business objectives that were compiled into MS Excel spreadsheets. From the spreadsheets, user and management representatives from each of several thousand sites and locations, such as small office/home office and mobile workers, were able to identify their specific needs. The spreadsheet results were used to develop a minimum number of profiles.

One of the inputs to the process of developing the client site profiles was the client country legal/regulatory profile. For instance, in certain countries in which the company operates, it was against regulations, or in some cases flat-out illegal, to do VoIP. In other cases VoIP is allowed, but there are restrictions on encryption of information, which for this company, is a very desirable aspect of VoIP that will keep information more secure than over traditional telephone lines. Although this step will not be needed for many IP Telephony projects, it is at least worthy of consideration. Output from the site profile creation was used as input to the development of private network, IP VPN, and completely outsourced Layer 2 VPN strategies in the technical track.

Rough-Order-of-Magnitude Pricing

The next step in the business track was to take configuration inputs, bandwidth requirements, and maintenance and support information from the technical track for three different network strategies: a completely private multimedia IP network, with the company basically acting as its own internal carrier; an IP VPN strategy, which completely outsourced the IP VPN with very strict SLA requirements; and a completely outsourced global Layer 2 VPN network, with similarly strict SLA requirements. Comprehensive cost and pricing models were developed for each option and compared with target ROI and TCO objectives.

Management Review and Site Prioritization

Various scenarios were presented to management based upon which areas of the company, and even specific offices and locations, would achieve the greatest benefits from a new telephony system. The final result of this step is that "green field" locations, that is to say new business locations coming online would, in most situations, be the first recipients of the new system, if a business need existed. If a clear business need did not exist, the green field sites would receive older telephony equipment that was displaced from existing sites that were upgraded.

Older equipment displaced as a result of a migration would be returned to a surplus equipment inventory and would be used to extend the life of offices that had older telephony gear in place and did not need or did not yet need the new packet voice system or were in a country with legal or regulatory restrictions on the use of VoIP. The surplus equipment management process will be described in more depth shortly.

Initial Migration/Green Field Plan and Renegotiation of Favorable Contracts

The next step was to translate management's needs into an actionable plan for the sites, order of migration, and action identified by management. This process resulted in the initial migration and green field plans with green field opportunities taking precedence over migration where there was a conflict for resources.

Armed with actual requirements and funding approval for the new sites and a clear indication of the needs of existing sites for the new systems, vendors and bandwidth providers were engaged in a renegotiation of existing contracts or negotiation of new contracts for green field sites. This process was part of a feedback loop that allowed management to reprioritize based upon favorable or unfavorable outcomes from the renegotiation process.

Joint Migration/Green Field Planning Effort

With a clear set of tasks, based upon business imperatives and management direction, it was now time for a joint meeting between the business team and the technical team to determine specific actions, dates, times, and responsibilities. The technical team had prepared templates for the actions needed for each site profile and could combine them, clear up any discrepancies, and create a task list, time line, and other project management tools, and integrate the operation into the overall schedule.

Contracts and Delivery

Contracts and delivery, although processed by the legal team, were managed jointly by the technical team and business team and were a key output from the joint migration/green field planning effort. Contract specifications had to align with key project dates and delivery of goods and turn ups of services had to be identified and provided back to the legal team to go to purchasing fulfillment and accounts payable. Although these details are often not treated seriously or taken into account, there are possible operational circumstances; consider, for instance, a location whose ISP contract is not paid and they lose their service, or the impact on corporate profitability if fixed assets are not received and accounted for properly. Although seemingly financial functions of little interest to the technical team, the reverse is actually true: they are of the greatest importance and should be taken into account at each step of the project. One of the outcomes of the business track was the surplus equipment management effort.

Inventory and Fixed Asset Accounting and Disposition of Old Equipment

One of the primary reasons for a migration to a next generation of telephony system—any next-generation system—for many of the company sites had nothing to do with advanced new capabilities. The real reason was manufacturer discontinuation of older systems and models and the diminishing availability and rising cost of components for maintenance, repair, and expansion of their existing, older vintage, telephony systems. A solution to this that extended the lifetime and created bottom line benefits of the older systems was to take equipment that had been decommissioned during the implementation of the new system and send it to one of three regional warehouses for refurbishing and placement in service, either for repair or upgrades, in other locations that were still using the older equipment.

This approach took what might otherwise have constituted garbage and repurposed it in a unique way that helped the company achieve its overall business objectives. The inventory management and fixed asset accounting for each of the components moving into and out of the regional refurbishment and warehouse centers was managed in the same way as all other assets of the company and will be until their ultimate disposal.

