



Delivering Hosted & Managed VoIP Services

Introduction

Enterprises are recognizing the benefits of hosted and managed VoIP services, which simplify their communication and IT infrastructures and offer lower rates through the provider's large-scale IP and peering infrastructure. However, quality and reliability concerns are slowing VoIP adoption; business-telephony is considered mission-critical, and often won't be replaced solely for financial reasons.

To address these concerns and win enterprise business, VoIP providers often back their offering with service level agreements (SLA's) that guarantee quality of service (QoS), assuring acceptable call quality, connection time, and system availability. To the operator, maintaining service quality and responding quickly when issues arise, are fundamental to meeting SLA requirements. To do so, providers need to develop best-in-class remote troubleshooting and preventative monitoring strategies.

Setup

Hosted and managed VoIP providers have control over data/voice operations centers. However, access to end-user enterprise locations may be limited with hosted solutions (Figure 1 & 2).

While passive testing provides excellent visibility into call signaling performance, active testing offers several ways to measure end-to-end, user-perceived speech, fax, and service quality. Because active testing is not limited to IP networks, it can be used to test service quality over the hybrid routes used in VoIP. For example, a test call can

originate from the PSTN, pass through a VoIP peering network, and terminate as a cellular call. Active testing is also used for provisioning and pre-deployment audits, where test calls are placed alongside existing or simulated network traffic. In monitoring, trending, and service level fault management applications, active test calls are grouped into test plans scheduled to execute at regular intervals. If a service quality issue is identified, on-demand testing provides detailed measurements to support remote troubleshooting efforts.

