



PRIORITIZING VOIP QUALITY

Protect Revenue Streams and Meet Customer Expectations with Integrated Media Troubleshooting

INTEGRATED MEDIA TROUBLESHOOTING WORKFLOW – USE CASE #1

Resolving Service Outages – Corrupt or Misprovisioned Data

As new services are implemented and network capacity is extended, operators must continuously upgrade network equipment and perform routine maintenance to keep everything operational. When vendor software loads are installed, configuration changes usually apply. When all goes well, subscribers are oblivious to such changes with virtually no impact to their service. When the introduction of a new software load does not perform as planned, outages can occur. During one such problematic upgrade, the NETSCOUT solution was used to identify, pinpoint and solve a problem before it morphed into a costly, large scale service outage. The following is a summary of the incident.

A Tier 3 engineer begins the day with a routine check of the daily network performance report that has been delivered to his inbox. The daily report gives the engineer a breakdown of call quality by presenting a number of metrics observed on the RTP streams over the past 24 hours. Immediately, the engineer notices that jitter metrics are above an acceptable level.

In order to determine the severity of the observed problem, the engineer uses NETSCOUT'S service assurance application to view the current and historical performance of all core nodes. His investigation centers on the average jitter KPI as reported by the daily report.

A simple query of the network for average jitter shows that there has been a noticeable spike in the amount of jitter experienced on the network and the problem is still in progress.

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Subscribers Expect Operators to Deliver Quality, Not Charge Them for It

The competition for voice revenues is intensifying as the race to gain operational efficiencies is often at odds with delivering the quality subscribers have come to expect. When multiple services begin to share network resources, voice performance, and subsequently, voice revenues may be at risk. To compete in this challenging environment carriers must distinguish themselves with guaranteed network Service Level Agreements (SLA) and innovative service offerings designed to save subscribers money with minimal network disruption and complete preservation of exceptional network quality.

Securing a winning reputation of consistent, dependable network superiority against the competition is tough. With modern networks built on a mix of technologies (TDM, IN and IP), operators are challenged to manage a mixed environment of network equipment, new protocols and services, complex translations, and customer premise equipment (CPE), just to name a few.

- Call paths are inherently more complex—often spanning multiple technologies and domains.
- Competition for network resources can impact quality—time- and latency-sensitive traffic shares the network with unrelated and unpredictable traffic.

As changes are made to the network and new technologies are introduced, the likelihood of an outage increases leaving network quality compromised. Faced with this threat, operators must be ready to act quickly to solve a number of complex issues. In some cases, finding the cause of a VoIP quality degradation issue for example is akin to searching for the proverbial “needle in the haystack.” If operators cannot get to the root of quality issues quickly and cost-effectively, they run the risk of losing customers and revenues.

In order to address the problems that can negatively impact a voice customer's service experience, operators can and do invest in sophisticated troubleshooting tools and problem management systems focused on individual and often disparate domains. Some of the more commonly used approaches include the following:

- Monitoring control plane traffic for a specific protocol
- Leveraging NEM-based, vendor-specific troubleshooting tools
- Developing proprietary and internal tools to monitor and troubleshoot voice quality
- Simulating subscriber traffic with active testing to derive QoE metrics
- Leveraging open source products to create home-grown solutions
- Collecting and aggregating metrics reported by network elements

While such point-based and purpose-specific solutions appear economical and may deliver some short-term benefits, long-term implications should also be considered. Managing a complex, unique network, where call paths traverse multiple technologies can result in the deployment of multiple solutions implemented by individual domain owners. In such cases, such an approach cannot provide the network-wide visibility that will be required to effectively resolve complex VoIP quality issues.

USE CASE #1 CONTINUED

Leveraging a guided drill through path, the engineer easily pinpoints the IP node which is the source of the problem. A release cause (8002 – No MOS Available) is observed. Continuing the investigation, the user drills directly into the affected calls to isolate those resulting in a poor quality experience for the operator's subscribers.

As further investigation is needed, the engineer launches a contextual session trace in order to view the selected call flow, including the source of the jitter problem.

With NETSCOUT's Iris Session Analyzer (ISA) the engineer confirms the source of the high jitter. Utilizing the integrated record and playback option, the engineer "listens" to the captured media to determine how the jitter may be affecting the subscriber's experience.

