
Echo Cancellation Testing

EC with Mixed TDM and IP Interfaces



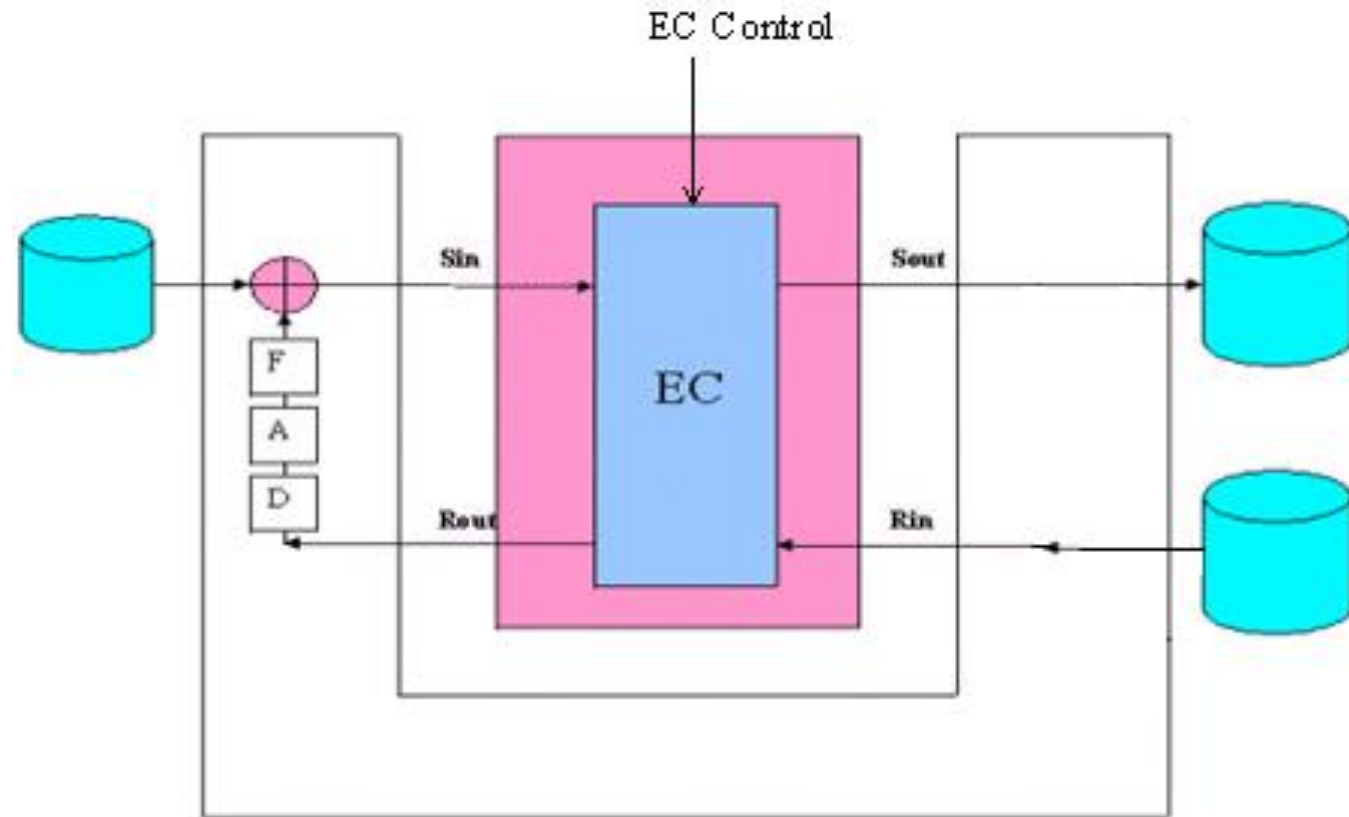
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EC Test Solutions

- G.168 ECT
 - Principles
 - Technical Difficulties
- EC with Mixed TDM and IP Interfaces
 - Using WCS and Principles
 - Technical difficulties
- TDM Environment
 - GUI based manual ECT
 - Automated ECT
 - TxRx
 - WCS
 - No hardware
- VoIP Environment
 - Manual ECT with RTP Toolbox
 - ATA configurations without TDM interface
 - Using Delay/Attenuate software to simulate echo path
 - Automated ECT with RTP Toolbox and CLI
 - Back-to-back configurations
 - Pure IP configurations
- EC with Mixed TDM and IP Interfaces
 - Using WCS and RTP Toolbox + CLI
 - Others

G.168 ECT

- Test principles
 - Transmit R_{in} , capture S_{out} and analyze S_{out} per G.168
 - Echo simulation + double talks
 - Control EC (H-register, NLP, comfort noise, etc.)

