

## **A Paper of Concept**

### **Advancing the delivery of 9-1-1 services nationwide using a concept of ubiquity and existing network features**

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Author's Note: The concepts delivered in this paper are not new. It has been recognized for some time that the current connectivity of 9-1-1 lacked some of the basic strengths inherent within the overall public switched network. This paper is presented at this time due to the increasing need to address serious emerging issues that can negatively affect our nation's 9-1-1 system. The concepts presented are part of NENA's considerations for options within its Future Path Plan for E9-1-1 services.

#### **Purpose**

With the advancement of technologies not usually associated with traditional telephony, the demands placed upon the nation's emergency services to accommodate them within the emergency service number arena are increasing. In an attempt to discover, address and incorporate these "over the horizon" technologies, the National Emergency Number Association (NENA) created a committee whose sole responsibility is to identify technologies or services that may impact the delivery of 9-1-1. This responsibility falls to those members of the Non-Traditional Communications Committee (NTCC) and has resulted in the identification of such technologies as voice over Internet protocol (VoIP), and automatic collision notification (ACN).

During the normal course of discovery, the committee has found certain similarities across these new technologies, the pinnacle of which is the ubiquitous form they take. Using the Internet as a model, VoIP may transit the Internet without regard to any "normal" function usually associated with the switched telephone network. From the dynamic assignment of addresses (as association with IP) to the non-distance sensitive nature of the call path, a user of VoIP enjoys the delivery of their voice anywhere in the world via connection with the larger World Wide Web. Getting a VoIP call to the appropriate public safety answering point (PSAP) will effectively require many calls to be rerouted across the nation or internationally, largely due to the relationship between the switched network of traditional telephony and that of the Internet.

With the certain knowledge of these emerging technologies, and the effect they can have on our nation's 9-1-1 system, this paper will present a "concept of network" that may relieve the public safety agencies of delayed or misrouted calls during times when seconds

count. Keeping in mind the events of September 11, 2001, there exists a greater urgency to establish a uniform national fabric of communication between all PSAPs, public and private emergency service providers, and the providers of national defense.

### **Proposition**

Most telephone networks of today utilize some form of automated long distance dialing. The form of this matrix is as follows:

**(NPA) NXX-XXXX**

Where:

NPA = area code

NXX = prefix

XXXX = local demarcation

Hypothesis: *Enable a method to allow direct call transfer from any point to any point, while advancing the essential call datum associated with 9-1-1, which may take the form of automatic number identification (ANI), or its equivalent, and call associated information which may take the form as automatic location information (ALI), or its equivalent, in a seamless, integrated manner.*

Following the tenants of NENA's Future Path Plan, the basic elements of reliability, predictability and cost must be considered. Keeping these rules in mind, this concept of operation perceives the reservation and application of 911 as a NXX. Illustratively, this form would be:

**(NPA) 911-XXXX**

Where:

NPA = area code

911 = prefix

XXXX = local termination

Following is an example of terminating a call within San Francisco from New Jersey. The number:

**(415) 911-1234**

Would route the call through the public switched telephone network (PSTN) from the New Jersey PSAP via normal call transfer protocol and terminate upon the customer premises equipment (CPE) within the San Francisco PSAP using regular 9-1-1 trunks.

The New Jersey communications personnel could then conference the call as if it were a local inter-tandem transfer.

Once transferred in such a manner, a trusted IP network among the nation's location identification services could return any ALI based information in much the same manner as any other Internet lookup is accomplished. In this scenario, any 9-1-1 call could be transferred without regard to geographic location or generation of PSAP CPE.

This concept of operation requires careful considerations and proven network disciplines. It can, however, address the growing concern regarding the delivery of 9-1-1 calls across the nation from a disparate group of entities, offering a baseline of both form and function.

### **Observations**

While the concept of 911 as an NXX may seem trivial to the casual reader, the real world considerations offer a much deeper set of challenges. 9-1-1 is, of its very nature, a collection of national, state and local politics, interest and investment. Though enacted by law as a universal emergency number, it has largely been up to local government to fund and initiate 9-1-1 services where it exists. This "local control" has led to a multitude of approaches from levels of service to how the system interacts with local emergency service providers.

Not to be left out, the telephone operating companies themselves have a plethora of operational, divisional and technological approaches to provisioning 9-1-1 to their customer base. Again, there are real world reasons for this approach, not the least of which is the report and order for divestiture which, for the reasons of this paper, prevented a single integrated approach other than those emanating from the strict discipline of network design and operation, and the suggested standards offered by NENA.

Because of this diversity, any approach to building a ubiquitous 9-1-1 network will require sensitivity to these stakeholder issues, and must take into account the inherent reluctance to change that permeates much of our culture. That being said, the same diversity can, if properly managed, lead to a best-of-breed solution for a national 9-1-1 network.

Taking a lesson from the existing public switched network, management of such a large pool of information such as NPA's and PSAP boundaries will present challenges not faced by our 9-1-1 communities heretofore. An entire infrastructure of databases and operations will be required. This infrastructure will be required to have an extremely high level of competency when it comes to remediation of errors, misroutes and overall network conditioning. Without solid oversight, the mission of a ubiquitous 9-1-1 network will fail due to lack of commitment and resources.

