MARCH 2011

WORKING GROUP 4B
TRANSITION TO NEXT GENERATION 9-1-1

Final Report

Table of Contents

1 Results in Brief

1.1 Executive Summary

PART ONE: Introduction

Working Group 4B of the Federal Communications Commission's (FCC) Communications Security, Reliability and Interoperability Council (CSRIC), addressed the issue area of the transition to Next Generation 9-1-1 (NG9-1-1) – a topic of considerable breadth and depth. Planning within the 9-1-1 community is still ongoing and there are a large number of complex technological, operational, funding and access issues that must be addressed to successfully implement a true NG9-1-1 system across the Nation. Deployment will likely be a complicated and evolutionary process, requiring the willing cooperation of an array of stakeholders. The intent of this document is to frame several transition issues, within the context of the CSRIC process, and offer recommendations for further action.

PART TWO: Objective, Scope, and Methodology

Originally envisioned to build on the work of CSRIC Working Group 4A, Working Group 4B was charged with investigating and determining what changes or additions in 9-1-1 related Voice over Internet Protocol (VoIP) standards and best practices are required for the evolution to an Internet Protocol (IP)-based NG9-1-1 system environment, both during the transition from E9-1-1 to NG9-1-1 and as identifiable for the longer-term, all-IP NG9-1-1 environment. This includes consideration of technical issues as well as operational and funding challenges for public safety answering points (PSAP) in a NG9-1-1 environment. In addition, the Working Group was directed to determine ways that NG9-1-1 architectures and technologies can improve 9-1-1 access for people with disabilities and non-English speaking communities.[1]

It quickly became apparent to Working Group 4B that preparing a report on transition to NG9-1-1 requires treatment of more than just VoIP issues. Since the transition must deal with all service types and all communications media types applicable to 9-1-1 services, the work of the 4B group attempts to take that into account. While this report is extensive, it is not meant to represent an exhaustive list of issues or recommendations and its content is limited to those topics covered during the allowed timeframe.

In order to develop the content of this report, the 53 members of CSRIC Working Group 4B divided into four subgroups to focus on each of the major topic areas: technology, system & operations, funding, and access. The subgroups were organized independently, by designated subgroup leads, to collect and develop content within the specific subject area. Regular meetings were held by subgroups to discuss, collaborate and recommend language for the report. Monthly conference calls were also conducted to coordinate the efforts of the four subgroups. Once subject matter was drafted, the individual subgroup contributions were consolidated into one report. A series of review sessions were organized for the consolidated report, concentrating on identifying incomplete content and deliberating subject matter that required reconsideration.

[1] CSRIC Working Group Descriptions; Source: http://www.fcc.gov/pshs/advisory/csric/wg-descriptions.pdf

Final acceptance of the report was achieved by electronic vote.

PART THREE: Background

The Nation's 9-1-1 system has existed for over 40 years. Dramatic improvements and changes in the public's use of communications technology, the saturation of the cellular phone market, and the adoption of digital, IP-based devices have rendered the analog, circuit-switched system obsolete. There is consensus within the 9-1-1 community on the shortcomings of the current system infrastructure and the need to take advantage of advances in information and communications technologies, to implement the next generation of the 9-1-1 system.

During the past decade, a number of efforts have contributed to the basic concepts of what we now label as NG9-1-1, including: the National Emergency Number Association (NENA) 9-1-1 Future Path Plan and NG9-1-1 Project, ongoing work by a variety of standards development organizations, Network Reliability and Interoperability Council (NRIC) VII, and the U.S. Department of Transportation's NG9-1-1 Initiative.

These efforts (and others) have made a significant contribution and fostered progress toward the current NG9-1-1 model. While much has been done, there are a variety of issues that must be addressed before full implementation of NG9-1-1 can occur. These issues are related to technology, operations, funding and access to 9-1-1.

Technology Issues in the NG9-1-1 Environment

The use of an IP technology base for NG9-1-1 systems allows transformation of E9-1-1 to a structure of software and database components that equal and exceed current 9-1-1 system features. This enables more complete support for current and future telecommunications services used to access 9-1-1 systems and 9-1-1 PSAPs, and other entities that process emergency calls.

The new structure of 9-1-1 systems, both in the call delivery network and within the PSAP, provides flexibility and more direct control of how 9-1-1 calls are processed. It also introduces new technological challenges. To address these challenges, the definition and scope of the Technology Subgroup's work included:

- Research and determination of what technology challenges will exist in an NG9-1-1 environment;
- Research and identification of technology issues that consider the differences between today's 9-1-1 and the NG9-1-1 environment; and
- Determination of how best to mitigate these technology challenges, identify new and suggest modifications to existing best practices and modes for a successful transition and later operations in an NG9-1-1 environment, and identify which group(s) should be responsible for implementing the recommendations and specify an appropriate timeline for completion.

The challenges identified by the Technology Subgroup center around these topics:

- **Technical Standards.** Critical to the transformation of the nation's 9-1-1 systems and PSAPs is adoption and adherence to a common set of standards (e.g., product,

interface, data, performance and operational standards)

- **Service and Access Providers.** The introduction of broadband networks and their use in originating emergency calls gives rise to an issue not contemplated in the original E9-1-1 system: the entity that supplies the broadband connection may not be same entity that originates the emergency call. The lack of formal relationships between the access network and the origination network has serious implications for the delivery of the caller's location.
- **Coordination and Control of NG9-1-1 Implementation.** There is no consensus within the 9-1-1 community on many questions related to how NG9-1-1 should be implemented. Without some form of coordination, deployment of NG9-1-1 could lack uniformity and extend over an inordinately lengthy period of time.
- **Existing 9-1-1 Best Practices (BPs).** Due to the differences in technology between E9-1-1 and NG9-1-1, not all existing BPs apply to NG9-1-1, and some BPs need further work to align them with NG9-1-1 characteristics and needs.

Operational Issues in the NG9-1-1 Environment

Operational issues in transitioning to the NG9-1-1 environment are divided into those that are specific to the operations within the PSAP and those involving operation of the 9-1-1 system.

PSAP operational issues are defined as those that affect the day-to-day operations of 9-1-1 systems and/or the PSAP related to the answering and processing of 9-1-1 calls and data. (Data includes text messages, pictures, video, telematics, data from other emerging technologies, and data associated with the processing of the call.) The NG9-1-1 environment will create significant changes in PSAP operations related to the variety of new data that must be processed, the basic changes in the 9-1-1 infrastructure, new flexibility and more direct control of how 9-1-1 calls are processed.

The subgroup assessed issues related to the following areas: PSAP Administrator Roles and Responsibilities, Education, Standards and Certification, Training, Operations, Contingency Planning, and Human Resources.

The following topics are among those included in the review of PSAP Operational Issues:

- Nationwide call routing and transfer
- The creation of virtual PSAPs and resource management of virtual PSAPs
- Delineating PSAP personnel roles and responsibilities
- Contingency planning / alternate PSAP call processing
- Multimedia call data processing, including text messaging

System operational issues are defined as issues related to the roles and responsibilities of 9-1-1 Authorities in the operation of the NG9-1-1 system. Implementation of NG9-1-1 will result in increased responsibilities for 9-1-1 Authorities in directly managing the components of the NG9-1-1 system. The subgroup assessed issues related to the following areas: 9-1-1 Authority Roles and Responsibilities, Education, Standards and Certification, Training, Operations, and Contingency Planning.

Among the System Operational Issues in the NG9-1-1 Environment identified, there is a need for:

- Expanded 9-1-1 Authority/ responsibility
- Examination of changing system operation roles and responsibilities
- Changes in State-level 9-1-1 statute regulation coordination and leadership
- Public education and awareness
- Fostering private-public policy stakeholder support
- NG9-1-1 technical and management training
- Call distribution policy rules and multi-agency business rules
- Location data management and validation
- Establishing the 9-1-1 Authority's responsibility for contingency planning.

Funding Issues in the NG9-1-1 Environment

Present methods of funding 9-1-1 systems vary widely and range from surcharges from wireline and wireless consumers to general tax funds collected either on a statewide or local basis. Periodically, other sources, such as one-time grants for specific and narrowly defined purposes, provide support for the 9-1-1 system. Revenues from long-established funding methods are eroding as more and more wireline subscribers disconnect their traditional wireline service in favor of more flexible and mobile wireless devices or other non-revenue generating services such as mobile Voice over Internet Protocol (VoIP).

Today's 9-1-1 funding model is also challenged by a variety of other factors, including inequity in collections across types of telecommunication service, shifting use of communications technologies by the subscriber where there are varying levels of surcharges, collection challenges with services such as prepaid wireless, auditing issues such as making sure the correct amount is being collected and remitted, and diversion of funds for non-9-1-1 purposes.

For those 9-1-1 Authorities with sound fund management processes and established equitable funding structures, the erosion of funds does not appear to be as significant a problem. However, the processes used by 9-1-1 Authorities vary significantly. In some cases, the technological challenges, coupled with increasingly difficult economics and funding challenges barely permit operation to keep pace in providing the response to emergencies that the American public expects and demands.

