NENA
Information Document on:

The Effect of Mass Calling Events on Legacy SR to PSAP Trunking

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1 Executive Overview

This NENA Information Document (NID) discusses a situation that was observed when a Mass Calling Event to 9-1-1 occurred within a Legacy 9-1-1 system provider platform. Investigation by the Network Reliability Steering Committee (NRSC) determined that certain types of Legacy Selective Routers (SR) are susceptible to removing SR to PSAP trunks from service during high call volume events. This document will discuss certain procedures, and policies that NENA, Legacy SR Operators, Public Safety agencies, and other equipment and network providers can do, alone or together, to prevent the SR from removing trunks from service.

The Network Reliability Steering Committee (NRSC) created a document outlining their findings. It is ATIS-0100034, which can be located at www.atis.org in the document center. A copy of the recommendations made in ATIS-0100034 is included in Appendix A of this NENA Information Document (NID).

2 Introduction

2.1 Operations Impacts Summary

This NID suggests that PSAP operations and policies, including call handling during periods of high call volume, and the use of overflow routes to backup PSAPs are reviewed based on the findings outlined in ATIS-0100034.

2.2 Technical Impacts Summary

This NID identifies several specifications (NENA and other standards bodies) that need to be updated as a result of learning about this situation.

This NID also suggests that 9-1-1 System Service providers review and consider the findings in ATIS-0100034 to manage the situations of high call volume events more effectively.

2.3 Security Impacts Summary

There are no security impacts affected by this NID.

2.4 Document Terminology

The terms "shall", "must", "mandatory", and "required" are used throughout this document to indicate normative requirements and to differentiate from those parameters that are recommendations. Recommendations are identified by the words "should", "may", "desirable" or "preferable".

2.5 Reason for Issue/Reissue

NENA reserves the right to modify this document. Upon revision, the reason(s) will be provided in the table below.

Version	Approval Date	Reason For Changes
NENA-INF-002.1-2012	08/28/2012	Initial Document

2.6 Recommendation for Additional Development Work

As indicated above, there is additional standards development work that needs to be performed. This document identifies existing standards that should include a topic on inter-call timing.

2.7 Date Compliance

All systems that are associated with the 9-1-1 process shall be designed and engineered to ensure that no detrimental, or other noticeable impact of any kind, will occur as a result of a date/time change up to 30 years subsequent to the manufacture of the system. This shall include embedded application(s), computer-based or any other type application.

To ensure true compliance, the manufacturer shall upon request, provide verifiable test results to an industry acceptable test plan such as Telcordia GR-2945 or equivalent.

2.8 Anticipated Timeline

It is anticipated that there are limited short term solutions that can be used to alleviate the problem caused in certain situations by a mass calling event.

However, long-term solutions for Legacy SR to PSAP trunking may never be developed due to cost considerations and the expected network transition to a NG9-1-1 architecture. In that case, unless short-term solutions are enacted, the problem could continue to persist on some legacy systems.

2.9 Cost Factors

Some of the NRSC recommended procedure changes can be made with simple or low cost modifications.

However, it is believed that a full remediation would require extensive SR or CPE modifications, and may not be cost effective for most network providers, CPE providers, or Public Safety agencies to fully deploy considering the age of today's legacy 9-1-1 network.

Alternatively, the final solution may be a migration to a different network design, such as a Next Generation 9-1-1 network.

2.10 Cost Recovery Considerations

Depending on the solutions implemented, cost recovery (i.e., to cover the implementation or remediation solutions) may be non-existent, or an extensive process utilizing many sources of funds, including the use of surcharge, local, state or federal grants or contributions, or other cost recovery alternatives.

2.11 Additional Impacts (non cost related)

The information referred to in this NENA document is known to have minor impacts, based on the analysis of the authoring group, and development has been started. The primary impacts include:

- Updating various NENA, ATIS, and Telcordia Specifications,
- Modifying 9-1-1 System Service Provider Operation Procedures, as well as PSAP Operational procedures, and

- Reviewing and implementing further changes based on the ATIS document.