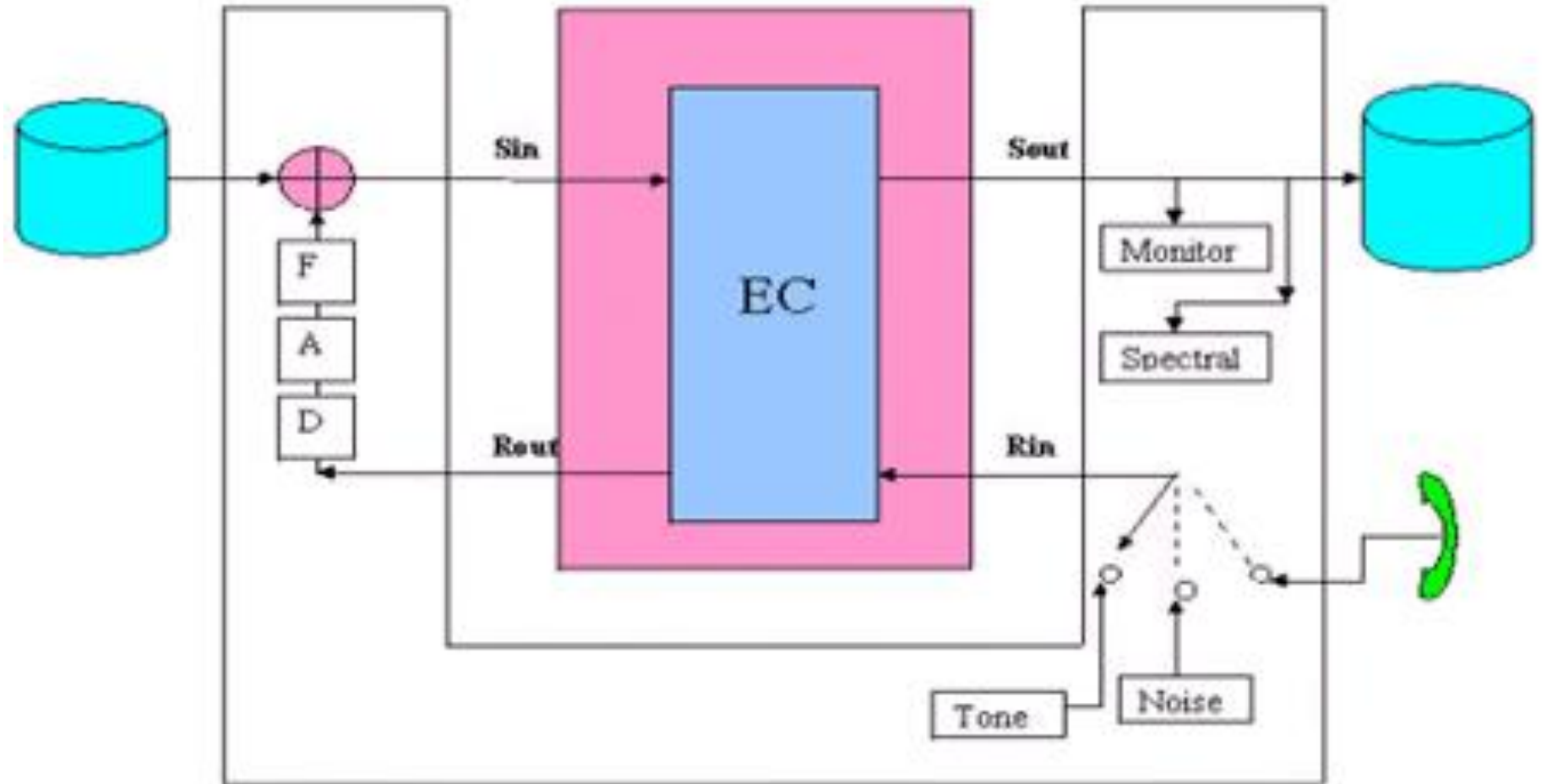


G.168 ECT

- Technical issues
 - Test signals, Rin and Sgen
 - Timing, Rin, Sgen and/or Sin (Test 2C, 3A,3B,3C, 8, 9, 10A)
 - EC control during tests (Test 2C/3A/3B/4/Test 6)
 - Analyzing Sout
 - Multiple TS testing
 - Delay control:
 - Delay = pure delay + dispersion + hardware + WCS
 - Hardware = 2 multiframe
 - WCS: response time + latency = 18 ms?
 - Firmware solution, one TS only for HD cards

ECT in TDM Environment

- GUI based manual ECT (XX065)
 - Delay/attenuate timeslot software
 - Play back a file
 - Record data to a file
 - GLCView

