SS7 Analysis and NetSurveyorWeb^m

GL Communications Inc.

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Platforms



tProbe[™] - Portable USB based T1 E1 VF FXO FXS and Serial Datacom Analyzer



Dual T1 E1 Express (PCIe) Board



Quad / Octal T1 E1 PCIe Card

tScan16™ with 16-port T1 E1 Breakout Box





SS7 Analyzer

- Decodes different SS7 layers like MTP2, MTP3, ISUP, TUP, SCCP, INAP (CS1, CS2), IUP, BICC, BISUP, BTUP and many application layer protocols from GSM/GPRS network like MAP, CAMEL(CAP), IS 41 etc.
- Supports the following types of SS7analyzers:
 - Real-time SS7 Analyzer
 - Remote/Offline SS7 Analyzers



Key Features

- Perform real-time / offline / remote analysis
- Consolidated GUI Summary of all decodes, detail & hex-dump views of each frame, statistics

view, & call detail record views

- Supports various protocol standards for proper decode
- Capture options Channel selection, CRC, bit reversion, bit inversion, scrambler and more
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields.
- Call Detail Recording feature includes data link groups that help in defining the direction of the calls in a given network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links



Key Features (Contd.)

- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, calling number, called number, and more are displayed
- Fine tune results with filtering and search capability based on OPC, DPC, ISUP message types, SCCP message types, CIC, and more
- Extensive statistics measurement ability
- Exports Summary View information to a comma delimited file for subsequent import into a database or spreadsheet
- Capability to export detail decodes information to an ASCII file
- Trace File Saving Options
- Remote-access capability



Different Views

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Different Views (Contd.)

- Summary View: This pane displays the columns that contain Card Number, Timeslots, Frame Number, Time, Frame Error Status, DPC, OPC, Status Field, SCCP Message, CIC, ISUP Message, and more in a tabular format
- **Detail View**: This pane displays in detail about a frame to analyze and decode by selecting it in the summary view
- Hex Dump View: This pane displays the frame information in HEX and ASCII format
- **Statistics View**: This pane displays the statistics that are calculated based on the protocol fields
- **Call Trace View (Optional)**: This pane displays the call specific information for each individual call from the captured data and display the information in an organized fashion



Protocol Standards



Please visit http://www.gl.com/ss7.html for a complete list of supported protocols & specifications for SS7



Real-time Analysis

- Streams can be captured on the selected time slots (contiguous or noncontiguous), sub-channels (fractional DS0 to DS1), Hyper-channels (n x 64 kbps, n x 56 kbps), or full bandwidth
- Frames may also be captured based on their FCS (16 bits, 32 bits, none), bit inversion, octet bit reversion, user/network side options
- Recorded trace file can then be analyzed offline
- Capability to export summary view details to comma separated values (CSV) format for subsequent import into a database or spreadsheet
- Capability to export detail decode information to an ASCII file

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Real-Time Capture

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Communications

Offline Analysis

File

- Off-line analysis is equivalent to capturing a file in pre-defined timeslots
- Captured frames or only the filtered frames can be exported to *.HDL file for the further off-line analysis
- Trace file for offline analysis can be loaded either through analyzer GUI or through simple command-line arguments





Invoke Offline Analysis (CLI)

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Communications

Offline Analysis GUI

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Filters - Real-time Capture Filter

Capture Filter		<u> </u>
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- Real-time capture filter can be set prior to capturing frames
- Real-time filter for HDLC based protocols is done by excluding LSSU (Link Status Signal Unit), FISU (Fill-in Signal Unit), or any other user-defined frame



Filters – Offline View Filter

- Isolates required frames from all frames in real-time, as well as offline
- Allows filtering according to various layers and protocol fields such as BIB, FIB, BSN, FSN, status field, DPC, OPC, SLC, SSN, ISUP message type, SCCP message type, and more





Search Options



• Search features helps users to search for a particular frame based on specific search criteria



Statistics

- Statistics is an important feature available in protocol analyzer and can be obtained for all frames both in realtime as well as offline mode
- Numerous statistics can be obtained to study the performance of the network based on protocol fields and different parameters

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Call Detail Records

- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, called number, calling number, release complete cause, OPC, DPC, etc. are displayed
- CDR Find option allows to search a particular call detail record from the captured traces

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Saving options for the trace files

- Captured trace files can be controlled by saving the trace using different conventions such as –
 - Trace files with user-defined prefixes
 - Trace file with date-time prefixes
 - Slider control to indicate the total number of files, file size, frame count, or time limit