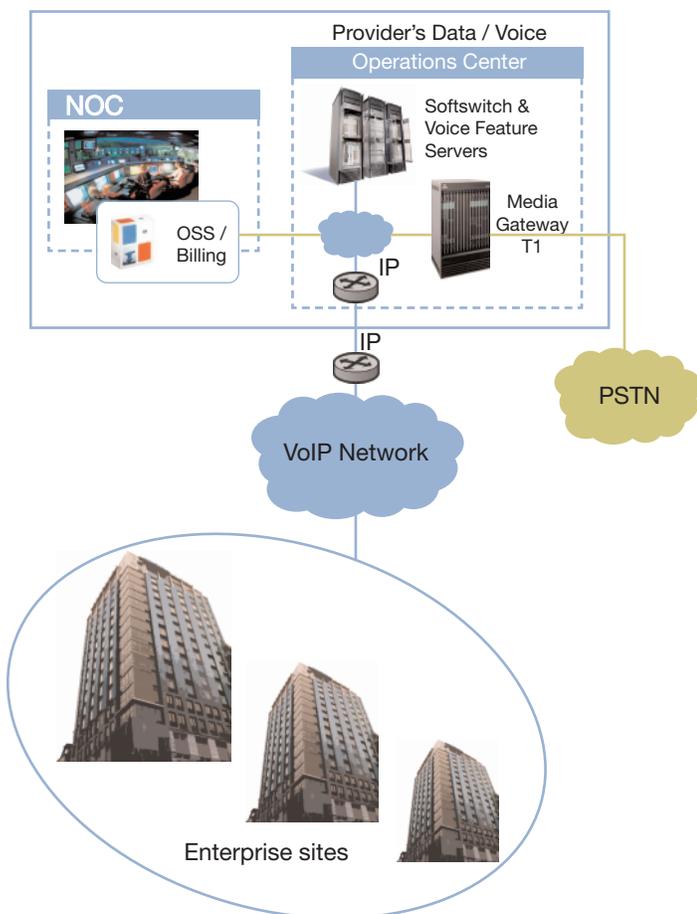


Figure 1 Hosted VoIP Network Provider

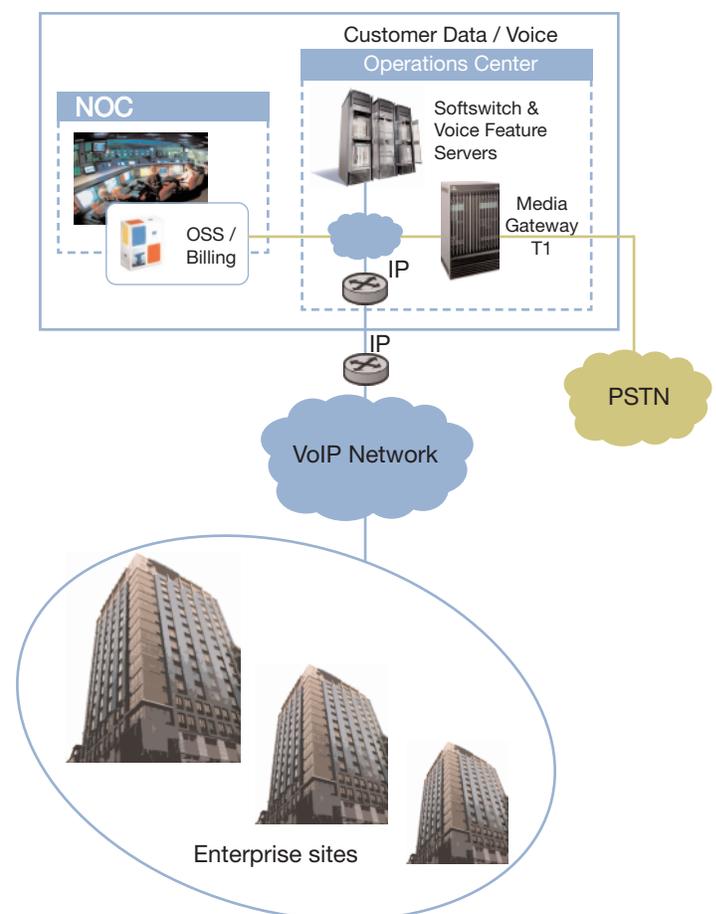


Figure 2 Managed VoIP Service Network

Media and Signalling Routes

Unlike public-switched telephony where signaling and media follow a single, end-to-end route, VoIP signaling and media (speech, video and fax) packets follow different network paths (Figure 3).

From a service assurance perspective, signaling messages can be easily accessed from the softswitch, but media-traffic is more elusive and difficult to capture OSS and fault-management systems.

Resolving Quality Issues

Because active and passive testing each offer distinct capabilities hosted and managed VoIP providers often use a combination of methods for service-quality monitoring, troubleshooting, provisioning and fault management.

VoIP Stress Testing

Similar to the way Bit Error Rate Testing (BERT) is used to validate the integrity of PSTN voice services, VoIP stress-testing helps operators detect long-term and transient speech-quality degradation. VoIP quality sometimes suffers several minutes into a call as jitter buffers in telephone adapters, session border controllers and media gateways fill to capacity and begin dropping voice packets. In addition, excessive network traffic can cause short-term VoIP quality problems when frequent routing changes result in delayed, lost, and out-of-order packets.

Stress-testing is conducted by placing a test call with a pre-specified duration up to several hours long. During the call, service quality results are reported at frequent, regular intervals (e.g. every 15 seconds).