As of the publication of this document, several 9-1-1 System Service Providers have already implemented changes discussed within the ATIS specification.

2.12 Intellectual Property Rights Policy

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2.13 Acronyms/Abbreviations

Some acronyms/abbreviations used in this document have not yet been included in the master glossary. After initial approval of this document, they will be included. See NENA Master Glossary of 9-1-1 Terminology located on the NENA web site for a complete listing of terms used in NENA documents.

Acronyms Used in this Document		
Acronym	**Description**	**(N)ew (U)pdate**
ALI	Automatic Location Identification	
ANI	Automatic Number Identification	
ATIS	Alliance for Telecommunications Industry Solutions	
CAMA	Centralized Automatic Message Accounting	
CPE	Customer Premises Equipment	
DC	Direct Current	N
E9-1-1	Enhanced 9-1-1	
E9-1-1 SSP	Enhanced 9-1-1 System Service Provider	
E-MF	Enhanced-Multi-Frequency	N

Acronyms Used in this Document		
GR	Generic Requirement	N
IP	Internet Protocol	
MF	Multi-frequency	
NENA	National Emergency Number Association	
NG9-1-1	Next Generation 9-1-1	
NID	NENA Information Document	N
NRSC	Network Reliability Steering Committee	N
POTS	Plain Old Telephone Service	N
PSAP	Public Safety Answering Point	
SR	Selective Router	

The following Terms and Definitions are used in this document:		
Term	**Definition**	**(N)ew (U)pdate**
CAMA-Like trunks	Router to PSAP trunk typically using Enhanced MF signaling	N
Guard Timer	An amount of time that the network specifies a trunk will be unavailable for seizure upon becoming idle	N
Legacy 9-1-1 System Service Provider	Traditional ILEC acting as a 9-1-1 System Service Provider	N
Mass Calling Event	A period of high 9-1-1 call volume triggered by an accident, man-made, natural, or weather related event	N
p.01	The probability that a maximum of 1 in 100 calls will experience blockage during the busy season and busy hour.	
Telcordia	A Telecommunications Consulting Body	N

3 Operations or Technical Description

The following sections describe specific details of how 9-1-1 calling in a mass calling event impacts public safety.

3.1 Definition of a Mass Calling Event

From time to time, certain situations can occur that will cause the number of 9-1-1 calls being offered to increase over the maximum number of calls usually received by a 9-1-1 system, or that a PSAP is designed to handle, within any given time frame. The situations that trigger the large volume of emergency calls, both wireline, and wireless, can be from events such as those that are weather related, man-made, or as a result of an accident (i.e., Storm, Explosion, etc.).

When these situations occur, the general public usually responds by generating a large number of calls to 9-1-1, either to alert authorities to problems the caller is having themselves, or to report the situation on behalf of others. We refer to the period as a "mass calling event" or as a "period of high 9-1-1 call volume." Depending on the trigger, these events can be short duration, or last for several hours. Regardless of the duration, the added call volume can impact the ability of the 9-1-1 network to deliver calls to Public Safety Answering Points (PSAPs). It can also affect the ability of PSAPs to be able to handle the traffic, and dispatch the necessary emergency services.

3.2 Caller behavior during Mass Calling Events

During periods of high call volume to 9-1-1, not all calls can be answered as quickly and efficiently as Public Safety agencies typically are able to do during periods of normal call volume. In this case, some calls could experience network congestion and route to some sort of treatment (i.e. regular or fast busy tone, or an announcement that all circuits are busy, etc.). In some cases, callers may be routed to a PSAP that is busy handling other callers, and be placed in a queue, or receive ringing tone until a telecommunicator becomes available to answer the call. Finally, callers might also overflow route to a backup PSAP or non ANI/ALI location (i.e., POTS line) able to handle their call because all of the circuits to the primary answering point are traffic busy or out of service.

