

QoS Analysis & Testing

Intrusive and non-intrusive solutions

Application Note

Sunrise Telecom QoS Analysis Platform Solutions



NeTracker & 3GMaster

Technology Overview

The migration of traditional PSTN networks and wireless networks towards all-over-IP core architectures is changing the service landscape for Service Providers (SPs). A particular challenge lies in addressing new quality of service (QoS) issues presented by these new packet-based architectures. On the positive side, the adoption of packet-switched technology for the core allows SPs to focus on a single network instead of different networks for voice and data services. This convergence allows what has been promised for years; "triple-play" services that include voice, video and data.

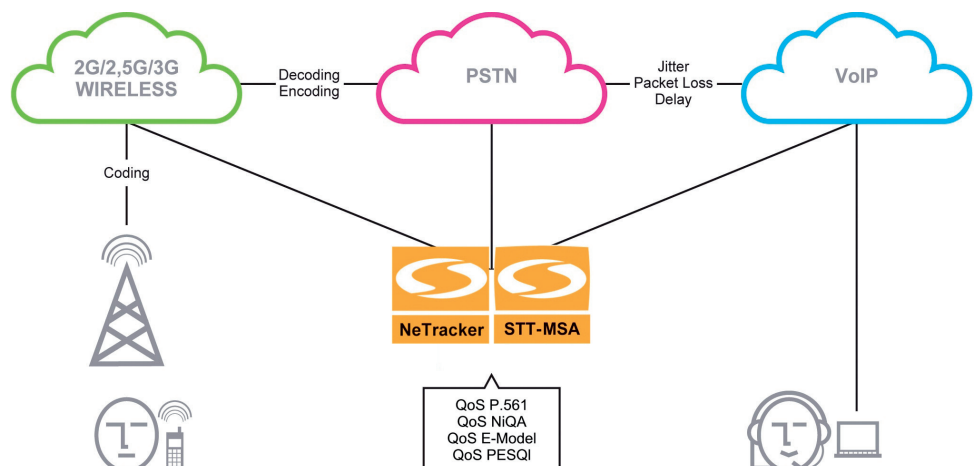
However, in contrast to the legacy circuit-switched approach where each call is secured by fixed bandwidth, VoIP and 3G network elements codes voice flows into packet-based streams and transmits them across the packet-switched IP core network. In this migration, the SP must ensure that the new architecture provides the same QoS that customers have come to appreciate

with traditional circuit-switched networks.

Here are issues the operator must consider:

- Packet loss, jitter and delay, which can be caused by network congestion, may have even more effect on voice quality
- CODECs used to encode/decode and compress digitally sampled audio signals try to mask packet loss by replaying the last packet, interpolating from previous packets or adding noise. This loss-concealment technique suffices when packets are lost individually or at random, but are ineffective with burst loss, in which much more signal is lost
- Packet loss may also occur at different rates during a call, so call quality varies over time

Thus, to ensure the highest possible voice quality in an IP-based network, it is imperative that the right intrusive and non-intrusive tools are used for troubleshooting and monitoring.



Voice quality: the Sunrise Telecom solution

Sunrise Telecom offers a complete suite of tools for both intrusive and non-intrusive voice quality evaluation.

The intrusive solution consists of generating loop-back voice calls in which an audio file is sent and received back, while voice quality is assessed with appropriate algorithms by comparing the source and received audio files. Intrusive testing allows highly accurate and objective testing, but valuable network resources are used during the tests (e.g. they are not available for the customer traffic during the test).

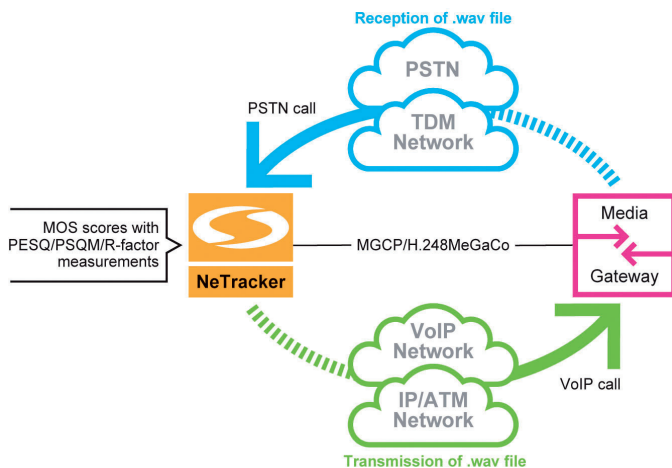
The non-intrusive solution entails monitoring live user traffic to determine the quality perceived by the customers themselves. Non-intrusive techniques allow for a larger number of tests at a much-reduced operational cost compared with intrusive monitoring. However they are slightly less accurate than intrusive techniques.

