

Best Practices for VoIP Network Assurance and Performance Management

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White Paper

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Table of Contents

Meeting the Challenges Ahead 3

What is a Network Assessment? 4

Benefits of an Accurate Assessment 6

Finding the Best Solution6

The PathView Cloud Advantage 8

Roadmap for VoIP Network Assurance with PathView Cloud 9

Pre-Deployment Network Assessment 9

Post-Deployment Network Assessment 9

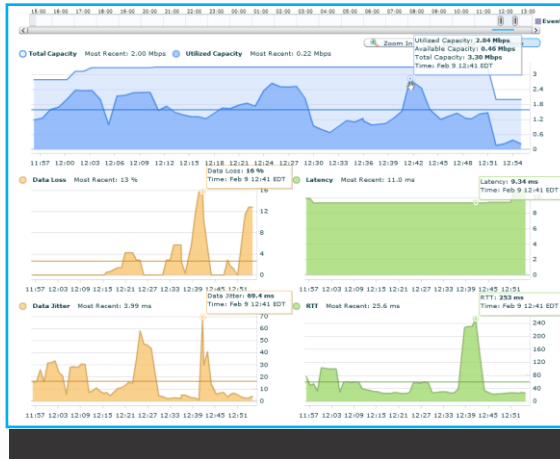
Ongoing Network Monitoring 10

Troubleshooting VoIP Services Delivery Issues 10

Reporting on VoIP Service Delivery 11

Conclusion

Introduction



If you are reading this guide, then the decision to move to a converged network within your organization has likely already been made. And one of the new applications you intend to implement is a voice-over-Internet-protocol (VoIP). Therefore, what's most important now is discovering how to assure that every time one of your company's employees picks up his or her VoIP handset, the moment isn't spoiled by poor voice quality or dropped calls.

But as Gartner analyst Jeff Snyder has warned, 85 percent of networks are not ready for VoIP. Furthermore, starting the transition to convergence by assessing your network's ability to handle VoIP is the only way to gain a complete understanding of the scope of the project.

Meeting the Challenges Ahead

With the advancement of IT infrastructure, the critical services the organization relies upon are now a technically dense collection of new and legacy hardware and software. Its dynamic nature makes it increasingly difficult to support and maintain. Its complexity also makes it fragile.

Therefore, the best mindset to have when starting your VoIP project is to think in terms of network dysfunction. You may be surprised to discover that networks don't always work the way you expect — or even as designed. Unfortunately, these network performance problems will significantly impact VoIP call quality.

Therefore, the task of transitioning physically separate voice and data networks onto a single shared infrastructure without compromising the quality of either voice or data traffic will require new practices and procedures. Analysts and experts alike agree a pre-deployment network assessment is the crucial first step.

Gartner analysts caution that 75 percent of enterprises that do not perform a pre-implementation analysis of their IP network infrastructure will not achieve a successful VoIP implementation.

An Effective VoIP Assessment will:

- Measure the call load capability of the network
- Identify the faults and shortcomings of the network
- Provide a holistic view of the network's ability to handle data and voice traffic
- Lower the project's cost estimates
- Verify service level agreements (SLAs)
- Eliminate the network as a gating factor in the VoIP project

What is a Network Assessment?

Organizations often underestimate the task of network assurance throughout the VoIP deployment life cycle. A mean opinion score [MOS] and a couple delay and loss measurements are not enough to judge call quality and network capability nor do they take into consideration the varying conditions of network traffic. Unfortunately, because the requirement isn't clear, some organizations use these measures alone to test their network's readiness for VoIP as well as afterward to see if their deployment was successful. And, some don't bother to test their network at all! Either method can be dangerous and costly.

