Gateway/Router Performance Measurements

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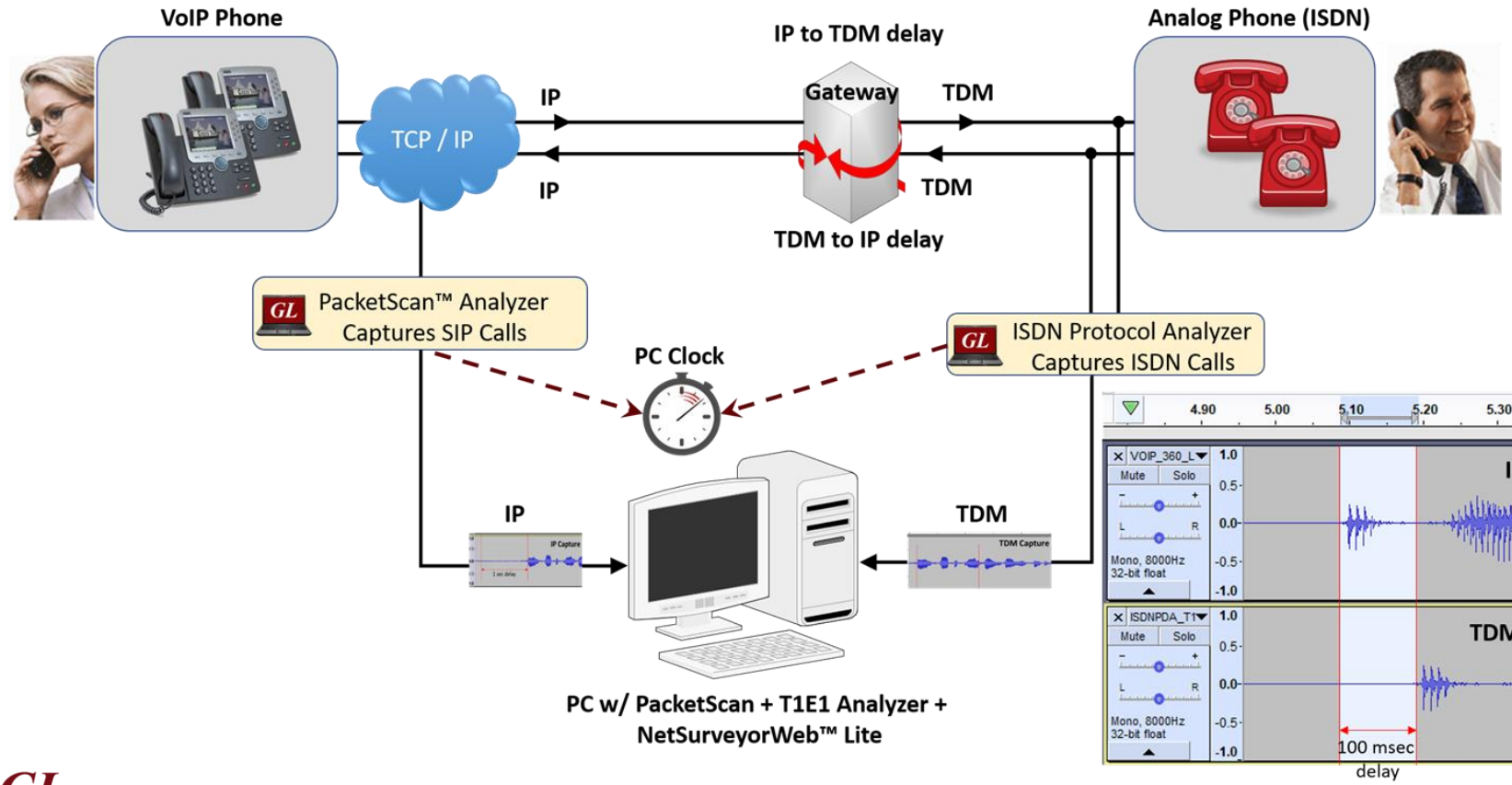
Gateway Delay Measurement



Folder Permissions

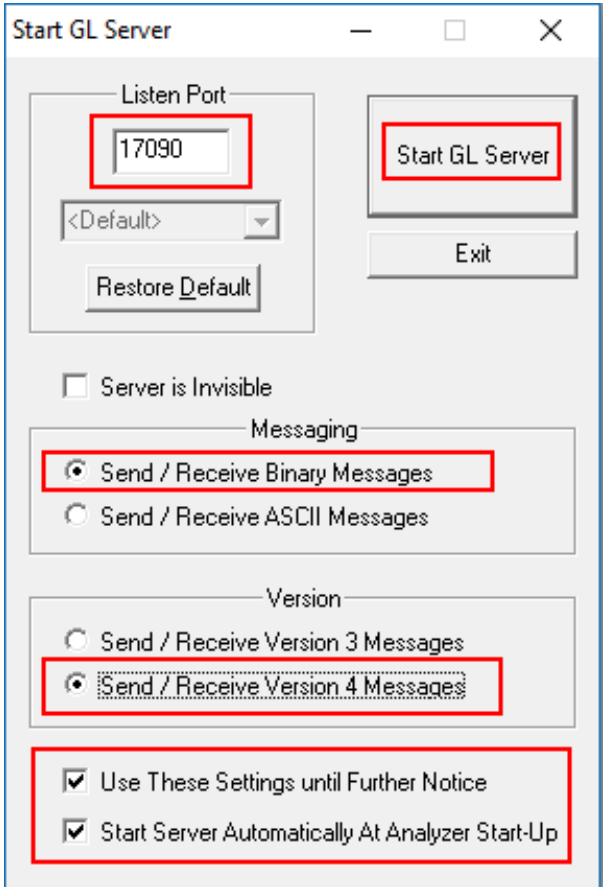
- Ensure that Read and Write permissions are provided for both T1 E1, PCMDelayMeasurement, and PacketScan installation directories.
- For example, for T1 E1, browse and select the ‘C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\’ directory.
- Share the selected folder with Read/Write permissions to access this folder through network
- Right-click on the directory and select **Properties** > **Security** tab.
- Click Edit from explorer menu. Click Add in the Permission window
- Type ‘**Everyone**’ and click ‘**Check Names**’. Click **OK** to add this user group to Permissions Window.
- Provide full control to the users added and click on **Apply** and **OK**
- If any other path is used other than default path, user need to provide security permission as mentioned above.

Configuring ACF, Traffic Recording, Export CSV in T1 E1 Protocol Analyzer

Start GL Server

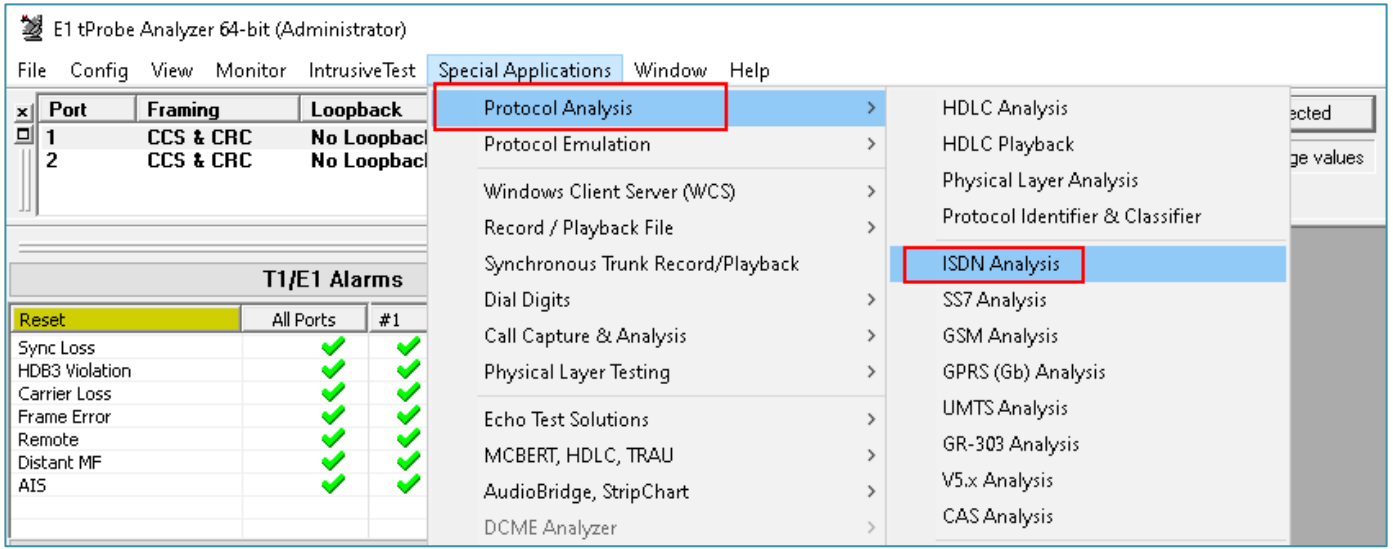
- In this example, we are configuring tProbe E1 Analyzer. Follow the below steps to enable call recording for tProbe applications.
- Now, double-click on the tProbe E1 Analyzer shortcut icon 

created on the Desktop, the application should invoke without any errors.
- In tProbe E1 Analyzer, select **Special Applications** > **Windows Server Client** > **WCS Server**. Select the options as shown in the figure and click on **Start**.



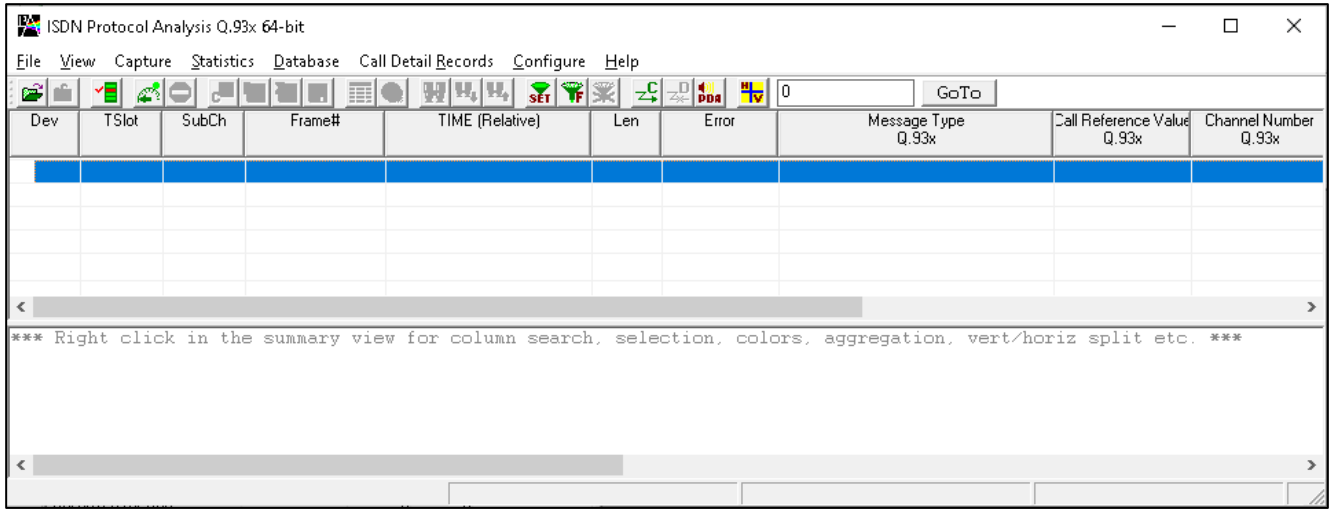
Configuring ISDN Protocol Analyzer

- In tProbe E1 Analyzer , select **Special Applications** > **Protocol Analysis**. Select ISDN Analyzer, this will invoke ISDN Analyzer window.



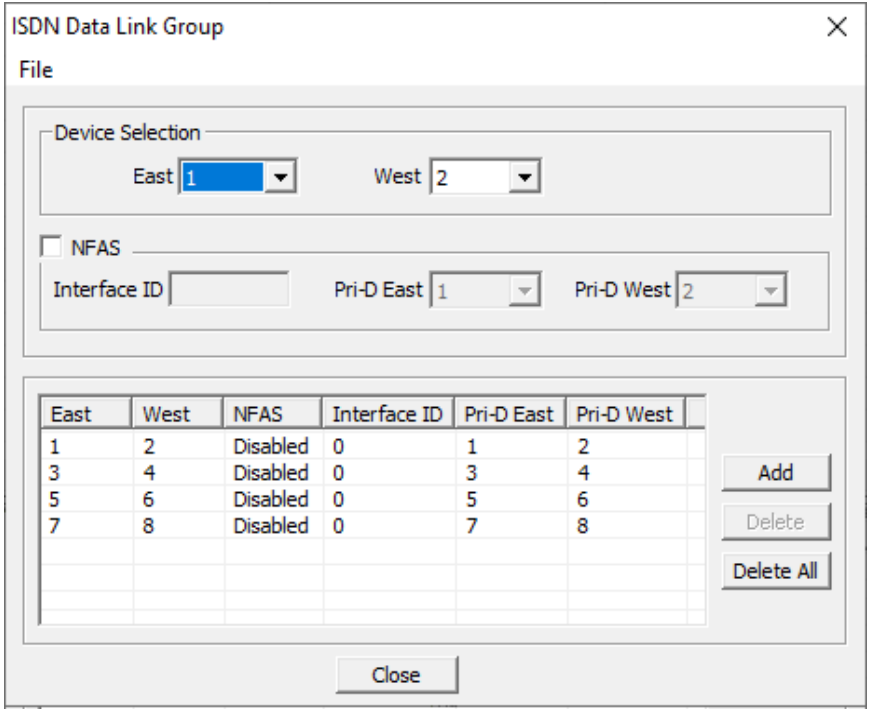
Configuring ISDN Protocol Analyzer

- Now, In the protocol analyzer GUI, select **Configure** > **Load All Options** and select **ISDN-NetSurveyor.ACF** file from the following path **C:\Program Files\GL Communications Inc\tProbe E1 Analyzer\PDA**.
- In the **ISDN** analyzer, click on **Stream/Interface** selection icon 
  and select signalling timeslot on all ports. Close the window after timeslot configuration. Now, on the right pane, select **Capture File Options** and change the path of **Temp.hdl** file to default T1 E1 installation directory.
- Now, on the **ISDN** analyzer, click on **PDA** icon  to invoke Packet Data Analyzer (PDA).



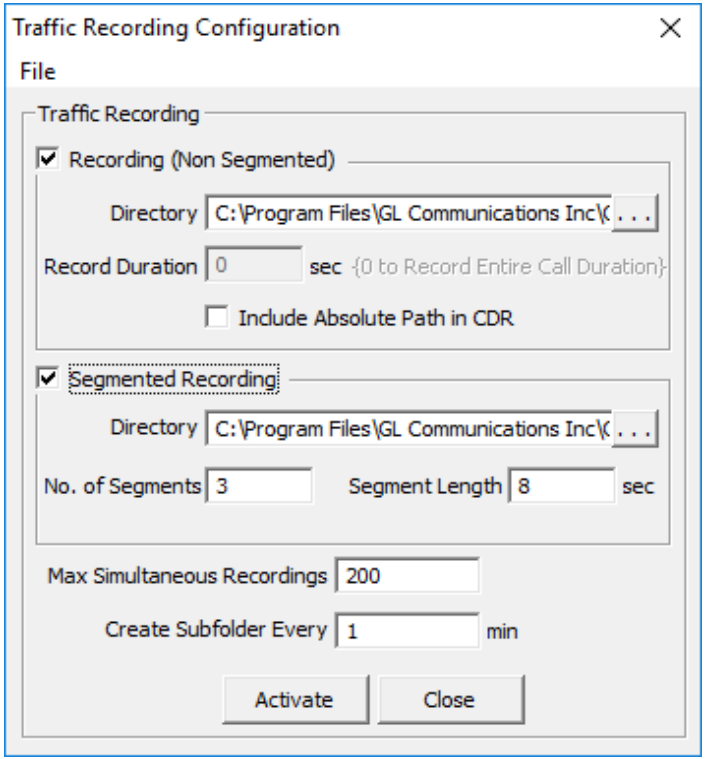
Configuring PDA

- In PDA, follow the below steps.
  - Select **GUI Configurations** > **Configure Frame Summary**, browse and select required *.ACF file. For example, select ISDN-NetSurveyor.ACF file from the following path **C:\Program Files\GL Communications tProbe E1 Analyzer\PDA**.
  - Select **GUI Configurations** > **Data Link Group**, configure the **East** and **West** port as required. Configure the NFAS, Interface ID, Pri-D East, and Pri-D West. Close the window.



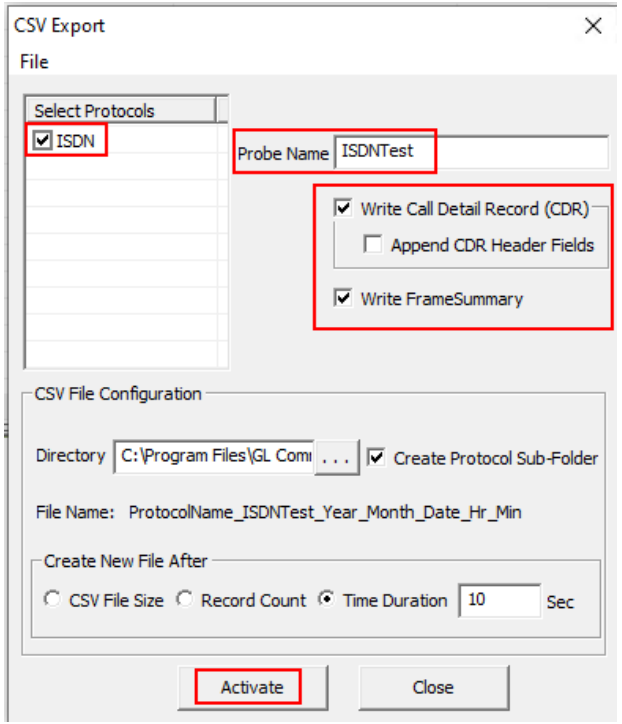
Configuring PDA

- In PDA, follow the below steps.
  - Select **GUI Configurations** > **Traffic Recording Configurations**, check the Non-Segmented and Segmented option to enable recording audio file as required. Also, user can configure number of voice segments and segment durations as required for further analysis. Click on Activate and reinvoke PDA from the T1E1 Protocol Analyzer window to see the changes. Refer to the figure.
  - Default path for Non Segmented Traffic Recording: “C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\VoiceFiles”
  - Default path for Segmented Traffic Recording: “C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\Segmented VoiceFiles”



Configuring PDA

- On PDA, select **File** > **Export CSV**, check the below options..
  - ➢ on the left pane, select required protocol
  - ➢ Provide Probe Name
  - ➢ Check the option Write Call Detail Record (CDR)
  - ➢ Check the option Write Frame Summary
  - ➢ Browse and specify CSV file saving path
  - ➢ Click on Activate to activate the selected options.
- From the ISDN analyzer main menu, select **File** > **Start Real-time**.



