Acoustic Echo Cancellation Compliance Test Software

## GL Communications Inc.

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Overview
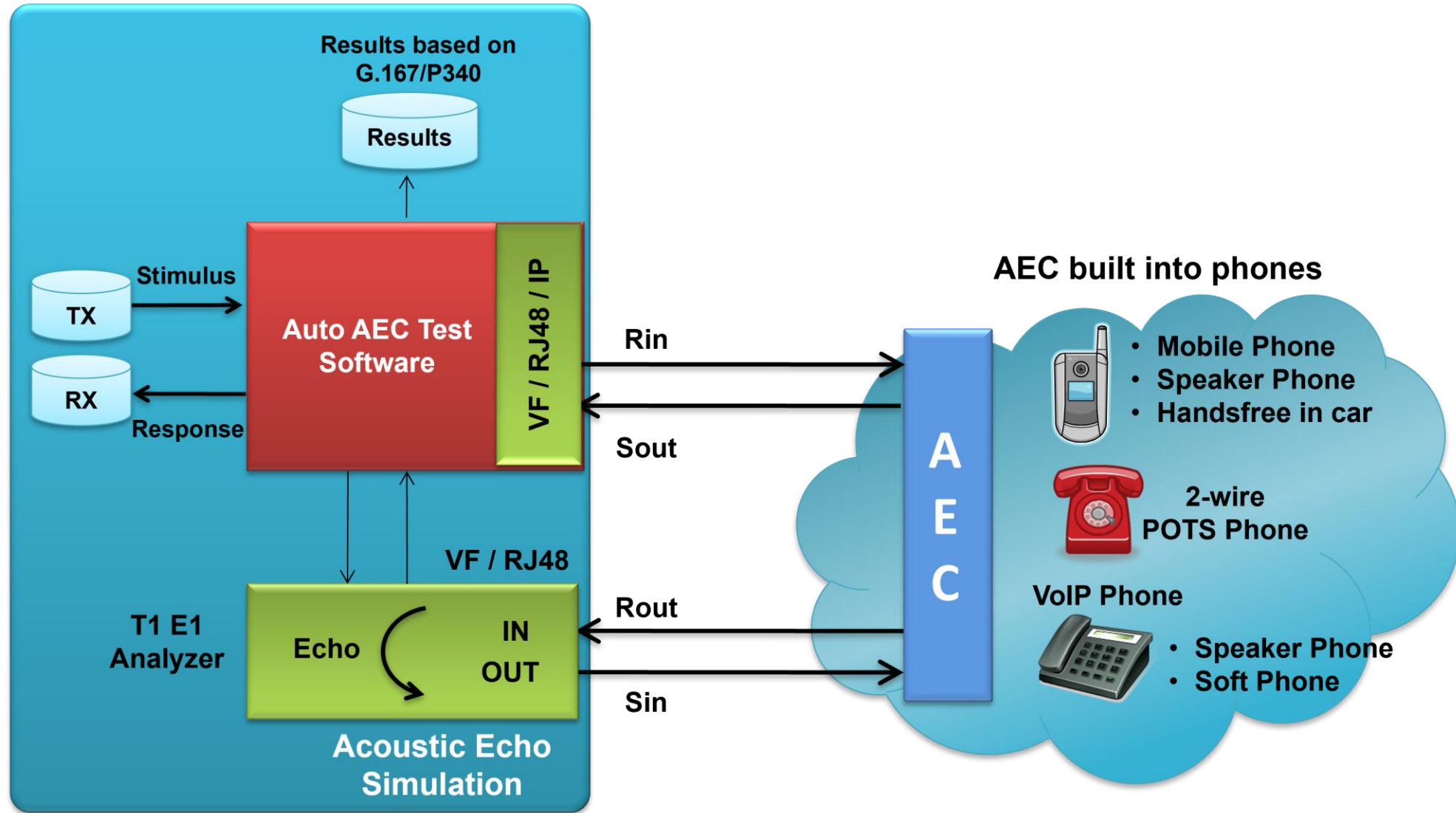
Basic Concept

- During the transmission and receiving of Rin, Rout, Sin and Sout, the AEC is manually or automatically controlled
- Rin or Sin files (stimulus and echo) are generated as per the user requirements
- Sout and Rout files are captured and automatically assessed
- AEC conformance to the ITU-T Specifications, G.167 (03/1993) and P.340 (05/2000)
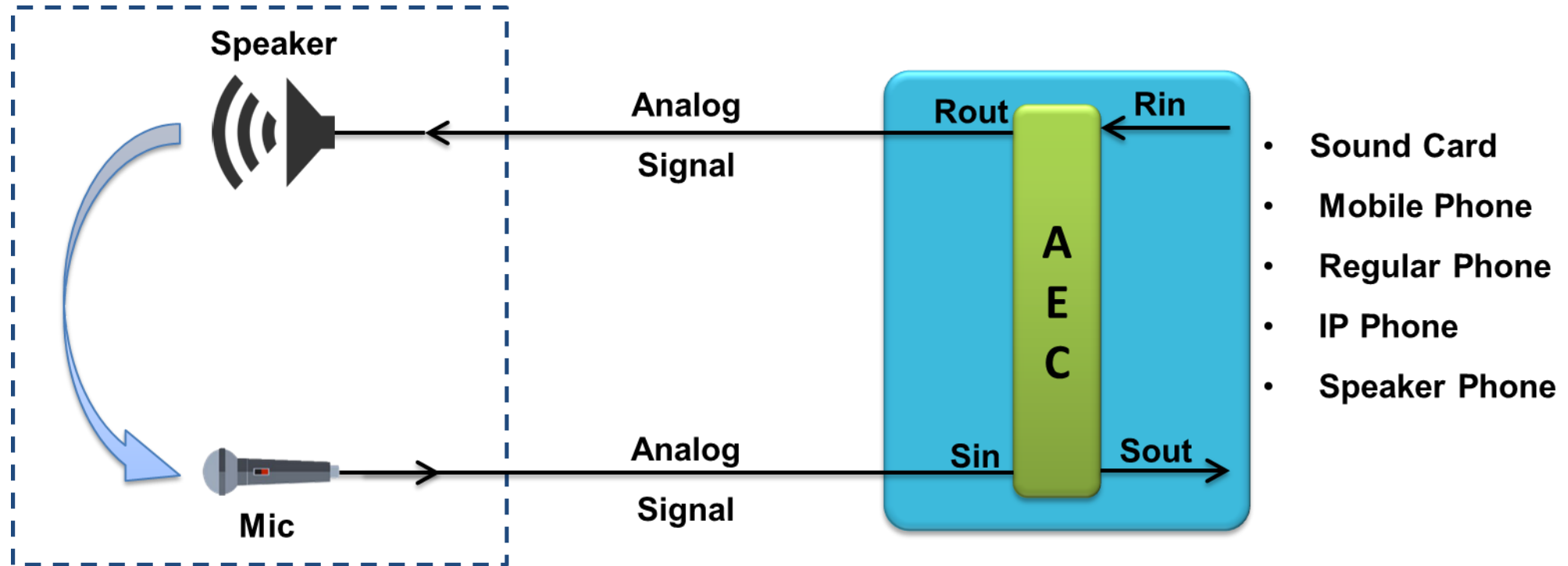
Acoustic Echo Simulation using Dual T1 E1 Card

- Automated Acoustic Echo Canceller (AEC) Test software uses WCS (Windows Client Server) software and Dual T1 E1 hardware platforms to transmit/receive files and to simulate the acoustic echoes in real time, which is used for TDM and VoIP applications
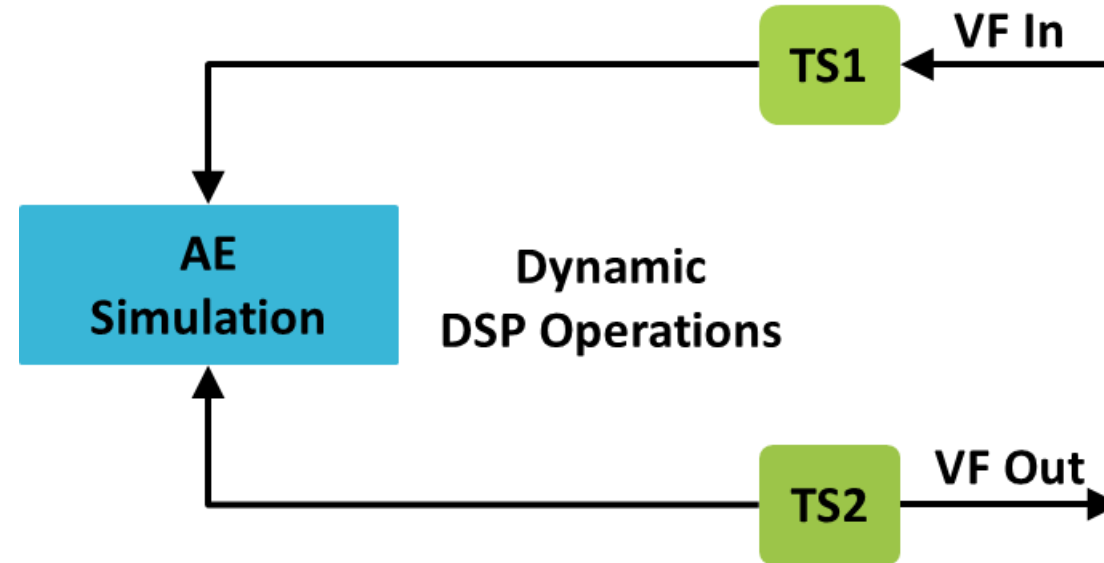
Acoustic Echo Cancellation and Overall Path