Intrusive Solution for VoIP: PESQ testing

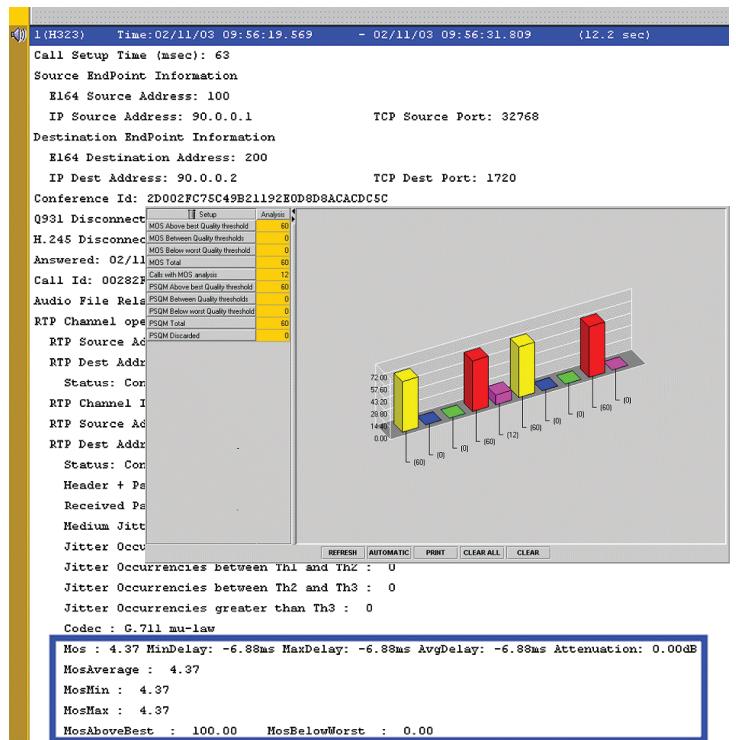
NeTracker® and STT-MSA both test voice channels by sending pre-recorded .wav files over the following signaling protocols:

- SS7 ISUP
- ISDN NT/TE
- SIP
- H.323
- POTS

PESQ analysis is run in real-time and off-line, where a Mean Opinion Score (MOS) value is calculated and provided. Charts and graphs are available in all result pages. This package (OPT-PESQ) allows intrusive testing of the quality provided over a traditional PSTN or SIP network.



Calls can be originated from PSTN to SIP/H.323 and vice versa



CDR with MOS scores and related chart

Non-intrusive Solution for VoIP: E-MODEL

Sunrise Telecom's non-intrusive VoIP monitoring solution makes it possible for operators to gather quality parameters from live traffic to investigate problems reported by the customers and to verify how the network behaves under different load conditions.

Sunrise Telecom leverages the state-of-the-art VQmon/SA E-Model algorithm to provide a highly accurate non-intrusive monitoring system. The system provides call quality metrics, including listening and conversational quality scores and detailed information on the severity and distribution of packet loss and discards due to jitter.

Sunrise Telecom's implementation is based on the well-established ITU G.107 E-Model, with extensions to support time-varying network impairments. The equipment monitors the RTP packet stream containing the voice samples and automatically recognizes individual call streams and CODEC types in use. It determines which packets were lost or discarded due to jitter and uses this to estimate call quality (MOS). MOS scores are then added to the Call Detail Record and, together with jitter and packet loss measurements, provide an extensive set of scoring for each call. This package (OPT-VoIP-VQMON) is available as a software option on all Sunrise platforms supporting VoIP Monitor packages, and is independent of the underlying signaling protocol.

