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Produced by the RCN Commission and the
National Emergency Number Association, Columbus, Ohio, USA

Introduction

Grading the performance of 9-1-1 is a critical first step in understanding how well 9-1-1 is serving the American public. Analyzing the factors that make 9-1-1 successful both today and tomorrow is the focus of this first-ever report, the Report Card to the Nation (RCN) on 9-1-1.

An RCN Commission was formed by the National Emergency Number Association (NENA) to review and grade the performance of 9-1-1. The RCN Commission set the scope and developed the criteria for grading. With the criteria established, NENA designed and conducted a research effort to gather primary and secondary data on 9-1-1 service, and the 9-1-1 industry. Close support and assistance in data gathering efforts were provided by the National Association of State Nine One One Administrators (NASNA) and the Association of Public Safety Communications Officials, International (APCO).

Current Status of 9-1-1

9-1-1 is a highly reliable, efficient and effective means for American citizens to call for emergency service. Most people know how and when to call 9-1-1, and it is a proven life-saving service to the public.

There are approximately 190 million calls to 9-1-1 each year – that’s more than 500,000 calls per day. As a public service, 9-1-1 is unequalled in terms of reliability.

The recent growth in wireless telecommunications has resulted in parallel growth in the number of wireless calls to 9-1-1. Today, over 25 percent of all 9-1-1 calls nationally are from wireless telephones, with even higher percentages shown to occur in metropolitan areas.

The Commission has graded 9-1-1 with an overall grade of **B**, for the measurement year 2000. Overall, 9-1-1 is a reliable, efficient, and effective means for American citizens to call for emergency assistance.

The remainder of this Report analyzes the components of this grade, and provides additional insight into the current status and future needs of 9-1-1.

9-1-1 Coverage

Wireline 9-1-1 is available to 97.8 percent of the U.S. population. However, there are 231 counties in the United States that are without even basic 9-1-1 services. Counties without 9-1-1 are primarily rural

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The Report Card to the Nation: Grading the Performance of 9-1-1

9-1-1 Quality of Service

A-

The current quality of service is largely reliable and contains the needed redundancy and security features to handle the current level of 9-1-1 calls. This Report also confirms that the American public has a high degree of trust and faith in the effectiveness of 9-1-1, and is highly satisfied with current service.

9-1-1 Availability

B

9-1-1 is widely available to approximately 97.8 percent of the U.S. population for wireline callers to 9-1-1. However, there are under-served areas, primarily in rural counties.

9-1-1 Public Awareness and Education

B

The American public is very aware of 9-1-1 and how and when to use it. The primary public education challenge is to reduce the number of non-emergency calls to 9-1-1.

9-1-1 Wireless

I

The Commission grades this aspect of 9-1-1 service as incomplete. FCC Docket 94-102 resulted in requirements for wireless carriers to provide location and call back information to 9-1-1 centers according to a mandated schedule. The implementation of this technology is behind schedule. Wireless 9-1-1 deployment must be accelerated.

9-1-1 Tomorrow

D

The 9-1-1 system must accommodate new technologies, increased competition and other institutional changes at a cost likely to exceed current levels of public funding. 9-1-1 needs sufficient investment if it is to meet future challenges that will impact 9-1-1 service.

Executive Summary

in character, with sparse population and generally high poverty levels. Other areas under-served by 9-1-1 include Native American lands and military installations.

9-1-1 in the Future

The ability of 9-1-1 to continue to perform at its current level is severely threatened by a number of advances in telecommunications including: high volume of wireless calls to 9-1-1, a growing telematics industry, and non-traditional devices based on new technologies that soon will have the capability and need to enter the 9-1-1 system. Originally built for wireline service only, the 9-1-1 system must be re-designed to accommodate new ways of accessing 9-1-1, increased competition and other institutional changes, at a cost likely to exceed current levels of public funding. 9-1-1 networks, supporting data systems, and other associated components must evolve into a new generation if they are to meet the public's expectation that 9-1-1 can deliver the appropriate response for emergencies.

Congressional Role

The Commission believes that 9-1-1 operation and coordination of 9-1-1 services by state and local governments will continue to be a sound method of administering the Nation's 9-1-1 service. However, the Commission believes that Congress and the Federal Government have an opportunity and responsibility to ensure the future success of 9-1-1.

Congress is in a unique position to:

- Enact legislation to encourage/require states to implement 9-1-1 legislation in under-served areas
- Help make resources available to state and local governments to complete 9-1-1 service, thereby making it available to every American
- Encourage legislation that provides economic incentives to industry participants to evolve the 9-1-1 infrastructure in an organized manner that supports technology and social trends
- Require Federal agencies such as the Federal Communications Commission and the U. S. Department of Transportation to continue to include 9-1-1 as an important component of their administrative, regulatory and implementation activities
- Support Public Safety in its effort to continually improve the level of 9-1-1 service, both wireline and wireless
- Request periodic reports from the RCN Commission on the status of 9-1-1 in the U.S.

In preparing this Report to Congress, the Commission has identified a first-tier data set that will serve as a baseline for measuring the scope and size of the Nation's 9-1-1 service.

For the year ending December 31, 1999, the following benchmark statistics were present for 9-1-1 service in America:

Total of 9-1-1 Calls Annually	190 Million
Wireline Calls to 9-1-1	140 Million
Wireless Calls to 9-1-1	50 Million
Percentage Wireless	26.5%
Percentage of U.S. Population Covered by 9-1-1	97.8%
Number of Counties without 9-1-1 Coverage¹	231
Number of PSAPs (Primary 9-1-1 Centers)	5,000
Number of Personnel Employed by 9-1-1 Systems/Agencies	97,000

These key metrics are just the beginning of information needed for a full and complete assessment of 9-1-1 in America. The Commission believes that the future success of 9-1-1 requires continued development of sophisticated data measurements and metrics for the industry. Towards this end, the Commission is actively identifying additional measurements and analyses required by the stakeholders and responders for 9-1-1.

In determining the scope of this study, the Commission segregated the analysis of 9-1-1 into the following grade categories:

- 9-1-1 Quality of Service
- 9-1-1 Availability
- 9-1-1 Public Awareness and Education
- 9-1-1 Wireless
- 9-1-1 Tomorrow

**The Report Card to the Nation:
Grading the Performance of 9-1-1**

- 9-1-1 Quality of Service (A-)**
The current quality of service is largely reliable and contains the needed redundancy and security features to handle the current level of 9-1-1 calls. This Report also confirms that the American public has a high degree of trust and faith in the effectiveness of 9-1-1, and is highly satisfied with current service.
- 9-1-1 Availability (B)**
9-1-1 is widely available to approximately 97.8 percent of the U.S. population for wireline callers to 9-1-1. However, there are under-served areas, primarily in rural counties.
- 9-1-1 Public Awareness and Education (B)**
The American public is very aware of 9-1-1 and how and when to use it. The primary public education challenge is to reduce the number of non-emergency calls to 9-1-1.
- 9-1-1 Wireless (I)**
The Commission grades this aspect of 9-1-1 service as incomplete. FCC Docket 94-102 resulted in requirements for wireless carriers to provide location and call back information to 9-1-1 centers according to a mandated schedule. The implementation of this technology is behind schedule. Wireless 9-1-1 deployment must be accelerated.
- 9-1-1 Tomorrow (D)**
The 9-1-1 system must accommodate new technologies, increased competition and other institutional changes at a cost likely to exceed current levels of public funding. 9-1-1 needs sufficient investment if it is to meet future challenges that will impact 9-1-1 service.

¹ Counties answering either full or partial 9-1-1 coverage were counted as having 9-1-1 for purposes of this Report.

