Network Monitoring Solutions for VoIP Network

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GL’s Network Monitoring Solutions

- VoIP Non-Intrusive Monitoring System
- VoIP Intrusive Monitoring System
- TDM Non-Intrusive Monitoring System
- TDM Intrusive Monitoring System
- References
A Few References

• US Postal Service - TDM & Packet Monitoring Solution
  – 600 T1 lines monitored
  – 100 LANs monitored

• US Air Force - SS7 & ISDN Monitoring Solution
  – 52 T1 E1 ISDN & SS7 with Voiceband Traffic

• Fairpoint Communications - SS7 Monitoring Solution
  – 56 T1 SS7 - still growing

• TDM & Packet Solutions
  – Hundreds to thousands sold every year
  – Almost every major equipment manufacturer and carrier in the world
References...USPS Deployment

USPS Deployment Details:

• 600+ T1 lines monitored simultaneously
• 70+ PacketScan™ monitoring locations
• Customizable views per site, per link, per problem
• Real-time and historical alarm displays
• Intrusive T1 BER testing using T1E1 Switch
• Quick T1 E1 J1 Switch hardware development specifically for USPS
• Customized software at probe and webservice locations
• PacketScan™ customized for USPS protocols - very quick response
GL's solution for USPS features an instant overall view of the health of the entire network with the ability to successively drill down to individual T1 lines.

Maintenance engineers can securely access the network view from literally "anywhere" that Internet access is available. They can also monitor, diagnose, and troubleshoot any T1 line remotely with simple to use scripts. The system can also monitor USPS's "Ethernet" traffic at all USPS hub locations.

More details, please visit http://www.gl.com/uspspressrelease.html.
References…USPS Deployment
Web Portal Interface
A Typical Deployment Scenario
GL's Network Monitoring Solutions (NMS) VoIP & TDM
Probes deployed at strategic locations in a network can transmit and collect voice, data, protocol, statistics, and performance information.
GL's Network Monitoring Solutions
VoIP & TDM

• Probes deployed at strategic locations in a network can transmit and collect voice, data, protocol, statistics, and performance information

• Probes relay information to a central / distributed Network Management System (NMS)
  • Client-server based
  • Web based system
  • Control, collect, and analyze the information provided by various probes
VoIP Network Monitoring Solutions

- Non-Intrusive

  - Packet and VoIP Monitoring and Surveillance System
    - PacketScan™ - Stackable PC Probes
    - Central Server with Oracle Database
    - Web Portal

- Voice Band Analyzer
  - Stackable PC Probes
  - Voice Quality Measurement – Speech Level, Noise, Echo
  - Central Server with Oracle Database
  - Web Portal
VoIP Network Monitoring Solutions...

- Intrusive

- Wireless / Wireline / VoIP Voice Quality Testing and Monitoring System
  - VQuad™ with VoIP / TDM / 2-Wire / Wireless Call Control
  - Client Server Architecture
  - Remote Client or Web Portal
  - Low Capacity – low cost – widely distributed

- PacketGen™ - Bulk Calling Suite – Client-Server Architecture
  - Stackable SIP Cores
  - Stackable RTP Cores
  - Remote GUI
GL's VoIP Network Monitoring Solutions...
Non-Intrusive (Passive) Network Monitoring Solutions for VoIP

- PacketScan™
- PacketScan™ with Voice Band Analyzer
VoIP NMS – Non Intrusive Solution 1
With Packet Monitoring Probes
Packet Monitoring Probes

- **PacketScan™ probe** monitors packet flows in real-time within a VoIP network.
- Supports all major VoIP protocols such as SIP, H.323, Megaco, and MGCP.

The essential elements are:
- **PacketScan™ probe**: Gathers IP packet details non-intrusively and forwards call detail records (CDRs) and statistics to a central database.
- **PacketScanWeb™**: Displays real-time data; navigate through records, and filter the collected VoIP traffic summary.
- **Central database**: Stores the data collected by the probes.
- **WebServer**: Provides real-time and historic views of the data through various 'browser based' clients.
VoIP NMS – Non Intrusive Solution 1
With Packet Monitoring Probes

- Multiple probes at different locations
- Monitoring different types of data (Protocols, QOS Statistics)
- All probes connected to centralized storage location (Database)
Non-Intrusive Solution

PacketScan™

- Monitor up to 50 to 100 calls per second per 1U rack PC probe
- Wide protocol support including VoIP Traffic Analysis
  SIP / H323 / Megaco / MGCP / RTP / RTCP / Video Analysis
- Widest selection of codecs supported (G.711, G.729, G.723, G.726, iLBC, GSM, SPEEX and so on)
- Performs detailed analysis of voice band streams
- Centralized monitoring system designed around open architecture for third party application integration
High Capacity PacketScan™ Architecture

Gateway — Fail Safe Network Tap — Traffic Segregation

PacketScan™ PacketScan™ PacketScan™ (Non-Intrusive)

To Central Data Base
Non-Intrusive Solution

PacketScan™...

