

***Solution Brief***

**VoIP Deployment and Management:**

**A Complete Life-Cycle Solution**

# Contents

Introduction.....	1
Business Drivers .....	2
Cost Savings .....	2
Productivity Gains .....	2
Competitive Advantages.....	2
Not “Just Another Application” .....	3
A Comprehensive Solution .....	5
Pre-deployment/Deployment.....	6
Ongoing Monitoring and Management .....	7
Troubleshooting.....	7
Planning for Future Growth.....	8
For More Information .....	9

## Introduction

As businesses search for new ways to cut costs, increase efficiency, and enhance their competitive advantage, they are increasingly choosing to move their phone systems to VoIP (voice over Internet protocol). Not only can VoIP systems significantly reduce toll rates and infrastructure costs, but tools that are often implemented in conjunction with these systems (such as unified communications, presence software, and automated attendant features) can appreciably boost employee productivity. Furthermore, VoIP systems can make companies more competitive—for example, by facilitating collaboration, which enables them to bring products to market more quickly.

When VoIP technology first emerged, IT executives were concerned about how well it would work. Those concerns are evaporating, however, as IT executives learn that the technology does indeed work, and that, if the network is properly architected, sound quality will meet their expectations. In fact, in many cases, the sound is too clear, causing end users to think they've lost the connection during momentary lapses in conversation. As a result, IT managers actually tune phone systems to add slight static into the call, so it sounds more like a traditional phone call.

How fast is VoIP usage growing? According to Nemertes Research, an independent research firm that specializes in quantifying the business impact of technology, 71 percent of organizations now use VoIP in some capacity; 25 percent are planning to deploy the technology within the coming year; and only 4 percent have no plans to move to VoIP.<sup>1</sup> In-Stat/MDR reports that the overall percentage of companies using VoIP communications quadrupled between 2003 and 2004, growing from 3 percent to 12 percent.<sup>2</sup> And Gartner predicts that voice and data traffic will increasingly be combined onto a single converged LAN network, with IP telephony applications eventually completely replacing circuit-switched PBX voice systems. "It is now not a question of 'if' IP telephony will be adopted but 'when,'" says Gartner.<sup>3</sup> Gartner also predicts that by 2010, 40 percent of companies will have completed the convergence of their entire voice and data network onto a single network, and more than 95 percent of large and midsized companies will have started the convergence process.<sup>4</sup>

According to the previously cited Nemertes report, even the nay-sayers admit that they'll eventually move to VoIP—even if they have to be dragged kicking and screaming! That's because vendor support and innovation in TDM (*Time Division Multiplexing*) systems is waning. "Like it or not," the Nemertes report concludes, "we're looking at a future that ultimately is all IP."

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<sup>1</sup> Network World Special Report, "VoIP: Challenges, Drivers, Hurdles and Recommendations." July 2005.

<sup>2</sup> InStat, "Business VoIP: An End-User's Perspective, 2004."

<sup>3</sup> Gartner, "The Road to Internet Protocol Telephony," 3 January 2005.

<sup>4</sup> Gartner, "Positions 2005: Voice and Data Will Converge Onto a Single Network via IP Telephony and Voice Over IP," 17 February 2005.

## **Business Drivers**

Business benefits of moving to VoIP fall into three categories: cost savings; productivity gains; and competitive advantages.

### **Cost Savings**

One of the key reasons that companies are moving to VoIP networks is cost savings. The Nemertes report cited above states that companies can reduce their international toll rates by 20 to 40 percent, depending on the country; reduce local loop costs by 25 to 60 percent; and reduce the cost of moves, adds, and changes by nearly \$100 per incident. Companies can realize further cost savings by leveraging a single wiring infrastructure to carry both voice and data instead of setting up two separate wiring systems; by using a single IT staff group to manage both voice and data; and by moving audio and video conferencing traffic to the IP network.

### **Productivity Gains**

According to the Nemertes report, employees are able to save anywhere from 10 minutes to one hour per day because of the tools typically implemented in conjunction with a VoIP rollout. For example, knowledge workers usually save 10 to 20 minutes per day by using such tools as unified communications (with voicemail and faxes coming into the same Inbox as their e-mail, and voice mail being read rather than listened to) and presence software (which helps them track down other employees when they need them).