Implementation of Changes to Business Operations

There are other important considerations in the business track that are noteworthy and interesting that appear in subsequent detailed diagrams but that are not specifically enumerated in the project map. They are:

- Training
- Dealing with user reluctance
- Standardization
- Impact assessment
- Changes to processes
- Staff implications

Training of users was accomplished via a multi-tiered approach. Representatives from each office, plant, remote location, department, and so on were trained on the system operation and any special capabilities specific to their business function. These representative were the same people who had been involved in the needs assessment, design and implementation/migration planning all along—being, in effect, ambassadors for the new system and, therefore, duly enthusiastic about its success. The representatives trained other users in both formal and informal settings and were available as liaisons to customer support, creating a frontline of support that was able to answer many of the basic questions and avoid too big an additional demand on the Help desk.

There was, of course, initial user reluctance, in many cases being somewhat strenuous. Most users eventually became familiar with the new systems, though many never completely got over their anxiety and were likely to blame the new phone system for any mishap.

Standardization of business systems and practices is somewhat different than the standardization discussed in the technical track. In the case of standardization of business practices, use of a new, single, consistent IP Telephony system organization-wide, regardless of the individual features or enhancements for a given operational area, allowed for a simplification of work processes, better transportability of employees between offices and job functions, and an overall organization-wide focus on a single system—all of which resulted in both tangible productivity improvements and intangible user satisfaction with the system.

Impact assessment was accomplished via a series of formal user surveys, getting higher marks from users over time, and productivity tools capable of measuring everything from “time to dial tone” and “connect time” and the overall impact of the project was judged to be positive and in most cases met management objectives or changes were put in place to get the system in line via changes to processes.

One last area of concern, and an area where management was upset somewhat in their initial thinking, was that of the staff implications of a move to a IP Telephony system. In management’s initial view, after the migration was complete, it would be possible to lay off the entire old telephony staff and translate the savings in salaries and costs directly to the bottom line. Their strong belief in this potential benefit was rooted in the belief that “VoIP is just another IP application. Get some IP phones, plug them into your existing IP network, and you’re ‘good to go.”

Several things conspired to frustrate them in these efforts, not the least of which that this belief is absolutely false—as previous chapters have ably demonstrated. Management was warned in very clear terms to avoid this situation. What management actually found is that they were replacing individual telephone, data, and video engineers with more valuable, less available multimedia “triple play” engineers. This replacement process was often through hiring but, more often, through training. The company was able to let the lowest-tier of least productive employees in each category go and to keep the new breed of triple play engineers. Much of the training was formal from outside sources, but some of the training was internal and on the job. The lesson in this for organizations implementing IP Telephony is to never neglect the value of the body of knowledge that traditional telco people bring to the project. The transport has shifted to IP, but the basic application—humans speaking with each other—remains unchanged.

Technical

The technical track runs in parallel with, and occasionally overlaps, the business and legal/regulatory tracks. It begins with a review of standards' status and maturity.

Review of Standards' Status and Maturity

At the time of the case study, the review of standards' status and maturity was a much more important element than it is today. Today, for instance, systems based upon the Session Initiation Protocol (SIP) are a given, while at the time of the case study, H.323, SIP, and ETSI TIPHON-based systems were all being considered. Standards, and even Internet Requests for Comment (RFCs) have come a long way both in terms of their refinement and the way in which they will be implemented in the marketplace.

Such a review as this today will start by identifying the underlying assumptions, or givens, and then delve into what may be less accurately known; this analysis will often go into the lower layers of the network, as well. Only passing consideration was given to Multi-Protocol Label Switching (MPLS), for instance, in this case study, while Ethernet MANs/WANs, MPLS, Virtual Private LAN Service (VPLS), and Layer 2 Pseudo-wire VPNs are all options for the type of QoS-assured networks needed for success in packet voice generally and VoIP specifically.

Develop Private Net, IP VPN, and Carrier/PTT Strategies

Following adoption of a set of standards, separate strategies were developed for using a completely private network, an outsourced IP VPN based on MPLS, and a Layer 2 carrier/PTT-provided VPN. What eventually occurred was the development of a compromise plan for a hybrid network that leveraged the best aspects of one or all of the approaches depending upon a fairly strict set of selection guidelines developed jointly by the business team to ensure that business requirements such as ROI, TCO, availability, and reliability were met; the technical team to ensure that technical elements were properly addressed; and the legal/regulatory team to ensure that a specific set of characteristics was contractually possible.