- Measurement Limitation in our Setup

- As depicted in the E1 card section , the analog signal is converted to Alaw format by the codec, which is again converted to linear range in WCS script. Acoustic echo is simulated in linear data format

- Echo simulated data is converted to Alaw format, which is again converted to analog signal by the codec and transmitted across the path

- 16-bit A/D or D/A has a theoretical SNR of 96 db (6 dB x 16 bits). Alaw has SNR of about 39 dB for signals between 0 dBm and -30 dBm using Alaw to simulate echo decreases the efficiency of the AEC because of the higher quantization noise. This is reflected as higher noise and less cancellation at Sout. Hence, accuracy of TCLwst measurement is decreased by around 7 to 10db
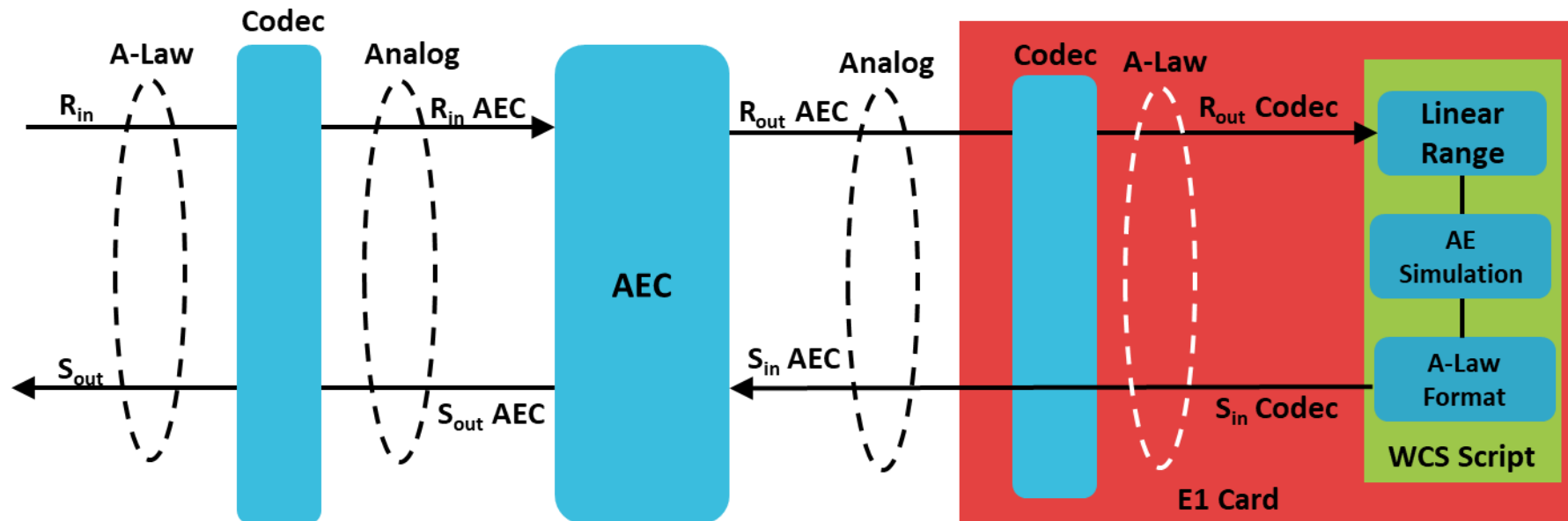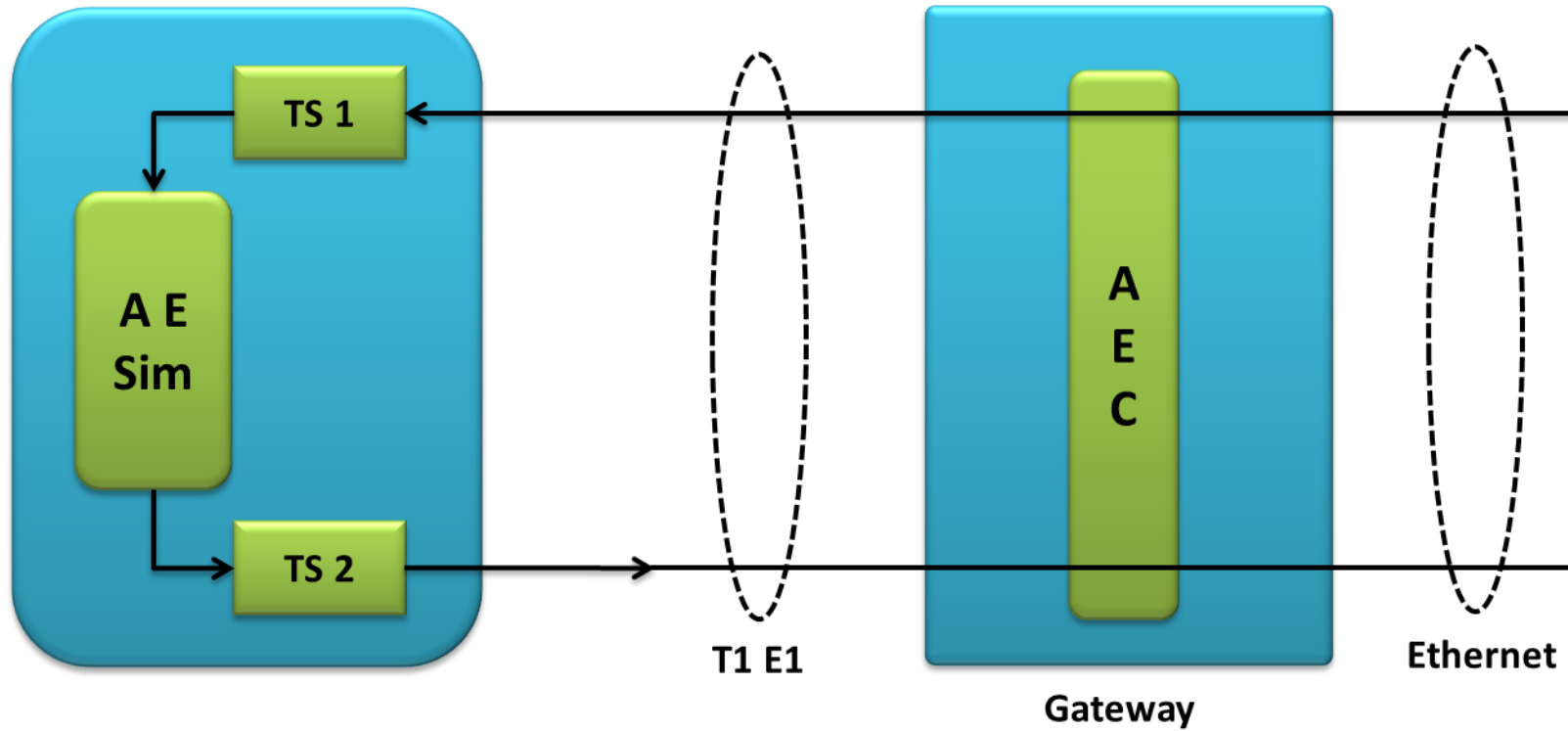
AEC and Signal Generation/Reception
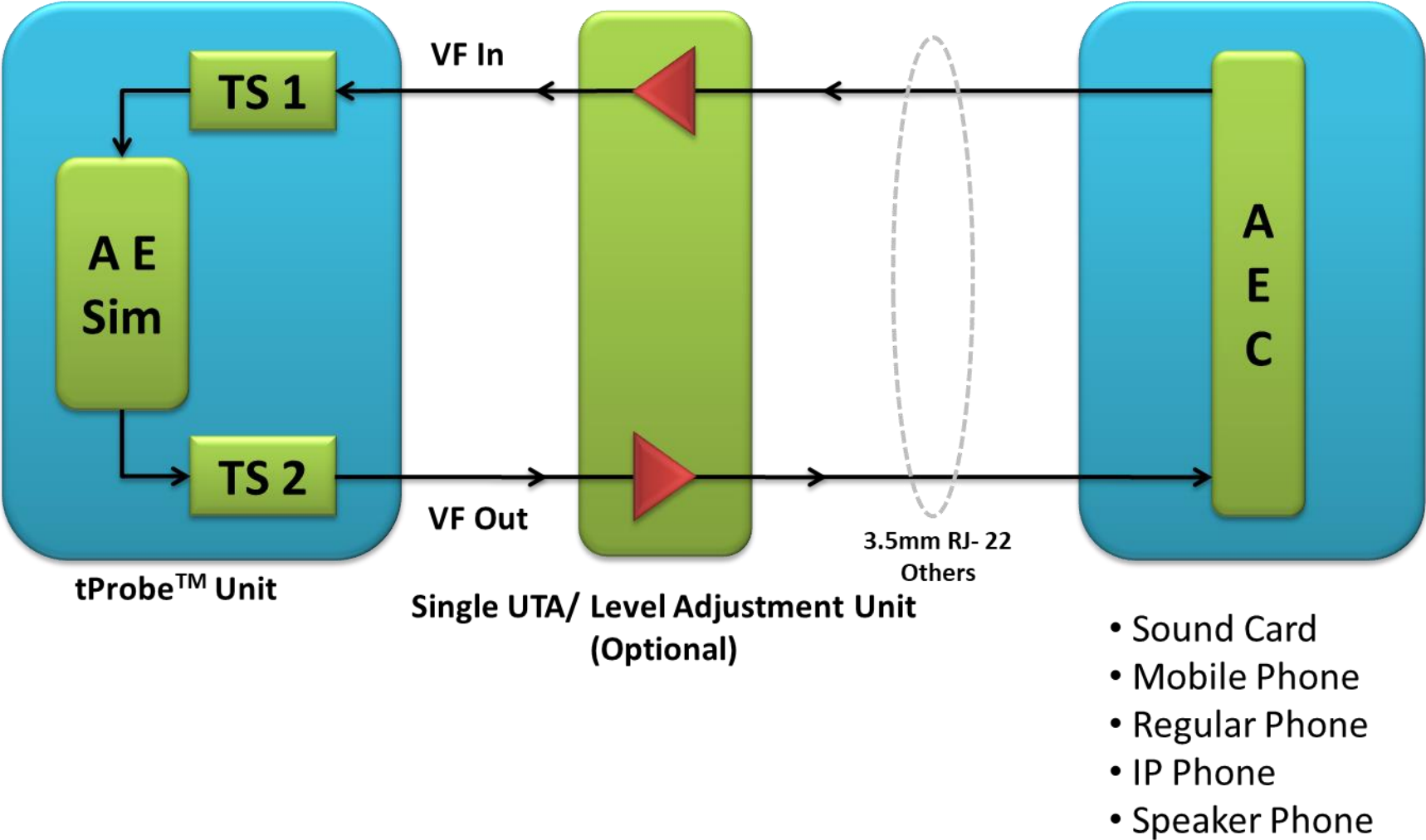
Typical Connections
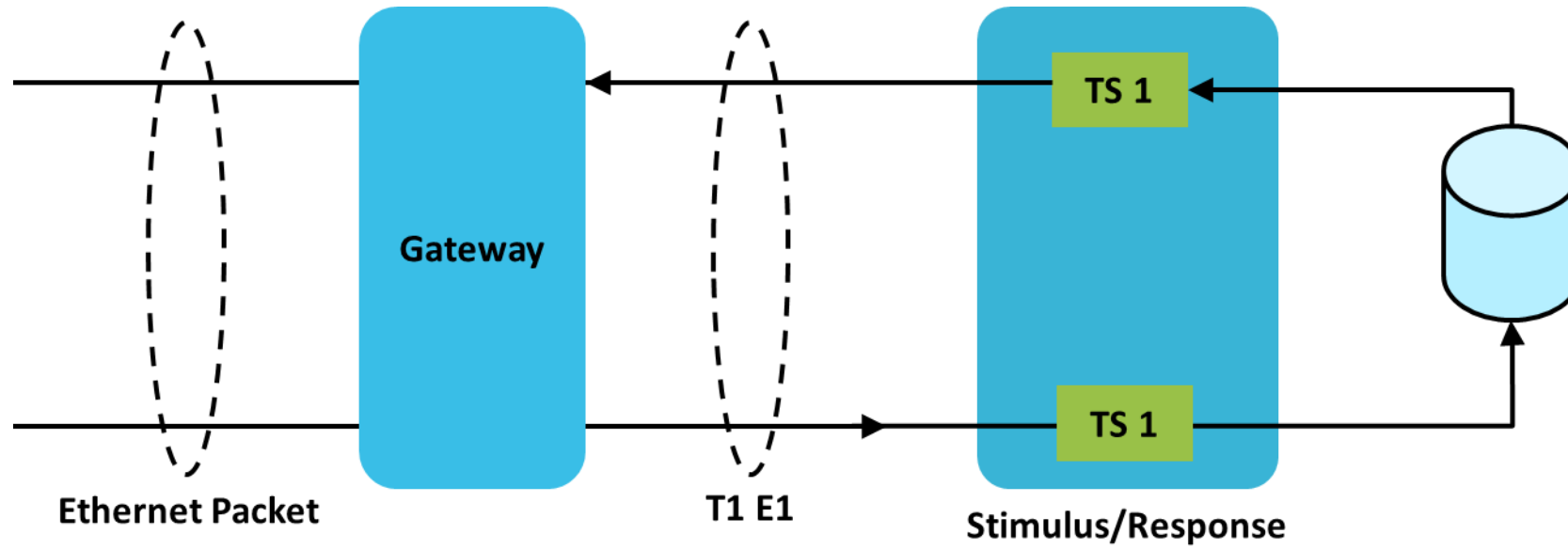
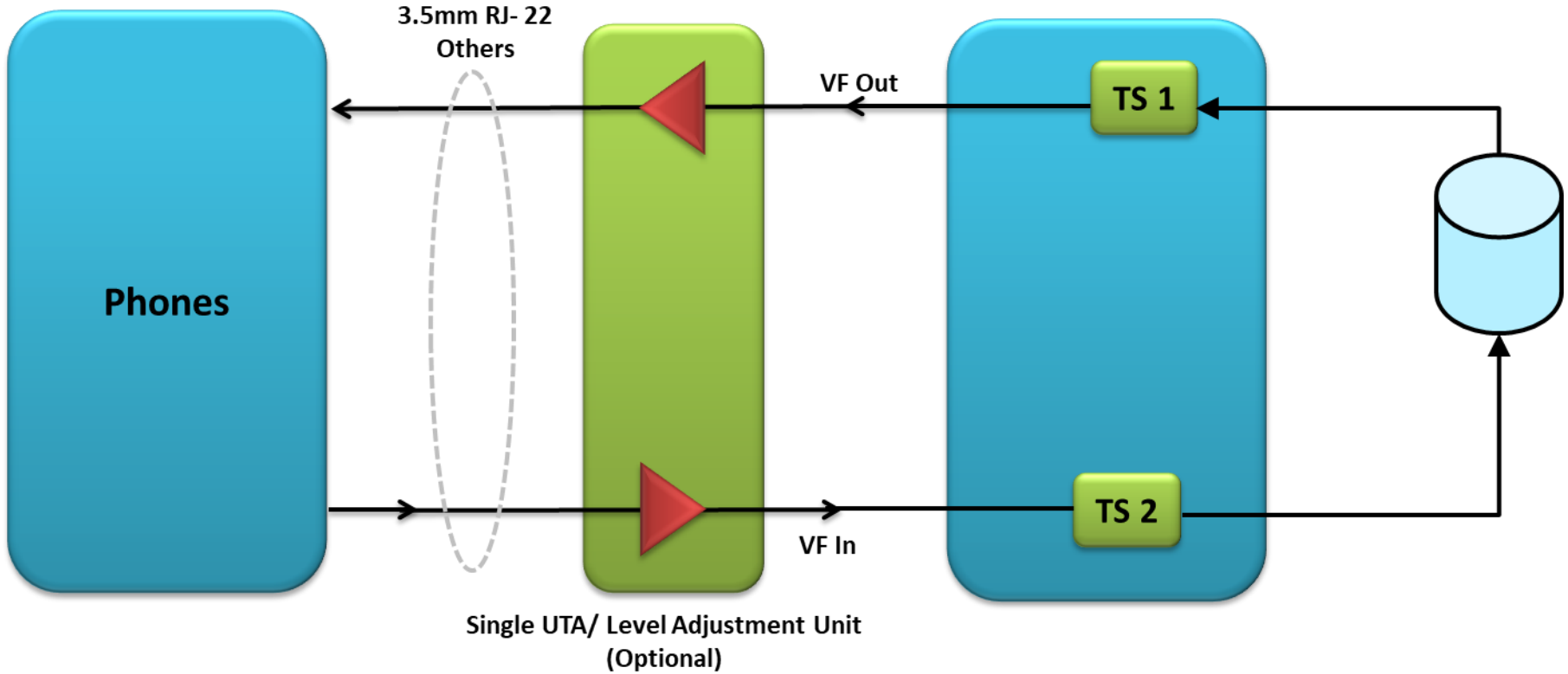# Acoustic Echo Canceller/Simulator for Digital & Packet Domains

