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E9-1-1 Institute IP Issues Committee

Business Operation Subcommittee

The document has been developed by the E9-1-1 Institute IP Issues Committee and its Business / Operations Subcommittee.

The following parties are recognized for their contributions in the development of this document.

Members

Agency or Company

Elaine W. Sexton – Chair IP Issues Business/
Operations Subcommittee

9-1-1 Program Administrator
Georgia Emergency Management Agency

Dorothy Spears-Dean

Deputy PSC Coordinator
Virginia Technologies Information Agency

Bill Marczak, ENP

BellSouth Telecommunications, Inc.

Allen Muse, ENP

Manager, Public Safety Relations
Cingular Wireless/AT&T

Sherri Powell

Director of Public Safety
Vonage

Frith Malin Sellers

Manager, Enhanced 9-1-1 Program Office
Snohomish County, Washington

The following Acronyms are used in this document:

9-1-1	A three-digit telephone number to facilitate the reporting of an emergency requiring response by a public safety agency.
Automatic Location Identification (ALI)	The automatic display of the caller's telephone number along with the address of the telephone and supplementary emergency services information of the location from which a call originates.
Automatic Number Identification (ANI)	Telephone number associated with the access line from which a call originates.

E9-1-1 Enhanced 9-1-1	An emergency telephone system that includes network switching, database, and CPE elements capable of providing Selective Routing, Selective Transfer, Fixed Transfer, call routing and location information.
FCC Federal Communications Commission	The federal government agency that regulates interstate communications by radio, television, wire, cable, and satellite
IMS	Internet Protocol (IP) Multimedia Subsystem
IP Internet Protocol	The method by which data is sent from one computer to another on the Internet or other networks.
IP PBX	Internet Protocol Private Branch Exchange
LEC Local Exchange Carrier	A Telecommunications Carrier (TC) under the state/local Public Utilities Act that provide local exchange telecommunications services. Also known as Incumbent Local Exchange Carriers (ILECs); Alternate Local Exchange Carriers (ALECs); Competitive Local Exchange Carriers (CLECs); Competitive Access Providers (CAPs); Certified Local Exchange Carriers (CLECs); and Local Service Providers (LSPs).
NANP North American Numbering Plan	Use of 10 digit dialing in the format of a 3 digit NPA followed by 3 digit NXX and 4 digit line number. NPA-NXX-XXXX.
NG 9-1-1 Next Generation 9-1-1	An IP-based replacement for E9-1-1 features and functions, supporting all sources of emergency access to 9-1-1, operating on managed, multipurpose IP networks, and expanding multimedia data capabilities for PSAPs and diverse emergency communications entities.
pANI Pseudo Automatic Number Identification	A telephone number used to support routing of wireless or VoIP 9-1-1 calls. It may identify a wireless cell, cell sector or PSAP to which the call should be routed. Also known as routing number.
PBX	Private Branch Exchange
PSAP Public Safety Answering Point	A facility equipped and staffed to receive and dispatch 9-1-1 calls.
VoIP Voice Over Internet Protocol	Provides distinct packetized voice information in digital format using the Internet Protocol. The IP address assigned to the user's telephone number may be static or dynamic.

Major Points

- Need for nationwide implementation of IP-based / Next Generation 9-1-1 Systems.
- Need for National Funding Program for implementation of Next Generation Systems.
- Need for nationwide standards for operation of Next Generation 9-1-1 Systems.

Introduction

Traditional Enhanced 9-1-1 (E9-1-1) service for wireline networks developed gradually, with local and regional differences. The original E9-1-1 system, (including for the most part, technical network standards), was developed by the former AT&T in the 1970's. The breakup of the Bell System in the early 1980's resulted in the regional Bell Operating Companies and local exchange carriers (LECs) implementing solutions that no longer followed a single standard for delivering 9-1-1 service. It could be argued that the nation's present 9-1-1 system is not a system at all, but rather a fragmented collection of local and regional networks, connected to a variety of equipment with varying capabilities. As long as 9-1-1 service involved only wireline telephones and therefore callers at known fixed locations, these variances were not an issue.

In the last 20 years, technology has evolved to include new mobile communications capabilities including wireless, VoIP, and text messaging. Over half of all 9-1-1 calls made today are from mobile devices and the trend is growing rapidly. However, the current E9-1-1 systems have evolved little since their invention during the late 1970's and have been "patched" to work with these new technologies.

In the early deployment days of 9-1-1, service was offered in an isolated fashion, county by county, or even municipality by municipality. Because telephone services were a local offering, 9-1-1 service and availability became a local choice as well. Eventually, disaster and emergency management followed the same paradigm.

The Current Situation

Today, our day-to-day lives take place in widespread areas with a multitude of communications options. 9-1-1 calls come from the highways, mountain tops, street corners, or anywhere a broadband connection is enabled. There is a clear and pressing need to link the various 9-1-1 systems together to coordinate emergency response across jurisdictional boundaries.

