Testing Emergency Call Services: 911, Enhanced 911 (E-911) and NG-911

Presenters:





Vijay Kulkarni Matt Yost

GL Communications Inc.

Test & Measurement Solutions

Technical Consulting Services

GL Communications Inc. - Overview

- Located in the United States Gaithersburg, Maryland
- Founded in 1986
- Engineering Consulting Services
- Test & Measurement Equipment
 - Wireless, VoIP, SONET-SDH, TDM
 - Visualization, Capture, Storage, Portability, Cost-Effectiveness



Background

- Rapid emergency services are essential
- FCC mandate locate callers < 50 meters / 80 percent of time 2021
- A Landline phone has a fixed location
- A VoIP phone can be relocated
- A Mobile phone is mobile, but locatable
- TTY, TDD, or Relay for Deaf
- Text-to-911 is becoming available
- Almost all mobile phones have GPS
- Smartphones have accurate location info and can provide it directly to PSAPs

Over the Top (OTT Apps for 911)

- Apple announced iPhone users who call 9-1-1 to automatically and securely share their location data with PSAPs
- The announcement could refocus wireless 9-1-1 location to device-based solutions from network-based technologies.
- Smartphone based location is better than network-based because smartphones are providing better accuracy, emergency call routing, and emergency caller tracking

911 Landscape – Past, Present, Future

- Why test CAMA trunks? After all, they are 2-wire legacy circuits
- **Carriers** rapidly transitioning to IP and Wireless infrastructure from Legacy
- PSAPs will be last to convert from Legacy to NG, price sensitive, tax payer funded
- Evolution 911, E-911, NG-911, OTT
- Gateways to interface to Legacy PSAPs

911 and E-911 Emergency Services



Introduction

- Centralized Automatic Message Accounting (CAMA) Trunk 2 wire analog trunk
- Selective Router (SR) routes the call to the proper PSAP
- Public Safety Access Point attendant and dispatch centers for emergency vehicles
- ANI Automatic Number Identification (ANI) i.e. the calling number of the distressed person
- Database Lookup calling # to street address

CAMA 2-wire Trunks vs. 2wire LoopStart Subscriber Lines

CAMA Trunk

- No Dial Tone in response to Off Hook
- ANI
- Answer Supervision
- Wink

2-wire LoopStart

- Dial Tone in response to Off Hook
- No ANI
- No Answer Supervision
- No Wink



Next Generation 911 (NG-911) Emergency Services



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Past Related Webinars



LoCation Services (LCS) in Mobile Networks – Architecture and Test Methods Mar 2017

00:51:28

Presented by : Matt Yost & Savita Majjagi

Test 911 and E-911 Emergency Services



911 Test Requirement & Solutions

- **Requirement**: One of the major PSAP vendor wished to emulate and analyze legacy 911 Emergency calls to test their 911 elements (PSAP, 911 Selective Router)
 - Emulate T1 CAMA trunks with CAMA signaling for the purpose of testing 911 Selective Router and/or the PSAP side
 - Emulate an analog PSAP trunk again either 911 Selective Router side and/or the PSAP side
 - > Analyze analog CAMA trunk with CDR, signaling analysis, digit analysis, and more
 - > Easy set up via GUI, but also programmability to satisfy slight variations

911 Test Requirement & Solutions...

- **Solution**: GL's versatile tProbe or any of our T1 E1 rack mount solution can perform all the requirement functionalities.
 - Generate/Receive 911 Emergency CAMA calls over T1 in bulk, and continue indefinitely
 - > Be the 911 Selective Router or the PSAP end or both simultaneously
 - Generate 911 Emergency CAMA calls over analog FXO or FXS, and continue indefinitely
 - > Follow the CAMA protocol precisely MF signaling for "calling #"
 - Reverse Battery
 - > Analyze/monitor T1 CAMA trunks for 911 calls, generate CDRs, get precise protocol exchange

Required GL Hardware, Software, and Accessories

- High End Notebook PC (SA005d),
- tProbe T1 (PTE001) with FXO/FXS Card (PTE015)
- Software MAPS FXO/FXS (PTA624), MAPS CAS Emulation (PTA651), CLI support for both MAPS

products (PKS170), MAPS SIP (PKS120), RTP Core (PKS102).

Digital CAMA Simulation



 CAMA emulation capabilities include - seizure and wink start detection, onhook and offhook detection and MF digit (ANI) generation/detection.

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Analog CAMA Simulation via Channel Bank



- for CAMA. The tProbe™ T1 line is connected to Channel Bank with FXO cards for interfacing to 2-wire equipment (911 selective router).
- Single FXO board within the channel bank can convert one digital T1 line into 8 Analog lines.

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Originating CAMA Call Simulation (FXO ports)



- The tProbe[™] FXO port can be directly connected to 911 selective router or PSAP on CAMA-type circuits for simulation of CAMA calls to the selective router or PSAP.
- The script will seize the line, wait for wink, dial ANI and wait for call connect.

Terminating CAMA Call Simulation (FXS ports)

- tProbe[™] FXS port connected to central office or selective router for terminating CAMA calls.
- The script will detect seizure from far side, provide wink, wait for ANI, and connect the call.