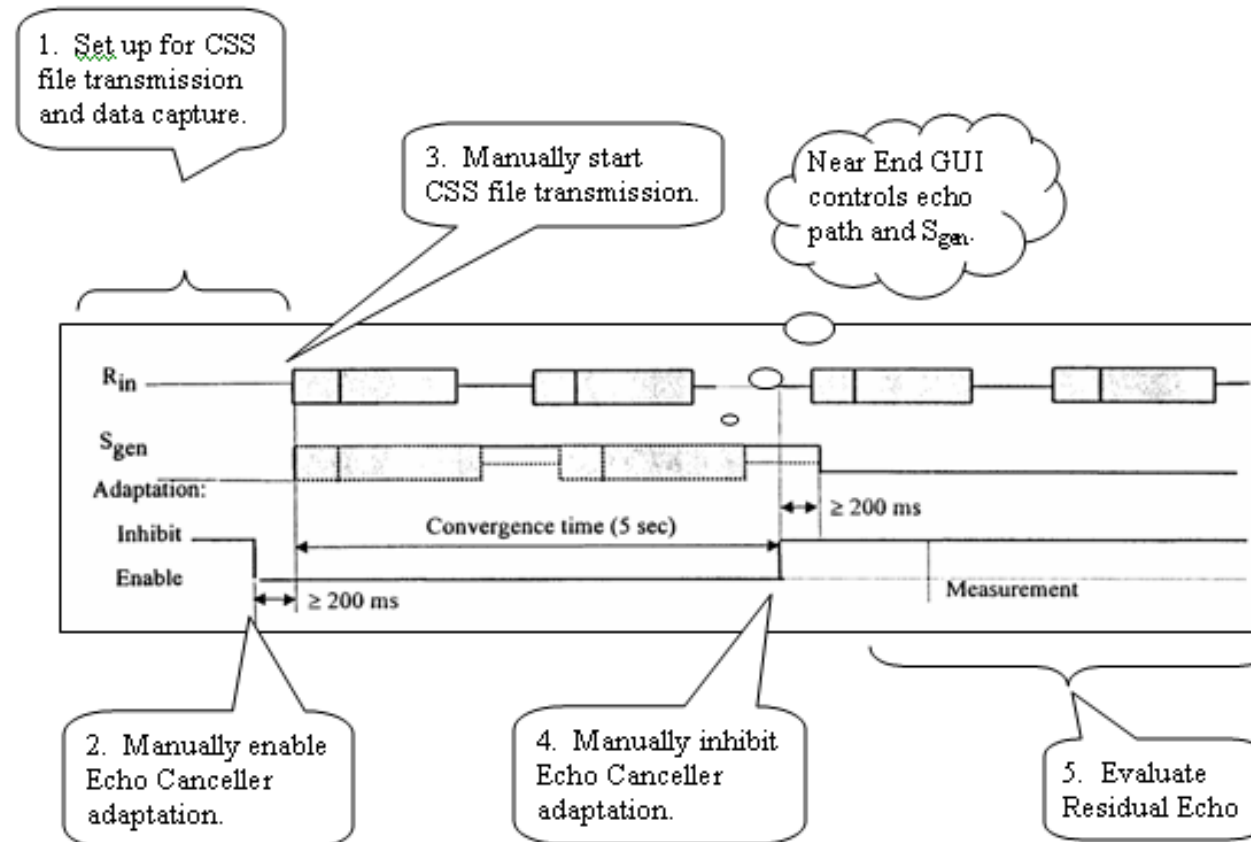


GUI based manual ECT (XX065)

- Technical difficulties
 - Test 3A: freeze H-register in 5 seconds
 - Test 3C: stop transmit Sgen in 5.6 seconds
 - Multiple TS testing simultaneously
 - Analyzing Sout – time consuming
 - Auto-analysis applications

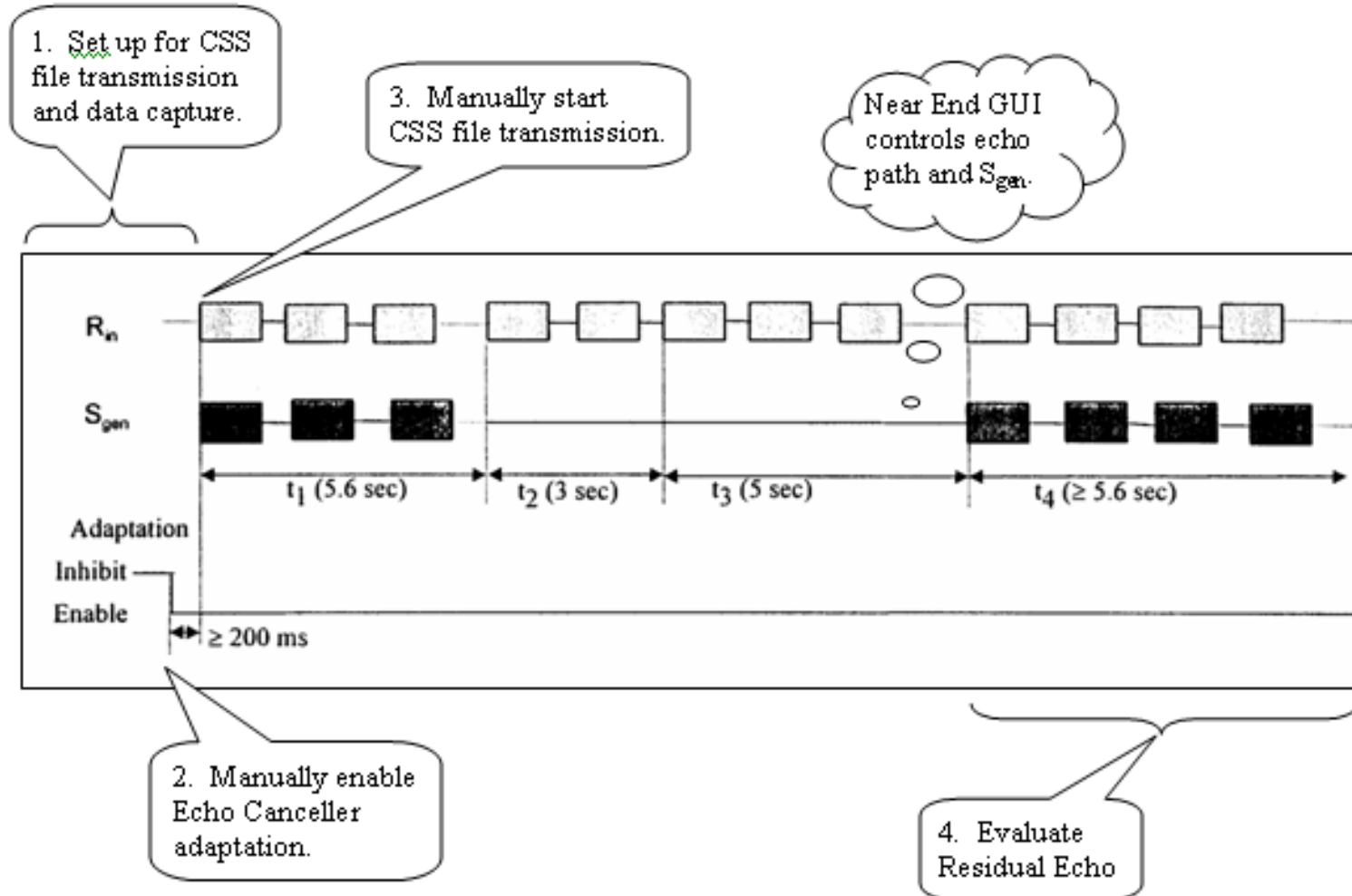
G.168 Test 3A Time Relationship

- Allowed convergence time is 5 seconds
 - This issue exists in AutoECT: (approximation 5 seconds or more)



