

Managing Remote IP Telephony Systems

by Gary Audin
Delphi, Inc.

Colleges and universities are constantly expanding their reach to serve their communities and students. Telephone communications must expand as well, and voice over IP is the most logical technology for this expansion. VoIP, also referred to as IP telephony (IPT), has primarily been deployed in large, centralized organizations, aiming to reap operational and capital cost savings. The major growth of IPT in coming years, however, will be through adoption and deployment in distributed, multisite environments in which economy of scale produces greater returns on investment. Technology introduced recently by equipment vendors such as Cisco is now facilitating cost-effective, out-of-the-box IPT for these distributed organizations. Many schools have Cisco-based router and LAN switch infrastructures; a reasonable evolution for these schools is to leverage these router products to support VoIP/IPT.

What Is a Distributed Campus?

Distributed organizations have many small sites including 5 to 25 devices (that is, PCs and telephones), a few midsize sites of 100 or more devices, and, most likely, a single large main site of hundreds to more than thousands of devices.

For organizations that support this array of sites, there should be two sizing levels for IPT products: one that can support 4 to 200 devices and a second that can support 200 to 1,000 devices. The large central site could be implemented by using a separate server-based IP PBX, while the smaller sites could be implemented with an IP PBX integrated into the

same router that is already supporting data transmission at the remote sites.

The distributed architecture provides voice features and functions that can be supported at each of a school's distributed sites and/or can be located at the main site. The telephone user interface can be common to all locations. The network of sites can be designed in such a way that the loss of any site, regardless of size, will not bring down the entire network because all sites can support all voice applications. The architecture provides distributed intelligence to the users where it is needed, whether it is local or remote. If one or more of the small or midsize router-based IPT systems fail, the larger central site can provide service as long as the network is still functioning.

The ability of a distributed approach to support features and functions locally without having to signal through the entire network is another of its capabilities. This functionality speeds the execution of the call request and reduces bandwidth requirements, providing superior disaster and recovery response because any site can work in concert with other surviving sites even if one is lost.

Extending Capital Expenditures and Resources

Extending the IP network to support voice traffic extends capital investment and reduces capital expenditures in the future. Leveraging existing IP-based LAN and WAN networks has produced an infrastructure that already supports a wide range of data applications. This functionality eliminates the need for a

Relationship to Cisco CallManager

The Cisco CallManager Express and Cisco Unity Express solutions are designed to work with Cisco CallManager products and their services. In a Cisco CallManager environment, Cisco Unity Express provides local storage and processing of voicemail and automated attendant services for the branch campus, thereby reducing WAN bandwidth and quality of service (QoS) concerns. IP phone operation is similar to the phone operation with Cisco CallManager. Very little user training

will be necessary should schools migrate to Cisco CallManager as they outgrow the Cisco CallManager Express solution. The Cisco CallManager Express platform can be exchanged for the CallManager server-based platform as the school grows without requiring major management and personnel retraining.

Deploying VoIP across Distributed Campuses

IPT in distributed campuses will be deployed over time, so the management solution needs to scale from a few to many locations. Subsequently, the solution needs to represent, digest, analyze, and display the data in various ways to address the differing skill levels of those at remote sites. The management solution must be able to set different service levels and thresholds for each particular location.

The management system for distributed IPT should:

- Report performance of the network
- Display network impairments
- Measure traffic utilization
- Alert to device failures
- Provide notification of calls that exceed performance thresholds on call quality
- Work through the existing IP data network

- Be useful in identifying possible security problems
- Report status and configurations of registered devices

Management Goals for Distributed VoIP/IPT

Organizations must be able to manage their environments both locally and globally. After identifying a particular problem in a remote campus, organizations must then go one layer higher to determine whether other locations in the region have the same problem. Knowledge of the problem can be aggregated to form a global view. Schools must be able to discriminate and give different views—a local, simple, or in-depth NOC view—based on the skill level and management policies for each site. The management product requires out-of-the-box features, auto discovery, and central configuration. These functions will enable remote

separate telecommunications infrastructure. To leverage staff and increase productivity, schools can keep the configuration and operation of the network and its devices as simple as possible to promote rapid deployment, ease of operation, and effective problem resolution.

Why VoIP/IPT Management Is Important

Although there are many benefits to IPT products and their associated technology, there is still an inherent need for these tools to be managed because they represent a per-office telephony system. The management solution must address fundamental requirements partly because of the limited knowledge and training of people available locally and as a result of the need for highly skilled centralized network operations center (NOC) personnel. One solution is PROGNOSIS IP Telephony Express, specifically designed for the Cisco CallManager Express and Cisco Unity Express products. (See “Relationship to Cisco CallManager” on this page.)

office personnel with limited expertise in deploying and maintaining IPT systems.

Managing Distributed IPT

As VoIP and IPT devices have become more intelligent, the ability to include management functions in the devices has increased while the cost of providing these management functions has decreased.

