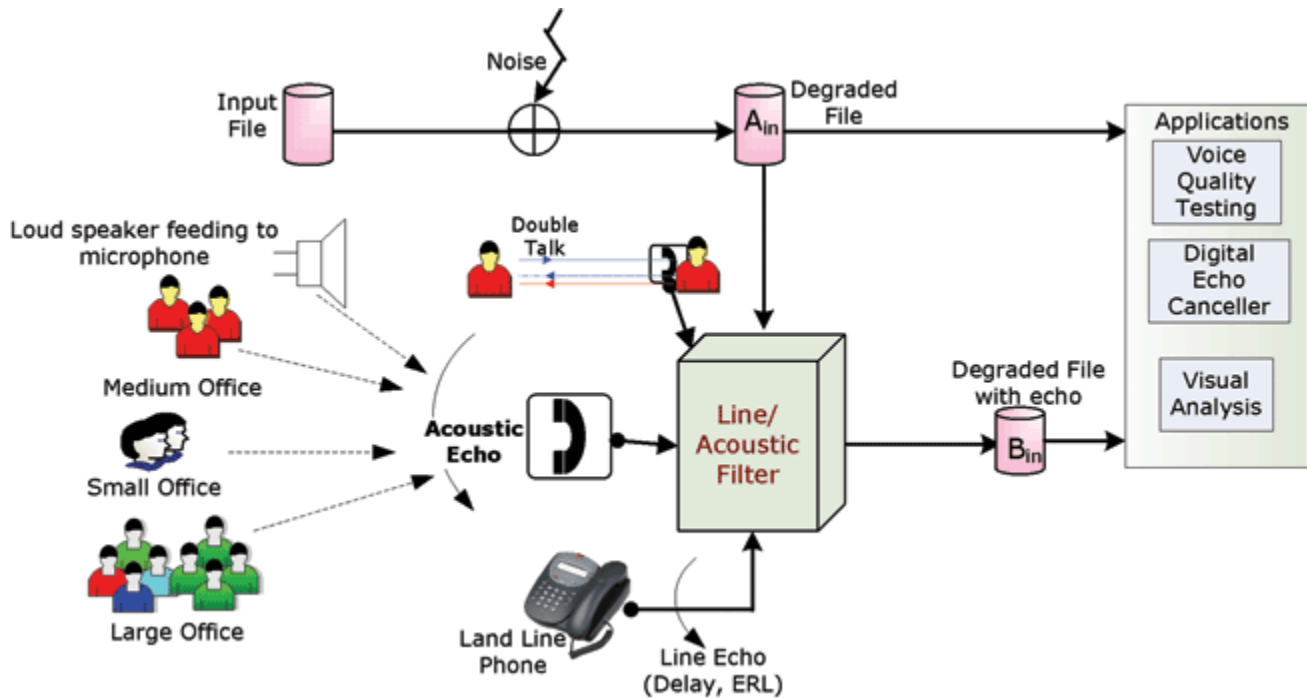# Audio Processing Utility (APU)

Overview

Audio Processing Utility is a pre-processing application used for manipulating the input audio (tones, and voice) files with impairments such as delay, noise, acoustic echo, line echo, and double talk. An echo file is generated if a corresponding line or acoustic echo filter is specified. It analyzes the given coefficients files and calculates the applied delay and ERL. The degraded audio output file can then be visually analyzed or used for further speech analysis with GL's Voice Quality Testing, Digital Echo Canceller and other applications.

APU (Audio Processing Utility) is designed to produce a specific configurable degraded file for a given input file. An echo file can also be generated if a corresponding line or acoustic echo filter is specified. In addition, if two files are specified as input files, then, the echo path characteristics will be calculated.

For more details, refer Audio Processing Utility webpage.