Menu checked options Protocol standard selection Network/User side selection	Using View Filter C All Frames (no filtering) C Filtered Only (use view filter) Save File Names	e Directory	<u></u>
' Time Format ['] View Filter View Search	© Sequential File Names	file name prefix	HDL file name suffix mber of digits
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Define Summary Columns

- Required protocol fields can be added through Define summary column option
- User can remove the protocol field which is not required





Data Link Group

 Data link groups that help in defining the direction of the calls in a given network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links

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Configuring INI Decode Options

 INI configuration file enables the user to enter the required custom values depending on the protocol

INI Decode Options		
Save Load Default		
Select summary columns to display Menu checked options Menu checked options Network/User side selection View Filter View Filter View Search TCP Connection Options Periodic Trace Saving Options Startup Options Data Link Groups Fre View Font Size INI Decode Options Capture Options	Edit INI C:\Program Files\GI Communications Inc\Usb E1 Analyzer\SS7Prot.ini [#PDU_ASSEMBLY] PDU_ASSEMBLY D11_NAME 0="ProtCantSS7ScortXudtAssemblu D11." PDU_ASSE \$\$77Prot.ini = Notepad [#MAP_VER] PDU_ASSEMBLY_D1L_NAME 0="ProtCantSS7ScortXudtAssemblu D11." PDU_ASSE \$\$77Prot.ini = Notepad [#MAP_VER] PDU_ASSEMBLY_D1L_NAME.0="ProtCaptS87ScortXudtAssembly.D1L" PDU_ASSEMBLY_PARSE_LEN_VAL_FILTER_LIST.0="ALL LEN 32-4096" [#MAP_VER] [#MAP_VER] IMAP_VERSION_VALUE = 99 CAMEL_VE [#INAP_VERSION_VALUE = 1] [NAP_CS_VERSION_VALUE = 1] [INAP_CS_VERSION_VALUE = 2] [#POTOCOD SSNINAP_M SSNINAP_N ;CAMEL_VERSION_VALUE = 6 SSNINAP_M ;POTOCOL_VERSION_VALUE = 3 SSNIAP_M (#PROTOCOL_VERSION_VALUE = 3) SSNINAP_MAX = 12 SSNINAP_MAX = 12 SSNINAP_MAX = 12 SSNINAP_MAX = 12 SSNIAP_M \$	
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TCP Connection Options

- Used for Network Surveillance and Monitoring
- Designed to send protocol summary information and binary frame data via TCP- IP connection to a Database Loader to load data into a database

TCP Connection Options	
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Select summary columns to display Menu checked options Protocol standard selection Network/User side selection Time Format View Filter View Search Periodic Trace Saving Options Startup Options Data Link Groups F_{F_F} view Font Size INI Decode Options Capture Options	IP Address (127.0.0.1 Local) IP Port 127.0.0.1 20019 Probe Name P1 Send Call Detail Records Send Traffic Summary Select Frame/Packet Information to be sent over TCP/IP Frame Octets SubCh Status Dev TStot SubCh Status Error VPI VCI PT HEC OSF AAL Type Frame Type CID LI UUI CPI ScOP PDU Type MessageType(UNI) Endpoint Ret/Val CRV TypeOfCall V



Save/Load All Configuration Settings

- Provides a consolidated interface for GUI and protocol settings required in the analyzer such as protocol selection, periodic saving options, etc.
- Configuration settings can be saved to a file, loaded from a configuration file, or just revert to the default values using the default option

Select summary columns to dis Menu checked options Protocol standard selection Network/User side selection	play As Captured Inverse Captured User Defined Network Side	Cards/Interfaces (comma delimited ranges)
Save in: 🔁 Usb E1 Analy	yzer 💌 🗲 I	€ 💣 🖩 -
A-Law Samples	CDMA	C Gprs
🗋 ARP	🚞 Data	🚞 Gr303
🚞 atm	🚞 Digital Echo Canceller	🛅 Gsm
🚞 Ber	🛅 docs	🛅 hdlc_isdn
🛅 Bin2Frame	🛅 dtmf	🛅 hlp
📄 BitFiles	🚞 Filter Files	🛅 IsdnEmulator
🛛 🛅 calldata	🛅 FrameRelay	
	🛅 GlcView	🛅 Mtd Files
🗋 capdata		
Capdata		<u> </u>



NetSurveyorWeb[™]- Network Surveillance System





Network Overview





Three Tier Architecture

NetSurveyor™								
Probes								
Data Storage								
	5							
Browser Access								



Data Storage

- A listener application is co-hosted with the database server running on the Data Layer, collecting data posted by the probes
- Supports MySQL and Oracle Database
- Stores the CDRs and Signaling Summary data