Upon further investigation, it is discovered that a recent upgrade to the media gateway software performed just prior to the spike in jitter has occurred in the network.

Conclusion

In this specific case, the engineer was able to determine that an upgrade of the media gateway equipment was the source of the problem. A simple daily report alerted the engineer to a network quality problem and while a series of guided drill downs facilitated thorough investigation. After capturing and sharing the PCAP from the ISA traces with the vendor, the operator received new configuration recommendations from the NEM. By applying these new configurations, voice quality to the media gateway was restored and further call quality issues were prevented.

In addition to the aforementioned complexity, there is also immense commercial pressure to accelerate the network migration in order to realize cost savings. Operators with multiple, domain-specific systems run the risk of creating a complex mesh of diverse IP monitoring and reporting tools that ultimately delay migration progress and increase the total cost of ownership (TCO).

- Troubleshooting issues across multiple systems extends the mean time to resolve as every path the call takes requires unique expertise.
- To get a complete picture of the call quality and isolate the root cause, time-consuming manual correlation is required.

Instead, operators can better handle the complexities of a mixed TDM/IP environment with a single, multi-faceted system. Such a system will deliver network-wide, vendor-independent capabilities out of the box and reduce the costs associated with troubleshooting complex network issues.

Network-wide Monitoring Plays an Important Role

The ability to monitor a multi-domain network has become increasingly more important to operators as operations teams are being asked to manage new services and customers. With existing revenue streams on the line, operators recognize the importance of ensuring that services are delivered with the highest quality while, at the same time, minimizing the reliance and costs associated with multiple and vendor-specific tools.

For many forward-looking operators, the desired solution instead involves standardizing on a single, centralized monitoring tool that can address any call type. With this approach operators are poised to accelerate detection, isolation and resolution of quality problems at a significant cost savings and shorten the migration to an all-IP network.

To meet this desire, leading network management vendors offer solutions that can deliver correlated service quality metrics and payload visibility for every call, across all network domains. With the high financial stakes associated with providing superior voice services, it is extremely important to have a clear picture of your current problem management strategy as well as your desired end goal when evaluating troubleshooting methods.

Conventional Troubleshooting Misses the Mark

A more traditional troubleshooting approach has proven successful and affordable for many operators over the years. Using this method, operators have had enormous success with providing "just-in-case" visibility to any problem that might occur specialized staffing trained to "hear" quality degradation and simplistic call flows that follow standardized hierarchies.

Unfortunately, with the complexity of IP network call paths, such an approach may no longer prove sustainable.

Deficiencies with the practice of storing all the information for all of the calls, all of the time are amplified by the presence of payload information.

- In conventional troubleshooting only the SS7 control plane information was available. In converged environments, operators now have the option to collect the media as well.
- While such a practice can improve the visibility to issues, the cost and complexity to provide it is substantial. Some operators will choose to increase disk space incrementally in order to store more however; this solution is likely short lived.

- Right-sizing storage for IP troubleshooting requires constant supervision and tuning in order to provide adequate time windows for media troubleshooting. The dynamic nature of IP call flows eliminates any one-size-fits all approach.
- In many cases, the information needed is not available when troubleshooting begins, even when a system has been sized to accommodate traffic growth.
- As IP becomes the dominant means for the transport of voice traffic, a system's ability to scale gracefully becomes more important. Even the highest capacity systems on the market may not be able to keep up with the VoIP network of only a few years from now.

Access to specialized personnel is a growing concern for operators wishing to reduce OPEX.

- While the migration to IP provides some significant cost-savings in terms of infrastructure, it does not address the need to economize expertise.
- For many operators, this network evolution has also left an abundance of TDM-focused personnel with limited knowledge of IP environments and IP call QoS techniques.

Changing call paths complicate monitoring and actionable media capture.

- In converged environments with TDM, IMS and IP topologies, calls can traverse many paths. As a result it becomes increasingly difficult to monitor and capture media in a meaningful way.
- When addressing call quality what is captured is as important as where it is captured. The media must be evaluated within the context of the associated signaling and affected subscriber.
- With point-based solutions, reconciliation of multiple hops leads to multiple, and disjointed panes of glass in order to effectively evaluate and troubleshoot quality issues.