• Gathers total packet count, reordered, duplicate and missing packet counts, gap, jitter, and delay

• Call Quality Of Service (QOS) for all calls with E-Model based (G.107) Mean Opinion Score (MOS) and R-factor

• Most of the processing (CDR, XDR, Wave file recording, etc) is performed at probe to reduce traffic over network, redundant local (probe) storage

• Results
  – Unlimited recording of signaling and traffic subject to hard disk storage
  – Collection and transmission of measurement data to central site database
  – A web server for remote access of near real time measurements
  – Customizable and detailed report development capability
PacketScan™…
Graphs
Non-Intrusive Solution

PacketScan™…

Graphs

GAP

JITTER
Non-Intrusive Solution

PacketScan™...

Graphs

Mean Opinion Score (Mos) During Call

MOS
Non-Intrusive Solution

PacketScan™...

Graphs

Quality Factors

RTP Packets Graph
Non-Intrusive Solution

PacketScan™...

Graphs

MOS

R-Factor
Non-Intrusive Solution

PacketScan™...

VQ Mon Settings
Jitter Buffer

VQ Mon Settings
Configurable E-Model Base Parameters
PacketScan™ Probe Benefits

- Data processing performed by software only probes
  - Allows quick upgrades and modifications
  - Utilizes and exploits the power of the latest PC processors (quad-core and beyond)

- Incrementally scalable architecture – ideal for small to large enterprise level deployments

- Fail-safe network taps with bifurcation hardware used to ease data presented to individual probes

- Statistics gathered on all traffic. Call recording (waveform captured) used on trigger-met calls
Remote Probe Control

- Ability to configure individual probes remotely – Provide full bios-level visibility to PC's video, keyboard and mouse controls
- Remote PC power cycling
Non-Intrusive Solution

PacketScanWeb™

Displays:

- Traffic summary ID, probe name, calling number, called number, start time, and duration

- View the information about direction, payload, SSRC, total, missing, duplicate, reordered packet count, packets discarded, delay, jitter, gap
Non-Intrusive Solution

PacketScanWeb™ …

![GL Communications Inc. PacketScan™ Real-time Monitoring System](image)

**DB Table Name:** SYSTEM.VOIPTRAFFICSUMMARY

<table>
<thead>
<tr>
<th>Traffic Summary ID</th>
<th>Probe Name</th>
<th>Calling Number</th>
<th>Called Number</th>
<th>Start Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1112922</td>
<td>Houston_IPTrunk</td>
<td>UserID1@192.168.10.120</td>
<td>UserID1@192.168.10.119</td>
<td>08:30:09.737</td>
<td>00:00</td>
</tr>
</tbody>
</table>

**Columns:****
- **Traffic Summary ID**
- **Probe Name**
- **Calling Number**
- **Called Number**
- **Start Time**
- **Duration**

**Columns (Detailed):****
- **Payload**
- **Total Packet Count**
- **Missing Packet Count**
- **Dropped Packet Count**
- **Reordered Packet Count**
- **Conversational MOS/R**
- **Listening MOS/R**
- **Packets Discarded**
- **Cumulative Packet Loss**
- **Gap (Min/Max/Average)**
- **Delay (Min/Max/Average)**
- **Jitter (Min/Max/Average)**
Non-Intrusive Solution

PacketScanWeb™ ...

- Users can specify the index of the starting record to be displayed to customize the navigation
Non-Intrusive Solution

PacketScanWeb™ ...