The automated attendant features on most VoIP system also provide productivity benefits. The Nemertes report cites the example of an entertainment company that eliminated or reassigned all but three receptionists to field calls for 10 U.S. offices—an approach that is possible with VoIP because transferring calls between cities doesn't result in toll charges. By doing so, the company saved more than \$90,000 per year in salaries.

Further productivity gains are possible by combining other applications with telephony. For example, a company might set up a call center application to automatically display a customer's record on the representative's screen when the customer calls in.

### **Competitive Advantages**

VoIP can also offer competitive advantages. For example, by using collaborative design tools, manufacturing companies can bring products to market more quickly than their competitors. The individuals involved save time by not having to travel, and the company can better afford the real-time portion of the tools when they are running over an IP infrastructure.

In other cases, salespeople trying to close a deal may need a critical piece of information from another person. By reaching the person immediately through a presence tool, they may be able to close the deal on the spot, rather than getting back to the prospect later and losing the momentum that can be critical to making the sale.

## Not “Just Another Application”

While there is no doubt that VoIP is the wave of the future—and that it will generate significant business benefits—there is still a great deal of misunderstanding about the challenges posed by the technology. All too often, IT executives say, “Voice is just another application. What’s the big deal?” The media—and some equipment vendors—have conditioned network managers to think that VoIP makes everything simpler. As long as they can measure the basics, such as latency (delays), packet loss, and outages, they think the network will be just fine.

But voice and other real-time applications are *not* the same as data applications in terms of tuning and ongoing management. VoIP phone systems are an extremely mission-critical application—one that must perform flawlessly or face the wrath of end users. Most current network infrastructure is optimized for data, not for converged data and voice traffic. And while data networks that achieve 99.9 percent availability are considered to be operating extremely well, that number falls well below what people expect from their phone systems, which generally deliver five 9s—99.999 percent availability.

Another issue to consider is packet loss and out-of-sequence packets—the cause of 50 percent of the quality of service (QoS) problems with VoIP systems. Packet issues are something that network managers traditionally have not had to worry about. After all, there is always some packet loss, and TCP/IP is designed to handle it. But VoIP does not use TCP. If a word is lost, it’s just dead air, which could easily result in a garbled phone conversation.

While end users will normally put up with some minor glitches when a new IT system is deployed, that is not the case with VoIP. If end users pick up the phone and cannot get a dial tone—or cannot connect to the number they are dialing, or cannot interpret what a caller is saying due to poor voice quality—their ability to conduct business will be seriously affected, and companies will find that unacceptable.

Therefore, in planning a move to VoIP, you will want to set the bar for acceptable quality much higher than with most IT applications. In order to obtain management’s approval and end-user acceptance, you will need to be able to deliver great quality and rock-solid performance from the moment the system is turned on.

Furthermore, the challenges don’t stop with the completion of the initial deployment. Many times organizations find that the rollout to the first set of users goes well, but they begin to experience problems when they try rolling out the system to a second set of users. Conversations become jittery and choppy; calls get cut off; and the whole system slows down. IT managers often try to solve these problems by the tried-and-true solution of adding more bandwidth—but VoIP performance problems generally are not bandwidth or throughput issues. The problem is likely to be latency, which is typically responsible for the other 50 percent of QoS issues experienced with VoIP systems (that is, the problems that aren’t due to packet loss or out-of-sequence packets).

And even if a VoIP system works fine through the complete rollout, it could always happen that later network changes might affect call quality. Similarly, a growing VoIP system could have a negative effect on other mission-critical applications.

In short, adding voice to the IP network adds a new level of complexity that current monitoring tools may not be equipped to handle. This is why, as organizations forge ahead with VoIP rollouts, IT and network managers increasingly say that they are becoming overwhelmed with the growing complexity of the network. For example, they may notice degraded performance from specific locations at certain times of the day, but they don't have the tools in place to drill down and figure out why the problem is occurring.

What network managers need are management tools that provide a clear view into the network—at all locations—to ensure predictable, consistent performance for all applications traveling across the LAN and WAN. They need tools that detail which applications use how much bandwidth and when; provide root-cause analyses for network slowdowns and outages; measure QoS performance in the routers and carrier networks; determine how policy affects QoS; and analyze network performance both in the main office and in branch offices. In short, they need tools that provide end-to-end management data, giving them complete vision into the network from edge to core.