The above clearly illustrates that a conventional approach cannot adequately nor cost-effectively support the troubleshooting needs of an operator committed to making VoIP quality transparent to their customers. For these operators, new requirements will apply.

- To accelerate the transition of the network, troubleshooting systems must be capable of monitoring many domains from a single point of view. This capability eliminates the need and costs associated with sustaining myopic point-based solutions.
- As engineers must retain their ability to investigate multi-leg calls regardless on the domain, correlation must expand to cover calls that traverse multiple nodes, vendors and networks.
- To effectively understand the subscriber experience, real-time payload analysis is required. A system must be able to capture and correlate control plane information from application, protocol and transport layers.
- In addition, a system that can leverage the inherent quality metrics present in protocols such as SIP EoCQ can provide valuable insights beyond physical monitoring points.
- In order to better manage deployed resources and minimize backhaul costs, the system must support selective media capture and storage at the point of collection.
- To bridge the workforce IP experience gap, the system must deliver easy-to-use, easy-to-implement workflows to guide users in the quick identification and isolation of call quality issues.

INTEGRATED MEDIA TROUBLESHOOTING WORKFLOW – USE CASE #2

Troubleshooting Poor Voice Quality – Subscriber Experiencing Noise on the Line

A subscriber calls customer support complaining about continued poor voice quality. Specially, the subscriber indicates there is significant background noise during his calls. After reviewing the customer's record, the agent discovers that the subscriber is an early adopter in a neighborhood which has recently been added to the carrier's network. The subscriber has already been through a number of standard troubleshooting procedures. Both his home equipment and device have already been changed out and a one-time discount applied to his bill. The subscriber is rightfully frustrated and has indicated that he is ready to cancel service and change providers. As a last resort, a truck roll to the subscriber's home is ordered. The responding technician's visit reveals no faults at the location. Per the report, both the equipment and the line to the home prove operational.

Based on a review of the subscriber's history, the trouble ticket is escalated to the operations team for more in-depth troubleshooting to determine the cause of the issue, save the account and prevent negative publicity from deterring new subscriber acquisitions in the neighborhood.

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A New Approach Cost-effectively Supports Commercial Success

With a solution designed to handle diverse and expansive protocol requirements across multiple network topologies, the flexibility to incorporate multiple sources of quality information and unique subscriber capabilities, NETSCOUT delivers a winning solution that cost-effectively meets modern troubleshooting needs from a single system.

With NETSCOUT'S Integrated Media Troubleshooting Workflow, operators can manage subscriber quality of experience with complete payload visibility. Cost savings and improved efficiencies in this endeavor are likewise realized through the application of NETSCOUT'S troubleshooting expertise.

With the NETSCOUT solution, data processing is accomplished at the point of collection and eliminates the need to backhaul information to a central server. This approach effectively reduces the load on internal data networks and can deliver latency-resilient queries for accelerated investigation of quality issues.

Furthermore, applying years of experience in conventional troubleshooting methods, NETSCOUT is also well-equipped to assist operators in determining specific data storage needs and in implementing a solution to meet those requirements.

Complete Real-time Payload Analysis

VoIP has become a critical battleground for operators where quality and commercial success are inextricably linked. With aggressive competitors ready to offer dissatisfied subscribers a viable alternative, operators need an accurate picture of the quality provided to secure customer loyalty. To gain this visibility, real-time media stream analysis is required. NETSCOUT delivers critical quality metrics through continuous, direct RTP processing at the monitoring point.

By processing RTP streams in real time, the need to store, capture or backhaul the payload is obsolete.

Unlike NETSCOUT, many vendors limit payload analysis capabilities to either incomplete or historical sources.

- While some systems derive metrics from control plane signaling (e.g. SIP), others leverage captured media streams for direct analysis post-capture. In both cases, the information compromises an operator's ability to resolve quality degradation within an acceptable timeframe.

Timely resolution of call quality requires a complete and accurate understanding of the underlying and contributing issues. This holistic approach requires extended visibility and inclusion of multiple QoS measurement sources. By diving deeper into each media stream with additional metrics, operators build a better picture of the experience provided to the subscriber.