Browser Based Access

• Access captured data over the web using an application such as GL's NetSurveyorWeb™



Browser based Clients



NetSurveyorWeb™

- Scalable and Flexible Architecture
- Multiple Probes (T1 E1/IP) non-intrusively monitor at remote locations
- Probes Feed Data to Centralized Database (Oracle, My SQL)
- Real-time and/or historical data
- Multi-user support, and user-friendly interface
- Accessible via browser-based clients (locally or remotely)
- Provides database query methods to query captured results, and gather status, statistics, and events
- Results are displayed both in tabular and graphical formats
- Provides protocol signaling, traffic, and call detail records (CDRs)
- Perform filter and/or search for specific information



Applications / Value

- Remote Protocol Analysis and Troubleshooting
- Traffic Optimization Engineering
- Call Detail Records, Statistics
- Quality of Service Measurements
- Revenue and Billing Verification
- Alarm Monitoring and Logging

Graph view Details view	Debug Summary(Export as CSV) Decode Type: OsS	57 ITU SS7 ANSI Back	^
5.33.205(23)	215.5.6(23)		
Initial Address		Card2 TimeSlot=23 Frame=0 at OK 10:31:20.962625 :	Len=65
5 33 205<->215 5 6		HDLC Frame Data + FCS	
Address Complete		======================================	-
Address Complete		BSN	= .1000000 (64)
215.5.6<->6.33.205		BIB	= 1 (1)
Call Progress		FSN	= .1010111 (87)
215.5.6<->5.33.205		FIB	= 1 (1)
Answer		LI	=111100 MSU Format
215.5.6<->5.33.205		======== MTP3 Layer ====================================	-
Release		Service Indicator	=0101 ISDN User Part
215.5.6<->5.33.205		Priority Code	= Priority Code 0
Release Complete		Sub-service field	= 10 National Network
5.33.205<->215.5.6	▶	DPC	= 215.5.6(00000110 00000101 110
		OPC .	= 5.33.205(11001101 00100001 00
		Signalling Link Selection	- 01110100 (116)
		circuit There and (272)	
		Circuit Ident Code (CIC)	- 11000110000001 (454)
		Mandatory Fixed Daramators	- 00000001 Initial Address
		Nature Of Connection Ind. Deremeter	
		Satallite indicator	00 No satellite sirguit
		Continuity shock indicator	
		Echo control dev ind(NatureofCon Ind)	= 1 Outgoing half echo c
		Forward Call Indicators Parameter	outgoing hair echo e
		Incoming international call Indicator	=0 Not an incoming inte
		End-to-end method indicator	=00. No end-to-end method
		Interworking Indicator	=0 No interworking enco
		IAM segment, ind (ForwardCallInd)	=0 No indication
		ISDN User Part Indicators	=1 ISDN User Part used
		ISDN User Part Preferences Indicators	= 00 ISDN User Part prefe
		ISDN User Part Access Indicators	=0 Originating Access n
		SCCP Method Indicator	=00. No Indication
<	V	1 waa ala ala ala ala ala ala ala ala ala	- · · · · ·
•			



NetSurveyorWeb™





Few References

- US Postal Service TDM and Packet Monitoring Solution
 - ➢ 600 T1 lines monitored
 - Over 100 LANs monitored
- US Air Force SS7 and ISDN Monitoring Solution
 > 52 T1 E1 ISDN and SS7 with Voiceband Traffic
- Fairpoint Communications SS7 Monitoring Solution
 > 56 T1 SS7 still growing
- TDM and Packet Solutions
 - Hundreds to thousands sold every year
 - > Almost every major equipment manufacturer and carrier in the worlds



Complex SS7 Networks - Actual Customer Example





SS7 Call Flow

CALLID : 2237	442 Go Back										
Graph view	Details view Merge view	Decode Type : 💿 ITU 🔵 ANSI			<u>Debug Summary (Expo</u>	rt as CSV)					
FRAMENO		Probename	Card	Linkname	Linkname Directional	TS1	TS2	CIC	SLS	OPC	
15439877	2015-07-01 03:10:55.570857	SS7	1	1.1.1>2.2.2	2.2.2>1.1.1	0	0	21	26	2.2.2	1.1.1
15439878	2015-07-01 03:10:55.720285	SS7	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2
15439879	2015-07-01 03:10:55.865857	SS7	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2
15439983	2015-07-01 03:11:10.920285	SS7	1	1.1.1>2.2.2	2.2.2>1.1.1	0	0	21	26	2.2.2	1.1.1
15439984	2015-07-01 03:11:11.066142	SS7	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2







