

# NRIC VII

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March 29, 2005

## FOCUS GROUP 1C Report #2

### Customer Notification During Major Failures in E911 Networks

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# 1 Results in Brief

## 1.1 Charter Application

The NRIC VII Council has been charged with reporting on ways to improve emergency communications networks. Per the NRIC VII Charter, Focus Group 1C is responsible for performing an analysis of the effectiveness of Best Practices aimed at E911 and Public Safety over the course of NRIC VII.

During the October 12, 2004 NRIC Steering Committee Meeting, several assignments were re-evaluated, changes were made and deliverables reassigned. Report #2 addresses the second interim milestone identified in the NRIC VII Charter for Focus Group 1A that was subsequently reassigned to Focus Group 1C:

“The Council shall present a report that “shall also specify the information to be sent to the person originating the E911 call when major failures occur in E911 networks.”<sup>1</sup>

Before completing this assignment, the following assumptions were made and parameters delineating the scope of the deliverable were put in place:

It was assumed that the information being sought is over and above the current reorder and busy signals commonly sent by the network during an outage. It was also assumed that messages include not only verbal messages but various network tones. These messages are limited only to voice/audible message and do not include data.

For purposes of this document, the 911 network is defined as end-to-end connectivity from the caller, through the Public Switched Telephone Network (“PSTN”), including both wireline and wireless networks, to a PSAP and including components unique to 911 services. IP-enabled networks were not considered in this analysis.

The Public Safety Authority (“PSA”) is defined as the administrative entities associated with Emergency Communications, which can be a Public Safety Answering Point (“PSAP”), or at the Federal, State, County or City governmental level.

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<sup>1</sup> NRIC VII Charter, [www.nric.org](http://www.nric.org)

Report #2 was to be submitted by April 4, 2005. The following is a list of the team members comprising Focus Group 1C that compiled this report:

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## **1.2 Major Findings**

Enhanced 911 (“E911”) network failure notifications are necessary to inform the public that the system is unavailable, and also to inform the public as to what actions can be taken to ensure access to available public safety services until such time as E911 services can be restored. There is no current network capability which provides for the delivery of messages to individual callers concerning a major failure within the E911 networks beyond tones indicating the unavailability of the network. At present, the most common indicator to a caller of a call failure is a reorder tone (a fast busy signal). While some failures will initiate a re-route to a recorded message, in general, broadcasting of messages providing the public with alternative access to public safety services currently must be generated outside of the PSTN. Because any given E911 network failure will be unique, given the many variables such as the area impacted, the capabilities of Public Safety to provide alternate access to emergency services, the extent and duration of the outage, and the demographics of the population served, any notification generated needs to be event specific and must take into consideration both network provider and PSA needs. Critical elements of the notification process are prompt notification to the PSA as outages occur and PSA/network service provider collaboration in planning for and accomplishing an effective response. In general, the Public Safety sector has systems already in place for alerting the public of special circumstances and emergency situations. Currently, the most effective way to inform the calling public of E911 outages due to network failures is by utilizing these public safety notification systems.

## **2 Executive Summary**

Service impacting outages should be anticipated and contingencies planned for when deploying and maintaining a reliable and robust E911 network. It is in the public interest that all parties engaged in providing E911 services collaborate in the effort required to mitigate the potential negative impact of an E911 network failure by notifying the public in the event of an outage. The involvement of the Public Safety sector in NRIC will enhance the collaboration that already exists in many locations. Applicable Best Practices (“BPs”) dealing with caller notification of E911 outages can now be identified and existing BPs modified to incorporate the needs of E911 and PSAP customers. Once notification protocols are identified, additional Best Practices can be identified. Recognizing that informing the public of E911 system outages is a joint responsibility, the resources of both the network service providers and the Public Safety sector can be used in concert to limit the impact on the public while building confidence in the situation management capabilities of both.