In cases where the call is not answered by a call taker, 9-1-1 callers usually do one of three things: wait for a call to be answered, hang up and re-attempt another call to 9-1-1, or hang up and do not call back to 9-1-1. During a high calling event, the latter two scenarios result in many abandoned calls. In addition, the increased number of calls and redial attempts to reach 9-1-1 results in a greater total number of calls made to 9-1-1, and also reduces the average time between calls.

3.3 Problem Statement

A blizzard on the East Coast of the United States during 2011 was one such event that triggered an extended period of mass calling to 9-1-1, resulting in a nearly continuous stream of calls being presented to the 9-1-1 network. New calls filled in the network immediately after previous callers disconnected, or abandoned their calls.

During this period, at least one 9-1-1 System Service Provider observed a situation where the number of calls during the event created a condition in which the Selective Router would release one call, and nearly immediately have another new call to offer to the PSAP.

The NRSC determined that in cases where there was a very short duration between calls, the PSAP CPE did not recognize a "disconnect" and "re-seizure" of a trunk as the presentation of a new call. This generated situations where the PSAP trunk did not respond to a new call as the SR would have expected. In some cases, the failure to respond occurred on two successive attempts on the same circuit. The NRSC concluded that if the provider followed standard practices for the telephone

network, any circuit with two successive call setup failures was automatically taken out of service, with the assumption that the circuit was faulty.

In cases where this was allowed to happen, the circuits to the PSAP could all be removed from service in a mass calling event. Without any overflow route or idle trunks to deliver the traffic to another PSAP or non ANI/ALI location, additional calls would be blocked.

Analysis of the situation identified a timing synchronization issue between the network Selective Router and the customer CPE. Further analysis indicated that there were areas in technical standards that did not address the inter-call intervals, so network and/or CPE behavior was ambiguous and not clearly defined by applicable standards.

3.4 Background on the Use of CAMA-Like trunks for the SR to PSAP interface

The Selective Router to PSAP interface in today's legacy 9-1-1 network typically uses "CAMA-like" trunks, commonly referred to as PSAP trunks. These trunks are based on the original inter-office CAMA (Centralized Automatic Message Accounting) circuits.

It was recognized long ago that this could be adapted for use in 9-1-1. The design was very reliable, and nearly ubiquitous in its deployment. It also was a method that could be used to pass a caller's telephone number toward a far end destination. Doing so would provide the 9-1-1 call center with additional valuable information (the caller's phone number) if the caller was unable to provide it to the call taker. Having that information not only allowed PSAPs to be able to call a caller back if they were disconnected, but the caller's number could be used to route a call, and/or trigger a dip into a database to retrieve the caller's telephone company account details, such as the name and address on the account (sometimes referred to as the Service Address).

3.5 PSAP trunk Signaling

The fundamental design of the PSAP trunk is a one way circuit with calls originated by the SR, and responded to by the CPE. Calls originated by the SR first send the caller's number (ANI) to the PSAP as a series of tones, and then a talk path is established between the caller and the call taker.

When a Selective Router has a call for a PSAP, it places a seizure on the trunk. When the PSAP has determined that it is ready to receive the caller's number (ANI), it responds with a "wink" back toward the SR.

When the call is complete, the SR typically releases the trunk toward the PSAP. If the PSAP releases the trunk first, it idles the circuit toward the selective router, and disconnects the call taker.

3.6 No wink due to short inter-call timing

The NRSC determined that during the mass calling event, the time between the SR releasing the trunk, and establishing a new call toward the PSAP was too short. This created a condition where the SR had a new call for the PSAP, but the PSAP thought that it was still connected to a previous call.

In this case, the CPE would not signal the SR with a wink. The SR in turn would wait a set period of time for the wink, and when it determined that the wink was not going to be provided, it treated that call as a no-wink condition.

Typically, a SR will have a time value established in its programming as the interval to wait before it decides that it has encountered a no-wink condition. In legacy 9-1-1 systems, this is usually a period between 4 and 16 seconds. (Most 9-1-1 system providers have this set at the lower value).