Configuring ACF File, Traffic Recording, CSV Export in PacketScan™

Configuration

- The below steps are one-time configuration only, if the application is configured for auto start, user need not to follow the below steps.
- User needs to enable precision delay timer option parameter in the IPcapt.ini file located in the PacketScan installation directory (C:\Program Files\GL Communications Inc\PacketScan). Search for the below parameter, set the value to ‘1’ and save the file.

  PRECISE_SYSTEM_TIME=1

- In case, Router/Gateway is not negotiated G.729B/G.729 codec then, user need to enforce G.729B/G.729 codec to negotiate the traffic. Now, edit IPprot.ini file located in the PacketScan installation directory (C:\Program Files\GL Communications Inc\PacketScan). Search for the below parameter, ensure that the value is set to ‘2’ for G.729B and ‘1’ for G.729.

  FORCE_G729_CODEC=2

ACF file Configuration

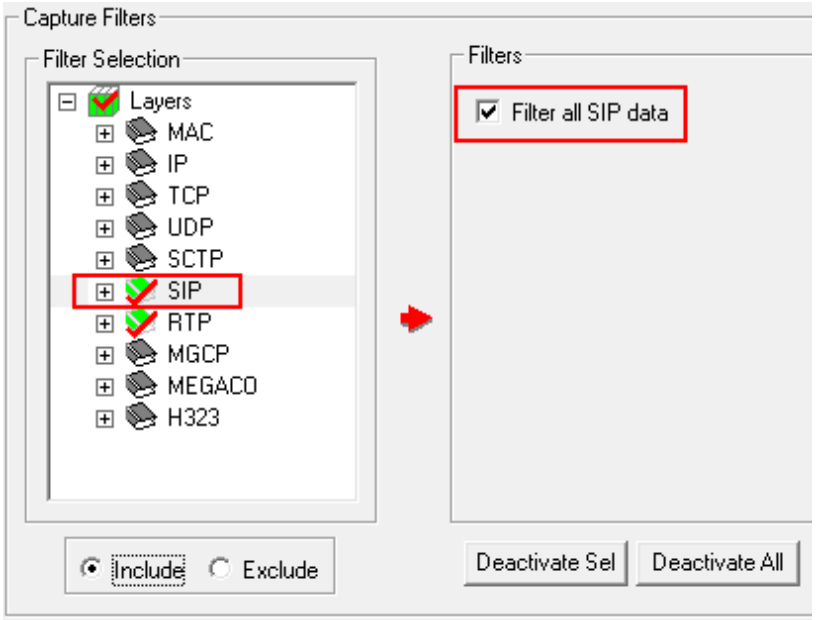
- Now, right click on the PacketScan icon 

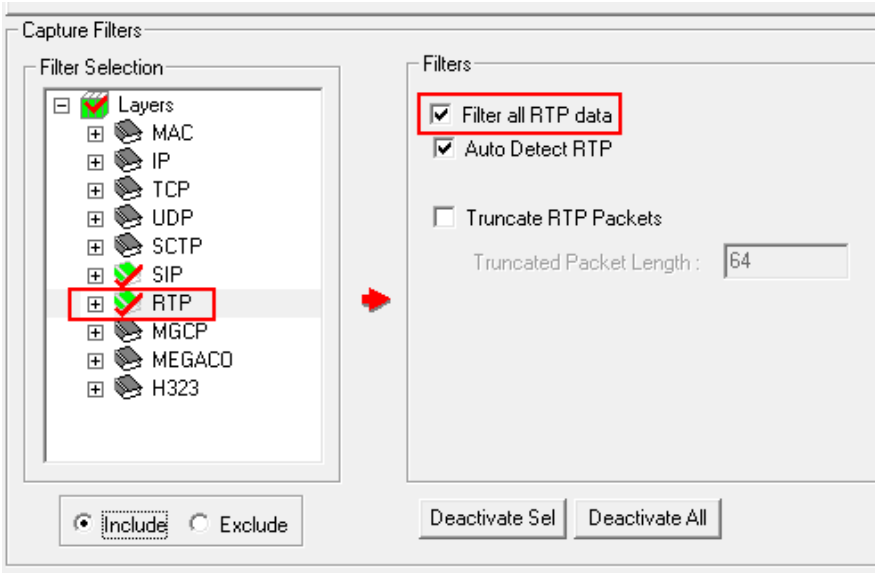
created on the desktop and select "Run as Administrator" to launch the application. The application should invoke without any errors.
- In the protocol analyzer GUI, select **Configure** → Load **All Options** and select **SIP-NetSurveyor.ACF** file from the following path **C:\Program Files\GL Communications Inc\PacketScan.**
  - Select **Capture** → **Stream/Interface** Selection and select the Ethernet card on which packet needs to be captured.
  - On the left pane, select **Capture File Options** and verify that **Circular Capture Buffer** is checked.

IMAGE

ACF file Configuration

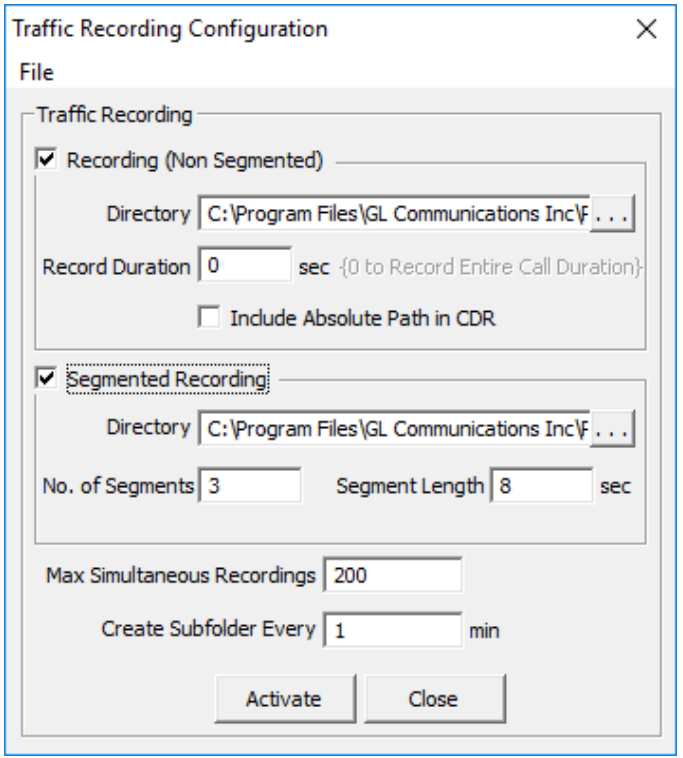
- Now, on the left pane, select **Capture Filter** option, click on **SIP** in the Filter Selection and check **Filter all SIP data**. Similarly, click on **RTP** in the Filter Selection and check **Filter all RTP data**. Do not activate any other filters in the **Capture Filter**. Refer the figures. After Filter configuration, close the window.





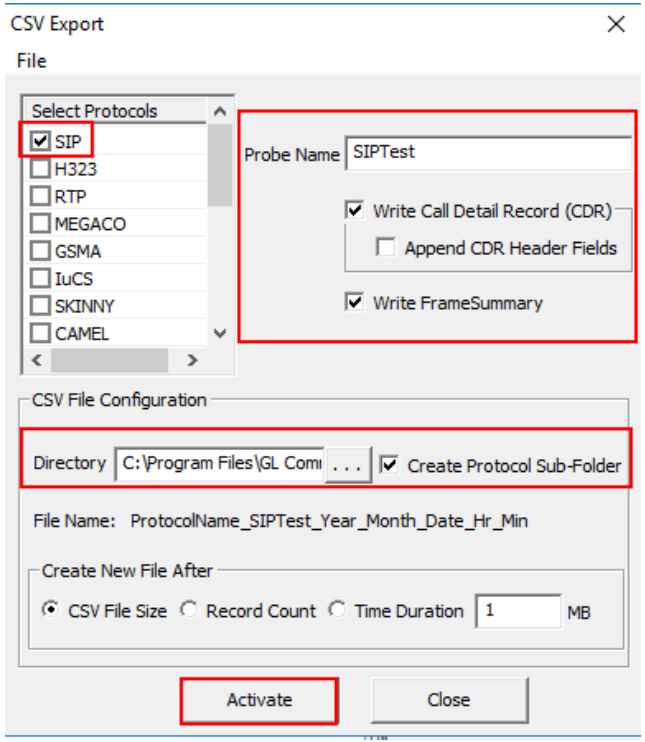
Configuring PDA

- In PacketScan analyzer main GUI, click on PDA icon to invoke PDA.
- Select **GUI Configurations → Configure Frame Summary**, select **SIP** protocol, browse and select required **SIP-NetSurveyor.ACF** file from the following path C:\Program Files\GL Communications Inc\PacketScan.
- Select **GUI Configurations → Traffic Recording Configurations**, check the **Non-Segmente**d and **Segmented** option to enable recording audio file as required. Also, user can configure number of voice segments and segment durations as required for further analysis. Click on **Activate** to see the changes. Refer to the figure.
  - **Default path for Non Segmented Traffic Recording**: "C:\Program Files\GL Communications Inc\PacketScan\glwfiles"
  - **Default path for Segmented Traffic Recording**: "C:\Program Files\GL Communications Inc\PacketScan\Segmented glwfiles"



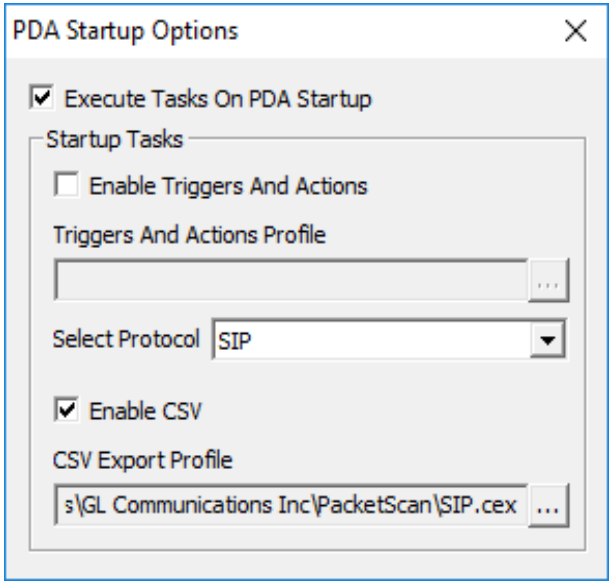
Configuring PDA

- On PDA, select **File → Export CSV**, check the below options.
  - on the left pane, select required protocol
  - Provide Probe Name
  - Check the option Write Call Detail Record (CDR)
  - Check the option Write Frame Summary
  - Browse and specify CSV file saving path
  - Click on **Activate** to activate the selected options
  - From the **PacketScan™** main menu, select File → **Start Real-time** or click **Start Real-time**  icon from the toolbar.



Auto Startup Configurations for PDA and ACF Files in PacketScan Analyzer

- The below steps are one-time configuration only, if the application is already enabled for auto start, user need not to follow the below steps.
- To auto start the protocol analyzer and PDA, follow the below steps.
  - On PDA, click on **File → Export CSV** this will invoke Export CSV window. Now, click on **File → Save Configuration As** to save the configuration in *.cex file format. This file when loaded, it will load all the previously configured options.
- In PDA, select GUI Configuration → **PDA Startup options** and verify the following options –
  - Check the option **"Execute Tasks on PDA Startup"**
  - Check the option **"Enable CSV"**
  - Select the same **"*.cex**" file saved previously from the installation directory **(e.g., C:\Program Files\GL Communications Inc\PacketScan Analyzer*.cex).**



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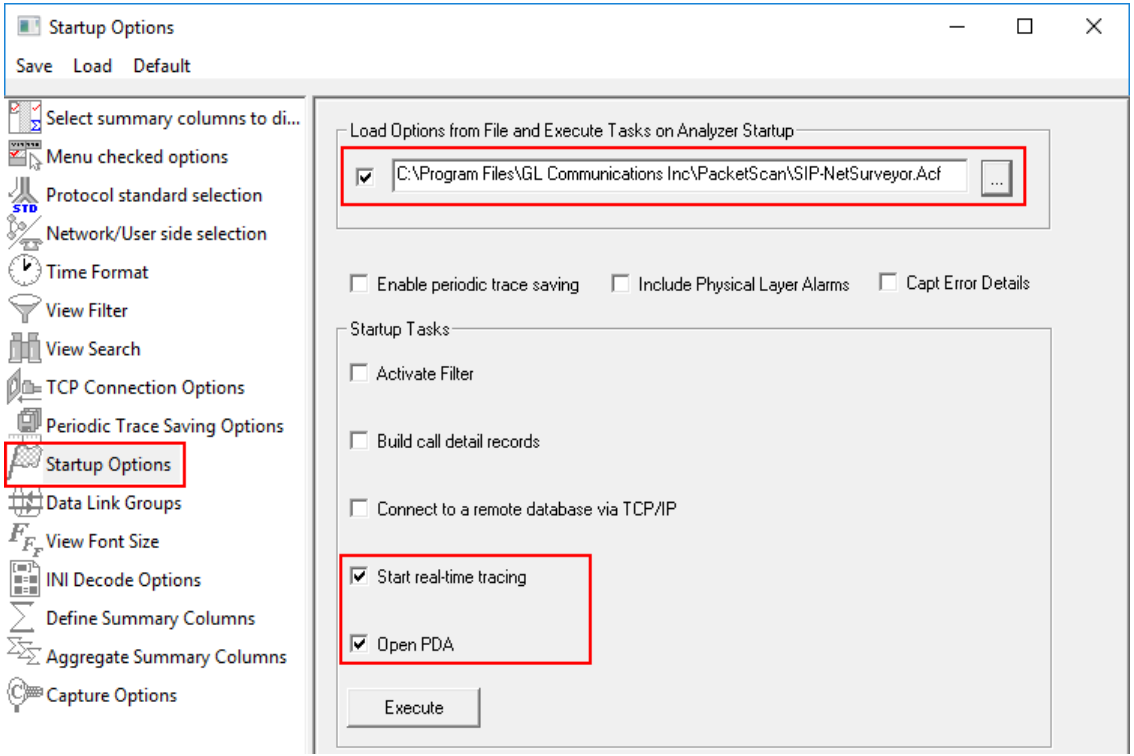
Auto Startup Configurations for PDA and ACF Files in PacketScan Analyzer

- Now, on the protocol analyzer main GUI, click on Startup Options from **Configure → Protocol and GUI Options** to configure the options as shown below. Click on browse button to select the *.ACF file. Check the option as highlighted in the below figure. Now, click on Save to over-write the selected *.ACF file. Close the application and invoke again.



Client Batch File Configuration for PCM Delay Measurement

- Now, go to **“C:\Program Files\GL Communications Inc\PCMDelayMeasurement”** path and edit the **PcmDelayMm_FCUCLI_Run.bat** file in Notepad. Search for the string USAGE EXAMPLES and configure the parameters as required.

  - Enter the source folder path, destination folder path, source file type, source file codec, destination file codec as required. An example is shown below.

- For TDM, enter the source file directory path which was previously configured in the section **Configuring ACF, Traffic Recording, Export CSV in T1 E1 Protocol Analyzer.**

- Create **Destination** folder and provide security permission for this folder. Specify the same Destination folder path in the both TDM and IP scripts. For example, below TDM and PacketScan™ scripts contains destination folder as “C:\Program Files\GL Communications Inc\PCMDelayMeasurement\16 bit PCM”.

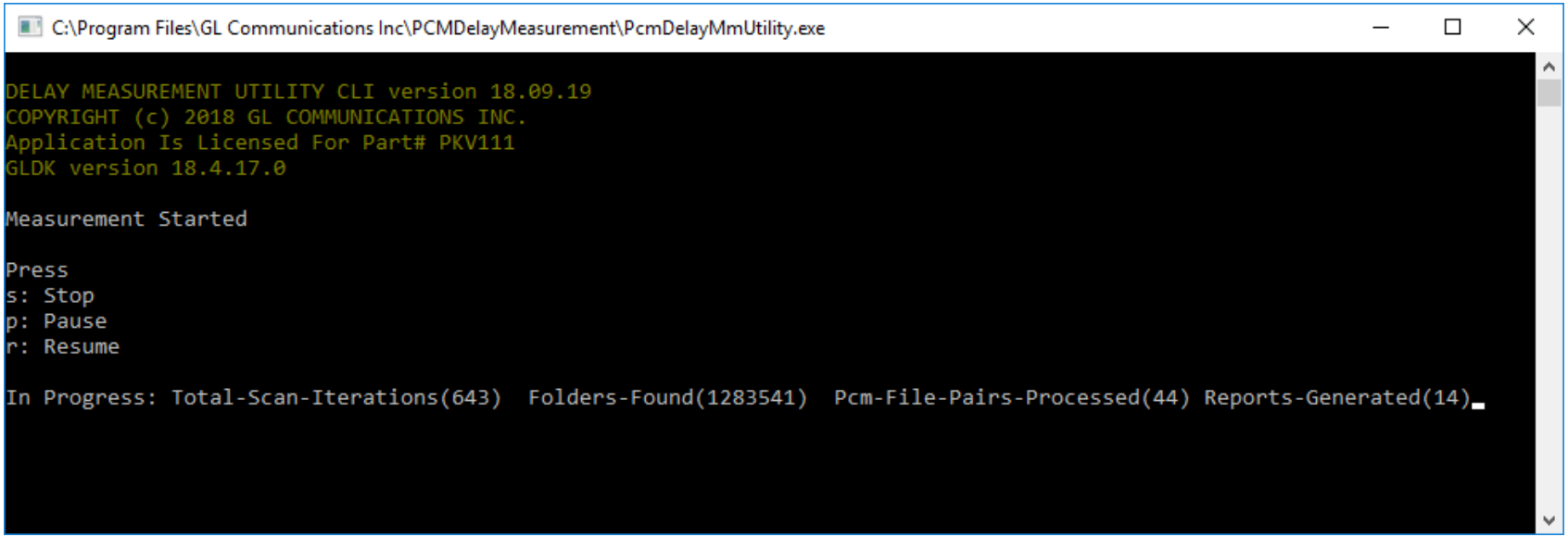
  - **start afcucli.exe AUTO** *SourceFolder "C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\SegmentedVoiceFiles" DestinationFolder "C:\Program Files\GL Communications Inc\PCMDelayMeasurement\16 bit PCM" SourceFileType pcm SourceFileCodec alaw DestinationFileType PCM DestinationFileCodec PCM deletesourceFiles 1 MoveSourceFiles 0.*

Client Batch File Configuration for PCM Delay Measurement

- For IP, enter the source file directory path which was previously configured in the section Configuring ACF File, Traffic Recording, CSV Export in PacketScan™. Here, user need to configure the path as mentioned in the Segmented Recordings.
  - **start afcucli.exe AUTO** *SourceFolder "C:\Program Files\GL Communications Inc\PacketScan\SegmentedGlwFiles" DestinationFolder "C:\Program Files\GL Communications Inc\PCMDelayMeasurement\16 bit PCM" SourceFileType glw SourceFileCodec alaw DestinationFileType PCM DestinationFileCodec PCM deletesourceFiles 1 MoveSourceFiles 0.*
- For more details on CLI Commands, refer to Delay-Measurement-UM.
- The destination folders configured in the above instances of afcucli.exe must be same. The same path should be provided for DELAYRECORDINGSFOLDER. The PCM Delay Measurement will fetch the files from this path.
- Now search for USAGE EXAMPLE again and enter the delay recordings folder path, left and right domain protocol, CSV write mode, CSV log path as required. An example is shown below.
  - **start PcmDelayMmUtility.exe** *DELAYRECORDINGSFOLDER "C:\Program Files\GL Communications Inc\PCMDelayMeasurement\16 bit PCM" leftDomainProtocol VOIP RightDomainProtocol ISUP CsvWriteMode 0 CsvWriteDuration 255 CsvLogPath "C:\Program Files\GL Communications Inc\PCMDelayMeasurement\DelayMeasurementLog" EnableDebugLogs 1 DebugFolderPath "C:\Program Files\GL Communications Inc\PCMDelayMeasurement\DelayMeasurementLog\DebugLogs" EnableVQScores 0 VQTServerIp "192.168.1.58" RemoteVqtFolderPath "" KeepPcmFiles 0 CsvLogPath "" CsvWriteMode 1 CsvWriteDuration 3000*

Client Batch File Configuration for PCM Delay Measurement

- Double click on PcmDelayMm_FCUCLI_Run.bat file from the following path “C:\Program Files\GL Communications Inc\PCMDelayMeasurement” to invoke Audio File Conversion Utility (AFCU) and PCM Delay Measurement Utility.
- Observe that PCM Delay measurement is started in the console window.