Typical Connections

Level Adjustment Unit between AEC and Acoustic Echo Simulator

tProbe™ Unit

Single UTA/ Level Adjustment Unit (Optional)

VF In

VF Out

3.5mm RJ- 22 Others

- Sound Card
- Mobile Phone
- Regular Phone
- IP Phone
- Speaker Phone

Level Adjustment Unit at the Stimulus / Response End

End to End Applications for Mobile, TDM, & VoIP

- Case 1: Simulation Digital – Stimulus Digital (TDM to TDM)

- Case 2: Simulation Analog – Stimulus Analog (TDM to TDM - Mobile Applications)

- Case 3: Simulation Digital – Stimulus RTP (VoIP to TDM with Gateway)

- Case 4: Simulation Analog – Stimulus RTP (VoIP to TDM with IP Phone)

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Simulation Digital - TDM to TDM

Case 1

- In this scenario, the AEC is assumed to be in the network. Acoustic echoes are simulated within the GL's T1 E1 platforms digitally. The generation of the stimulus signal and the capture of the response signal is also performed by GL's T1 E1 platforms
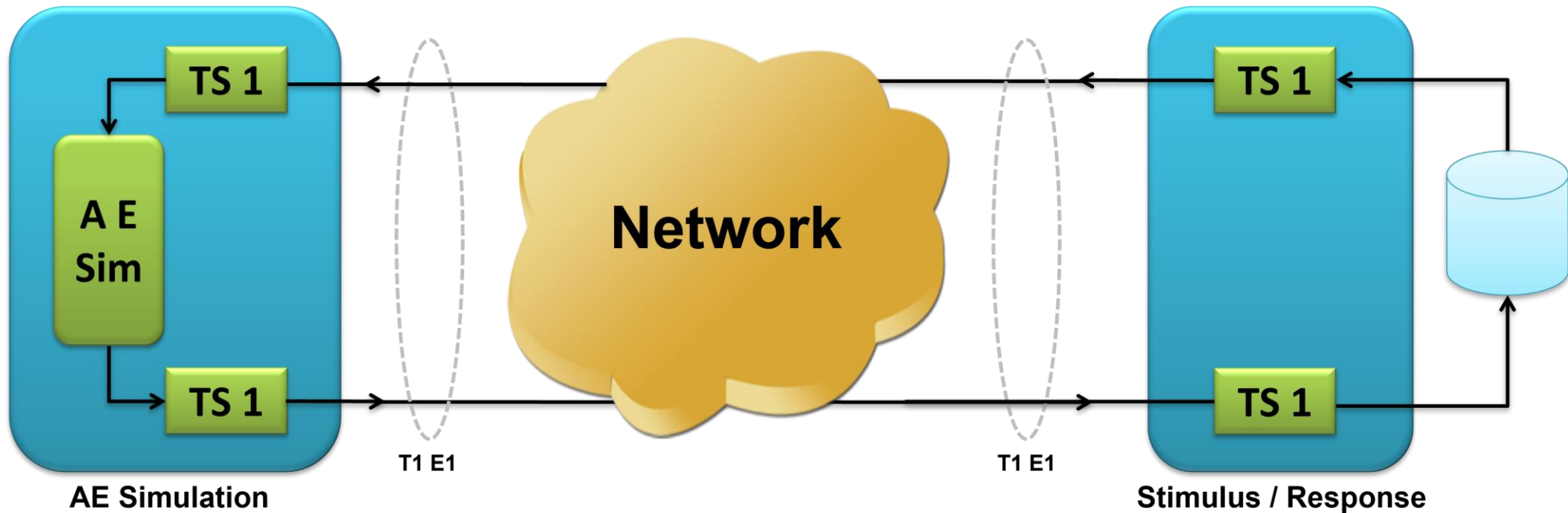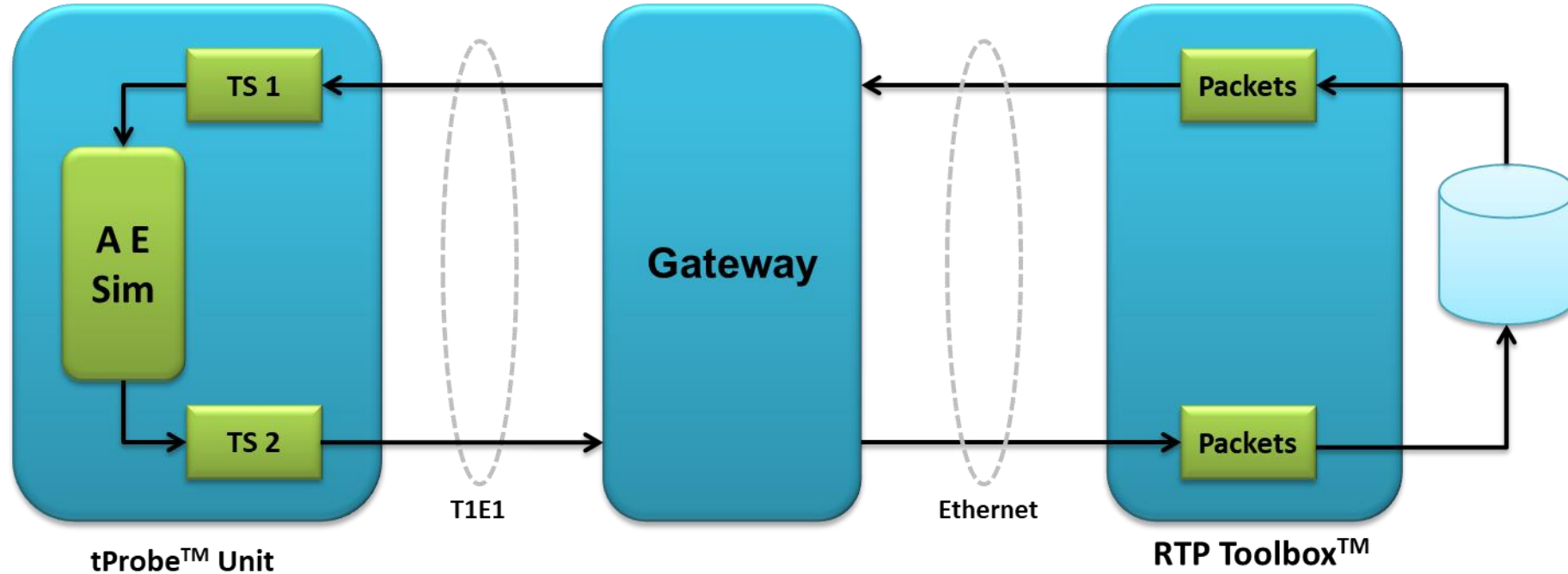
TDM to TDM with Gateway
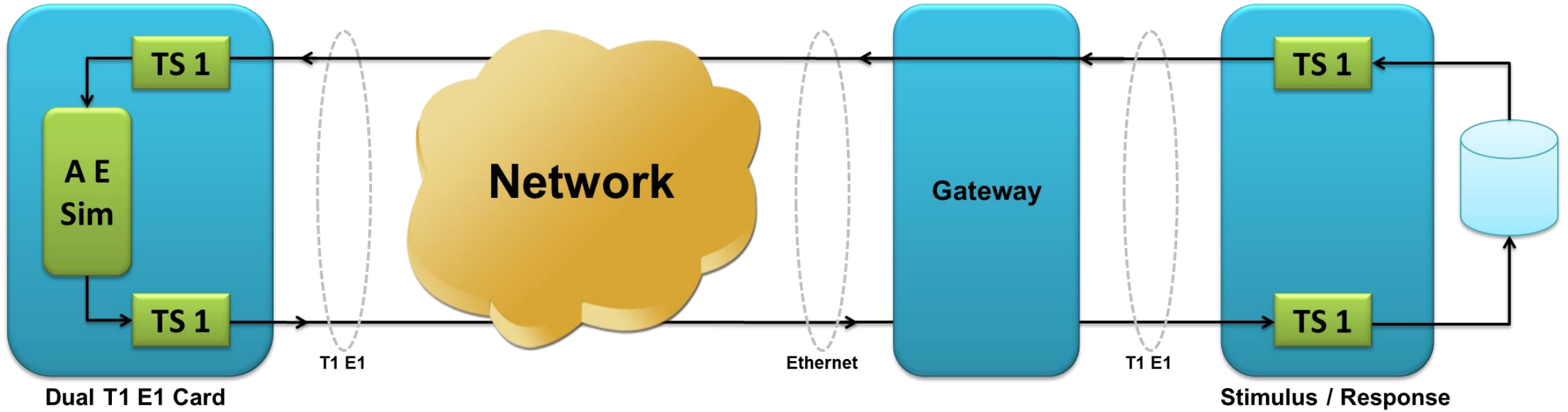
Simulation Analog – TDM to TDM (Mobile Applications)

