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# Echo Canceller Testing

EC with Mixed TDM and IP Interfaces

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 ***GL Communications Inc.***

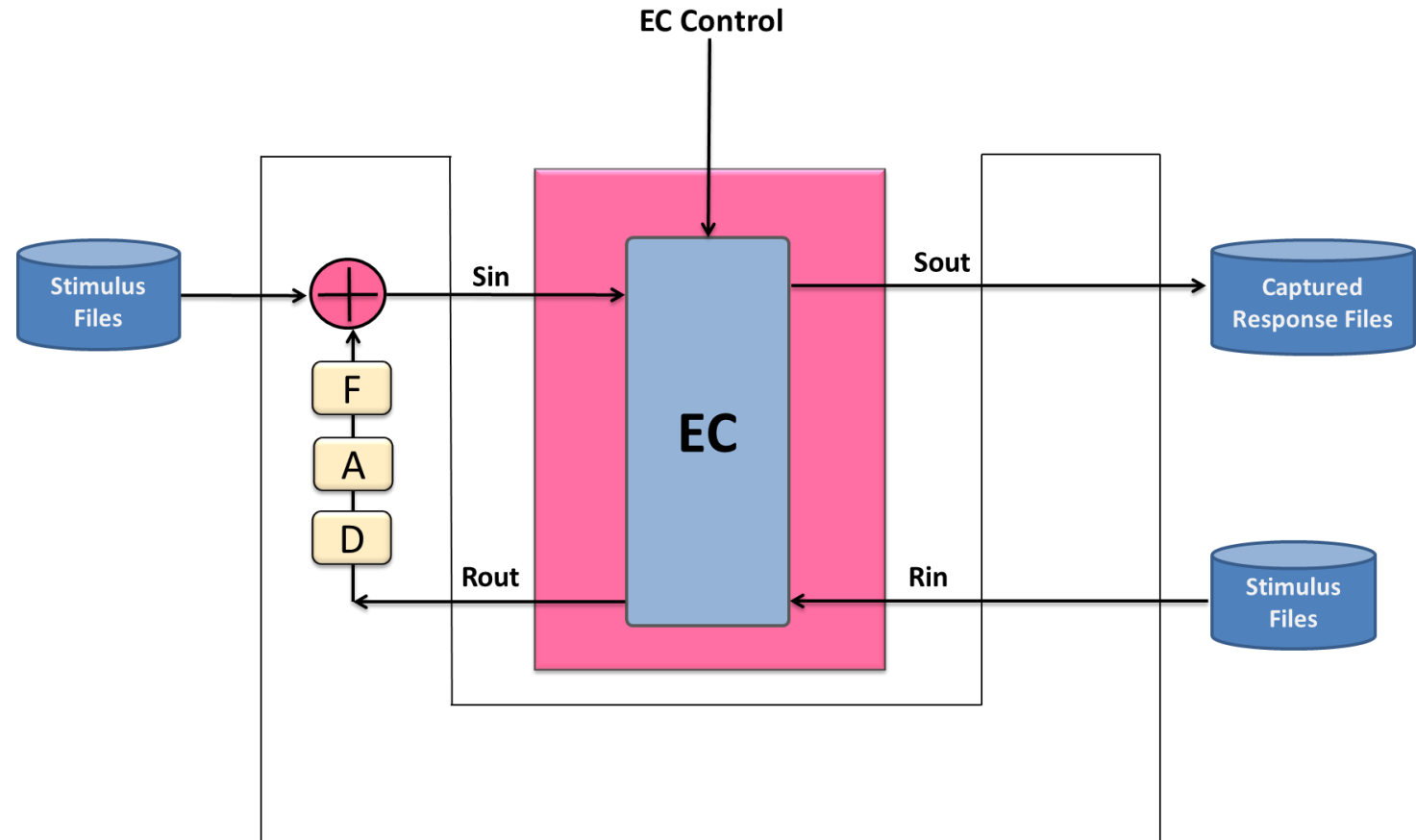
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# EC Test Solutions

- 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 Rin, capture Sout and analyze Sout per G.168
  - Echo simulation + double talks
  - Control EC (H-register, NLP, comfort noise, etc.)