Operators need to access and analyze KPIs such as Mean Opinion Score (MOS), jitter, packet loss, and out of sequence packets as well as other key metrics in order to detect issues that may point to quality degradations.

NETSCOUT'S solution addresses this need with per-leg MOS reporting by protocol displayed contextually with the control plane signaling and media in a single display.

- Protocol support includes, but is not limited to, H.248 End of Call Quality (EoCQ), SIP and SIP EoCQ, RTCP and RTCP-XR with quality metrics derived from RTP flows. A complete list of supported EoCQ metrics is available upon request.

USE CASE #2 CONTINUED

The engineer uses NETSCOUT'S service assurance application to view the historical performance of the core nodes associated with the subscriber's location and the available call paths. Through this initial analysis, the engineer is able to see the MOS for each node and immediately concludes that the problem is not prevalent across the network. The engineer then determines that additional investigation is required to understand the root cause of the problem.

To further pinpoint the location of the quality degradation, the engineer launches Iris Session Analyzer (ISA). With ISA, the engineer can filter on many different options, including but not limited to, specific nodes, calling/called party numbers, IP addresses, protocols and media types. In this instance, the subscriber's number is used to filter the session trace. At this time the engineer also activates media capture for the subscriber. Selection of this option will allow the engineer to capture the RTP (all payload data) related to all calls made by the subscriber during the investigation. All RTP captures are stored locally at the monitoring point (on the probe) thus eliminating the need to backhaul information to a centralized server.

Once retrieved, all of the subscriber's are presented to the user. The information on the ladder diagram presents the call paths as well as the media MOS scores in a single window. By clicking on any one of the call legs, the engineer can access more detailed information about the payload including packet loss, jitter and inter-packet arrival time.

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In many cases, supporting such an extensive array of EoCQ metrics from one centralized display can actually eliminate the need to “record “ and “playback” the media at all—minimizing RTP storage requirements and backhaul capacity requirements.

These EoCQ metrics not only appear in the Iris Session Analyzer display as shown but also play an important role in the creation of higher quality xDRs that flow through the system to enhance capacity upgrade planning, QoS performance tuning and codec performance benchmarking.

By monitoring and analyzing all the IP data in real time, regardless of the source, operators can safely rely on NETSCOUT for an accurate view of quality with KPIs available on a per leg and per call basis. Storage of these KPIs enable aggregated views of network and node group quality. This enables the production of meaningful reports and alarms to drive the transformation of operations teams from reactive to proactive problem management

Optimized Storage Methodology

As discussed in previous sections, approaches that recommend storing all of the RTP, all of the time will hit capacity limits as VoIP gains dominance. Leveraging years of experience in monitoring some of the world’s largest mobile, fixed and converged networks, NETSCOUT recognized this limitation early on and sought to design a superior architecture that could accommodate current needs and support long-term IP traffic growth.

With the NETSCOUT solution, while all call signaling and control data units are stored, additional flexibility provides operators the means to proactively manage the storage of user-selected media data (RTP) from the payload. This is an extremely important and valuable capability as, in many scenarios, investing capital in storing information when the majority of the data may never be used is unnecessary and a poor allocation of limited resources.

A store-by-request methodology like the one offered by NETSCOUT on the other hand enables operators to decide when to capture RTP in real time for replay in order to “hear” the call quality that is experienced.

- Using a simple GUI-driven implementation, users can selectively activate and deactivate RTP capture when troubleshooting calls in progress or prior to launching test calls to ensure that the information needed is present and available for analysis.
- Capture triggering may be invoked based on calling and called numbers for real-time and targeted subscriber troubleshooting. IP addresses and port numbers may also be used to trigger RTP capture and extend visibility beyond individuals to proactively isolate specific nodes contributing to widespread issues.

NETSCOUT’S RTP capture capabilities may also be used support real-time troubleshooting to protect and support the experience of High Value Accounts, VIPs and frequent help desk callers. In these situations it may also be necessary to continuously collect information on a specific subscriber or group of subscribers, including RTP, as part of an overall SLA management initiative. For these scenarios, the NETSCOUT solution can support this capability with unattended capture options when needed.

Once the RTP is captured, the NETSCOUT solution provides additional convenience with integrated Wireshark playback capabilities.