Main Features

- Generate echo files with appropriate acoustic and hybrid echo
- Generates degraded voice files with noise, power level, and interference
- Supports high-quality voice over IP, with substantial packet delay and loss
- The files generated can be used to test VQT, ECs, and P.56 active speech level
- Supports A-law, μ-law, Windows PCM (*.wav), and 16-bit Intel linear PCM audio file
- Supported Codecs are G.711 μ-law, G.711 A-law, G.723.1, G.726, G.729, G.729a, G.729b, G.729ab, G.729e, G.729g, iLBC (20ms and 30ms frame)
- Analyzes filter coefficients, ERL (Echo Return Loss), and delay from the generated files
- Supports line echo filter model of ITU-T G168 specification and three proprietary acoustic echo filter models
- Graphical representation of output files

Typical applications of APU

P.56 active speech level algorithm testing: For a well-defined input file, APU will generate a precisely controlled degraded file. This degraded file can be used to test P.56 active speech level algorithm applications

VQT (Voice Quality Testing): The input voice file and the controlled degraded file can be fed into the VQT algorithm and test VQT applications

EC (Echo Canceller) testing: The input (reference file) file and the echo file can be used to test the EC. APU can generate line echo and acoustic echo files, and test line EC and acoustic EC, which makes it unique.

Offline echo analysis: The offline echo analysis function of APU will analyze the stimulus & degraded signal files and calculate the echo path filter coefficients, ERL and delay.

Operations

The degraded files can be generated either by adding Noise, Filter, and/or Double Talk. Commonly, only the noise file is added to the input file, to generate a degraded (A_{in}) file. The reference file and the degraded file can be used for voice quality testing.

These degraded files may be further filtered as per line / acoustic echo models to generate echoed files. Double talk files can also be added to the echo signals. The degraded and echoed files can be used in ECs (echo cancellers).
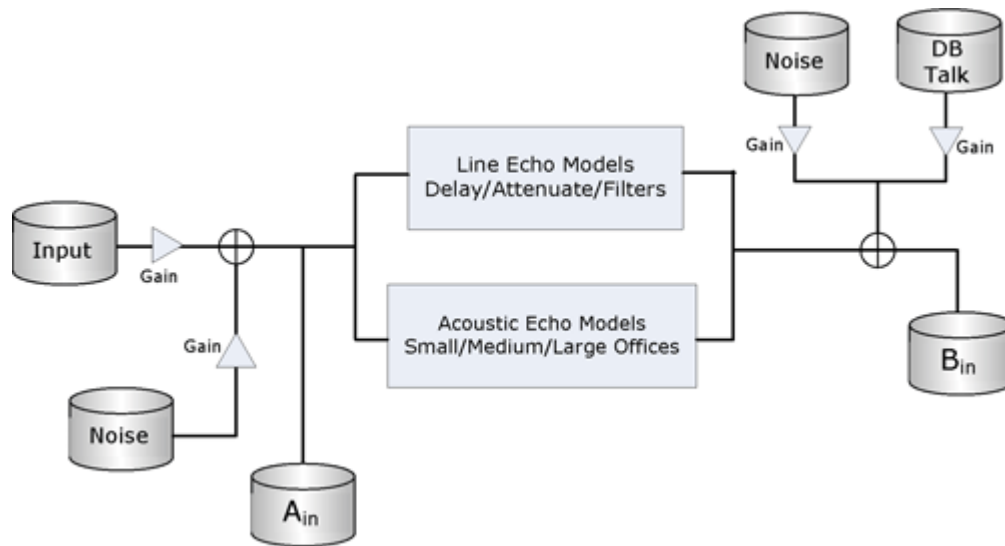
APU Operations

Adding Noise and Filter

White Noise of specified power (dBm0) and SNR (dB) or Noise from specified file is added to the input file to generate degraded files. The degraded files are filtered as per line or acoustic echo models to generate echoed files. Options for Line Echo filter are M1~M8 as per ITU-T G.168 specifications (Version 08/2004) or "Others" for user-defined filters. A1~A3 (acoustic filters) are GL proprietary implementations of the acoustic filters such as small office, medium office and large office.

Adding Noise and Filter

Adding Double Talk

Users can either select tones of required frequency (Hz) and power level (dBm0) or choose a double talk file of certain power level to generate degraded B_{in} files. The power of the selected file can also be adjusted to the user defined level. Double talk files can also be added to the echo version of A_{in} file along with noise to generate Bin files.

