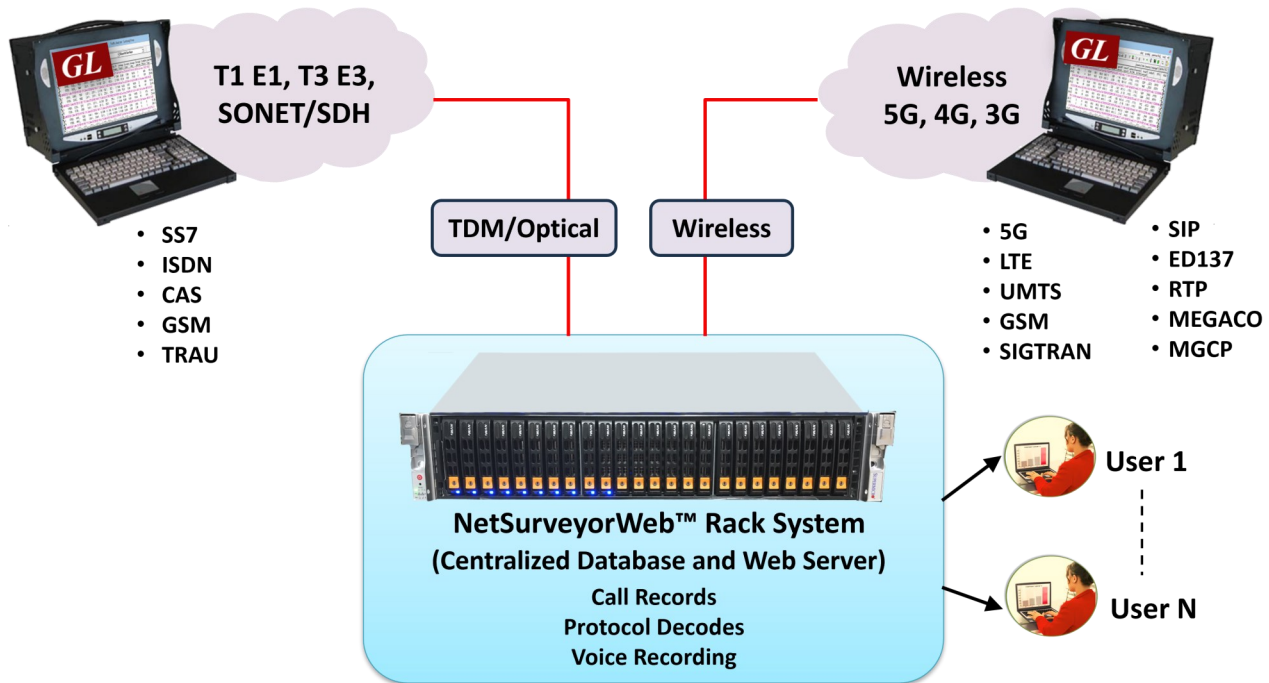


Network Monitoring and Surveillance Solutions

For TDM, VoIP, and Wireless Networks



Overview

GL's Network Monitoring and Surveillance System is web-based application that facilitate display of CDRs by connecting to TDM, Optical, or IP probes through a web server for monitoring physical layer, signaling and traffic at various points in such networks. Supported protocols include SIP, SS7, ISDN, VoIP (SIGTRAN, SIP, H.323), GSM, GSM A TRAU, MAP, IuCS, CAMEL, IuPS, LTE, and so on.

GL provides a variety of solutions for network wide monitoring and surveillance. The solutions consists of:

- Intrusive and non-intrusive 'PC Probes' for TDM, VoIP, and Wireless networks
- Probes deployed at strategic locations in a network transmit and collect voice, data, protocol, statistics, quality measurements, and performance information. These are relayed to a centrally distributed network management system (NMS)
- NMS may be client-server based or Web based system and consists of a database and applications for controlling, collecting, and analyzing the information provided by the various probes

The system can be used for billing verification, remote protocol analysis, traffic engineering, calculating key performance indicators, failure analysis, and call trace functionality. The architecture is uniform across all types of networks, TDM, IP, and Wireless. This results in a reliable, user-friendly and uniform approach to Reports, Administration, and Maintenance.

GL's current NMS solutions for VoIP, Wireless, and TDM networks are:

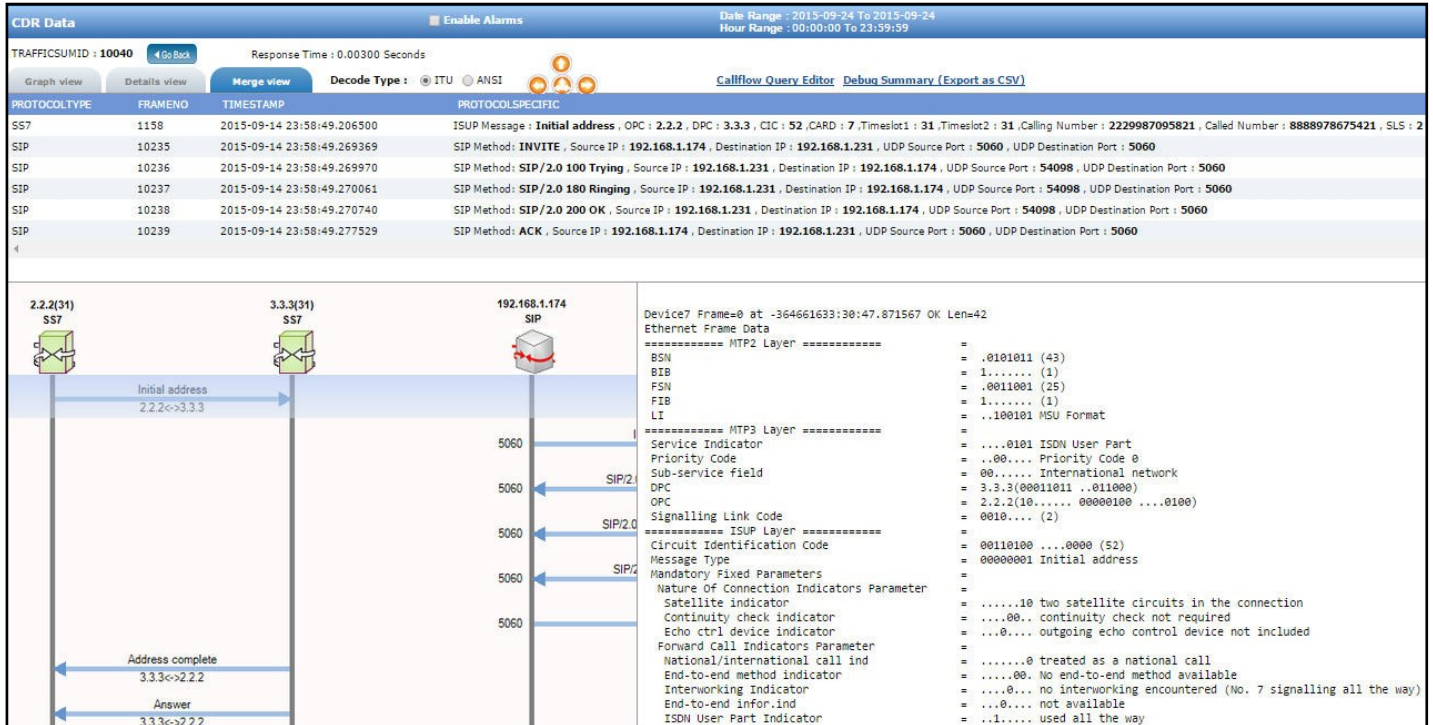
- [Voice, Video, and Data Quality Testing and Monitoring System for any network](#)
- [IP Network Monitoring and Surveillance System \(passive / non-intrusive\)](#) - SIP, RTP, H.323, SIGTRAN, MAP
- [Wireless Network Monitoring and Surveillance System \(passive / non-intrusive\)](#) - GSM, UMTS, LTE, Diameter, IMS
- [TDM and Optical Network Monitoring and Surveillance System \(passive / non-intrusive probes\)](#) - SS7, ISDN, GSM Abis, TRAU
- [Digital T1 / E1 Line Monitoring, Test, and Diagnostic System](#)

For more details, refer to [Network Monitoring Solutions](#) webpage.

 **GL Communications Inc.**

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IP Network Monitoring and Surveillance System (VoIP)



NetSurveyorWeb™ CDR View (VoIP)

GL's [PacketScan™](#) probes are used to capture, and monitor packet flows in real-time within a IP network. All major IP protocols are supported. PacketScan™ also performs detailed analysis of voice band streams gathering QOS statistics such as MOS (Mean Opinion Score), total packet count, reordered, duplicate and missing packet counts, gap, jitter, and delay. A central database stores the real-time and historic data. The system also facilitates various views using a web interface.