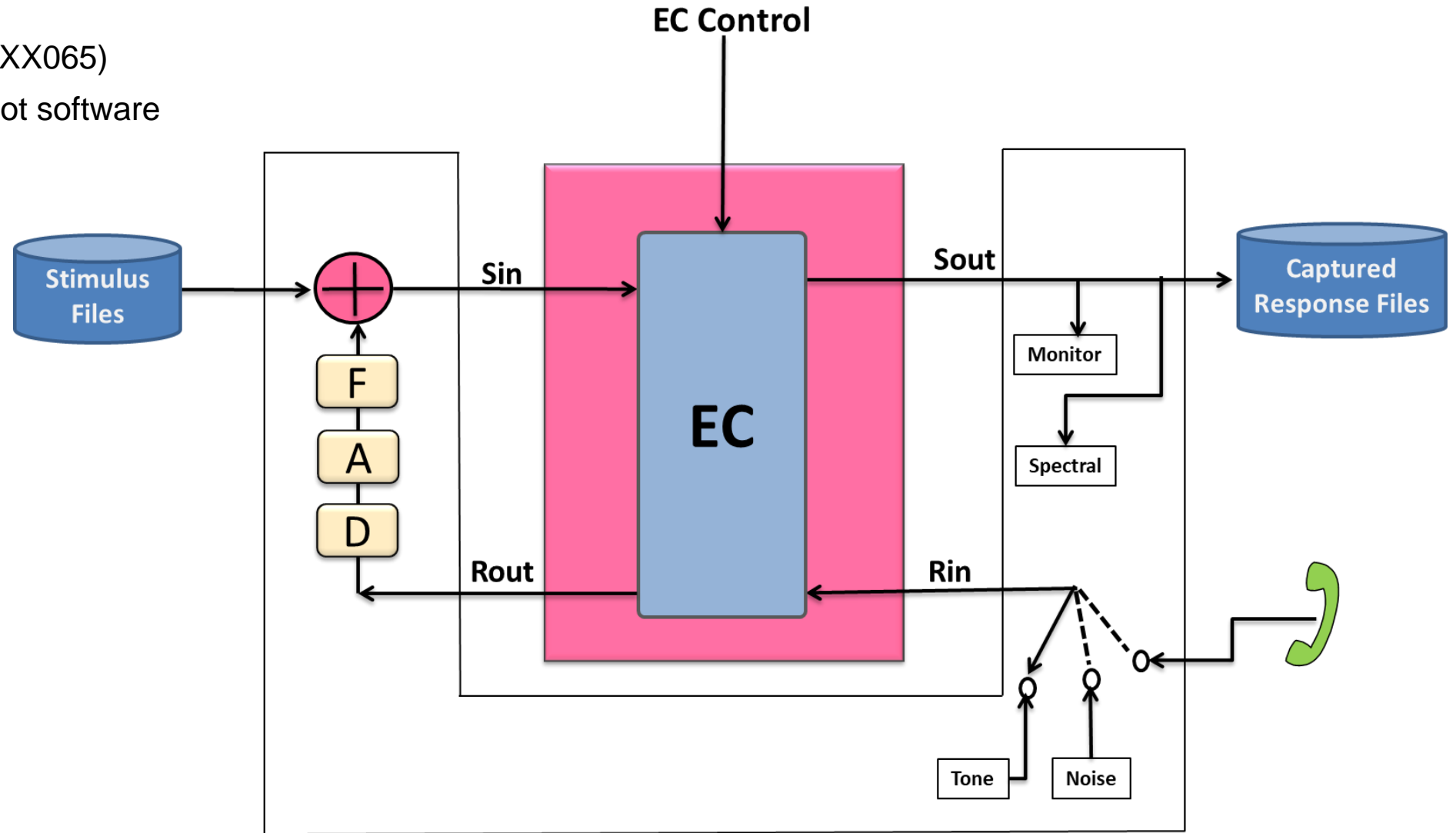


# G.168 ECT

- 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

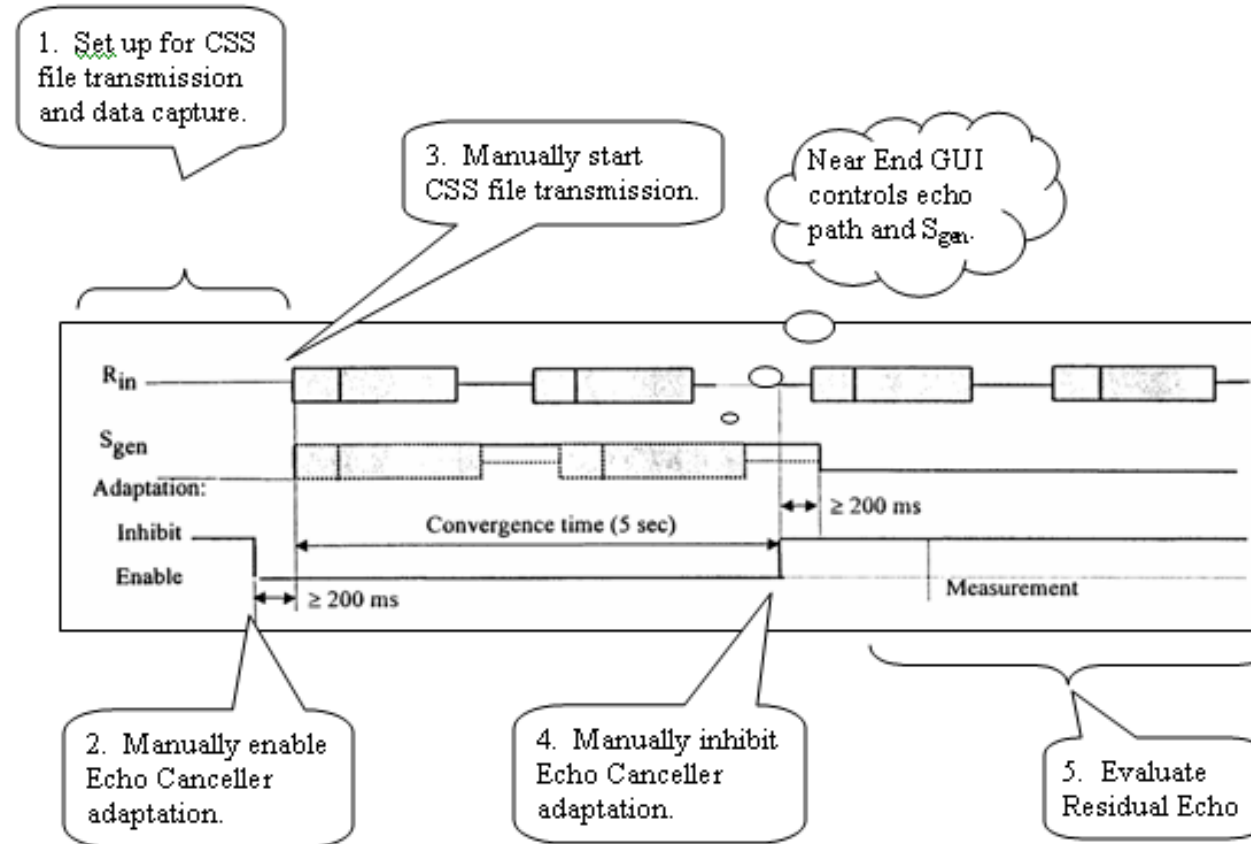


# GUI based manual ECT (XX065)