It is nationally accepted that the call-takers and dispatchers in the local 9-1-1 centers are the true first responders to any incident, whether isolated or widespread, man-made or natural, accidental or deliberate. Yet, when funding is made available by the Federal Government through programs such as the Homeland Security Act, inclusion of 9-1-1 services and infrastructure is severely lacking and under-represented. It is simply not good enough to just facilitate implementation of a regional, statewide, or nationwide IP-based network(s) for 9-1-1 service. The federal government must ensure that there is adequate funding at the PSAP Authority level to implement, prepare, train, and maintain their 9-1-1 systems for the future of 9-1-1. The federal government must ensure that standards are adopted and enforced for service delivery. As the nation and its citizens embark on a journey to implement next

generation services and convergence, such as IP-based and IP-enabled 9-1-1 systems, we need a better road map and rules of the road to ensure that every citizen and resident is able to access and obtain the same level and quality of enhanced 9-1-1 services.

Current 9-1-1 systems have limited messaging capability (query and response), limited data content, and are constrained by the limited capabilities of networks and PSAP equipment. Yet, the communications industry is going through a major evolution transformation to the multi-media world. Traditional communication companies are transforming their circuit switched networks into packet switched networks to accommodate the transport of voice, data, and video. The future network of choice appears to be the IP Multimedia Subsystem (IMS), which is designed to handle voice, data, and video.

Communication services are changing quickly, and it seems that new devices and services are introduced daily. The convergence of different technologies such as wireline and wireless and the seamless interoperability between different types of networks will allow a telephone call to be transparently switched between the different technologies. Communication is becoming increasingly mobile and no longer constrained to a fixed location. Devices are now being designed to allow international roaming.

Next Generation 9-1-1

The evolution of communications technology provides an opportunity for major improvements in the current E9-1-1 infrastructure to be made. These improvements include new multimedia services that will enhance public safety, reduce response times, and save lives. With technology flourishing, new devices, networks, protocols, and components are being introduced today. Sadly, the development of standards is lagging behind the introduction of the new technology. It could be years before there is a comprehensive set of guidelines and standards to follow. For Next Generation 9-1-1 to work effectively, we need standards as soon as possible.

As the next generation 9-1-1 (NG9-1-1) systems are rolled out, they must interface with legacy systems for years to come. In addition, any standards that are set for NG9-1-1 must have built in flexibility to interface with legacy systems as well as allow the technology to evolve. This adds to the complexity and cost of development.

Some of the obstacles facing the NG9-1-1 architecture include, but are not limited to, the following:

- Access. Every communications service requires equal access to the 9-1-1 system.
- Numbering Administration. International roaming, the introduction of non-North American Numbering Plan (NANP) telephone numbers, and the distribution of Emergency Service Query Keys (p-ANI) need to be coordinated.
- Location Determination Technology. There is no uniform capability to automatically determine a caller's physical location from wireless devices, as well as nomadic and mobile VoIP phones. Currently, VoIP subscribers must provide their location whenever they move.
- Mapping. Consistent use of accurate mapping data is needed at the PSAP and by 9-1-1 integrators to correctly route 9-1-1 calls and dispatch emergency responders.

- E9-1-1 Database. There is a growing need to integrate E9-1-1 databases to provide nationwide coverage and support E9-1-1 call routing by validating the location of the caller and routing the call to the most appropriate 9-1-1 center.
- Coordinate Based Routing. Technology solutions are needed to identify a caller's location using coordinates, mapping those coordinates to a specific 9-1-1 service boundary, then routing the call to the appropriate 9-1-1 center based on those coordinates (rather than the association of a telephone number to a fixed address).
- Equipment Upgrades. Almost every 9-1-1 center will need to upgrade its equipment in order to receive the caller's call-back number (i.e., ANI), location information (i.e., ALI), voice, and multimedia (video, maps, text messages, etc.) on their 9-1-1 equipment.
- Network Security. It is essential to ensure that IP networks are resistant and resilient against denial of service attacks and other types of harm that may be perpetrated on the network. In addition, because the migration to an IP network will expose 9-1-1 equipment to viruses, there is a need to constantly apply security update patches to protect the 9-1-1 center and the networks from attack.
- PBX Location. The migration of Enterprise Private Branch Exchange (PBX) service to IP-PBX networks signifies the need to identify the caller's location at the station level. Such stations are becoming increasingly mobile and often extend outside the typical boundary of an enterprise (an example is remote access to a company's network).

The roles of emergency service providers and networks will change drastically as IP technology expands beyond the traditional wireline fixed location communication devices. The current limited data provided during emergency calls will expand to use robust multimedia information. The evolution of emergency communications will come at a price. It is imperative that global standards be developed quickly to reduce the cost of retrofitting interfaces to handle emergency services. It is even more imperative to provide a consistent funding mechanism for 9-1-1 service that extends beyond the traditional funding methods in place now.