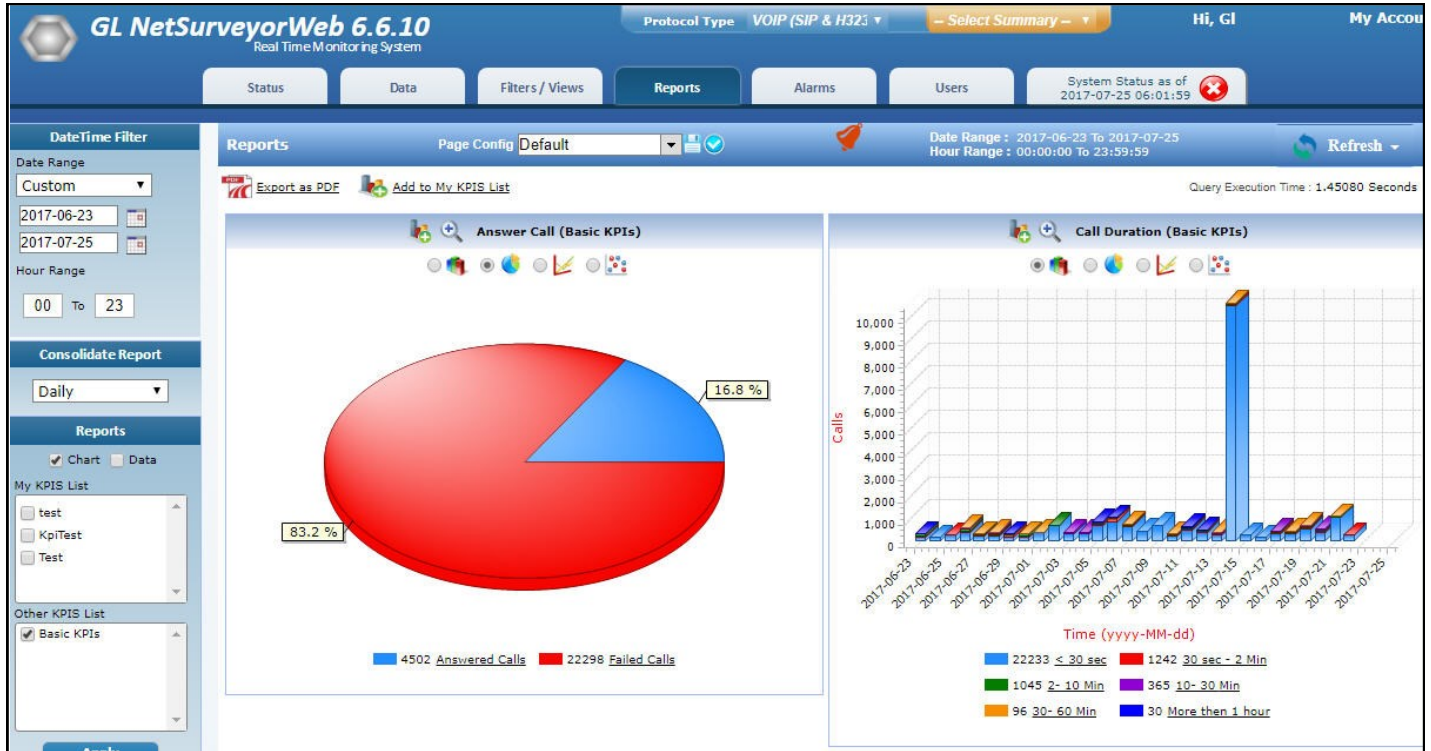
- GL's PacketScan™ acts as a probe and gathers IP packet information in a non-intrusive fashion, and forwards call detail records (CDRs) as well as statistics to a central database
- A central database stores the real-time and historic data into a relational database (Oracle) using ODBC. A web-server accesses the data and allows clients across WAN to view results. It provides a user friendly interface to query and display database custom records
- [NetSurveyorWeb™](#) facilitates result display using a web interface. With this, one can view real-time data, navigate through records, filter the collected VoIP traffic summary, and graphically analyze the Answer Call, MOS, call duration, failed calls, session request delay, PDD, and so on through a simple web browser

For more details, refer to [Network Monitoring Solutions](#) webpage.

IP Network Monitoring and Surveillance System (VoIP) (Contd.)

Supported Protocols with PacketScan™.

- SIP, SIP-I, SIP-T, H323, MEGACO, MGCP
- SCCP (Skinny), SIGTRAN – SS7, ISDN
- All traffic – Digits, Tones, Voice, Video, T.38 Fax



NetSurveyorWeb™ – KPIs in Reports View

Wireless Network Monitoring and Surveillance System (over IP or TDM)

The screenshot displays the GL NetSurveyorWeb 5.9.9 interface. The top navigation bar includes 'Status', 'Data', 'Filters / Views', 'Reports', 'Alarms', 'Users', and 'Admin'. The main content area shows 'CDR Data' with a search filter for 'Trafficsumid' set to '7305737'. A table of call records is visible, with the selected record (7305737) highlighted. Below the table, a waveform visualization is shown with playback controls (Backward, Play/Pause, Forward, Toggle Mute). The table columns include Trafficsumid, Profilename, Starttime, Duration, Dev Number #1, Channel Number #1, Start SubChannel #1, End SubChannel #1, TotalPackets #1, CodecType #1, CrcErrors #1, BadFrames #1, Dev Number #2, and Channel #2.

| Trafficsumid | Profilename | Starttime | Duration | Dev Number #1 | Channel Number #1 | Start SubChannel #1 | End SubChannel #1 | TotalPackets #1 | CodecType #1 | CrcErrors #1 | BadFrames #1 | Dev Number #2 | Channel #2 |
|--------------|-------------|-------------------------|-----------------|---------------|-------------------|---------------------|-------------------|-----------------|--------------|--------------|--------------|---------------|------------|
| 7305737 | p1 | 2015-06-05 10:19:42.952 | 00:11:25.000260 | 5 | 28 | 2 | 2 | 34216 | AMR | 1 | 0 | 6 | 28 |
| 7302286 | p1 | 2015-06-05 10:19:42.822 | 00:00:00.000000 | 5 | 1 | 5 | 5 | 0 | AMR | 0 | 0 | 6 | 1 |
| 7302285 | p1 | 2015-06-05 10:19:42.682 | 00:00:29.000214 | 5 | 29 | 2 | 2 | 1104 | AMR | 0 | 0 | 6 | 29 |
| 7301997 | p1 | 2015-06-05 10:19:42.507 | 00:00:01.000511 | 1 | 29 | 3 | 3 | 0 | AMR | 0 | 0 | 2 | 29 |
| 7304822 | p1 | 2015-06-05 10:19:42.450 | 00:00:01.000420 | 1 | 1 | 5 | 6 | 61 | AMR_WB | 61 | 0 | 2 | 1 |
| 7302284 | p1 | 2015-06-05 10:19:42.450 | 00:00:46.000256 | 5 | 13 | 7 | 7 | 1979 | AMR | 0 | 0 | 6 | 13 |
| 7303639 | p1 | 2015-06-05 10:19:42.431 | 00:05:01.000880 | 3 | 21 | 6 | 6 | 15081 | AMR | 0 | 0 | 4 | 21 |
| 7302449 | p1 | 2015-06-05 10:19:42.395 | 00:00:03.000700 | 3 | 21 | 5 | 5 | 312 | AMR | 0 | 0 | 4 | 21 |
| 7304501 | p1 | 2015-06-05 10:19:42.325 | 00:00:00.000453 | 3 | 18 | 2 | 2 | 21 | AMR | 0 | 0 | 4 | 18 |
| 7305636 | p1 | 2015-06-05 10:19:42.203 | 00:00:00.000220 | 1 | 6 | 4 | 4 | 12 | AMR | 0 | 0 | 2 | 6 |
| 7302283 | p1 | 2015-06-05 10:19:41.854 | 00:00:11.000000 | 1 | 22 | 1 | 1 | 551 | AMR | 0 | 0 | 2 | 22 |
| 7301994 | p1 | 2015-06-05 10:19:41.222 | 00:00:12.000600 | 3 | 29 | 4 | 4 | 631 | AMR | 0 | 0 | 4 | 29 |
| 7302894 | p1 | 2015-06-05 10:19:40.528 | 00:00:00.000280 | 1 | 11 | 2 | 2 | 15 | AMR | 0 | 0 | 2 | 11 |
| 7302282 | p1 | 2015-06-05 10:19:40.310 | 00:00:48.000400 | 5 | 5 | 1 | 1 | 2093 | AMR | 0 | 0 | 6 | 5 |
| 7301993 | p1 | 2015-06-05 10:19:40.211 | 00:00:05.000680 | 5 | 4 | 4 | 4 | 0 | HR | 0 | 0 | 6 | 4 |