Merge View

CALLID : 2237442	Go Back											
Graph view	Details view Merge view	Decode Type : 🔘 ITU 💿 ANSI			Debug Summary (Export	as CSV)						
FRAMENO	Timestamp	Probename			Linkname Directional			CIC	SLS	OPC	DPC	ISUP Message Type
15439877	2015-07-01 03:10:55.570857	SS7	1	1.1.1>2.2.2	2.2.2>1.1.1	0	0	21	26	2.2.2	1.1.1	Initial Address
15439878	2015-07-01 03:10:55.720285	SS7	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2	Address Complete
15439879	2015-07-01 03:10:55.865857	SS7	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2	Answer
15439983	2015-07-01 03:11:10.920285	557	1	1.1.1>2.2.2	2.2.2>1.1.1	0	0	21	26	2.2.2	1.1.1	Release
15439984	2015-07-01 03:11:11.066142	557	1	1.1.1>2.2.2	1.1.1>2.2.2	0	0	21	26	1.1.1	2.2.2	Release Complete

- I - I



Device1 Frame=0 at 03:10:55.570857 OK Len=46		
Ethernet Frame Data		
======== MTP2 Layer =========	=	
BSN	=	.1010100 (84)
BIB	=	1 (1)
FSN	=	.0010011 (19)
FIB	=	1(1)
LI	=	101001 MSU Format
======== MTP3 Layer =========	=	
Service Indicator	=	0101 ISDN User Part
Priority Code	=	00 Priority Code 0
Sub-service field	=	10 National Network
DPC	=	1.1.1(00000001 0000001 00000001)
OPC	=	2.2.2(00000010 00000010 00000010)
Signalling Link Selection	=	00011010 (26)
========= ISUP Layer ==========	=	
Circuit Ident Code (CIC)	=	00010101000000 (21)
Message Type	=	00000001 Initial Address
Mandatory Fixed Parameters	=	
Nature Of Connection Ind. Parameter	=	
Satellite indicator	=	00 No satellite circuit in the connection
Continuity check indicator	=	00 Continuity check not required (default)
Echo control dev.ind(NatureofCon.Ind)	=	0 Outgoing half echo control device not included
Forward Call Indicators Parameter	=	
Incoming international call Indicator	=	0 Not an incoming international call
End-to-end method indicator	=	00. No end-to-end method available
Interworking Indicator	=	0 No interworking encountered
IAM segment.ind(ForwardCallInd)	=	0 No indication
ISDN User Part Indicators	=	1 ISDN User Part used all the way
ISDN User Part Preferences Indicators	=	00 ISDN User Part preferred all the way (default)
ISDN User Part Access Indicators	=	1 Originating Access ISDN



Customized Filters

Custom Filters	
Called number Image: Control of the state o	
Basic O Expression	
Add Filter Clear All Show Expression	
Called Number S5551234 And Add Condition X	
Status Data Filters / Views Reports Alarms	Admin
DateTime Filter CDR Data CDR Data Date Range: 2012-06-22 Hour Range: 00:00:01 To Hour Range: 00:00:01 To	To 2012-07-10 23:59:59
Date Range All Hour Range 00:00:01 Export as PDF Filter : called number Query Execution Time : 0.03600 Seconds	
23:59:59 V Quick Search: Call Id C Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	View View
Apply LINKNAME(S) <u>Call Id</u> <u>Probename</u> <u>Called Number</u>	<u>Starttime</u>
Call Flow 591 SS1 5551234	2012-07-10 16:21:29
Call Flow 588 SS1 5551234	2012-07-10 16:21:29
Column View Call Flow 590 SS1 5551234	2012-07-10 16:21:29
called number	2012-07-10 16:21:29
Call Flow 586 SS1 5551234	2012-07-10 16:21:28

User can filter the data displayed by defining one or more Custom Filters profiles. Multiple Filter option
allows users to filter the data by multiple filter profiles



SS7 Key Performance Indicators (KPI)





GSM KPI



VoIP Key Performance Indicators (KPI)



Notifications / Alarm Alerts



Alert Types

- Email Alerts
- Visual Alarm
- Audible Alarm
- Set Alarm Severity
- Log to File

- Define real-time network conditions to generate alarms
- Define different actions based on the generated alarms



