



# LAYING THE GROUNDWORK FOR IP TELEPHONY

A White Paper By

**NEC** NEC Unified Solutions, Inc.



## Introduction

You've studied the promising ROI's for IP Telephony and researched vendor solutions that appear to fit your company's needs. If you've done your homework, you also know that merging voice and data networks into one integrated network is a complex undertaking that requires careful analysis of existing infrastructure. An objective evaluation of network capabilities is essential to any IP Telephony implementation for several reasons:

- Knowing the **existing traffic demands** on your data and voice networks will help you determine QoS requirements and potential increased (or decreased) bandwidth needs for your new IP Telephony network.
- Detecting and resolving **underlying network issues** such as bottlenecks in certain LAN segments or frequent retransmissions of data packets will clear the path for a smoother implementation.
- Having an accurate picture of your **current network topology** may also uncover areas that require improvement prior to implementation, such as re-routing multi-site paths to more efficient configurations.
- Establishing a **baseline** of existing network performance offers a solid basis of comparison against future expected levels so you know how well you're meeting your technology goals.

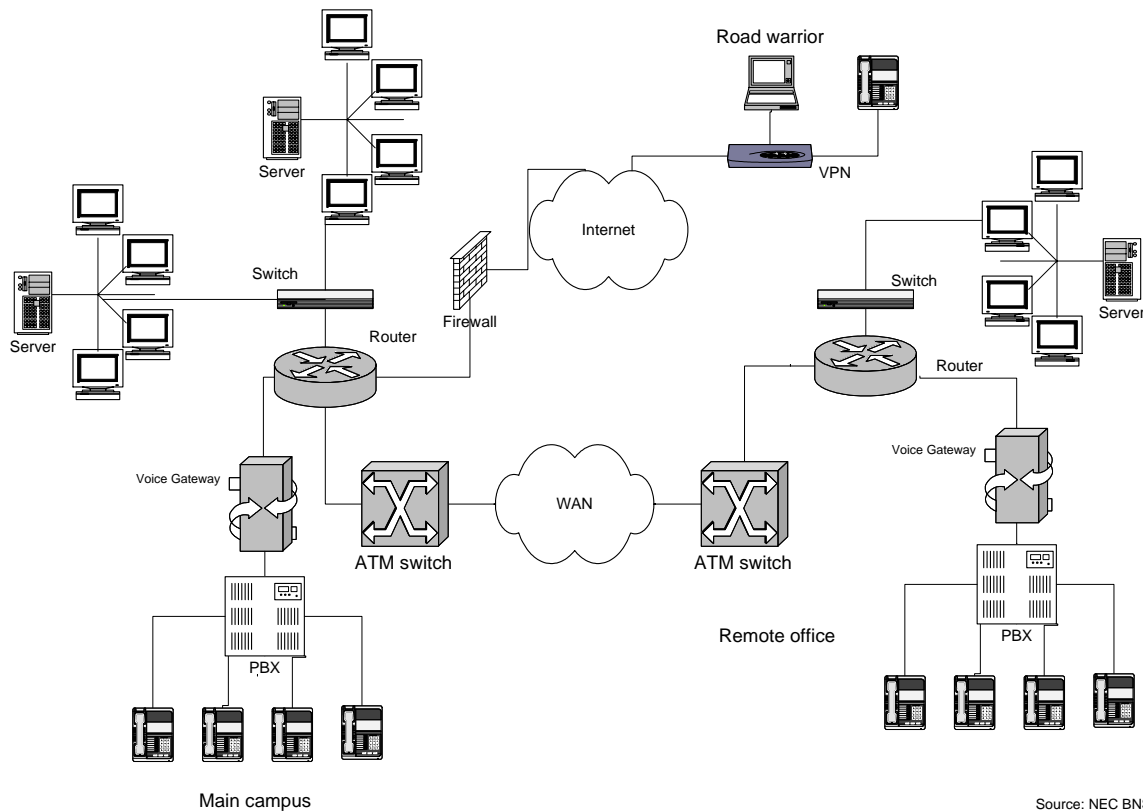
This paper explains the components and process involved in an IP Telephony Assessment and how it can help you lay the groundwork for a successful IP Telephony implementation.