NetSurveyorWeb™ CDR View (IP/TDM)

GL's [PacketScan™](#) or [T1 E1 / T3 E3 / OC-3 / OC-12 Hardware](#) probes non-intrusively monitor networks for both signaling and data. Almost all the standard protocols on 2G, 3G, and 4G wireless networks are supported.

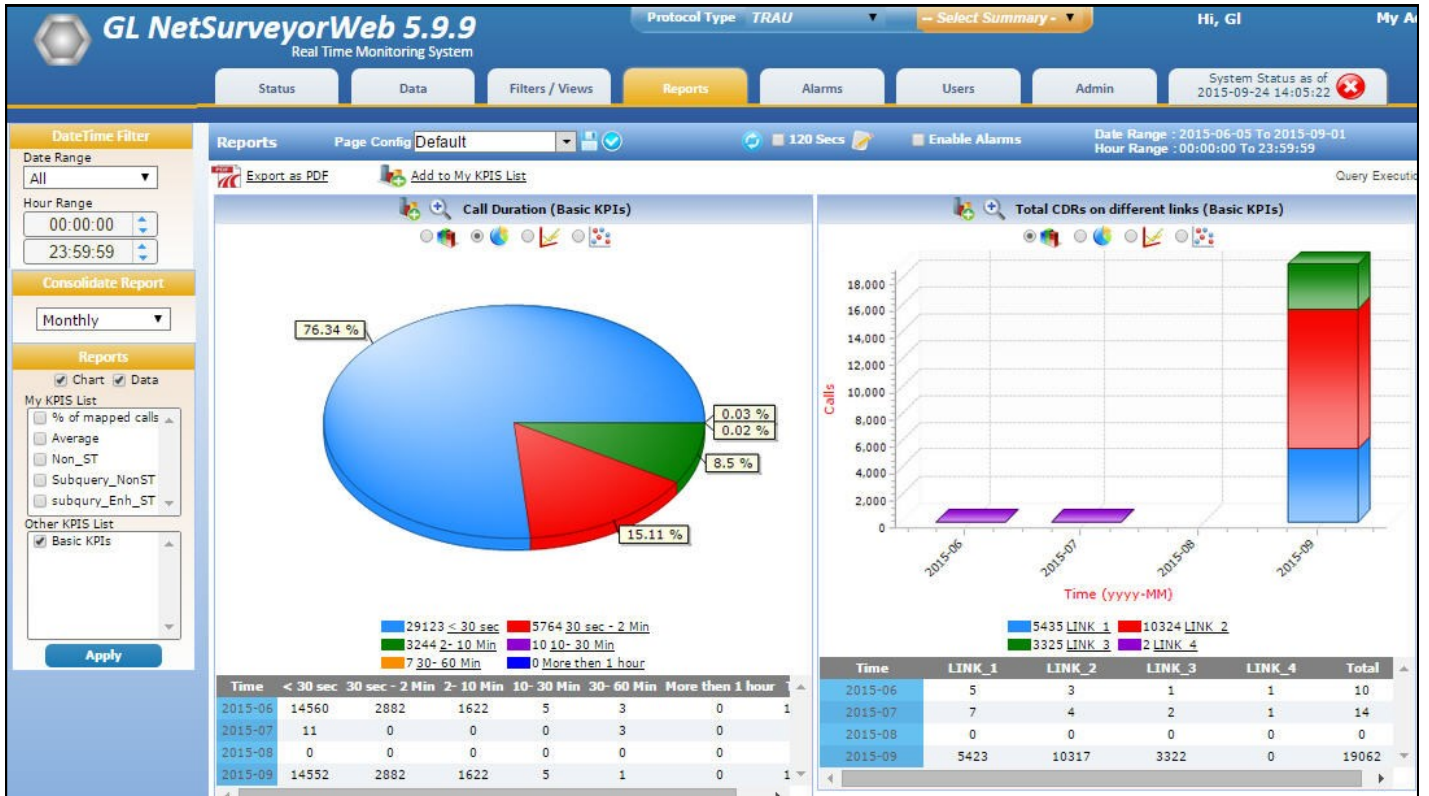
- These intelligent protocol analyzers extract relevant contents in a non-intrusive fashion, and forwards call detail records (CDRs) as well as statistics to a central DB for storage, display, and control
- A central database stores the real-time and historic data into a relational database (Oracle) using ODBC. A web-server accesses the data and allows clients across WAN to view results. It provides a user friendly interface to query and display database custom records
- [NetSurveyorWeb™](#) facilitates result display using a web interface. With this, one can view real-time data, navigate through records, filter the collected traffic summary, and graphically analyze the results through a simple web browser