- In this scenario, the AEC is assumed to be in a mobile phone and accessed thru an analog interface. Again, GL's T1 E1 platforms with analog interfaces are used to convert analog signals to digital and subsequent processing is performed digitally. Level adjustment accessories are used between mobile phone and the Dual T1 E1 (tProbe™ unit) to accommodate various signal levels and impedances
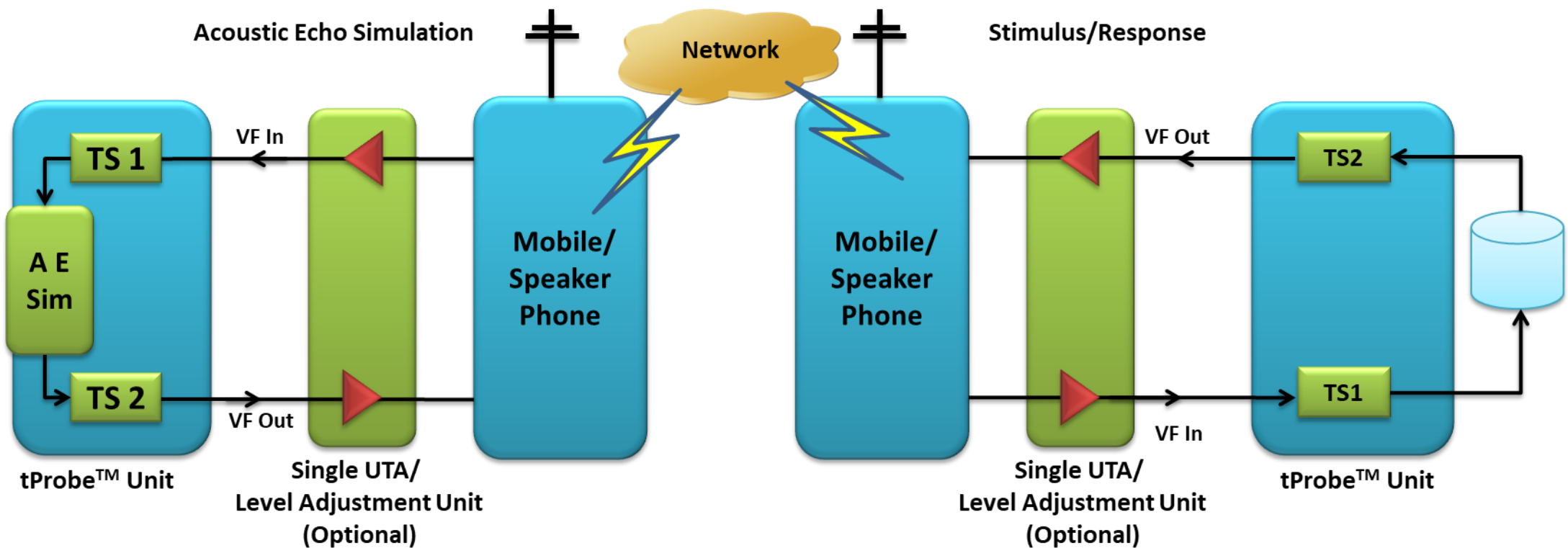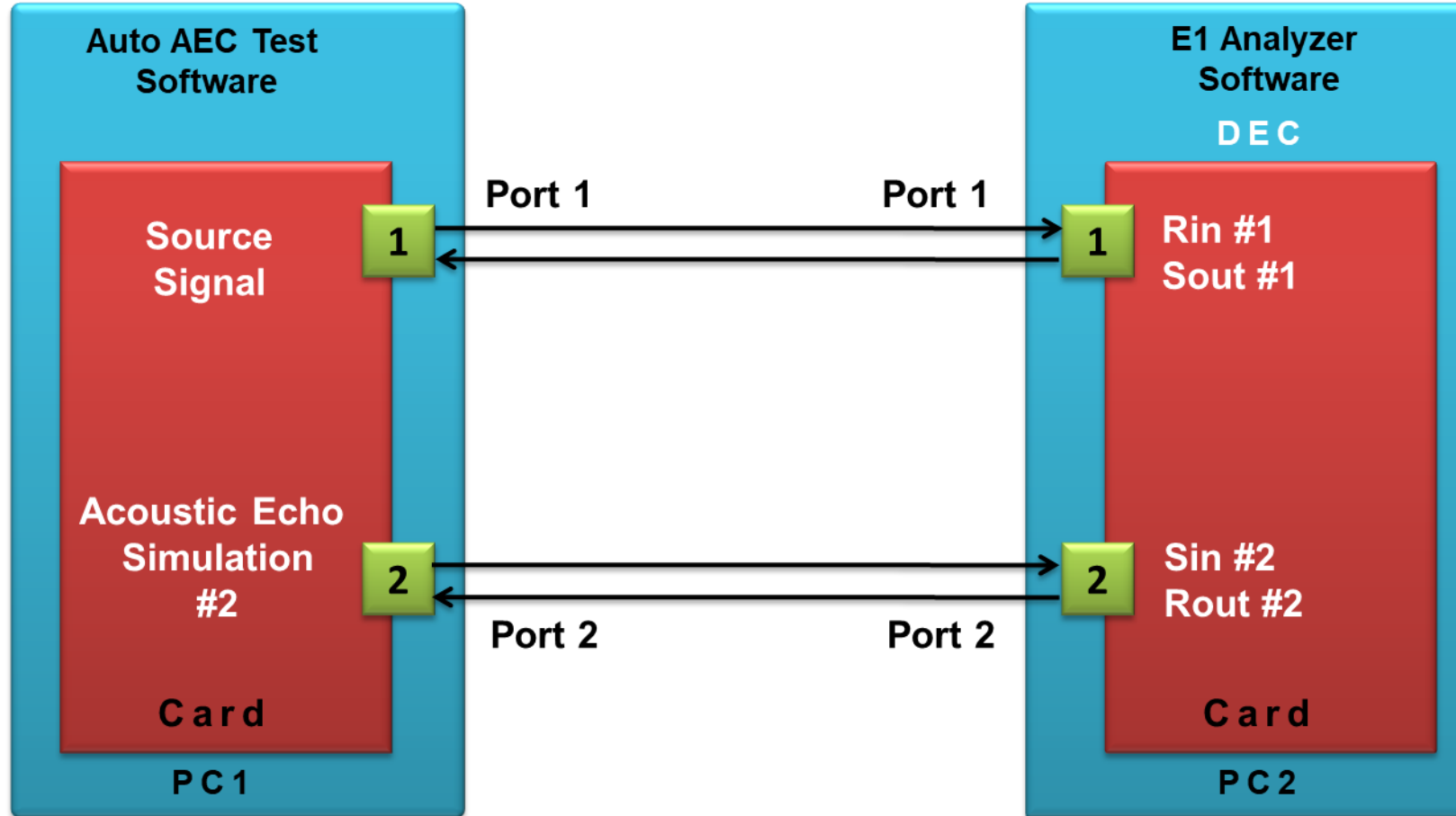
VoIP to TDM with Gateway