9-1-1 at a Glance: Defining the Profile of the Nation's 9-1-1 Service

The Report Card: An Important First Step in Monitoring 9-1-1

Overall responsibility for this Report to Congress rests with the RCN Commission, formed by NENA as the entity to provide overall guidance for the Report. NENA led the data collection effort with guidance from Deloitte & Touche on survey design and sampling methodology. Harris Interactive conducted the public survey on awareness of and satisfaction with 9-1-1 service.

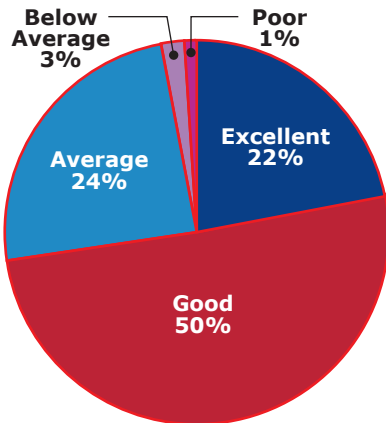
A summary of the study methodology is presented in Appendix A.

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Figure 1

Rating of 9-1-1 Emergency Calling System

“Overall, how would you rate the 9-1-1 emergency calling system?”

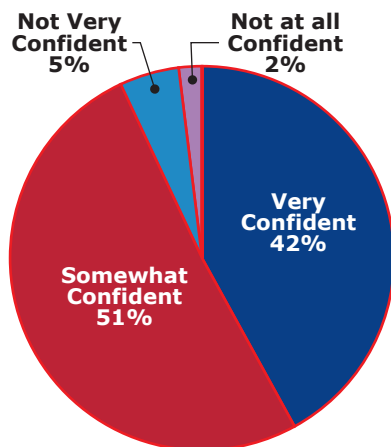


Base: Familiar with 9-1-1 (n=2001)
©2001 NENA, Harris Interactive

Figure 2

Confidence in 9-1-1 Emergency Calling System

“How confident are you that if you had to call 9-1-1 you would receive the appropriate assistance?”



Base: Familiar with 9-1-1 (n=2001)
©2001 NENA, Harris Interactive

9-1-1 Quality of Service: Grade A-

The Commission finds the current 9-1-1 network to be highly reliable. Virtually all of the 190 million calls to 9-1-1 are successfully delivered to a 9-1-1 center. The 9-1-1 network contains features such as redundancy and default routing that ensure call delivery, even if portions of the public switched telephone network experience difficulties.

Reliability of the 9-1-1 network can be measured through 9-1-1 outage reports from service providers to the Network Reliability Council. Data shows that there are very few instances where circuits in the 9-1-1 network fail for longer than 30 minutes. 9-1-1 service is perhaps the most reliable public service available today.

A critical component of 9-1-1 service is the database that provides detailed information regarding the telephone number and, in the case of wireline telephones, location of the caller. These databases, usually maintained by the local telephone company in cooperation with the 9-1-1 center, enable equipment at the 9-1-1 center to display the call back number and address of the caller, and then match the address to the appropriate response agency, (either police, fire or EMS) all within seconds of the 9-1-1 call being initiated.

The quality of 9-1-1 databases is outstanding not only with respect to the inventory of telephone numbers and locations, but also with regard to the updating of databases that literally occurs on a daily, and sometimes hourly, basis. New telephone subscribers are entered into the 9-1-1 database system virtually real-time.

The 9-1-1 network, combined with the 9-1-1 database and the equipment at the 9-1-1 center that accesses the 9-1-1 database, is designed to ensure the highest possible level of reliability.

The final component of quality of service are the nearly 100,000 professionals employed in 9-1-1 centers throughout the U.S. Whether in a two-position 9-1-1 center in a rural area or in a 200-position 9-1-1 center in Chicago or Los Angeles, dedicated telecommunicators, supervisors, data base managers, training managers, and 9-1-1 center managers make the quality of service what it is today.

Harris Poll data gathered in conjunction with this report indicates that the American public is satisfied with the current level of service when dialing 9-1-1. Americans rate the level of 9-1-1 service highly. Nearly three-fourths rate the system as either good or excellent with just over one in five (22%) giving it the top rating. One in four (25%) give the emergency calling system a rating of average, while very few rate it below that. Americans are also confident (42% very confident, 51% somewhat confident) that if they had to call 9-1-1 they would receive the appropriate assistance. [Figures 1 & 2]

Among those who have called 9-1-1 with an emergency, satisfaction levels with the service received were high. Users of the 9-1-1 system were most satisfied with call answer time and the quality of telecommunicator service.

Roughly two-thirds were very satisfied with the amount of time it took for their call to be answered (67%) and the quality of service received from the 9-1-1 telecommunicator (65%). An additional one-fourth were somewhat satisfied with each of these service attributes, leaving only one in ten who were not very or not at all satisfied.

When rating the amount of time it took for police/fire/emergency medical service personnel to respond to their emergency, satisfaction was again high although slightly tempered. Half (50%) of those who have used 9-1-1 were very satisfied with the response time and an additional one-third (31%) were somewhat satisfied. Roughly one in five (19%) were not satisfied with the time it took for emergency personnel to respond. [Table 1]

Conclusion

This study found that there is an overall high level of public satisfaction with the quality of service for 9-1-1. Existing 9-1-1 networks perform well and deliver calls consistently to the 9-1-1 centers. However, the 9-1-1 networks are being strained to accommodate new initiatives to promote competition in local telecommunications and to keep up with advances in technology. Service could be better and costs could be lower. More up-to-date information could be available. Call takers could have more sophisticated tools at their command.

The Commission believes stakeholders need to make the political, social and economic commitments necessary to provide the most advanced, most reliable and most helpful 9-1-1 service to all Americans.

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Table 1
Satisfaction with 9-1-1 Services

Base: Have called 9-1-1 (n=1103)
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"How satisfied were you with each of the following?"				
	Very satisfied	Somewhat satisfied	Not very satisfied	Not at all satisfied
The amount of time it took your call to be answered	67%	22%	7%	4%
The quality of service you received from the 9-1-1 operator	65%	25%	7%	3%
The amount of time it took for police/fire/EMS personnel to respond to your emergency	50%	31%	10%	9%

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9-1-1 Availability: Grade B

There are over 3,000 counties in the U.S., most of which have 9-1-1 coverage. However, there are some areas in the U.S. where 9-1-1 service is not available.

Universal access is a challenge:

- 231 counties have no 9-1-1 service – wireline or wireless.
- 6% of land in the U.S. is not covered by 9-1-1.
- Because 9-1-1 is usually funded by local entities, poor, rural areas cannot afford the cost of initializing service or purchasing necessary equipment.
- Once funding has been allocated, it can take up to 18 months to achieve fully operational 9-1-1 service.
- A growing number of 9-1-1 callers are being served by PBXs (Private Branch Exchanges) that do not support E9-1-1.