Typically, the legacy telephone network will automatically remove a circuit from service if it encounters two successive no-wink conditions on the trunk as a protection mechanism. However various types of 9-1-1 Selective Routing switches have options to prevent the removal of 9-1-1 circuits from service under these (no wink) conditions.

A no-wink condition on a PSAP trunk creates potential problems for the 9-1-1 network and the caller. It increases the perceived call setup time to the caller. This can cause further calls to be abandoned, and new calls attempted, increasing the load on the system. If procedures are not established to prevent PSAP trunks from being removed from service when they experience two successive no wink attempts, the SR to PSAP trunk group can be reduced in size, and ultimately have no active circuits remaining to carry the traffic. At that point, further calls will either overflow route, or experience a network busy condition and be routed to treatment (i.e., regular or fast busy, or a "calls cannot be completed" announcement).

3.7 ATIS NRSC document:

As discussed above, this situation has been earlier reviewed by the Alliance for Telecommunications Industry Solutions (ATIS) NRSC. They have produced a report titled *NRSC 9-1-1 CAMA Trunk Throughput Optimization Analysis* (ATIS – 0100034). Their conclusion supported the instance of short inter-call timing as a problem in mass calling events. The ATIS document discussed much of the technical issues related to this situation.

3.8 Standards review

The NRSC team determined that this was a timing situation between the SR and the CPE. They identified four standards that define the SR to PSAP interface:

- Telcordia GR-350-CORE (E9-1-1 Public Safety Answering Point Interface Between a 1/1AESS Switch and Customer Premises Equipment);
- Telcordia GR-2953-CORE (Enhanced MF Signaling: E9-1-1 Tandem to PSAP Interface);
- NENA 03-002 (NENA Standard for the Implementation of Enhanced MF Signaling, E9-1-1 Tandem to PSAP); and
- ATIS-0600414.1998(R2007) (Network to Customer Installation Interfaces – Enhanced 9-1-1 Analog Voice grade PSAP Access Using Loop Reverse – Battery Signaling).

The NRSC's review of these documents shows that the first three (GR-350, GR-2953, NENA 03-002) have no reference to timing intervals between calls. The ATIS document (ATIS-0600414) specifies that when a disconnect is from the caller direction the network (SR) shall apply an on hook signal toward the CPE for at least 700 mSec.[1] Therefore some of the standards and specifications on how to handle disconnects need to be further defined by the industry to clarify inter-call timing.

[1] See ATIS-0600414.1998 section 4.8.1.1

This NID recommends that if a document or standard addresses the router to PSAP signaling or behavior between the two locations that it includes a discussion about duration between calls. This NID does not define what the minimum inter-call interval is, or should be. We note however that the ATIS spec uses 700 mSec as the value. Other data and legacy 9-1-1 SR documentation indicates that a value of 1250 mSec[2], with an option for 1650 mSec, is used as a guard time between calls.

It is recommended that the following documents or standards should specify the need for some sort of inter-call interval. If possible, they should define that value, although the 9-1-1 industry may need to convene to agree upon what should be the industry accepted inter-call interval on a SR to PSAP trunk.

- NENA – 03-002
- Telcordia GR-2953- CORE
- Telcordia GR-350-CORE

The three standards listed above may not necessarily be the only documents that need to be modified to add a discussion of inter-call intervals. For example, participants should consider other sources of information regarding DC signaling states, such as, NENA 04-001 (E911 PSAP CPE TID) section 7.2.4.1 which indicates that periods of DC loop current interruptions up to 350 mSec might occur in or near the call setup period. Reviews of standards that reference "guard" timing could also assist in determining what the appropriate inter-call interval should be. A guard timer is a value that specifies the amount of time during which a trunk will be unavailable for seizure following a release, to allow the trunk to clear before being re-seized.