NetSurveyorWeb CSV Loader Configuration

NetSurveyorWeb CSV Loader Configuration

- If the CSV Loader is already configured, user need not to follow the below steps.
- To verify the web server installation, double click on NetSurveyorWeb™ internet explorer shortcut on the desktop, or type in the URL as **'http://localhost/NetsurveyorWeb**/' in the Internet Explorer address bar to view the web page
- Provide the **User Name** and **Password** to login to the portal. **Note**: Default User Name and Password = 'gl'
- Click on the Loader Configuration button option available on the main screen. This prompts the loader configuration screen as shown below. If this Loader Configuration option is not displayed on the screen by default, then from the left pane select **Admin → CSV Loader Status** option to view the loader configuration screen.

➢ **Path**: Provide CSV file path location of CDR, Summary, and Delay measurement log files as configured in **TDM** and **IP** sections. CSV files are in the following default path:

C:\Program Files\GL Communications Inc\PacketScan\CSVFiles\SIP\CDR

C:\Program Files\GL Communications Inc\PacketScan\CSVFiles\SIP\Frame Summary

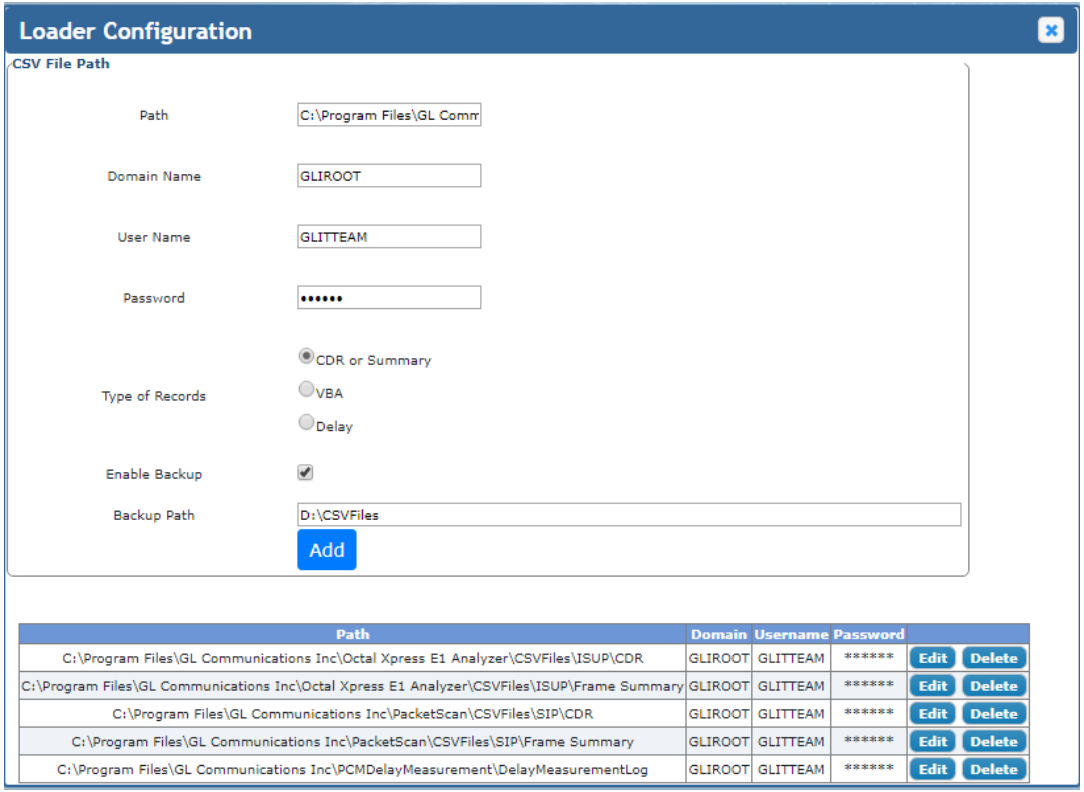
C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\CSVFiles\ISUP\CDR

C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer\CSVFiles\ISUP\Frame Summary

C:\Program Files\GL Communications Inc\PCMDelayMeasurement\DelayMeasurementLog

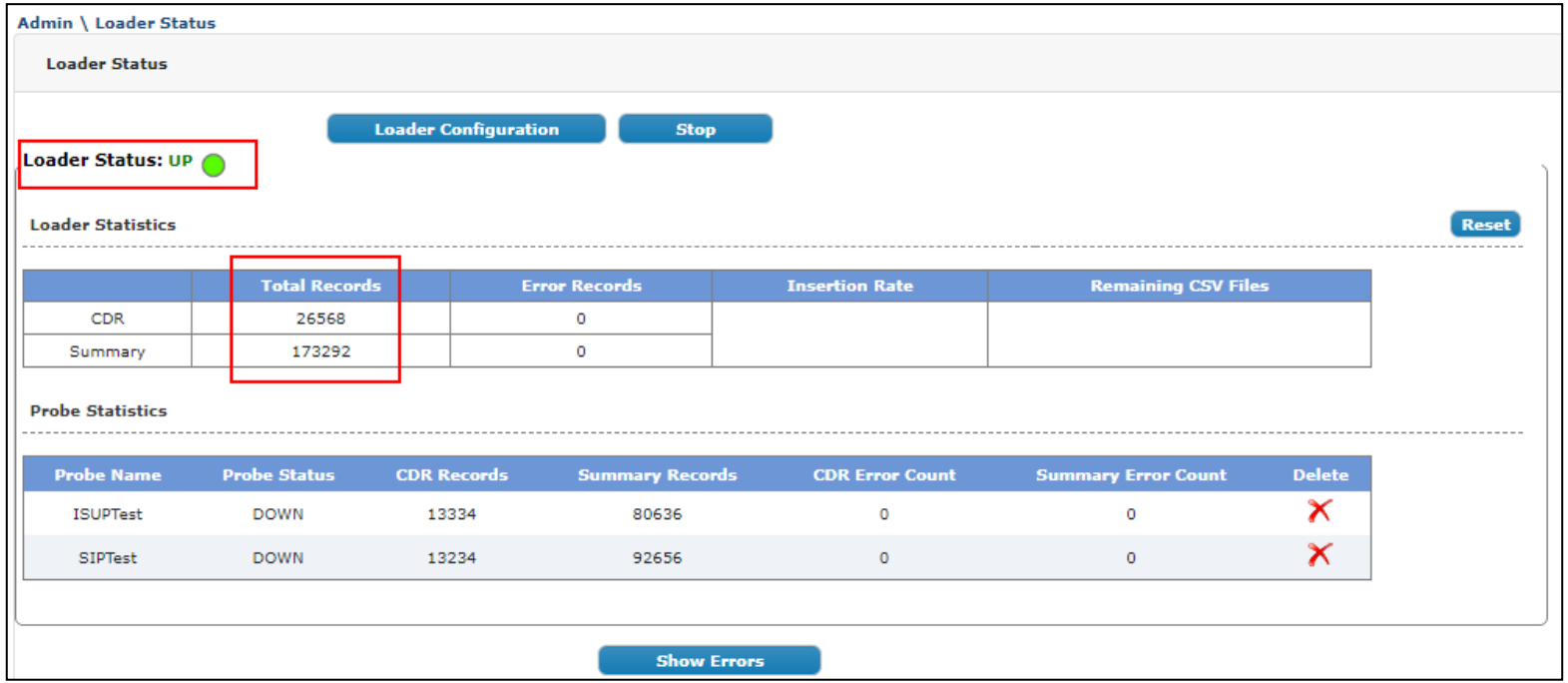
NetSurveyorWeb CSV Loader Configuration

- **Domain Name**: Enter system domain name
- **User Name**: Enter the system user name
- **Password**: Enter the system password
- **Type of Records**: Select the type of records as required. It can be CDR/Summary, VBA, or Delay.
- **Enable Backup**: Check this option to enable CSV file backup
- **Add**: Click on **Add** to add the loader configuration. Refer to the below figure.
- Close the Loader Configuration window and **Start** the CSV Loader.



NetSurveyorWeb CSV Loader Configuration

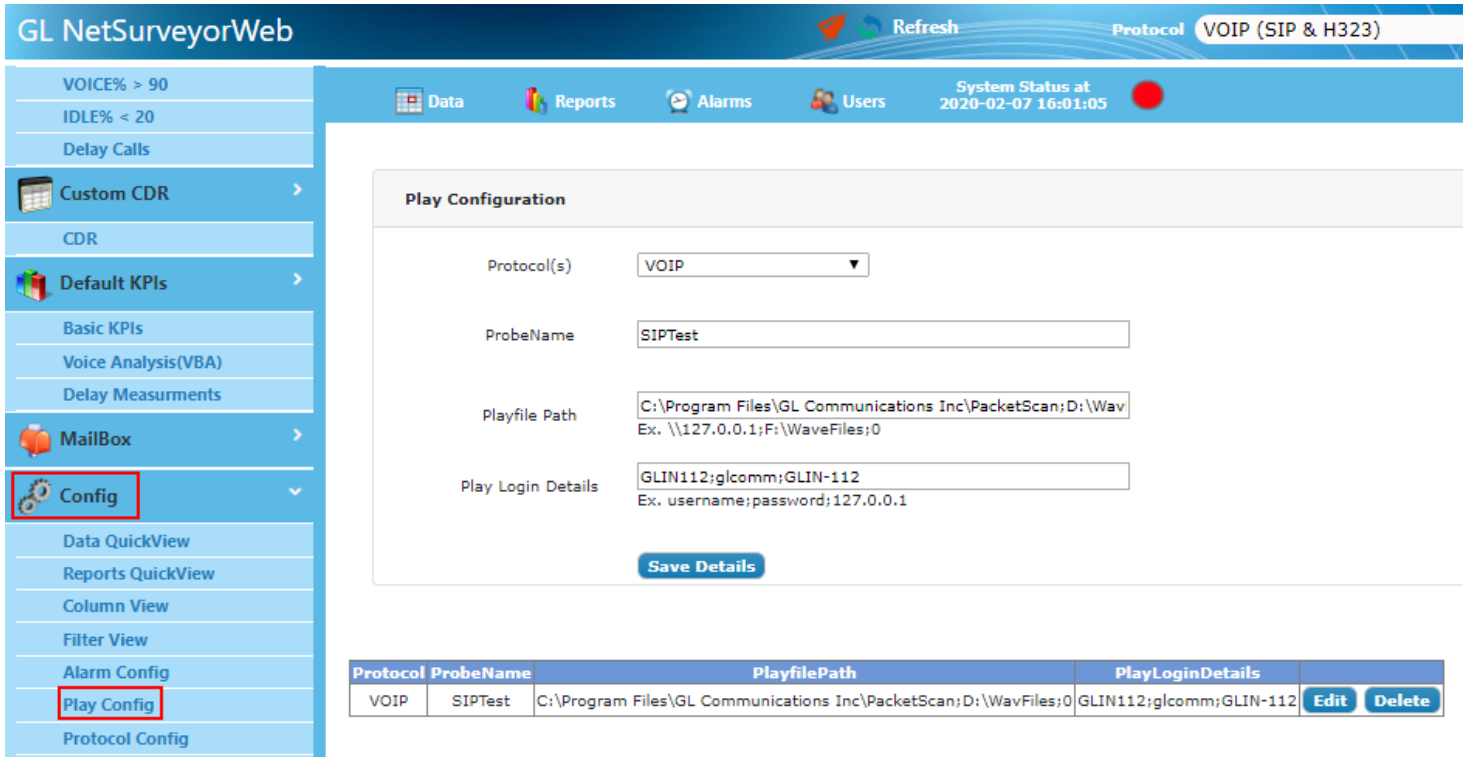
- Now, observe that **Loader Status** is UP indicating Green LED. Also, observe that CDR and Frame Summary count is getting updated. It confirms that error free data is being received..



NetSurveyorWeb CSV Loader Configuration

- To play the voice file in **NetSureyorWeb™** application follow the below steps
- On the left pane, click on **Config → Play Config** to configure PCM/GLW and WAV file path.
- Select the required protocol.
- Enter the Probe Name as configured in PDA.
- Specify the PCM/GLW and WAV file path in the below format.
- VoiceFile Path;WavFile Path;0
- The default Play File path for VoIP protocol is
- C:\Program Files\GL Communications Inc\PacketScan;C:\WavFiles;0
- The default Play File path for ISUP protocol is
- C:\Program Files\GL Communications Inc\Octal Xpress E1 Analyzer;C:\WavFiles;0
- Provide the login credentials of the system where PCM/GLW files are located.
- After configuration, click on **Save Details.**

NetSurveyorWeb CSV Loader Configuration



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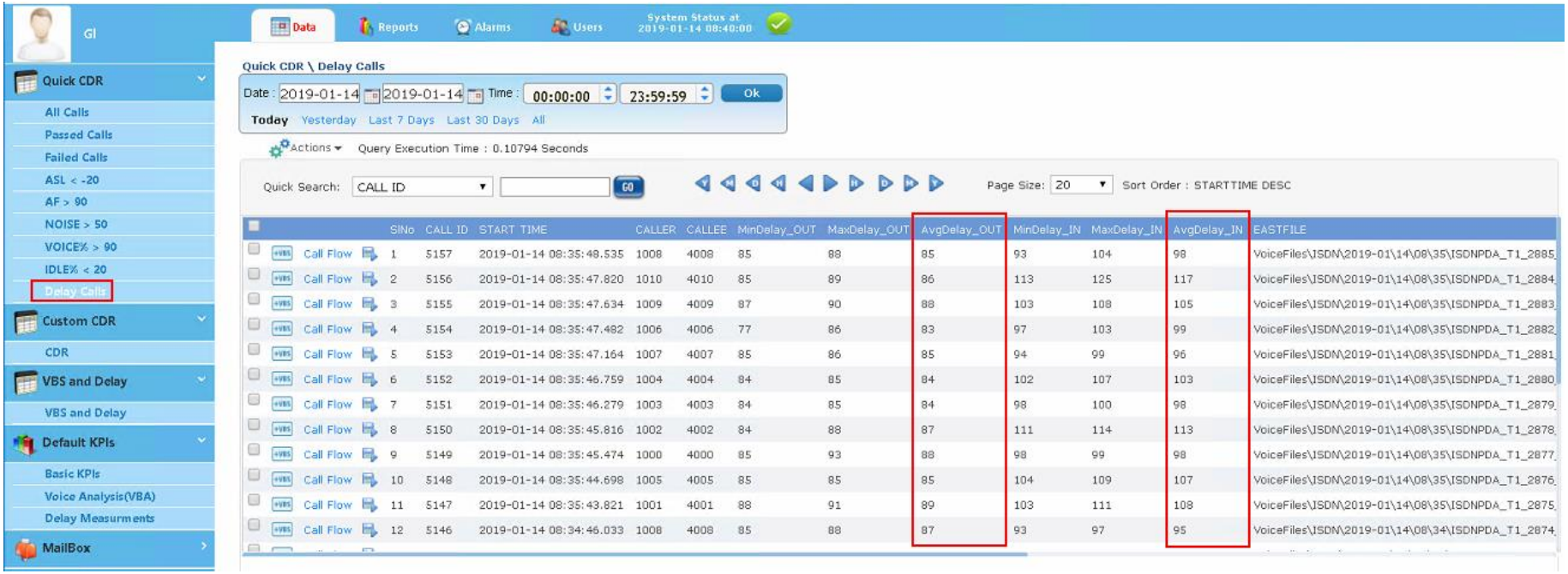
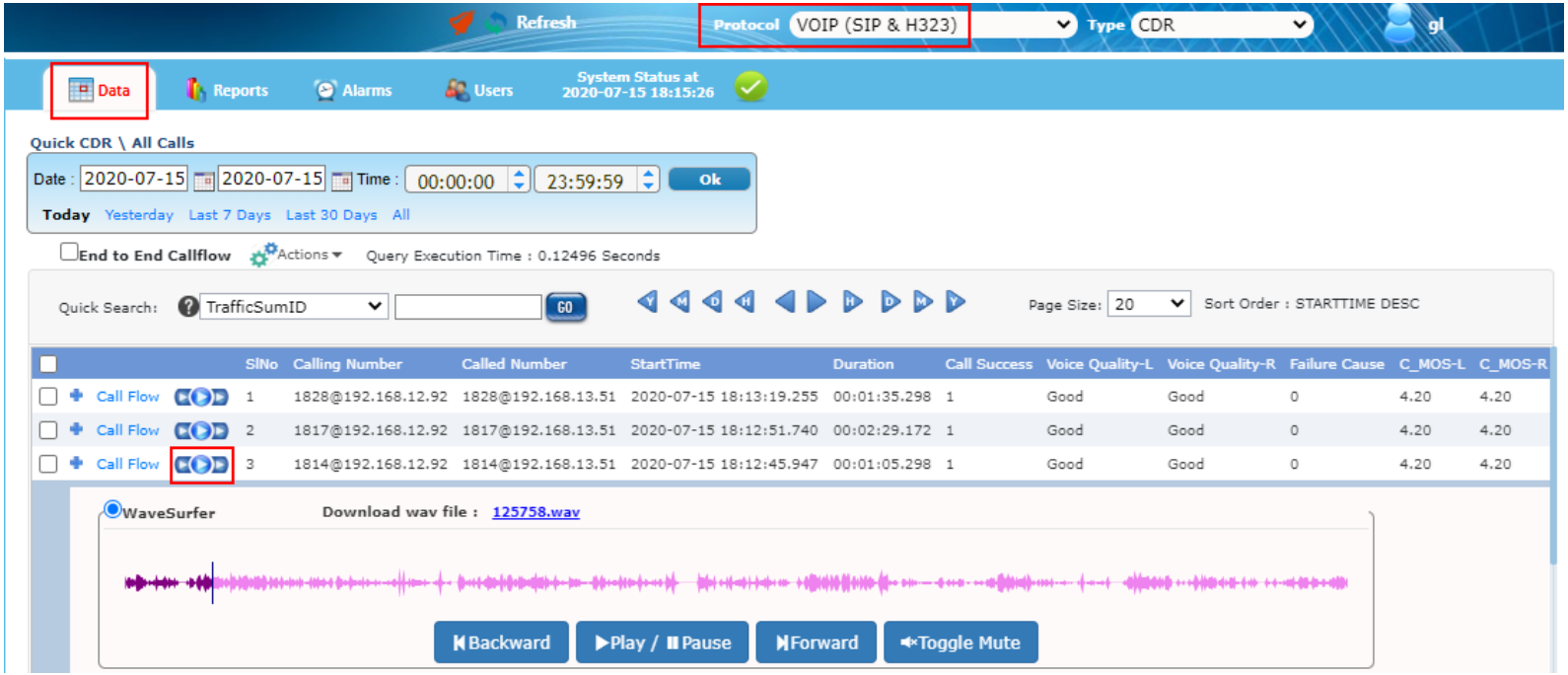
Verification