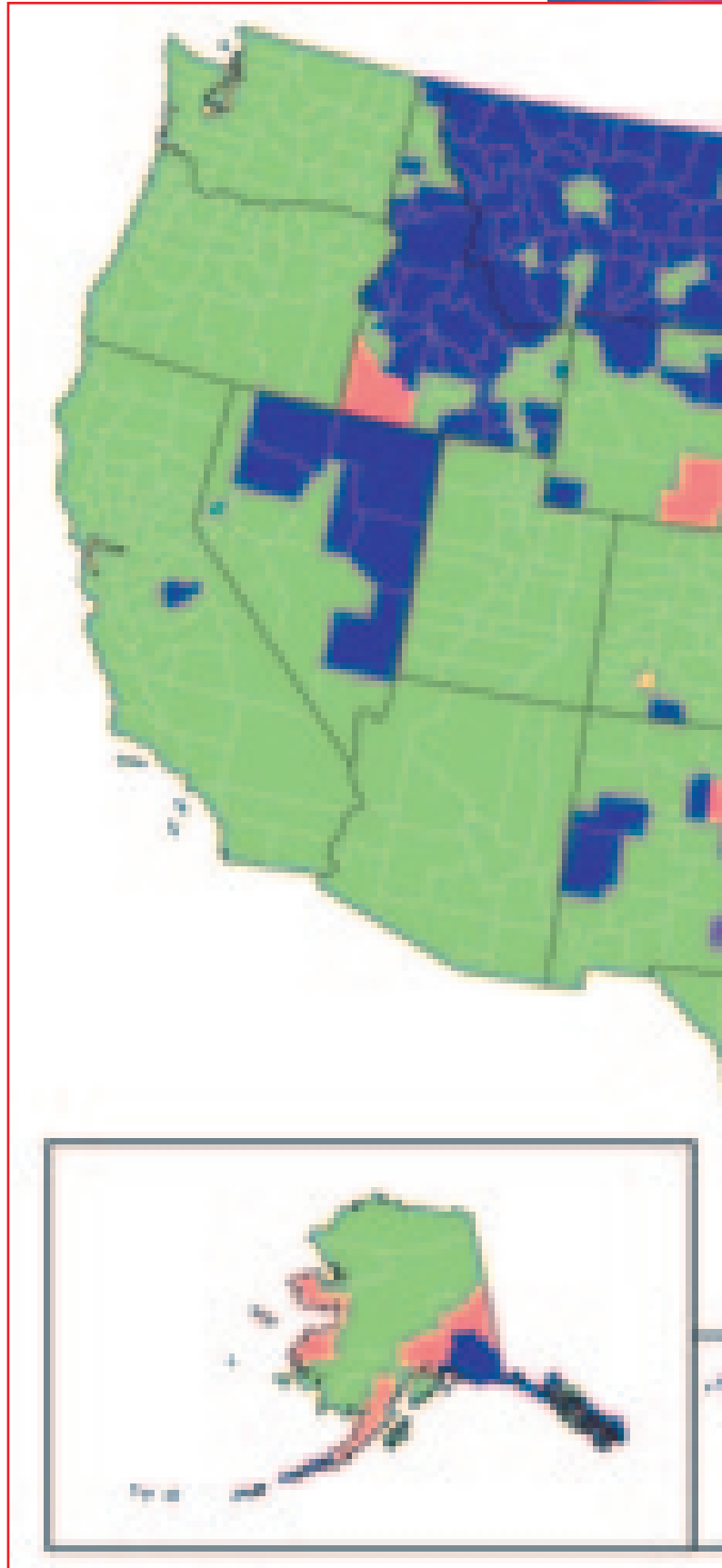
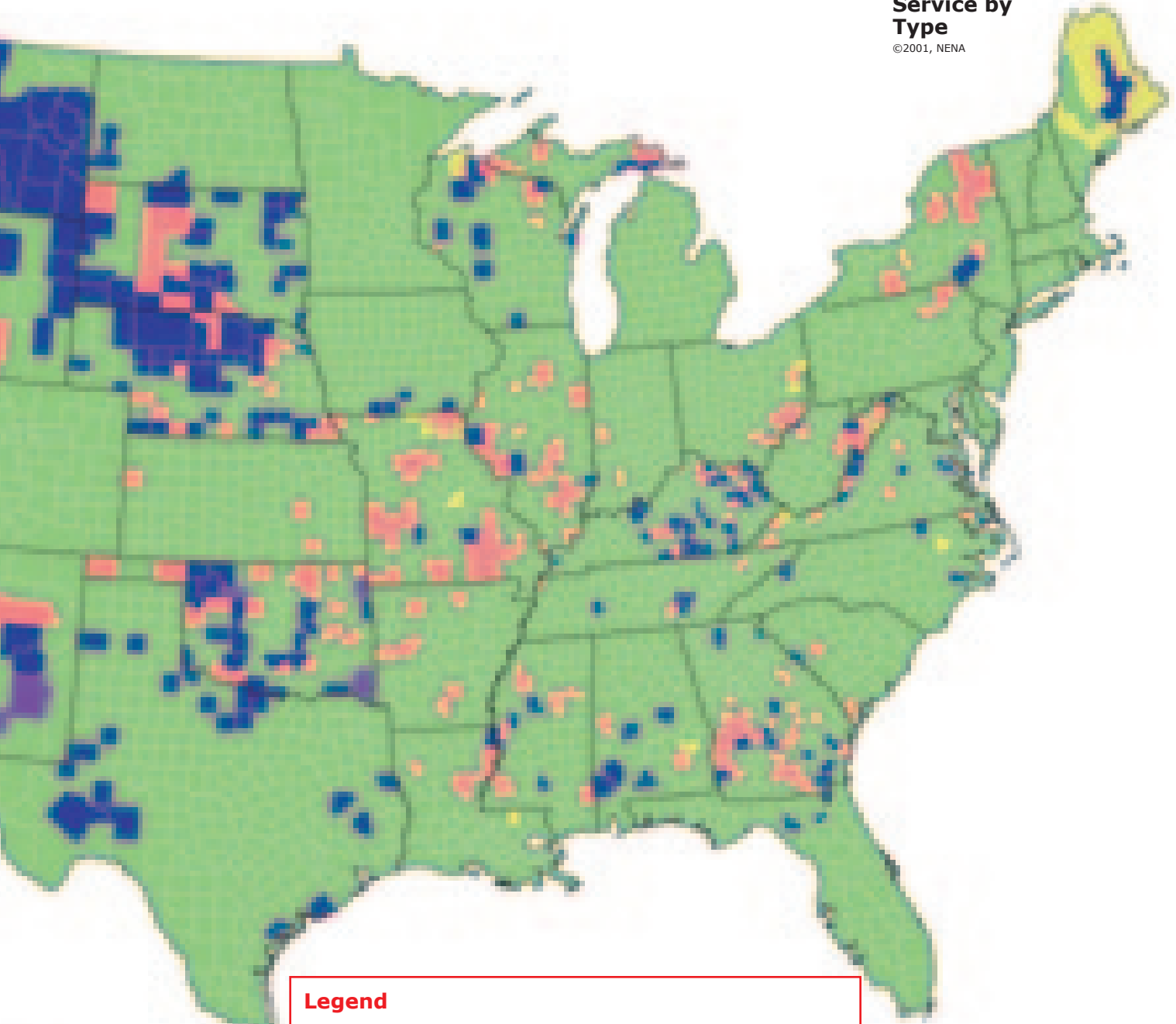


Figure 3
Distribution of 9-1-1 Service by Type
 ©2001, NENA



Legend

9-1-1 Service Status

- No 9-1-1 Service
- In Process of Implementing 9-1-1
- Some or All Parts of the County Have Basic 9-1-1 Service
- Partial Enhanced 9-1-1/Partial Basic 9-1-1
- Some or All Parts of the County Have Enhanced 9-1-1 Service

*Data is from recipients participating in NENA's survey during the RCN. May 2001

Not to Scale

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According to the Cellular Telecommunications and Internet Association (CTIA), 86 million people subscribed to wireless telephone service in 1999, and nearly 110 million by year-end 2000. [Table 2] More and more of the mobile public are dialing 9-1-1 every day. NENA estimates that of the 190 million calls made to 9-1-1 in 1999, 50 million of them (26.5 percent of the total) were made from wireless telephone users. In many metropolitan areas this percentage is much higher.