Funding for such a system will not be trivial. Local resources were long ago stretched by the advancement of technologies and an expanding population base without a concurrent rise in funding. When viewed within the context of a national infrastructure, it is clear some form of federal funding will be required to accomplish this goal. However, when taken on a national scope, the costs associated with such a system may be more effective than when taken on a state-by-state or local government perspective. In fact, the ability to

apply 911 as an NXX can have a profound effect on how this nation's emergency services are provided and the communication improvements that would be possible. In fact, it very well may be that the largest stakeholder in this entire concept is the Federal Government and its responsibility for national defense.

### **A Hypothetical Model**

***Assumptions: Having obtained funding and secured an appropriate administrative body (NENA), the process of building an interconnected network of voice and data can proceed.***

By establishing 911 as an NXX, further security is applied limiting access to this NXX to those authorized within the network equipment as indicated by NENA. Likewise, a secure "trusted host" network is established linking all authorized providers of location information systems either across the World Wide Web or dedicated trunks. In both cases, however, severe security constraints must be established to prevent the inevitable attempts to "hack" the system.

Using a variety of resources such as local MSAG and routing tables, each public safety answering point is issued a series of (NPA)-911-XXXX for each of its enhanced or basic 9-1-1 ports either located upon a selective router or, in the case of basic, a line appearance on the CPE. Concurrently, each PSAP is identified within the network as basic or enhanced this having to do with the expectation of the delivery of ALI.

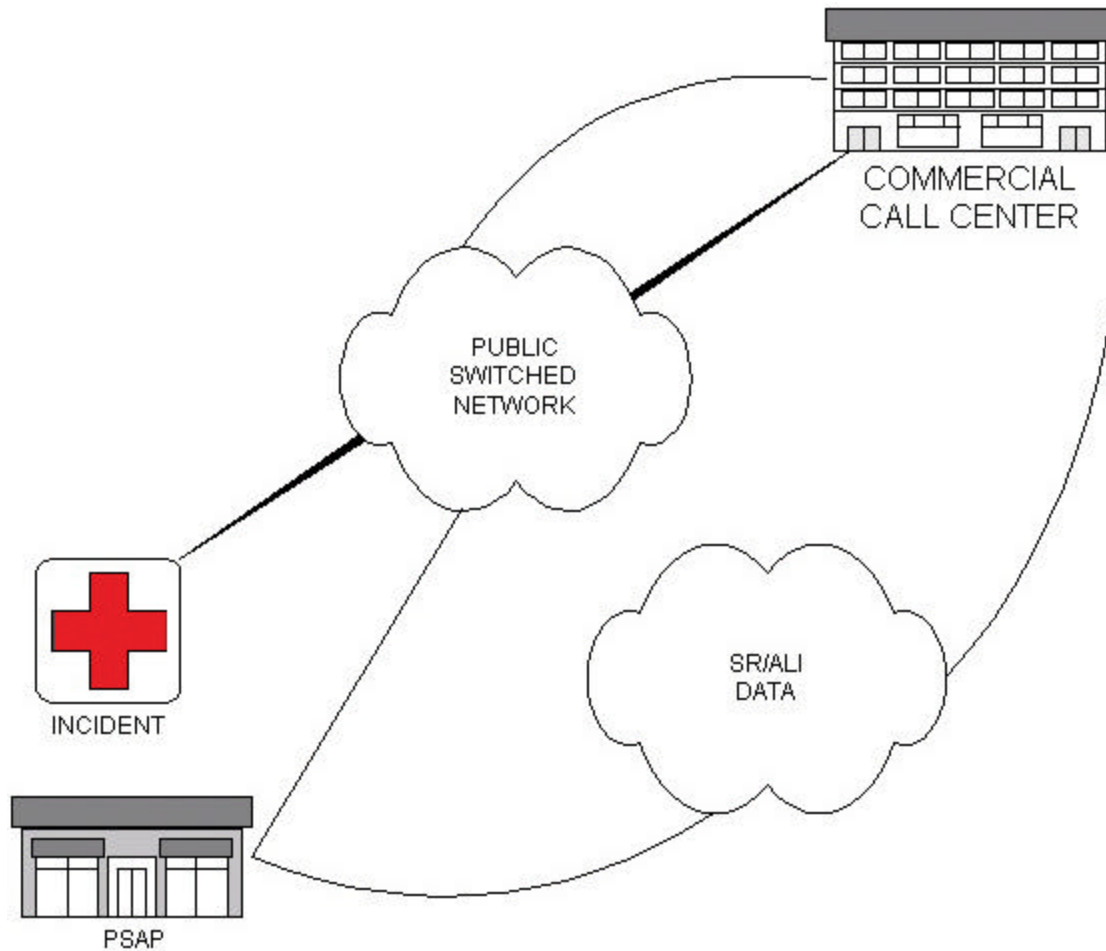


Figure 1. Simple Form of Ubiquity

In Figure 1, we see the ability to reach the PSAP through traditional means of local origination as well as some remote location by using ports assigned to a secure (NPA)-911-XXXX. Once the PSAP receives ANI, an ALI bid is placed and the information retrieved from the privately networked selective router/ALI cloud.