- Now, go to **NetSurveyorWeb™** application, on the left pane, under **Quick CDR** click on **Delay Calls** and observe the Average Delay IN/OUT results as shown in the below figure.



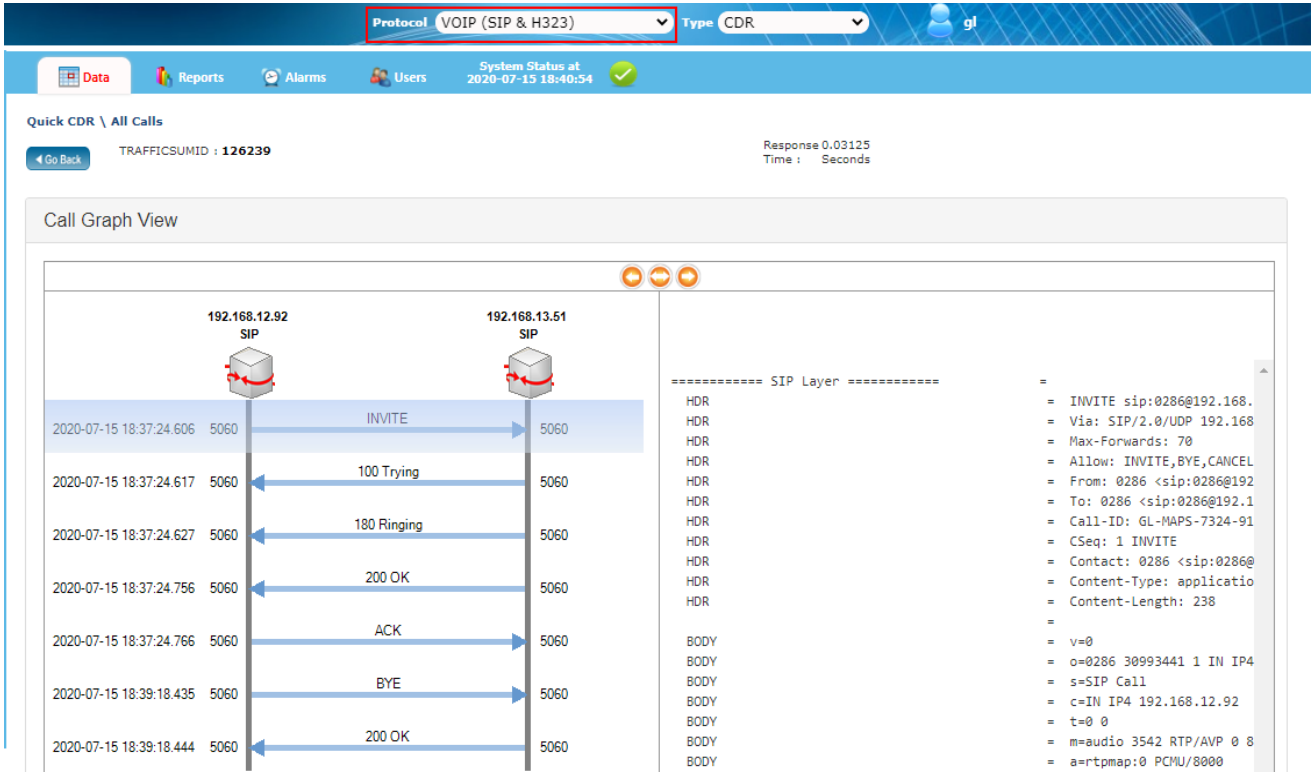
Verification

- Click on **play** icon available for each call in the log to play the CDR call files directly as shown below.



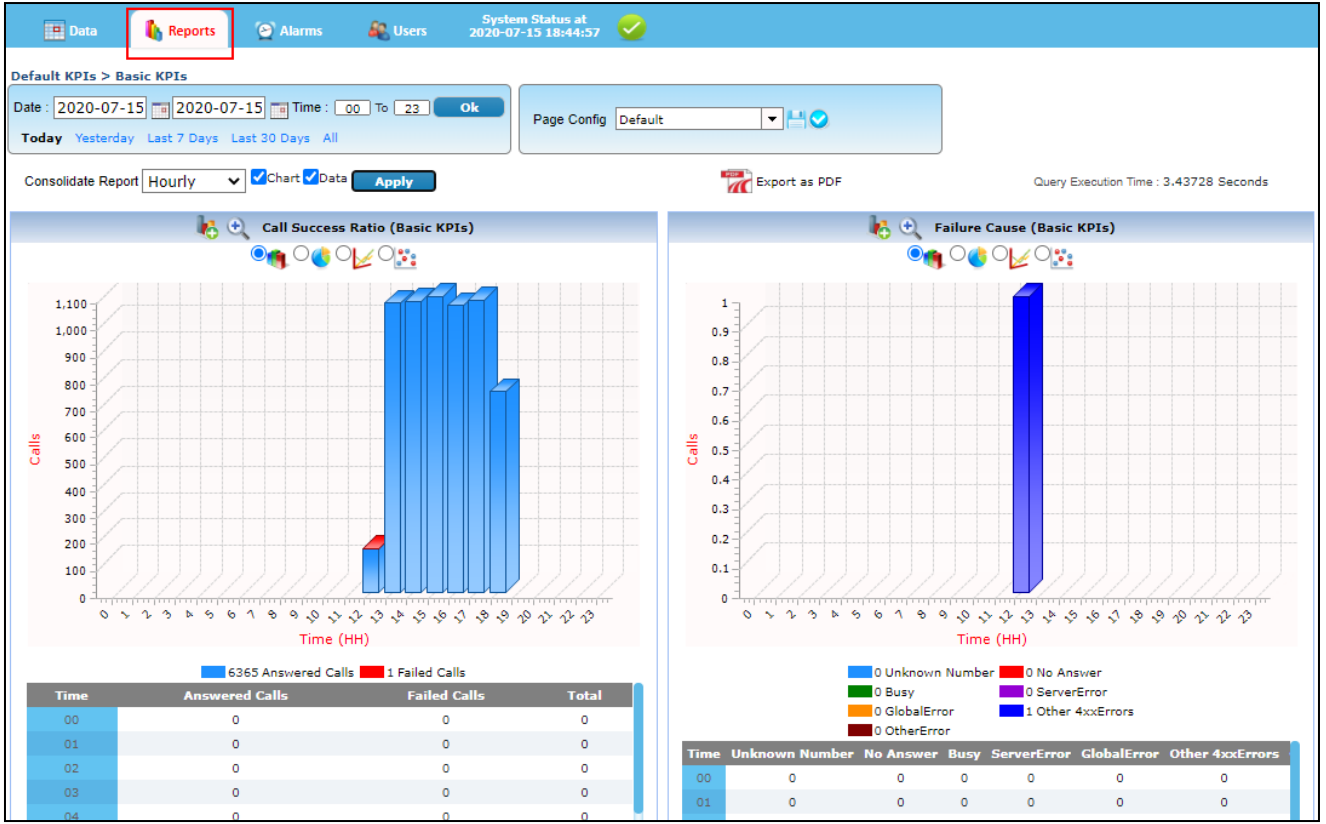
Verification

- User can click on the **Call Flow** available for each call to view the call flow as shown in the screen below.



Verification

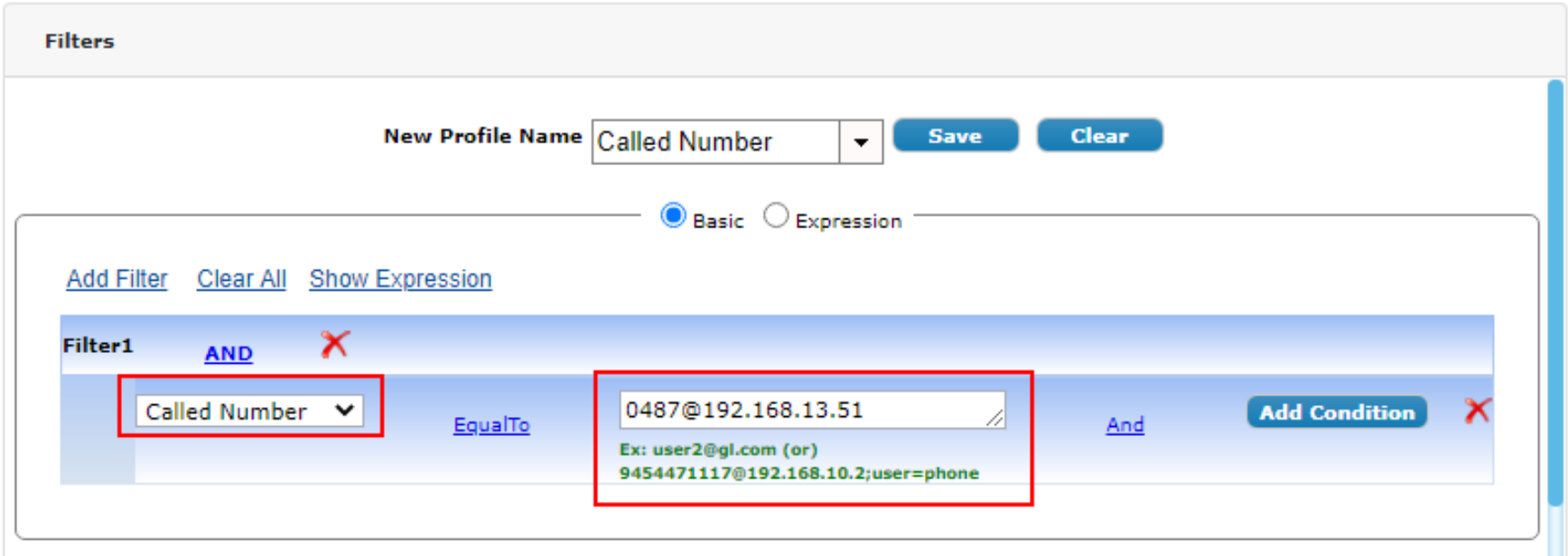
- From the top menu list click **Reports** tab to view the call related KPIs for the selected protocol type as shown in the figure below.



Filtering Calls

- To create custom filter profiles, perform the following steps:
- On the left pane, select **Config → Filter View.**
- Click on '**Add Filter**' to add the filter and select the column to be filtered from the drop-down list. For example, select **Called Number** column to filter the data. If the filter is already existed, then user can click on delete icon and can able to add the required filter.
- Ensure that **EqualTo** expression is selected, user can change the expression as required, to change the expression mouse over on **EqualTo** link and change the logical expression.
- Check the 'Yes' option.
- Mouse over on '**And**' link to select 'And'/ 'OR' logical operators between two filters. In this example '**And**' operator is selected.
- Enter the name as required for the created filter profile in the **New Profile Name** and click **Save**. Refer to the figure.

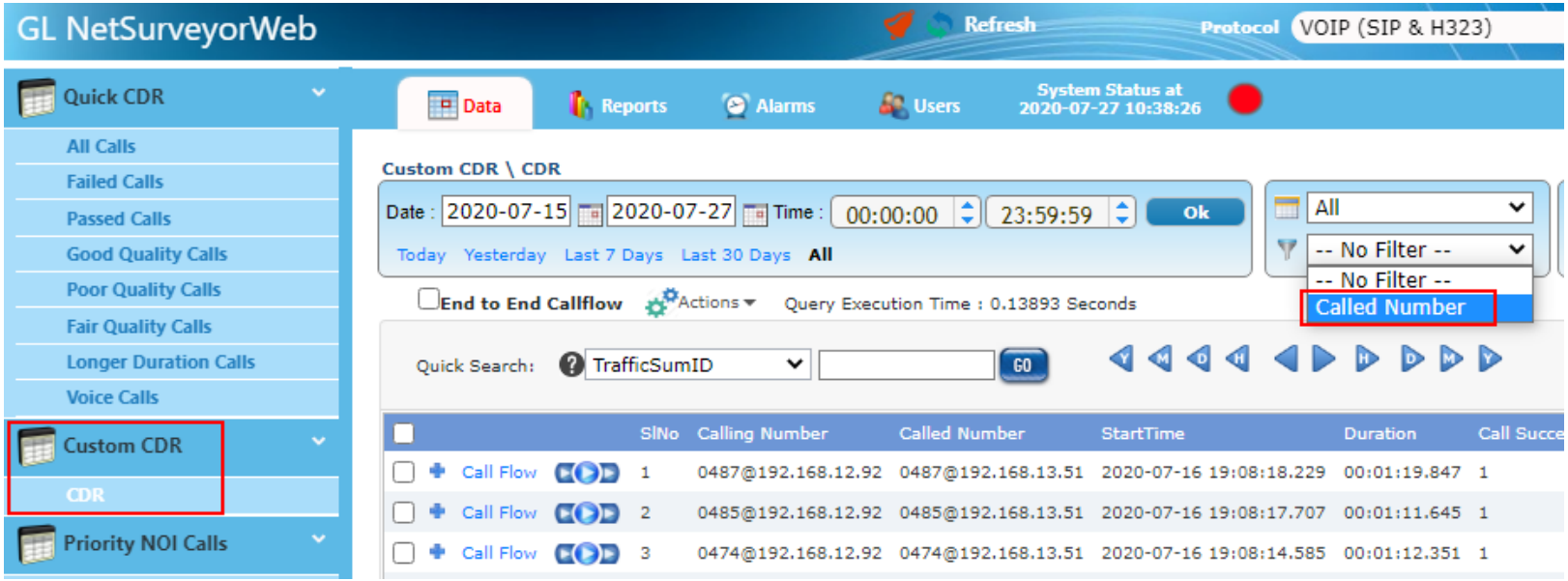
Filtering Calls



Apply Custom Filter Profile

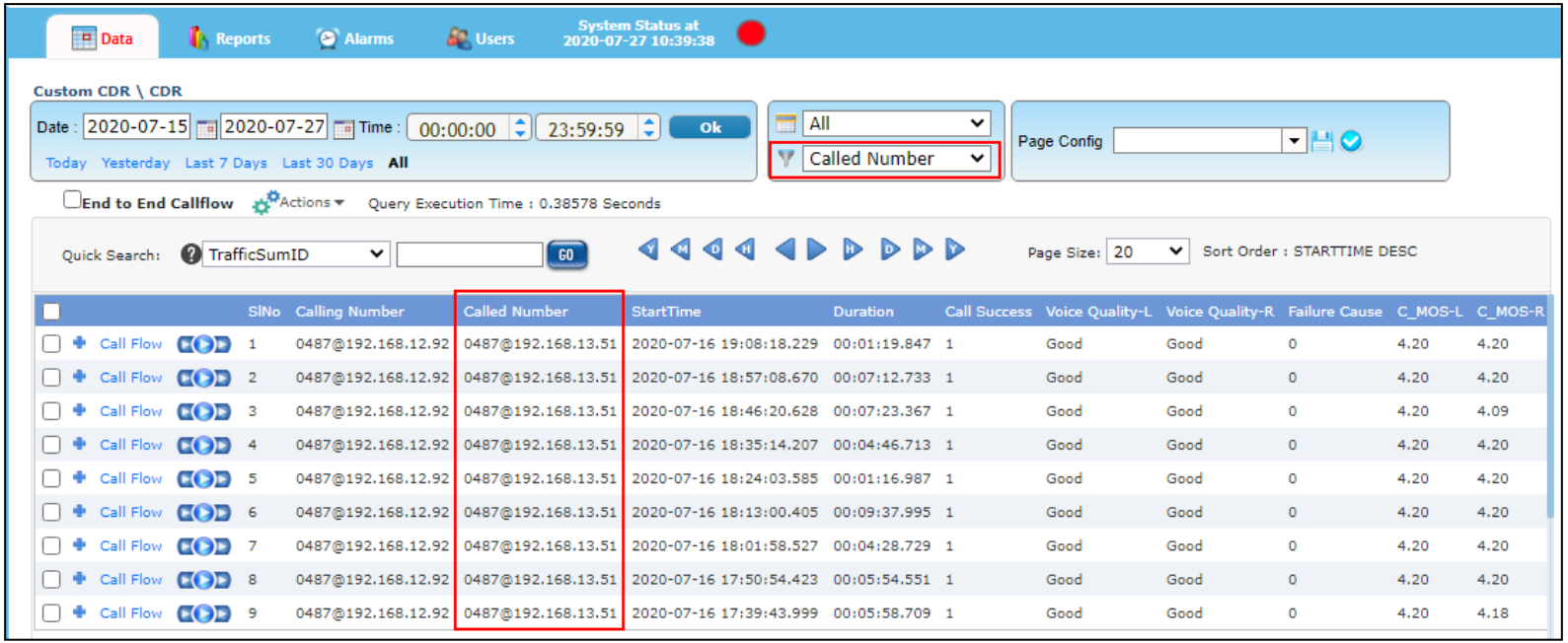
The Saved custom filter can be applied on the data to view the data as customized. To view the customized data, do the following:

- On the left pane, click on **Custom CDR → CDR**, select the required filter. For example, select **Called Number** filter. Refer to the below figure.



