SEVANA
IT solutions & services

Non-intrusive voice quality testing using NIQA - competitive alternative for P.563

Endre Domiczi
Sevana Oy

SEVANA
IT solutions & services

Overview

- Voice quality in commercial and enterprise voice services
- What is voice quality?
- Non-intrusive voice quality measurement
- Limitations of traditional approaches
- Sevana NIQA
- Applications
- Value proposition
- Contacts

SEVANA
IT solutions & services

Voice quality in commercial and enterprise voice services

- Integration of commercial and enterprise voice services into packet-switched networks cuts costs and brings value
- Customer expectations of service quality are the key issue
- Only way to win and retain customers is to make sure the quality of service meets customers' expectations
- Customers are used to the quality of circuit-switched networks

SEVANA
IT solutions & services

Voice quality in commercial and enterprise voice services

- Integrated into packet-switched networks voice quality services require more attention to QoS sustainability:
  - Complex network solutions to control packet loss, jitter and delay
  - Minimizing quality impairments for vocoders, VAD, jitter buffers, echo cancellers and different signal processors

It is vital to have knowledge of the service quality delivered to the customers!

SEVANA
IT solutions & services

What is voice quality?

- Origins of voice quality degradation:
  - Noise
  - Silence
  - Low bit-rate encoding
  - Network errors (both in mobile and packet-switched)
  - Delays, Echo, Jitter, etc
  - Handsets/terminals

SEVANA
IT solutions & services

What is voice quality?

- Voice or speech quality corresponds to the clarity or clearness of speech delivered from a speaker to a listener
- In packet-switched networks voice quality is affected by especially many factors as:
  - Vocoder selection
  - Front-end and signal level clippings
  - Signal loss and packet loss
  - Signal gain/ attenuation
  - Echo cancellation in double talk
  - Signal noise from equipment and disturbances from analog networks

SEVANA
IT solutions & services

What is voice quality for a voice service provider?

- Unhappy customers stop using the service
- Continuously unhappy customers move to competitors and spread negative word of mouth
- If the goal is to obtain new and retain existing customers a service provider requires:
  - Effective means to test and monitor quality of voice services
  - Ability to receive voice quality metrics for end-users

All mentioned above is a must for transparency and visibility required for effective service quality management!

SEVANA
IT solutions & services

What is voice quality for IP network?

- I have IP network, I measure packet loss, delay and jitter – that's enough to monitor the quality of service!
  - No, it's not! Do you know what impact to actual speech quality introduce each of these parameters? Which one causes the main problem? Can you match these parameters from statistics against overall objective speech quality of the «bad» call?
  - Can you always discover how all IP network parameters influence each other and how that affects the voice quality?
  - It's much easier to diagnose and analyze a problem when one can match IP network parameters against the overall speech quality of a problematic call or route.

Voice quality score is an essential part for monitoring and analyzing quality of service in IP networks!

SEVANA
IT solutions & services

What is voice quality score?

International Telecommunications Union (ITU-T) in the middle of 90-s. Introduced recommendation P.800 (P.830) «Methods for subjective determination of transmission quality», which describes conditions for voice quality testing, audio contents, scoring and methods to evaluate results. Typically “Methods for subjective determination of transmission quality” are used to obtain mean subjective quality score according to five-digit scale (Mean Opinion Score – MOS):

Quality Score:	MOS score is what voice quality testing
5 – Excellent	software tries to reproduce
4 – Good	
3 – Fair	MOS score is well-known metric
2 – Poor	in the industry
1 - Bad	

SEVANA
IT solutions & services

Non-intrusive voice quality measurement

Intrusive or active measurements of voice quality implemented for example in Sevana AQuA product provide valuable measurement for end-to-end that are typically more accurate. However, this approach may involve additional complexity when making test calls and generating test signals although AQuA generates two test signals for most accurate testing that still involves additional usage of resources due to test calls generation.

Non-intrusive voice quality measurements are passive methods for measuring voice quality on traffic generated by existing callers. The measurements can easily be applied as for packet-switched as well as circuit-switched networks.

Non-intrusive testing is simple and cost effective not utilizing bandwidth or traffic resources being fully software based. Non-intrusive methods that return speech quality score (MOS) are the key for measuring actual callers' traffic.