Funding

With the widespread use of wireless services and the explosive growth in VoIP services, the limitations to the present infrastructure for 9-1-1 service are obvious. Most notably, are the funding limitations, and they present the industry and policy makers with a difficult challenge.

Historically, PSAPs, or 9-1-1 Authorities, set 9-1-1 revenues aside for a period of years, replaced the old equipment with new equipment, and started saving again. Funding sources must be identified and in place to make these continuous improvements. This type of funding requirement is entirely separate from the maintenance and repair associated with operating call-taking equipment. The system of the future will be constantly evolving, with new features and capabilities becoming available on a regular basis. Total system replacements to obtain new features will no longer be economically feasible.

When the traditional landline 9-1-1 networks were established, the incumbent Local Exchange Carrier (or ILEC) provided 9-1-1 service and charged rates that were set, or tarified, by the state public utility authority. To ensure local funding to pay for the service, the ILECs lobbied their respective state legislatures to allow collection of a surcharge on customer phone bills. Thus, Enhanced 9-1-1 service (at least landline) was paid for with a user fee. The fee varied from one political jurisdiction to another. Of course, this meant that 9-1-1 service was not universal; if there was no political or taxpayer support, the service was not provided. Historically, 9-1-1 referendums and fees have been overwhelmingly supported by the public.

The FCC Wireless Ruling (FCC Order 94-102), which was adopted in 1996, required wireless carriers to connect to the E9-1-1 network, and left cost recovery up to each state. Some states passed cost recovery legislation, and wireless E9-1-1 service was implemented quickly. Other states have never acted on cost recovery, and PSAP upgrades for wireless E9-1-1 service have languished. The lack of PSAP upgrades for Phase 2 have impacted the PSAP's ability to receive E9-1-1 data on VoIP calls.

Most state and local governments place some sort of 9-1-1 charge, tax, or fee on landline and wireless customers. However, few state and local governments have been authorized to charge the same type of 9-1-1 fee on unregulated VoIP service providers. As individuals switch from traditional wireline phone service to VoIP phone service, 9-1-1 authorities are going to become increasingly pressured to provide the same, or better, level of service with dwindling funds. As a result, the funding sources for E9-1-1 service are fragmented and inequitable. Finally, because most 9-1-1 surcharges are set by statute or ordinance, the fee itself has not kept pace with inflation, which has resulted in a cut in the spending ability of 9-1-1 authorities and PSAPs.

Another problem is that many state and local governments view 9-1-1 subscriber fees as another source of general fund revenue, and divert the local or state 9-1-1 funds for non-9-1-1 purposes. The General Accounting Office (GAO) reports that several states have diverted 9-1-1 funds for non-9-1-1 purposes in the past, and it is expected that this trend will continue. The ENHANCED 9-1-1 Act of 2004 imposes penalties on local 9-1-1 agencies if their respective state 9-1-1 funds are diverted. This penalty has not had the desired effect, as those diverting the funds do not feel the penalty directly; 9-1-1 centers and the residents they serve feel the pinch in terms of increased budget pressures, increased agency fees and taxes, and increased hold times for 9-1-1 callers, to name a few. In addition, the monies authorized by the Act have yet to be appropriated by Congress. It would be more effective if penalties were applied at the state level in the form of reduced highway aid or educational funding; then states would be reluctant to divert 9-1-1 funds.

Papers have been written and presentations have been given about the need to create a new funding paradigm to account for the explosive growth in technology and telecommunications and to account for the fact that telecommunications is no longer local, but national in nature. However, no solution has been presented that will solve this conundrum: telecommunications is becoming increasingly borderless, but 9-1-1 service and emergency response are still, and always will be, a local response. It does not matter what the funding source is, so long as it is technology neutral and meets the complete cost of funding 9-1-1 service. If something goes wrong during a 9-1-1 call, local authorities are still held accountable to the public for the lack of response or the wrong response. Any funding paradigm that is created needs to account for this fact.

CONCLUSION

The way we do business in the 9-1-1 community nationwide is changing rapidly. Currently, in the vast majority of our 9-1-1 centers, we attempt to respond to today's requests for service using yesterday's technology. The new technology associated with Next Generation 9-1-1 cannot be implemented piecemeal and on an "as a local government can afford it" basis. We must have a plan and funding in place to implement Next Generation 9-1-1 nationwide. National standards must also be in place for 9-1-1 operations. As previously stated, we no longer live in small isolated communities. The demand for service is on a much larger scale. Our neighbors in the next county and in the next state must have the same technology and

ability to process 9-1-1 calls and data on the same level if we are to be successful with Next Generation 9-1-1.