- In this scenario, the stimulus and response signals are generated by GL's RTP Toolbox™ through an Ethernet interface and simulation is performed digitally by GL's T1 E1 platforms, whether accessed through analog or digital interfaces
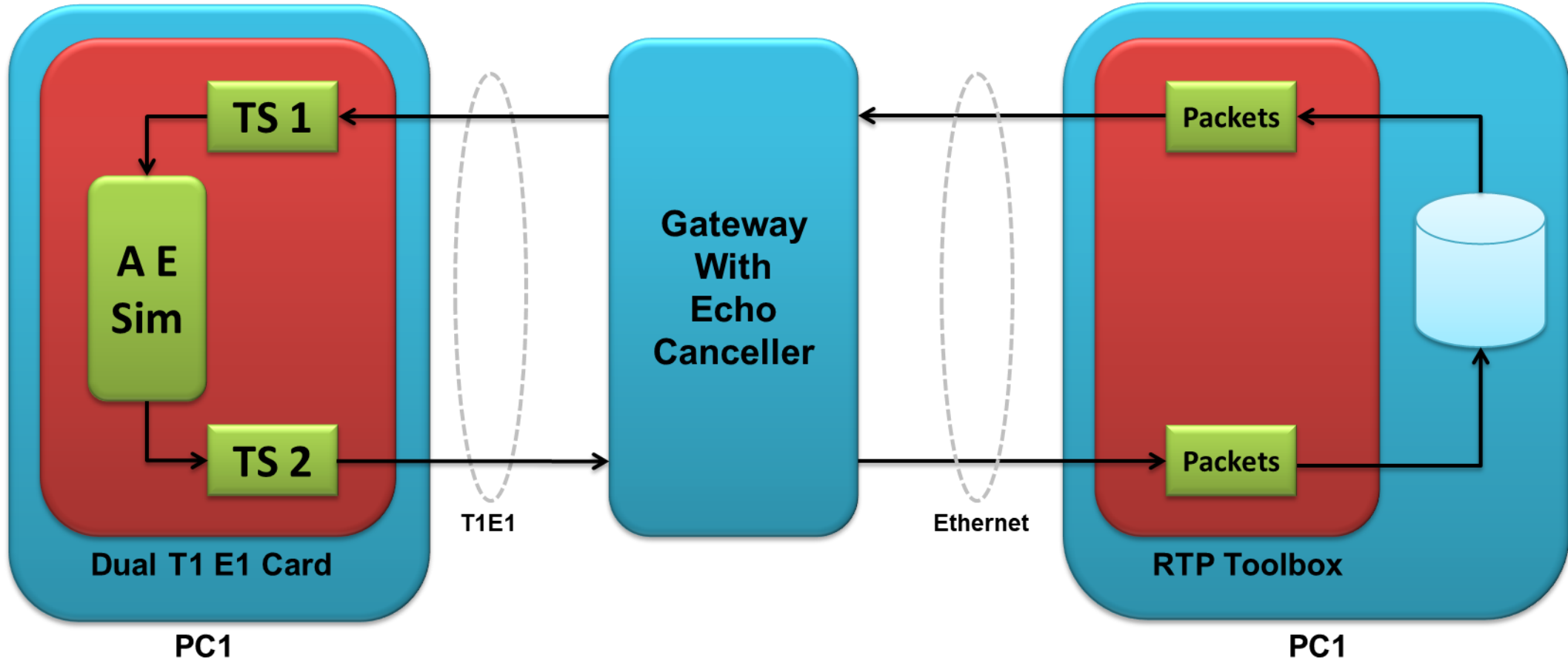
VoIP to TDM with IP Phone