SEVANA
IT solutions & services

Limitations of traditional approaches for non-intrusive voice quality measurement

- There are lots of factors and metrics in packet-switched networks that affect voice quality:
  - Jitter buffers, packet loss, echo, noise, gain, codec implementations, gateways, load
- Methods based on RTP packet measurement and analysis cannot be accurate enough as they cannot consider influence from other processes in the network.
- Approaches that also consider codec impacts into overall voice quality still cannot take into account all or many important factors.
- Non-intrusive methods that return a MOS-like score based on psycho-acoustic algorithms are the most accurate means to obtain transparency in analysis QoS of voice communication systems.

SEVANA
IT solutions & services

Uncovering vital benefits for having a MOS-like score attached to record of other network specific quality metrics

• Existing methods for measuring voice quality in packet-switched networks utilize information about:

  – Jitter, packet loss, echo, noise, gain, codec, gateways, load

Based on available metrics one can evaluate speech quality in the communication system (f.e. E-model, ITU G.107 and ITU G.108)

However, when one is able to receive a MOS-like value based on psycho-acoustic model related to human perception then the measurement record would f.e. Contain:

Jitter, % of lost packets, code, route, gateway, RTT, MOS-like

Isn't it clear that the MOS-like score is the key to do any further analysis on the test stats discovering how other metrics were affected when the voice quality went down. Figuring out the affected metrics would lead to discover what part or condition of the network caused the quality drop. And for analysis purposes one can utilize any data analysis tools, f.e. OLAP that is already available in modern databases.

SEVANA
IT solutions & services

Sevana NIQA: why?

It's widely thought that ITU-T recommendation for non-intrusive voice quality testing P.563 provides a high level of correlation between automated and expert quality scores. However, simple tests based on ITU-T sound database for codec testing may raise some doubts about the consistence of the algorithm provided together with its description:

MOS Range	Average Score		Average error
	MOS	P.563	
4 – 5	4,25	2,45	1,79
3 – 4	3,42	1,70	1,69
2 – 3	2,56	1,71	0,97
1 – 2	1,68	1,49	0,55

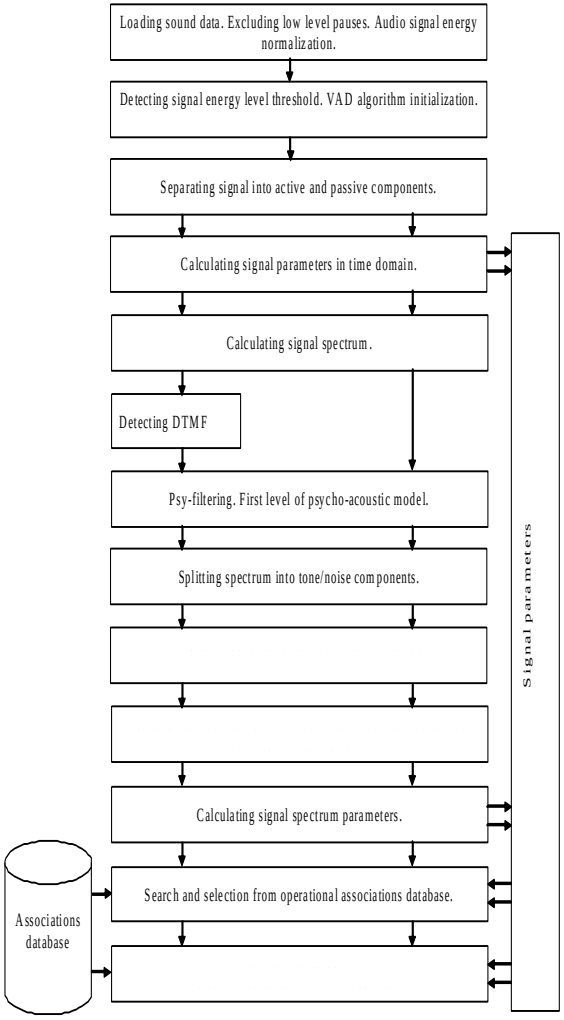
The problem discovered in the distributed P.563 algorithm implementation required development of an alternative solution - Sevana NIQA (Non-Intrusive Quality Analyzer).

SEVANA
IT solutions & services

Sevana NIQA: how?

NIQA's (Non-Intrusive Quality Analyzer) approach is based on a database of trained etalons called associations. Each association corresponds to a group of files that have close expert estimations of sound quality and common set of reasons for sound quality degradation. For each association NIQA calculates and stores a distribution of parameters' values.