- Filter the required call records based on the start time and date of each call
Features Easily Added

- Customer Access and Report Viewing
- Report Customization
- Call Correlation Capability
Customer Access and Report Viewing

- Secured login access per customer
- Presents customer specific filtered data
- Customizable report viewing (Quality of Service Results)
- Maps call records from multiple monitoring locations to a single individual call
- Ladder Diagrams
VoIP NMS – Non Intrusive Solution 2

With Voice Band Monitoring Probes
Voice Band Analyzer Probes

- Wireless, VoIP & TDM Probes gather voice files non-intrusively and feed it to VBA for analysis
  - VoIP Probe – PacketScan™
  - TDM Probe – T1 E1 Cards with CCA option
  - Wireless Probe - GSM, CDMA, and 3G Call Capture Products
- Scalable network solution for detailed analysis of voiceband traffic
- Software defined architecture
- Operates on recorded calls in near real-time from VoIP and TDM networks
Non-Intrusive Solution

Voice Band Analyzer Probes...

- Monitor noise, line echo, acoustic echo, speech levels and voice activity factor

- 100 to 500 calls per hour per 1U rack PC probe

- Results
  - Unlimited storage of results for analysis subject to hard drive size
  - Collection and transmission of measurement data to central site database
  - A web server for remote access of near real time measurements
Non-Intrusive Solution

VBA Web View

Displays:

- Call ID, direction of the call, probe name, calling number, called number, start time,
- Elapsed time, speech level/% active, RMS/noise level, clip, DC offset, and more
Non-Intrusive Solution

VBA Web View...

- Users can specify the index of the starting record to be displayed to customize the navigation
Intrusive (Active)
Network Monitoring Solutions for VoIP

- VQuad™ with VQT System
- PacketGen™
Voice Quality Testing (VQT) & Monitoring System (VoIP/ TDM/ Wireless)

- Integrated solution for TDM, 2-Wire, VoIP, and Wireless networks

- Low density network solution for proactive testing of voice connections end-to-end

- Components
  - VQuad™ Command Center (per Region) - Remotely controls multiple Distributed VQuad™ Nodes (Sites)
  - Distributed VQuad™ Nodes - Controls individual or multiple wireless, landline, and / or VoIP telephony terminals
  - Remote Client NetViewer™ - Remotely monitors and controls centralized command center and each Distributed VQuad™ Nodes
  - Voice Quality Testing (VQT) Software
Intrusive Solution

VQuad™ Command Center...
Scheduler –
Run SuperScript(1) at 9am
Stop SuperScript(1) at 159pm
Run SuperScript(2) at 2am
Stop SuperScript(1) at 559pm
Run SuperScript(1) at 6pm
Stop SuperScript(1) at 859am

SuperScript –
Start SiteScript(1), SiteScript(2), SiteScript(3)
Pause 20 min (run time)
Stop SiteScript(1), SiteScript(2), SiteScript(3)
Pause 5 min (off time)
Start SiteScript(4), SiteScript(2)
Pause 30 min (run time)
Stop SiteScript(4), SiteScript(2)
Pause 3 min (off time)
SiteScript –
Start CallControlScript(1)
Pause 5 min (run time)
Stop CallControlScript(1)
Pause 1 min (off time)
Start CallControlScript(2)
Pause 8 min (run time)
Stop CallControlScript(2)
Pause 1 min (off time)

CallControlScript -
Continuous Run
Start AFT(1) Local
Start AFT(1) Remote
Place Call
Perform RTD
Disconnect Call
VQuad™ Command Center...

- Controls all distributed sites (network nodes)
- Full automation, scripting, and scheduling for the entire region
- Voice transmission and reception tasks for each site at user-defined times
VQuad™ Command Center

- Controls & monitors working status of each VQuad™ Node (Site) in real-time
- Provide automation using scripts & scheduler
- Gathers the received (degraded) voice files automatically from each site
- Queries for VQT measurement results, RTD (Round Trip Delay) results, along with Call Control and error / data logs
- Allows defining threshold level for statistics – Auto generates email if results fall below threshold
Intrusive Solution

Distributed VQuad™ Node

DCOSS, APS, MobNetMon™, PacketGen™, T1E1 Analyzer

TCP/IP

Reference Voice Files

VQT Analysis

Degraded Voice Files

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Distributed VQuad™ Node…

- Mobile Phones or Radios
- Analog / Digital / VoIP Phone Handsets
- FXO Analog Interfaces, i.e. 2-Wire PSTN
- VoIP (SIP / RTP) Interface
- T1 E1 (ISDN / CAS) Interface
Intrusive Solution

Distributed VQuad™ Node...