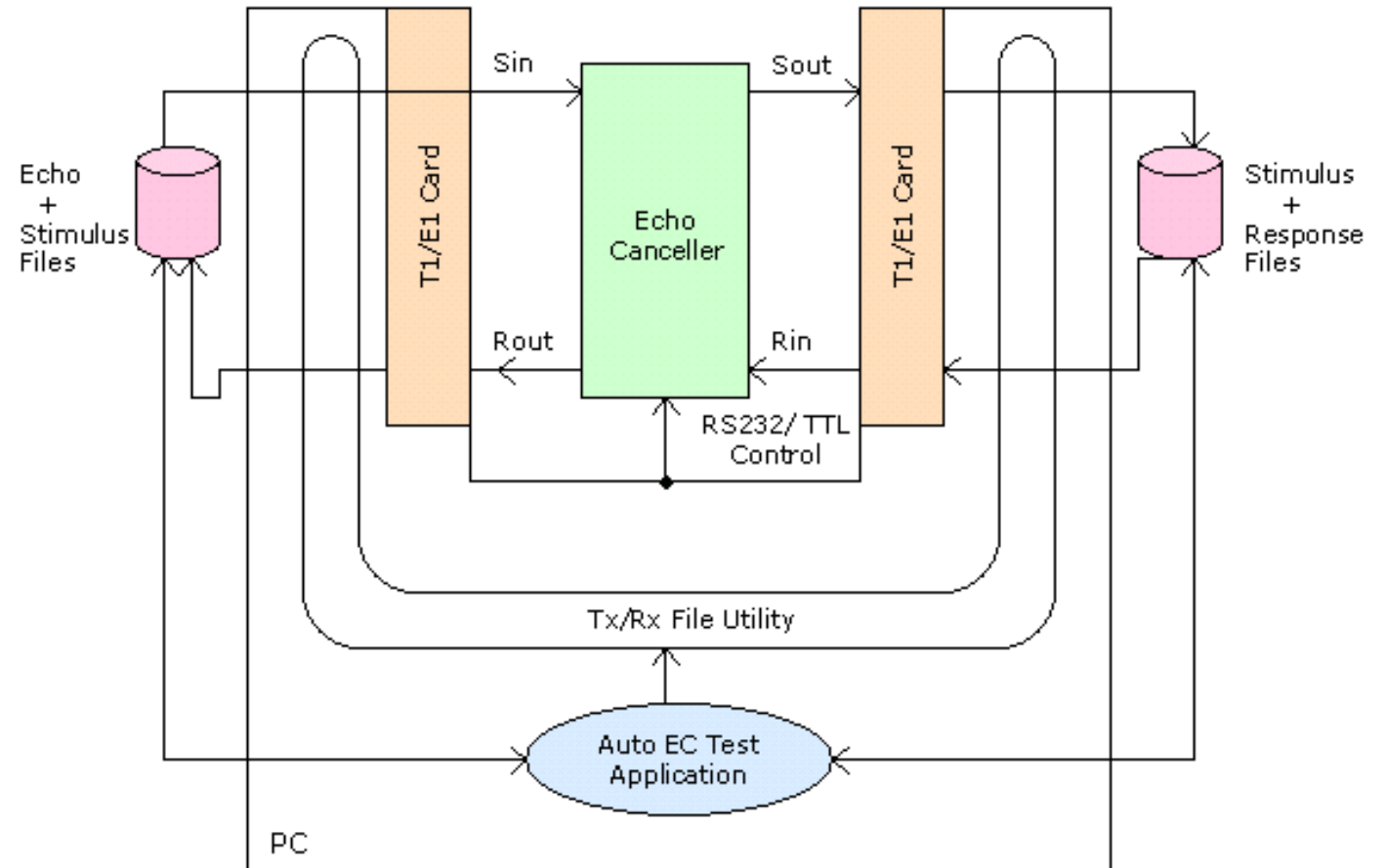
G.168 Test 3C Time Relationship

- Stop Sgen in 5.6 seconds
 - Solution: prepare Sgen file. Then, need sync between Rin and Sgen



ECT in TDM Environment

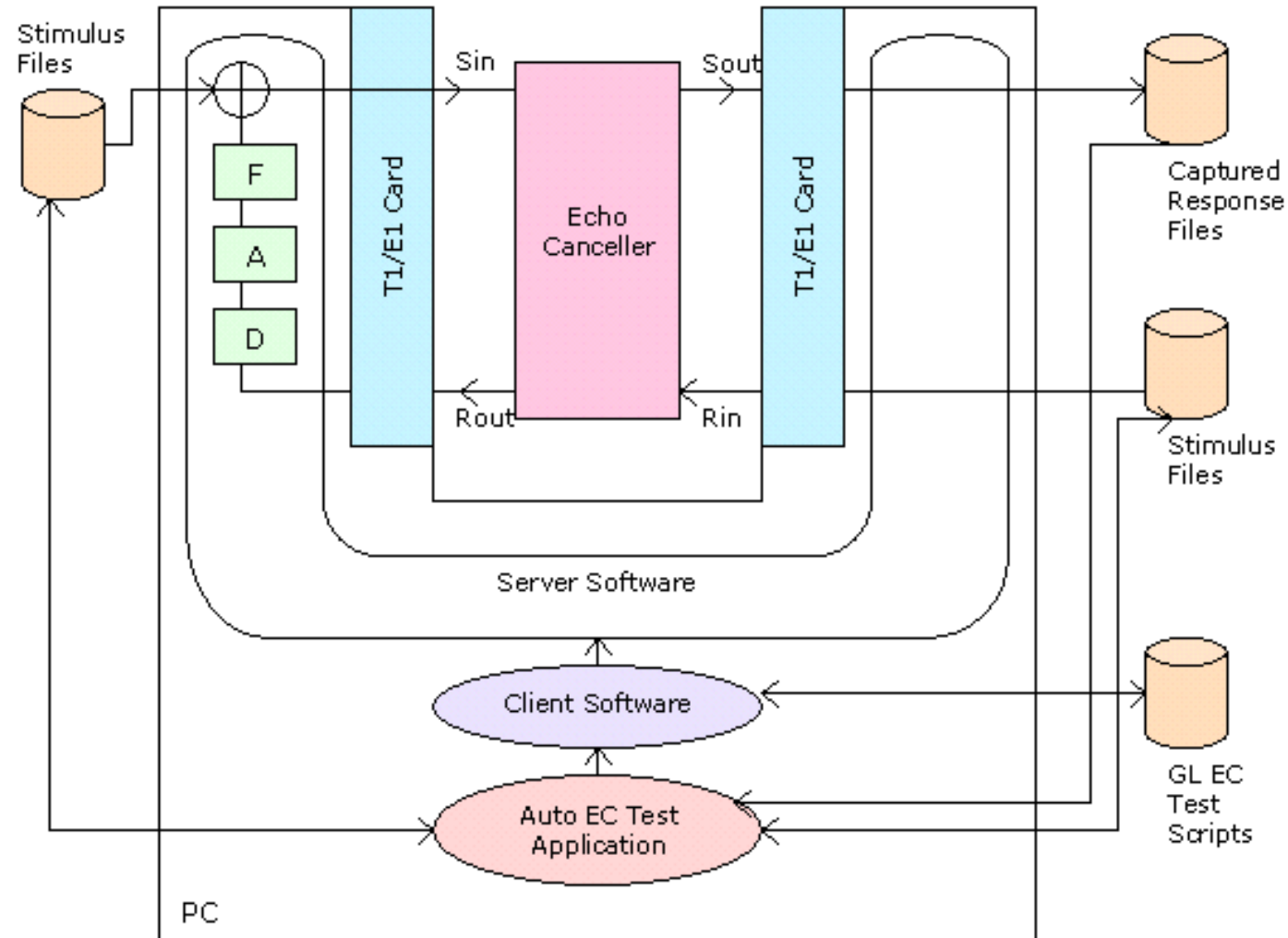
- Automated ECT (XX067) – TxRx based solution
 - Pre-prepared Rin and Sin
 - Using sync feature of TxRx: SyncTxMF 1-2