## Areas Assessed

The success of a new IP Telephony implementation depends on the capability of its existing network components. So from the data network side, every device that is expected to carry application traffic needs to be tested and benchmarked, from the WAN to the LAN. These devices include routers, switches, servers, gateways and VPN, to name a few. More often than not, these devices are not IP Telephony-ready and will require upgrading, modifying or replacing. Testing will help to confirm and validate this need.

This critical first step is conducted by a Network Engineer and will determine what kind of traffic patterns occur throughout the day; peak utilization times might warrant increased amounts of bandwidth to support IP Telephony, for instance. Other factors studied are type of users and traffic, their priority, packet types, application usage and transmission problems. Because IP Telephony is sensitive to time and delay, the existing network design will also be assessed for ways to make routing more efficient.





**Fig. 1.1: All WAN, LAN and voice devices should be tested for IP Telephony readiness.**

Maintaining good voice quality is a key consideration in IP Telephony implementations, so it is important to know whether your PBX's and voice gateways can adequately handle IP Telephony traffic. To assess this, a voice quality testing device measures the network's current voice quality. IP Telephony traffic is then injected and the measurements are taken again. Measuring the gap in the data enables a Network Engineer to determine any improvements that must be made to ensure good voice quality in the new IP Telephony environment.

## Voice Quality

Most users will expect excellent "toll-call" voice quality even if it occurs through a time-insensitive packet network. Since this is the standard by which IP Telephony will be measured, appraising voice parameters such as clarity, delay and echo becomes paramount to maintaining good voice quality in a network anticipating IP Telephony.

**Clarity** refers to the clearness of a voice signal and how intelligible it sounds to the ear. Many voice quality testers use two algorithms, PSQM (Perceptual Speech Quality Measurement) and PAMS (Perceptual



Analysis Measurement System), to measure clarity of a voice signal after it has been transmitted from a phone.

**Delay** is the time it takes for a voice signal to travel from the caller to the person called. The concern over time lag is a particular issue for IP Telephony, since packet networks introduce additional transactions into a call, including packetization of the voice signal. Routers or switches may also add small amounts of time as well. A properly calibrated network, however, will experience little discernable delay.

**Echo** refers to the sound of the speaker's voice returning to his/her ear via the same telephone. In many cases, echo is caused by an electrical mismatch between the trunk line and the phone line. A voice quality tester can measure echo produced through natural or simulated voice signals. A Network Engineer can also run tests to isolate the cause.

NEC Unified Solutions' IP Telephony Assessment also examines the quality of service delivered by a network, specifically jitter and packet loss. Jitter, which renders conversations choppy through uneven delays, can become noticeable in an IP Telephony network if not detected and controlled before implementation. Likewise, the additional traffic that IP Telephony brings may cause routers and switches to drop packets, and calls, if it is not properly addressed beforehand.