Although management processes and funding status varies, one thing is clear: the transition to NG9-1-1 will require development of new funding models. Without implementation of new funding models to provide an adequate alternate and additional source of revenue for NG9-1-1 systems, the transition period to NG9-1-1 will be protracted and compromised, service to our citizens will be jeopardized, and Public Safety's ability to keep pace with technological developments will be hampered.

The Funding Subgroup investigated and evaluated currently available funding models related to 9-1-1 and E9-1-1 for effectiveness. The subgroup attempted to identify gaps, including challenges related to implementation of best practices and models by stakeholders within the 9-1-1 system.

The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

Access Issues in the NG9-1-1 Environment (People with Disabilities/Non-English Speaking)

Within the general population of the United States, there are specific groups of individuals whose needs might be better served in future 9-1-1 systems by taking into consideration the specific challenges they experience in attempting to access the current 9-1-1 system. Historically, these individuals have been underserved by the 9-1-1 system, but NG9-1-1 holds promise for meeting their needs in "calling" for emergency help.

A number of references were consulted in considering the varying needs of people with disabilities. Included in the subgroup's discussion were definitions and data established by:

- The Individuals with Disabilities Education Act[2] (IDEA);
- U.S. Census Bureau statistics/reports; and
- The National Institute on Deafness and Other Communication Disorders (NIDCD).

Even within specific groups, access challenges are not uniform. Among people who are deaf or have a hearing loss, for example, there are four distinct categories of functional needs – each with different communication challenges:

1. People who are deaf *and* use a manual language (American Sign Language [ASL], signed English, Pidgin Sign English [PSE], Cued Speech, or foreign signed language);
2. People who are late deafened or oral deaf *and* rely on text;
3. People who are hard of hearing *and* rely on residual hearing and assistive devices and/or text; and
4. People who are deaf/blind (ranging from profoundly deaf and totally blind to someone with some vision and some hearing loss).

The access subgroup identified 23 methods currently used by people with access-challenges, to ensure that those methods can be used to access emergency services in the future. Some of the communication methods in use by people who are deaf, hard-of-hearing, have a speech disability, and others today include: Voice, Short Message Service (SMS), Real time text (RTT, TTY emulation), E-mail, Instant Messaging (IM), Video-conferencing (a caller who uses a sign language interpreter and telecommunicator), Captioned telephone, and other Telecommunications Relay Services (TRS).

PART FOUR: Analysis and Findings

Based on the issues identified, Working Group 4B analyzed current best practices, examples and

[2] http://idea.ed.gov/explore/view/p/%2Croot%2Cstatute%2C

models that could address the challenges presented. In some cases, a gap analysis was utilized to identify issue areas requiring new action. Several subgroups also conducted an assessment of current and proposed standards as part of their analysis.

Technology Analysis & Findings in the NG9-1-1 Environment

The analyses and findings of the Technology Subgroup are organized into the following sections:

- IP-based Next Generation 9-1-1
- Originating Service Providers (OSPs) in NG9-1-1
- System Service Providers (SSPs) in NG9-1-1
- PSAP Technology Issues

Additionally, there was analysis into the limitations on the use of SMS for texting to 9-1-1, a review of NG9-1-1 transitional issues, and an assessment of current/proposed standards and best practices.

Selected technology-based findings include:

Originating Service Providers (OSPs)[3] in NG9-1-1

Each category of OSP will migrate to next generation networks as appropriate standards are developed and individual company business drivers support the migration. The following topics are among those that must be considered:

- **Data Validation**—For those carriers that validate subscriber addresses, the methods for validation may change.
- **Interconnection to NG9-1-1 networks (ESInets)**—There must be cooperation between the OSP and the NG9-1-1 provider to migrate traffic to the ESInets.
- **Coexistence of E9-1-1 and NG9-1-1**—OSPs may have to interconnect to both within their service area.
- **Location Acquisition**—Legacy techniques for location acquisition may evolve to support the capabilities of NG9-1-1.
- **Multimedia Messaging**—As some OSPs deploy new media types (e.g., text, video, etc.), they may provide those services to NG9-1-1 and emergency entities, including PSAPs.

Limitations on the Use of SMS for Texting to 9-1-1

The wireless industry is developing standards for next generation non-voice communications to emergency services. Until that service is defined, standardized, and deployed on next generation wireless networks, any solution that relies solely on the use of SMS does not provide the full capability required for texting to emergency services (such as location-based routing, session

[3] In this document, OSPs are defined as including: Commercial Mobile Radio Service (CMRS) Providers, Wireline Service Providers, VoIP Service Providers (VSP) and Mobile Satellite Service Carriers.

control, etc.).

Some of the limitations of SMS include: SMS is a best effort service with no delivery or performance guarantees, in the current SMS environment, the originating network or mobile device provides no location information, and there is no security, authentication, or non-repudiation of SMS messages.

Review of NG9-1-1 Transition Issues

Several topics regarding the transition to NG9-1-1 were reviewed in the following categories:

- Networks
- Network Management/Administration
- Security
- General Information Display
- Database Management and Auditing
    - Geographic Information Systems (GIS)
    - Location Validation / Routing Databases
    - Call Management and Policy Routing Databases
- Software Applications and Services
- Supporting Elements

Assessment of Current/Proposed Standards and Best Practices

While it is too early in the process to know what specific best practices will be needed to address the transition to NG9-1-1, the technology subgroup identified existing and new best practices that can be used as the transition to NG9-1-1 commences. Some of these best practices included: network diversity requirements, call-handling in the event of call overflow or network outages, and emergency services gateway provisioning and testing.

Operational Analysis & Findings in the NG9-1-1 Environment

The analyses and findings of the Operations Subgroup are organized into PSAP Operational issues in NG9-1-1 and System Operational issues in NG9-1-1. An assessment and gap analysis includes a review of 15 PSAP Operational issues and 21 System Operational issues. References to existing operational best practices and standards, where available, have also been provided.

Assessing the PSAP Operational issues, the subgroup found that some work has been done in the 9-1-1 community by organizations like NENA, the Association of Public-Safety Communications Officials (APCO), and the National Fire Protection Association (NFPA), to issue standards and best practices for some of the topics reviewed. However, much of the analysis found gaps in current standards and best practices that either didn't address NG9-1-1 issues or would need to be reviewed and updated as needed to be more applicable to NG9-1-1.

The System Operational issues review also found NENA, APCO, NFPA, and the Federal Geographic Data Committee (FGDC) had existing materials applicable to many of the system-level topics identified. However, in a similar manner to the PSAP Operational issues, gaps in

existing standards and best practices exist.

Funding Analysis & Findings in the NG9-1-1 Environment

The analyses and findings of the Funding Subgroup are organized into the following sections:

- Assessment of Current Funding Sources
- Analysis of Alternate Funding Models
- Review of Cost Differentials Based on New Funding Structures
- Review of Regulatory and Legislative Issues

In addition to reviewing current funding mechanisms, the funding subgroup identified the challenges of collecting from prepaid cellular and Voice over IP (VoIP) services, as well as the ongoing problems of 9-1-1 fund diversion by states and/or local authorities for non-9-1-1 purposes.

The Funding Subgroup's research and findings led to a number of observations, including:

- Over the past several years, communications services have shifted from traditional wireline to wireless subscribers, not necessarily a decline in the number of subscribers to communications services.
- More recently, a transition has been occurring from traditional wireline services to either strictly mobile service in either wireless technologies or mobile VoIP without any static wireline service.
- When states or 9-1-1 Authorities do not have parity in their surcharge rates across all technologies and services, they experience declining 9-1-1 revenues.
- Methods for funding 9-1-1 are limited and generally include surcharges or taxes.
- For funding mechanisms that are dependent on the number of subscribers, any decline in subscribers is a significant concern.
- In states, locales, or regions where 9-1-1 fund management is sound (good collections mechanisms, transparency in fund management, appropriate auditing and accountability, fund is used for intended purpose), there is less concern about funding shortfalls today or in the foreseeable future.
- When raiding of 9-1-1 funds occurs, it compromises the ability to adequately fund future 9-1-1 technologies and operations and increases threats to the communications network, not to mention eroding public trust.
- NG9-1-1 will further test even adequate funding because it will operate in parallel (with associated costs) with the current system for a yet undefined period of time.
- Current economic conditions present challenges for increased surcharges or taxation to fund NG9-1-1.

Access Analysis & Findings in the NG9-1-1 Environment

NG9-1-1 offers the opportunity for realizing not only improved access to emergency services but also equal access for those with disabilities and for non- or limited-English speaking callers. A number of separate efforts have recognized this potential, including: USDOT's NG9-1-1 Initiative, NENA's Next Generation Partner Program, and FCC's NRIC VII.