## **3 Objective, Scope, and Methodology**

### **3.1 Objective**

Informing the public of an E911 outage is only relevant if the information provided includes an alternate access to emergency services. In the event of an E911 network failure, can a message be introduced that would direct the caller to an alternative method of accessing public safety services? If so, what should that message contain? It must be recognized that when E911 is dialed there is a high degree of expectation that someone will answer who can aid in providing emergency assistance. Furthermore, E911 is not generally dialed without some sense of urgency on the part of the caller. This will necessitate additional sensitivity in message content development and delivery.

### **3.2 Scope**

For any message to be useful from the caller's perspective, the message should provide the caller with instructions on obtaining alternate access to emergency services and, if possible, make allowances for differences in language. It would, in effect, need to be a message that replaces the established "dial 911 in an emergency" with a different set of instructions. This more expansive view of messaging during E911 network failures, while necessary to evaluate the impact to all parties, must also take precautions against creating additional network capacity issues at a time when it can least afford the additional processing and holding times that might be required.

### **3.3 Methodology**

A technical feasibility analysis was performed with all elements of the 911 network being evaluated. Points within the network with the potential for experiencing a major failure that would preclude delivery of the dialed 911 call to the PSAP were identified. Once identified, each point or network element was further examined regarding the feasibility of introducing a notification function. Appendix 1, Section 7.1 contains a table cataloging the various network elements, cross-referenced with potential options for notification delivery. Appendix 1, Section 7.2 contains an illustration of the E911 Network topology used in this analysis.

## **4 Analysis and Findings**

### **4.1 Current Environment**

Network design currently provides for audible messaging to callers in certain cases where call delivery cannot be accomplished. These are commonly a busy signal when the called number is unavailable and a fast busy signal when there is congestion or other unavailability of network components. Although these "messages" are generally recognized by telephone users and are clear indicators of call failures (even noted on TTY displays as flashing light call progress indicators), they offer no alternative access to emergency services.

Currently, public safety organizations rely heavily on tools such as the Emergency Alert System (“EAS”), Mass Calling Systems, and the Media in general, i.e. radio and television, for notifying the public of emergency situations and of E911 network failures.

## **4.2 Network Evaluations**

An evaluation of the architectures and capabilities of both the PSTN and the Public Safety network was made. While inter-twined, each has its own distinct functionality and responsibility.

PSTN architecture and functionality regarding the E911 system was examined. As stated by Focus Group 1C’s earlier analysis, outages of the E911 system can be due to disruptions to the network in general but are most frequently isolated to a particular element or component of the network. After an evaluation of the current network architecture and the physical and functional attributes of the elements within that architecture, it was determined that there is no current capability within the existing PSTN that allows for notification messages to be inserted, much less delivery of a message which can communicate to the caller the circumstances preventing call completion to the PSAP or offer an alternative access method. If development of such capabilities were implemented, it would require a collaborative intervention that would re-route the E911 call to a recording appropriate to the given outage.

The architecture, capabilities and functionality of the E911 system in general and the PSAPs in particular were examined next. In any circumstance, and independent of the proposed network caller notification, a notification process is generally in place for the network service provider to notify the impacted E911 jurisdiction or designated PSAP(s) of any outage in the network, so they, in turn, can determine an appropriate course of action. Even though it is the E911 jurisdiction or impacted PSAP that ultimately determines the appropriate course of action, close cooperation among the affected network service providers, E911 service providers, and PSAs is needed so PSA managers can assess the nature and extent of the outage and determine the best means to provide an alternate means to access public safety services and notify impacted customers of the situation.

## **4.3 Public Notification of E911 Network Failures**

A number of public notification tools are available and may be deployed in anticipation of a need to inform the public of actions to be taken during emergencies or crisis situations. Those tools can be and are being adapted for use during an E911 network failure. In the event of an E911 network failure, the PSA is perfectly positioned to assume the role of informing the public of alternate methods for accessing public safety services.

Outside of the PSTN’s portion of the E911 network, automated dialing systems are commonly used to notify the public of emergency or crisis situations. An automated dialing system literally calls all landline phones in an impacted area delivering a message specific to the situation. These automated dialing systems utilize the same information

databases used by E911 and the PSAPs. This allows for a comprehensive and effective notification process for a given geography. Care must be utilized in employing these systems to preclude negative impacts on network capacity such as switch overload, including notifying carriers of the pending broadcast (BP 3202).