Apply Custom Filter Profile

- The data as per the applied filter profile is displayed in the CDR view. The applied filter conditions are displayed in the below figure.



	SlNo	Calling Number	Called Number	StartTime	Duration	Call Success	Voice Quality-L	Voice Quality-R	Failure Cause	C_MOS-L	C_MOS-R
Call Flow	1	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 19:08:18.229	00:01:19.847	1	Good	Good	0	4.20	4.20
Call Flow	2	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:57:08.670	00:07:12.733	1	Good	Good	0	4.20	4.20
Call Flow	3	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:46:20.628	00:07:23.367	1	Good	Good	0	4.20	4.09
Call Flow	4	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:35:14.207	00:04:46.713	1	Good	Good	0	4.20	4.20
Call Flow	5	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:24:03.585	00:01:16.987	1	Good	Good	0	4.20	4.20
Call Flow	6	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:13:00.405	00:09:37.995	1	Good	Good	0	4.20	4.20
Call Flow	7	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 18:01:58.527	00:04:28.729	1	Good	Good	0	4.20	4.20
Call Flow	8	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 17:50:54.423	00:05:54.551	1	Good	Good	0	4.20	4.20
Call Flow	9	0487@192.168.12.92	0487@192.168.13.51	2020-07-16 17:39:43.999	00:05:58.709	1	Good	Good	0	4.20	4.18

Delay Measurement

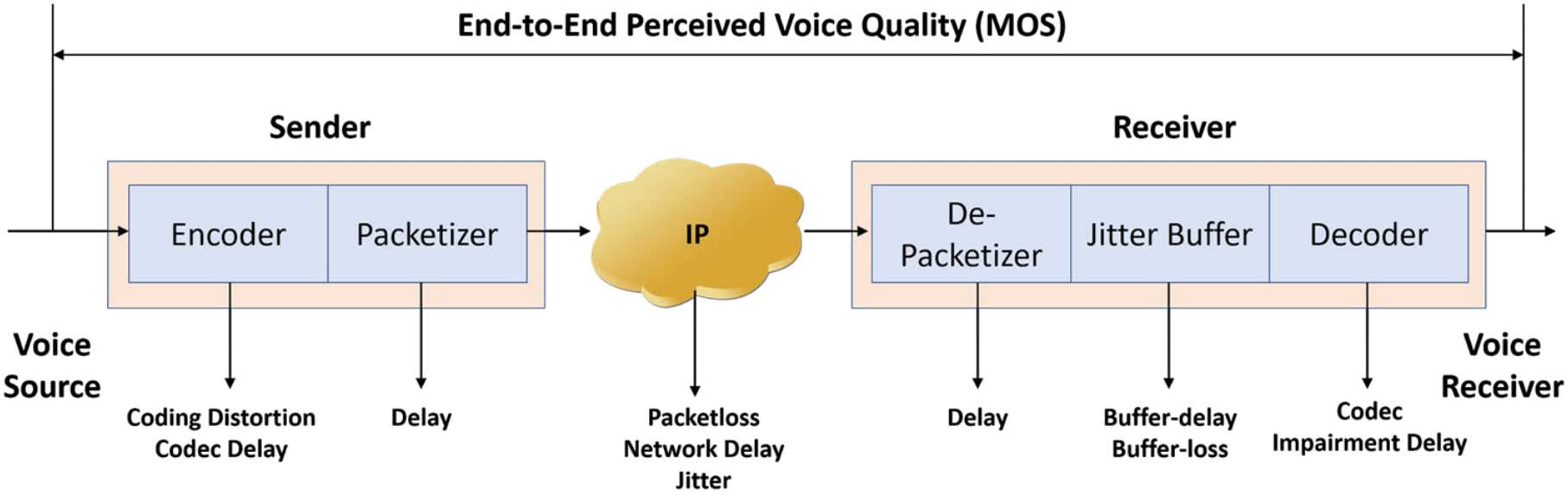
Networks in Transition

- Transition to All IP may be Slow at the Edge but Fast at the Core
- Carriers transitioning faster than enterprises
- Technology pressuring transitioning faster
- Enterprises reluctant to transition until ROI is met
- Gateways provide the bridge for economical transition

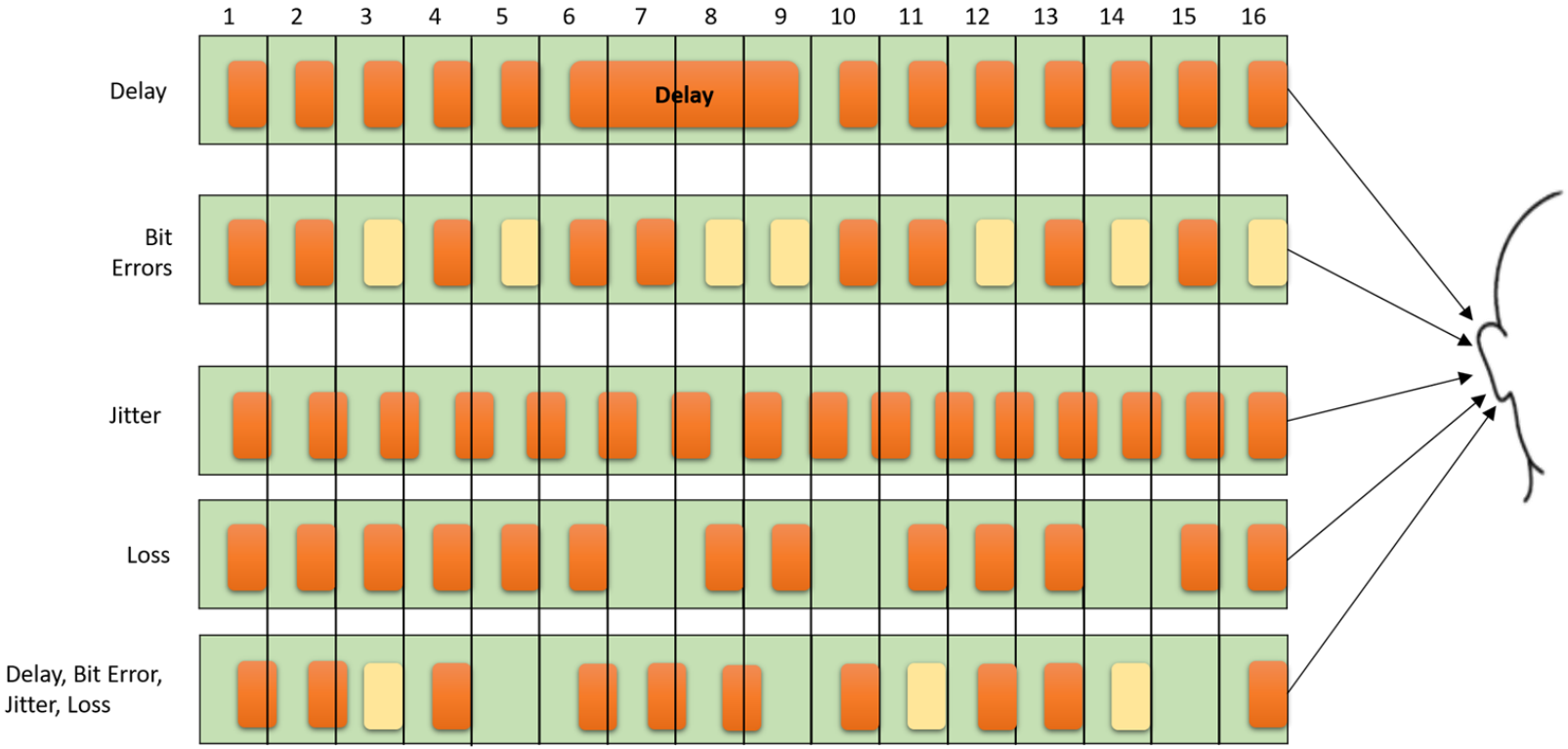
What is a Gateway?

- Interworking between different networks, communication protocols, codecs, physical connections
- Conversion from one technology to another
  - Wired to/from Wireless, Analog to/from TDM, TDM to/from IP
- Conversion of signaling and/or media,
  - CAS to/from ISDN, ISDN to/from SS7, SIGTRAN to/from SS7
  - TDM (Alaw, uLaw) to/from Packet (G.729, G.722, AMR, etc)
- Impairments - Delay, Bit Errors, Jitter, Loss, Out of Sequence

Factors Affecting Voice Quality



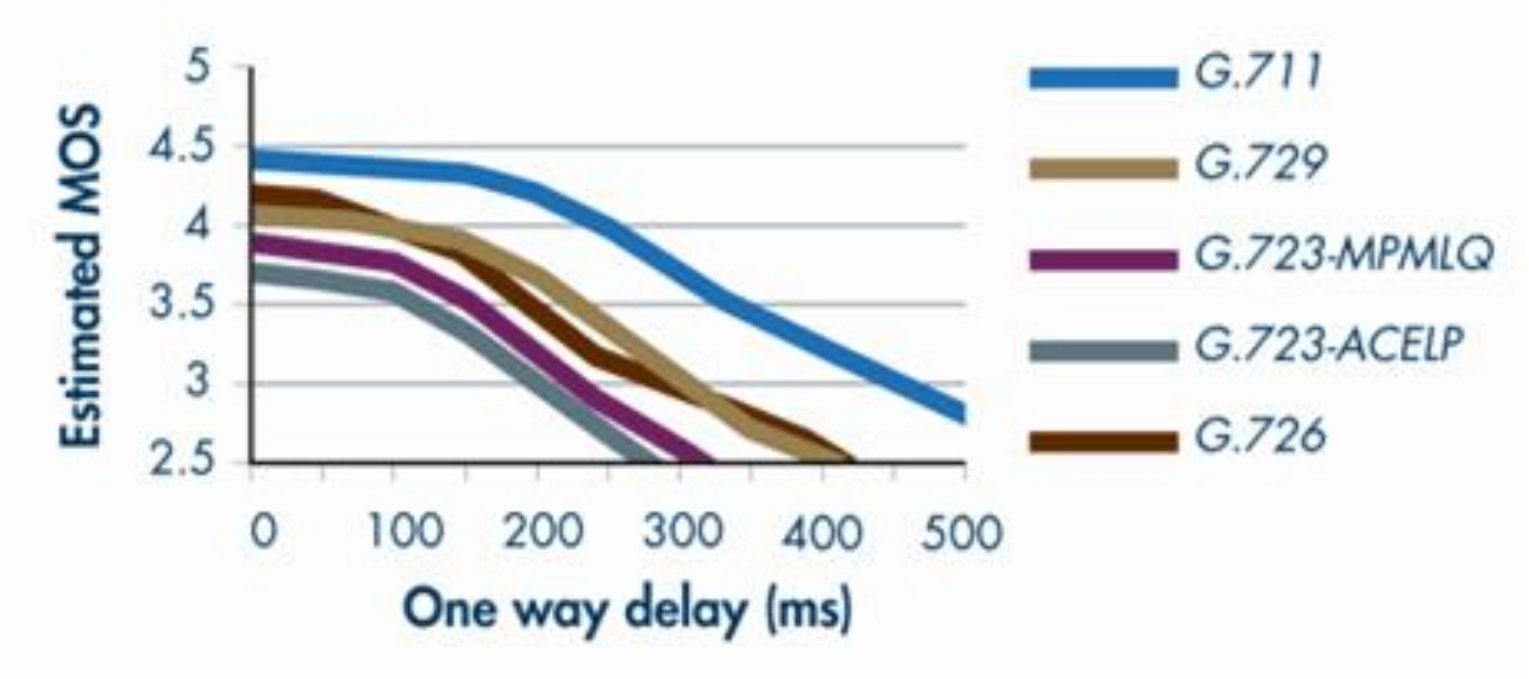
Network & Gateway Impact on Listening Quality



One Way Delay

One Way Delay (msec)	Perceived Quality
0-100	Acceptable for most users
100-150	Acceptable but perceptible
150-250	Typical of Satellites; annoying
250+	Unacceptable for general

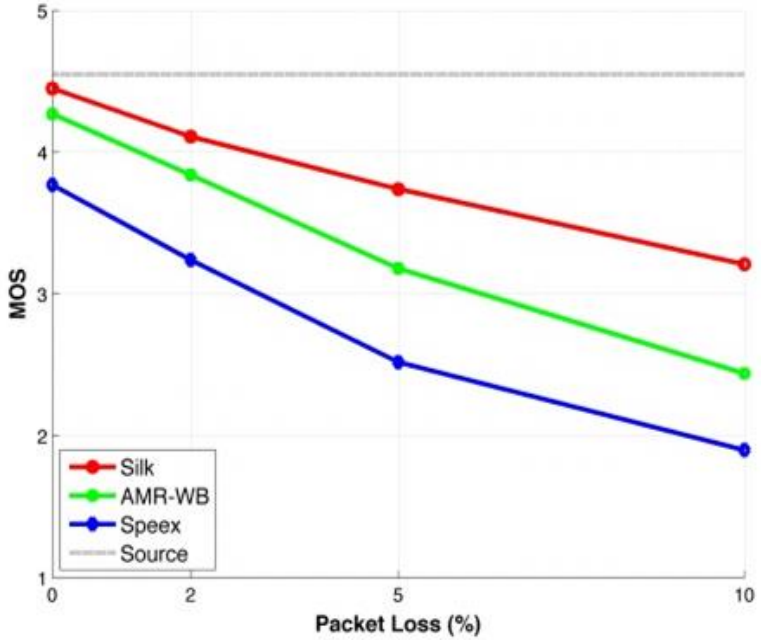
Codec Comparison - No Packet Loss



From Robert Pepper - Cloud Communications Advisor

GL Communications

Robust to Jitter and Packet Loss



MOS scores for Wideband speech signals at different packet loss rates. All codecs were operated at a bitrate of 18.25 kbps.

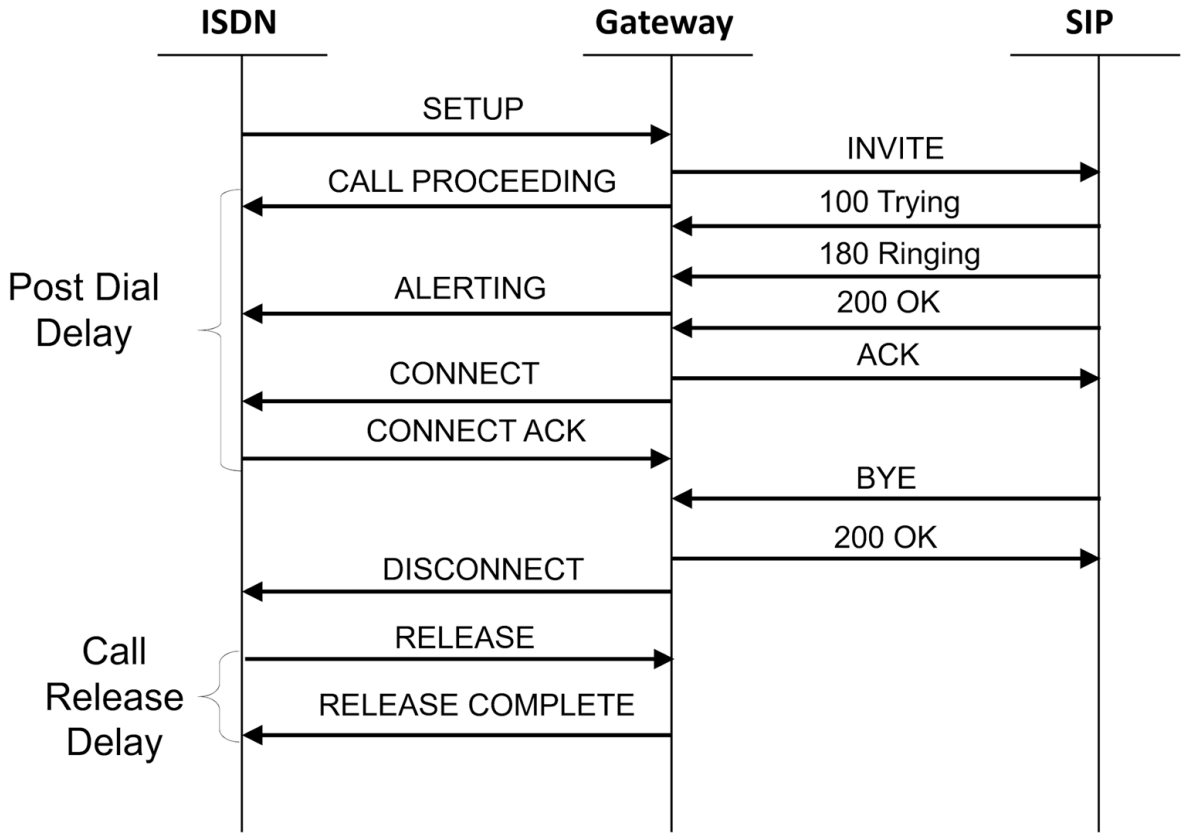
From Jonathan Christensen, eComm 2009

GL Communications

Other Impairments

- Echo Cancellation - Line echo and Acoustic echo
- Digit transmission
  - Inband - DTMF, MF, MFC-R2
  - Out-of-band - DTMF, MF, MFC-R2
- Fax transmission
  - Pass thru
  - T.38
- Background noise - (C-message)