During the last five years, there have been some amazing changes in communications in use by the public. For example, the CTIA has reported that while 7.7 percent of US households were wireless only in June 2005, that has grown to 24.5 percent in the same month of 2010.[4] It also reports that while there were 7.2 billion (SMS) messages sent in June 2005, there were 173.2 billion in the same month of 2010. This method of communication (texting), in earlier years reserved mostly for people who are deaf, hard-of-hearing, deaf-blind, and who have a speech disability, has definitely become a mainstream communications choice.

Although 1.81 trillion SMS messages are sent in the United States annually,[5] there is no nationwide single solution in place for providing emergency services access (9-1-1) using SMS. Various interim, often locally based, services are in place but there remains disagreement about whether this method of access should even be considered for 9-1-1 because of its unreliability and other factors. Selected access-based findings include:

- People with disabilities have been historically underserved by the 9-1-1 system, and the development of new technologies has widened the gap for those individuals that need equal access to 9-1-1. Working Group 4B recognizes that the needs of people with disabilities should be met.
- A long term solution may be provided by Non-Voice Emergency Services (NOVES), a new service for which requirements are currently being developed in the NENA Next Generation Messaging Group and in the 3GPP SA1 group. NOVES may support the following examples of non-verbal communications to an emergency services network:
    - Text messages from citizen to emergency services
    - Session-based IM type sessions with emergency services
    - Multimedia (e.g., pictures, video clips) transfer to emergency services either during or after other communications with emergency services
    - Real-time video session with emergency services
- In addition to supporting the general public, this capability would facilitate emergency communications to emergency services by people who are deaf, hard of hearing or have a speech disability. The estimated schedule for NOVES industry standards includes a possible March 2012 completion date.
- Given the scheduled completion date for NOVES industry standards and projected timetable for deployment, Working Group 4B recognizes that there are people with disabilities who cannot access 9-1-1 today, and it may be unreasonable to expect that this community simply wait until a long term solution is completed and deployed.
- In the near term, the Working Group recognizes that solutions are appearing in the marketplace in limited areas that may allow the use of SMS-based messaging for some emergency situations, which could be utilized by specific groups, such as people with disabilities.
- Existing interim emergency access (9-1-1) solutions are either available from vendor(s) today and/or are in various stages of development, testing, or trials. These interim solutions include:
    - SMS text direct to PSAP

[4] http://www.ctia.org/advocacy/index.cfm/AID/10323
[5] Ibid.

- Call 9-1-1 with SMS text back (also known as SMS with silent voice call)
- National SMS text 9-1-1 relay center
- SMS short code or 10-digit text to an individual PSAP
- Handset software TTY emulation

PART FIVE: Recommendations

Based on the research, analysis and findings of the working group, recommendations made within this document are organized into technical, operational, funding and access categories and are **summarized** within this Executive Summary.

Technology

Although technology-related work has been underway in the 9-1-1 community for some time, there is much work that still must be completed to support the technical needs of a transition to NG9-1-1. Both NENA and APCO, along with a host of standards development organizations have been working to establish the technical requirements, system design, network and database needs for the overall NG9-1-1 system. This work must continue and be supported by 9-1-1 stakeholders and additional participation in the technical working groups, committees and standards development should be encouraged.

Recommendations of the Technology subgroup include:

- Additional work to review and modify BP's identified in the report need further work to align them with NG9-1-1 characteristics and needs. Evaluate the timing to develop future BPs, applicable to NG9-1-1, which are not definable yet.
- Accelerate research and development into emerging technologies for people with disabilities to access 9-1-1. This may include in the near term, technologies such as handset/device-based TTY emulation. In the longer term, evaluation, research and development of real-time text standards and emerging technologies should be intensified while the next generation systems are being designed.
- Additional coordination between the various standards development organizations is needed. In order to maintain interoperability across NG9-1-1 systems and networks, well understood areas of focus and responsibility, and non-overlapping standards efforts will help ensure the compatibility needed to realize the full potential of NG9-1-1.
- FCC should take appropriate actions to support introduction of appropriate legislation to address the liability protection concerns related to the use of SMS in accessing 9-1-1, as well as support national efforts to provide appropriate public education. In addition, the considerations of the current limitations must be well understood, especially with regard to the significantly difference in behavior of SMS versus voice calling.
- 9-1-1 Authorities and PSAPs should inventory and evaluate the IP networks that they are already using because it is likely that multiple, limited-purpose networks will already exist. Consolidation of legacy networks into single (or as few as possible) networks should be strongly urged, rather than multiple, limited-purpose networks.

- The design and engineering of NG9-1-1 systems must take into account the impact on 9-1-1 systems and PSAPs as standardized security practices are implemented where they have not been in place before. Identifying the technical expertise required to design, implement and administer security in a complex network architecture for mission-critical systems will be a priority.

Operations

Much work needs to be done to address the operational issues in the NG9-1-1 environment. A great deal of collaboration will be required to accomplish the work, and strong leaders need to emerge to help with the collaboration. NENA and APCO as associations have already started to address operational issues and will play key roles going forward. Both associations should be encouraged to continue their collaborative efforts and more participation on joint work groups should be promoted.

States will have an important role in the operation of NG9-1-1 and must have the authority to take decisive action. Today, many states are already taking action, however others have done nothing to move toward NG9-1-1. Additionally, regional coordination among PSAPs is needed within the states.

Recommendations of the Operations subgroup include:

- In support of NG9-1-1 nationwide call routing and transfer capabilities, the National 9-1-1 Program Office, as well as other entities, should be considered for the role of establishing and maintaining the National Forest Guide.
- Promoting collaboration by PSAP administrators through developing relationships with PSAPs outside of their normal service jurisdiction, in an effort to improve their ability to handle calls in an overflow, backup, or disaster situation.
- NENA and APCO should develop standards, which should be implemented at the state, regional, and local PSAP levels, on a variety of operational needs, including: virtual PSAPs, multimedia call processing, text messaging to 9-1-1, and nationwide call transfer procedures.
- Increase educational opportunities offered to 9-1-1 Authorities, Statewide 9-1-1 coordinators, and 9-1-1 stakeholders through educational programs provided by NENA, and APCO, and the National 9-1-1 Program Office.
- Development of models of consortium arrangements and governance supporting system operations roles and responsibilities, regional and state-level coordination should be identified by NENA and the National 9-1-1 Program Office.
- FCC should work with appropriate Federal agencies and non-governmental organizations (e.g., National Association of Regulatory Utility Commissioners [NARUC] and National Conference on State Legislatures [NCSL]) to evaluate regulations, legislation, and tariffs to identify and make recommendations on needed modifications.
- Development of public education programs to inform stakeholders about NG9-1-1 is needed. The APCO/NENA NG9-1-1 Education work group should complete its work and enlist the assistance of the National 9-1-1 Program Office, NENA, and the

National Governors' Association in development and distribution of a nationwide message.

Funding

Current funding efforts that support today's 9-1-1 range from insufficient to marginally sufficient with some being sufficient for today's needs. Both capital and operational budgeting needs will need to be evaluated for the transition to NG9-1-1. However, it is likely that without new funding sources, that are sufficient and sustainable for a "new" network, current funding for 9-1-1 will be unable to absorb the additional costs of implementing or maintaining NG9-1-1.

Recommendations of the Funding subgroup include:

- Existing surcharges and taxes alone may no longer be adequate to fund both a legacy 9-1-1 system and a transition to next generation services, and as such, new and existing funding models should be evaluated.
- Funding sources must be predictable and sustainable and not reliant on one specific service type.
- Fund diversion or raiding should be prohibited. Sound account management practices call for transparency and accountability in the collection of funds by the government.
- A comprehensive next generation plan and strategy must be developed in sufficient detail to provide direction to states and to establish the framework at a national level and to ensure that the transition to NG9-1-1 is effective.
- States should be analyzing their existing 9-1-1 enabling legislation and subsequent rules, interpreting their 9-1-1 statute to ensure that it properly addresses a transition to NG9-1-1 and development of model legislation should be encouraged.
- Technical standards development and application throughout the NG9-1-1 system are critical to ensure interoperability and minimize cost. Adherence to adopted NG9-1-1 standards should be required for eligibility to funding.
- The National 9-1-1 Program should act as a collector of available grant opportunities and a repository of grant information to assist states and 9-1-1 Authorities with NG9-1-1 transition.
- Implementation, Transition and Maintenance costs will need to be identified at the national-level, state-level, and PSAP level. Data and personnel costs will need to be identified as well.
- The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

Access

As the FCC's Section 504 Handbook states, "The starting point for providing access is simple courtesy and common sense…. It is when people with disabilities are overlooked as potential or actual consumers that barriers are raised. And, ironically, it is these, often unconscious, barriers

that can be the hardest to overcome."[6]

Recommendations of the Access subgroup include:

- As recommended by NRIC VII in 2005: "PSAPs should be able to receive and reply to e-mail, SMS and store and forward messages. However, because of their latency and unreliable delivery, such messaging is problematic for emergency communication and users should be educated as to of limitations inherent to these services."[7]
- The first recommendation should remain in effect through transition to NG9-1-1 and until there is a generally available real-time text (RTT) solution throughout the wireless industry and across devices.
- Work underway for NOVES industry standards should be encouraged and accelerated. Technical standards leaders in this area should reach out to the accessibility community so that all parties are in agreement on what is being done. Guidance and assistance in coordinating by the FCC could be helpful.
- International awareness and coordination is needed, especially as trials in various countries regarding text messaging and video (sign language) access to emergency services are conducted.
- Interpreter training needs to be in place for the emergency call environment.
- Federal agencies should consider how best to certify devices and services or develop other processes to ensure that the devices and services can properly provide emergency services access as/when needed.
- New access methods should be protected from fraudulent use, from misuse overload, and from intentional overload such that real emergency calls and requests have difficulty getting through to those who can help.