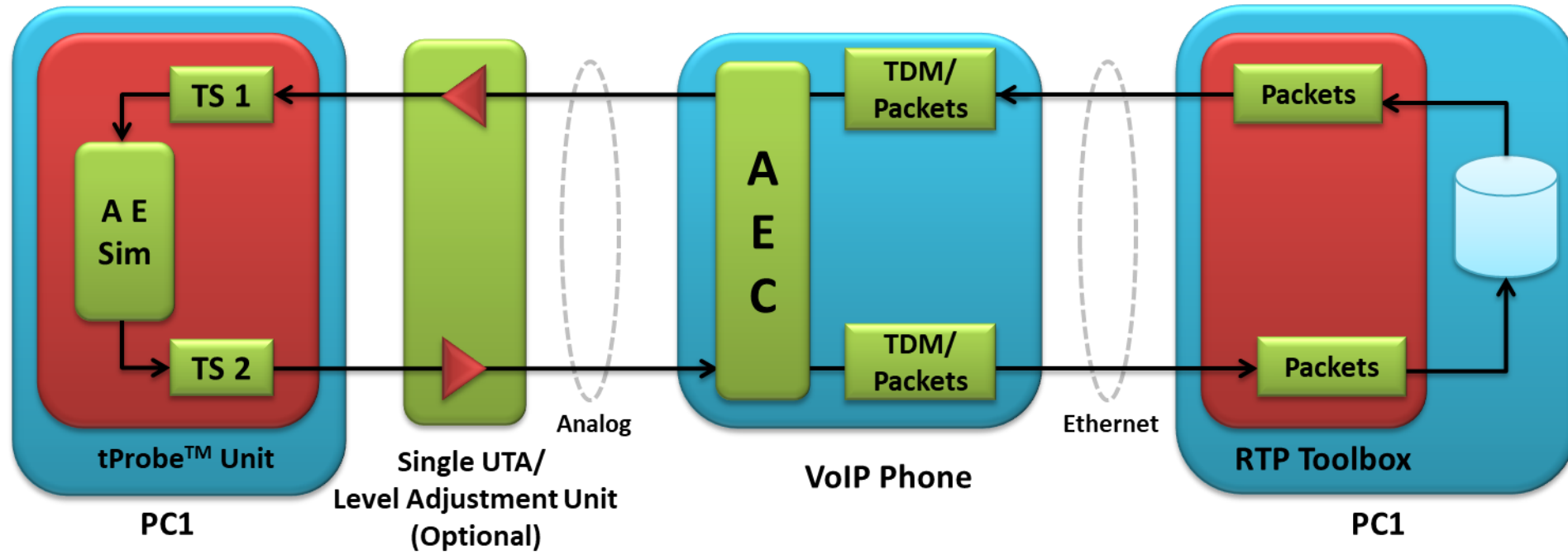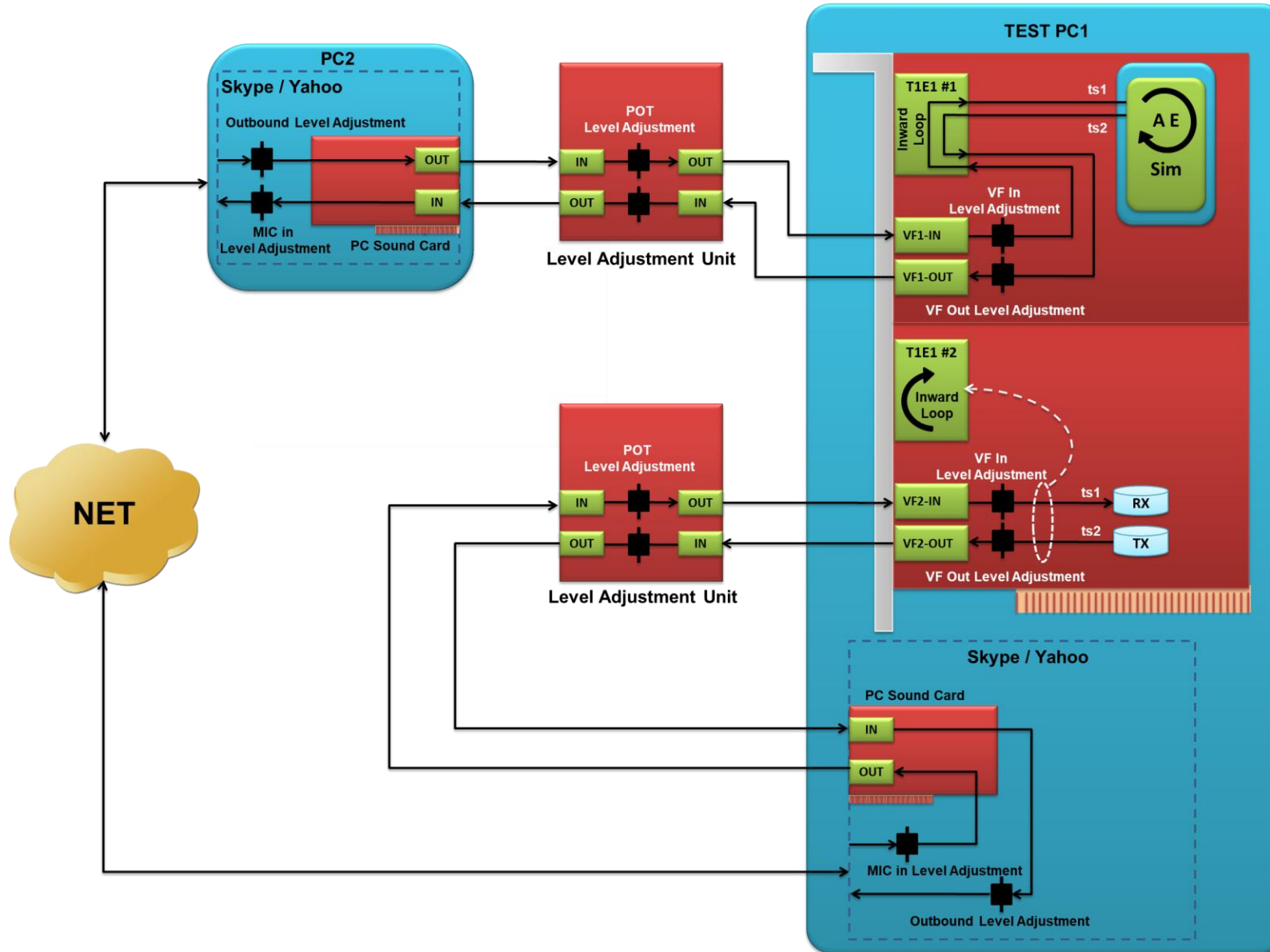
TDM to TDM Acoustic Echo Simulation using DEC
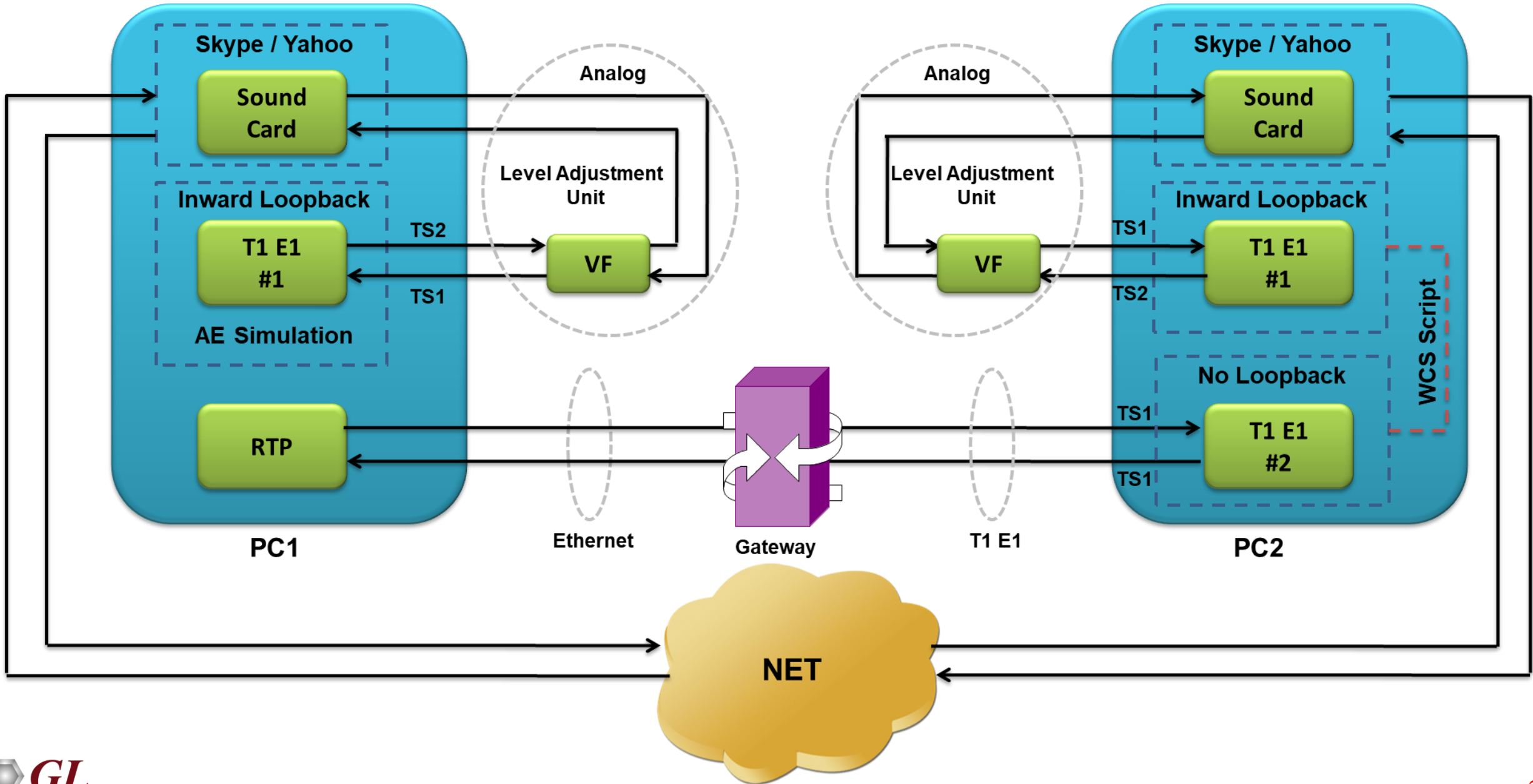
VOIP – TDM Acoustic Echo Simulation using DEC
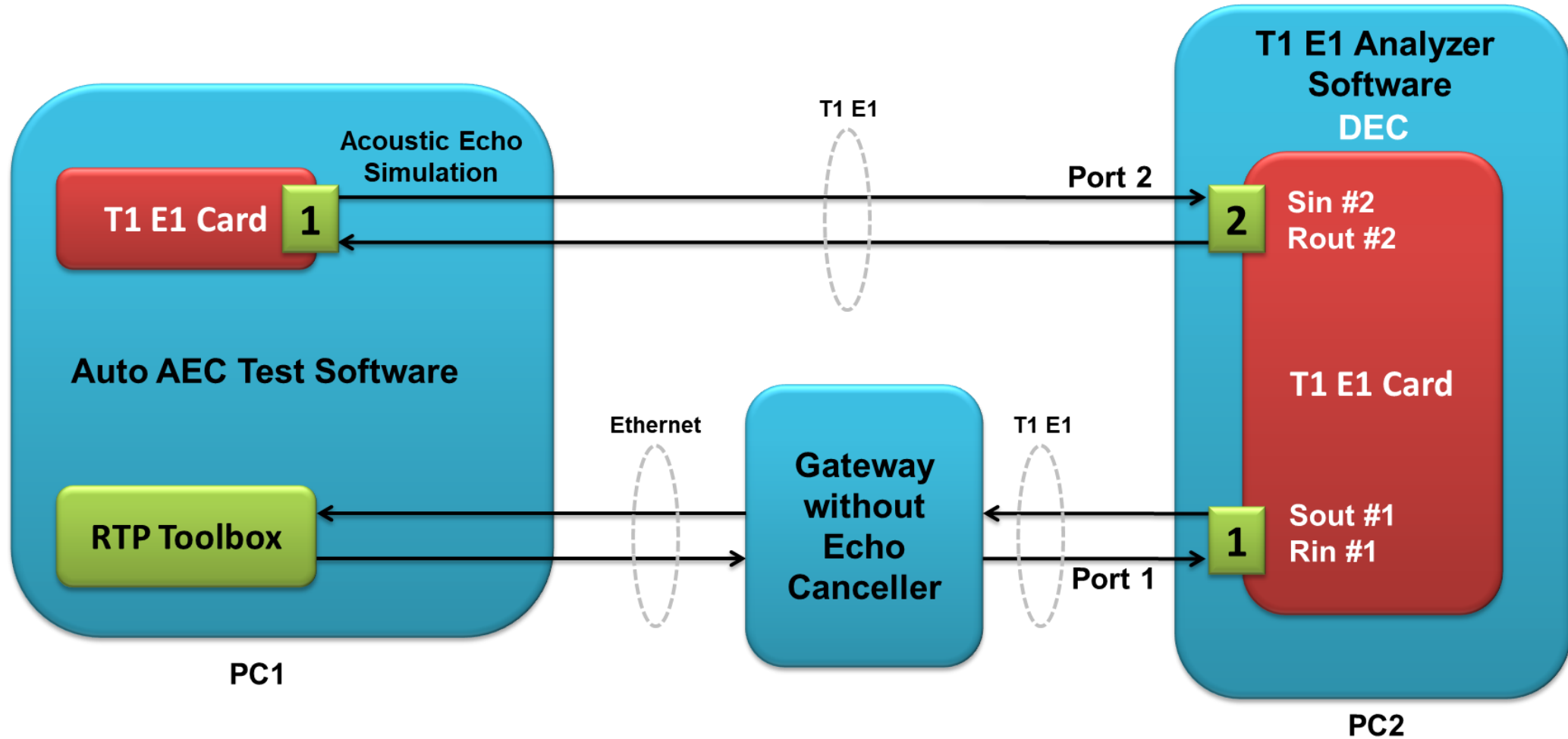
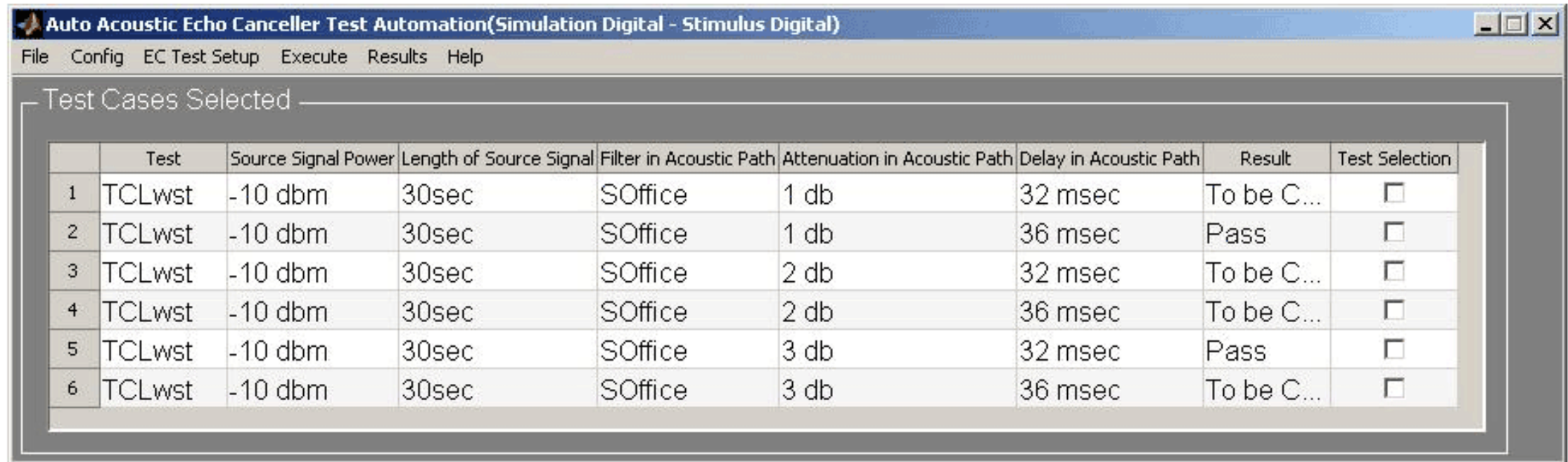# VoIP – TDM for Acoustic Echo Canceller Simulation using Gateway