Automation thru File Based Tx/Rx File Utility

ECT in TDM Environment

- Automated ECT (XX067) – WCS based solution
 - Echo generated on-the-fly



Automation thru Windows Client/Server

ECT in TDM Environment

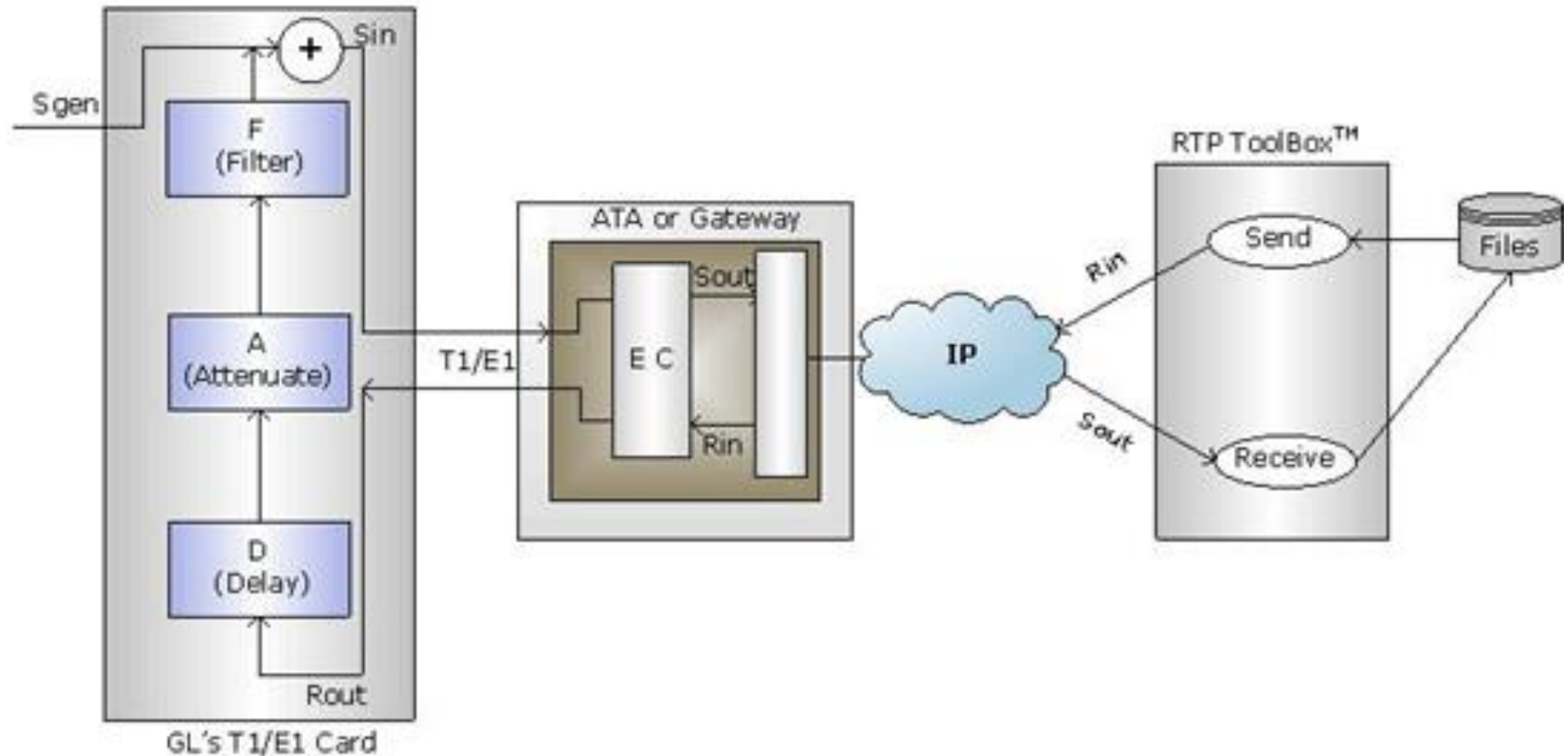
- Automated ECT (XX067) – No hardware solution
 - Rin and Sin files are prepared, and pause
 - Users input these Rin/Sin files to test software version EC
 - Users captures Rout and Sout files
 - AutoECT analyzes Rout/Sout files automatically
 - Repeat the above-mentioned process for the next test case