PART SIX: Conclusions

CSRIC Working Group 4B has spent nearly a year researching, analyzing and evaluating a wide variety of models, best practices, standards and examples to address the technological, operational, funding and access issues that must be addressed as part of a successful transition to NG9-1-1 across the Nation. While this report is extensive, it is not meant to represent an exhaustive list of issues or recommendations and its content is limited to those topics covered during the allowed timeframe. The intent of this document is to frame NG9-1-1 transition issues within the context of the CSRIC process, and offer recommendations for further action.

Although the document contains more detailed information, some of the common themes and conclusions that will need to be addressed within the transition to NG9-1-1 include:

[6] The second edition of the *Federal Communications Commission Section 504 Programs & Activities Accessibility Handbook* (*Section 504 Handbook*), Section 2, Basic Principles of Access, p. 8. Available at: http://www.fcc.gov/cgb/dro/504/introduction.html

[7] NRIC VII—September 2005, Focus Group 1B—Long-Term Issues for Emergency/E9-1-1 Services Report, p. 55, section 6.1.5. Available at: http://www.nric.org/fg/index.html

- Clear rules, strategy and policy for how the transition to NG9-1-1 will be accomplished must be established. The transition must happen in a reasonable time frame, and without unduly burdening any party.
- Industry associations and other Standards organizations need to provide harmonized NG9-1-1 standards that foster the development and transition to NG9-1-1, including non-voice accessibility.
- Use of SMS to contact 9-1-1 is a contentious issue within the industry and its stakeholders, and the legislative and regulatory environment does not adequately enable non-voice services. Additional research is needed to build consensus.
- Existing legislation, regulations, and liability issues for NG9-1-1 must be addressed. Significant NG9-1-1 implementation will not proceed until the legacy legislative and regulatory framework allows the features and applications of NG9-1-1 to exist.
- A Blue Ribbon Panel should be formed as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.
- Accurate, cost-based funding models, which reflect fully funding NG9-1-1 needs, must be developed.
- NG9-1-1 provides improved access to emergency services for people with disabilities and/or special needs and the non-English speaking/signing/texting community. Acceleration of efforts to provide equal access to all people contacting emergency services is required.

Throughout this report, there is repeated call for more involved federal action to drive and coordinate the mission and funding of NG9-1-1. Congressional action is needed to establish an adequate and sustainable funding mechanism and federal leadership and fortitude will be essential. Although the transition to NG9-1-1 will not be inexpensive, the nation cannot afford to not move forward. Not only is it essential for the nation's communication system to keep pace with communication technologies used by our citizens, the current 9-1-1 system neglects a growing population of people with disabilities, who remain un-/underserved.

Working Group 4B sees FCC's role in the transition to NG9-1-1 as one of citizen advocate and protector, a role consistent with the FCC's mission. Since its inception in 1934, the FCC has been "charged with regulating interstate and international communications by radio, television, wire, satellite, and cable." More specifically, the Policy Division mission states that the FCC "serves the public interest by developing policies that advance public safety communications for first responders, health care, 9-1-1 services, and persons with disabilities. These policy areas include 9-1-1/E9-1-1, operability and interoperability, communications infrastructure protection, network security and reliability." The FCC should not only be a key participant in the development of the national strategy for NG9-1-1, they should seek from Congress a clarification, or if necessary an expansion, of responsibilities that will assist, promote and facilitate the transition to NG9-1-1. Just as the FCC has protected the citizen's rights in radio, television and wireline/wireless communications, FCC oversight is necessary to ensure that these new communications services do not diminish, but rather enhance and advance communications capabilities and services.

2 Introduction

This final report documents the efforts undertaken by the Communications Security, Reliability and Interoperability Council (CSRIC) Working Group 4B with respect to the standards and best practices required for the evolution of Internet Protocol (IP) based originating service providers (OSP) to the IP-based Next Generation 9-1-1 (NG9-1-1) system environment, both during the transition from Enhanced 9-1-1 (E9-1-1) to NG9-1-1 and as identifiable for the longer term all-IP NG9-1-1 environment.

Section 101 of the New and Emerging Technologies 911 Improvement Act (codified at 47 U.S.C. §615a-1(h)) requires the Federal Communications Commission (FCC) to develop several best practices related to the implementation of 9-1-1 service for IP-enabled voice service providers, commonly known as voice over IP (VoIP) providers. The CSRIC Working Group 4B will evaluate and recommend to the Council how the changes and additions to standards and best practices should be accomplished, which groups should perform that work, and an appropriate work schedule. [8]

2.1 CSRIC Structure

Figure 2-1 below presents the organization of the CSRIC—the Steering Committee, and 10 working groups, including Working Group 4B, Transition to NG9–1–1, whose activities and recommendations are the subject of this report.

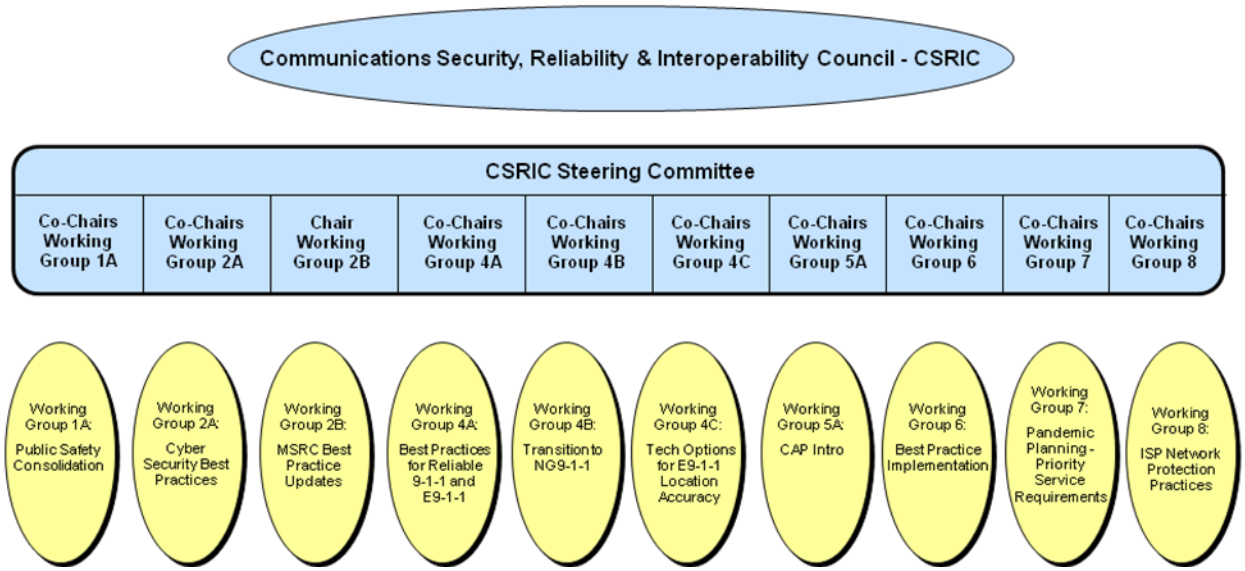

Figure 2-1: CSRIC Organizational Structure

[8] CSRIC Working Group Descriptions; Source: http://www.fcc.gov/pshs/advisory/csric/wg-descriptions.pdf

2.2 Working Group 4B Team Members

Table 1-1 lists the chairs, subgroup leads, and members of Working Group 4B.