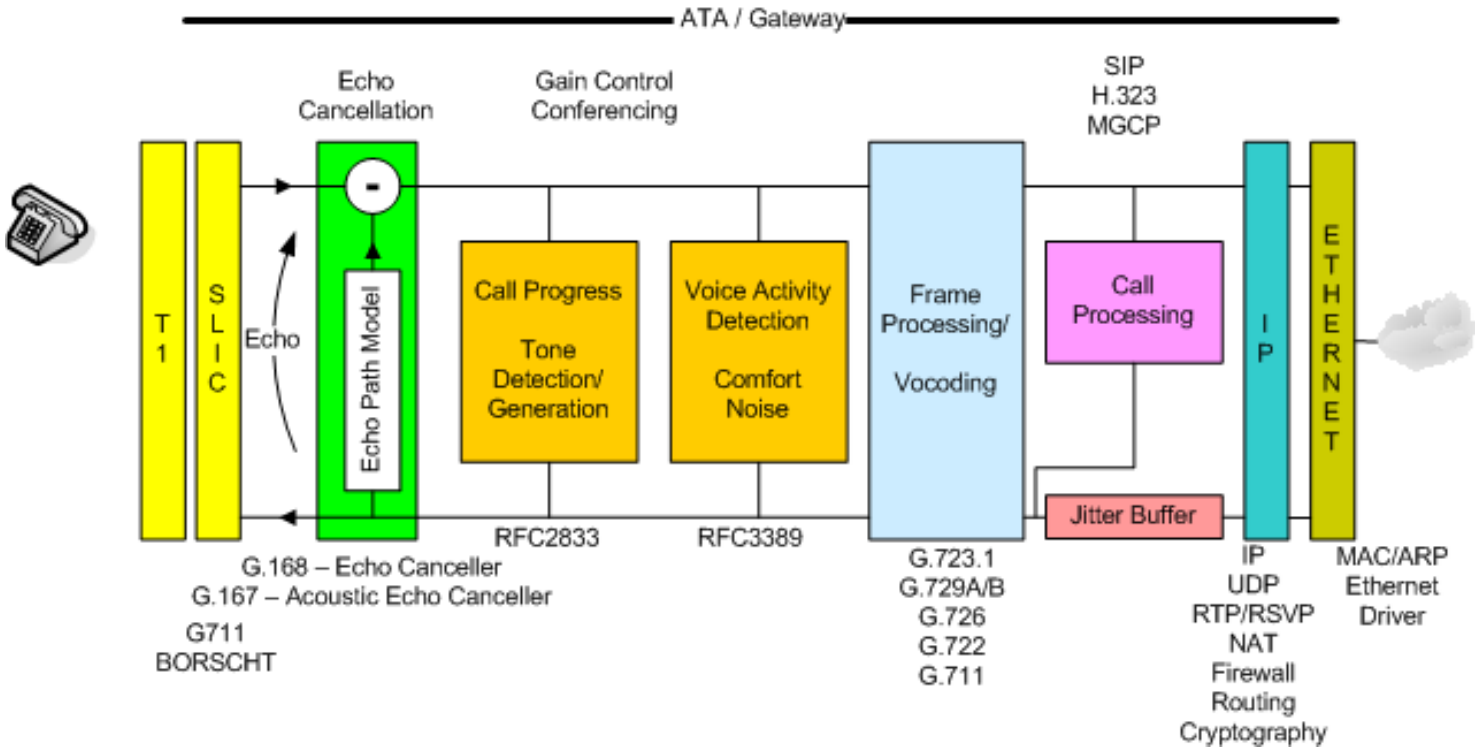
Signaling Gateway



Various Signaling Metrics

- Dial tone delay - off hook to dial tone
- Post dial delay - last digit to ringback
- Answer signal delay - answer indication delay
- Call setup delay - last digit to far end ring
- Dial to ring delay - same as above
- Call release delay - on hook to on hook
- Successive call delay - minimum intercall delay
- Simultaneous sustained calls
- Maximum call rate - in calls/sec

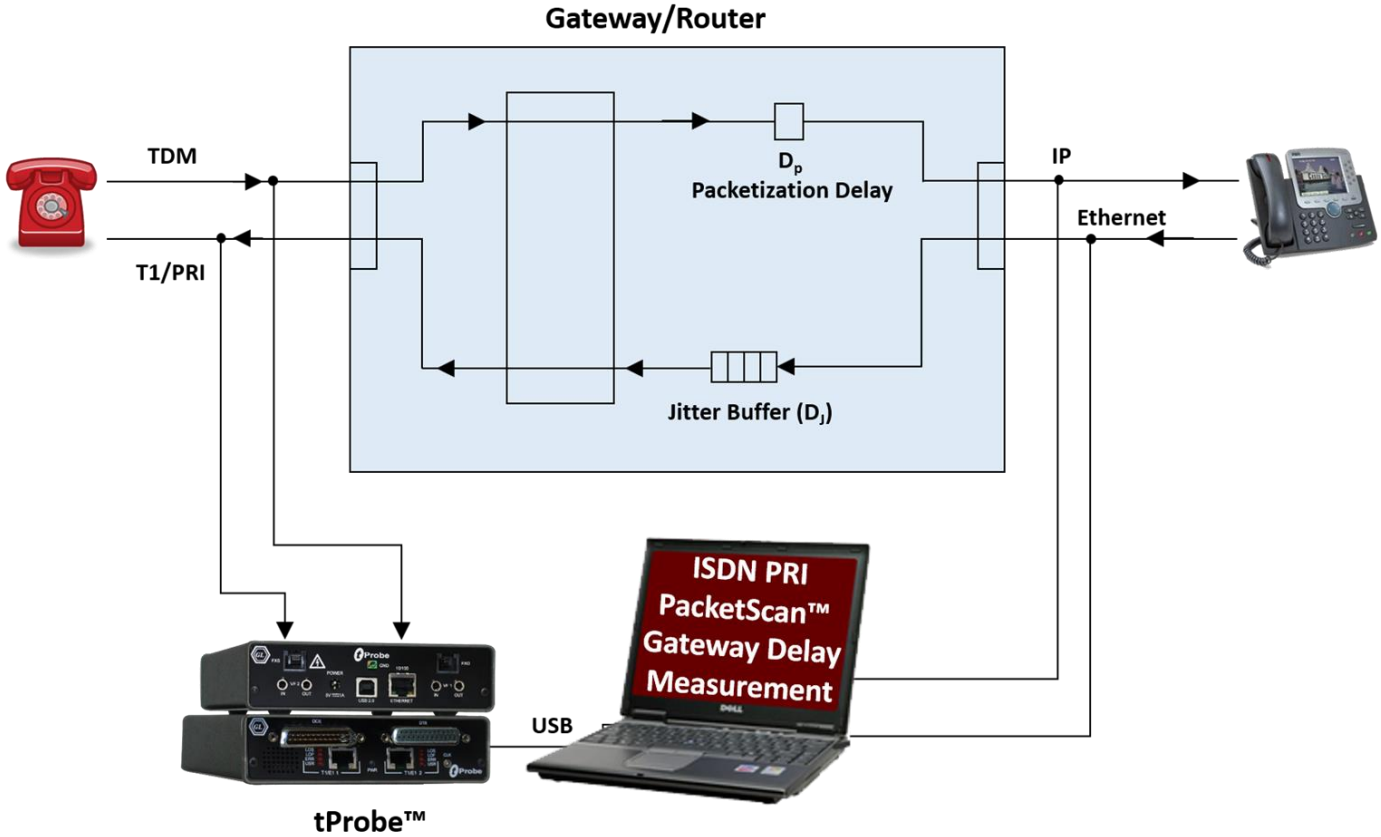
ATA, Gateway Architecture



Basic Test Tools for Gateway Performance Measurements

- Call Emulation - MAPS™ ISDN, MAPS™ SS7, MAPS™ SIP, etc
- Protocol Analysis - PacketScan, SS7 and ISDN Protocol Analyzer, etc.
- Detailed Analysis and Call Capture companion software
- NetSurveyorWeb™ Lite - tens of thousands of calls to fifty thousand calls
- NetSurveyorWeb™ - hundreds of thousands of calls to millions of calls

Gateway Delay Internals



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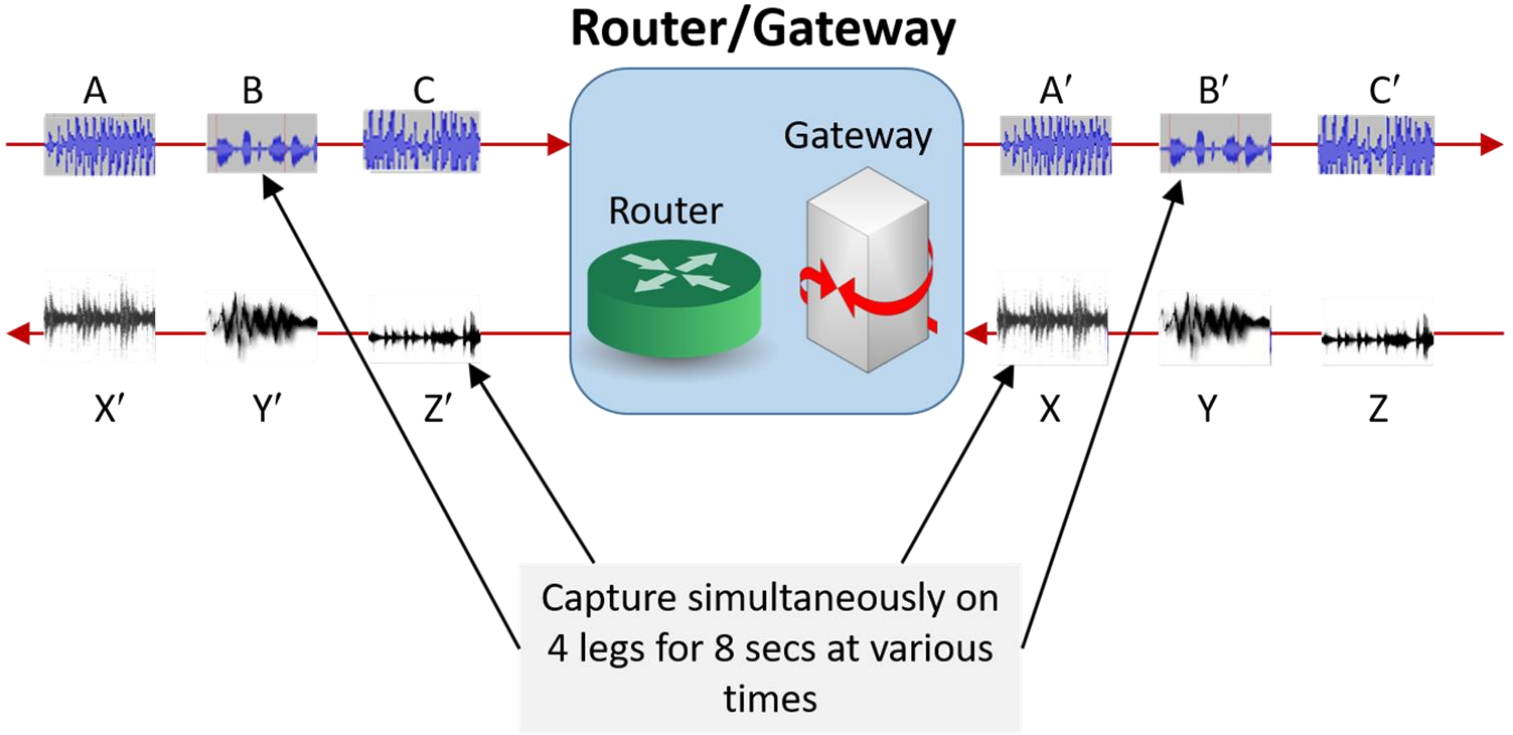
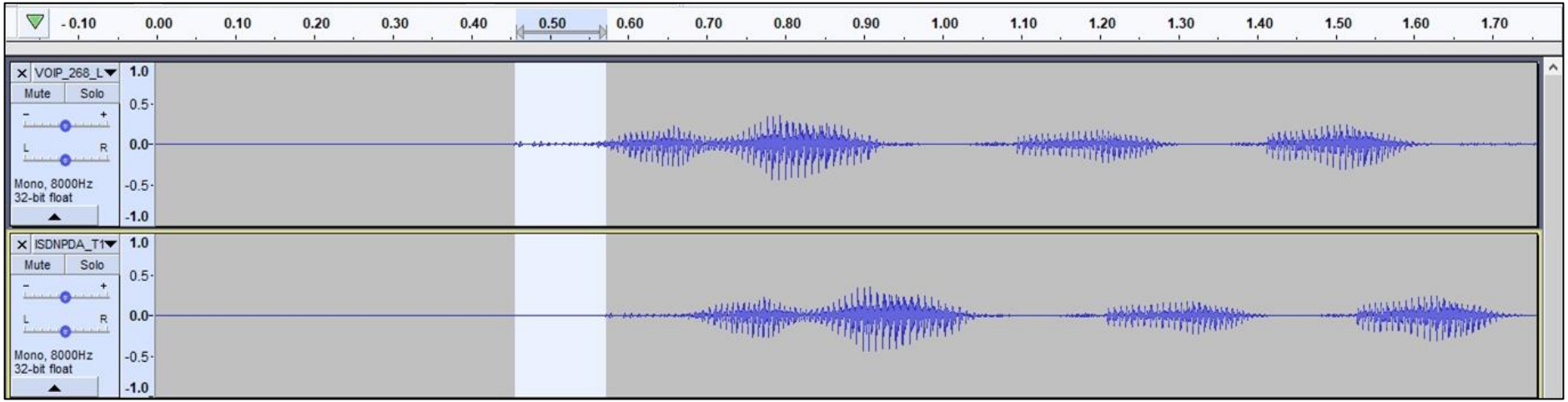
Gateway Delay Measurement (cont.)

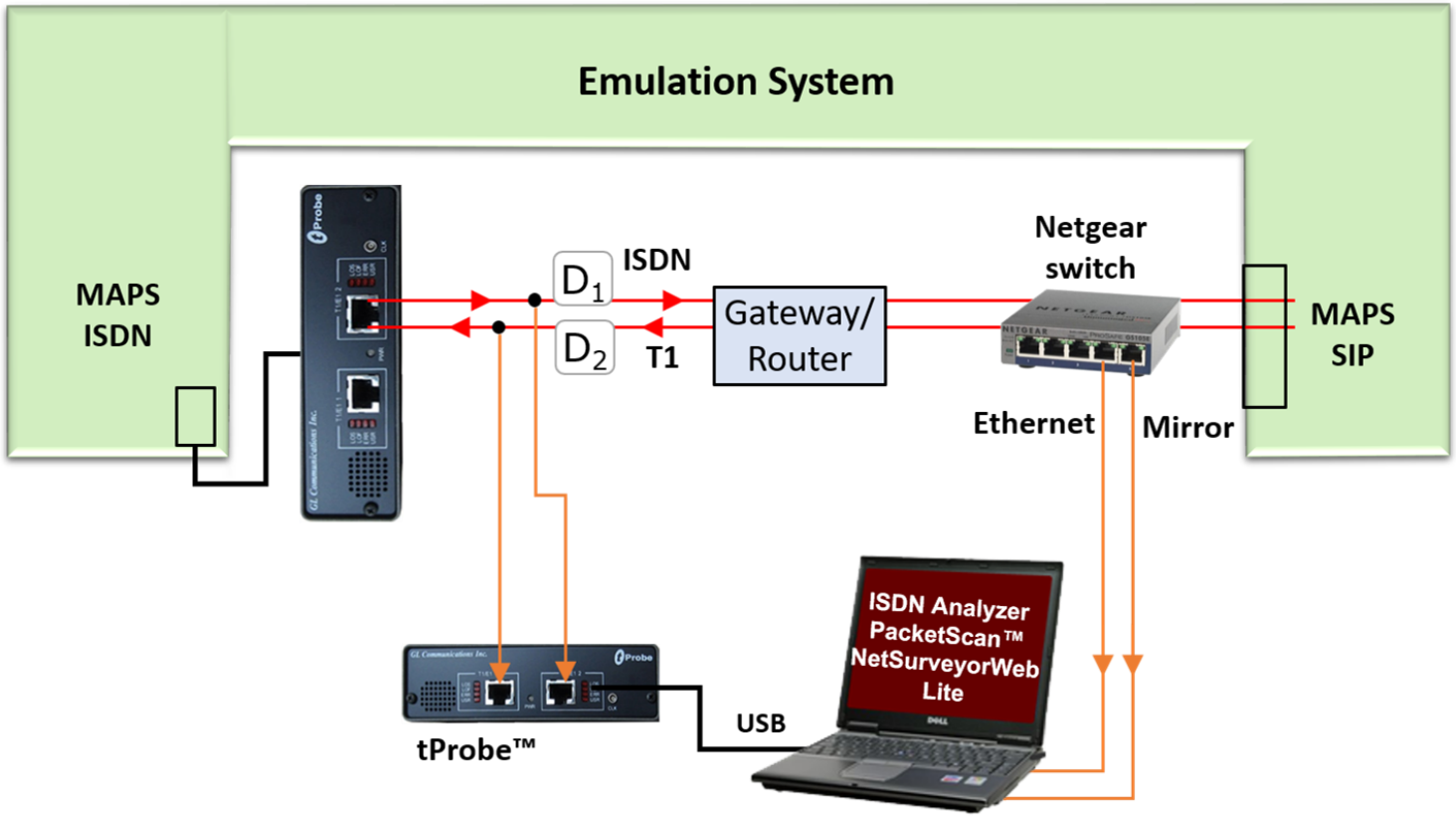


Manual Verification



Confirm VoIP to TDM Delay (116 msec)