For more details, refer to [Network Monitoring Solutions](#) webpage.

Wireless Network Monitoring and Surveillance System (over IP or TDM) (Contd.)

Supported Protocols

- LTE, Diameter, IMS (over IP)
- GSM A, GSM-R (over IP)
- GSM Abis and TRAU (over TDM)
- GPRS Gb and Gn (over IP)
- UMTS IuCS, IuPS, and IuH (over IP)
- All traffic – Digits, Tones, Voice, Video, T.38 Fax, Mobile GTP Traffic



NetSurveyorWeb™ – KPIs in Reports View

TDM and Optical Networks Monitoring and Surveillance System (T1 E1 T3E3 OC-3/STM-1 OC-12/STM-4)

The screenshot displays the NetSurveyorWeb CDR View (SS7) interface. At the top, it shows 'CDR Data' with 'Enable Alarms' and a date range of '2015-09-24 To 2015-09-24'. The call ID is '12760120'. Below this, there are tabs for 'Graph view', 'Details view', and 'Merge view'. The 'Decode Type' is set to 'ITU' and 'ANSI'. A 'Debug Summary (Export as CSV)' link is visible.

| FRAMENO | Timestamp | Probename | Card | Linkname | Linkname Directional | TS1 | TS2 | CIC | SLS | OPC | DPC | ISUP Message Type | Calling Number |
|----------|----------------------------|-----------|------|-------------|----------------------|-----|-----|-----|-----|-------|-------|-------------------|----------------|
| 53739208 | 2015-09-24 05:17:18.691000 | SS7_Probe | 1 | 1.1.1>2.2.2 | 1.1.1>2.2.2 | 23 | 23 | 1 | 1 | 1.1.1 | 2.2.2 | Initial Address | 9987095801 |
| 53739209 | 2015-09-24 05:17:18.821625 | SS7_Probe | 1 | 1.1.1>2.2.2 | 2.2.2>1.1.1 | 23 | 23 | 1 | 1 | 2.2.2 | 1.1.1 | Address Complete | |
| 53739210 | 2015-09-24 05:17:18.949000 | SS7_Probe | 1 | 1.1.1>2.2.2 | 2.2.2>1.1.1 | 23 | 23 | 1 | 1 | 2.2.2 | 1.1.1 | Release | |
| 53739211 | 2015-09-24 05:17:19.076625 | SS7_Probe | 1 | 1.1.1>2.2.2 | 1.1.1>2.2.2 | 23 | 23 | 1 | 1 | 1.1.1 | 2.2.2 | Release Complete | |

The bottom section shows a detailed debug summary for the selected call. It includes a sequence diagram on the left and a list of parameters on the right. The sequence diagram shows the flow of messages between nodes 1.1.1 and 2.2.2, including 'Initial Address', 'Address Complete', 'Release', and 'Release Complete'. The debug summary lists various parameters such as Service Indicator, Priority Code, Sub-service field, DPC, OPC, Signalling Link Code, and ISUP Layer parameters.

NetSurveyorWeb™ CDR View (SS7)

GL's provides non-intrusive analyzer probes for a network wide management of T1 E1 / T3 E3 / Optical lines, including line health, non-intrusive diagnostics, and much more. The essential elements of the systems are:

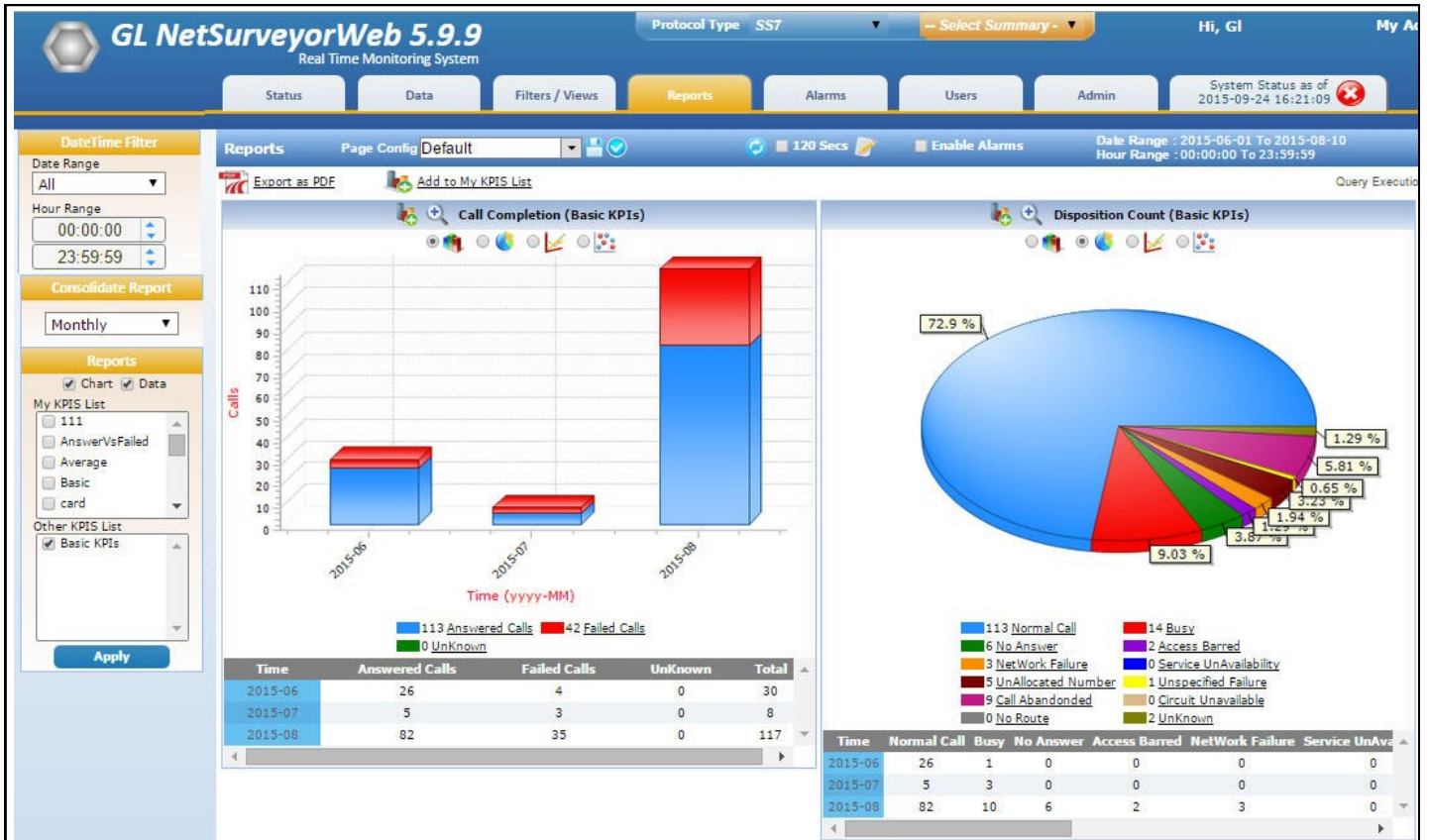
- [T1 E1 / T3 E3 / OC-3 / OC-12 Hardware](#) probes non-intrusively monitor networks for both signaling and data, including ISDN, SS7, GSM, TRAU, and others. These intelligent protocol analyzers extract relevant contents, and forwards call detail records (CDRs) and statistics to a central NMS for storage, display, and control.
- A central database stores the real-time and historic data into a relational database (Oracle) using ODBC. A web-server accesses the data and allows clients across WAN to view results. It provides a user friendly interface to query and display database custom records.
- The [NetSurveyorWeb™](#) is a web-based client connected to T1 E1 / T3 E3 / Optical probes through a web server and facilitates result display using a web interface as shown in the screenshot. The NetSurveyorWeb™ is driven by non-intrusive T1 E1 / T3 E3 / Optical hardware probes, intelligent software, and a database engine. With this, one can view real-time data (Probe name, Disposition, Calling number, Called number, Duration, and so on), navigate through records, filter the required call records (based on the start time and date of each call) through a simple web browser. Custom Filter option allows users to filter the call records based on various signaling and traffic data.

For more details, refer to [Network Monitoring Solutions](#) webpage.

TDM and Optical Networks Monitoring and Surveillance System (T1 E1 T3E3 OC-3/STM-1 OC-12/STM-4) (Contd.)

Supported Protocols

- SS7, ISDN
- GSM A, Abis, GSM-R, TRAU
- UMTS IuCS, IuH
- All traffic – Digits, Tones, Voice, Fax



NetSurveyorWeb™ – KPIs in Reports View

Digital T1 / E1 Line Monitoring, Test, and Diagnostic System

The screenshot displays the GL NetSurveyorWeb 5.9.9 interface. The top navigation bar includes 'Status', 'Data', 'Filters / Views', 'Reports', 'Alarms', 'Users', and 'Admin'. The main content area is divided into two sections: 'CDR Data' and 'Link Status'.