AutoECT Improvements

- AutoECT improvement rooms
 - Multiple TS testing
 - Delay issues: WCS based delay overhead = 18 ms?
 - Sout PCM File Viewer with G.168 Mask
 - Our competitor provides this free ware
 - AutoECT result presentation
 - Pass/fail information
 - Requirements, measured values are partially outputted
 - Detailed failed cases offline investigation capability
 - AutoECT Test Setup and Result Viewer

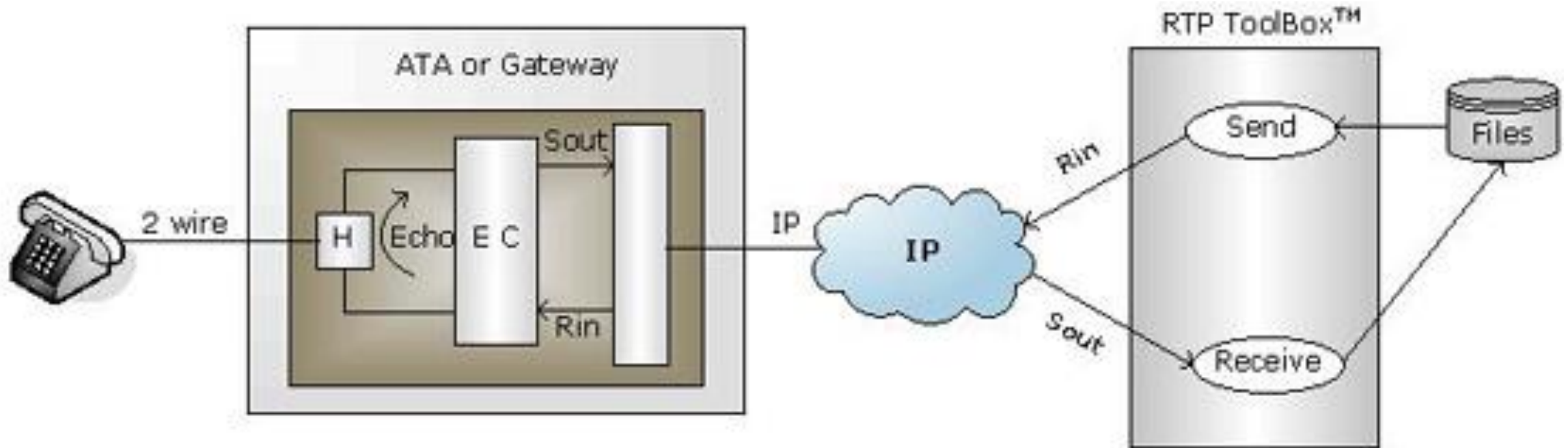
ECT in VoIP Environment

- Manual ECT with RTP Toolbox (PKB105) – with TDM interface
 - Rin and Sgen files (16-bit linear PCM) are pre-prepared
 - Using RTP Toolbox to Play back and Record files
 - Delay/attenuate software in TDM side
 - GLCView