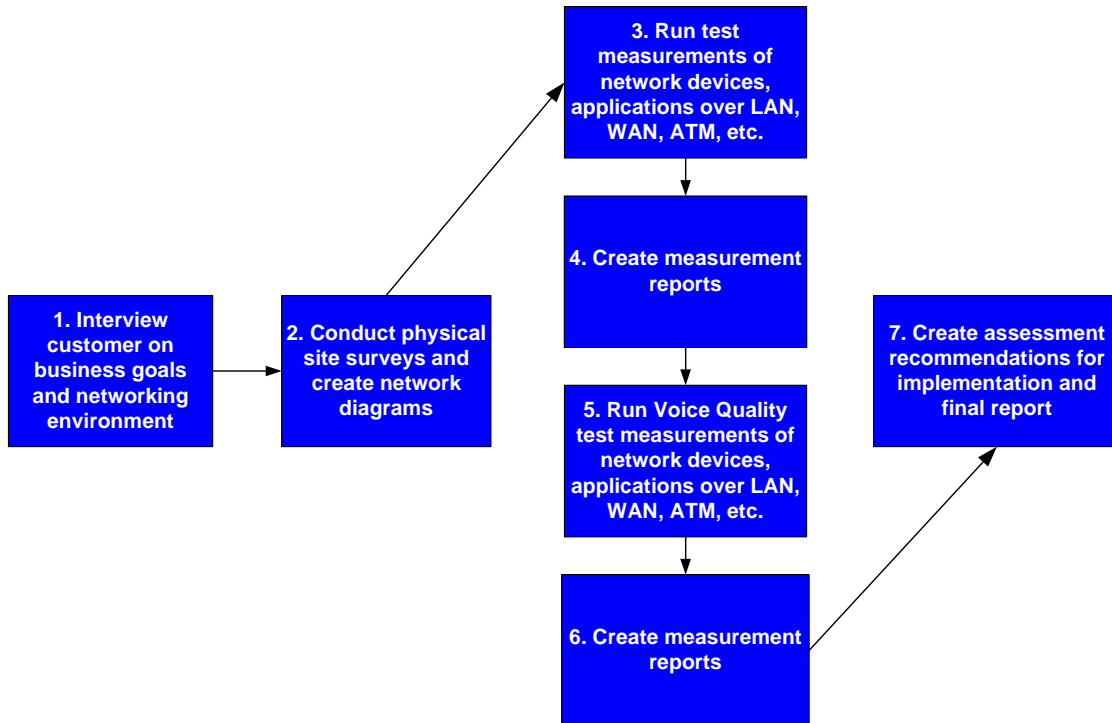
## The Assessment Process

Some IP Telephony assessments focus solely on answering the question: "How well will IP Telephony run on my existing network?" In this scenario, IP Telephony traffic is "injected" into the network flow and voice quality factors analyzed to see how much improvement needs to be made before IP Telephony can run successfully.

While it is beneficial to know what voice quality issues exist with IP Telephony prior to implementation, it is equally important to analyze the health of the data network – since this is the platform on which IP Telephony will run, and ultimately depend on. Conducting voice quality tests will tell you how much delay you have, but not where network congestion – a major culprit behind packet loss – is occurring. Knowing what issues are occurring on the data side is just as important as understanding those on the voice side, since each impacts the other.

NEC Unified Solutions' IP Telephony Assessment takes a holistic approach by first performing a comprehensive analysis of the data and voice networks before assessing voice quality.





**Fig. 1.2: NEC Unified Solutions' IP Telephony Assessment Process**

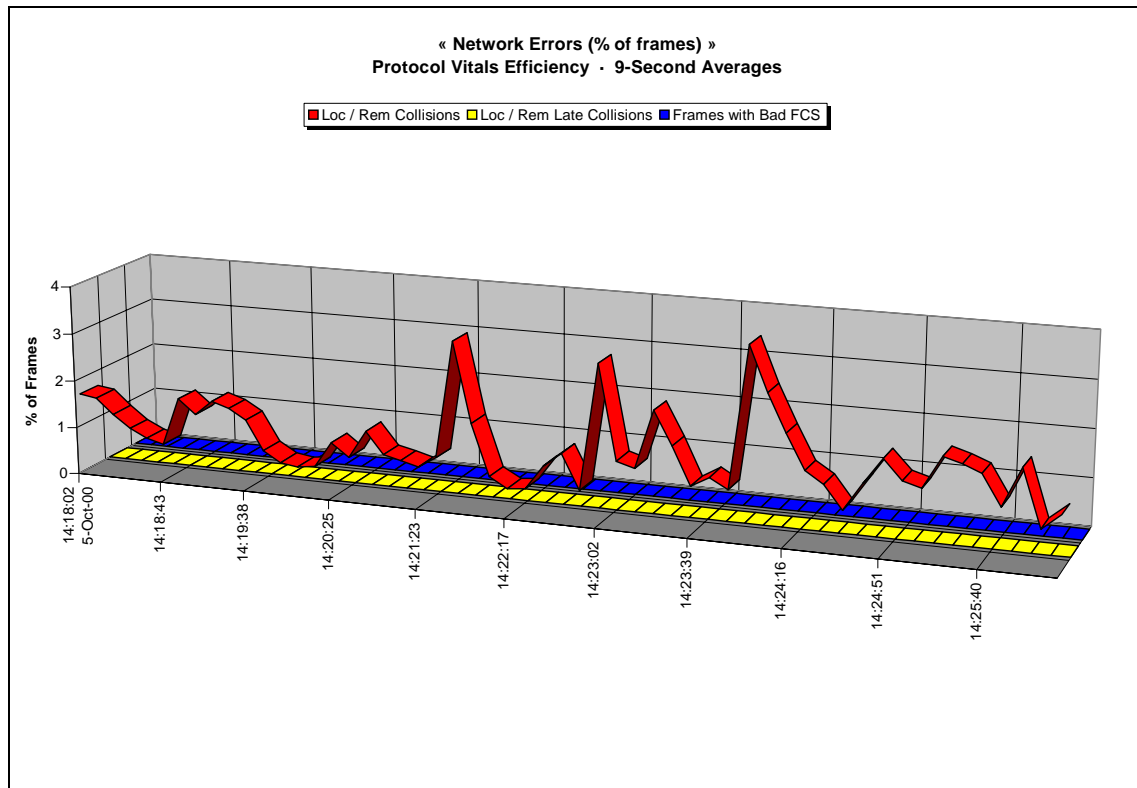
The process begins with gathering detailed information about your network infrastructure; i.e. LAN/WAN protocols in use, IT policies and procedures, targeted service levels and an inventory of affected network devices. Business expectations are also important to note and figure prominently in the subsequent recommendations.