- Excluding low level pauses
- Utilize VAD to distinguish active and inactive components
- Excluding DTMF
- First level of psycho-acoustic model
- Second level of psycho-acoustic model
- Associations search, weighting, generating MOS-like score



SEVANA
IT solutions & services

Sevana NIQA: what're the results?

Sevana NIQA has been tested utilizing the same ITU-T speech database that is used for conformance testing of P.563 algorithm. In the tests we used a total of 376 English language recordings. All recordings were sorted into 4 groups depending on their MOS scores (represented in the documentation attached to the sound database). For all groups of recordings we determined average expert scores and average NIQA scores (Table 2). In order to illustrate comparison with P.563 we also calculated average errors for P.563 and NIQA scores for the same tests.

MOS Range	Average Score		Average Error	
	MOS	NIQA	NIQA	P.563
4 – 5	4,25	3,44	0,83	1,79
3 – 4	3,42	3,06	0,51	1,69
2 – 3	2,56	2,61	0,43	0,97
1 – 2	1,68	2,36	0,68	0,55

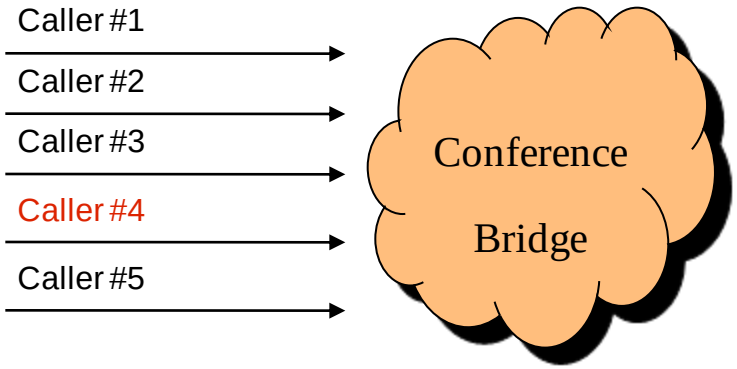
The results clearly show that NIQA allows receiving much higher accuracy between generated quality scores and expert estimations than P.563. NIQA scores are less precise only for records with very low MOS scores (in the range from 1 to 2). In all other cases NIQA provides 2-3 times higher quality scores precision compared to MOS values.

SEVANA
IT solutions & services

Applications: audio conferencing

Case: sales audio conference, participants have different locations, one of the conference participants is driving a car that produces such strong noise that ruins quality for all other conference members.

Task: detect what conference leg introduces the noise?



The same approach applies for QoS monitoring

When NIQA monitoring is applied to the audio stream or file representing each conference leg (done on demand, continuously during the conference, or after the conference) the MOS-score of the noisy participant will immediately go down when SNR changes.

SEVANA
IT solutions & services

Applications: VoIP, Converged networks, mobile, LTE

- Real-time monitoring
- Network testing, optimization
- Fault detection
- And many more...

Sevana NIQA is the only non-intrusive voice quality testing product that can be trained to detect customer-specific reasons for voice quality loss as well as language and gender detection of the callers!

SEVANA
IT solutions & services

Value proposition

- How expensive is loosing customers due to bad quality?
- How important is to be sure your SLA is always valid?
- Do you know NIQA has no annual royalties?
- Have you contacted Sevana concerning NIQA pricing?

Request information about NIQA and pay less if the only thing you need is to continuously monitor when and why your customers were unhappy about voice quality in your network!

SEVANA
IT solutions & services

Value proposition

- Available for evaluation
- Strong competitor for ITU P.563/P.564
- Ability to be trained to detect reasons for quality loss
- Ability to be trained for customer specific needs
- Multi-platform
- High performance
- Outstanding pricing

SEVANA
IT solutions & services

Benefits

- NIQA is available as a server solution without any limitations for amount of simultaneous tests
- NIQA license does not involve any royalty or other annual fee
- NIQA is available for all platforms and servers (32 bit and 64 bit, Windows, Linux, MAC)
- NIQA is easy to deploy and use for products and solutions development
- NIQA provides prediction of voice quality (MOS-like score) and can be utilized in VoIP, PSTN, ISDN, GSM, CDMA, LTE/4G networks and combinations of those
- NIQA is also available as a service

SEVANA
IT solutions & services

Contact us

Endre Domiczi
Email: sales@sevana.fi
Phone: +358 9 23164165
Web: http://www.sevana.fi