3.9 Changes to caller behavior relative to the evolution of the network

The NRSC document identifies how caller behavior has changed over the recent years from a predominance of wireline calls to a predominance of wireless calls. It also recognizes that many calls are not being made by a user that is having, or associated with the emergency, but are instead being made by a bystander or Good Samaritan on behalf of someone with an emergency.

This change in behavior creates situations that increase the number of potential callers for any emergency. If, for example, the average number of calls increases and is spread over the same number of circuits, then it stands to reason that the average interval between calls decreases.

In addition, since many calls are Good Samaritan type calls, those callers may have a tendency to abandon the call after a short period of ringing with the assumption that the emergency has already been reported. This however does not alleviate PSAPs from expending efforts in returning calls to those callers, and places further loads on the available public safety staff. This can place additional emergency calls in queue, many of which are of a short duration (i.e., for a previously reported incident), but the increase in call volume can further reduce the average period between calls.

Therefore, if the average period between calls has decreased in time, then the likelihood increases that the inter-call interval timing may be too short for the CPE to recognize a new call, and the 9-1-1 network can experience call setup problem between a legacy SR and PSAP CPE.

[2] Documentation from Lucent 5ESS switching documents.

3.10 NRSC List of Proposed Recommendations

This document, as well as the NRSC report, has noted how caller behavior and the number of telecommunications service providers that are delivering traffic to the 9-1-1 network has increased over time. This also has increased the likelihood of periods where short inter-call intervals could occur. The NRSC report has also indicated that in the case of one particular vendor's legacy 9-1-1 selective router, there is no current option to prevent short inter-call setup intervals from being generated.

During the drafting of the NRSC document, it was stated that there was a request made to the Legacy 9-1-1 Selective Router Provider affected by a mass call event in 2005 to modify the code in their switch to prevent calls from being offered to the PSAP with a short inter-call interval. The Legacy 9-1-1 Selective Router Provider's vendor chose not to modify their code and has declined more recent requests as well. However, they offered a suggestion to alleviate the problem. Their primary suggestion was to increase the router to PSAP trunk capacity and sizing (so that with more trunks, average inter-call timing would be less likely to cause problems when calls were spread over the larger trunk group).

Technical experts and PSAP Administrators recognize that an increase in trunk group sizing is not a solution as it neither guarantees that inter-call timing will be any less likely to be a problem during periods of mass calling, be economically feasible, or appropriate based on proper p.01 congestion control guidelines.

Therefore, the NRSC produced a list of recommendations that could be implemented to alleviate the problem, and create a network that self recovers after a period of high call volume. Details of the recommendations can be found in the ATIS document, and will not be individually discussed here[3].

Those recommendations include actions that the 9-1-1 System Service Providers, and Public Safety Entities could take as technical possibilities. Those included options that could be implemented in the short term to reduce the potential for future inter-call timing failures (allowing systems and providers to be more quickly alerted to the occurrence of the situation). It also included recommendations for the longer term, as the industry migrates away from the current TDM architecture toward an NG9-1-1 SIP based architecture.

It should be noted that these recommendations were formulated based on a list of available and possible technical solutions. Not all solutions will be appropriate for every 9-1-1 System Service Provider or Public Safety Entity.

3.11 Possibility of Similar Problems in a NG9-1-1 Environment

At the fundamental level, this problem was caused by the 9-1-1 network offering calls to PSAP equipment too quickly for the two entities to effectively communicate and manage the traffic. It is not guaranteed that this situation will not occur in a Next Generation environment just because the network will not utilize CAMA-Like (MF based) signaling.

In a NG9-1-1 environment, calls will be offered to the CPE as a SIP "INVITE" message rather than a seizure on an analog wired interface. In addition to the SIP "INVITE" message, there will be a

[3] The recommendations listed in ATIS-0100034 are included as Appendix A for the reader's benefit.

number of other SIP messages as well, that are used to route, establish, and eventually tear down or disconnect the "call." If any of those messages were to fail to be generated, or fail to reach its destination, then that could interrupt the call setup or disconnect in a manner similar to the legacy network not receiving a "wink" from the CPE.