TDM – TDM using Skype/Yahoo

VoIP – TDM using Skype/Yahoo

Configure Test Cases

- For teleconference systems and for hands-free communication on both sides, TCLwst shall be at least 40 dB

- For hands-free telephones and videophones interworking with distant users connected to the PSTN, TCLwst shall be at least 45 dB

- For mobile radio systems, TCLwst shall be at least [45 dB] when no acoustic noise is added at the Sin interface

- Test cases executed at least once, displays 'pass' or 'fail' in result column

Auto Acoustic Echo Canceller Test Automation(Simulation Digital - Stimulus Digital)

File   Config   EC Test Setup   Execute   Results   Help

Test Cases Selected

	Test	Source Signal Power	Length of Source Signal	Filter in Acoustic Path	Attenuation in Acoustic Path	Delay in Acoustic Path	Result	Test Selection
1	TCLwst	-10 dbm	30sec	SOffice	1 db	32 msec	To be C...	☐
2	TCLwst	-10 dbm	30sec	SOffice	1 db	36 msec	Pass	☐
3	TCLwst	-10 dbm	30sec	SOffice	2 db	32 msec	To be C...	☐
4	TCLwst	-10 dbm	30sec	SOffice	2 db	36 msec	To be C...	☐
5	TCLwst	-10 dbm	30sec	SOffice	3 db	32 msec	Pass	☐
6	TCLwst	-10 dbm	30sec	SOffice	3 db	36 msec	To be C...	☐

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Initialize GL Cards

RS232 Control Settings

Test Parameters for TCLwst

Result Display

Report Analysis and Plot Results

- Generation of report with the plots (Report Analysis) and plotting of Rin and Sout waveforms with option for recalculation of test parameter across different region in the waveform (Plot Results)
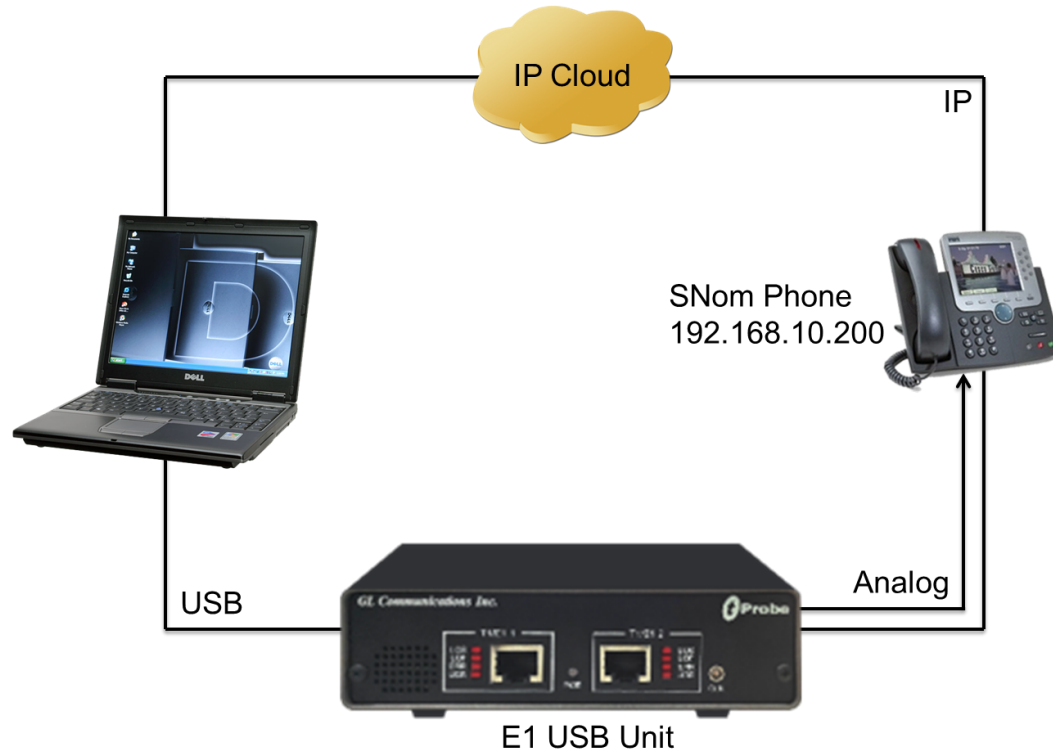
Auto AEC within SNom IP Phone

- As depicted in the setup the AEC is within the SNom IP phone

- The AEC performance is limited to A-law transmission

- Auto AEC Compliance Testing software is run in the host computer that is in PC1

- Respective E1 card's analyzer software is run in PC1

- RTP Toolbox™ can be run on same machine or on another PC
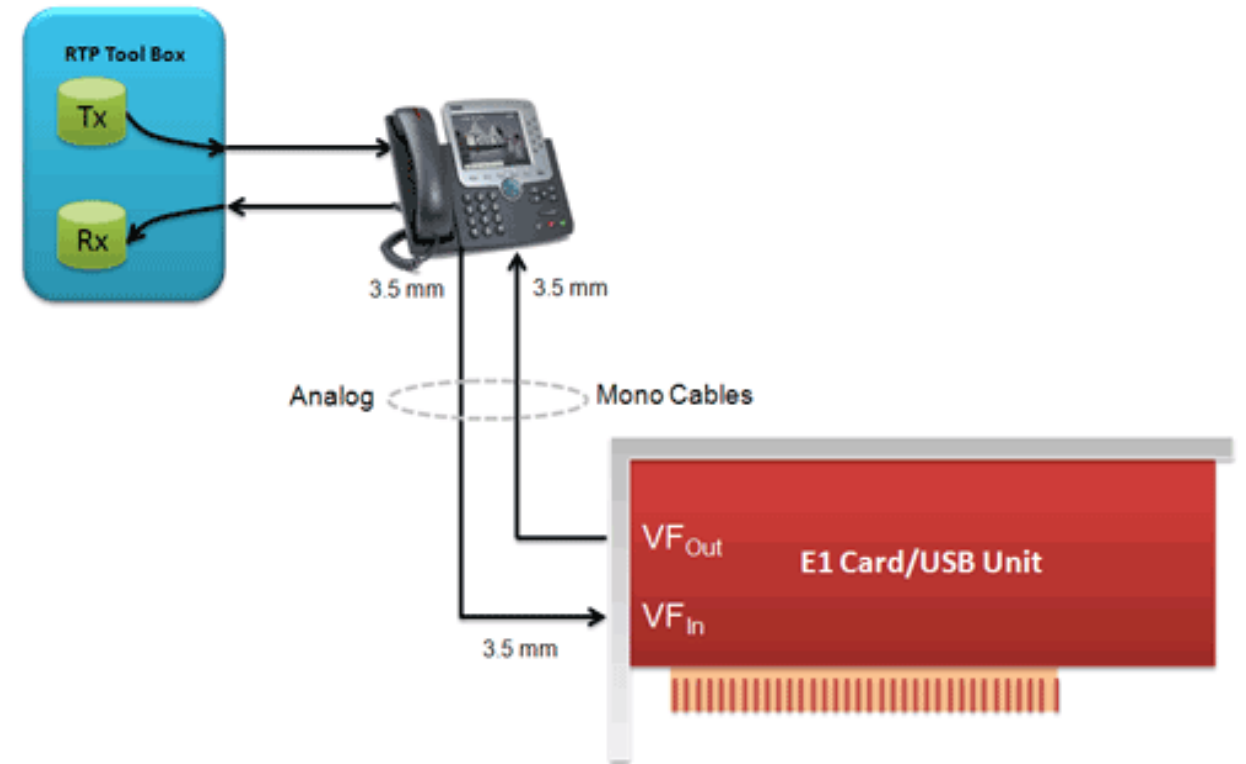
Auto AEC Supported Test Cases
(G.167, P.340)

Test Cases	Description	G.167	P.340
TCLwst	Weighted terminal coupling loss – single talk	Yes	Yes
TCLwdt	Weighted terminal coupling loss – double talk	Yes	Yes
Ardt	Received speech attenuation during double talk	No	No
Asdt	Sent speech attenuation during double talk	No	No
Drdt	Received speech distortion during double talk	No	No
Dsdt	Sent speech distortion during double talk	No	No
Pr	Maximum frequency shift (or pitch ratio)	No	No
Tonst	Break-in time – simple talk	Yes	Yes
Tondt	Break-in time – double talk	Yes	Yes
Tic	Initial convergence time	No	No
Trdt	Recovery time after double talk	No	No
TCLwpv	Terminal coupling loss during echo path variation	No	No
Trpv	Recovery time after echo path variation	No	No

Thank you