Supervision of perceived quality in VoIP telephony services

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Introduction

The supervision of speech quality is a real challenge for the operators of IP telephony. At first it is important for the VoIP providers to determine the performances of the service proposed to their customers. It is also necessary of detect possible degradations so as to cure as soon as possible the problems of QoS degradation. And in cases of VoIP service degradation, it is necessary to determine the responsibility domain by identifying and locating the problem.

To ensure the supervision of speech quality, there are several technical solutions

Presentation of analysis devices

Generally, the technical evaluation of the speech quality of an IP telephony service is performed by probes. According to the operating mode, there are two types of probes: intrusive probes and no-intrusive probes.

The intrusive probes correspond to active devices which require to establish communications. These probes are generally able to establish themselves the calls by replace the telephony terminals. The implementation of intrusive probes requires to have two accesses on the network what can be in some cases a drawback (accessibility with the network not always easy, problem of synchronization for the probe…). The intrusive probes generate a traffic and can work with a reference (i.e. by comparing the receiving and the sending signal).

The no-intrusive probes correspond to passive devices which perform on real communications without disturbing them. This operating mode is an advantage because that corresponds to an analysis of the communications really established by the users and because there is no additional traffic generated. These probes require one access on the network what also corresponds to an advantage. The fact of being no-intrusive forces the probes to perform without reference what represents a difficulty for this type of device.

The intrusive and no-intrusive probes can perform at the protocol level (analyzes RTP flow for example) but also on the speech signal.

By their characteristics, the intrusive probes are more adapted to the expertise while the non-intrusive probes are more adapted to supervision of QoS.

Different types of implementations of the no-intrusive probes

For the passive probes, we discern 3 technical types of implementation:

- **External hard probes**: it is devices similar to protocol analyzers. When the analyses are performed on the speech signal, the probe must reconstruct the audio signal from the IP packets. Some probes use a model to evaluate the voice quality only from RTP flow (P-VTP methods),
- **Internal soft probes in network equipments:** it is imbedded software agents into network equipments. These agents are able to determine the QoS metrics like jitter and packet loss ratio. The evaluation of speech quality is also possible from RTP flow with a model,
- **Internal soft probes inside IP terminals:** it is imbedded software agents like internal soft probes in network equipments. These agents determine QoS metrics by taking into account the impact of the network and the telephony terminal. These probes perform the QoS analysis on the RTP flow but also in specific cases they are able to analyze the audio signal.

Specific tool developed for the needs for France Telecom

This tool corresponds to an internal soft probe imbedded into termination equipment like PC with softphone or IPphone. It aim is to evaluate the speech quality perceived by the user. To be done, the probe is implemented closer as possible to the ear of the speaker. For each call this probe analyzes at the reception the signalization, the network QoS and speech quality aspects.

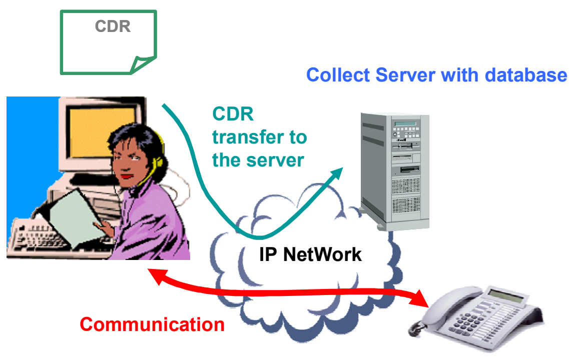

Figure 1: principle of the probe

This probe is design with a network and an audio filter. The network filter is imbedded on the protocol stack to analyze the signalization (date and hour of communication, duration, codec, type of terminals...) and the QoS network (jitter, packet loss ratio and delay).

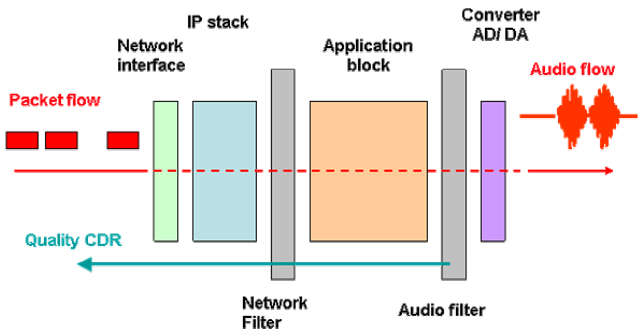

Figure 2: Probe integration on terminal

The audio filter is installed behind the decoder. It analyzes a copy of the audio signal at the reception. This analysis evaluates parameters like the active speech level, the noise level, the speech activity factor and the end to end delay. On the speech signal, the probe determines also the presence and the occurrence of degradation like cut and metallic noise. With metrics on the audio signal, the probe determines a MOS quality score.

At the end of each communication, the probe creates a CDR with the XML format. In this CDR the probe places all the indicators on signalization, network QoS and speech quality. This CDR is send to a collect server with the https protocol, to be store on a data base.

These CDR are used by the telephony operator to generate statistics and road-maps. They are also used to generate alerts or alarms in the event of QoS and speech quality degradation. The sending of indicators to a collect server in quasi real time makes possible to manage a proactive policy on QoS.

This type of probe works independently of the signalization protocol (H.323, SIP or MGCP) but also independently of the negotiated codec (G.711, G.729, G.723.1).

Conclusion

The type of probe developed by France Telecom makes it possible to identify degradations of speech quality at the end of the communication. This probe determines degradations perceived by the user by taking of account the distortion generated by the network but also by the terminal.

The sending of indicators to a collect server for each communication makes it possible to improve the contact user provider by taking into account in quasi real time the information of QoS.

This type of probe can also be useful in the case of SLA implementation by checking the well implementation of the elements of the contract.