For instance, some locations, especially in areas in which the company has a strong presence, are sufficiently dense to be serviced by a company-provided private IP network; in some very remote locations, the company operates their private IP network over PTT-provided leased lines or over global carrier Ethernet WANs. In other areas, sites are served by global IP VPN connections over a service-provider MPLS cloud. The actual selection criteria were put into an Excel spreadsheet to allow a multi-column menu approach in selecting what to provide to a given site based upon a variety of criteria, including application mix, QoS criteria, total site bandwidth, location, traditional vs. IP telephony, and other similar qualifiers.

Private Backbone Design/Upsize for Voice Traffic and Backbone Re-engineering

As an outcome of the design process, the company instigated the steps required to prepare their existing private backbone to handle both the new voice traffic that would be originating and terminating on their network as well as transit traffic that would be crossing their backbone. The company used a set of network assessment tools in this phase that were invaluable in gathering live data about the operation of the existing network and predicting the possible outcomes, and resulting impact on, VoIP voice quality of certain design changes. The company found that the outcomes were not always what they thought they would be and certain, often less expensive, architectural and operational changes yielded better overall improvements in forecasted voice quality than more expensive changes.

Establish Common Standards and Test Plan

After a careful evaluation of the three architectural choices, and the adoption of a hybrid, best of breed approach, a set of standards and test plans for the voice application were developed. By establishing a set of standards and testing methodologies for the overriding voice application, as opposed to basing testing on the underlying technologies, the company came closer to measurements, testing, and problem resolution techniques, that would have a more direct impact on their users than they would have otherwise. Delay, for instance, was calculated "mouth to ear" as opposed to from network edge to network edge or site to site. Mean Opinion Scores (MOSs) were estimated and R-Values calculated for purposes of comparison, and SLA compliance and a single, comprehensive, set of metrics was developed regardless of where in the world the voice system user was connected.

Establish Private Net, IP VPN, and Carrier/PTT Demo/Test Capabilities

To fully test functionality and validate the network design, full test-bed networks were created to match the private net, IP VPN, and Carrier/PTT systems. These test beds also allowed hybrid configurations to be developed quickly for purposes of hybrid testing of real-world configurations. Engineers, both from the internal company staff and from outside sources including service providers, carriers, PTT authorities and consultants who had worked on the test systems, were designated to either the support team or migration team. Support team members would support the migration and ongoing operations efforts and would be given a permanent staff position. Members of the migration team were temporary and would not remain on staff after the migration was completed. This distinction was not completely enforced, however, and some support team members left or were terminated and some migration team members were given permanent positions, based upon their performance during the migration and other factors.

Training/Staging for Migration Teams

Most of the training for the migration teams occurred in the actual staging of equipment that would be taken to the field. Systems were installed and initial testing and configuration performed before the systems were taken or shipped to the field. Migration team members received a minimum of training because an investment in their training would not yield a return in the long run and they would be supported centrally by support team members.

Training for Support Teams

Because the support teams were to be the ongoing multimedia support for the network, the interim period prior to and in the beginning phases of implementation were a period of near-constant formal and informal training. The support team members were to be the elite engineers, and a substantial investment was made in their training and at each step along the way the specific training they received was tracked back to the business benefits of the skills and a sort of informal Return on Training Investment (ROTI) was calculated.

Review of Planning and New Telephony Project Rollouts

After a review of planning, and appropriate modifications for specific circumstances, the new telephony project rollout was begun. If your network is to go no further than the borders of the contiguous 48 states, your legal and regulatory issues will be minimal. If you use a service provider, rather than taking a do-it-yourself approach, the issues will be even less complicated. However, if you will be operating in multiple countries, using a variety of providers or some other complicating factors, you will be spending more time on legal and regulatory areas. At the very least, use the following items from the case study as a checklist to determine whether you need to be concerned about the specific areas.

Legal

The legal track is executed primarily by attorney's and includes contracts, compliance with specific legal requirements, and the resolution of disputes with areas outside the company or legal complaints arising within the company related to human resources issues.

Closing Contracts for Old Telephony System

One of the most important legal areas, from a standpoint of financial impact, is in closing out contracts for the old telephony systems and related services. Ordinarily, audits of bills are conducted within the business track with input and guidance from the technical track and, to the extent that any moves, adds, or changes comply with the existing contracts can all be handled without legal intervention. The reason the legal department is involved in this area, more-so than in other situations, is that the changes to contracts, and contract cancellations, related to the new packet voice project do not always track the dates and conditions foreseen in contracts. It is also often the case that contracts can be renegotiated, often at more favorable rates or conditions, as a part of the project.