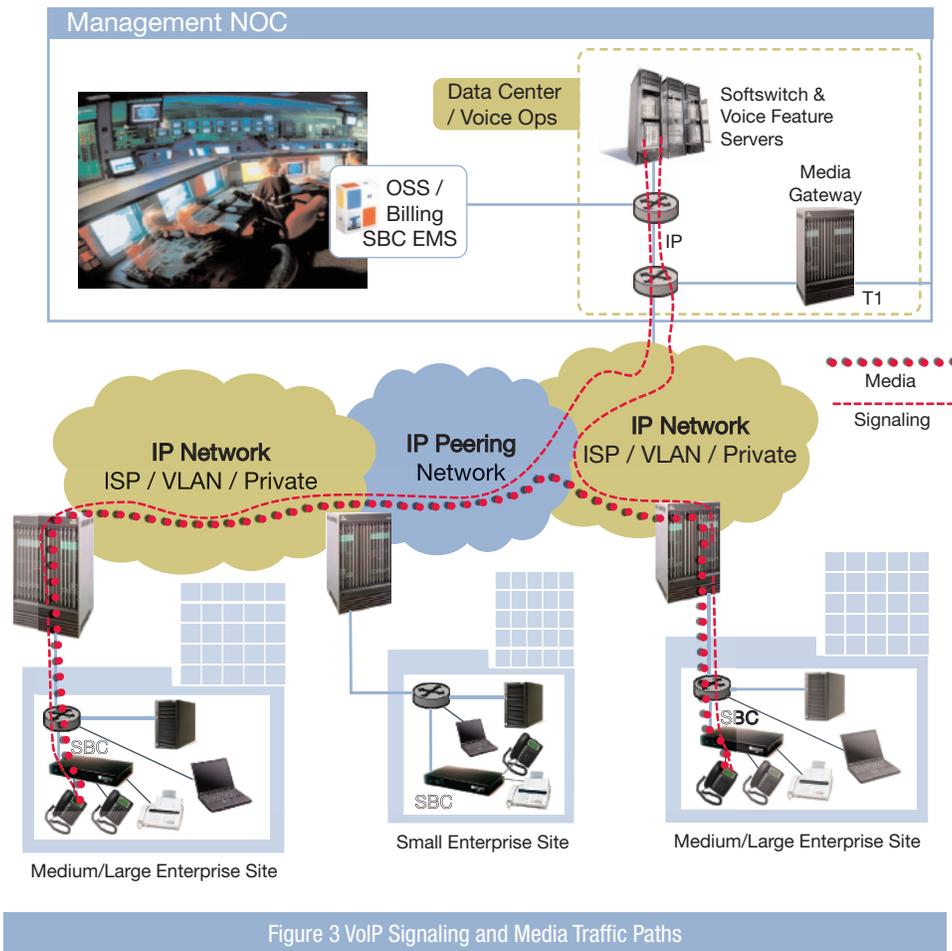


Figure 3 VoIP Signaling and Media Traffic Paths

Interactive VoIP Quality Testing

Interactive Voice Response (IVR) guided testing is the most recent active test technology; the test probe hosts an interactive test agent that uses natural speech to guide technicians or subscribers through a series of simple steps leading to detailed speech quality, DTMF, echo and noise tests without any far-end test probe or responder.

Designed to reduce installation, troubleshooting and trouble-ticket resolution time, interactive testing is ideally integrated into customer support systems to provide immediate test data when customers call with service issues. Test results can be used by customer support to guide the caller through corrective actions, by operations staff to remotely correct the problem or to dispatch a field technician if field repair is required.

On-Net Mesh-Testing

VoIP speech and fax quality from site-to-site is one of the most important aspects to monitor, as it is normally subject to strict SLAs. Active testing is enabled by low-cost probes installed in large enterprise sites. The test server controls the probes to place calls from site-to-site in a mesh configuration. For smaller sites, where the cost of a probe is not justified, low-cost analog test responders can be connected to the session border controller (SBC) serving the site. Alternatively, if the SBC supports loop-back testing (the capability to reflect test calls back to the originating probe) tests can be conducted directly to these appliances without requiring an on-site responder.