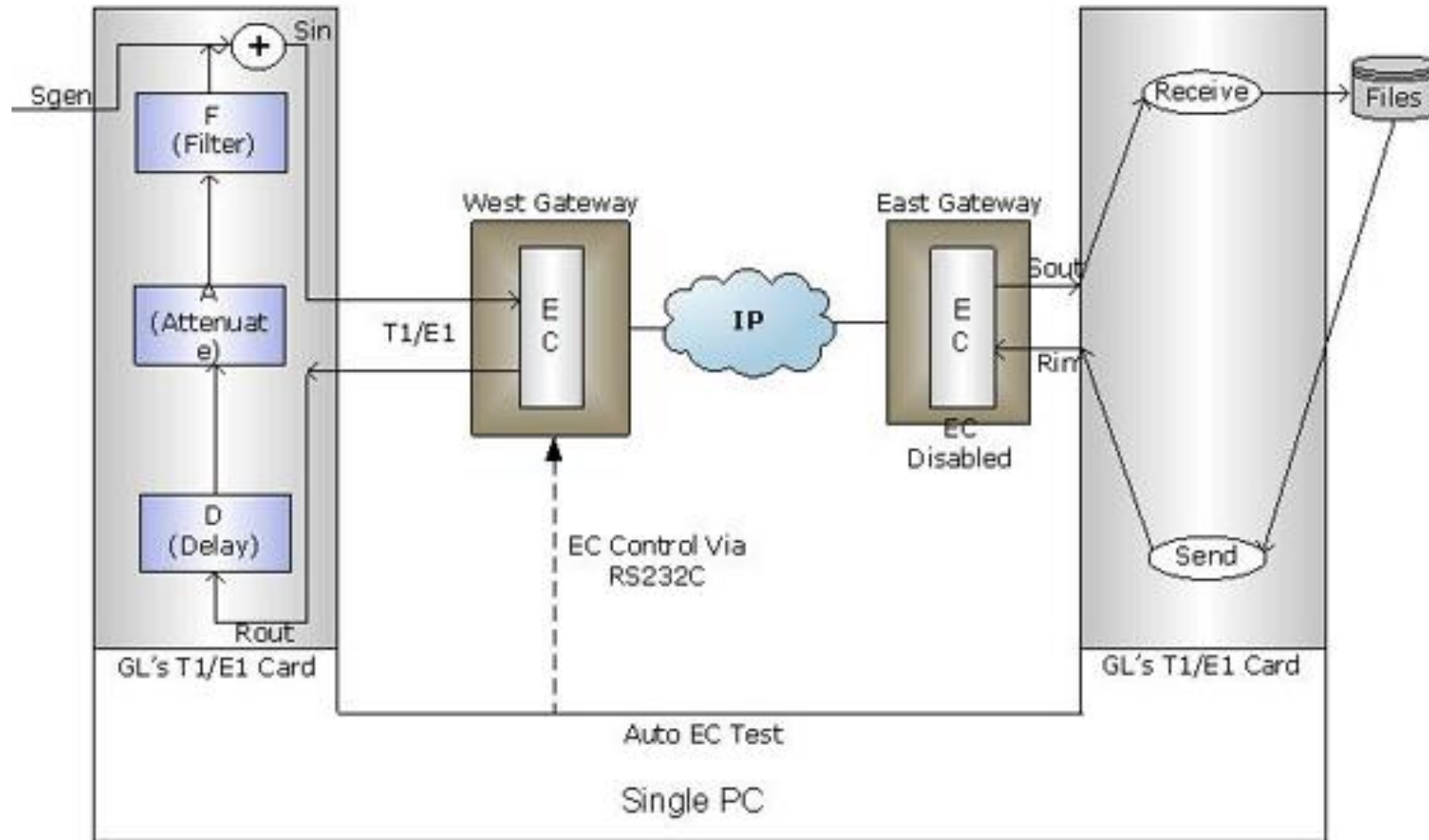
ECT in VoIP Environment

- Manual ECT with RTP Toolbox (PKB105) – with ATA configuration
 - Rin and Sgen files (16-bit linear PCM) are pre-prepared
 - Using RTP Toolbox to Play back and Record files
 - GLCView



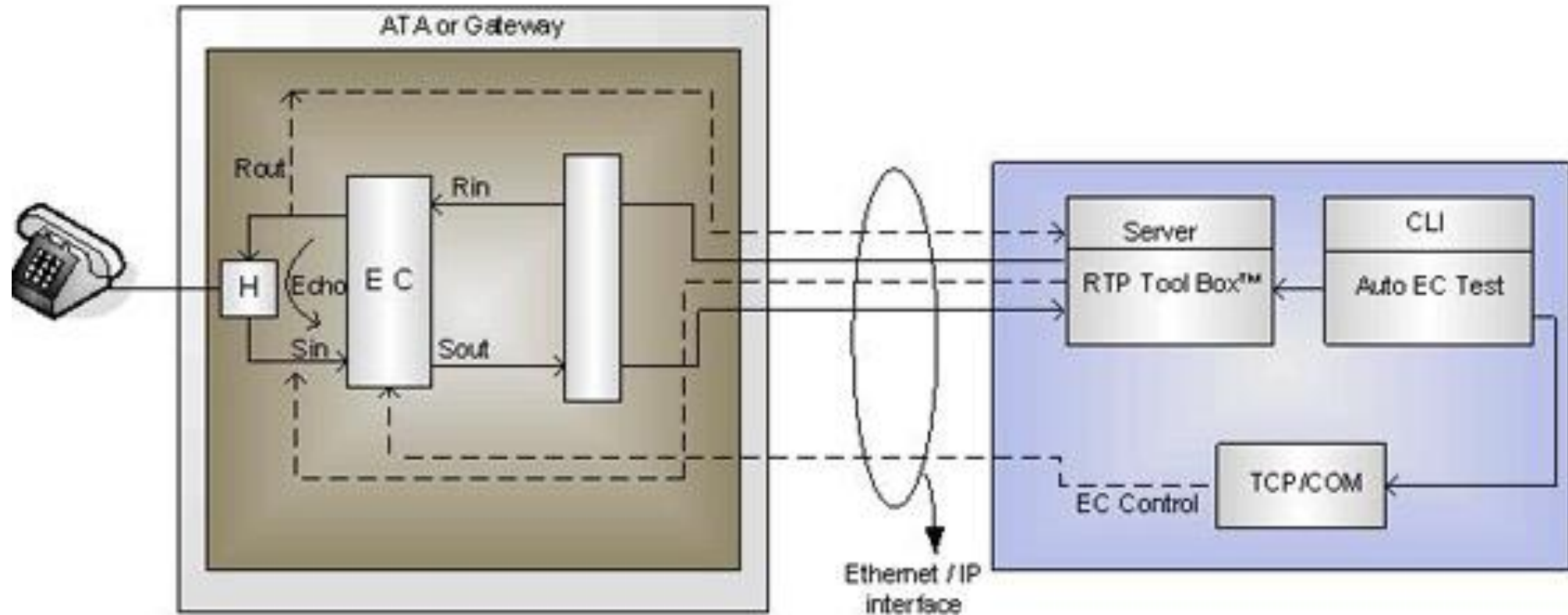
ECT in VoIP Environment

- AutoECT: back-to-back configuration
 - Like TDM AutoECT, but WCS based solution is applicable only