Table 1-1: List of Working Group Members

Working Group Co-Chairs:

Laurie Flaherty—U.S. Department of Transportation (USDOT), National Highway Traffic Safety Administration (NHTSA)
Brian Fontes—National Emergency Number Association (NENA)

Working Group Subgroup Leads:

Technology: AnnMarie Cederberg—Qwest, Mark Grady—INdigital (alternate)
Operations: Marlys Davis—King County, Washington Enhanced 911 Program Office
Funding: Nancy Pollock—iXP Corporation, Inc.
Access: Rick Jones— N-1-1/8XX Essential Services Interoperability Council (NESIC), Lise Hamlin—Hearing Loss Association of America (alternate)

Name	Representing Organization/Company	TECH	OPS	FUND	ACC
Akundi, Anand	Telcordia	X			
Anderson, Michael	Ericsson	X			
Armstrong, Michael	Verizon	X			
Arocho, Angel	Comcast Cable	X			
Berger, Becky	State of Montana, Public Safety Services Bureau		X		
Breen, Tom	AT&T	X			
Brownlee, Karin	Kansas Senate, National Conference of State Legislatures. (NCSL) Communications, Financial Services & Interstate Commerce Committee			X	
Brownlow, Bill	National Public Safety Telecommunications Council (NPSTC)				
Burke, Thomas	National Association of Regulatory Utility Commissioners (NARUC)				X
Cederberg, Ann Marie	Qwest	X	X	X	X
Chiaramonte, John	USDOT NG9-1-1 Program	X	X	X	X
Davis, Marlys	King County, Washington Enhanced 911 Program Office		X		
Dickinson, Dick	TeleCommunication Systems, Inc. (TCS)	X			
Dunn, Tim	T-Mobile USA, Inc.	X	X		
Eggimann, Pete	Metropolitan Emergency Services Board (MESB)		X	X	
Goerke, Jim	Texas 911 Alliance		X	X	
Grady, Mark	INdigital	X			X
Green, Jeanna	Sprint		X	X	
Halley, Patrick	Next Generation Safety Consortium (NGSC)				
Hamlin, Lise	Hearing Loss Association of America				X
Hastings, Anna	Alliance for Telecommunications Industry Solutions (ATIS)	X		X	
Hixson, Roger	NENA	X			

Name	Representing Organization/Company	TECH	OPS	FUND	ACC
Hogle, Tim	Sprint Nextel				
Hughes, Randy	U.S. Department of the Interior, Bureau of Indian Affairs, Office of the Chief Information Officer (OCIO)				
Jones, Doug	Verizon	X			
Jones, Rick	N-1-1/8XX Essential Services Interoperability Council (NESIC)	X	X		X
Kavaleri, Teddy	District of Columbia, Office of Unified Communications (OUC)				
Keller, Matt	Motorola	X			
Kemper, Rick	CTIA—The Wireless Association	X			
Linsner, Marc	Cisco Systems/Internet Engineering Task Force (IETF)	X			
Lovett, Danny	Charlotte-Mecklenburg Police (North Carolina)	X	X	X	X
McGinnis, Kevin	The National Association of State EMS Officials (NASEMSO)				
McMahon, Kathy	Association of Public-Safety Communications Officials International (APCO)	X			
Meier, Robin	ATIS	X	X	X	X
Merklinger, John	City of Rochester/Monroe County, NY, Emergency Communications Department				
Militeau, Christian	IETF	X			X
Moseley, Bob	Fraternal Order of Police (Maryland)		X		
Musgrove, Peter	AT&T	X			X
Neilsen, Andy	State of California, 9-1-1 Emergency Communications Office				
Nixon, Jim	T-Mobile USA, Inc.			X	X
Pollock, Nancy	iXP Corporation, Inc.			X	
Ray, Amar	CenturyLink	X			X
Rosen, Brian	Neustar				X
Schumacher, Greg	Sprint Nextel				X
Sherry, Robert	Intrado	X	X		
Spence-Lenss, Carey	Intrado			X	
Suraci, Frank	U.S. Department of Homeland Security, National Communications System (NCS)				
Tersmette, Mike	PlantCML			X	X
Weinert, Stephen	U.S. Department of Homeland Security (DHS), National Communications System (NCS)	X	X		
Wisely, Stephen	Association of Public-Safety Communications Officials International (APCO)		X		

Other valuable contributors include:

Brian Daly, AT&T
Judy Harkins, Gallaudet University
Harriett Miller-Brown, State of Michigan
Jackie Mines, State of Minnesota
Lynn Questell, State of Tennessee
Richard Taylor, State of North Carolina
Norman Williams, Gallaudet University

3 Objective, Scope, and Methodology

3.1 Objective

Building on the work of CSRIC Working Group 4A, Working Group 4B has been charged with investigating and determining what changes in or additions to 9-1-1 related VoIP standards and best practices are required for the evolution of IP-based OSPs to the IP-based NG9-1-1 system environment, both during the transition from E9-1-1 to NG9-1-1 and as identifiable for the longer term all-IP NG9-1-1 environment. This includes consideration of technical issues as well as operational and funding challenges for public safety answering points (PSAP) in a NG9-1-1 environment. In addition, the Working Group has been directed to determine ways that NG9-1-1 architectures and technologies can improve 9-1-1 access for people with disabilities and non-English speaking communities.[9]

It quickly became apparent to Working Group 4B members that preparing a report on Transition to NG9-1-1 requires addressing more than just VoIP issues. Because the transition must deal with all service types and all communications media types applicable to 9-1-1 services, and the various issues in all of these areas, the work of the 4B Group attempts to take that into account.

3.2 Scope

The scope of this report is limited to the standards and best practices related to the transition of 9-1-1 related VoIP services from E9-1-1 to NG9-1-1 and the implementation of an all-IP NG9-1-1 environment. The Working Group 4B effort was established with a 12-month duration from the completion of Working Group 4A or until the completion of the CSRIC charter, whichever occurs first.

3.3 Methodology

To develop the content of this report, the CSRIC Working Group 4B members applied their diverse backgrounds in public safety and industry, as well as considerable institutional knowledge, to research and analyze the report objectives.

Initially, Working Group 4B divided into subgroups that focused on each of the major topic areas: technology, system and operations, funding, and access. Designated subgroup leads independently organized the subgroups to collect and develop content within the specific subject area. Collectively, they used an array of research sources, including published literature, case studies, state-centric feasibility studies, congressional and legislative reports, state transition plans, federal and state legislation and rules, industry association documents, and presentations by subject matter experts, legislators, and other interested parties. In addition, the subgroups reviewed existing materials and standards, particularly those developed by NENA, APCO, and the National Association of State 9-1-1 Administrators (NASNA). Regular meetings were held to discuss, collaborate, and recommend language for the report. Conference calls occurred biweekly from May through August, and then weekly during September and October. Throughout the process, written contributions were solicited from subgroup members for a range of topics to help provide input and guidance for the final report's composition.

[9] CSRIC Working Group Descriptions; Source: http://www.fcc.gov/pshs/advisory/csric/wg-descriptions.pdf

Once subject matter was drafted for the focus areas, the individual subgroup contributions were consolidated, and the effort transitioned from addressing individual subgroup content to overall report objectives and cohesiveness. A subsequent series of review sessions were organized consisting of the co-chairs, subgroup leads, and several members from each of the subgroups. This effort focused on collecting and consolidating comments, identifying incomplete content, and deliberating on subject matter that required reconsideration. Again, offline revisions were consolidated, and the full CSRIC Working Group 4B reviewed and finalized the document.

4 Background

4.1 Background/NG9-1-1 Overview

Over the last decade, a variety of efforts to design and plan the transition to NG9-1-1 have successfully concluded or their work continues today. A summary of selected efforts is included in this section as a source of background information.

4.1.1 9–1–1 Future Path Plan

In 2000, NENA initiated work on a technical strategy that became known as the NENA Future Path Plan. This proposal considered how existing 9–1–1/E9-1-1 capability could be updated technologically to become more feature rich and contained the basic concepts of what is now label NG9-1-1.

The objectives of the NENA Future Path Plan were to ensure that—

- Any 9-1-1 call originator, using voice or text, must be able to access the nation's 9-1-1 systems, and have his/her call, with caller location identification, delivered to the appropriate answering point.
- The answering point must receive and be able to manage the data and be able to transfer the 9-1-1 call to a variety of emergency service points, both local and distant, and those entities must have access to the call information for call and incident handling.

4.1.2 Standards Development Organizations Activities

Standards work for NG9-1-1 has been occurring in a number of standards development organizations, including the IETF, the 3rd Generation Partnership Project (3GPP), and ATIS.

The IETF is the international standards body for the Internet. IETF protocols define what Internet Protocol is, and how IP networks work. Among other protocols, IETF has defined the Session Initiation Protocol (SIP), the protocol most commonly used to create multimedia calls on the Internet. SIP has been adopted by 3GPP, the organization defining standards for IP Multimedia Systems (IMS).

In 2002, the IETF began work on supporting emergency calling in the Internet. Three work groups have been formed, one dealing with location (a key aspect of emergency calling), one addressing emergency calls placed from citizens and visitors to a PSAP, and one considering emergency notification systems from authorities to citizens and visitors.

The IETF work has resulted in a number of key protocol and data architectures that underpin the NG9-1-1 system. IETF work includes the representation of the location used within NG9-1-1 and the protocol mechanisms that are used to carry it, the routing mechanism that uses location to direct a call to the right PSAP, and the overall call signaling architecture based on SIP.

In 2003, 3GPP initiated a study on support for IMS emergency calls, which concluded in a report in June 2007 for Release 7. In 2005, 3GPP initiated specifications for IMS emergency

sessions, and the initial version of the specifications was completed for Release 7 (March 2007). Additional enhancements were made in Release 8 (completed in December 2008) and Release 9 (completed December 2009). The 2009 version of the report defines the requirements and architecture for IMS emergency calls. ATIS initiated a project in 2010 to define the interface from these IMS-based networks to the Emergency Services IP network (ESInet) of NG9-1-1 for emergency voice calls. The 3GPP Non-voice Emergency Services project will be developing the interface from IMS networks to the ESInet for NG9-1-1 non-voice emergency services.