One Way Delay Measurement Setup



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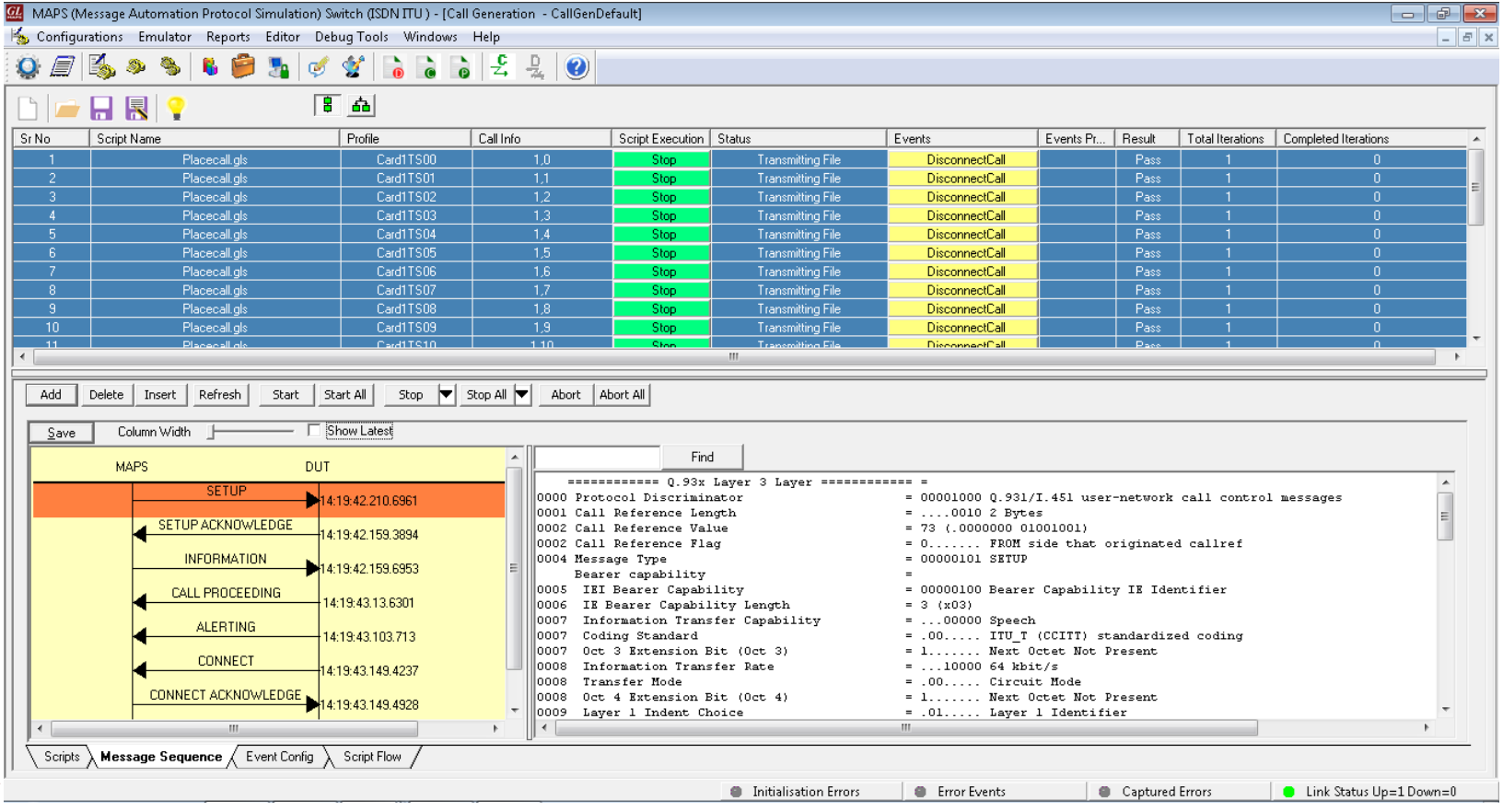
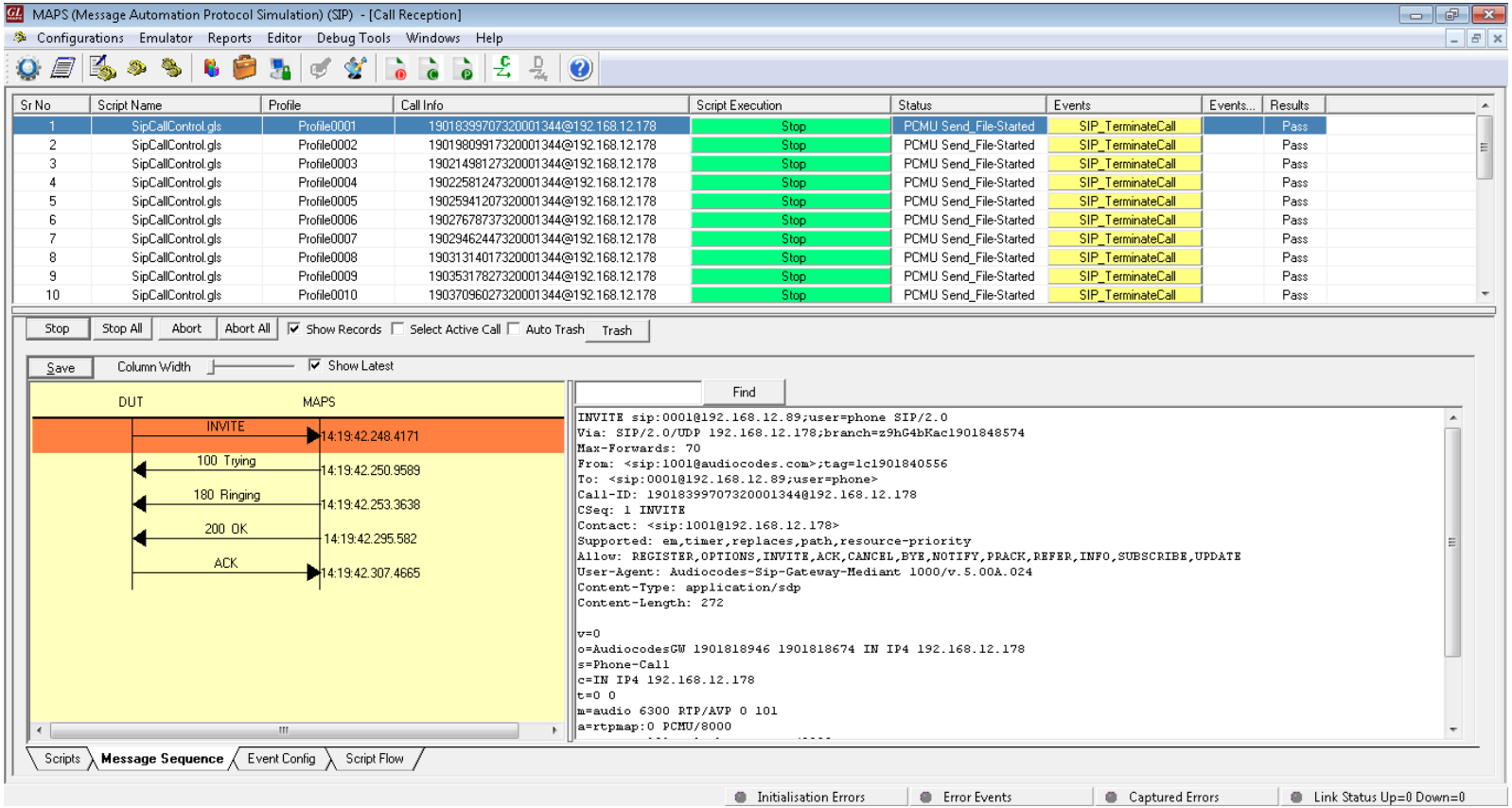
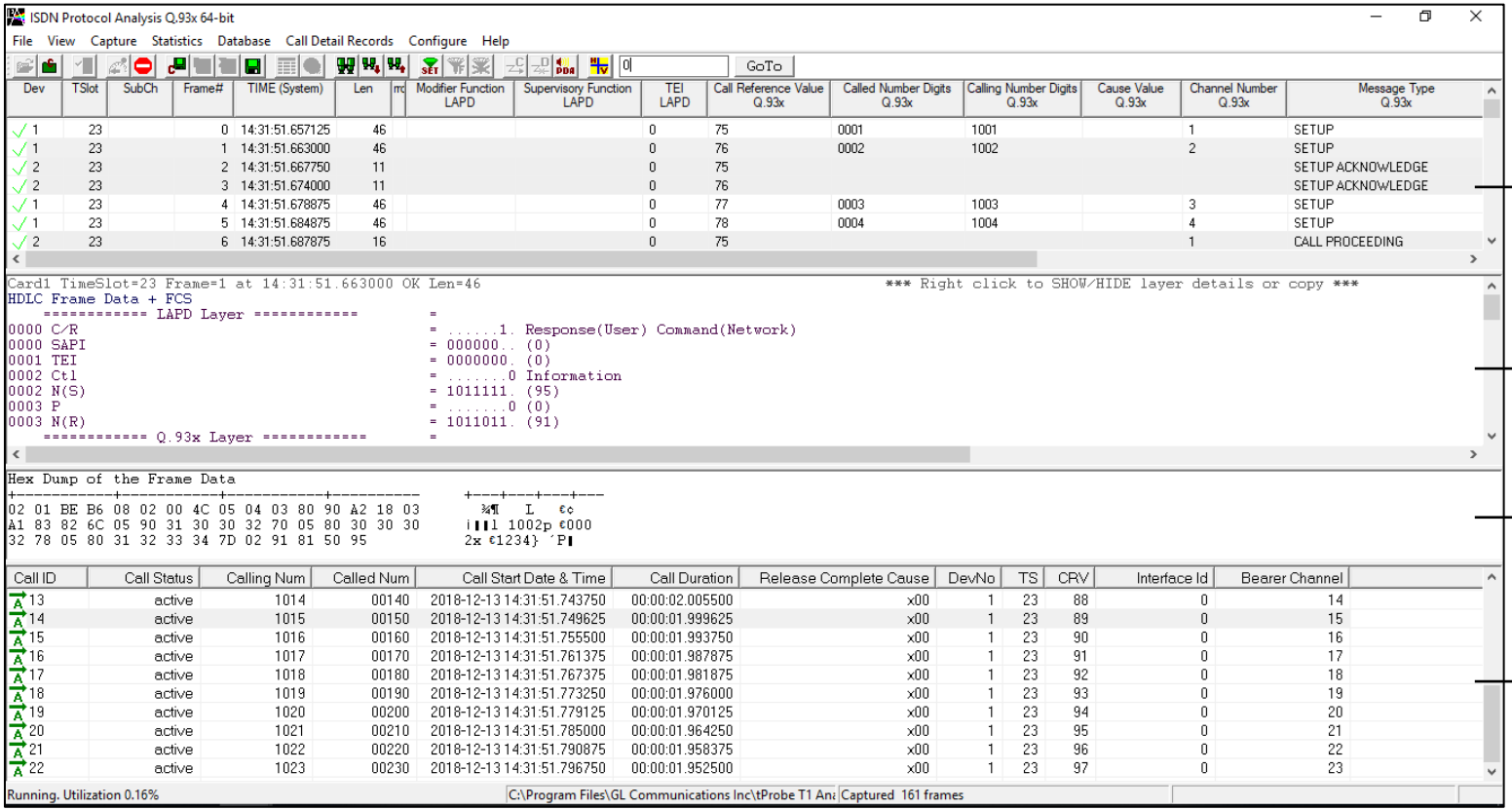
MAPS™ ISDN Call Generation