An IPT management system must do the following:

- Help manage resources efficiently and inexpensively
- Alert managers to problems quickly
- Provide information in a useful and easy-to-read format
- Reduce the time required to diagnose and resolve problems
- Help reduce problems in the future
- Measure the performance of the IPT devices
- Determine the configuration and update status of all devices
- Provide information about the users' operation of features and functions

Figure 1: Example of how schools can view the status and performance of all phones at a particular branch site (PROGNOSIS screen shot courtesy Integrated Research)

Devices			Phones	Mailboxes			
S	C	H	MAC Address	IP Address	Model	MOS	
✓	✓	✓	000D.290A.BB61	10.1.1.86	7960	****	
✓	✓	✓	000D.290A.B918	10.1.1.87	7960	****	
✓	✗	✓	0050.3EFF.DB5D	10.1.1.88	7960	****	
✓	✓	✓	000D.28E8.10D9	10.1.1.89	7960	****	
✗	✓	✓	000D.290A.B8FB	****	****	****	
✓	✓	✓	000D.290A.BB61	10.1.1.86	7960	****	
✓	✓	✓	000D.290A.B918	10.1.1.87	7960	****	
✓	✗	✓	0050.3EFF.DB5D	10.1.1.88	7960	****	
✓	✓	✓	000D.28E8.10D9	10.1.1.89	7960	****	
✗	✓	✓	000D.290A.B8FB	****	****	****	
✓	✓	✓	000D.290A.BB61	10.1.1.86	7960	****	
✓	✓	✓	000D.290A.B918	10.1.1.87	7960	****	
✓	✗	✓	0050.3EFF.DB5D	10.1.1.88	7960	****	
✓	✓	✓	000D.28E8.10D9	10.1.1.89	7960	****	
✗	✓	✓	000D.290A.B8FB	****	****	****	
✓	✓	✓	000D.290A.BB61	10.1.1.86	7960	****	
✓	✓	✓	000D.290A.B918	10.1.1.87	7960	****	
✓	✗	✓	0050.3EFF.DB5D	10.1.1.88	7960	****	
✓	✓	✓	000D.28E8.10D9	10.1.1.89	7960	****	
✗	✓	✓	000D.290A.B8FB	****	****	****	

20 phones

What to Manage

Managing an IPT environment is not limited to monitoring the calls and the traffic that the calls produce. There are three general layers of management:

- Service assurance is composed of all functions that deal with infrastructure problems in real time and quasi-real time. These functions usually provide monitoring of availability, performance, and accuracy; alerts; root-cause identification of problems and suggestions for corrective actions; and, finally, security.
- The verification layer is the keystone in the liaison between business and IT operations. This layer is where service levels are agreed upon and specific performance targets are assigned to the infrastructure management groups.
- The forecast layer is concerned with the changes to fundamental IT services. The changes may be needed immediately as a reaction to unforeseen problems in architecture and infrastructure capacity (performance management). This layer also includes planning for changes (capacity planning).

Because different remote offices have different people using the IPT phone system, the offices will need to be able to set different service levels and thresholds for their particular locations. As mentioned earlier, organizations cannot expect or afford IT-trained individuals to reside at each of the remote locations.

Managing from a central location can provide insights into problems that span multiple sites. Problems may be occurring in a network region that is beyond the view of local personnel. The central site can determine where network resources (for example, bandwidth) need to be increased or QoS capabilities need to be installed in the network. In a sense, local management can be outsourced to the central site when the local site cannot deal with the problems.

IT management has a series of “pain points” that will drive the decision to procure a well-designed IPT management system. The following lists highlight goals and questions that will be part of the management decision for distributed telephony.

Questions:

- How does the organization ensure call quality?
- When is QoS dropping and why?
- Are any devices unavailable and why?
- Are there IP phones and gateways that cannot register?

- What are the hardware and software inventories at the remote sites?

Goals:

- Effectively manage thousands of devices
- Receive alerts when thresholds are breached
- Provide access to call usage information
- Proactively monitor voicemail usage
- Control moves, adds, and changes for asset management and security

The answers to these questions and the defined goals can then be applied to the management elements puzzle, which is made up of the following pieces:

Although call quality is subjective, there are methods for calculating it by using packet loss, delay, and jitter measurements on a per-call basis and reported in real time. Calls for which the measurements fall short of the preset thresholds can be flagged. The central site as well as local sites can obtain this information immediately.

The bandwidth available to and from the remote sites will affect call quality. Insight into bandwidth use provides the ability to operate in the most effective way while providing visibility into capacity issues.

In distributed environments, when employees move from office to office or change their campus locations, they take their handset with them. This situation creates an asset management headache. The IPT management solution should monitor the devices and endpoints that are registered, connected, and disconnected so that organizations can keep a registry of IP phone assets—assigning people to the phones.