This NENA Information Document recommends that the NG9-1-1 standards and protocols recognize the potential for failed call setups or disconnects, and address that issue as necessary. NG 9-1-1 network developers should design the network so that failed signaling messages do not create a similar situation that could be experienced in the legacy 9-1-1 network today. It shall be up to the NG 9-1-1 developers to determine what steps are necessary to address failed call setup or disconnects, and take appropriate actions to manage those occurrences. As 9-1-1 Service providers develop more experience through NG9-1-1 deployments, management techniques will be learned. These may involve re-routing the call to an alternate destination (based on policy routing rules), or it may entail canceling the call attempt altogether.

3.12 **Conclusion:**

The purpose of the discussion and information provided above is to alert the reader and user of legacy 9-1-1 systems of a situation that can occur in a particular legacy network 9-1-1 vendor's Selective Router equipment. Detailed technical analysis and recommendations were created by the Network Reliability Steering Committee in a special specification: *ATIS-0100034 NRSC 9-1-1 CAMA Trunk Throughput Optimization Analysis*, located free of charge at www.atis.org in the document center. The technical solutions and suggestions in the ATIS reference may not be applicable to each Public Safety Agency or 9-1-1 System Service Provider, but should be considered in relation to the political, technical, financial, and operational environment for each entity.

It has been suggested that migration away from the legacy MF network to a NG9-1-1 network will eliminate the problem that occurs due to short inter-call intervals in the legacy CAMA-Like world. However, it is uncertain that a similar situation won't occur in a NG9-1-1 world. As more experience is obtained in the provisioning, implementation, and management of Next Generation 9-1-1 systems, system managers will become more familiar with events that mimic failed call attempts or disconnects.

Readers of this document should consider the alternatives and manage their networks and 9-1-1 systems according to what is best for their callers, and Public Safety. In some cases, consultation between Public Safety personnel and 9-1-1 System Service Providers may be required to select a course of action appropriate and manageable for both entities.

4 Recommended Reading and References

- *ATIS-0100034 NRSC 9-1-1 CAMA Trunk Throughput Optimization Analysis*, located free of charge at www.atis.org in the document center.

5 Recommendations made in this document

This is a summary of the recommendations made within this document.

- Public Safety Professionals and appropriate Standards Setting bodies should determine as an industry what the appropriate "minimum" inter-call interval should be on a Legacy SR switch for CAMA-Like (Enhanced MF) PSAP trunks.
- NENA and Telcordia should update the following standards to include sections on "inter-call timing" based on the industry consensus based inter-call interval:
  - NENA 03-002
  - Telcordia GR-2953-CORE
  - Telcordia GR-350-CORE
- System participants should obtain, review, and implement any appropriate changes as suggested by ATIS-0100034. System participants include, but may not be limited to:
  - 9-1-1 System Service Providers
  - Selective Router manufacturers
  - 9-1-1 CPE manufacturers
  - Public Safety Answering Point management
  - NENA
  - Standards bodies
- NG9-1-1 Network and System Developers are encouraged to recognize that SIP signaling errors could generate call setup failures and other errors similar to the call setup failures caused by short inter-call intervals on CAMA-Like PSAP trunks. Developers of NG911 systems should make provisions for this possibility, and develop procedures to handle or manage those call failures or signaling errors according to standard IP based telephony practices.
- NENA should add the new Acronyms and Abbreviations listed in section 2.14 to the NENA Master Glossary of 9-1-1 Terminology (NENA 00-001).

6 Appendix A

Recommendations made in ATIS-0100034 *NRSC 9-1-1 CAMA Trunk Throughput Optimization Analysis*

NRSC Recommendations for 9-1-1 Selective Router Service Provider Mitigation[4]

A proposal of recommendations, considerations of best practices, and processes to prevent or mitigate this problem:

1) Strongly recommend that every PSAP trunk group have a 24x7 ANI/ALI capable backup PSAP capable of answering and dispatch calls in case the call overflows or the primary PSAP is out of service or traffic busy. Discourage PSAPs from choosing to have their calls overflow to busy tone treatment – even for wireless calls.