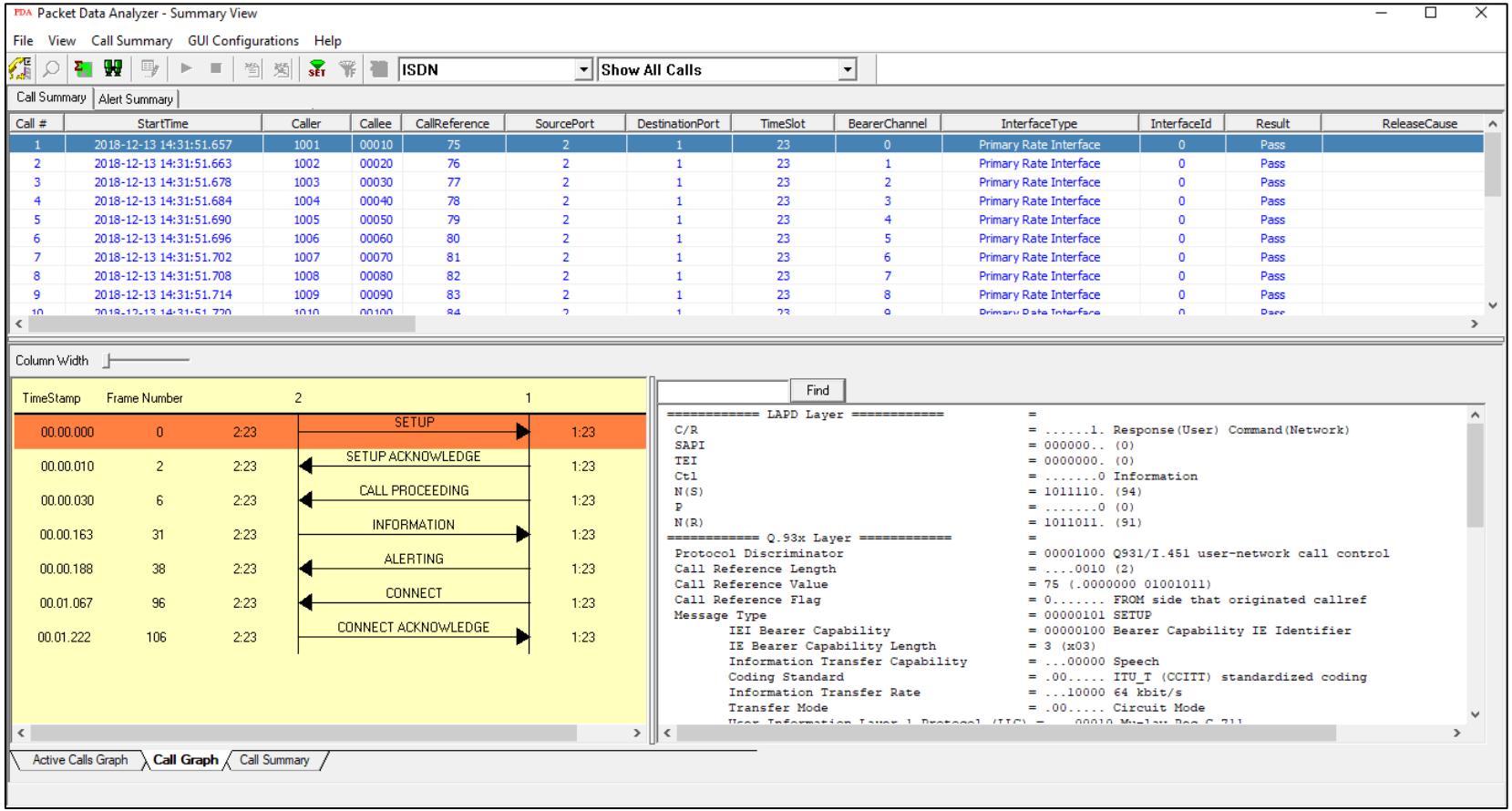
MAPS™ SIP Call Reception



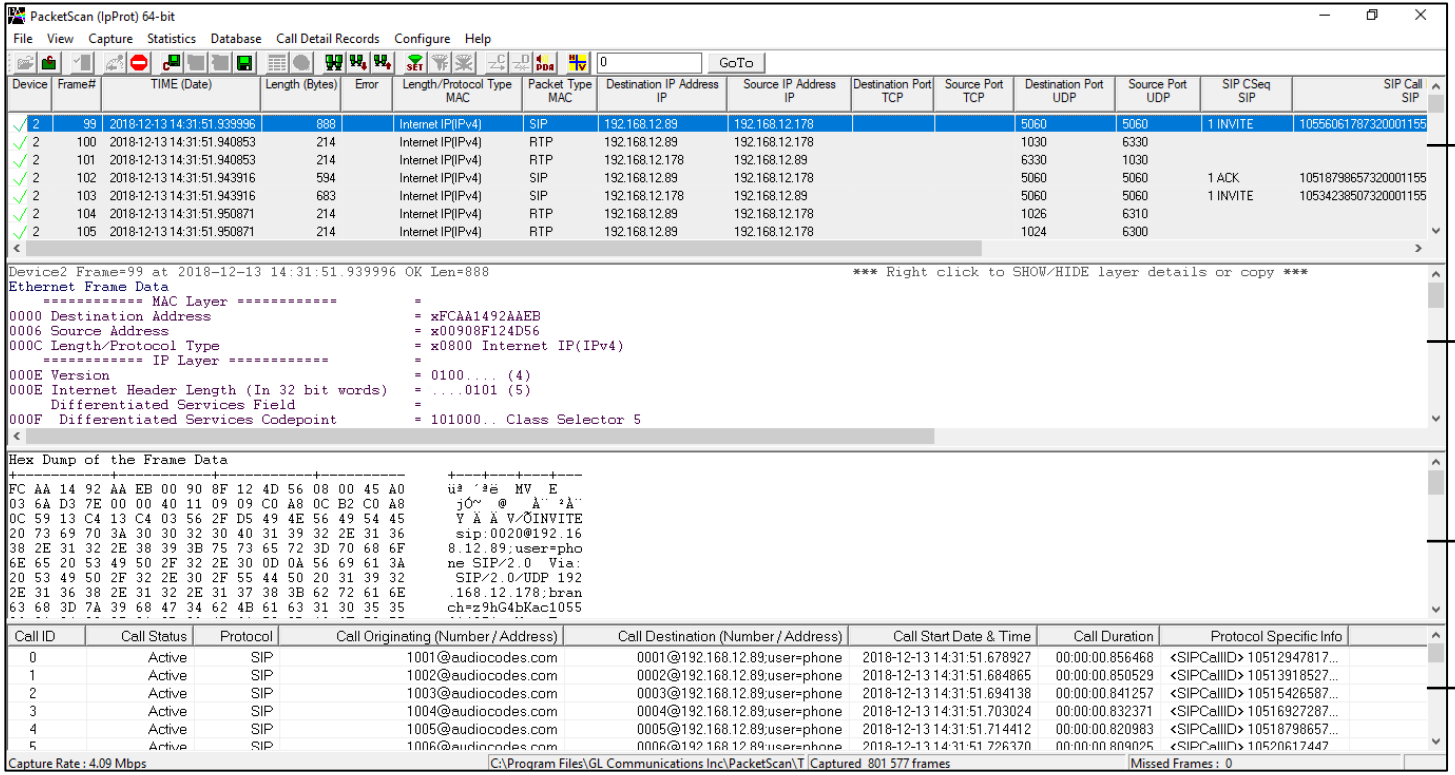
ISDN Protocol Analyzer



ISDN Packet Data Analyzer



PacketScan™ Protocol Analyzer



Summary View

Detail View

Hex Dump View

CDR View

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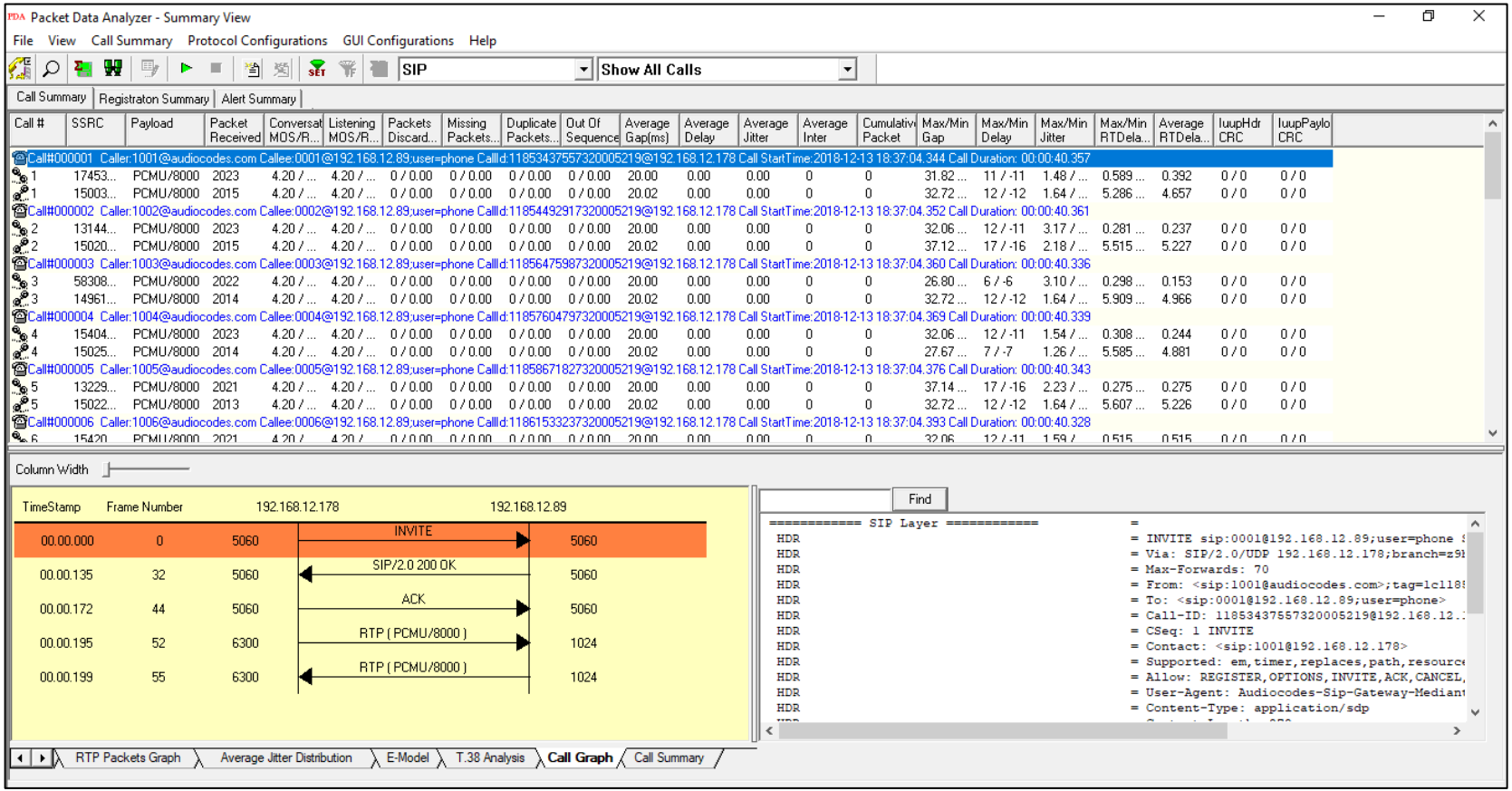
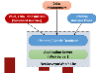
PacketScan™ Packet Data Analyzer



NetSurveyorWeb™ Lite Monitoring System



- The NetSurveyorWeb™ Lite system comprises of three tier distributed architecture driven by non-intrusive hardware probes, web server, intelligent software, and a database engine.
- All components of the system reside at the PROBE-PC. The architecture allows the user to simply deploy it at multiple locations in the network and perform critical measurements.

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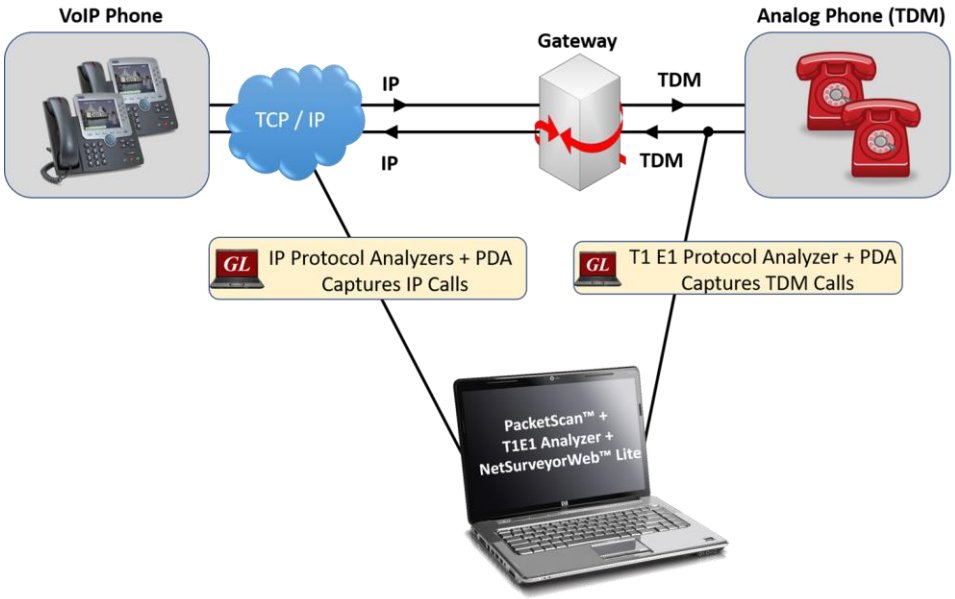
Delay Measurement in NetSurveyorWeb™ Lite



- NetSurveyorWeb™ Lite works with Delay Measurement tools to analyse captured voice traffic and provide precise one-way delay metrics.
- For a given call which traverse through Gateway, traffic is sampled at both TDM and IP analyzer at the same point of time running in the same server.
- These captured segments of SIP and ISDN calls will be saved in *.pcm formats. These samples will be given to delay measurement module which compares the time differences between matching burst from the two samples and provides the delay metrics.

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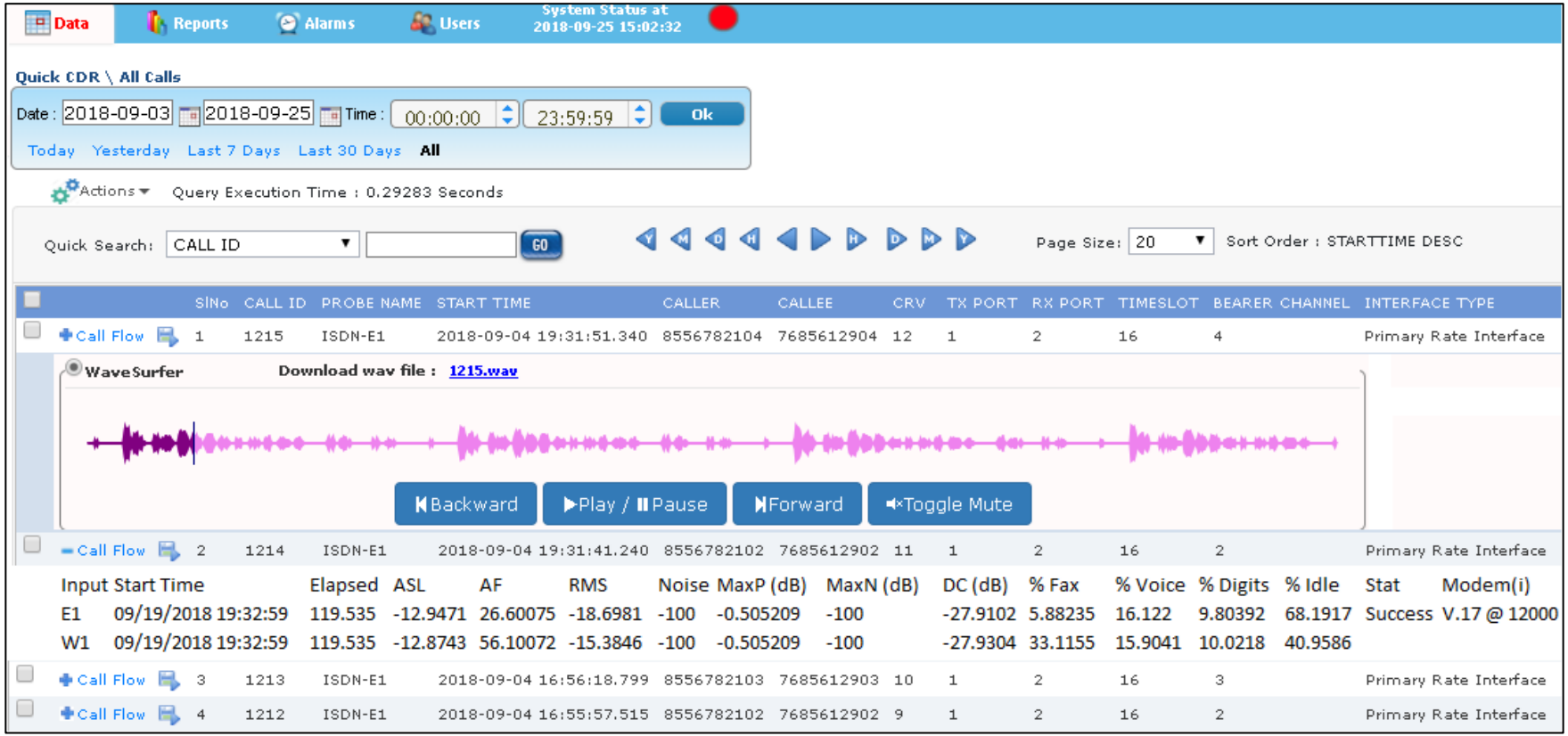
NetSurveyorWeb™ Lite - Data view



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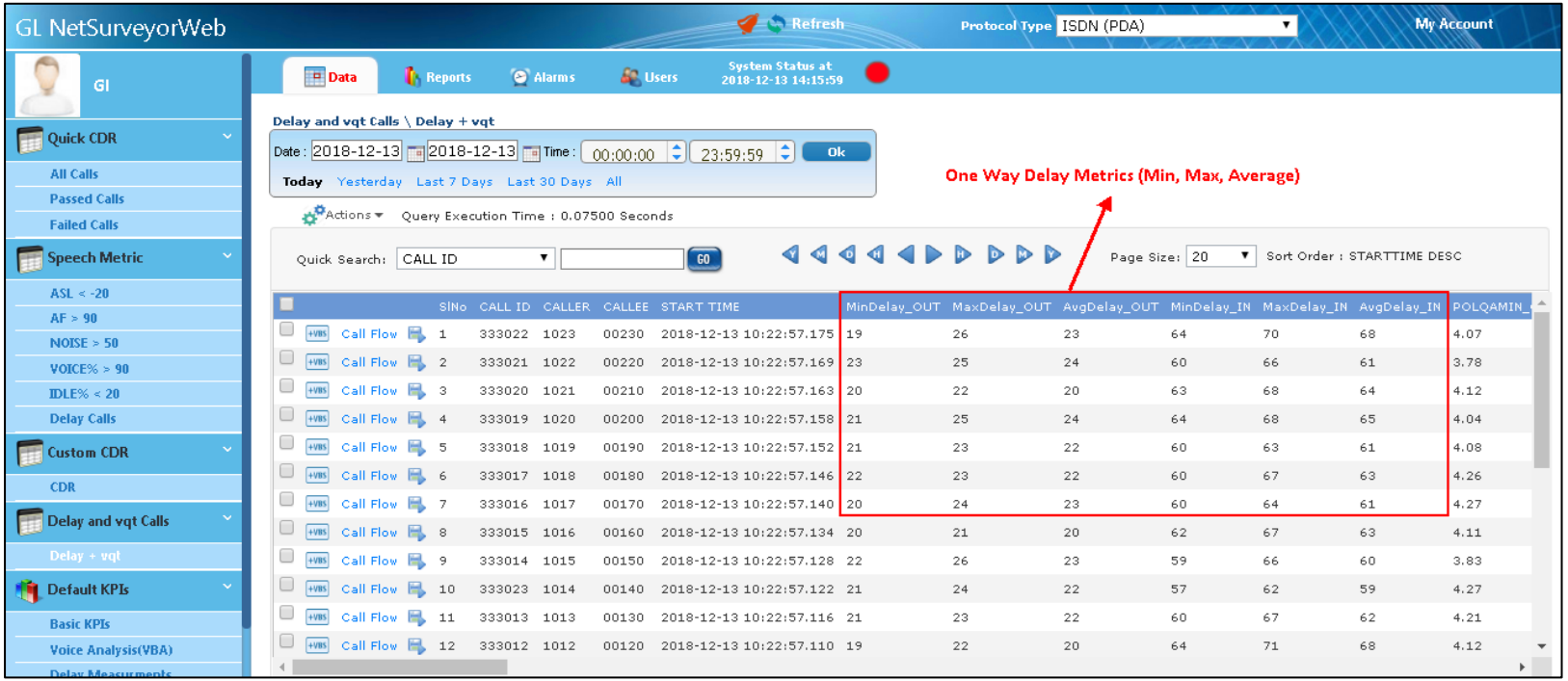
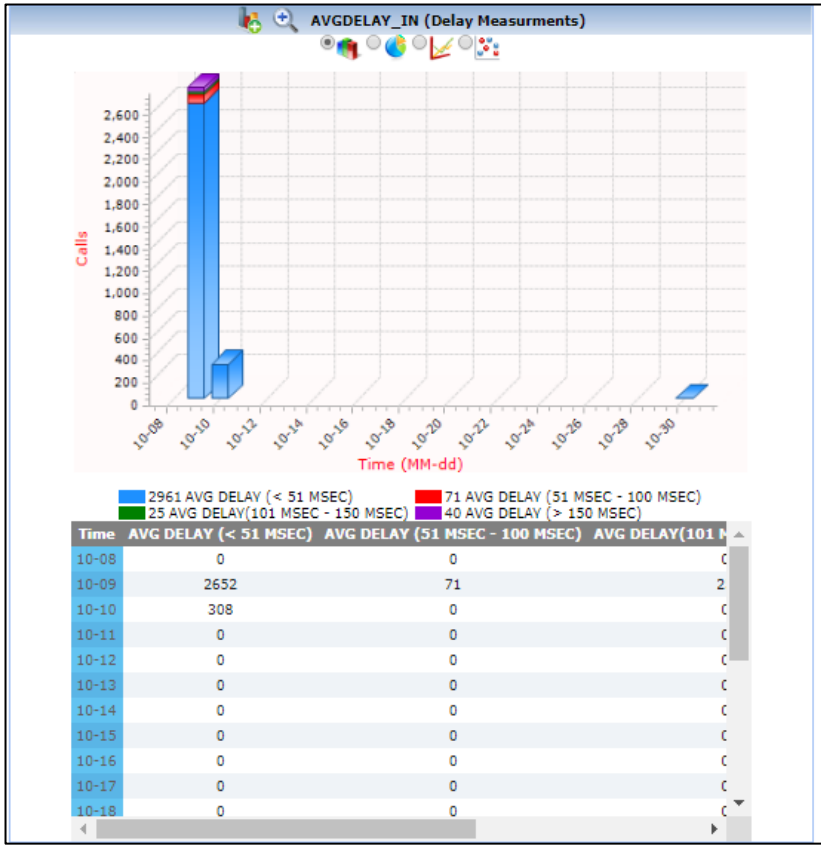
One-Way Delay Metrics in NetSurveyorWeb™ Lite

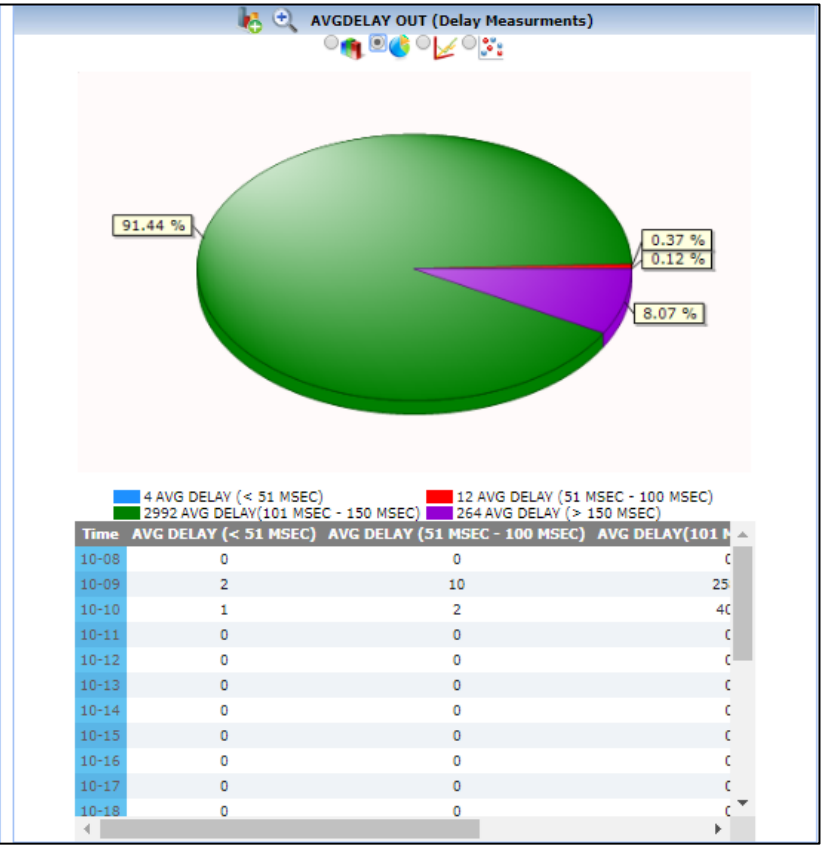


- All delay metrics from different capture and analysis tools are consolidated into central database and presented in web-browser to drill down to calls-of-interest.

Delay Measurement KPI



Time	AVG DELAY (< 51 MSEC)	AVG DELAY (51 MSEC - 100 MSEC)	AVG DELAY(101
10-08	0	0	0
10-09	2652	71	2
10-10	308	0	0
10-11	0	0	0
10-12	0	0	0
10-13	0	0	0
10-14	0	0	0
10-15	0	0	0
10-16	0	0	0
10-17	0	0	0
10-18	0	0	0



Time	AVG DELAY (< 51 MSEC)	AVG DELAY (51 MSEC - 100 MSEC)	AVG DELAY(101
10-08	0	0	0
10-09	2	10	25
10-10	1	2	40
10-11	0	0	0
10-12	0	0	0
10-13	0	0	0
10-14	0	0	0
10-15	0	0	0
10-16	0	0	0
10-17	0	0	0
10-18	0	0	0

GL Communications

Thank you!