The Emergency Alert System (“EAS”) has a number of approved uses for notification of extraordinary events impacting the public. One of the uses approved by the Federal Communications Commission is notification of E911 outages via a radio broadcast. (Appendix 1, Section 7.3 references a file containing the FCC rules regarding the use of EAS during a 911 outage situation.) This particular approach has the advantage of not relying on the connectivity to the PSTN by the radio and television stations who will broadcast the message. In addition to a direct message, the EAS alerts the media to outages and in turn, the media does what it does best by turning events into “breaking news” thus widely spreading the information. The message is usually generated based on public safety requirements. Furthermore, alerting the media to a given situation creates additional opportunities for expanding notification via interrupted programming and/or live interviews by leveraging the media’s interest in informing the public of the situation and steps the public should be taking. The notification messages are developed cooperatively among involved network service providers and affected PSAs to ensure accurate information is conveyed. Effective notification may involve several different length messages tailored to the time allowed. The audio portion of EAS messages is limited to about 15 seconds, instant message service text or freeway billboard messages must be distilled to a few key words in order to convey meaning on a tiny display or in a short read-time, while a television or radio interview can get 3 or 4 minutes of information to the public.

#### ***4.4 Association of Best Practices***

Current Best Practices relating to E911 were initially developed to address network reliability and survivability. As such, Best Practices dealing specifically and directly with E911 outage notification to the public have not yet been identified. However, there are limited procedures in place for network service providers that provide for notification to the PSA(s) when there is an E911 network impacting outage.

While there are numerous Best Practices that call for cooperation between the PSAs and network service providers in planning for contingency programs, those BPs were developed from the perspective of the telecommunications network service providers prior to the involvement of the Public Safety Sector in the NRIC process. Going forward, the scope and perspective of BPs dealing with notification process and protocols should reflect a network service provider and Public Safety collaboration.

Any new or modified BPs relating to customer notification of 911 network failures will be included in this Focus Group’s later deliverables.

## **5 Summary of Key Findings**

There is no current network capability which provides for the delivery of audible messages to individual callers concerning a major failure within the E911 networks beyond tones indicating call failure.

E911 network failure notifications are necessary to inform the public that the system is unavailable. Furthermore they are necessary to inform the public as to what actions can be taken to ensure access to available public safety services until such time as E911 services can be restored.

Outages are unpredictable and will vary in location, size and severity of impact. Messages specific to the outage and reflecting the needs of the public, particularly during emergency or crisis situation, will be most effective.

PSAs commonly have the capabilities to deliver messages to the public within their existing emergency notification tools. In particular, the FCC has authorized the use of EAS for E911 outage notification. This capability does not necessarily rely on the PSTN.

## **6 Next Steps**

Per the NRIC Charter, the next deliverable from Focus Group 1C will be a report on its survey to determine how effective Best Practices have been for emergency communications.

The final deliverable from Focus Group 1C will be a report containing the newest version of each of the Best Practices for emergency communications. Per the Charter, the report shall be based on its Best Practices survey and shall include revised language for the Best Practices to make them more precise. The report shall also summarize conclusions from its analysis of 63,100 outages.

