



White Paper

Best Practices for VoIP Network Assurance



Best Practices for VoIP Network Assurance

Table of Contents

- MEETING THE CHALLENGES AHEAD 3
- WHAT IS A NETWORK ASSESSMENT? 4
- BENEFITS OF AN ACCURATE ASSESSMENT 6
- FINDING THE BEST ASSESSMENT SOLUTION 6
- THE APPCRITICAL ADVANTAGE 7
- WHAT’S IN THE REPORT? 8
- 4 STEPS TO VOIP ASSURANCE WITH APPCRITICAL
 - 1. THE TESTING/RESOLUTION CYCLE 9
 - 2. BASELINE AND DOCUMENT 9
 - 3. REGULAR MAINTENANCE CYCLE 10
 - 4. REACTIVE HELPDESK INFRASTRUCTURE 11
- CONCLUSION

Best Practices for VoIP Network Assurance

If you are reading this guide, then the decision to move to a converged network within your organization has likely already been made. And the first new application 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 executives picks up their 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. Due to its unique time sensitiveness, small delays that may go unnoticed while transferring data on the network can make VoIP communications unbearable.

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.

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What is a Network Assessment?

Organizations often underestimate the task of pre-deployment assessment. 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 forgo this step altogether, proceeding with automatic network upgrades. Either method can be dangerous and costly. While it is widely accepted that upgrades to the network will be required to support VoIP, only with a network assessment can a targeted approach be taken.

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 project cost projections
- Verify SLAs
- Eliminate the network as a factor in the VoIP project

Providing reliable VoIP network assurance requires a four-prong approach, which is best defined as follows:

- 1) Pre-deployment assessment [Will it work?]
- 2) Post-deployment assessment [Does it work?]
- 3) Regular maintenance checks [How to keep it working]
- 4) Break/fix strategy [Unforeseen problems]

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, 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 one-time 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 & WAN capable of supporting VoIP? What portions are? Which aren't?
- b) Are the service level agreements being met by the service providers? Is the service level sufficient to meet needs?
- c) What configuration faults need to be fixed?
- d) What components need upgrading?
- e) What is the call load capability?
- f) What is the best and worse call quality given a variety of conditions?

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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 “stickyfinger” 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.

Root cause analysis

“Yesterday’s solutions and practices are limiting. Diagnosis needs to be quick; resolution immediate. When the phone is down, there is no time to analyze charts and graphs.”

— Martin Webb
Manager,
Data Network Operations,
Province of British Columbia

2) Post-deployment assessment

The objective of post-deployment 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) Regular maintenance assessment

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 re-evaluate 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 maintenance 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) Break/fix strategy

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.

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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 break/fix 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 in the system that are failing. Finding where to focus is often more difficult than fixing the fault.

Key to successful VoIP Implementation

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

— Gartner

Benefits of an Accurate Assessment

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 Assessment 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.

- **Stressful, somewhat intrusive**

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 not the desired technique when you're experiencing problems.

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Only easily deployed solution

“AppCritical 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*

- **Deployment is a logistical challenge**
Requires software installed at both ends of every network connection to be tested. Testing 100 endpoints requires at least 100 software installations
- **Requires many points of presence in the network**
Liability concerns accompany the installation of software throughout the network. There are also additional costs incurred when maintaining agent machines.
- **Doesn't work if you don't have access to the other end**
Requires 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.
- **Network expertise is needed to interpret results**
Doesn't pinpoint exact cause and location of problem - relies on root cause analysis of historical data. Result of testing indicates symptoms of poor quality but not the location, particular cause and resolution recommendations.
- **Poor for post-deployment problems**
The overhead of deployment logistics and competition with existing converged network traffic make simulators ineffective for resolving post-deployment problems.

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

- **Deployment is a logistical challenge**
These hardware-based solutions require special network connectivity. They also usually require special configuration by the network administrator and access to secured network areas.
- **No end-to-end analysis capabilities**
Passive monitoring systems analyze only individual points in the network. They do not provide a complete picture of full network paths.
- **Network expertise is needed to interpret results**
These systems can tell you that a particular call was bad, but not why, where or what caused the failure.
- **Ineffective for pre-deployment assessments**
Does not work if there is no actual traffic to passively observe.

Best Practices for VoIP Network Assurance

The AppCritical Advantage

AppCritical does more. A hybrid of sorts, it is neither a traffic simulator or a passive monitor. Entirely software-based, AppCritical 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.

AppCritical 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 mis-configured devices, and provide a report for any IP network located anywhere worldwide regardless of the distance covered and latency involved.

AppCritical 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 AppCritical provides the complete picture — and it does so within a matter of hours.