**Theoretical Application: ACN**

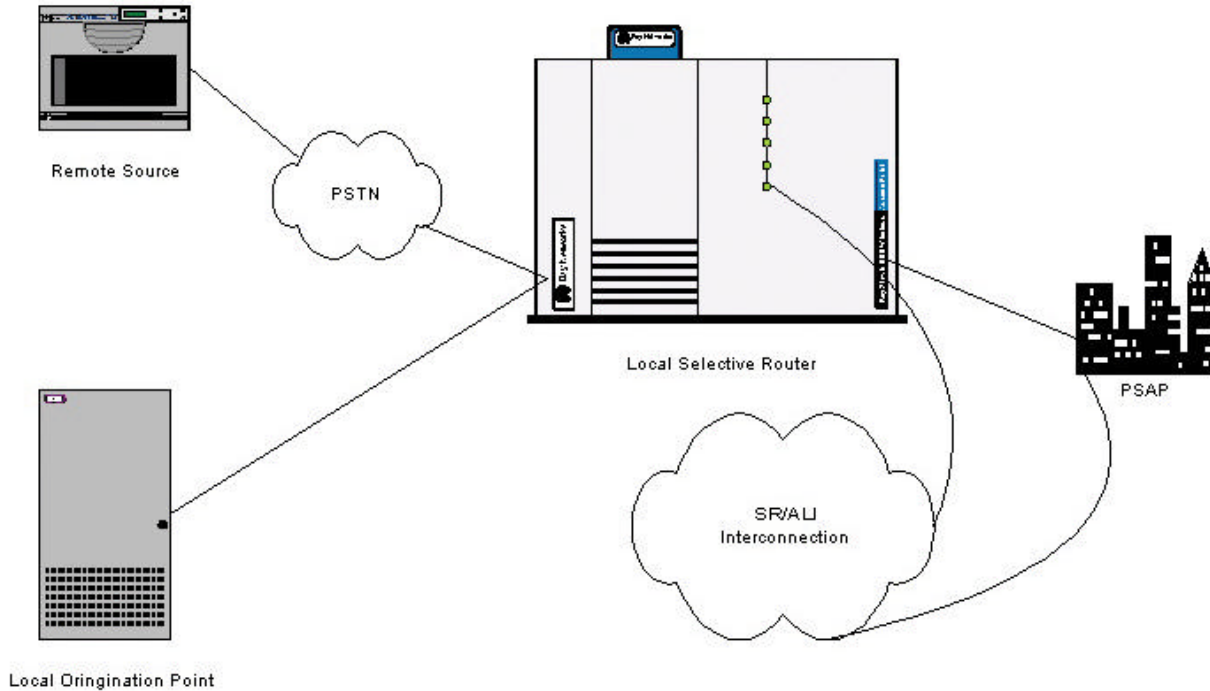


Figure 2. ACN Application

In a very familiar application of automatic collision notification, the ubiquitous network shows its inherent strength of call propagation. In this case, an ACN-equipped vehicle has a collision. The on-board unit calls the commercial call center (CCC) and reports vital information as well as its location. The CCC is NENA authorized and has access to the 911/NXX and SR/ALI networks. It plots the location of the incident, queries the SR/ALI database regarding which PSAP (nationally) is responsible for taking the call and forwards the voice call along with the associated call datum (ANI) to the PSAP via (NPA)-911-XXXX. Simultaneously, it populates the ALI data record and associates it with the ANI datum sent to the PSAP. The call transits the PSTN and arrives on the trunk side of the selective router and is queued to the PSAP in a nominal fashion. Upon receipt of the call, the CPE again queries the same SR/ALI cloud, “tosses” the ANI into it and receives a response in the form of what the CCC has dynamically updated the cloud with. This information is then processed at the PSAP and appropriate action is taken.

## Conclusion

Obtaining ubiquity within the 9-1-1 network should, and in most professional minds must, be of a foregone conclusion. The advent of wireless communications is causing a paradigm shift not seen since the advent of enhanced 9-1-1. The closed “islands” of 9-1-1 service that made such common sense in the late ‘70s have outlived their ability to provide services equal to the challenges of advancing technology.

Current short-term fixes such as tandem-to-tandem transfer are, at best, regional in their approach. Moving calls across regions and indeed across country will require bold

individuals taking measured steps to achieve the goal. As previously stated, our world of emergency communications and the public's impression of their role have taken a sudden and serious change to the proactive. Raising the bar on service is nothing new to the nation's emergency number professional. Over the years, we have witnessed the improbable become commonplace and the impossible just another challenge.

This paper is intended to serve as the vehicle by which the process of ubiquity begins. It will require strong support from the technical, administrative, political and local providers of emergency telephone service to become reality. But there should be little doubt that ignoring this matter will not eliminate the need. And should NENA not take the leading role in promulgating this issue, others surely will. Better it be those who understand what is at stake and lead the evolution than those who may have narrower vision and less understanding.