Providing reliable VoIP network assurance requires a five-step approach:

- 1.) Pre-deployment assessment [Will it work?]
- 2.) Post-deployment assessment [Does it work?]
- 3.) Ongoing monitoring [How to keep it working]
- 4.) Troubleshooting [Unforeseen problems]
- 5.) And of course, accurate reports at each stage

1. Pre-deployment Assessment:

Not to be confused with a feasibility assessment, a VoIP pre-deployment assessment should look at the current state of the converged network, evaluate its ability to support VoIP and identify the dysfunctions that are restricting performance and the requirements to meet call load need. In contrast, a feasibility assessment — often termed a “quick and dirty” within the industry — is simply a onetime test that waves either a red or green flag — and with only 15% of networks able to handle VoIP, there's lots of red being seen.

The pre-deployment assessment should be done prior to purchasing or deploying any VoIP equipment or making any upgrades. It should provide a complete analysis of the end-to-end data network, recording important measurements such as bandwidth, utilization, throughput, loss, jitter, latency and MOS. It should identify and isolate faults on the network that currently inhibit application performance.

Basically, this baseline assessment should answer:

- a) Is this LAN and WAN capable of supporting VoIP? Which segments are? Which are not?
- b) Are the service level agreements being met by the service providers? Is the service level sufficient to meet the needs?
- c) Which configuration faults need to be fixed?
- d) Which components need upgrading?
- e) What is the call load capability?
- f) What is the best and worst call quality given a variety of conditions?



AppNeta's PathView microAppliance is a small, zero administration device that remotely tests and troubleshoots complex networks, even through third-party infrastructure.

The baseline assessment should be an iterative process that will need to be repeated several times before moving onto the next steps. Networks are plagued with configuration faults (such as duplex mismatches and slow-performing NICs) that result in poor network performance and once fixed often remove the need for some upgrades. As “sticky-finger” errors are corrected along the way, the quality and performance capability of the network will improve for all applications.

It is best to reassess as modifications are made. Only at this stage is it practical to evaluate the condition of your network and create an upgrade/improvement strategy.

2) Post-deployment Assessment

The objective of a post-deployment assessment is to quantify the quality of the installation before turning the system live to users. This ensures that the installation was successful in providing the quality level required before users come onto the system and complain about poor or dropped calls.

Many of the testing procedures in pre-deployment testing need to be repeated in post-deployment. This is because adding new IP equipment into an existing network changes the dynamics of that network and will most likely introduce a few new fault conditions.

Post-deployment testing should be performed within each VoIP deployment site as soon as it is ready and then between sites to evaluate the inter-site communication performance. Post-deployment testing should be done early and often to minimize the cost of fault resolution and also to provide an opportunity to apply lessons learned later on during the installation. In this phase you’ll re-verify the baselines established in the pre-deployment phase.

3) Ongoing Monitoring

Every day your IP network changes as devices are added, moved and removed. These could be IP phones, laptops, routers or switches — it doesn’t matter as each change has an impact. They all contribute to the churn all IP networks experience. It is critical to reevaluate your network to find and fix the inevitable faults that come along with change. Finding faults before they become business inhibitors increases quality and reduces costs. In this manner, you’ll receive maximum benefit from your VoIP investment.

Regular monitoring builds upon all the assessments and testing performed in support of a deployment. You continue to verify key quality metrics of all the devices and the overall IP network health.

4) Troubleshooting

Despite our best intentions there will always be cases where service interruptions occur. During these times, it is critical to have technology capable of quickly pinpointing the source of failing applications and defining **remediation steps**.

Key to Successful VoIP Implementation:

75% of enterprises that do not perform a pre-implementation analysis of their IP network will not achieve a successful VoIP implementation.

— Gartner

A failing network that impacts voice is a serious situation. This is not the time to pour over reams of historical data. Introducing significant amounts of additional traffic for an extended period of time only exacerbates the situation and doesn't provide the immediate resolution you require.