2) Properly size trunk groups such that they are not over-sized, to avoid ring-no answer conditions because there are more trunks than call takers available.

3) Identify or develop standards that can demonstrate to SR vendors or CPE vendors which functionality/features need to change or be corrected. If that option is available, correct the equipment.

4) Develop a list – based on testing – of CPE types that are more susceptible to the short call interval situation, so that 9-1-1 system providers know which PSAPs are more likely to experience the problem. While all CPE types may be susceptible to this issue, knowing the susceptibility of the PSAP's chosen CPE type will help 9-1-1 system providers prioritize likelihood of trunks being made busy during high call volume events, allowing better network management.

5) Revise procedures to provide more active monitoring of the network to identify service issues particularly during high 9-1-1 traffic load conditions, and/or implement temporary or permanent changes to the trunk busy percentage parameters in the SR to prevent trunks from being removed from service. The NRSC is not recommending specific busy percentage parameters, realizing that SR Service Providers are best suited to analyze their own networks and apply the percentage that best meets their needs.

6) Collaborate with NENA, Telcordia, and relevant ATIS Committees to recommend an update to their specifications of SR to PSAP trunks to clarify the call teardown and re-establishment timing parameters.

7) Similarly, recommend to vendors of Next Generation 9-1-1 (NG9-1-1) equipment to be aware of the problem, and make sure new calls (especially those that may be part of a "Denial of Service" attack) don't disconnect and re-connect before the program of the NG9-1-1 CPE is also ready to receive the next call.

8) Establish internal procedures to recognize trouble conditions, and notify Public Safety Agencies when they suspect something is wrong or are seeing network troubles. The appropriate PSAPs should be notified immediately when

[4] Text Copied from ATIS-0100034. See source for full document.

trunks to the PSAP are being modified or are out of service and 9-1-1 communications are adversely affected.

9) Aggregate as an industry, with FCC support, to request that GENBAND modify their design to add a "guard timer"[5] to the LDT type PSAP trunk so that the inter-call timing interval is increased to be in alignment with any revised industry standards resulting from NRSC recommendations.

10) Deliver the recommendations listed in the following section for PSAP operations and SOP modifications to NENA to be addressed by the TDC/ODC committees.

NRSC Recommendations for Changes to PSAP Operations and SOPs[6]

To help mitigate the instances of high call volume events impacting PSAP operations, it is recommended that Public Safety Agencies should consider implementing the following recommendations:

1) Place highest priority on answering incoming calls to 9-1-1, and reduce callbacks on abandoned calls during high call volumes, so that calls in progress are answered with the highest priority.

2) Establish arrangements with backup PSAPs capable of handling and dispatching overflow calls. Do not consolidate PSAPs to fewer than two per area to allow a minimum of two active PSAPs that can handle a situation in each Public Safety jurisdiction. Ensure that each PSAP is capable of handling and dispatching services for the caller location, regardless of whether the call is an overflow or not.

3) Be more pro-active in contacting the 9-1-1 Service Provider when abnormal traffic conditions (such as loss of wireless callers) exist.

4) Activate or staff additional call taker positions in advance of periods of expected high call volumes, such as calling in additional call takers with enough time to reach the PSAP before trouble conditions (such as poor weather) prevent them from being able to travel.

5) Address calling behavior with public education training, such as informing the public what types of calls should be made to 9-1-1 (i.e., when to call for yourself, when to call for others, etc.).

Other Considerations[7]

The NRSC reviewed other considerations in mitigating the situation during the development of this paper. These included both technical and operational considerations that Service Providers might consider when developing their mitigation plans and processes. Among those considered included:

- *Alternative SR to PSAP signaling methods that exist today* -- e.g., 5E ISDN BRI or DMS p-Phone interfaces, Internet Protocol (IP), or Signaling System

[5] The guard timer or guard timer function could consist of hardware, software, or other design at the vendor's discretion.