- 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

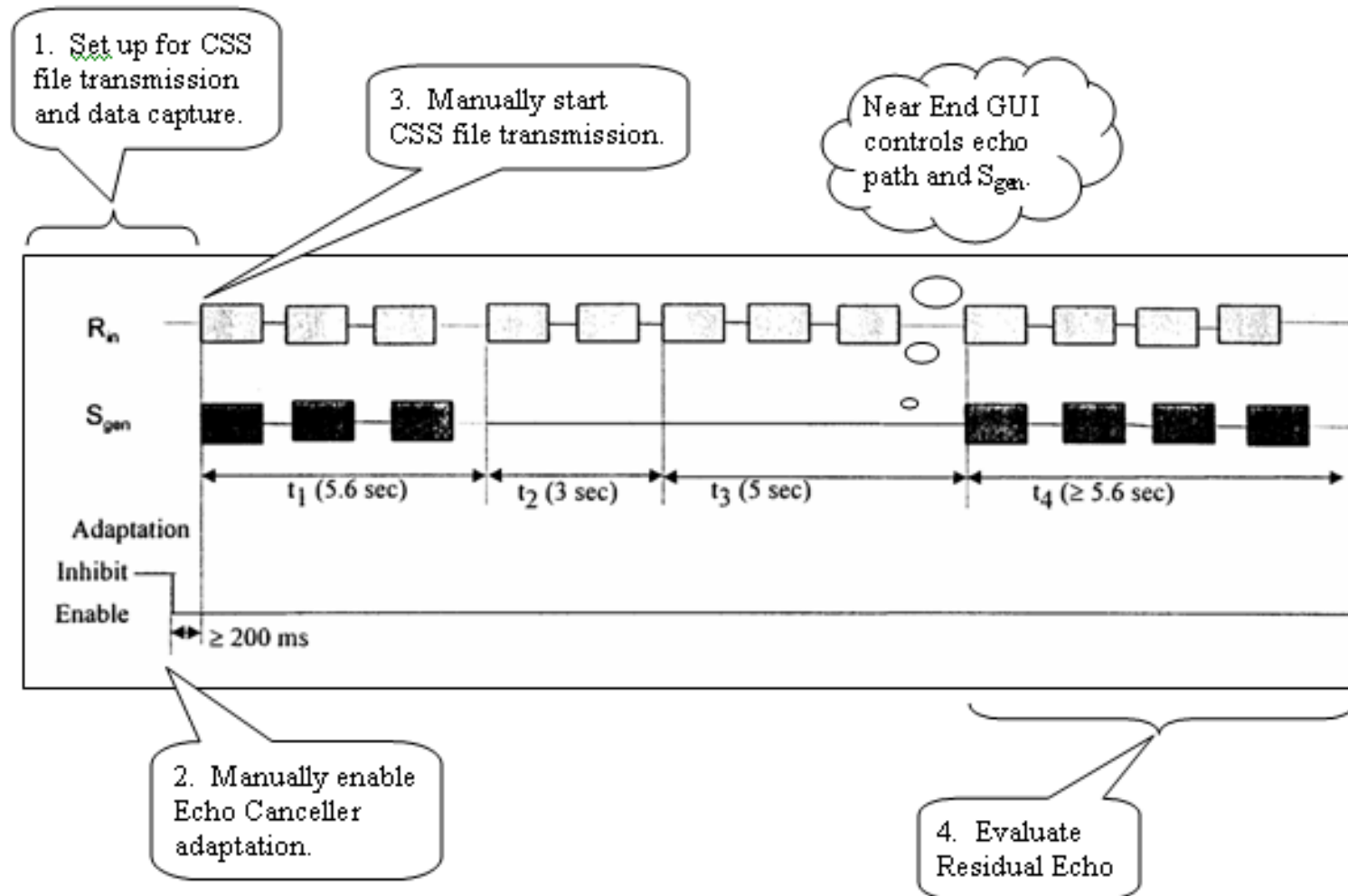
# G.168 Test 3A Time Relationship

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