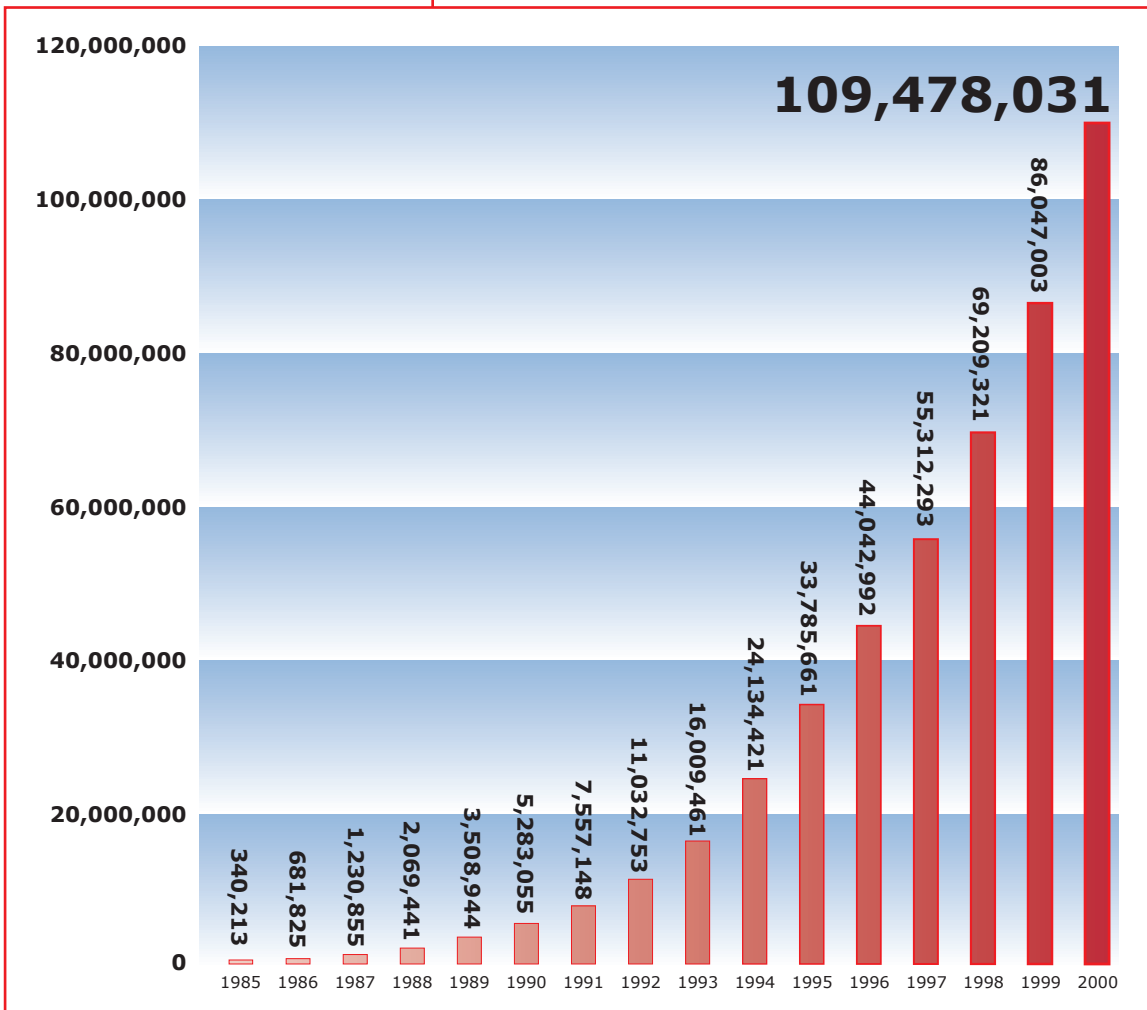
After years of critical discussions over the need for wireless 9-1-1 service, the FCC Docket 94-102 resulted in a requirement to have call-back and location determination of wireless calls available by October 1, 2001 through a two-phase process. Many states are now advancing legislation to support the upgrade to more effective wireless 9-1-1 service.

The implementation of wireless standards for location technology has been lagging behind regulators' wishes. This is due in part to many factors ranging from the unavailability of public funds for enhancing the wireless 9-1-1 system to technological and educational barriers to implementation.

With legislation, funding, and the technology in hand or on the way, the wireless Phase I and Phase II challenges will be met, even if later than October 2001.

Table 2
Wireless Telephone Service — Estimated Subscribers

©2001, CTIA



9-1-1 Public Awareness and Education: Grade B

Nearly all Americans are familiar with the 9-1-1 emergency calling system. Beyond general familiarity, most Americans also give the system high marks and have confidence in the system. Roughly half of all adults responded that they have used the 9-1-1 emergency system at some time. Knowledge about the specifics of usage, fees and operational responsibility, however, can be improved.

Demonstrating nearly universal awareness, an overwhelming 95% of all U.S. adults are very familiar with the 9-1-1 emergency calling system, understanding what it is intended for and when to use the service. Nearly all of those remaining (4%) understand what 9-1-1 is intended for, but are unfamiliar with when to use the service. Less than one percent of adults report that they are not very or not at all familiar with the 9-1-1 emergency calling system. [Table 3]

Knowledge of how 9-1-1 really works varied. The majority (96%) of Americans believe that 9-1-1 is available everywhere in the United States. When questioned about the ability to automatically identify a caller's address or location when dialing 9-1-1, nearly all believe their address is known when dialing from home (94%). A majority also believe this can be done when calling from a pay phone (55%). Few believe the technology is currently available to identify the location of 9-1-1 calls made from a cellular telephone (15%). [Figures 4 & 5]

Responsibility for the operation of 9-1-1 services is viewed predominantly as a local responsibility, although many (35%) are not sure who runs the service and a significant minority believe the phone company, state police and fire departments as well as the Federal government have operational responsibilities. Most often named as responsible for operating 9-1-1 service is local police department (51%), followed closely by local fire (31%) and EMS (28%). While operational responsibilities are somewhat understood by most, nearly half (48%) of all adults are not sure whether or not their local 9-1-1 service is regulated by the Federal government. Those who remain are split (24% yes, 28% no) on whether or not their local 9-1-1 service is federally regulated. [Table 4 & Figure 6]

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Table 3

Familiarity with 9-1-1 Emergency Calling System

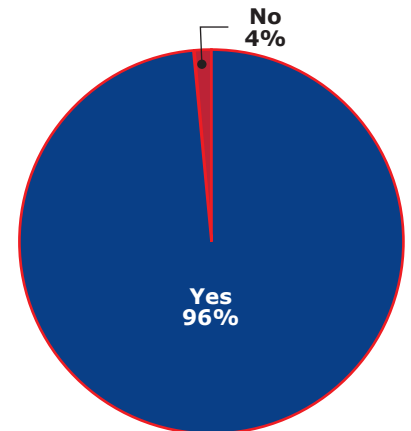
"How familiar are you with the 9-1-1 emergency calling system?"	Total
Very familiar; I understand what 9-1-1 is intended for, and I know when to use the service.	95%
Somewhat familiar; I understand what 9-1-1 is intended for, but I am unfamiliar with when to use the service.	4%
Not very familiar; I have heard of 9-1-1, but I am not sure what it is used for.	<1%
Not at all familiar; I have never heard of 9-1-1.	<1%

Base: All Respondents (n=2003)
©2001 NENA, Harris Interactive

Figure 4

Availability of 9-1-1

"Do you believe that 9-1-1 is available everywhere in the United States?"



Base: Familiar with 9-1-1 (n=2001)
©2001 NENA, Harris Interactive

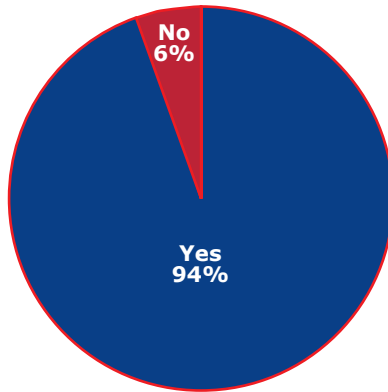
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Figure 5
Ability to Identify Address or Location of 9-1-1 Caller

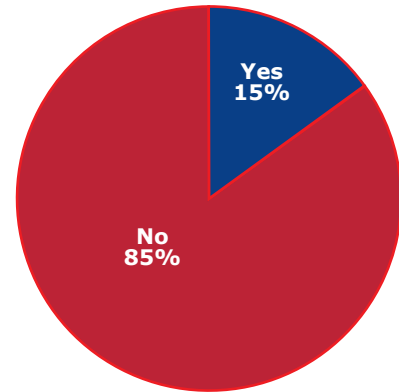
“Do you believe the 9-1-1 operator can automatically identify your address/location when you call 9-1-1 on ...?”