[6] Text Copied from ATIS-0100034. See source for full document.

[7] Text Copied from ATIS-0100034. See source for full document.

Seven (SS7)[8]. The NRSC does not believe these are feasible alternatives due to the non-similar nature between the two platforms requiring substantial cost, network, and CPE changes for both Service Providers and Public Safety providers. For example:

- A 5ESS ISDN BRI circuit requires three (3) channels per trunk versus a single channel for Time Division Multiplexing (TDM) CAMA.
- A DMS p-PHONE design has potential timing issues when engineered through too many back to back carrier systems.
- IP based trunk solutions require a gateway to convert TDM to IP and IP to TDM, and there is uncertainty regarding whether the gateway would experience timing issues.
- SS7 is not a viable signaling scheme to the PSAP because PSAPs do not have SS7 signaling links.

- *Migrate to a new NG 9-1-1 IP based transport*. At this time, there is not enough evidence to suggest that this is a viable short term solution to this specific situation. Cost, time to deploy, and lack of empirical evidence that NG 9-1-1 networks are not susceptible to the same short inter-call time periods makes this a longer term consideration. The NENA i3 standard model defines that as an alternative PSAP processing model, in next generation systems all calls may be presented to the PSAP such that the PSAP CPE may control its own capacity limits and reject or redirect a call. This action by the PSAP CPE would cause the Emergency Service Routing Proxy (ESRP)/Policy Routing Function (PRF) to invoke an Alternate Routing rule.

- *Modified SR behavior on CAMA type trunks through SR and CPE software/hardware updates*. The NRSC believes that modifying the GENBAND DMS-100 SR to add a guard timing function could provide a near term solution to this issue, assuming these changes might be incorporated in a cost-effective manner while the industry proceeds in the transition toward a NG9-1-1 IP based architecture. Separately, the investment in costly and complex software and hardware changes on the multiple types of CPE systems in use are not cost effective, are risky, and could take significant time to develop and implement even as more and more providers move away from legacy CPE systems. The NRSC believes that although there may be limited instances where vendors may be willing to revisit limited software loads and provide a timing solution; it would be offered as an enhancement and not a resolution to an existing deficiency of the 9-1-1 network.

- *Increased 9-1-1 trunk capacity between the SR and PSAP*. Several Service Providers have worked in the past with an SR vendor, who recommended an increase of SR to PSAP trunk quantities beyond P.01 grade of service to minimize trunk out of service conditions during high call volume events. Based on P.01 grade of service standards, the NRSC does not concur that this is a feasible solution to this situation. Refer to the Trunk Sizing section of this

[8] Not all existing CPE types may be able to handle a call using ISDN-BRI or p-Phone technology, placing another obstacle to using another call setup alternative as a potential remedy.

document for more detail. Proper 9-1-1 trunk group sizing is necessary for efficient alternate routing strategies, controlling costs, and preventing too many calls to be queued to the PSAP that cannot be processed. NENA has accepted an issue statement to review the P.01 grade of service and results of that work may be a longer term consideration.

- *Migrate off the DMS-100 platform to another legacy SR solution*. The NRSC does not recommend this solution because of the cost and effort to do so. Alternative platforms might not be available. This requires considerable effort and re-engineering to be performed. High call volume events are also rather in-frequent so a mass change out to another SR platform could be high cost for a minimal return where other alternatives are more conducive to remediation of the events.

- *Use end office to SR congestion control methods to reduce traffic to PSAP trunk group*. Discussion in other sections of this document indicates how the NRSC does not believe this to be an appropriate traffic management technique. Not recommended because it doesn't work -- 1 call from each of 10 carriers in an area could occur, and still flood a PSAP, while not even coming close to head end trunk group capacity.

7 Previous Acknowledgments

None. This is the initial document.