# G.168 Test 3C Time Relationship

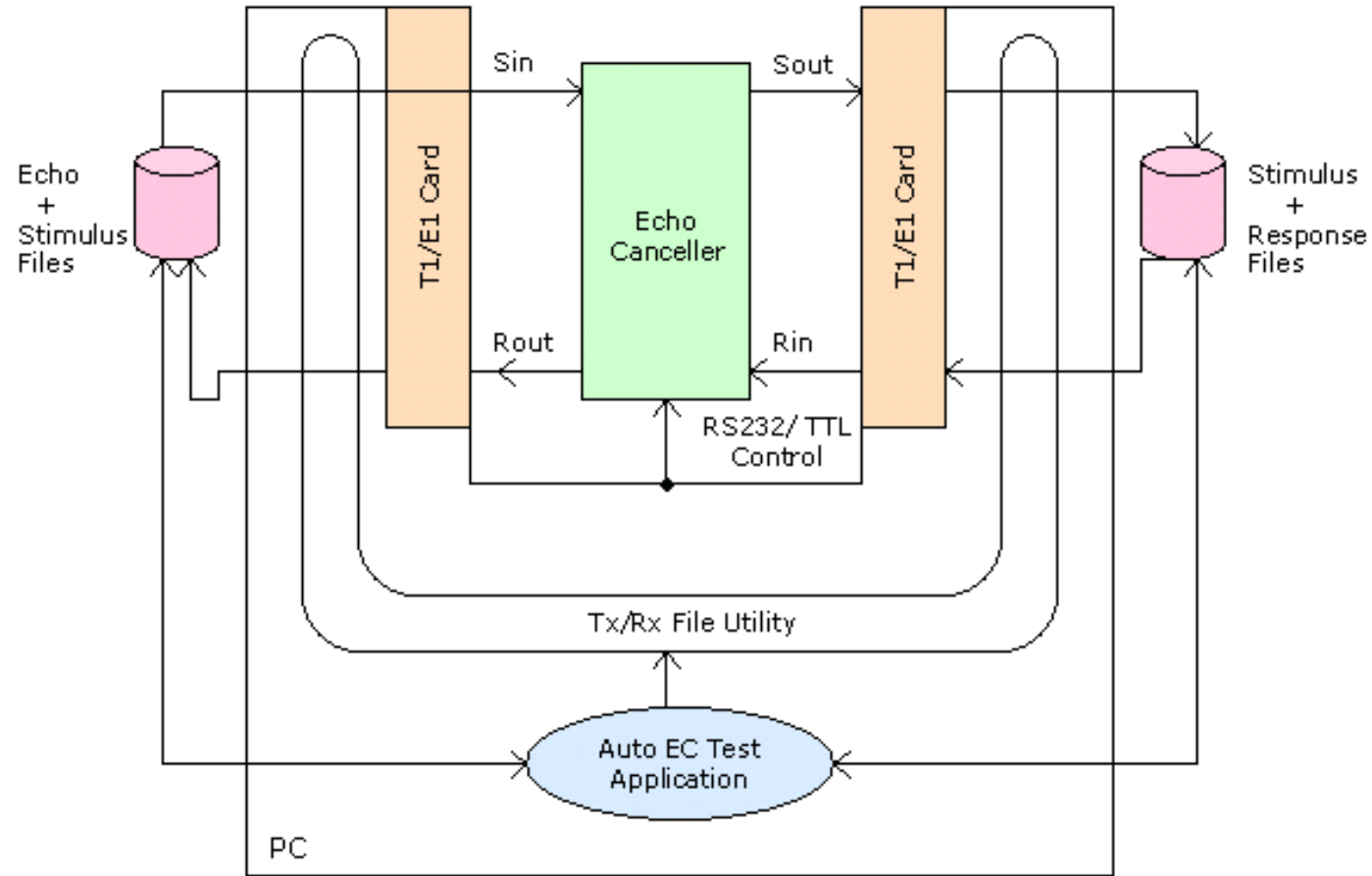
- Stop Sgen in 5.6 seconds
  - Solution: prepare Sgen file. Then, need sync between Rin and Sgen