After information has been gathered, the Network Engineer will conduct and document a physical survey of the site(s) to determine whether the physical environment, i.e. cabling, circuits, security, is helping or hindering the current network in its journey to IP Telephony.

As the testing of the network begins, the Network Engineer uses a protocol analyzer to test various network segments (LAN, WAN) for variables such as peak usage, dropped packets, retransmissions, etc.

After all sites have been tested, statistical reports are generated and analyzed for causes of network issues such as congestion or packet retransmissions.





**Fig. 1.3: Sample statistical graph showing errors in a customer's network.**

At this point, voice quality tests of the existing voice infrastructure, i.e. PBX and voice gateways will be conducted to establish a baseline against which to measure IP Telephony performance. IP Telephony traffic is then injected in the network flow for measurement. As in the network testing, detailed statistical reports are generated for analysis.

Using the combined information collected from the interviews, site survey(s) and test reports, the Network Engineer creates a final assessment report containing his analysis, findings and recommendations, outlining any necessary improvements in network infrastructure that should be made prior to Telephony implementation. A Network Specialist also validates the report. An implementation plan with budgetary estimates can be included at the customer's request.

Since an IP Telephony Assessment also serves as a baseline for future implementation, it would be beneficial to conduct another IP Telephony Assessment post-implementation to verify whether the anticipated level of voice quality has been met.

The decision to outsource the critical services of a Network and IP Telephony Assessment is an important one. There are many factors to consider including: Does my staff have the tools and expertise required to perform the assessments? Does my staff understand voice technology? If I want to build the expertise in-house, have I budgeted for the expenses associated with building the expertise?



When making this decision, consider your business requirements, timeframe to deploy and internal core competencies. Deploying a successful IP Telephony solution for your organization will depend as much on the planning and services you select prior to the implementation as the IP Telephony products you choose.

## Conclusion

IP Telephony offers many benefits because of its ability to consolidate separate voice and data networks. However, before purchasing any hardware, companies should first have an objective evaluation conducted of their existing infrastructure and network performance. The IP Telephony Assessment from NEC Unified Solutions provides an effective way to address any underlying network performance or topology issues that could hinder an IP Telephony implementation, while providing a baseline for future voice quality.

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### About NEC Unified Solutions

NEC Unified Solutions Inc., a leader in integrated communications solutions for the enterprise, delivers the industry's most innovative suite of products, applications and services that help customers achieve their business goals. With more than a century of communications and networking expertise, NEC Unified Solutions, Inc., a subsidiary of NEC America and affiliate of NEC Corporation (NASDAQ: NIPNY), offers the broadest range of communications services and solution choices, flexible product platforms and applications, and an open migration path to protect investments. NEC Unified Solutions, Inc. serves the Fortune 1000 and customers across the globe in vertical markets such as hospitality, education, government and healthcare. For more information, visit [www.necunifiedsolutions.com](http://www.necunifiedsolutions.com).

### Document Information

This document is intended to provide outline information only and can change without prior notice.



## **Additional Resources**

*IP Telephony — The Integration of Robust VoIP Services*, by Bill Douskalis  
(Prentice Hall)

“The Network Assessment as a Baseline for Success,” NEC Unified Solutions,  
Inc.

“What You Need to Know Before You Deploy VoIP,” Tolly Research, Inc.