The unique characteristics of AppCritical’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 end-point 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.

What’s in the Report?

A vital component of the assessment process is the report — presentation of the information in a useful format to the decision makers. Used to justify upgrades and quantify investment required to move successfully to VoIP, the reports should clearly and concisely identify the condition of the network as well as the areas that need fixing and how to fix them.

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.

AppCritical Differentiators

- Detailed, in-depth diagnostics of network-performance faults [not just observations]
- Complete path visibility
- Can test to everything with an IP address
- Predictive MOS
- QoS considerations
- Device and vendor Independence
- Measures key performance metrics
- Install and testing within minutes
- Visibility in networks not owned or controlled by the organization
- Tests live IP networks without interruption
- Holistic approach views the network for data and voice
- In-depth analysis without being in fault domain

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Roadmap for VoIP Network Assurance with AppCritical

1. Define and implement testing/resolution cycle
2. Baseline and document
3. Define and implement regular maintenance cycle
4. Deploy and implement reactive helpdesk infrastructure

Details

1. Define Pre-Deployment Assessment Testing Cycle
 - a. Define paths to be tested
 - Include all WAN paths
 - Define agent-based path to each server
 - Use LAN discovery in each LAN
 - Include all known handsets and clients
 - b. Iteratively test and resolve WANs
 - c. Iteratively test and resolve servers
 - d. Iteratively test and resolve all clients and handsets including LAN discovery of other clients

Summary: Appropriate to network topology, assess outward from critical servers and central network to remote clients and LAN. Completely resolve common server and WAN link issues before beginning iterative sweeps of LANs to identify and resolve local and end-host-specific issues.

2. Baseline

- a. Capture entire set of paths/end-points for reference baseline
- b. Document and confirm against success criteria

Summary: Once success criteria are achieved, re-assess entire set of paths to act as assessment confirmation and baseline. Document in detail and at high level for final sign-off. Archive final results as reference for future re-assessment, or as part of the maintenance and/or helpdesk processes.

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.

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3. Maintenance Cycle

a. Define post-deployment testing cycle

- Identical to pre-deployment for rapid comparison and projection

b. Execute immediately after deployment

- Confirm with baseline testing
- Iterate and resolve for new instances

c. Repeat baseline as required

d. Automate re-assessment on regular basis

- Define critical thresholds on basis of component type
- Define notification criteria
- Define re-assessment period

AppCritical Recommendation:

- Hourly re-assessment of identified WAN and server paths
- Weekly re-assessment of identified paths
- Monthly assessment of discovered paths

e. Repeat for any major revisions/upgrades to network

f. Re-document on monthly basis for analysis and reporting

Never-Ending Job

Because IP networks are entities with a continually evolving mixture of interrelated knowns and unknowns, the job of VoIP quality assurance will prove never-ending.

Fortunately, AppCritical 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.

Summary: As appropriate to the requirements, repurpose existing assessment infrastructure for use within maintenance and regular re-assessment process. Apply proactive/automated testing and notification against current and functional success criteria.

Best Practices for VoIP Network Assurance

4. Diagnostic Support/HelpDesk

a. Deploy support infrastructure using existing testing infrastructure, in addition including:

- central Web support desk
- case ID-based access to pre-/post-deployment references
- self-testing for end-user
- on-demand sequencer deployment

b. Utilize deployed assessment infrastructure as well as on-demand deployment on reactive basis

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. AppCritical 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.

Summary: As appropriate to the requirements, integrate support and help-desk capabilities with expanded assessment infrastructure. Baseline documentation and archived testing provide the context for rapid resolution of trouble calls and basis for professional services.

Conclusion: Not all solutions are created equal

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, AppCritical adapts to your needs, and provides a complete approach. Unmatched in the marketplace, its scalability and functionalities meet the specific needs of pre-deployment assessment, on-going maintenance as well as immediate action for break/fix situations. It takes advantage of original investment during the pre-deployment stage to provide unparalleled network assurance through the network life cycle.

Best Practices for VoIP Network Assurance



Apparent Networks develops and markets software that provides a unique approach to managing the performance of network-dependent applications. The Company's AppCritical solution measures and diagnoses live, converged networks with continuous real-time monitoring. It provides unbroken, end-to-end visibility into the critical performance characteristics of network resources needed for voice, video and data applications.

AppCritical has been successfully deployed by large enterprises, managed service providers and tier-one technology vendors to assure end-user quality of experience. Customers include: 3Com, Affiliated Computer Services, Boeing, Electronic Arts, Fujitsu, Hewlett-Packard, IBM, Network Appliance, Nortel, Siemens, Symantec, TELUS, and Toshiba.

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