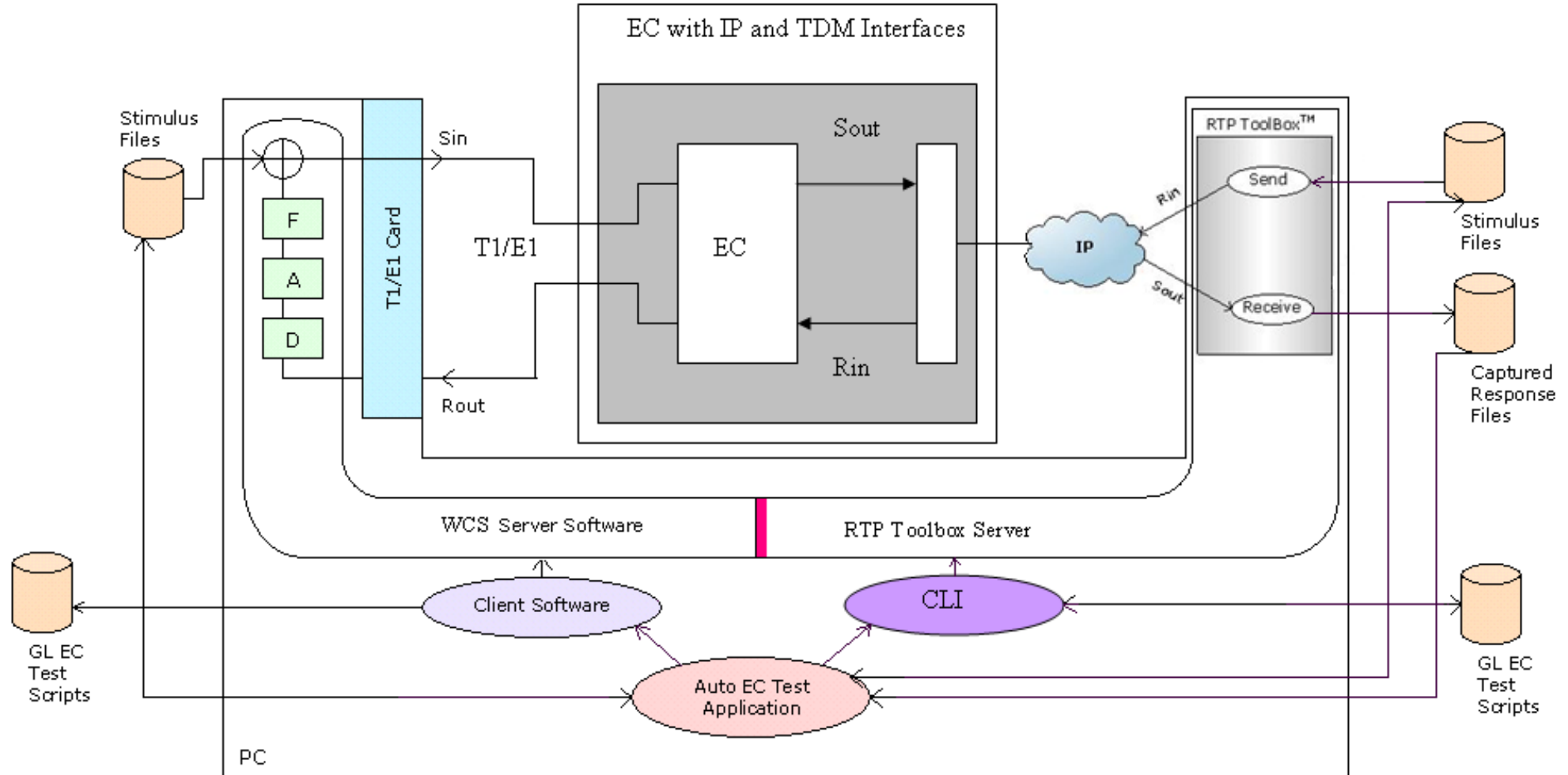
ECT in VoIP Environment

- AutoECT: pure IP configuration
 - Similar TDM AutoECT with TxRx solution
 - Rin/Sin files are pre-prepared
 - Require that the network is LTI system



ECT in Mixed TDM/IP Interface

- Proposed solution: AutoECT in mixed TDM/IP configuration



ECT in Mixed TDM/IP Interface

- Proposed solution: AutoECT in mixed TDM/IP configuration
 - Call CLI with a script file to send Rin and capture Sout from the IP
 - Call WCS with a script file to generate echo, and send Sin
 - Use RS232 serial port and TCP/COM converter to control EC
 - Analyze Sout automatically

ECT in Mixed TDM/IP Interface

- Technical issue
 - RTP Toolbox Server: DSP operations
 - Sync operation like TxRx in TDM (SyncTxMF 1-2)
 - Capture signal, process it, and re-transmit it
 - ❖ Pure IP configuration AutoECT will be improved
 - Others
 - WCS: sync transmit Sgen based on the received Rout signal
 - Sync RTP Toolbox and WCS

ECT in Mixed TDM/IP Interface

- G.168 Test (21 Tests) Details
 - No Sgen tests (11 tests)
 - Test 2A (Part A, Part B), Test 2B (Part A, Part B), Test 4, Test 5, Test 6, Test 7, Test 10B, Test 15A, Test 15B
 - Tests required Sgen (10 tests)
 - Test 2C (Part A, Part B, Part C), Test 3A, Test 3B (Part A, Part B), Test 3C, Test 8, Test 9, Test 10A
 - Tests required to freeze H-register (7 tests)
 - Test 2C (Part A, Part B), Test 3A, Test 3B (Part A, Part B), Test 4, Test 6
 - Timing critical tests
 - Test 3A, Test 3C, Test 8, Test 10A
 - Others
 - Test 5 must terminate echo loop during tests

ECT in Mixed TDM/IP Interface

- Tests can be done with proposed solutions:
 - For the no Sgen tests, it can be implemented, except Test 5
 - Test 2A (Part A, Part B), Test 2B (Part A, Part B), Test 4, Test 6, Test 7, Test 10B, Test 15A, Test 15B
 - For Test 5, some mechanism to terminate the WCS client is needed, otherwise, sync WCS client and CLI is needed

ECT in Mixed TDM/IP Interface

- Difficult tests
 - The timing critical tests are difficult to implement with the current versions of WCS and RTP Toolbox
 - Test 3A, Test 3B, Test 8, and Test 10A
 - Solution: WCS needs to know when to transmit Sgen
 - Test 8: Sgen may be sent before Rin is sent within 90 ms
 - Others

ECT in Mixed TDM/IP Interface

- Summary
 - Using the WCS and RTP Toolbox Server with CLI, we can develop AutoECT for TDM/IP combined interfaces
 - Technical difficulty: sync WCS and RTP Toolbox Server in some operations

ECT Improvements

- We have a broad-spectrum solutions for ECT
- Improvements for AutoECT in TDM
 - Sout Viewer
 - Offline Analysis
 - AutoECT result data presentation
 - Multiple TS testing
- Developments for AutoECT in VoIP
 - Combined TDM/IP Interface
 - Improve AutoEC for pure IP configuration
- Others
 - Acoustic ECT (?)

Thank You