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The 3-dB Transcoding Penalty in Digital Cellular and Interoperability with Future Voice/Audio Coding Standards

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In spite of the widespread attention to data and video, voice is still responsible for up to 75% of the revenue in wireless communications systems today. An unfortunate characteristic of 2nd and 3rd generation digital cellular systems has been the need to transcode at most network interfaces, since the voice codec at the other end of the call is usually unknown and cannot be negotiated. Fourth generation systems such as LTE also require transcoding when the call leaves the LTE network. Transcoding at network interfaces adds complexity, degrades quality, and increases latency, all of which directly impact the quality and cost of voice communications. We investigate the issues in voice communications over tandem connections of wireline and wireless communications links using rate distortion theoretic results and speech coding studies and show that each transcoding operation can incur a 3-dB penalty in source coding performance, in addition to increased latency and complexity. We also present several suggestions for addressing this performance. We then present characteristics of evolving standards for wideband (50 Hz to 7 kHz), superwideband (50 Hz to 14 kHz), and fullband (20 Hz to 20 kHz) speech/audio and how these codecs will interoperate with future wireless systems. This research was supported, in part, by NSF Grant Nos. CCF-0728646 and CCF-0917230.

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