Base: Familiar with 9-1-1 (n=2001)
 ©2001 NENA, Harris Interactive

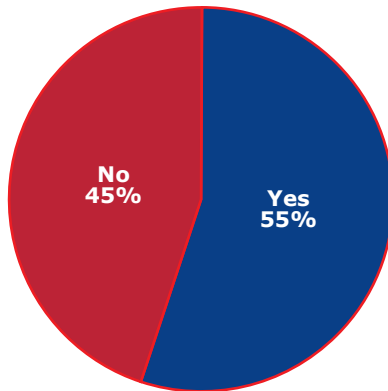
Your home telephone



A cellular telephone



A pay telephone



None of these

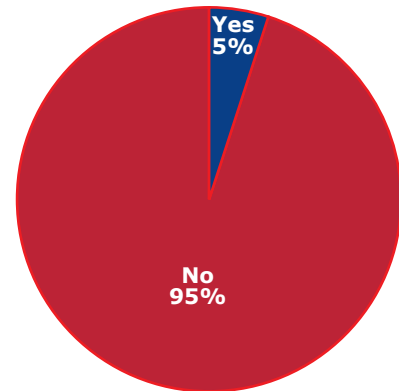
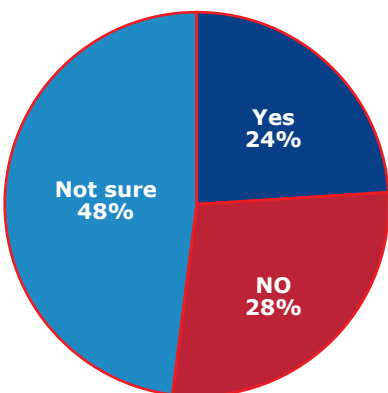


Figure 6
Federal Regulation of Local 9-1-1 Services
 “Do you believe that the 9-1-1 service you receive locally is regulated by the Federal Government?”



Base: Familiar with 9-1-1 (n=2001)
 ©2001 NENA, Harris Interactive

Table 4
Responsibility for Operating 9-1-1 Service
“Do you know who is responsible for operating your 9-1-1 service?”*

	Total %
Federal Government	7
State Police Department	16
State Fire Department	10
Local Police Department	51
Local Fire Department	31
Local EMS	28
Phone Company	12
Not sure	35

Base: Familiar with (n=2001)
 * Respondents selected all agencies they believe participate in operating 9-1-1.

9-1-1 Wireless: Grade I

CTIA estimates that there were 110 million wireless telephones in the U.S. in 2000. Because so much effort has gone into building the 9-1-1 system's ability to identify the fixed location of call origination in wireline calls, the lack of fixed location in wireless calls has taxed the system. With more than 25 percent of all calls originating from wireless handsets, the 9-1-1 system is struggling to bring aboard the technology to locate the origin of these calls, and provide the equipment, data handling capacities, and the Public Safety Answering Point (PSAP) personnel competencies essential to provide the needed services in a changing environment.

The entire 9-1-1 community must be viewed as stakeholders in 9-1-1 wireless services, including the carriers, handset manufacturers, telephone companies/networks, the public safety community, and the public. Each brings a different set of goals, motives, and timelines. Wireless is easily as much of a core issue for 9-1-1 viability as any other issue. Successfully dealing with wireless technology will signal the next era for 9-1-1. A lack of success will prove what some critics are now saying, that 9-1-1 has peaked, that public confidence is eroding, that the system cannot keep up with the technology.

Under the Phase I/Phase II FCC mandate, carriers in response to a PSAP that properly requests Phase I service, must define and deliver data related to the cell site location and the caller's callback number. Interconnecting with the in-place 9-1-1 system does this. Phase II will provide more detailed information on caller location, but through a choice of two technologies for the carrier – either network- or handset-based location determination.

The grade for Wireless is “incomplete” (I) due to the fact that wireless Enhanced 9-1-1 (E9-1-1) is a work in progress. The October 1, 2001 date for phased-in deployment of Phase II is fast approaching, yet current estimates are that it will be as many as 4 years before Phase II is fully implemented. Phase II is not a flash-cut process. Carriers choosing network-based technologies must establish the necessary hardware and software into their networks to meet the request from a PSAP for E9-1-1 wireless service. With handset-based technologies, the deployment could take even longer, up to 4 years from the October 2001 date.

Wireless E9-1-1 has progressed rapidly since 1996. Investment in the development of location technologies has been substantial, and several technologies have been developed and field-tested. Many PSAPs and states representing PSAPs have requested Phase II and are preparing to use this new location technology once available. Ways to accelerate deployment are being investigated by the public safety community.

The Commission estimates that less than 50% of the U.S. public has wireless 9-1-1 Phase I service as of this report. There is currently, no community in the United States with Phase II location services. This level of service was originally mandated by the FCC to be implemented by October 1, 1999. The extended deadline for these services is October 1, 2001. Most major wireless carriers have requested an extension or a waiver of compliance with this mandate, and it is expected that the October 1, 2001 deadline will be further extended.

The National Emergency Number Association is partnering with the U.S. Department of Transportation to manage a multi-party initiative to collect data and conduct outreach and education activities to accelerate the implementation of wireless location services for 9-1-1. Much

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work remains to be done by PSAPs, vendors and wireless carriers to meet Phase II requirements. Through these efforts these parties must cooperate and find innovative solutions to implement wireless location services for 9-1-1.

Technology Issues

There is an obvious need for both systematic legislation and technology standards, which will allow protocols, structures, device compatibilities, and other features that will help save time and confusion downstream. Once considered “non-traditional” devices, wireless handsets are increasingly becoming the preferred, if not the only, telephonic device used by growing segments of the population. Not well anticipated in the original planning for the architecture of 9-1-1, they tax the systems, methods, procedures, workstations, and training within the public safety system.

A sufficient network engineering issue is understanding and applying the same basic engineering techniques as have been used for 9-1-1 networks to the newer wireless case. The only thing more unusual about wireless 9-1-1 network engineering is the potential level of ‘mass calling’ due to multiple calls about the same event, and this can also be provided for in current engineering methods. Congestion control at the earliest possible point in the call path is standard in wireline but currently unrealized in wireless 9-1-1.

Discussions on implementation of technical solutions for caller location are roughly categorized into two camps: network-based and handset-based solutions. Wireless carriers and their customers will choose which technologies and which features best meet their needs.

Carrier Issues

Wireless carriers must choose among switching, routing, and transport solutions for their 9-1-1 calls. One such choice, call-path associated signaling (CAS), uses a 20-digit message and is not well supported on the existing 9-1-1 network. No easier is an alternative non-call-path technology (NCAS) that sends some data through an edit parallel messaging system, and does not require switching, transport, or other upgrades. A Hybrid option requires no new components, but does require software additions to in-place switching and data components. It goes hand-in-hand that the more robust forms of data infrastructure require more advanced technologies.

Since wireless communication depends strongly on the existing 9-1-1 systems, optimizing the potential of wireless is necessarily restricted without modifications to the in-place 9-1-1 systems. Without agreement on technologies, standards, protocols and the like, each market still has the option to implement whatever technology is available or works for the given circumstances. Technology solutions abound. More cooperation among wireless carriers, PSAPs, and 9-1-1 service system providers, can help simplify and make more precise that very dynamic and difficult process of providing wireless caller location to the PSAP.