Features

- Call Quality Measurements on live audio VoIP traffic
- Storage of Call Quality Measurements in the CDR:
 - Listening quality R-factor
 - Conversational (user) quality R-factor
 - G.107 R-factor
 - Nominal (generally accepted maximum obtainable) R-factor for the voice stream given a typical transmission system and voice CODEC selection for the call
 - Listening quality MOS score
 - Conversational quality MOS score calculated for the voice stream
 - Listening quality MOS score normalized to the PESQ scale
 - Nominal (generally accepted maximum obtainable) MOS score for the voice stream given a typical transmission system and voice CODEC selection for the call
- Customized scoring for the following geographical areas:
 - North / South America, Europe, Africa, Asia, Japan, Australia

Applications

- Monitoring the quality of live calls as experienced by customers
- SLA verification
- Verification of user complaints about audio quality
- Understanding the network behavior during real usage

A Non-intrusive Solution for Voice: NiQA

Sunrise Telecom has also implemented the Non-intrusive Quality Assessment (NiQA) algorithm, which is designed to assess the listening quality of live customer traffic.

The algorithm is non-network specific and can be deployed in a wide range of circuit and packet-switched network topologies. With multiple locations in a network, it is possible to make comparisons of results between more than one monitoring point located in different geographical areas and running different protocols. This allows the performance of specific links or network subsystems to be monitored. MOS scores are available in CDRs and as dedicated statistics.

Non-intrusive Solution for Voice over PCM

All NeTracker®, 3GMaster® and STT-MSA platforms implement non-intrusive QoS measurements for the PCM G.711 links according to the ITU P.561 specification related to the INMD (In-service Non-intrusive Monitor Devices) for voice trunks over E1 and T1. Measurements can be performed over GSM-A, ISUP and ISDN.

Up to 128 signaling time slots can be monitored in real time for each piece of equipment and measurements can be made for up to 25 calls simultaneously. In addition, all platforms implement VQMON (based on the ITU G.107 E-Model), and provide R-value and MOS scores for each call. Measurements can be performed over ISUP and ISDN. Signaling CDRs and Audio CDRs are stored locally in an ultra-secure format for client confidentiality and operator protection.

Results in the CDRs

The following measurements are available in the CDRs:

- **Activity Factor:** ratio between the active time and the total time elapsed during a measurement
- **Speech Level:** electrical energy generated by the conversion of acoustical talker energy excluding any noise that is not part of the speech
- **Noise Level:** electrical energy caused by spurious signals
- **Composite Level:** measurement of the level over the whole waveform
- **One-way Transmission:** temporary loss of one direction of the transmission. One-way transmission can occur in some genuinely connected calls and the probabilities of this situation will be taken into account in deciding whether to classify apparent one-way transmission as a fault or not

Results in the statistics

The following results are available in a dedicated statistic:

- **Doubletalk:** a condition where one participant in a telephone conversation starts talking before the other has finished.
- **Echo Path Loss:** attenuation of the echo signal corresponding to the difference between the levels of the original and of the echo signals
- **Echo Path Delay:** delay of the echo corresponding to the time taken by the original signal at a given measurement point to come back as an echo

Ordering Information

All platforms

Part Number	Details
OPT-VoIP-VQMON	Non-Intrusive QoS Analysis based on ITU G107 E-Model (R-Value and MOS)
OPT-PCM-IMPAIR	Non-Intrusive Impairments Measurement and Analysis over G711 voice stream into PCM time slots
OPT-NiQA	NiQA - Non-Intrusive Impairments Measurement and Analysis over PSTN (TDM flows) and VOIP (RTP Flows)
OPT-AUDIO-MON	It enables audio recording and playback
OPT-PESQ	Intrusive QoS Analysis based on ITU P.862 (PESQ) algorithm
OPT-SIG-AN	Signal Analyzer Package for post analysis of the audio files recorded over the unit
OPT-AUDIO-AMRNB	AMR Narrow Band Codec support for UMTS IuCS user plane

All other suites, protocol packages, options & accessories:

Please contact your local Distributor or Sales Representative.