Double Talk

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Input and Output Files

Input to APU can be tone of specified frequency (Hz) and power level (dBm0) or could be voice from a specified file. Supported input files are A-Law, μ-Law, or 16 bit linear PCM audio files. APU supports four output file formats – A-law, μ-law, Windows PCM (*.wav), and 16 bit Intel linear PCM audio files.
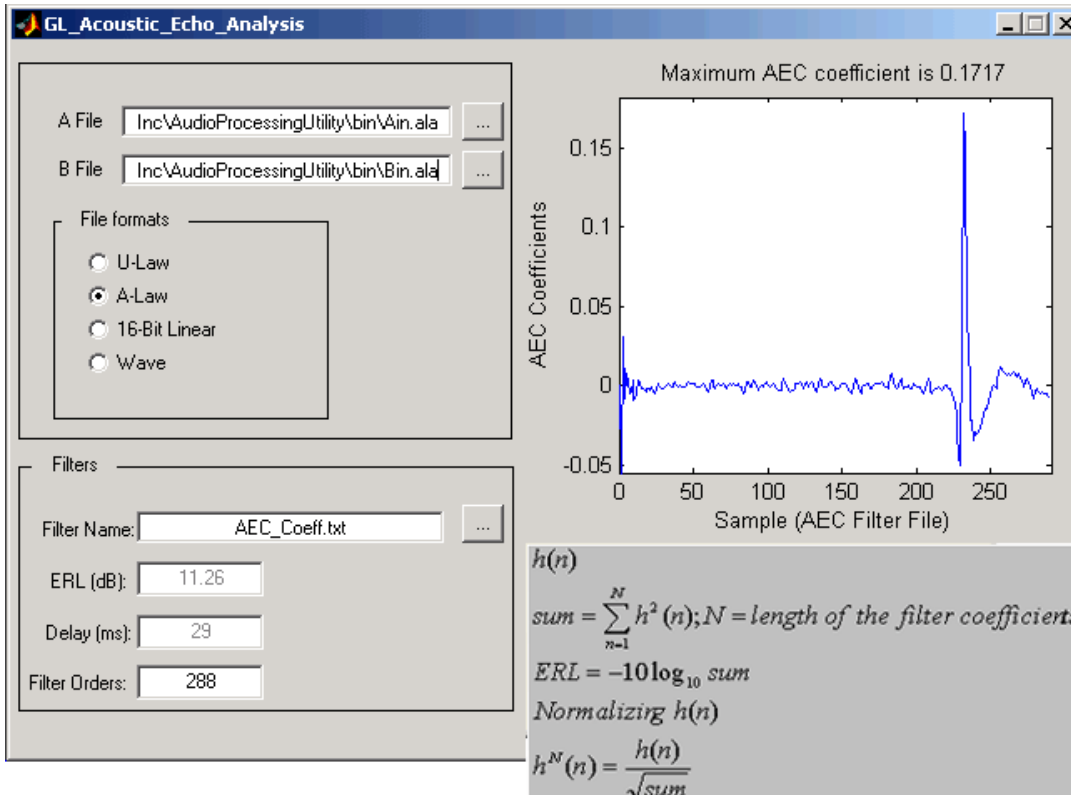

Input and Output Files in Hz, dBm0, or Voice

Offline Analysis

A_{in} is the stimulus signal, and B_{in} is the signal with echoes. The offline echo analysis function of APU will analyze these two files and calculate the echo path filter coefficients, ERL and delay as shown in the screen below.

$$sum = \sum_{n=1}^{N} h^2(n); N = length\ of\ the\ filter\ coefficients$$

$$ERL = -10\log_{10} sum$$

Normalizing $h(n)$

$$h^N(n) = \frac{h(n)}{\sqrt{sum}}$$

Offline Echo Analysis

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Buyer's Guide

Item No	Product Description
PKB070	Audio Processing Utility (included with EMU037, PKB105, PKB081, PKB067, PKB080, and VBA032)

Item No	Related Software
XX066	Digital Echo Canceller
XX031	Call Capture and Analysis
VBA032	Near Real-time Voice-band Analyzer
PKV100	PacketScan™ (Online and Offline)
XX062	Echo Path Delay/Loss Simulation Software
XX063	Echo Path Delay/Loss Measurement Software
XX067	Automated Echo Canceller Testing with or without VQT
VQT010	VQuad™ Software

Item No	Related Hardware
PTE001	tProbe™ T1 E1 Base Unit
FTE001	QuadXpress T1 E1 Main Board (Quad Port– requires additional licenses)
ETE001	OctalXpress T1 E1 Main Board plus Daughter Board (Octal Port– requires additional licenses)
XTE001	Dual Express (PCIe) T1 E1 Boards

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more details, refer Audio Processing Utility webpage.