New Contracts

In addition to disposition of existing contracts, new contracts to replace old contracts or with completely new vendors need to be negotiated. In this case, the legal team collaborates with the business and technical teams to ensure that the contracted goods or services meet the stated business needs and that any accompanying SLA is properly constructed and administered.

Regulatory

Regulatory issues within the U.S. could be the topic of another guide entirely; the good news is that regulatory issues generally do not directly impact private organizations that are constructing their own private packet voice systems—though they will impact the companies providing goods or services. This is not the case in many other countries around the globe.

Compliance with National Law and Telco/PTT Regulation

Any company implementing a packet voice capability must be aware of local regulation and law governing voice systems. Some countries are very open on the topic while others prop up corrupt regimes, or those seen as corrupt by the U.S. government, using the hard currencies they receive in settlement compensation when the money collected for calls to their country exceeds the money collected for calls from their country. In other situations, the issues might be less regulatory and more contractual, where a contract for voice services through a carrier or PTT authority includes minimum minutes or dollar volumes.

In the case of the case study subject company, a database was created with all these factors and more, and that database was used as an input into the business and technical tracks. Some of the other areas tracked in the database are highlighted in the following sections.

Security and Privacy Issues

The extent to which voice communications, and often data communications, can be made private is often strictly controlled in certain countries or under certain conditions. Although it is very desirable for certain organizations to use sophisticated encryption techniques to keep their information secure from competitors, governments, and even non-authorized employees, the tools to do so are often prohibited. This is a problem in general for fixed location operations, but for the mobile employee who may be traveling from country to country, knowledge of these restrictions is very important as possession of certain hardware and software may be cause for detention at the borders or by law enforcement authorities.

Carrier/PTT IP Bypass and Local Tail Drop-Off

One of the cost saving elements of VoIP is that it allows bypass of the traditional carrier/PTT systems, allowing those older systems to be less heavily loaded and eventually removed. This capability is not allowed in many global jurisdictions nor is local tail drop-off, which allows delivery of a local call on a traditional circuit that has originated elsewhere in the network. This restriction is often related to calls carried between company locations for individuals outside the company but can restrict intra-company systems use as well.

PBX and Gateway Issues

Many of the restrictions on VoIP can be avoided by careful placement and creative use of traditional PBXs, VoIP gateways, and other systems. If, for instance, a country does not allow VoIP calls, placement of a VoIP gateway in an adjacent country that does allow VoIP calls will allow calls to be turned into traditional TDM calls before crossing the border into the restrictive country. Regionalization of gateways also allows concentration of support staff and may result in overall higher system availability and lower support costs.

Contact Centers/Call Centers

One final area of the utmost importance to many organizations, but not addressed explicitly in the IP Telephony project map, is contact or call centers. Many organizations, be they commercial, academic, or government, very survival rests on their contact centers and the ability to do outbound calling to solicit customers, while many other organizations use contact centers for internal support or to provide aid to customers and prospects. Either way, an organizational shift to VoIP opens the doors to many contact/call center capabilities that are too difficult, too expensive, or not technically feasible using older technology.

Special Considerations and Contingency Planning

There are many special considerations in shifting call center operations to a VoIP platform. These include all-VoIP or hybrid traditional/VoIP, off-shoring the call center to another country, and on-shoring (which is the outsourcing of the call center to in-country providers and, possibly, distributed call centers that allow operators to take calls from their cubicles or their home). The distribution of operators over such a broad geographic area as is facilitated by call takers working at home also alleviates much of the contingency planning that must occur with a single call center where all call center functions are concentrated in one place.

Phased Implementation and Call-Taker Training

Part of the migration of call centers to VoIP should involve a safe, secure, phased implementation to the eventual hybrid or all-IP network. Training can often be accomplished online using network-based training and collaboration tools, further increasing the financial and operational benefits of a move to IP Telephony. Planning for migration of a call center to VoIP can best be achieved as a completely separate project from the rest of the migration.

Summary

This chapter, though it couldn't provide every implementation and migration detail applicable to every environment, has hopefully provided a foundation on which you can build a successful implementation. Combine the information provided in this chapter with your own experience and knowledge to synthesize new ideas, new approaches, and new ways to be successful in your IP Telephony project.

The next chapter will focus on how to keep things running smoothly after the migration and implementation. Much time will be spent on the "tools of the trade" that allow you to monitor your networks and ensure that they remain within the guidelines established within the SLA.