Acoustic Echo Control in a VoIP Network

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Introducing the Problem

What can you do when there are handsets connected to your voice gateway or your base station, and the handsets don't provide enough echo cancellation for your network topology? It doesn't matter if the handset is of poor quality or if the handset just wasn't designed with sufficient echo control for a network with longer delay. What matters is whether or not the users experience echo. If you can make the users happy by tackling this echo at the network end regardless of what handsets exist in the field or are yet to be fielded, you are the hero. If you don't tackle the problem, your equipment (or service) becomes the one branded with poor voice quality. It doesn't matter to the user that the fault lies with lousy handsets. If your competitor's gateway takes care of the echo yours doesn't, your equipment will remain stocked in the warehouse and your competitor's will be in the field.

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Introducing the Solution: Network Acoustic Echo Control (NAEC)

The conventional wisdom in echo cancellation is this: place the echo canceller as "close to" the echo source as possible. Think of yourself as an echo canceller. You can hear the signal that is being sent to the speaker and you can hear the signal that is coming back from the microphone. The signal from the microphone contains some echo that is caused by the coupling between the speaker and the microphone. But the microphone input signal also contains speech from the person who is sitting in front of the microphone. It is your (the echo canceller's) job to estimate the echo and remove it from the microphone input signal without removing that person's speech.

In order to remove the echo, you need to model the characteristics of the speaker to microphone coupling path, also known as the echo path. There is a direct, "line-of-sight", component, and there are other components due to reflections from walls and objects in the proximity of the speaker and microphone. The accuracy of the echo model that you create is best if you have a clear, undistorted measure of the signal going to the speaker as well as the signal coming from the microphone. The "closer" you are to the speaker and microphone, the fewer sources of distortion there will be.

So, one might ask, why would I ever want to put the echo control in the network (gateway or base station) rather than in the handset? Gateways are not "close to" the handset by any means. There

are many sources of considerable distortion that lie between a gateway (or base station) and a handset, including a packet network (or air interface in the case of a base station), bit errors, lost packets, speech compression, and silence compression. You, the echo canceller sitting at the gateway, no longer have an accurate measure of the signal that actually gets played out through the speaker, and the signal coming back from the microphone is distorted as well by the time it reaches you. You are no longer able to develop an accurate model of the echo path, so you are no longer able to perform echo cancellation as well as you could if you were “close to” the speaker and microphone.

So let’s ask again, why would I ever want to put the echo control in the network (gateway or base station) rather than in the handset? Answer: You, the gateway or base station, have no control over the handset that is communicating via your gateway. You, the gateway manufacturer, have no control over what handsets are in the field. The only thing that you have control over is your gateway. If there is echo out at the handset side, the only place in the network in which you take care of the echo is in your gateway. That’s the only tool in your toolbox. You need to make it a darned good tool.

Adaptive Digital’s Network Acoustic Echo Control (NAEC) algorithm is that tool.

PRODUCT AVAILABLILITY

Adaptive Digital’s NAEC is available as multi-channel turnkey DSP solution, or an algorithm (software library) that can be integrated into your larger DSP application software.

Turnkey: TMS320C6424 DSP, TMS320C6452 DSP, ADT G.PAK

Algorithm: TMS320C64X, TMS320C64X+, TMS320C67X, TMS320C67X+, TMS320C674X, TMS320C55X