Alarm Configuration

	Alarm Configu	ration				
p1 Load	Existing Profile Delete	New Profile Nam	enew alarr	m profile Sav	e	
Alarm Condition	Condition Name Billing Durat	ion				
Add Filter Clear All Filters Show Expression Filter1 AND			Alarm Ty Visual V	ype Audible	Export Data	Alarm Severity Minor 💽 🗹 Log
Billing Duration Secs 💌 <u>GreaterThan</u> Billing Duration Secs 💌 <u>LessThan</u>	12 Ex: 40.02875 15	<u>And</u>	Email Alerts	kokulkarni@ql.com:s	Send Email	
	EX: 40.02675		Subject: Message:	SS7 Alarams This is SS7 alaram b	based on cic value	

- Alarm Condition provides the options to set the filter conditions for the alarm
- Alarm Action provides options to set the actions to be taken when an alarm is detected such as the visual alarm type, audible alarm type, exporting data, set alarm severity, log to file, and generate email alerts



Alarm Status and Log

- Each alarm profile can be set against Date-Time, and Sampling Rate condition during which the selected Alarm Condition is said to be active
- For example, if the user selects 5 minutes as the sampling rate, NetSurveyorWeb[™] will check for the alarm conditions every 5 minutes and triggers the actions such as a visible alert or sending an email alert as set in the alarm configuration

					Alarm S	tatus				
					Add	Save				
	- 1				and and a					
Alarm Name	Alarm	Type Alar	m Count		lime Filter	r	Action E	xpected lime		Delete
ew alarm profile	e 💌 Minor	-	0	Now TO NoLimit (DN All Days at ev	very 1 Minute	<u>Time Filte</u>	<u>s</u> Start		<u>Delete</u>
					Alarm Log					
	14 4	Page 1 of 9)		View Records pe	r page: 20	•	Total : 1	176	
	ALARM_ID	ALARM_S	EVERITY	LINE_NUMBER	MI	ESSAGE		TIMEST	ГАМР	
	246	0		273				2012-07-02	16:10:48	
	246	0		272				2012-07-02	16:04:48	
	241	0		271				2012-07-02	15:58:51	
	214	0		243	This is SS7 alar	am based on	cic value	2012-06-29	11:35:51	
	214	0		242	This is SS7 alar	am based on	cic value	2012-06-29	11:10:51	
	214	0		241	This is SS7 alar	am based on	cic value	2012-06-29	11:07:51	
	214	0		224	This is SS7 alar	am based on	cic value	2012-06-28	17:50:40	
	214	0		223	This is SS7 alar	am based on	cic value	2012-06-28	17:18:40	
	214	0		222	This is SS7 alar	am based on	cic value	2012-06-28	17:09:40	
	214	0		221	This is SS7 alar	am based on	cic value	2012-06-28	17:07:18	



Report Generation



Call Flow

8698

SS7-Probe

00:00:00.048250

0.014625



Probe / Loader Status

🏵 🔲 120 Secs	2		Probe Status		
	<u>Probe Name</u>	<u>Probe Status</u>	Last Data Received Timestamp	Delete	
	♣ VOIP-SIP	OFFLINE	2014-10-15 12:24:59	Delete Probe	
	VOIP-SIP	OFFLINE	2014-10-15 08:04:52	Delete Probe	
	VOIP-PORTA	OFFLINE	2014-10-15 12:38:44	LOADER	STATUS : ONLINE
	- VOIP-PORTA	ONLINE	2014-10-15 12:50:45	- Co	Name : GLWEB
	Probe Name Pro	be IP Address Probe Type	Last Online Confirmation First Online Confirmation Last	Dat Connection	n to Database : Connected
	VOIP-PORTA 10.	2.12.22 CDR	2014-10-15 12:50:47 2014-10-10 13:58:03 2014	-10	Log Enabled : Yes
	🕂 SS7-Probe	ONLINE	2014-10-15 12:50:44	Total Prob Unique Prob	es Connected: 4 es Connected: 2
	🕂 SS7-Probe	ONLINE	2014-10-15 12:50:44	Summary Re	cords Loaded : 1253355
	✿ SS7_Probe6	ONLINE	2014-10-15 12:50:45	VBA Re	cords Loaded : 0
	SS7_Probe6	OFFLINE	2014-10-14 14:56:31	Summary DB CDR DB	Insert errors: 0 Insert errors: 0
	♣ SS7_Probe4	ONLINE	2014-10-15 12:50:45	VBA DB	Insert errors : 0
	♣ SS7_Probe4	OFFLINE	2014-10-15 03:21:29	Average record	15 per second : 76 Is per second : 71
				Maximum record	is per second : 14065

- Occurance of Overrun : 0
 - Total Overruns : 0
- Total number of messages : 30

Thank you