## 7 Appendix 1—Sources and Documentation

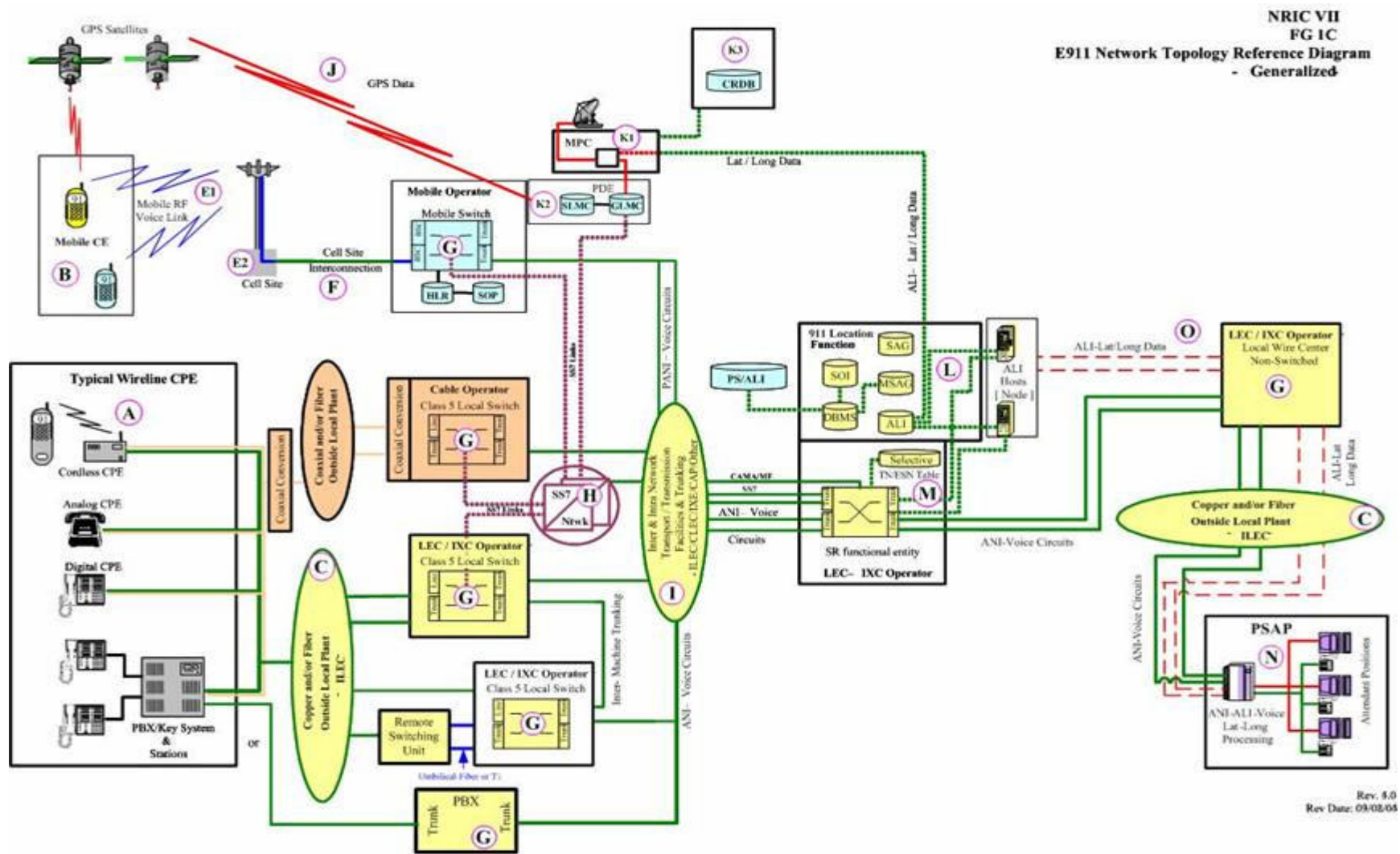
### 7.1 Network Component Analysis Table

The letters on the left correspond to the reference diagram in Section 7.2.

The question is what message should be delivered to E911 callers when E911 is unavailable. It is assumed that the objective is to determine what options, if any, exist to provide the caller a verbal/audible message indicating that 911 service is unavailable and suggest alternatives to E911 for contacting Public Safety Services. The primary purpose of this table is the cross-referencing of information relative to what happens when E911 is dialed within various network failure scenarios and cataloging the notification options generally available. For purposes of this discussion it is assumed that there exists a network failure with no contingency or back-up provisions in place.