International standardization is important to NG9-1-1 because devices purchased abroad and used by citizens and visitors must be able to be used for emergency calling. The European Telecommunications Standards Institute (ETSI) EMTEL is currently defining the user requirements for communication from citizens to authorities/organizations (emergency calls) based on European requirements.

Because of the global nature of Internet communications, non-U.S. communications service providers (and non-U.S. devices) will need to be able to connect into the NG9-1-1 system. It is thus essential that certain aspects of the U.S. NG9-1-1 system be based on internationally accepted technical standards. NENA and others have made significant progress toward this goal.

4.1.3 NENA NG9-1-1 Project

In 2003, NENA established a technical committee to incorporate IP-based mechanisms into 9-1-1. A three-phased approach was outlined:

- i1—documenting, at-that-time existing practices for VoIP calling to 9-1-1
- i2—defining the architecture and standards for VoIP that could be used by all VoIP providers to interface to E9-1-1 systems
- i3—defining the architecture and standards for how the entire 9-1-1 system would be redesigned to use IP-based technology.

The i3 effort led to the core architecture of NG9-1–1. NENA, recognizing that this would also require various other work efforts over time to define policy/legislation/regulation impact, database management, system operations and administration, and PSAP operations requirements and standards, as well as transition plans, has greatly expanded its efforts beyond the i3 technical work. Building on IETF standards and working from the NENA Future Path Plan, the NENA i3 effort has resulted in requirements,[10] architecture,[11] and detailed technical standards[12] for the ESInet and the NG9-1-1 services that are provided on the network. The work includes interfaces that define the way a wide variety of devices and services present emergency calls to the ESInet, and mechanisms to route and service those calls within the ESInet. NENA has also produced a transition plan document that describes how PSAPs and origination networks evolve from the current E9-1-1 system to NG9-1-1. This document describes how ESInets should be designed, and NENA is working on other operations and technical documents that will define how NG9-1-1 will be deployed and managed.

[10] NENA 08-751 NENA i3 Technical Requirements document
[11] NENA 08-002 Functional & Interface Standards for NG9-1-1 (i3)
[12] NENA 08-003 Detailed Functional and Interface Specification for the NENA i3 Solution—Stage 3

The NENA NG9-1–1 Project was formed in 2004 to tie all aspects of NG9-1-1 together. The ongoing project encompasses and coordinates many actions aimed to establish the capabilities for IP-based NG9-1-1 within this decade. Components of the NENA NG9-1-1 Project include: Technical Committee,[13] Operations Committee,[14] Next Generation Partner Program (NGPP),[15] and the Next Generation 9-1-1 Transition Planning Committee (NGTPC).[16] More information can be found at http://www.nena.org/ng911-project.

4.1.4 Network Reliability and Interoperability Council VII

The Network Reliability and Interoperability Council (NRIC) was a precursor to CSRIC, charged generally with the responsibility of advising the FCC on matters dealing with the optimal reliability and interoperability of wireless, wireline, satellite, cable, and public data networks. NRIC VII represented the seventh Charter of that Council (2004–2005). In part the charter stated:

"The scope of this activity also encompasses recommendations that shall ensure the security and sustainability of communications networks throughout the United States; ensure the availability of adequate communications capacity during events or periods of exceptional stress due to natural disaster, terrorist attacks or similar occurrences; and facilitate the rapid restoration of telecommunications services in the event of widespread or major disruptions in the provision of communications services."[17]

Among other matters, NRIC VII specifically addressed emergency communication networks, including E9-1-1. Regarding the latter, Council attention included the following areas:

- Near Term Issues for Emergency/E9-1-1 Services
- Long Term Issues for Emergency/E9-1-1 Services
- Analysis of Effectiveness of Best Practices Aimed at E9-1-1 and Public Safety
- Communication Issues for Emergency Communications Beyond E9-1-1.

The final recommendations associated with the Long-Term Issues addressed the current and future challenges facing the E9-1-1 community, and the need for nationwide "IP-based E9-1-1 capability." Recommendations also suggested that such a capability would be deployed within "an Internetwork (federation) of managed and secured Emergency Service IP Networks." The final recommendations associated with the Communications Issues Beyond E9-1-1 addressed how such a capability and deployment would support emergency response, including "modern, integrated information capabilities to support local, regional and national emergency needs." CSRIC Working Group 4B finds the NRIC work still very germane to its tasks and urges readers of this document to review the NRIC work.

For more information regarding NRIC VII, see: http://www.nric.org/

[13] http://www.nena.org/technical-committee
[14] http://www.nena.org/operations-committee
[15] http://www.nena.org/ng-partner-program
[16] http://www.nena.org/technical-committee/next-generation-transition-planning
[17] http://www.nric.org/charter_vii/index.html

4.1.5 USDOT NG9-1-1 Initiative

In 2005, USDOT began a 3-year program established to develop a national framework and deployment plan for an NG9-1-1 system. The NG9-1-1 Initiative, administered within the Research and Innovative Technology Administration (RITA), part of USDOT's Intelligent Transportation Systems (ITS) program, focused on the research required to produce a design for a next generation 9-1-1 system. The goal was to provide a system capable of providing a wider range of voice, data, and video transmission from different types of communication devices into the PSAPs and onto emergency responder networks.

The Initiative's approach focused in two areas: technical/engineering and institutional/ transitional. Technical activities centered on documenting NG9-1-1 system requirements, gathering information on and documenting a system architecture, and demonstrating a proof-of-concept system. Institutional activities focused on an assessment of the cost, value, and risk of a next generation 9-1-1 system and on developing a transition plan identified and evaluated all non-technical factors (e.g., stakeholders, impacts, and benefits) that need consideration for a successful nationwide transition.

In the development of a national NG9-1-1 system architecture, the NG9-1-1 Initiative team worked closely with industry, state and local governments and Authorities, and a diverse group of stakeholders to accomplish a three-phase set of research and demonstration activities.

For more information regarding the USDOT Next Generation 9-1-1 Initiative, see: http://www.its.dot.gov/NG911

4.1.6 Early Adopters/NG9-1-1 Planning Efforts

There are several "early adopters" of NG9-1-1 technologies at the state and local levels, as well as planning and design efforts currently underway. Appendix C, Section 6, includes summaries of the following selected examples of these efforts:

- Alabama Next Generation Emergency Network (ANGEN)
- Indiana Statewide 9-1-1 Plan
- Counties of Southern Illinois 9-1-1 (CSI)
- Texas Next Generation 9-1-1 Project
- Washington State Next Generation 9-1-1 Plan.

In addition, NENA maintains a spreadsheet of counties, regions, and states that are considering or in the process of implementing an IP network or next generation-related components in preparation for NG9-1-1.[18] The National 9-1-1 Program tracks more than $40 million worth of grants authorized by the Ensuring Needed Help Arrives Near Callers Employing 911 Act of 2004 (ENHANCE 9-1-1 Act) awarded to 30 states and territories in late 2009. Many of the awardees are using the grant money to implement NG9-1-1 components, and a summary of their projects is available on the National 9-1-1 Program's website.[19]

[18] NENA. Status of NG9-1-1 Related State Activity. Available at: http://www.nena.org/ng911-project/state-status
[19] National 9-1-1 Program *ENHANCE 911 Act Grant Program Summaries.* Available at: http://911.gov/grants.html

4.2 Technology Issues in the NG9-1-1 Environment

This section describes the technology issues that must be addressed in the NG9-1-1 transition environment.

4.2.1 Overview of NG9-1-1 Technology Topics

The use of IP as the technology base for NG9-1-1 systems allows transformation of E9-1-1 structure—made up of time-division multiplexing (TDM) transport, switch-based functions, and controlling databases—to a structure of software and database components that equals or exceeds current 9-1-1 system features. This, in turn, enables more complete support for current and future telecommunications services used to access 9-1-1 systems and PSAPs and other entities that process emergency calls. The new structure of 9-1-1 systems, which includes both those systems that provide support before interaction occurs with the PSAP and those actually resident at the PSAP, provides flexibility and more direct control of how 9-1-1 calls are processed.

As 9-1-1 moves to using IP technologies, the separation of application from access enables the ability to take advantage of multiple transport options. This provides Public Safety with expanded choices in building fault-tolerant systems by using various underlying transport facilities. The Best Practices reviewed in this report reflects the ability to use multiple IP transport facilities used by diverse networks operated by multiple providers; such last-mile transport options may include wired and wireless technologies. This concept should be embraced by network designers going forward.