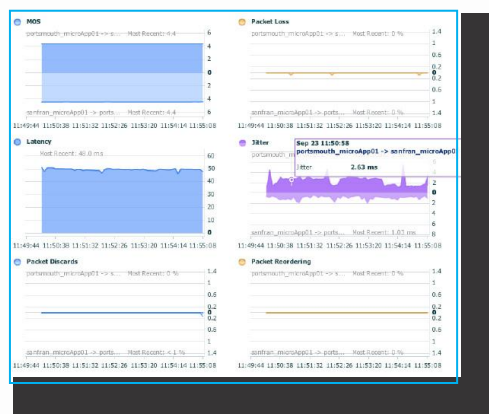
A troubleshooting scenario is usually initiated with a user or customer complaining about poor quality. Ideally this would be brought to your operation center's attention through regular maintenance and not a dissatisfied user. When it does happen, you need to quickly focus your attention on the components that are failing. Finding where to focus is often more difficult than fixing the fault.

A comprehensive baseline assessment of the existing infrastructure is the only way to understand the scope of your VoIP project and to accurately assess needs and costs.

Gartner analyst Richard Matlus warns that approximately 75 percent of companies will underestimate upgrades/ replacements to their data networks when adding VoIP. Blaming inadequate baseline and network inventories, he adds that surveying a representative sample and making assumptions based on these results can be a costly mistake — getting price and performance wrong due to insufficient baseline information. Zeus Kerravala, vice president of enterprise infrastructure at the Yankee Group, notes that some firms' costs have increased by 30 to 40 percent with VoIP because of the labor costs of dealing with network problems.

Finding the Best Solution

Traditional network management solutions, which rely on observations made over a lengthy time period and analysis of historical data make it difficult, if not impossible, to accurately monitor, measure, troubleshoot and report voice performance. These solutions, which rely on software or hardware agents, typically fit into one of two categories: traffic simulators or passive monitors. Both of these methods have advantages as well as drawbacks.



Traffic Simulators are software or hardware placed at two (or more) points to run simulated VoIP traffic between pairs. Simulated flows are analyzed for undesirable behaviors.

Each testing stream consumes network resources equivalent to one real voice stream. More than a handful of test streams consume a significant amount of network capacity — which may not be appropriate in a live converged network. Certainly this is not the desired technique when you're experiencing problems.

“PathView Cloud is easily deployed — a claim no other end-to-end network management product can make — and, more important, it gets at network performance problems that often go undiagnosed.”
— Network Computing

Traffic simulators require software installed at both ends of every network connection to be tested. Testing 100 endpoints requires at least 100 software installations.

Liability concerns accompany the installation of software throughout the network. There are also additional costs incurred when maintaining agent machines.

Traffic simulators require direct access to both sides of test path. If you don't have remote login or someone at the remote location to perform installation then you cannot test.

Traffic simulators do not pinpoint exact cause and location of problem – instead, they rely on root cause analysis of historical data. Result of testing indicates symptoms of poor quality but not the location, particular cause and resolution recommendations.

The overhead of deployment logistics and competition with existing converged network traffic make simulators ineffective for resolving post-deployment problems.

Passive Monitoring

Passive Monitoring is done with hardware or software placed at critical points such as gateways and switches. These systems build statistical profiles and monitor individual calls.

These hardware-based solutions require special network connectivity. They also usually require special configuration by the network administrator and access to secured network areas.

Passive monitoring systems analyze only individual points in the network. They do not provide a complete picture of full network paths.

These systems can tell you that a particular call was bad, but not why, where or what caused the failure.

Passive monitoring systems do not work if there is no actual traffic to passively observe.

The PathView Cloud Advantage

PathView Cloud does more. A hybrid of sorts, it is neither a traffic simulator nor a passive monitor. PathView Cloud generates a series of packet bursts that are placed on the network in a proprietary manner and collect the information required for a full analysis of the involved network segment from end-to-end. It is an extremely “light touch” product that can be used on live networks without creating any interference or placing any significant load on the network.

