Calculation of packet loss impact for E-model

Martin Klimo
University of Zilina, Moyzesova 20, 010 26 Zilina, Slovakia
e-mail: martin@frkis.utc.sk, tel. +421-41-5134329

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Abstract
There are several approaches for the voice transmission quality evaluation such as MOS calculation, impairment factor calculation or equivalent quantizing distortion calculation. Using Overall Rating "R" seems to be the most topical. R-value is calculated by the E-model, which is based on idea of impairments factors calculation from primary network parameters. Paper will present how to follow this idea for packet loss and how the impact of packet loss calculation can be incorporated to E-model.
The impact of lost voice samples (due to lost packets) will be presented using a difference between the transmitted signal and the received signal in which lost samples were replaced by sample approximations, and SNR will be used as an objective measure. Under certain assumptions the noise caused by the lost samples (or packets) leads to a simple formula for Signal-to-Noise Ratio expressed in dB. A model in which will be assumed that voice samples may be lost individually will be presented as an introduction. It is not true when IP packets carry the voice samples. In this case samples are lost in blocks created by packets. There are two main factors taken into account in this contribution – forward masking and speech autocorrelation. Both these factors leads to the fact, that a loss of two subsequent samples is perceived in a different way comparing with effect of two lost samples belonging to the different packets. Modelling of the effect of forward masking and short-term autocorrelation will be based on two ideas: first will use a mechanism where lost samples are replaced by linear combination of previous available samples, second will use the fact that masking factor exponentially decreases with the distance between existing and lost samples. This approaches allows include these effects to the VoIP QoS degradation model on relatively simple basis.
The impact of lost packets on voice transmission quality is expressed through the equipment impairment factor Ie in E-model. We propose to incorporate the influence of lost packets to the simultaneous impact factor Is using the analytical calculation of SNR. The main reason is the definition of Is as a sum of all impairments which may occur more or less simultaneously with the voice transmission, and the possibility to obtain Is value by calculation of loss probability.
To compare the results with ETSI Tiphon measurements, the impact of packet loss percentage was calculated for the same conditions. Slides will also give a comparison between our model in which the packet loss is incorporated into the simultaneous impairment factor and ITU-T Rec. G.113 Annex 1, where the packet loss is assumed within the equipment impairment factor.