# ECT in TDM Environment

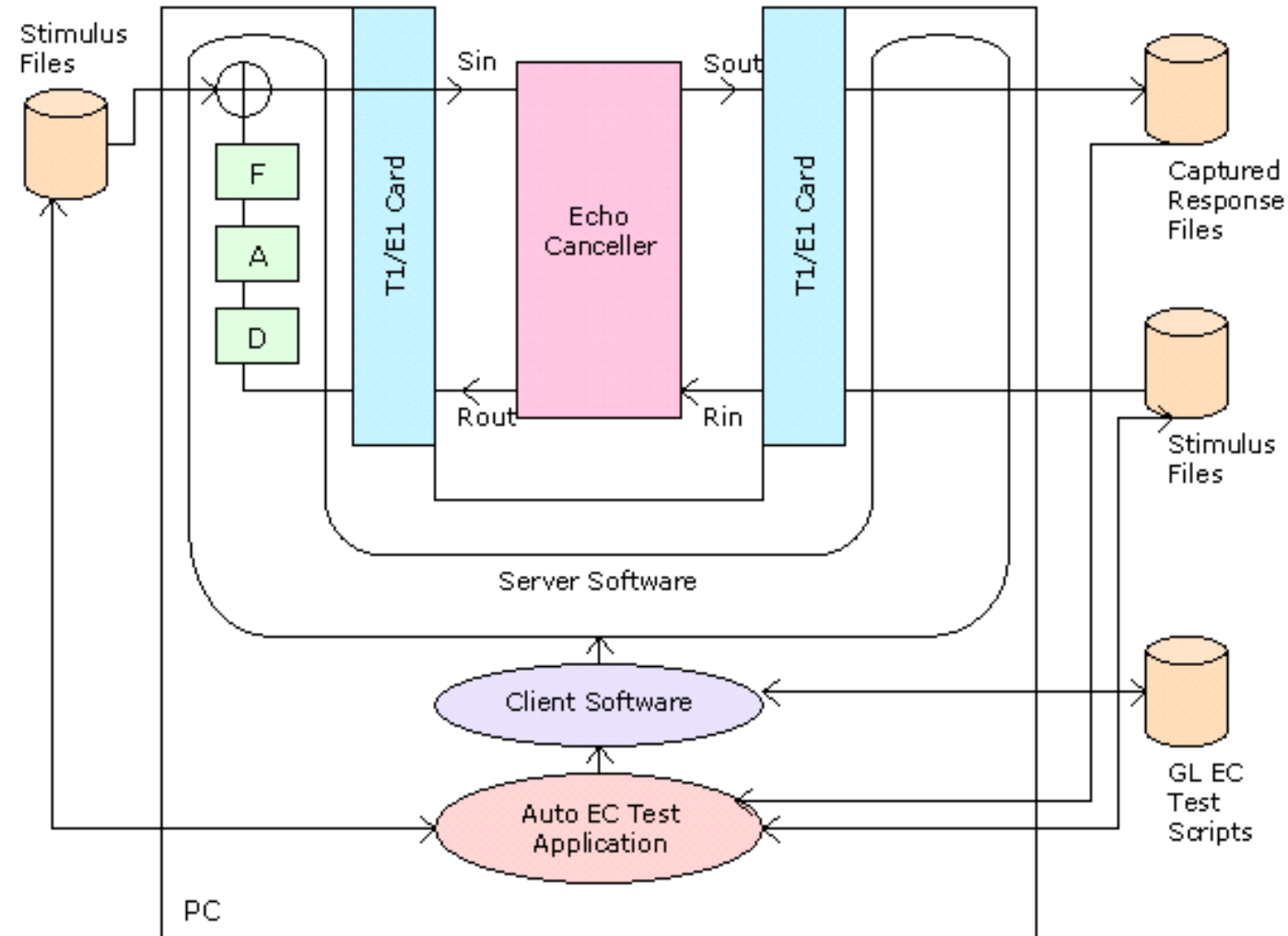
- Automated ECT (XX067) – TxRx based solution
  - Pre-prepared Rin and Sin
  - Using sync feature of TxRx: SyncTxMF 1-2



Automation thru File Based Tx/Rx File Utility

# ECT in TDM Environment

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



# ECT in TDM Environment

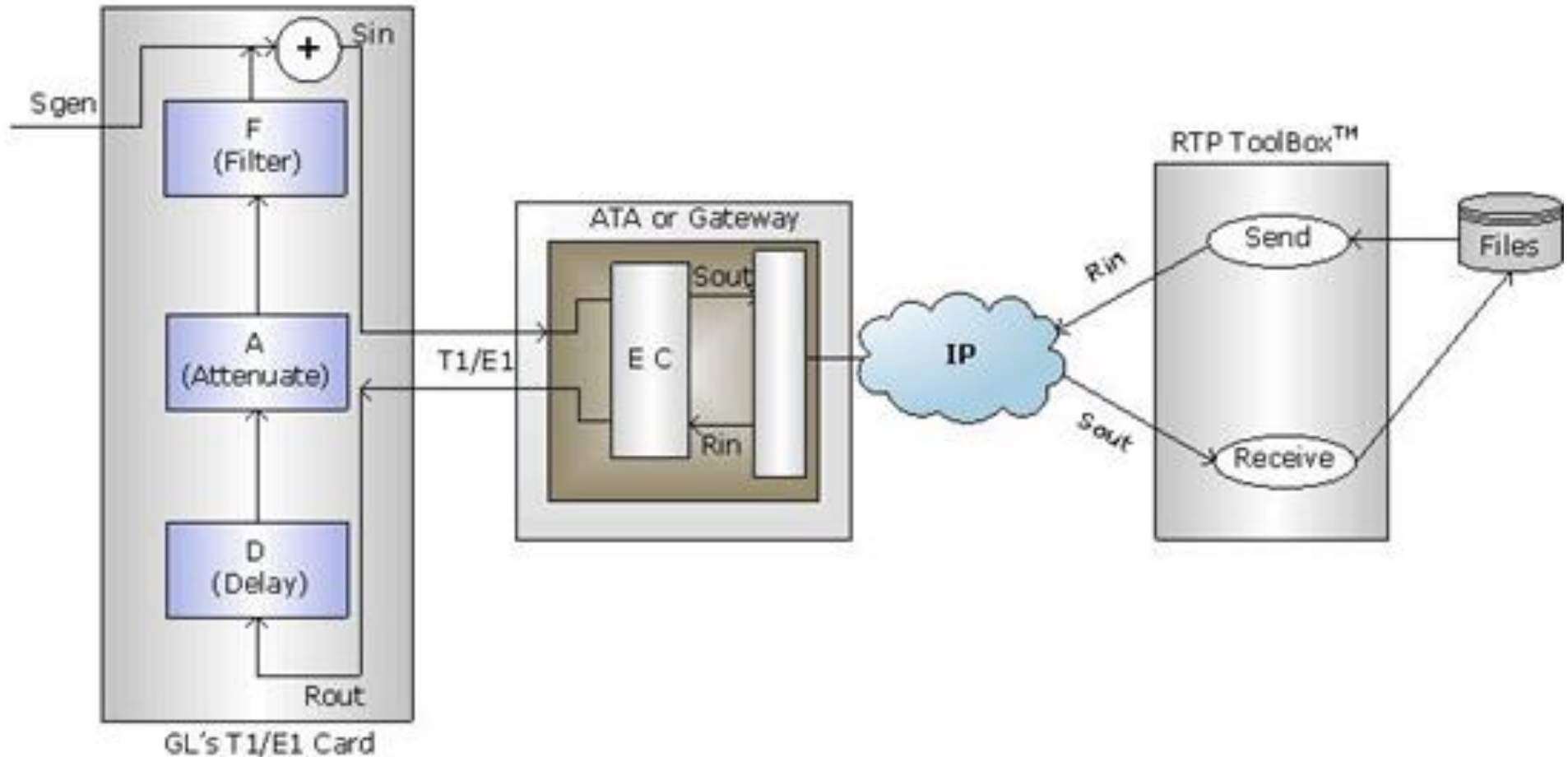
- Automated ECT (XX067) – No hardware solution
  - Rin and Sin files are prepared, and pause
  - Users input these Rin/Sin files to test software version EC
  - Users captures Rout and Sout files
  - AutoECT analyzes Rout/Sout files automatically
  - Repeat the above-mentioned process for the next test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