PathView Cloud does not require any passwords, community strings, or even ownership of the devices it will be testing. It can be used on internal LANs or external WANs and can provide accurate, detailed analysis (including full bandwidth measurements and fault diagnosis) of any network segment, even across the Internet. It can conduct its analysis, locate and identify misconfigured devices, and provide a report for any IP network located anywhere worldwide regardless of the distance covered and latency involved.

PathView Cloud is the industry's only VoIP network assessment and troubleshooting solution that is capable of analyzing networks not owned or controlled by an organization. It thoroughly investigates the quality of the network beyond traditional ownership demarcation points — from end-to-end. Its agent-free installation means access to only one point on the network is needed as it resonates from within — testing to every networked device with an IP address. You don't have to settle for sampling a few devices and paths because PathView Cloud provides the complete picture — and it does so within a matter of hours.

The unique characteristics of PathView Cloud's testing methodology allow it to not only be used for analyzing and identifying faults in existing VoIP deployments, but also for pre-deployment analysis of all parts of an existing infrastructure to determine the suitability of each segment for multiple VoIP deployment scenarios.

Patent-pending algorithms are used to provide predictive MOS that detail the best, average, and worst performance that can be expected for a specified simultaneous call load. Because this is measured through active testing without the need for endpoint agents, a single technician can analyze thousands of links (both internal LAN-based clients, servers, and handsets as well as external WAN connections) within a single day. Full reporting capabilities allow the automatic creation of detailed and summary reports containing as much or as little information as desired.

Holistic Approach — The age-old philosophy that the whole is worth more than the sum of its parts applies aptly to converged networks. The testing of each individual functional component in converged networks is important to guarantee that each element can not only support voice alongside data, but do so by assuring low latency, jitter, and packet loss without limiting the total bandwidth available to, and required by, the VoIP streams.

Depending on your role within the organization, it may prove helpful to have a range of reports — from a high-level presentation for the executives who have to sign off on investment to a detailed version for the team in the trenches that will need to make it happen.

1. Perform a pre-deployment network assessment
2. Assess the impact of VoIP on the network post-deployment
3. Continuously monitor the network's impact on VoIP service delivery
4. Troubleshoot problems that arise with VoIP service delivery
5. Report on the network's impact on VoIP service delivery

Pre-deployment Network Assessment

Steps to take:

1. Define paths to be tested
 - a. WAN paths including segments that pass through third party networks
 - b. Define the agent-based path to each server
 - c. Use LAN discovery in each LAN
 - d. Include known handsets and clients
2. Define performance characteristics to test and thresholds that must be met
 - a. MOS scores, jitter, latency, and bandwidth
3. Iteratively test and resolve WANs
4. Iteratively test and resolve servers
5. Iteratively test and resolve all clients and handsets including LAN discovery of other clients
6. Capture entire set of paths and end-points for reference baseline

Summary:

Pre-deployment network assessments are critical to the successful deployment of VoIP applications. Appropriate to network topology, assess outward from critical servers and central networks to remote clients and LANs. Completely resolve common server and WAN link issues before beginning iterative sweeps of LANS to identify and resolve local, third-party and end target issues.

Post-deployment Network Assessment

Steps to take:

1. Define post-deployment testing cycle
 - a. Identical to rep-deployment for rapid comparison and projection
2. Execute immediately after deployment
 - a. Confirm with baseline testing
 - b. Iterate and resolve for new instances
3. Document and confirm results against success criteria
4. Capture results for future reference baseline

Summary:

Understanding the impact that VoIP deployment has on the rest of the networked services is critical. At this point in time, problems can be found and fixed before the VoIP deployment impacts users. Once

success criteria are achieved, re-assess the entire set of paths to act as an assessment confirmation and baseline performance for future tests. Document in detail and at the high level for the final sign-off. Archive final results as a reference for future assessments or as part of the maintenance and/or help desk process.