Alerts can reduce the time to diagnose and repair problems. Alerts can also notify the school of performance problems that are not caused by a failure.

Schools can monitor gateway utilization to reduce costs. There may be overcapacity for the PSTN access from the gateway. Reducing the number of PSTN ports or channels will reduce the ongoing carrier costs. Insight into calling patterns between offices will also allow an organization to optimize the trunking among the sites.

Monitoring the router configuration changes, such as who has logged on to routers over time and who has tried to log on and failed, is extremely important. This information can be used to observe patterns that may be attempts at breaching router security.

Schools want to be able to identify whether a problem relates to the device or network congestion. Monitoring key systems parameters of the router—CPU utilization, process memory, network interface performance, and systems uptime—will provide insight into its health, status, and performance.

Organizations phase in new technology and resources slowly. The software and hardware will become inconsistent with other locations and different routers will perform differently. Schools must be able to keep an asset register of different versions of products used in sites. They must be able to set up service levels and performance thresholds that are unique to the versions being used.

Distributed remote campuses need a simple, out-of-the-box solution to manage their IPT systems. The health of a site's local IPT system can be provided with green light, amber light, or red light status updates that are easy to interpret. The IT department cannot afford to deploy trained IPT staff to

Figure 2: Example of how a school can centrally manage the performance and availability of its entire distributed environment (*PROGNOSIS screen shot courtesy Integrated Research*)

Name	Status	DialPeers	Phones	Calls
Entire Network	88 %	78 %	74 %	77 %
Ford	82 %	47 %	38 %	78 %
Canada	50 %	40 %	34 %	66 %
CME CALGARY	Down	0/3	0/36	0/0
CME TORONTO	Up	3/2	21/25	4/6
NorthEast	0 %	0 %	0 %	0/0
CME BOSTON	Down	0/2	0/49	0/0
CME NYC	Down	0/4	0/85	0/0
NorthWest	100 %	100 %	83 %	82 %
SouthWest	100 %	66 %	100 %	70 %
CME LA	Up	2/3	43/43	7/10
CME SFO	Up	N/A	N/A	N/A
Ski Resorts	100 %	82 %	94 %	81 %
Aspen	100 %	100 %	98 %	81 %
CME Restaurant	Up	3/3	36/37	15/18
CME Clubhouse	Up	5/0	14/14	4/8

the remote sites. The information provided to the unskilled staff at the remote site must:

- Be simple to understand
- Provide an intuitive and simple information display
- Require little training to use
- Allow nontechnical personnel to understand the meaning of the information and take appropriate action

Some elements that should be managed in the simple view include:

- Availability of the device at a local level
- Number of phones registered
- Number of phones failed
- Asset register (local)
- Basic utilization reports (local)
- Alerts to phone problems
- Alerts to network congestion
- Ability to escalate local alerts to the NOC (or MSP or local technical personnel)

The interface for the simple view should be “locked down” so that people cannot change access rights and thresholds unless allowed by the central site management system. The central site must have the ability to override the local personnel’s operations. The local system should also automatically escalate/forward problems to the central site based on thresholds or problem aging. (See Figure 1 on page 16.)

The management system must be able to collect historical information for each distributed office, then take that

information and aggregate up a level for a regional view, then again for a global view. The in-depth view should provide the ability to map the environment into a hierarchical view comprising diverse geographical regions.

This view should deliver metrics for active call quality and historic call quality, both locally and globally, and provide reports about inbound and outbound calls, calls to the PSTN, and office-to-office (intranet) calls. It should also include dial peer metrics, such as successful calls, refused calls, failed calls, and disconnected calls. (See Figure 2.)

In addition to managing voice, the organization needs to manage associated applications such as Cisco Unity Express, Cisco’s voicemail messaging system. This router-based solution resides locally on the network. As with any application, the Cisco Unity Express solution can suffer from the same performance fluctuations as the servers and systems on which it resides. Hence, obtaining a view of the router’s performance is essential to understanding the performance of the voicemail resident on the router. This information should be supplied in a simple view or an in-depth technical view for NOC.

Managing resources, especially remote resources, presents many staffing, equipment, and software problems. Effectively managing IPT systems produces satisfied users and efficient operation. Thus, a school must invest in managing its IPT system investments.

Management systems can filter information, thereby reducing the administrator’s management burden. There is no truly self-managing technology. Effectively managing resources, such as bandwidth, can reduce carrier costs while ensuring user satisfaction. Management system information can catch security problems early, help anticipate performance issues, and diagnose and resolve failures quickly.

Gary Audin is president of Delphi, Inc., a consulting and training firm based in Arlington, Virginia. He has spoken at numerous ACUTA events, contributed often to ACUTA publications, and delivered more than 2,000 technology seminars. Reach Gary at delphi-inc@att.net or by phone at 703/908-0965.