Location Issues

With a call volume of approximately 50 million wireless 9-1-1 calls last year, local authorities are concerned that their inability to pinpoint callers' locations will cause life-threatening delays.

Many wireless 9-1-1 callers today either do not know their specific location, or are unable to clearly articulate it during an emergency. As such, the PSAP often faces the need to investigate multiple locations to determine whether they are receiving multiple calls related to the same event or are receiving calls from separate events. The process of investigating multiple locations ties up resources that would otherwise be available to handle other calls, thus undermining availability and also potentially delaying a response to other real needs.

Emergencies in both rural and urban areas pose their own unique challenges for members of the public safety community. For example, data from the United States Department of Transportation shows that 58 percent of all fatal accidents occur in rural settings, and of those accidents, only 11 percent take place on the more heavily traveled interstate system. Time is of the essence in preventing death and minimizing injury, especially during the "golden hour" between the time of an accident involving injuries and the victim's arrival at the hospital. Nearly one-third of accident victims in rural areas do not arrive at the hospital within an hour, largely due to public safety's inability to quickly reach the accident scene.

It is likely that the investment in Phase II technology will actually save money in the long run. The number of wireless 9-1-1 calls will continue to increase. Without location, the time required to process the call and response will remain far above that of wireline calls. Eventually, more and more call takers and positions will be required to handle the volume. In the long run, technology is far less expensive than people. Technology will allow fewer call takers to process more calls more efficiently and get assistance to people more quickly, tending to reduce medical costs.

The Challenges

It is incumbent upon legislators/regulators at all levels to advance the process for their jurisdictions. One approach suggests that by collecting a wireless E9-1-1 surcharge and establishing state administrative mechanisms, the necessary rules and procedures will be created. With the development of implementation plans, a cooperative effort can plan, coordinate and implement adoption while also providing a structure for maintenance and operation of the system.

Wireless presents challenges other than location detection, portability and trunk sizing – many of which relate to slow implementation: knowledge transfer, standards problems, lack of partnering, and the need for road block removal. Public safety organizations, together with CTIA and Federal agencies, are working to accelerate wireless implementation through data collection, workshops and wireless forums, and technology transfer programs.

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9-1-1 Tomorrow: Grade D

While 9-1-1 service works well today, there are signs that the 9-1-1 system has not kept up with rapid changes in telecommunications technology. For that reason, a grade of D has been assigned for the future outlook of 9-1-1, primarily because of the inability to respond to technological changes.

Network: More than 90% of 9-1-1 networks use outdated analog technology that is slow (by today's standards) in delivering calls, although the reliability of these networks is excellent. The data transport is typically no faster than 9,600 bits per second (also slow by today's standards) and delivers only text. The ability of 9-1-1 networks to accommodate Federal mandates (e.g., wireless, Local Number Portability) and new technology (e.g., Internet Protocol telephony, Automatic Collision Notification) is being strained because these networks are performing beyond original design.

New services that could enhance 9-1-1, such as Automatic Collision Notification and hypertext links, are not available via any automated and standard interface. As a result some new services that could be used to save lives and properties are standing in the wings awaiting standards and implementation.

Signaling System 7 (SS7) is the standard signaling protocol for the telecom industry. Historically, the 9-1-1 systems operated by the telephone companies have operated in analog mode, since it supported E9-1-1 needs for wireline telephones and was less costly. Today, the majority of 9-1-1 selective routing tandems are digital switches. SS7 is the transmission path of choice with the implementation of a modernized 9-1-1 network architecture. Catalysts for this change have been the Competitive Local Exchange Carriers (CLECs) and Wireless Service Providers (WSPs), the majority of which demand the exclusive use of digital facilities. While using digital technology consistent with the Public Switched Telephone Network (PSTN) for 9-1-1 service may lower the ongoing maintenance costs, the cost of converting from analog to digital is often seen as prohibitive by 9-1-1 authorities, many of whom have limited funding.

This digital signaling mode virtually eliminates Automatic Number Identification (ANI) failures and is capable of carrying more information faster than its analog predecessor. Call setup times – a source of complaint in many areas – are typically 40% faster with SS7. SS7 is also capable of carrying wireless call data. This includes the identification of the callback number, the cell the call originated from, and the latitude and longitude of the caller. The transition from analog to SS7 across North America is a slow process, however, due to lack of public policy and the availability of funding mechanisms to allow recovery of cost.

Analog signaling works, but it is limited in its application. Some 9-1-1 systems are in the process of converting to SS7 signaling and a few have already completed this transition. All 9-1-1 networks should be upgraded from analog to digital signaling.

Digital networking is needed to:

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- Transport the greater data needed by wireless 9-1-1 (e.g., the 9-1-1 caller's callback number and location information)
- Allow integration of data from diverse sources, such as Automatic Collision Notification systems and satellite wireless carriers
- Reduce call setup and connection time

The challenge is to create an environment where the LEC has an economic means to deploy newer technologies and services, created by the PSAP's ability to purchase them.

Congress is urged to consider the status of the 9-1-1 network and how pending telecommunications and public safety legislation may further impact 9-1-1 service. Congress is also urged to consider ways to encourage accelerated upgrading of established 9-1-1 networks in order to provide better service to the American people.

Databases: There are three areas for database management improvement:

1. Increase the information available about a caller's location,
2. Improve the process to correct Automatic Location Identification (ALI) record errors or "records not found," and
3. Improve PSAP access to data stored in databases other than traditional ALI databases.

The challenge is to evolve from simple text-based records to multiple media (e.g., geo-files, building maps, photos, video) that are available from local and centralized databases working together.

The current process of reporting call misroutes or records not found via paper forms and facsimile is no longer adequate.

The challenge is to enable real-time communication among authorized PSAP personnel, LECs and the ALI database system and manager to enable almost immediate corrections and updates.

Local Number Portability enables a person to take his/her telephone number when switching from one service provider to another. Failures in these processes result in emergency responders being sent to wrong addresses.

Concurrently, with Local Number Portability (LNP) becoming more prevalent, the PSAPs can no longer tell which service provider serves a particular telephone number. The FCC needs to encourage real-time access to LNP records. This will enable PSAPs to have an alternate method of determining the serving LEC in order to locate 9-1-1 callers whose location records are not automatically provided.

Traditional ALI databases consist of address and some related information about the caller's location stored in a plain-text database. Future needs may require PSAPs to access data contained in multiple databases just to offer an existing level of service (e.g., wireline ALI in one location, wireless ALI in another location). PSAPs would have an opportunity to improve their level of service by accessing data on automobile collisions (ACN), individual medical history (special restricted databases) and premises (e.g., floor plans, photos of buildings). The security and integrity of access to data is of paramount importance.

The challenge is to enable database networking such that a PSAP or any entity responding to an emergency can easily access the data stored in one or more databases.

In summary, the ability of 9-1-1 to continue to perform under its current level is severely threatened by a number of technological advances in telecommunications, including wireless, a growing tele-

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matics industry, and non-traditional technologies devices that soon will have the capability and need to enter the 9-1-1 system. Originally built for wireline service only, the 9-1-1 system must be “re-invented” to accommodate new technologies, increased competition and other institutional changes, at a cost likely to exceed current levels of public funding. A critical need today is enlightened public policy for the improvement of 9-1-1 systems. 9-1-1 networks, supporting data systems, and other associated components, must evolve into a new generation if they are to meet the public’s expectation that 9-1-1 deliver timely and effective response.

History of 9-1-1

In 1967, a Presidential Commission recommended that a nationally uniform three-digit telephone number be used to reach emergency response agencies. The inception of 9-1-1 is credited to the American Telephone and Telegraph Company (AT&T), which responded by establishing the digits “9-1-1” as the dial-in code that could provide general access to public safety emergency responses throughout the nation. On February 16, 1968, Senator Rankin Fite completed the first 9-1-1 call in the U.S. in Haleyville, Alabama.