The following documents were instrumental in the work of the Technology Subgroup and will provide much-needed information required as the industry moves toward NG9-1-1:

- NENA 08-003 (pre-publication draft standard, as of September 2, 2010), "Detailed Functional and Interface Specification for the NENA i3 Solution—Stage 3." Once published, the document will be available at: http://www.nena.org/standards/technical/i3-solution
- NRIC Best Practices List. Available at: (https://www.fcc.gov/nors/outage/bestpractice/BestPractice.cfm)
- NENA NGTPC. *NG9-1-1 Transition Plan Considerations* (still in DRAFT). Once published, the document will be available at: http://www.nena.org/technical-committee/next-generation-transition-planning
- U.S. Department of Transportation, Intelligent Transportation Systems. *Next Generation 9-1-1 (NG9-1-1) System Initiative Transition Plan.* February 2009. Available at: http://www.its.dot.gov/ng911/pdf/NG911_Transition_PlanFinal.pdf
- The National E9-1-1 Implementation Coordination Office. *A National Plan for Migrating to IP-Enabled 9-1-1 Systems*. September 2009. Available at: http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf
- NENA NGPP. *Policy Transition Implementation Handbook*. March 2010. Available at: http://www.nena.org/government-affairs/stories/ngpp-transition-policy-implementation-handbook.

4.2.1.1 Definition and Scope

The definition and scope of the subgroup's work includes—

- Research and determine what technology challenges will exist in an NG9-1-1 environment
- Research and identify technology issues that consider the differences between today's 9-1-1 and the NG9-1-1 environment
- Determine how best to mitigate these technology challenges, identify new and suggest modifications to existing best practices and modes for a successful transition and later operations in an NG9-1-1 environment, and identify which group(s) should be responsible for implementing the recommendations and specify an appropriate timeline for completion.

4.2.1.2 Types of Standards

Critical to the transformation of the nation's 9-1-1 systems and PSAPs is adoption and adherence to a common set of standards. Many necessary standards already exist and still more are being actively developed. Those of most interest and applicability to NG9-1-1 can be grouped into the following six categories:

- **Product Standard**—Describes the expectations and minimum requirements for a particular product or functional entity, typically in the context of a specific use.
- **Interface Standard**—Describes the requirements for connecting two or more functional entities to one another. For example, a user interface standard would describe the interaction between a human and a machine.
- **Data Standard**—Describes the definition, format, layout, and other characteristics of data shared across systems. Data standards help to ensure the seamless exchange of data between disparate systems and permit a common understanding to interpret and use data consistently.
- **Test Methodologies Standard**—Describes the test methodologies, processes, and other requirements associated with determining the performance of a particular product.
- **Performance Standard**—Describes how a product or service should function, often in terms of quality, functionality, timeliness, etc.
- **Operational Standard**—Describes how a function or business process should occur, setting minimum requirements for performance or delivery. Operational standards could include standard operating procedures (SOP), training guidelines, and policies.

The first three categories (product, interface, and data) are primarily ***design standards*** that describe how a product should be developed and define the particular attributes or characteristics associated with its construction. Alternately, ***performance standards*** describe how a product should function and the testing used to determine that it meets all affirmed requirements. [20]

The following groups are all working on issues associated with the transition to NG9-1-1 and will be key participants in creating and publishing standards for the industry to follow:

- NENA (http://www.nena.org)

[20] The National 911 Program *Next Generation 9-1-1 (NG9-1-1) Standards Review*; Source: http://www.911.gov/ (not yet published)

- ATIS (http://www.atis.org)
- IETF (http://www.ietf.org)
- APCO (http://www.apco911.org)
- Telecommunications Industry Association (TIA) (http://www.tiaonline.org)
- 3GPP/3GPP2 (http://www.3gpp.org) / (http://www.3gpp2.org)
- Institute of Electrical and Electronics Engineers (IEEE). (http://www.ieee.org)

4.2.1.3 Service and Access Providers

The introduction of broadband networks, and their use in originating emergency calls gives rise to an issue not contemplated in the original E9-1-1 system: in some instances, the entity that supplies the broadband connection may not be same entity that originates the emergency call. In wireline and wireless telephony services, the entity that provides the access network (twisted pairs to residences for wireline, radio access network for wireless) is the same entity that provides the telephony service. With VoIP, that may be true, but it may not. In IMS-based VoIP networks, it is true that the access network and broadband network may be provided by the same entity. An Interconnected VoIP Service Provider, for example, may supply the telephony service while a cable company provides the access (broadband) network. This situation occurs more frequently with multimedia origination services. For example, an Internet Service Provider (ISP) may provide an instant messaging (IM) system that is supported by a provider's fiber optic or a wireless provider's radio access network (RAN).

For 9-1-1, it is the access network that knows the location of the caller, and yet it is the origination network that provides the signaling and the media. When the access network and the origination network are operated by the same entity, this is not an issue; however, when they are operated by different entities, location information needs to come from the access network.

The FCC has long recognized this problem; the current VoIP regulations for 9-1-1 require a self-declared (user-supplied) location because of the unavailability of the location from the access network, and the lack of relationships between the access network and the origination network. The FCC CSRIC Working Group 4C is addressing 9-1-1 location accuracy and identifying gaps associated with location.

4.2.1.4 Standards-Related Issues

The current NENA and IETF architectures were developed with a focus on VoIP service providers. Additional standards effort is ongoing to support 3GPP IMS-based networks and their interface to the ESInet.

3GPP specifications for IMS emergency calls were completed for Release 7 (March 2007). Additional enhancements were made in Release 8 (completed in December 2008) and Release 9 (completed December 2009). ATIS initiated a project in 2010 to define the interface from these IMS-based networks to the ESInet of NG9-1-1 for emergency voice calls. The 3GPP Non-voice Emergency Services project will be developing the interface from IMS networks to the ESInet for NG9-1-1 non-voice emergency services.

The interface between originating networks and the ESInet, i3, is a standard interface defined by NENA; its purpose is to ensure that originating networks can interface to the ESInet in an interoperable manner. ATIS is working on a standard that would support the IMS environment

with minimal impacts on the ESInet architecture and interface.

A concern for all parties involved in the deployment of NG9-1-1 is that there are several instances of more than one standard from which to choose, which could give rise to problems related to interoperability. The development of the IETF and NENA architecture standards was largely completed before 3GPP began its technical work. Detailed technical interface work continues, as design standards for end-to-end NG9-1-1 continue in development. For example, NENA's 08-003 technical interface document is not in a final state as of this writing, and NENA is already planning a second version of this interface document. 3GPP also continues the development of its technical interface document for emergency services in an IMS environment (3GPP TS 24.229). Efforts should focus on tying together the NENA, IETF, ATIS, and 3GPP standardization efforts. 3GPP has started work on IP-based emergency services networks related to non-voice emergency calls. CSRIC notes that deployment of NG9-1-1 with non-wireless applications, largely based on NENA 08-003 standards, has already begun. Standardization efforts are needed to develop a common and understood interface between the exit point of an OSP's network and the entry point of an NG9-1-1 ESInet.

The challenges related to the multiple standards efforts was recognized by industry participants in several NG9-1-1 working groups, and the result was the definition of standards roles and responsibilities in addressing NG9-1-1 standards. It was recognized that NENA should provide requirements for emergency services networks and offer suggested requirements for end-user devices and origination networks to provide input toward an end-to-end solution. It was also recognized that 3GPP and ATIS should be responsible for providing requirements for end-user devices and origination networks.

These standards roles should be carried forward in all future emergency services standards work. Of course, the intention of all parties should be to try to negotiate to define mutually satisfactory interfaces, and allow IP-based systems to evolve to meet changing environments and standards.

4.2.1.4.1 Non-Voice Technical Standards

NENA has defined Non-Voice-Centric (NVC) Emergency Services as next generation emergency services supporting non-voice centric communications between end users and emergency authorities using real-time session-based text and other multi-media. NVC Emergency Services supports location determination of the end device, location updates, and location transport in a manner similar to next generation emergency voice communications. NVC Emergency Services support additional media in a two-way voice emergency communications session between end users and emergency authorities (e.g., PSAPs). NVC Emergency Services may also support use cases for emergency services without requiring two-way emergency voice communications.

The IETF and NENA NG9-1-1 technical standards provide a complete interface for several forms of non-voice text messaging. These include real time text (RTT), which is a character at a time, (Teletypewriter [TTY]-like), and several forms of IM, including "page-mode" which is similar in appearance to Short Message Service (SMS), but uses a different method of signaling than SMS.

The IETF/NENA standards are based on SIP, the signaling protocol used for VoIP, text, and video, including the protocols used by fourth generation (4G) wireless systems. Other standards

used by text systems exist today that are not SIP based. Some include proprietary protocols such as those used by the America Online (AOL) Instant Messenger service. Other non-voice networks use different protocols, such as the Extensible Messaging and Presence Protocol (XMPP). It is straightforward to interwork these protocols within a SIP framework, and the use of interworking is the way PSAPs will receive non-voice and text in an NG9-1-1 environment.

PSAPs that upgrade to NG9-1-1—and that conform to NENA recommended standards—will be able to receive non-voice emergency communications from any of these protocols. Any OSP can connect via the interworking mechanism defined in the NG9-1-1 standards.