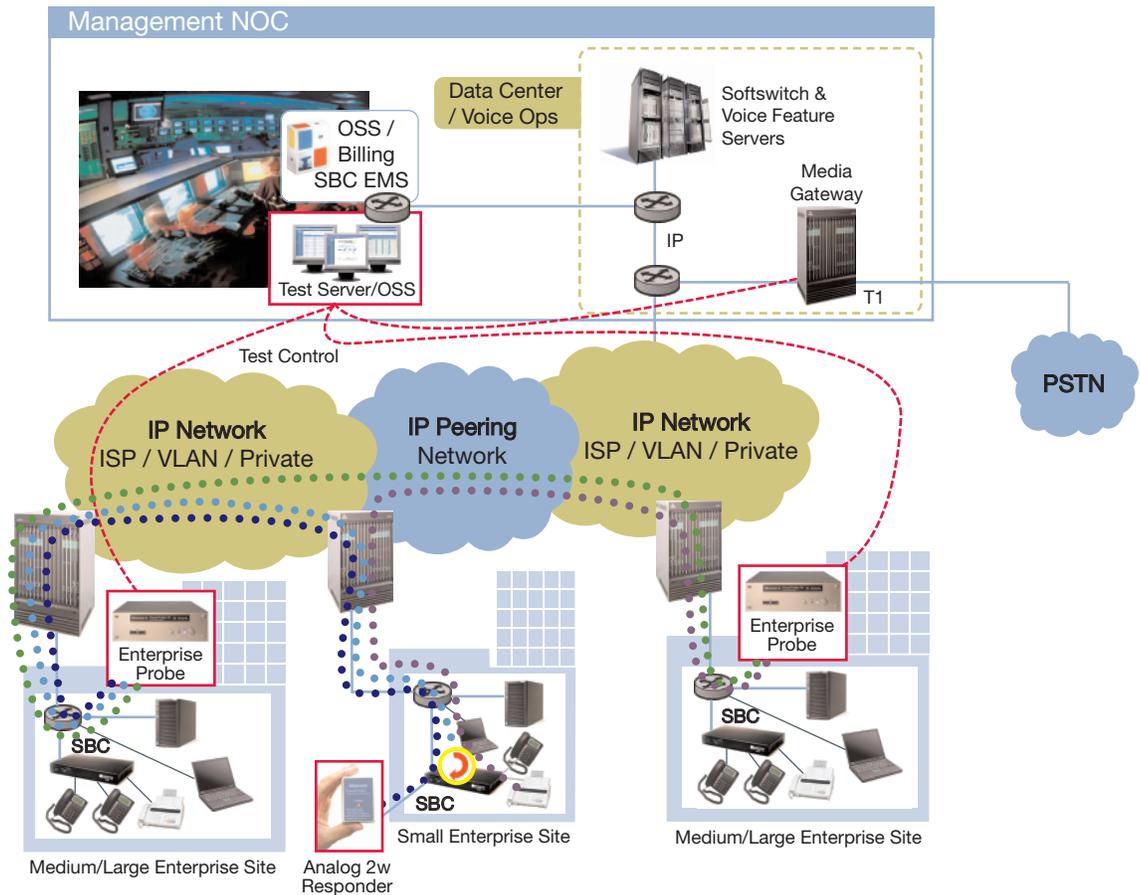


Figure 4 Test Call Paths for Multi-site Mesh-Testing

Site to NOC / PSTN Gateway

Testing from the Network (& Voice) Operations Center (NOC) to enterprise sites allows VoIP providers to isolate and quantify per-site service quality, while optionally including the effects the media gateway has on calls placed to the PSTN. Test calls validating VoIP, fax, and fax-over-IP service can be placed to site-installed test probes, responders, or to SBCs featuring loop-back functionality. NOC-to-site tests placed on-demand are highly-effective in troubleshooting service issues, whereas automated tests provide site-specific monitoring, provisioning, and benchmarking.

Single-Ended Off-Net Testing

Customers often report service-quality issues that an end-to-end test cannot confirm. This frequently happens when a subscriber is placing a call outside the hosted/managed VoIP network, i.e. off-net (for example, a long-distance call overseas). To ensure that PSTN partner-carriers and VoIP-peering networks are providing service levels defined by their SLAs, VoIP operators can use single-ended testing to verify call and fax quality to off-net destinations.

Single-ended testing measures voice, signaling, fax, Internet and modem service quality without requiring far-end probes or responders. Instead, public fax machines, interactive voice response (IVR) systems, modems, video conferencing terminals or IP servers are used as test destinations. A database of suitable public terminations, coded by country, region, area code and city allows the test system to conduct troubleshooting and automated monitoring calls to any location worldwide.

Test calls can be placed from enterprise probes or from the NOC/gateway, allowing operations to validate the end-user experience as well as partner carrier performance independently.

Best Practices from Install to Monitoring

To consistently deliver business-grade service quality, Tier-1 VoIP providers have established a series of best-practices for provisioning, monitoring and troubleshooting

their hosted and managed offerings. The small install-footprint and high return on investment (ROI) of service quality test systems permits Tier-2 and smaller VoIP operators to take advantage of this same service assurance strategy.

The best-practice approach relies on tactical pre-and-post deployment testing to proactively identify service quality issues before end-users are noticeably affected. A combination of active and passive test methods are used to monitor service level quality.

Table 1 provides a step-by-step summary of this best-practice approach to VoIP test and monitoring.

A	Pre-deployment testing to validate network capacity and call performance	Test Legend A Active P Passive
A	Provisioning tests to confirm install/config.	
A	Establish quality baselines after install	
Monitor to proactively detect quality degradation		
A	Schedule test calls off-hours (e.g. every day at 6AM)	
A	Perform site-to-site (mesh testing), site to off-net, voice-ops/NOC/PSTN to site. Voice and Fax.	
P	Monitor signaling with passive system, real time.	
A	Stress test managed network with 24 hour / long duration VoIP test calls.	
A	Provide interactive VoIP tests for IT staff to troubleshoot their own problems, log/quantify service quality issues.	

Table 1 Best-Practice Procedure to Deliver Business-Grade VoIP

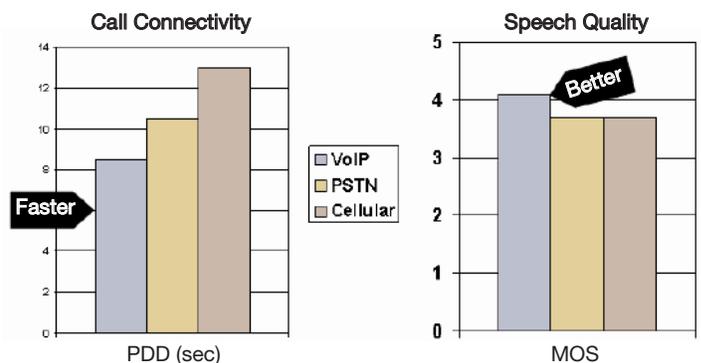


Figure 5 VoIP vs. PSTN & GSM Service Quality

Conclusions

Recent call-quality studies have shown that managed VoIP connects faster, and sounds better than the PSTN service it is designed to replace. Successful service providers focus on service quality at all steps of the VoIP deployment lifecycle, from pre-deployment through long-term customer care.

Using a combination of passive and automated active testing, call connectivity, speech quality, fax and business services can be proactively managed and maintained, allowing providers to offer SLAs that assure the quality and reliability businesses require.

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