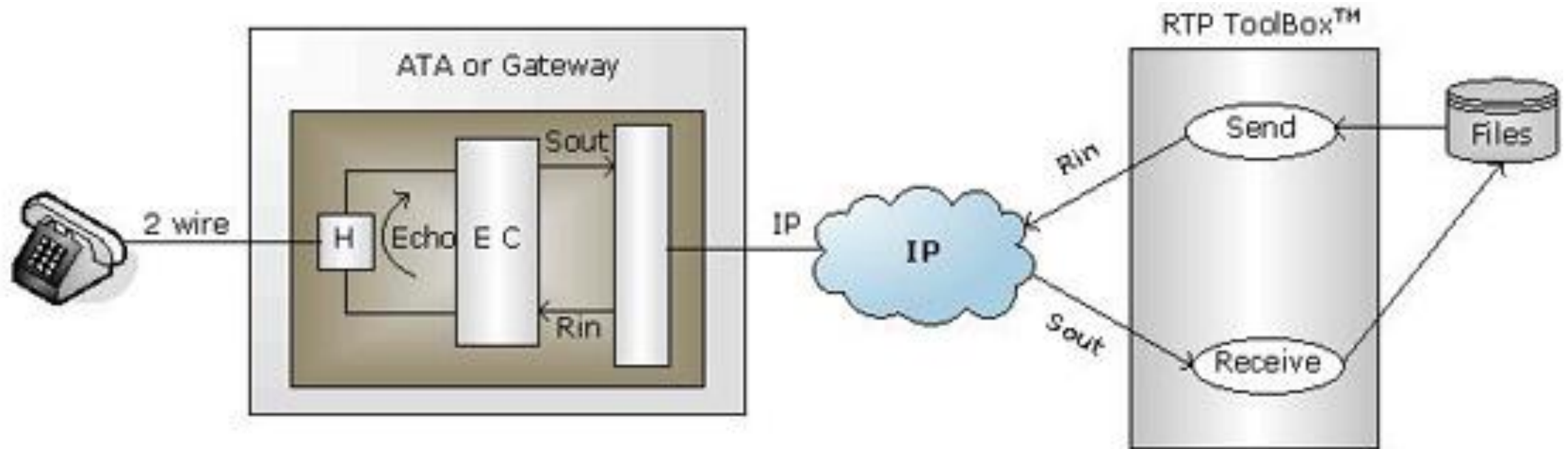
# ECT in VoIP Environment

- 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



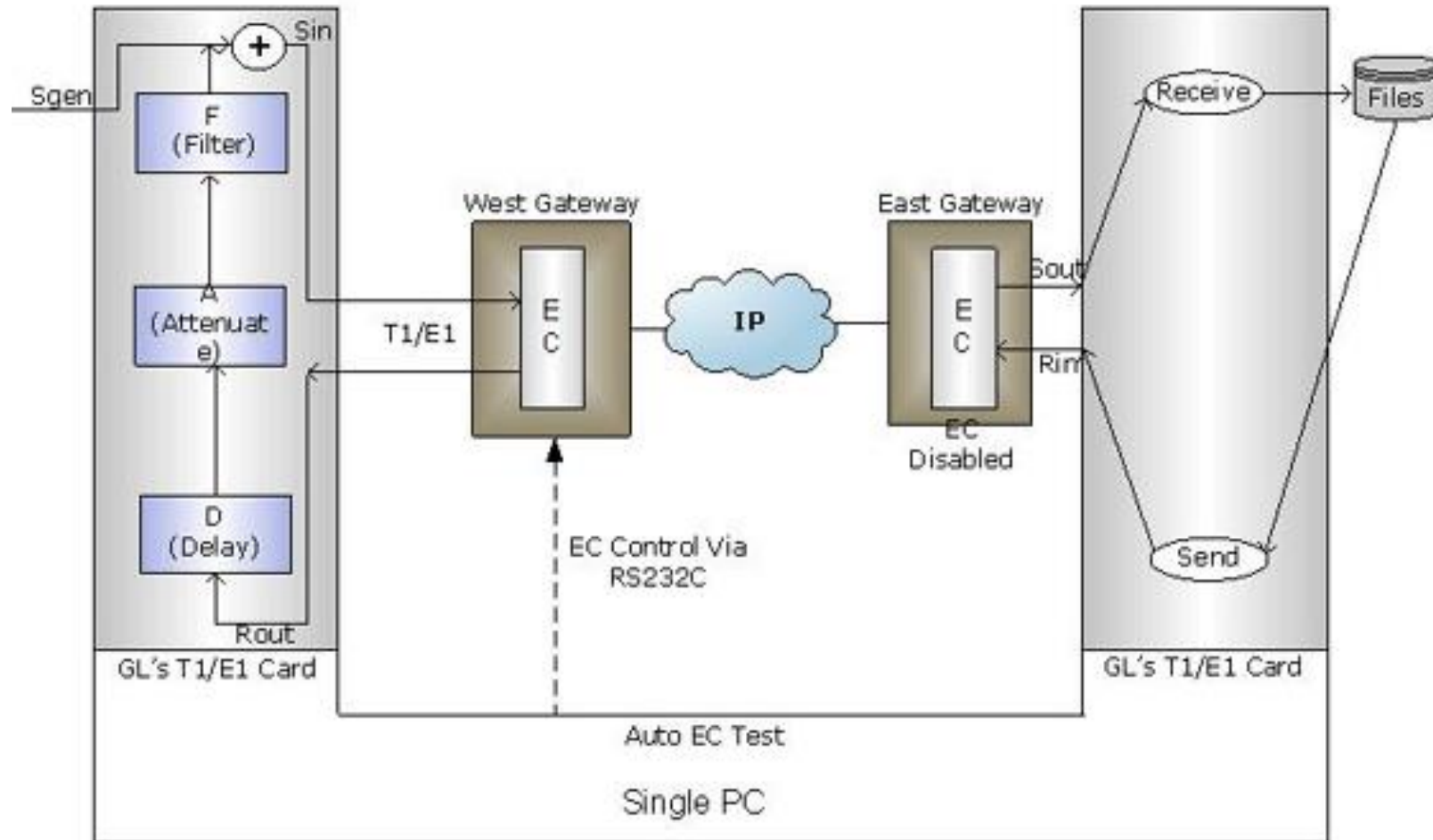
# ECT in VoIP Environment

- 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



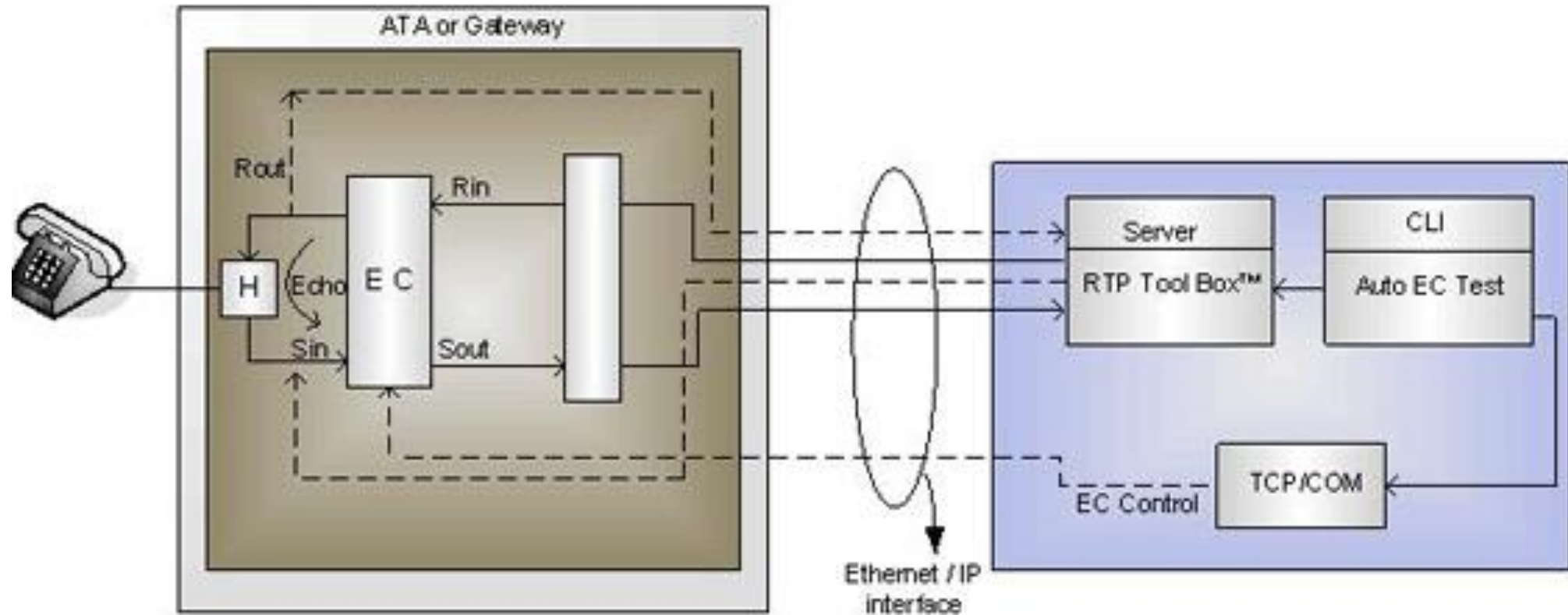