## A Comprehensive Solution

Fluke Networks offers such a solution—a comprehensive approach that enables you to manage the complete VoIP lifecycle, from predeployment qualification of your network through deployment, ongoing monitoring and management, troubleshooting, and planning for future growth. The solution includes:

- **NetTool™ VoIP**, an easy-to-use, portable tool for testing communications between the IP phone and other elements of the VoIP network, and for troubleshooting problems at the network's edge.
- **OptiView™ Protocol Expert Plus**, a protocol analysis and monitoring solution that can quickly isolate and resolve problems such as network degradation and slow response times.
- **OptiView™ Link Analyzer**, a hardware analyzer that gives you full visibility into your network traffic. Working with Protocol Expert Plus, it reports on network traffic and provides real-time packet capture and analysis, QoS metrics, and alerts.
- **OptiView™ Integrated Network Analyzer**, a portable analyzer that captures and analyzes voice traffic, using advanced algorithms to determine the voice quality being delivered. It generates QoS assessments for each call without the need to perform detailed decoding.
- **OptiView™ WAN Analyzer**, a multi-function analyzer that provides in-depth analysis of WAN interfaces, including the ability to combine all VoIP-related traffic together in a single group to provide a better understanding of the VoIP system's overall impact on business-critical WAN links.
- **ReporterAnalyzer™**, a NetFlow-based monitoring and analysis solution that provides an enterprise-wide view into which applications are using bandwidth, who is using them, and when. With ReporterAnalyzer, you can verify that VoIP calls are properly prioritized and see how VoIP flows and volumes are changing over time, so you can better plan for future growth.

Together, these tools comprise the most-awarded network management solution in the industry. For example, the combination of OptiView Link Analyzer and OptiView Protocol Expert Plus was *Network Computing* magazine's winner for its 2005 Well-Connected Award. The two products also received high marks from *Network World* in its "Clear Choice" evaluation of VoIP analysis tools. The magazine noted that the OptiView products did the best job of monitoring and reporting key QoS conditions, both across all protocols and in standard SIP-only environments, and also got top marks for the level of protocol detail and real traffic analysis they provided in monitoring real VoIP traffic on the network.

What makes this comprehensive, single-vendor solution unique is that:

- **All products offer both network and VoIP specific analytics**—an essential combination, since each has a potential impact on the other.

- **QoS analytics isolate statistics by channel**, a more powerful approach than single-call measurements because it isolates the *direction* of degradation. By doing so, it makes troubleshooting easier and quicker.
- **All products use real-time monitoring or packet analysis**, grading traffic levels and QoS metrics on *real* traffic, not the synthetic tests used by many other solutions. By basing results on real traffic, the Fluke Networks solution eliminates the discrepancies that often occur between synthetic tests and what users are actually experiencing. And because this approach measures the actual load that VoIP traffic is placing on your WAN and LAN links, it helps you plan capacity more effectively.
- **The Fluke solution provides end-to-end VoIP lifecycle management**, with differentiated measurement and analysis solutions that align to your deployment needs.

Now let's take a closer look at how these tools can help keep your VoIP system running smoothly at each stage of the lifecycle.

## Pre-deployment

You can save time and prevent later difficulties by making sure your network is ready to support VoIP *before* you actually begin deployment—that is, that it can meet the speed and bandwidth requirements and is capable of delivering Power over Ethernet (PoE). NetTool VoIP can help you with this task. Before deployment, you can use NetTool VoIP to verify that the drop is active (i.e., that the wall jack, cable, patch cable, and switch ports are all functional); that the phone is able to receive power from the switch; that it is able to communicate properly with network servers; that the switch port is configured properly; and that the network infrastructure is capable of sending PoE to each phone.

You can also use Link Analyzer and Protocol Expert Plus to calculate a performance baseline. It's important to take this step *before* deployment, so you can later verify what impact, if any, the VoIP system has on overall network performance.

## Deployment

NetTool VoIP can also help you during deployment, enabling you to verify that your IP phones are working correctly. In fact, NetTool VoIP is the only tool that enables you to *directly monitor* transmissions between the IP phone and the VoIP network, so you can see exactly what is going on. With NetTool VoIP, you can observe the conversation between the IP phone and the network during phone bootup and initialization to verify that all elements of the VoIP system are properly communicating with each other. You can also monitor and measure call setup time to determine if it is within the acceptable range and verify that the voice quality is satisfactory (i.e., that jitter and dropped packets are within acceptable levels).

Finally, upon completing deployment, you can use Link Analyzer and Protocol Expert Plus to take a performance baseline measurement of the VoIP system, calculating an aggregate health score for all VoIP calls carried over each link or VLAN. That way, if problems are reported later, you can compare the performance at that point with the earlier baseline.