Monitoring of CAMA type trunks using MAPS[™] FXO FXS

- The tProbe[™] T1 FXO port can be tapped onto CAMA-type circuits for non-intrusive monitoring of 911 service.
- Monitoring capabilities include seizure and wink start detection, onhook and offhook detection and MF digit (calling party ANI) detection.
- A normal analog call is routed based on the destination (called party) phone number.
 However, 911 calls are routed based on the calling party number.



Call Monitoring Process of a 10-digit ANI Transmission

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	KP 42421	30000 ANI				
	NF 92921		12:59:42.796000			
	- NF 42421					
	Ringback Tone	e (optional)	12:59:43.068000			
	Ringback Tone	e (optional)	12:59:43.068000			

2-Wire Line Volt Graph



The monitoring script is used to monitor a CAMA line between the central office and selective router, or between the selective router and PSAP. This script continuously monitor line current and voltages of FXO and FXS ports.
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Demonstrations



Next Generation 911

Introduction (NG-911)

- The FCC mandates that all PSTN, VoIP, and Wireless networks provide 911 services.
- NG 911 networks based on NENA i3 standards multimedia
- Text-to-911 services already becoming available

Test Solutions for Next Generation 911 (NG-911) for Public Safety



Test Requirements for NG 911

- Test NG-PSAP(s) for Voice calls, SMS and Instant Messaging
- Test solution to simulate SIP+MSRP endpoints, establish the connected sessions, and record related transport statistics on the MSRP text flows as part of the results
- Testing call performance based on different voice codec, narrowband and wideband codec
- Scripts to perform advanced tests using SIP methods like SUBSCRIBE/NOTIFY, REFER and INFO for testing NG 911 interfaces.
- API Integration for automated testing
- Test advanced voice features such as interactive voice response (IVR), conferencing
- Measurement and reporting tools to monitor overall network health, signaling performance, call volume quality vs time, call duration, identify problem and alert management
- Speech quality measurements Listening MOS, Conversational MOS, PESQ, POLQA, Delay, SNR, Signal Level, Packet Loss

GL's Test Solutions for NG-911

- GL offers enhanced MAPS[™] SIP emulator for Emergency Services Internet Protocol Networks (ESInets) to enable call delivery using Session Internet Protocol (SIP), as well as Instant Messaging (IM) delivery conforming with RFC 4975/4976 - Message Session Relay Protocol (MSRP) protocol.
- MAPS[™] SIP allows SIP vendors, wireless carriers, NG-911 service providers, and emergency communications centers to test IP applications for satisfactory working of NG-911 services prior to deployment.
- MAPS[™] SIP can simulate the end-points (SIP/RTP or SIP/MSRP User Agents) in an NG-911 network and send and receive communications over ESInets.

Typical IM Simulation between SIP/MSRP Endpoints



Audio and IM Call Generation

MAPS (Message Automat	ion Protocol Simulati	ion) (SIP) (MSRP) - [(Call Generation -	CallGenDefa	ult]						
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2 SipCallControl.gls	Profile0002	GL-MAPS_40_25626	66267-3638-3500@1	92.168.12.212	Stop	Send_File-Completed	SIP_TerminateCall		Pass	1	0
3 SipCallControl.gls	Profile0003	GL-MAPS_31_25593	37103-3628-3500@1	92.168.12.212	Start	PCMU Call Terminated	None		Pass	1	1
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IM Only Call Generation

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NetSurveyorWeb[™] for Monitoring Emergency Services Network

NetSurveyorWeb[™] – Main Features

- Web-based network surveillance system for air traffic monitoring
- Works with multiple PacketScan[™] Probes to non-intrusively monitor at remote locations
- Scalable and Flexible Architecture
- Real-time and/or historical analysis
- Multi-user support and user-friendly interface
- Filter and Search Options. Provides quick database query methods
- Results are displayed both in tabular and graphical formats
- Provides protocol signaling, traffic, and call detail records (CDRs)
- Generates Reports and Alarms.

NetSurveyorWeb[™] - CDR View (CAS)

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NetSurveyorWeb[™] - Playing Voice Files (CAS)



NetSurveyorWeb[™] - Call Graph (CAS)



NetSurveyorWeb[™] – CDR View (SIP)

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NetSurveyorWeb[™] – Reports and Graphs



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NetSurveyorWeb[™] – Notifications / Alarm Alerts

Alert Types

• Email Alerts

• Visual Alarm

• Audible Alarm

• Log to File

• Set Alarm Severity

AUDIBLE	NetSur	evor				
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LOG INTO TABLE	View Calls	156	testkpi	Minor	2014-10-16 11:08:16	alarm kpis
	View Calls	156	testfilter	Minor	2014-10-16 11:08:16	voip cdr alarm filter

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

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NetSurveyorWeb[™] – Notifications / Alarm Alerts



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Webinar and Live Demo

Click on the below Play icon to view the webinar



Call Flow Comparison using PSAP and Selective Router

Terminating to "PSAP"

Terminating to "Selective Router (SR)"



Off Hook, Reverse Battery (RB) Automatic Number Identification (ANI)

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PBX acts like a landline phone and sends 911 to a CO or in this case directly to a Selective Router

Call Flow Comparison using PSAP and Selective Router...

Termination to "PSAP"





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Thank you Any Questions?



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Technical Consulting Services