USE CASE #2 CONTINUED

Through correlation of the different call types made by the subscriber, the engineer is able to isolate a number of potential causes. In this case, it is determined that the quality issue is most likely related to one of the following isolation causes: location, Voice Activity Detection (VAD)/ Codec, time of day, or congestion due to incorrect class of service set for voice traffic. At this point, the engineer clicks on “Analyze Media” to “listen” to the captured media.

After reviewing multiple calls captured over a period of 24 hours, the engineer is able to rule out time of day, and congestion. The problem is ultimately narrowed down to location. As the subscriber is an early adopter in a newly connected neighborhood, there is no pattern of customer care calls with similar complaints to provide any context. However, within days, the engineer is able to validate that new activations are experiencing the same “noise” as described by the subscriber. From this revelation, the equipment at the neighborhood is targeted as the problem cause.

Conclusion

In this specific case, the engineer was able to determine that a configuration issue with the neighborhood equipment was the source of the problem. After sharing the captured PCAP from the ISA traces with the equipment vendor, the NEM was able to make new configuration recommendations to remedy the situation and restore voice quality to the subscriber and future subscribers in the neighborhood.

The NETSCOUT Advantage

It is clear that working with a challenging environment and being laser-focus on delivering QoS creates an opportunity for operators to re-think problem management processes. With extensive and global Tier 1 experience, NETSCOUT is well-equipped to assist operators in this transition delivering both a unique solution and a consultative approach.

Facing limited OPEX and CAPEX budgets, the selection of multi-function, single vendor approach has some clear advantages from a Total Cost of Ownership (TCO) perspective.

NETSCOUT effectively addresses this concern with its Iris Session Analyzer product. Leveraging the Integrated Media Troubleshooting Workflow, operators have the horsepower they need to proactively prioritize VoIP quality.

Complete, Real-time Payload Analysis improves understanding of complex issues and accelerates resolution through a centralized interface. With NETSCOUT, a comprehensive set of metrics enable the isolation and localization of service degradation.

- Optimized Storage Methodologies provides the keys to controlling costs. Sophisticated, yet flexible capture criteria empower operators to capture and store only what is needed, when it is needed.
- Growth Protection is provided with a resilient and flexible architecture specifically designed to successfully and cost-efficiently support operators through their IP migration. With proven deployments in Tier 1 accounts around the world, NETSCOUT delivers massive scalability when it is needed.

While the benefits presented in the previous sections center around the application of the Iris Session Analyzer product, additional products may extend the value of the solution beyond basic troubleshooting.

Iris Session Analyzer

- Relevant troubleshooting information is easily accessible from a single application.
- From a standard ladder diagram, troubleshooting personnel can easily access and explore the details behind summary QoS metrics displayed on the associated media arrows with a single-click expansion.
- Extended media analysis and playback capabilities for authorized personnel may be launched natively, eliminating the need to save and transfer PCAP files for analysis using another tool. In addition, extensive export options facilitate the sharing of any information presented during the session trace with other departments for accelerated and coordinated analysis.
- For each reported MOS scoring, underlying metrics are easily presented with a single mouse click.
- NETSCOUT takes advantage of the inherent EoCQ protocols (end of call metrics) reported by the involved network nodes to augment aggregated quality metrics. In essence Iris Session Analyzer effectively centralizes the analysis of multi-vendor metrics—eliminating the need to look at each NEM on a per-vendor basis.
- Technicians can “listen” to the media without the need to save off PCAP files for disjointed analysis in another tool. The NETSCOUT solution is capable of storing RTP at the point of collection—eliminating the costs and complexities associated with information backhaul.

NETSCOUT

Americas East

310 Littleton Road
Westford, MA 01886-4105
Phone: 978-614-4000
Toll Free: 800-357-7666

Americas

3033 W. President
George Bush HGWAY
Plano, Texas
USA 75075

EMEA

One Thames Valley
Wokingham Road
Bracknell, Berkshire
RG42 1NG

APAC

238A Thomson Road #23-02/05
Novena Square Tower A
Singapore
307684 SG

NETSCOUT offers sales, support, and services in over 32 countries.

For more information, please
visit www.netscout.com or call us
at 1-800-833-9200 option 1
or +1-469-330-4000

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