IP networks are entities that continually evolve and change with both known and unknown variables. Therefore, the job of VoIP quality assurance never ends. Fortunately, PathView Cloud provides end-to-end testing of live voice, data and converged networks without interruption of service, allowing your organization to continually attend to the job at hand.

Ongoing Network Monitoring

Steps to take:

1. Automate real-time monitoring on a continual basis
 - a. Define critical performance thresholds that must be met
 - b. Define notification criteria when thresholds are violated
2. Repeat for any major revisions or upgrades to the network
3. Document on a regular basis for analysis and reporting

Summary:

Ongoing monitoring allows network administrators find problems before their users are impacted. As appropriate to the requirements, repurpose existing assessment infrastructure for use within the ongoing monitoring process. Apply proactive / automated testing and notification against current and functional success criteria.

Troubleshooting VoIP Issues:

Steps to take:

- Automate troubleshooting escalation when performance thresholds are violated
 - o Deep dive into specific network path with problem
 - o Automate the troubleshooting process with diagnostic information to fix problems
- Manually initiate troubleshooting process if performance trends indicate future problem
 - o Find and fix problems before users are impacted

Summary:

Finding and fixing problems in complex networks often outside the network manager's control can consume much time and resources. Additionally, overall business productivity is often impacted when network problems arise. Having tools to automatically find and fix problems is critical to ensure uninterrupted service delivery.

Steps to take:

- Define audience receiving reports and what information they need
 - o Summary vs. detail
 - o Business impact vs. network details
- Define data to collect and report structure
- Define reporting interval
 - o Daily, weekly, monthly
- Define delivery mechanism and format
 - o Dashboard vs. email
 - o Pdf vs. xml vs. xls vs. other format
- Automate report generation and distribution

Summary:

A vital component of the VoIP deployment process is the report – presentation of the information in a useful format for decision makers. Used to justify upgrades and quantify investment required to move successfully to VoIP, the report should clearly and concisely quantify the end-to-end view of VoIP performance– not just how your network is performing but rather how the end user experiences VoIP. Know how your service providers and carriers are performing and whether any problems are related to them or your own network. Communicate effectively with executives, management, peers, customers and providers through clear, easy-to-understand graphics and customized views for different audiences.

Predictability Means Preparedness

VoIP is a real-time application that is susceptible to problems resulting from the shared nature of the network infrastructure — a potential problem for mission-critical applications. PathView Cloud offers MOS predictability, meaning it will measure and report call quality as it exists at the time of testing and will also provide MOS readings given the varying operational traffic conditions. This feature is especially beneficial as some network faults, such as duplex errors, may degrade voice quality in an unpredictable manner making diagnosis with other methods difficult.



Conclusion:

The success of VoIP relies upon the success of many individual network components. When one is not performing as required, call quality will suffer without a clear cause to the end user. This is true during every stage of VoIP usage — from deployment through to day-to-day operation.

Since no two networks are exactly the same, no two network assurance programs will be either. Fortunately, PathView Cloud adapts to your needs, and provides a complete approach. Unmatched in the marketplace, its affordability and functionality meet the specific needs of pre deployment assessment, ongoing monitoring, troubleshooting tough network problems and reporting on its impact on the business. It takes advantage of original investment during the pre deployment stage to provide unparalleled network assurance throughout the VoIP deployment life cycle.

About AppNeta

AppNeta delivers instant-value network performance management solutions required to drive exceptional application performance across all data center, cloud, remote office and mobile environments. AppNeta's award-winning PathView Cloud solutions leverage a zero administration, cloud-based service to meet the performance demands of today's distributed network infrastructure and mainstream network-dependent applications including unified communications, cloud services and virtual service delivery. With more than 1,000 users worldwide, AppNeta provides unmatched performance insight to network engineers and IT outsourcers, enabling predictable and efficient delivery of today's business-critical application services from wherever they originate to wherever they are consumed.

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