Since that first 9-1-1 call, 9-1-1 has grown as a service to provide millions of Americans with an efficient, dedicated, and expedient link to emergency services.

A majority of the 9-1-1 installations in America occurred from 1970 through 1990. The architecture technology in much of America’s 9-1-1 network was installed with the features of that period.

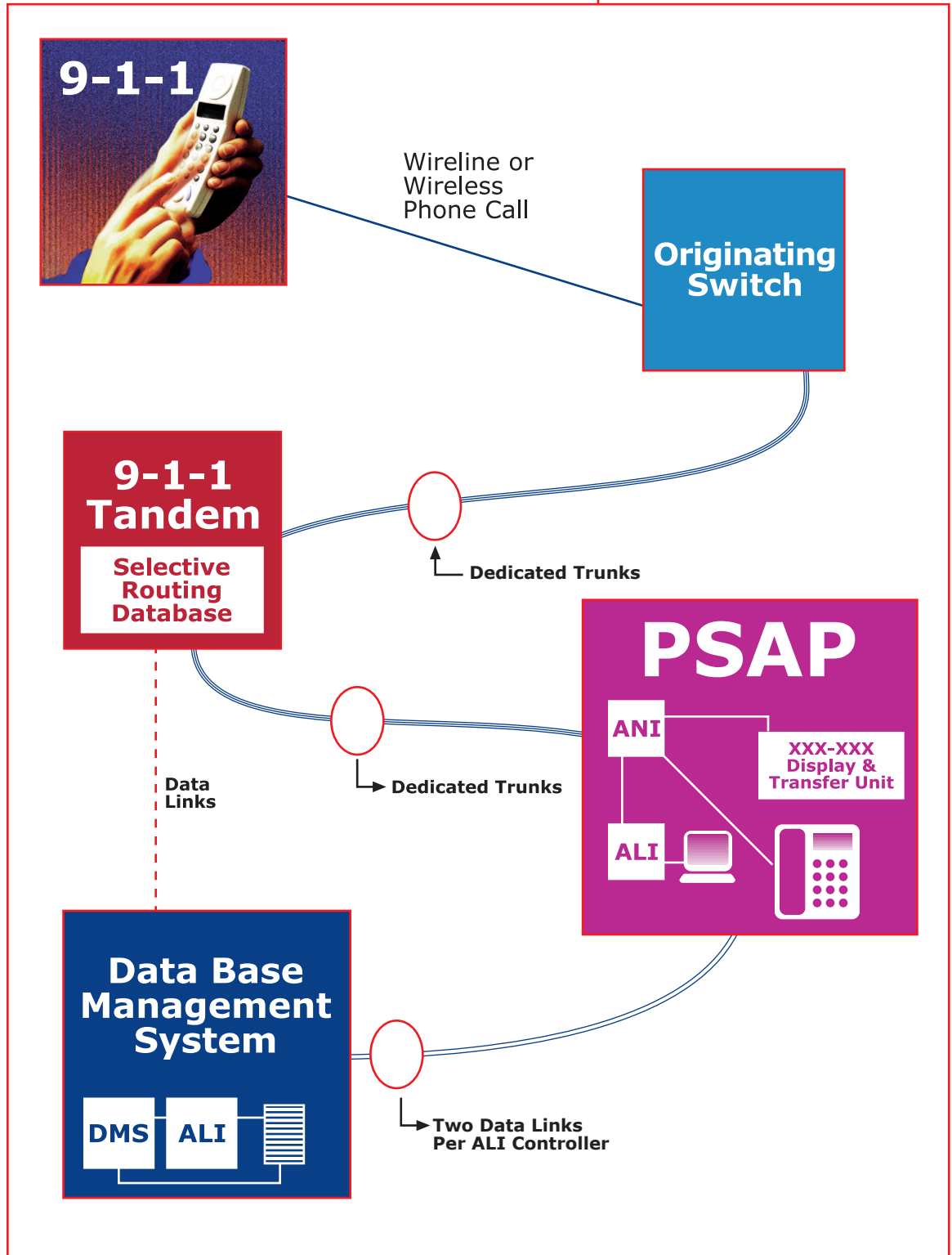
Today, 9-1-1 is firmly embedded in the American psyche, and is largely viewed as a vital public asset. Research conducted for this Report confirms that 9-1-1 is recognized by the vast majority of Americans as the universal number for emergency assistance.

9-1-1 was officially recognized by Congress in 1999, as Congress adopted the Wireless Communications and Public Safety Act of 1999, 113 Stat. 1286, declaring 9-1-1 to be the universal number for emergency calling in the United States. The Act also added provisions that provided for wireless liability protection for wireless carriers and 9-1-1 systems similar to that provided for wireline communications in a given state; and that relaxed the privacy protections in Section 222 of the Communications Act where needed to advance the response to 9-1-1 calls.

How 9-1-1 Calls Flow

9-1-1 networks provide the path from the 9-1-1 caller through a 9-1-1 service provider's local exchange carrier (LEC or telephone company) routing switch to the Public Safety Answering Point (PSAP) that answers calls for help.

Figure 7
**Network E9-1-1 System
Call Flow Chart**



Appendix A: Study Methodology

The staff of the National Emergency Number Association led the data collection effort with guidance from Deloitte & Touche on survey design, analysis and sample methodology.

Four primary surveys were completed:

- PSAP 9-1-1 system survey
- 9-1-1 service provider survey
- 9-1-1 coverage area survey
- Public awareness and satisfaction poll

PSAP 9-1-1 System Survey

Information regarding current operations and staffing was obtained by surveying more than 4,000 9-1-1 centers throughout the U.S. A short form requesting limited information was returned by 1,429 respondents representing 2,035 primary PSAPs and a long form requesting more detailed information was returned by 340 respondents representing 569 primary PSAPs.

Data was compiled and analyzed, and summary tables were then prepared for inclusion in this Report Card to Congress. For some key data elements, secondary sources were used to supplement and corroborate National roll-up data for this report.

9-1-1 Service Provider Survey

NENA surveyed all major 9-1-1 service providers to obtain information on 9-1-1 network infrastructure and call statistics. A detailed profile of the 9-1-1 service provider environment resulted.

9-1-1 Coverage Area Survey

NENA's list of PSAPs and their coverage areas was updated for the Report. Calls to state, county and local 9-1-1 coordinators assured the completeness of information. Population served was estimated using U.S. Bureau of the Census population estimates from the April 2000 Census.

The product of the survey is a map of U.S. counties showing 9-1-1 coverage as of May 2001.

Public Awareness and Satisfaction Poll

Harris Interactive was commissioned to conduct a poll on public awareness of and satisfaction with 9-1-1 service. A random survey of 2,001 adults in July 2000 examined a number of topics, including:

- Familiarity with the 9-1-1 emergency calling system
- Experience using 9-1-1 services
- Rating of the 9-1-1 emergency calling system
- Knowledge of appropriate 9-1-1 usage
- Understanding of 9-1-1 coverage and services available from home and cellular telephones
- Knowledge of responsibility for operation of 9-1-1 services

State Level Grades

The Commission believes that this first Report Card should be extended to grade the effectiveness of 9-1-1 services on a state-by-state basis. Throughout the next few months, NENA will be conducting outreach activities for state leaders in 9-1-1. Through this effort, parties will be consulted, and a consensus will be developed regarding the relevant factors and metrics that will provide for a state-level Report Card.

NENA

NENA is a non-profit organization solely dedicated to education, research, and standards for 9-1-1. NENA performs research, develops education for executives in 9-1-1 on operations, management, and technical aspects of 9-1-1 management. NENA actively maintains a recommended standards development process for 9-1-1 equipment, a certification program for 9-1-1 professionals, and a certification program for wireless location technologies.