CDR Data Table:

| #ID | Probe Name | Datetime | Alarm Type | Alarm Condition | Port# | Alarm Count |
|------|------------|----------------------------|------------|-----------------|-------|-------------|
| 1312 | SS7_Probe | 2015-07-16 05:28:27.199000 | 3 | 2 | 1 | 1 |
| 1311 | SS7_Probe | 2015-07-16 05:28:27.199000 | 1 | 2 | 1 | 1 |
| 1310 | SS7_Probe | 2015-07-16 05:28:27.199000 | 3 | 2 | 1 | 1 |
| 1309 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1308 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1307 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1306 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1305 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1304 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1303 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1302 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1301 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1300 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |
| 1299 | SS7_Probe | 2015-07-16 05:28:27.199000 | 2 | 2 | 1 | 1 |

Link Status Table:

| Probe Name | Link Name | Circuit ID | Sync Loss | Carrier Loss | Blue Alarm | Yellow Alarm | AIS | Frequency Deviation | Line Level (dBm) |
|--------------|----------------|------------|-----------|--------------|------------|--------------|-----|---------------------|------------------|
| D1 | D1:1 | | (0) | (0) | (0) | (0) | (0) | -103 | 0.5 |
| SS7Probe_Lab | SS7Probe_Lab:4 | | (0) | (0) | (0) | (0) | (0) | | 0.5 |
| SS7Probe_MD | SS7Probe_MD:1 | | (0) | (1) | (1) | (0) | (0) | | |
| SS7Probe_MD | SS7Probe_MD:2 | | (0) | (0) | (0) | (0) | (0) | | |
| SS7Probe_MD | SS7Probe_MD:3 | | (0) | (0) | (0) | (0) | (0) | | |
| SS7Probe_MD | SS7Probe_MD:4 | | (0) | (0) | (0) | (0) | (0) | | 0.5 |

NetSurveyorWeb™ for T1 E1 Physical Layer

GL's T1 E1 Network Monitoring System provides network wide management of T1 and E1 lines including line health, intrusive diagnostics, non-intrusive monitoring, and much more. It's a web-based client connected to TDM probes (SS7, ISDN, GSM,...) through a web server that facilitates result display using a web interface.

The essential elements of the systems are:

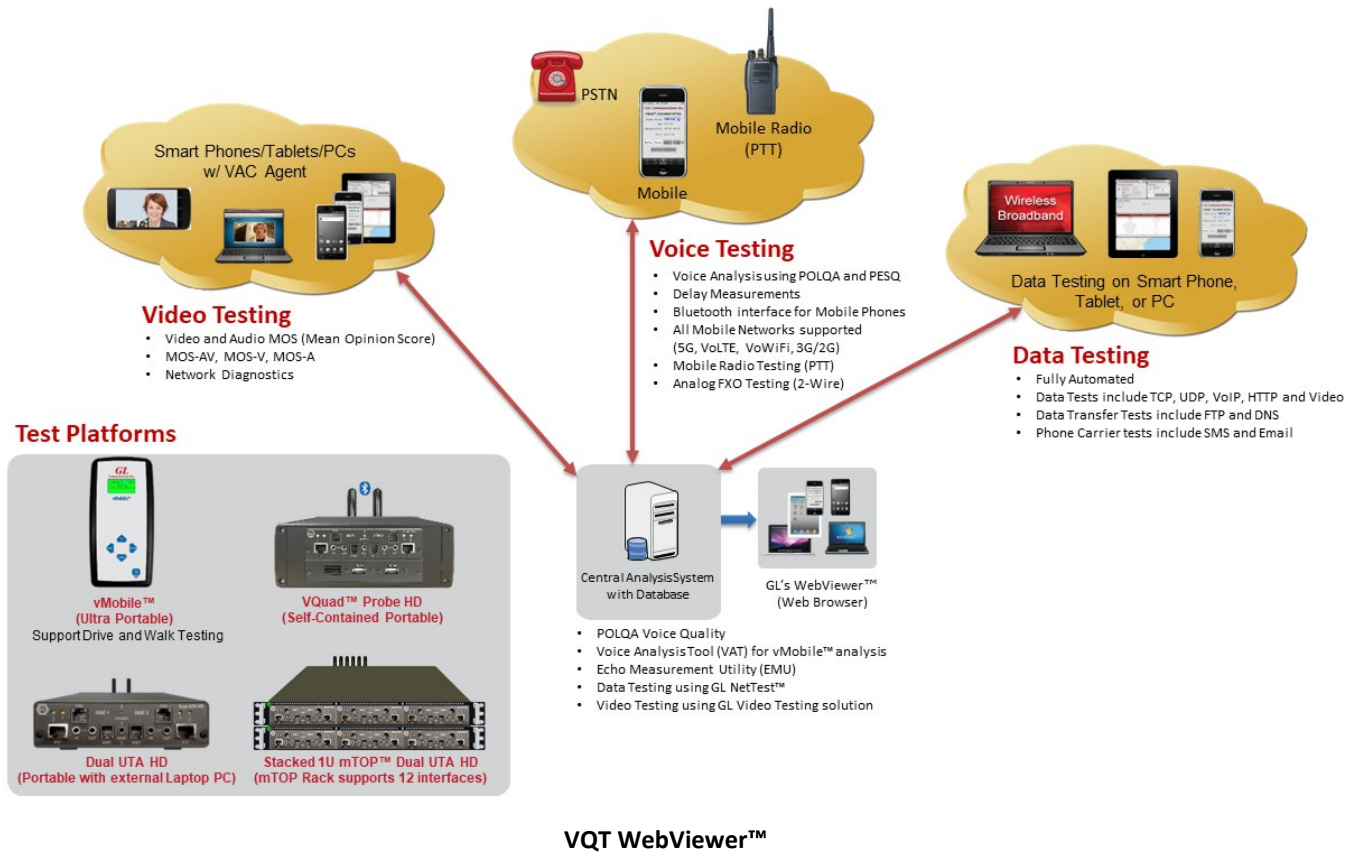
- PC based [T1 and E1 probes](#) that collect physical and line level status and performance information. The Intrusive and Non-intrusive "probes" for TDM networks are deployed at strategic locations in a network. They can transmit and collect voice, data, protocol, statistics, and performance information. These probes can relay information to a central / distributed Network Management System (NMS)
- A "[T1 E1 J1 Switch](#)" for non-intrusive monitoring or intrusive diagnostics; The switch is "fail safe" during power disruptions and USB controlled by the PC that houses the probes
- The web-based client [NetSurveyorWeb™ for T1 E1 Physical Layer](#) provides an instant overall graphical view of the health of the TDM network with drill down to individual lines; secure access through WEB; remote monitoring and diagnostics to troubleshoot any T1 E1 line; and a central database and applications for controlling, collecting, and analyzing the information provided by the various probes

