Hermes: Data Transmission over Unknown Voice Channels

Internal Document: Project Summary

While the cellular revolution has made voice connectivity ubiquitous in the developing world, data services are largely absent or are prohibitively expensive. In this paper, we present Hermes, a point-to-point data connectivity solution that works by modulating data onto acoustic signals that are sent over a cellular voice call. The main challenge is that most voice codecs greatly distort signals that are not voice-like; furthermore, the backhaul can be highly heterogeneous and of low quality, thereby introducing unpredictable distortions. Hermes modulates data over the extremely narrow-band (approximately 3kHz bandwidth) acoustic carrier, while being severely constrained by the requirement that the resulting sound signals are voice-like, as far as the voice codecs are concerned. Hermes uses a robust data transcoding and modulation scheme to detect and correct errors in the face of bit flips, insertions and deletions; it also adapts the modulation parameters to the observed bit error rate on the actual voice channel. Through real-world experiments, we show that Hermes achieves approximately 1.2 kbps goodput which when compared to SMS, improves throughput by a factor of 5 and reduces the cost-per-byte by over a factor of 50x.

This project was led by Aditya Dhananjay, whose publication record is below [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16].

References