## **Ongoing Monitoring and Management**

After deployment, you need to monitor bandwidth usage and QoS for both the VoIP system and the network as a whole. You will also need to take regular performance measurements to verify that the VoIP QoS continues to meet your organization's standards. Finally, when alarms occur, you need a means of capturing and decoding packets in order to analyze where the problem lies and quickly resolve it.

OptiView Link Analyzer and Protocol Expert Plus can help, giving you 100 percent visibility into your network, even at Gigabit line speeds. Together, they provide you with real-time monitoring and packet capture capabilities, checking bandwidth utilization and generating alarms when QoS thresholds are exceeded. They also give you a troubleshooting tool for responding to alarms, enabling you to go back and look at the packets in a conversation that had problems and determine exactly where the problem occurred.

ReporterAnalyzer is another helpful tool. Serving as a flexible analysis engine, it helps you understand how application traffic, including VoIP traffic, is affecting overall network performance. Through a combination of real-time insight and long-term data analysis, it identifies the VoIP system's role in traffic volume and prioritization as well as the call pathways the system uses. ReporterAnalyzer also helps you determine the best approach for solving a performance problem—which isn't necessarily a matter of just adding more bandwidth. Protocol growth charts can track VoIP-related traffic volumes across your entire enterprise so that you can determine in advance if, when, and where additional bandwidth will be required.

Still another helpful tool is the portable OptiView Integrated Network Analyzer, which gives you a comprehensive view of your entire network—including wireless and VLAN segments. By capturing packets and automatically analyzing them in depth, it helps you isolate call setup problems at different locations on the network and enables you to determine which network segments need reconfiguration or upgrading. This tool provides detailed decodes of the most commonly used VoIP protocols, including H323, SCCP, MGCP, and SIP.

Finally, the OptiView WAN Analyzer provides site, segment, or circuit-specific in-depth analysis from the physical layer to the application layer. Combining network discovery and statistical analysis elements with line-rate packet capture, the WAN Analyzer allows you to remotely evaluate the status of your business-critical WAN links and can show you within seconds whether your service provider is providing you with the service that you're paying for, how that link is being used, and whether or not there are any performance issues.

## **Troubleshooting**

The network's edge is a good place to start troubleshooting, and NetTool VoIP is the ideal tool, showing communication details between the IP phone and call server. NetTool VoIP is portable, lightweight, and easy to use, so a frontline technician can take it to a user's desktop to perform the initial troubleshooting. With NetTool VoIP in-line between the phone and the call manager, the technician can see everything that happens during a call and directly observe the communication between the IP phone and the call manager. In short, NetTool VoIP empowers the frontline staff to resolve some issues on their own, without having to escalate them to the next level.

If no problem exists at the network edge, other Fluke Networks tools enable you to perform more in-depth troubleshooting at the Network Operations Center. For example, Link Analyzer and Protocol Expert Plus generate real-time QoS analysis of every call on the VoIP VLAN or within a central link, helping to identify both single-user problems and those that are propagated among many users. The products' QoS metrics help isolate the direction of degradation, while their packet analysis capabilities can help uncover configuration problems on the network. Powerful, customizable filters help you capture the exact traffic you need to solve a problem, and expert diagnostics enable you to identify and resolve common problems without the need for extensive packet analysis.

OptiView Integrated Network Analyzer can also help, showing detailed VoIP information for every call captured. The statistics it generates simplify troubleshooting by quickly identifying the route a call takes and the gateway involved.

### **Planning for Future Growth**

Many organizations deploy VoIP in batches, starting with a pilot program and then rolling it out more extensively. Studying trend and baseline data from your current system will help you determine whether you have enough capacity to handle growth or need to add new resources.

ReporterAnalyzer provides helpful capacity planning information. By showing the rate at which VoIP traffic volume has grown over time, it enables you to determine where upgrades are needed to support the data flow required for optimal performance. Link Analyzer and Protocol Expert Plus also help, providing a performance baseline by calculating an aggregate health score for all VoIP calls carried over a specific link or VLAN.

## **For More Information**

To learn more about how Fluke's comprehensive VoIP lifecycle management solution can help you, visit our VoIP Lifecycle Management Solutions site, [www.flukenetworks.com/voip](http://www.flukenetworks.com/voip), or call 1-800-283-5853 to connect with customer service.