	Potential Point of Failure	911 dialing will result in?	Potential Network Generated Notification	Public Notification Option
M O N	Selective Router	Fast Busy Signal	Network generated reorder tone.	Yes, for geography served by SR
	Selective Router to PSAP	Fast Busy Signal	Network generated reorder tone.	Yes, for geography served by PSAP
	PSAP	Network Busy Signal, Ring with No Answer, No Ring No Answer - Situation specific	Network generated reorder tone, Ring with No Answer - Situation specific	Assuming PSAP aware... Yes for geography served by PSAP
A C C	Call originators equipment	Situation Specific	None	None
	Transport from call originator to Central Office	No dial tone, dialing unavailable	None	Yes, for impacted geographic area
	Remote Central Office Failure	No dialing available. Possible no dial tone.	None	Yes, for impacted geographic area
G I	Umbilical from Remote Central Office to Host Central Office	Fast Busy, with routing to a 10 digit number, slow busy	Network generated reorder tone.	Yes, for impacted geographic area
	Central Office	No dialing available, no dial tone	None	Yes, for impacted geographic area
H E2	Transport from Central Office to Selective Router	Fast Busy Signal	Network generated reorder tone.	Yes, for geographic area served by Central Office and any remote offices
	SS7 Network Signaling unavailable	Situation Specific - from no impact to no call initiation after dialing	Switch specific - Network generated reorder tone.	Yes, for impacted geographic area
F G	Cell Site	No service available	No service available or roaming indication	Yes, for impacted geographic area
	Interconnection facility from Cell Site to Mobile Switching Center	No service available	No service available or roaming indication	Yes, for impacted geographic area
I	Mobile Switching Center	No service available	No service available or roaming indication	Yes, for impacted geographic area
	Transport from MSC to Selective Router	Fast Busy signal	Network generated reorder tone.	Yes, for impacted geographic area

## 7.2 Network Topology Reference Diagram



## Network Topology Diagram Reference Point Descriptions

Reference Point	Description	Comment I	Comment II
A	Wireline CPE	Customer Premises Equipment	
B	Wireless CE	Customer Equipment	
C	LEC Operator "Last Mile" Outside Plant	LEC (Incumbent or Competitive Provider) IXC/CAP/Other Transmission Facilities	-
D	Cable Operator Coaxial Outside Plant		
E1	Mobile CE to Cell Site RF Voice Link	Mobile customer equipment transmission to cell site	
E2	Mobile Operator RF Cell Site	Cell site	Reference E2 is not to be confused with the E2 interface utilized between wireless network and 911 service provider
F	Cell Site to Mobile Switch Backhaul	LEC (Incumbent or Competitive Provider) IXC/CAP/Other Transmission Facilities	
G	Wireline / Cable / Wireless Operator Switches	Class 5 Level Switches, PBX, or equivalent	
H	SS7 Network & Links	Reflects all operator and 3rd party provider STP's and Links	Use of SS7 signaling is optional; traditional methods utilize CAMA signaling
I	Intra & Inter Network Switching Transmission Facilities	LEC (Incumbent or Competitive Provider) IXC/CAP/Other Transmission Facilities	Class 4 Access Tandem
J	GPS Data	GPS data to PDE	Part of AGPS solution
K1	Mobile Positioning Center	Mobile Services Provider Interface	
K2	Positioning Determining Entity	Mobile Operator Equipment-location of Mobile Cell Site & Subscriber	
K3	Coordinate Routing Data Base	Database providing routing instructions on wireless call utilizing latitude & longitude translated to routing table for appropriate PSAP based on location data	
L	Wireline Operator E911 Location Function	Traditional E911 data processes supporting location information provided to PSAP on wireline 911 call	
M	911 Service Provider Selective Router	May or may not be a telephone central office	
N	Public Safety Answering Point - PSAP	Staff, Equipment, and Physical facility which performs PSAP defined responsibilities	
O	PSAP to Operator transmission link	For use only with Public Safety	
SR	Selective Router	Equipment and software providing routing functions in the traditional E911 network	
SR 2	Selective Router routing instructions	TN/ESN Table or dynamic ALI	

### ***7.3 EAS Rules Document***

See the attached file entitled “7.3 FCC EAS Rules,” which captures Title 47, Chapter 1, Section 11 of the FCC rules regarding EAS.