Features

- Supports 4 to 8 simultaneous connections to telephony devices (Wireless, VoIP, Analog, 2-Wire, T1E1 (ISDN/CAS))
- Software defined architecture
- Automated traffic generation/reception with full synchronization including voice/digits/tones
- Automated call control scripts for individual probes and entire network
- Remote access & control of VQuad™ using NetViewer™
Intrusive Solution

Distributed VQuad™ Node Features…

- Assess Voice Quality using VQT Analysis Software

- Results
  - Detailed logging with Time stamping
  - Unlimited storage of results for analysis
  - Collection and transmission of measurement data to central site database

- Bi-Directional testing, Round-Trip Delay Measurement

- Drive Testing with optional real-time mapping (Map your coverage)
Intrusive Solution

Remote Client NetViewer™
Remote Client NetViewer™...

- Control individual Command Centers (per Region) and individual sites
- Build / edit individual VQuad™ and Command Center automation scripts
- Start / stop automation test
- Complete status of command center (per region) and individual sites
Remote Client NetViewer™...

- Query VQT results including MOS, jitter, clipping, RTD, call control
- Complete statistics of current region including VQT, RTD, Call Control
- Provide real-time script flow of each individual test
Intrusive Solution

Voice Quality Analysis Software
Voice Quality Analysis Software...

- Supports ITU standard algorithms - PESQ LQ/LQO per Rec. P.862/P.862.1, PAMS per Rec. P.800, PSQM per Rec. P.861

- Threshold Rating System (Excellent / Good / Fair / Poor)

- Automatically or manually analyze the degraded files using VQT Software

- Sort / Search capability on results

- Complete logging of results within database

- Detailed results including Jitter (min / max / avg), Clipping (front/back/all), Latency, and Noise / Signal Measurements (activity / peak)
VoIP NMS - Intrusive Solution 2

Intrusive Solution

- Automated command line scripts for traffic
- Remote PacketGen™
  - Graphical User Interface
  - Command Line Interface
- Additional Nodes - Increased traffic for a specific SIP node
A PC-based real-time VoIP bulk call generator

Medium density network solution for stress testing and precise analysis of VoIP networks
PacketGen™ Features

- **Manual and Bulk Call generation**
  - Various traffic generation capabilities – voice, tones, digits, and more
  - Up to 250 concurrent calls with full duplex RTP
  - 50 to 100 calls per second per 1U rack PC probe
  - Multiple probes with single GUI at central site
  - Generate test calls to IP Phone, ATA, PSTN, Wi-Fi, Cellular
  - Software defined architecture

- **Scalability**
  - Central or Distributed architecture for SIP/RTP core

- **Remotely Controllable**
  - CLI scripting ideal for regression testing
PacketGen™ Features...

- **Codecs**
  - G.729ab, G.726, G.711 (A-law, µ-law)
  - GSM, AMR (Narrow band and Wideband)
  - EVRC, SMV, ILBC (15.2kbps and 13.33kbps)
  - SPEEX (Narrow Band and Wideband)
  - G.722.1, G.722 and ISAC

- **RTP Impairment**
  - Latency, Packet loss, Duplicate and Out of order Packets
  - Automated and user-defined Impairment generation on individual calls

- **Voice-band Generation and Analysis Capability**
  - Real-time DTMF, MF, Tones, Levels, Spectral, and Oscilloscope Displays
PacketGen™ Features...

- Assess Voice Quality using ITU-P.862.1 and 862.2 (wideband codecs)
  - Record and Listen to Live Calls
  - Voice Quality Rating of results as Excellent, Good, Fair, Poor

- Results
  - Unlimited storage of results for analysis
  - Collection and transmission of measurement data to central site database
PacketGen™ - Applications

- Stress Testing
  - Load Router DSPs, Load Network pipe
  - Find Gateway access limitations
  - Generate proxy registration load

- Error handling
  - Test error correction
  - Jitter buffers

- Regression and Acceptance Testing
  - OEM testing
  - Field Acceptance Test Traffic Generation

- Matrix Testing
  - Distributed network call agent-to-agent over customer networks
  - One-Way Transmission – Send bi-directional traffic to verify continuity
  - Service Level Agreement Verification
PacketGen™ - Command Line Interface

- Operate PacketGen™ from a DOS based console (instead of the GUI) or easily integrate into their other applications

- CLI supports all the functionalities of the GUI except the configuration functions
Intrusive Solution

PacketGen™ - Scripting Traffic Actions

- Simple user interface to create scripts
- Automated script control of traffic - Detect Digits and Tones, Play/Record files, ...
- Conditional Statements, Stack Multiple Actions
Thank You!

Questions Period