# ECT in VoIP Environment

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



# ECT in VoIP Environment

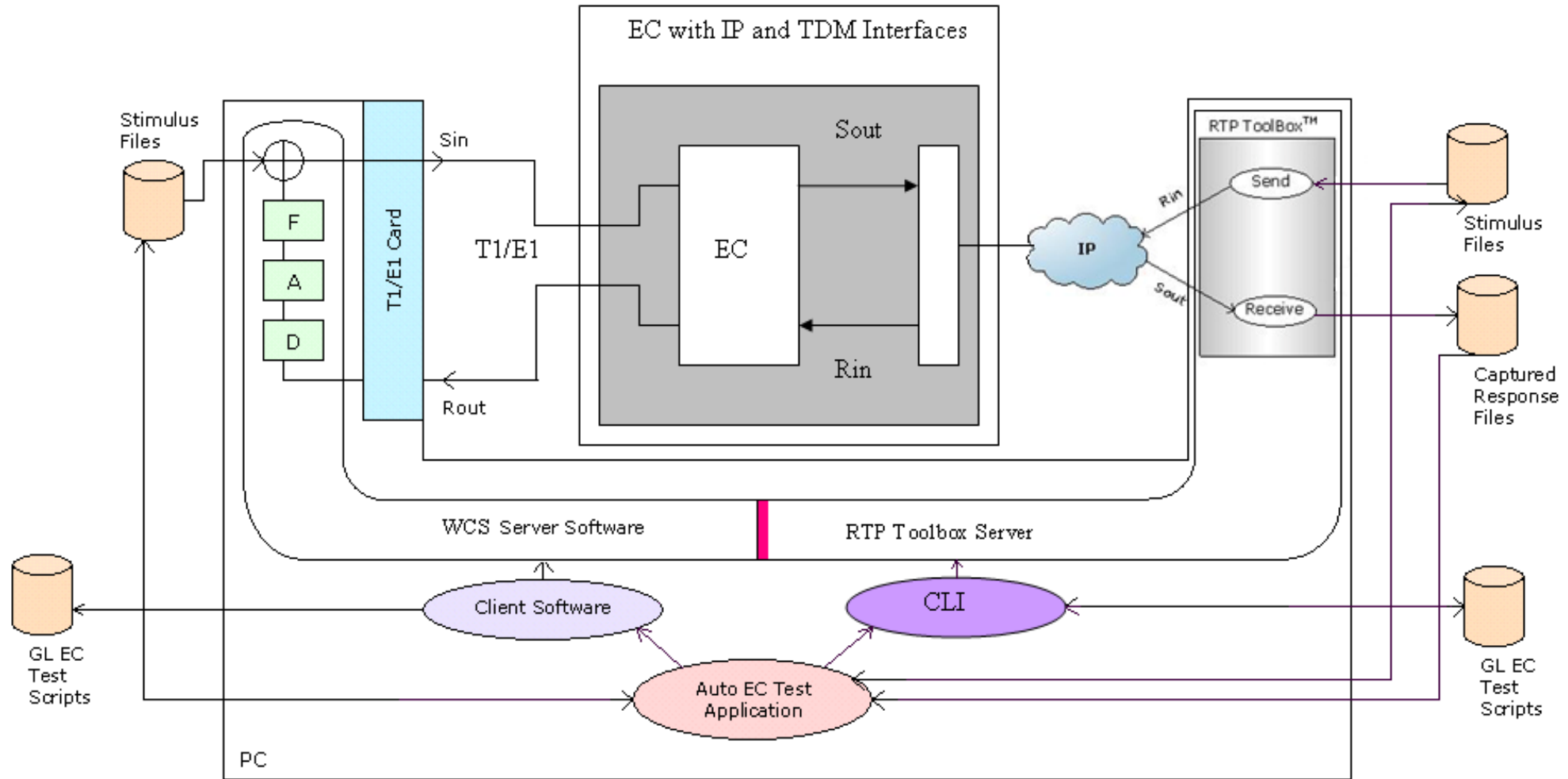
- AutoECT: pure IP configuration
  - Similar TDM AutoECT with TxRx solution
  - Rin/Sin files are pre-prepared
  - Require that the network is LTI system





# 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**