Supported Alarms

- MTP Layer Status
- Sync Loss, Carrier Loss
- Yellow Alarm, Blue Alarm, AIS
- Frequency Deviations and Power Level
- Customize Alarm Conditions
- Generate email alerts, visual alerts, audible alerts, and even logs

For more details, refer to [Digital T1 E1 Line Monitoring NetSurveyorWeb™](#) webpage.

Voice, Video, and Data Quality Monitoring System (Wireless, IP, and TDM Networks)



GL's WebViewer™ provides real-time voice, video, and data quality measurements across a diverse set of networks. Voice, Data, and Video calls are automatically placed between end points; quality is measured and provided for display at an NMS. Voice Quality Testing (VQT) supports international standard voice quality test methods, including, PESQ, POLQA, MOS (Mean Opinion Score), Round Trip Delay (RTD), Jitter, Clipping, Voice band quality metrics, etc. Video Quality Test Solution provides support for Android, PC and Linux based clients (end points) for active Video Quality Testing. The Data Tests supported includes TCP, UDP, VoIP, Route, HTTP, FTP, DNS, SMS, Email, PhoneInfo, SIMInfo, and UEInfo.

The essential elements of this system are:

- Intrusive VoIP / TDM Nodes** - GL's VQuad™, is a low density network probe used for proactive testing of end-to-end voice connections. It is a common probe for Wireless, VoIP and TDM networks
- Controls individual or multiple wireless, landline or VoIP telephony terminals. Various associated applications (Voice Quality, Video Quality, Data tests, Echo and Delay tests, Fax tests, Voice Band Analysis) works with VQuad™ to provide "end-to-end assessment" with additional test and measuring capabilities. All the results are automatically transferred to the Central Database for access via the GL WebViewer™
- Voice Quality Testing (VQT) - software for analysis according to widely accepted ITU (International Telecommunications Union) voice comparison algorithms (POLQA, PESQ LQ/LQO/WB). GL also supports mobile device based manual and automated Voice Testing using NetTest VQT app (supported on rooted Android devices) within the network
- The **WebViewer™** uses a simple web browser with facilities to query the results either manually or automatically as well as output the results/statistics. These results include [VQuad™](#) Call Event, User Defined Events, Bluetooth® events, [Data Test](#) (NetTest from PC and NetTest from Mobile Device), [VQT, VBA, Delay and Echo Measurement](#) results and [Fax TxRx Events](#) which can be saved to either text or Excel format. WebViewer™ includes support for user-defined statistics with both tabular and graphical outputs

For more details, refer to [Intrusive Method of Speech Quality Assessment](#) webpage.

Buyer's Guide

| Item No | Product Description |
|------------------------|--|
| PKV170 | Network Surveillance Software with Centralized Database Engine and Client |
| PKV175 | T1 E1 Physical Line Monitoring Option for Network Surveillance - requires PKV170 |
| PKV172 | ISDN Call Detail Record (CDR) Option for Network Surveillance - requires PKV170. requires OLV100 at the central site. |
| PKV092 | CAS Call Detail Records (CDR) Option for Network Surveillance. requires OLV092 at the central site. |
| PKV173 | SS7/SIGTRAN Call Detail Record (CDR) Option for Network Surveillance - requires OLV120 for SS7 and PKV106 for SIGTRAN at the central site. |
| PKV174 | GSM (TDM or IP) and TRAU Call Detail Record (CDR) Option for Network Surveillance - requires OLV150 for GSM and OLV153 for TRAU at the central site. |
| PKV176 | VoIP (SIP, MGCP, MEGACO etc.) Call Detail Record (CDR) Option for Network Surveillance - requires PKV101 at the central site. |

| Item No | Related Software |
|------------------------|-------------------------------------|
| PKV169 | Network Surveillance Lite Software. |
| PKV171 | Network Surveillance Agent Toolkit |

| Item No | Related Hardware |
|------------------------|--|
| PKV100 | PacketScan™ - (Online and Offline) |
| PKV120 | PacketScan HD™ w/4 x 1GigE |
| PTE001 | tProbe™ Dual T1 E1 Laptop Analyzer |
| XTE001 | Dual T1 E1 Express (PCIe) Boards |
| TTE001 | tScan16™ T1 E1 Boards |
| FTE001 | QuadXpress T1 E1 Main Board |
| ETE001 | OctalXpress T1 E1 Main Board plus Daughter Board |

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

For more information, refer to [NetSurveyorWeb™](#) webpage.



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