Deloitte & Touche

Deloitte & Touche LLP is one of the largest and most highly regarded certified public accounting and professional service organizations in the world. They have an outstanding reputation for serving organizations in all major segments of the economy including government, real estate, high technology, manufacturing, commerce, banking, public utilities, transportation, and service organizations.

Harris Interactive

Harris Interactive is an internationally recognized polling and market research firm. Harris conducts nationwide surveys that can take into account population and regional diversity. The firm conducts surveys by direct interviews and through electronic media.

Data Collection Specialists

Glossary of Terms

- 9-1-1**
A three-digit telephone number to facilitate the reporting of an emergency requiring response by a public safety agency.
- 9-1-1 Network**
Literally, the dedicated circuits, and switching components used to transport voice from the originating central office, PBX, or other equivalent point to the 9-1-1 controller unit at the PSAP.
- 9-1-1 Service**
The delivery of 9-1-1 dialed calls from the originating switch to the PSAP call taker, with associated delivery of ANI and ALI data.
- 9-1-1 System**
The set of network, database and CPE components required to provide 9-1-1 service.
- ALI**
Automatic Location Identification; the automatic display at the PSAP of the caller's telephone number, the address/location of the telephone and supplementary emergency services information.
- ANI**
Automatic Number Identification; telephone number associated with the access line from which a call originates.
- Analog**
As applied to 9-1-1, call transport using signaling involving a physical change, such as voltage or frequency. Analog trunking using multi-frequency tones (MF).
- Association of Public Safety Communications Officials (APCO)**
The Association of Public-Safety Communications Officials - International, Inc. is a not-for-profit professional organization dedicated to the enhancement of public safety communications. APCO exists to serve the people who manage, operate, maintain and supply the communications systems.
- Automatic Collision Notification (ACN)**
A service provided by vendors such as OnStar and ATX that allows sensors in vehicles to automatically initiate a call to a central answering point upon specific levels of vehicle impact, air bag deployment, etc.
- Basic 9-1-1**
An emergency telephone system, which automatically connects 9-1-1 callers to a designated answering point. Call routing is determined by originating central office only. Basic 9-1-1 may or may not support ANI and/or ALI.
- Cellular Telecommunications and Internet Association (CTIA)**
The Cellular Telecommunications and Internet Association (CTIA) is the international organization that represents all elements of wireless communication - cellular, personal communication services, enhanced specialized mobile radio, and mobile satellite services - serving the interests of service providers, manufacturers, and others.
- Company Identifier (Company ID)**
A 3 to 5 character identifier chosen by the Local Exchange Carrier that distinguishes the entity providing dial tone to the end user. The Company Identifier is maintained by NENA in a nationally accessible database.
- Customer Premises Equipment (CPE)**
Terminal equipment at a Public Safety Answering Point.
- Data Base**
An organized collection of information, typically stored in computer systems, comprised of fields, records (data) and indexes. In 9-1-1, such databases include master street address guide (MSAG), telephone number/emergency service number (ESN), and telephone customer records.
- Dedicated Trunk**
A telephone circuit used for a single purpose such as transmission of a 9-1-1 calls.
- Default Routing**
The capability to route a 9-1-1 call to a designated (default) PSAP when the incoming 9-1-1 call cannot be selectively routed due to an ANI failure or other cause.
- Enhanced 9-1-1 (E9-1-1)**
An emergency telephone system which includes network switching, database and CPE elements capable of providing Selective Routing, Selective Transfer, Fixed Transfer, ANI and ALI.
- Hypertext Link**
A way to connect two Internet resources via a simple word or phrase on which a user can click to start the connection, and easily access cross-references.
- Integrated Services Digital Network (ISDN)**
A digital interface providing multiple channels for simultaneous functions between the network and CPE.
- Internet Protocol Telephony**
Blending of voice, data, and video using Internet Protocol for each, across the Internet or other existing IP-based LANs and WANs, effectively collapsing three previously separate networks into one.
- Local Exchange Carrier (LEC)**
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), and Local Service Providers (LSPs).

Glossary of Terms

- Local Number Portability (LNP)**
A process by which a telephone number may be reassigned from one Local Exchange Carrier to another.
- National Association of State Nine One One Administrators (NASNA)**
The National Association of State Nine One One Administrators is a not-for-profit corporation of full time state 9-1-1 coordinators whose primary responsibility is to administer 9-1-1 programs in their respective states. NASNA members review public policy issues, federal regulations, technology issues and funding mechanisms that impact 9-1-1 delivery.
- National Emergency Number Association (NENA)**
The National Emergency Number Association is a not-for-profit corporation established in 1982 to further the goal of "One Nation-One Number." NENA is a networking source and promotes research, planning and training. NENA strives to educate, set standards and provide certification programs, legislative representation and technical assistance for implementing and managing 9-1-1 systems.
- PBX (Private Branch Exchange)**
A smaller version of the phone company central switching office, usually privately owned by a non-telephone business. A PBX connects to the larger telephone network for external call handling, and usually requires dialing an access digit such as 9 or 8 to make an external call.
- Primary PSAP**
A PSAP to which 9-1-1 calls are routed directly from the 9-1-1 Control Office. (See PSAP below)
- Public Safety Agency**
An entity that provides fire fighting, law enforcement, emergency medical, or other emergency service.
- Public Safety Answering Point (PSAP)**
A facility equipped and staffed to receive 9-1-1 calls. A Primary PSAP receives the calls directly. If the call is relayed or transferred, the next receiving PSAP is designated a Secondary PSAP.
- Public Switched Telephone Network (PSTN)**
The network of equipment, lines, and controls assembled to establish communication paths between calling and called parties in North America.
- Redundancy**
Duplication of components, running in parallel, to increase reliability.
- Selective Routing (SR)**
The routing of a 9-1-1 call to the proper PSAP based upon the location of the caller.
- Service Provider**
An entity providing one or more of the following 9-1-1 elements: network, CPE, or database service.
- Signaling System 7 (SS7) / Common Channel Signaling 7 (CCS7)**
An inter-office signaling network separate from the voice path network, utilizing high-speed data transmission to accomplish call processing. (The Public Switched Telephone Network is in the process of upgrading from MF Signaling to SS7)
- Switch**
Telephone company facility where subscriber lines or inter-switch trunks are joined to switching equipment for connecting subscribers to each other, locally or long distance.
- Telecommunicator**
As used in 9-1-1, a person who is trained and employed in public safety telecommunications. The term applies to call takers, dispatchers, radio operators, data terminal operators or any combination of such functions in a PSAP.
- Trunk**
Typically, a communication path between central office switches, or between the 9-1-1 Control Office and the PSAP.
- Wireless**
A phone system that operates locally without wires, using radio links for call transport.
- Wireless Phase I**
Required by FCC Report and Order 96-264 pursuant to Notice of Proposed Rulemaking (NPRM) 94-102. The delivery of a wireless 9-1-1 call with callback number and identification of the cell-sector from which the call originated. Call routing is determined by cell-sector. (Target date April 1998)
- Wireless Phase II**
Required by FCC Report and Order 96-264 pursuant to Notice of Proposed Rulemaking (NPRM) 94-102. The delivery of a wireless 9-1-1 call with Phase I requirements plus location of the caller within 100 meters 67% of the time for network-based caller location systems and within 50 meters 67% of the time for handset-based location systems. (Target start date October 2001)
- Wireless Telecommunications**
The family of Telecommunications services under the heading of Commercial Mobile Radio Service. Includes Cellular, Personal Communications Services (PCS), Mobile Satellite Services (MSS) and Enhanced Specialized Mobile Radio (ESMR).
- Wireline**
The transmission of speech or data using wired connections.

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