4.2.1.5 Coordination and Control of NG9-1-1 Implementation

One of the primary concerns all parties have regarding transition to NG9-1-1 is what will drive the transition if there is no incentive for many parties to upgrade because of the measurable costs and other issues. For example, legacy wireline or wireless origination networks may hesitate to upgrade. Although their customers may have the capability to benefit from the advantages of NG9-1-1, especially in disaster situations, upgrading before legacy PSAPs upgrade does not provide benefit, i.e., it is mostly a cost without a corresponding benefit. There needs to be a compelling reason for the origination networks to upgrade their networks before the PSAPs are upgraded. The FCC mandated wireless and VoIP network providers to upgrade to E9-1-1. In the next upgrade to NG9-1-1, the FCC must now also consider the legacy wireline originating network providers, particularly those who provide legacy 9-1-1 systems.

Conversely, some PSAPs may want to upgrade, but may not be able to afford to do so. Unfortunately, if transition takes a long period of time (the upgrades for wireless Phase II have been ongoing for over a decade), the operators of the current E9-1-1 system will see a decreasing customer base and revenue, against relatively fixed costs. At some point, it becomes uneconomical to operate the old system.

Even for PSAPs that are early adopters, all transition plans would have both the old system and the new system operating in parallel for some time. Someone would have to pay for both systems for an indeterminate period.

Similarly if an OSP with a large footprint (such as a national wireless carrier) is involved in a transition to NG9-1-1, but many of the PSAPs it serves are not, it must operate and maintain both legacy E9-1-1 and NG9-1-1 systems for an indeterminate period. Given these economic challenges, what is the impetus for an OSP to upgrade to NG9-1-1 in the foreseeable future?

The 9-1-1 and originating network provider communities have not reached consensus on answers to these questions. Although neither Public Safety nor an OSP should be expected to maintain two systems for an extended period of time, there is no precedent for one to have any ability to force an upgrade on the other.

In the legacy 9-1-1 network, the costs of the system can be distributed among the various PSAPs. If one PSAP elects to forego the use of the legacy selective router (SR), for example, the costs of selective routing are shared by fewer PSAPs, increasing the cost to each. During the transition to the NENA i3 architecture for NG9-1-1, a Legacy Selective Router Gateway (LSRG) will bridge an existing E9-1-1 system to an NG9-1-1 system. It will allow calls to transit the LSRG depending on the upgrade status of the originating network, the primary PSAP,

and any secondary PSAPs to which the call may be transferred. The LSRG is designed to enable upgrades in any order, thereby preserving the ability to route a call from any origination network to any primary or secondary PSAP.

One of the ways that an origination network or PSAPs can "upgrade" to NG9-1-1 is to use components called "Legacy Network Gateways" (LNG) and "Legacy PSAP Gateways" (LPG). These gateways are designed to provide a way for a legacy network or PSAP to maintain their current interfaces and yet be part of an ESInet. For older wireline and wireless systems, this upgrade might be all that would ever be completed. For PSAPs, the LPG is a temporary solution. Once all PSAPs are upgraded to i3 or transitioned to a LPG, and all origination networks are upgraded to full i3 or transitioned to an LNG, the SR, the automatic location information (ALI) system, and the LSRG can be decommissioned.

4.2.1.6 9-1-1 Best Practices

Due to the differences in technology between E9-1-1 and NG9-1-1, not all previous best practices apply to NG9-1-1, and some modified best practices in this report need further work to align them with NG9-1-1 characteristics and needs. There is little experience with NG9-1-1 to date, so some future best practices that will apply to NG9-1-1 are not yet definable and must be left to future efforts.

Review of specific current and proposed technology best practices are included in Section 5.1.1.2.3 of this document.

4.3 Operational Issues in the NG9-1-1 Environment

This section describes the operational issues that must be addressed in the NG9-1-1 transition environment.

4.3.1 Overview, Definition, and Scope of NG9-1-1 PSAP Operational Issues 9-1-1

PSAP operational issues are defined as any that affect the day-to-day operations of 9-1-1 systems and/or the PSAP that are related to the answering and processing of 9-1-1 calls and data. Data includes text messages, pictures, video, telematics, data from other emerging technologies, and data associated with the processing of the call. The training needs of 9-1-1 call takers and technical PSAP staff associated with the operational changes that will result from NG9-1-1 must be assessed. Training will be necessary on call taker SOPs for day-to-day operations and during continuity of operations activations, when the PSAP is sharing calls with other PSAPs, or when the PSAP is receiving additional calls on behalf of another PSAP. The subgroup assessed issues related to the following areas: PSAP Administrator Roles and Responsibilities, Education, Standards and Certification, Training, Operations, Contingency Planning, and Human Resources.

4.3.1.1 Nationwide Call Routing and Transfer

NG9-1-1 standards provide mechanisms that replicate PSAP information, including routing data, map display data, and policy data in multiple, geographically diverse copies. These replicas are used by other PSAPs that answer out-of-area calls. PSAPs need to develop policies and procedures, and make arrangements with other entities so that replicas of their data will be

available under all scenarios, including widespread disaster. Appropriate access policies must be developed that control which entities can access these replicas.

Routing of calls that are either initially misrouted, or calls where the location of the incident is served by a different PSAP than the location of the caller, depend on a chain of NG9-1-1 Emergency Call Routing Functions (ECRF) and "Forest Guides" (small databases containing Internet addresses of ECRFs and the service areas they cover). States must create statewide ECRFs or Forest Guides that serve the state. In addition, a national forest guide must be created. Relationships between local/regional 9-1-1 authorities and the managers of the state level ECRF/Forest Guide must be established and maintained. Refer to Section 5.1.1.2.2 for additional information.

To support the ability to transfer calls and data to PSAPs nationwide, national (and perhaps international) procedures for transfers should be developed. One feature of NG9-1-1 is the ability to transfer a call (with all associated data), to another PSAP for processing. As NG9-1-1 systems and ESInets interconnect nationally, if a caller reports an emergency occurring in another county (or another state), the local PSAP should be able to transfer the caller to the appropriate PSAP, based on the geographic location of the emergency. National procedures to guide the operational methods and processing of call transfers must be developed to guide both the transferring PSAP and the receiving PSAP.

4.3.1.2 Virtual PSAPs

PSAP administrators must be prepared to handle the use of virtual PSAPs. NG9-1-1 systems will be set up to serve large geographic areas (regional, statewide, or even multi-state systems are possible), including sharing call-handling applications among multiple agencies. This type of wide area network (WAN)/data center configuration will allow telecommunicators to have access to all of their call-handling applications, including radio communications, from anywhere they can sign on to the network regardless of their physical location. This will allow PSAP operations for a specific city or county to be conducted from a remote location or locations on the WAN. PSAP administrators will need to assess whether the application of virtual workers is appropriate for their PSAP. All aspects of the PSAP operation will be affected, including data security and law enforcement access to data. Therefore, the consideration of virtual employees will require visionary leadership, comprehensive assessment, and a will to create a culture within the PSAP that allows for success.

4.3.1.3 PSAP Personnel Roles and Education

PSAP personnel should be educated regarding their roles in IP-enabled 9-1-1. In an NG9-1-1 environment, those employed in the emergency communications field may be expected to take on new and/or altered responsibilities, although the fundamental job duties do not change in NG9-1-1. Because of the new tools available to telecommunicators and other Public Safety personnel, which create a new information exchange environment, a comprehensive training effort must be undertaken. This should be done before the deployment of new hardware, software, and services associated with the transition to NG9-1-1.

Training PSAP personnel to understand and use the functions and feature set made available by NG9-1-1 implementation is essential to ensuring that the system performs as intended, that the overall quality of emergency response is improved, and that the cost and effort to facilitate the

migration are deemed worthwhile. Thorough, timely, and ongoing training must be developed and implemented for use during NG9-1-1 development, deployment, and maintenance.

4.3.1.4 Telecommunicator Certification

Certification requirements should be developed by a governing authority. The designated governing authority should have the ability to suspend or revoke certificates.

Certification standards must contain requirements that an applicant attend a required training course within a specified time after employment begins to receive certification. The applicant must also complete a designated probation period. Continued education and training should be required for certificate renewal.

4.3.1.5 Introductory and Continuing Education

Revamped introductory training, as well as continuing education and retraining for experienced telecommunicators, will be critical to prepare and train telecommunicators and other personnel to handle the increased quantity and quality of information available with IP-enabled calls. Properly designed training programs can effectively prepare telecommunicators to respond to the needs of an IP-enabled system while maintaining the level of service expected by the public. Increased levels of training will be required, and as a result, it will be more important to retain trained telecommunicators. There will be opportunities for alternative forms of training in NG9-1-1, such as leveraging the NG9-1-1 network to provide multimedia forms of training. In an NG9-1-1 environment, 9-1-1 telecommunicators will take on new and altered responsibilities, use new types of information, and work in a transformed information exchange environment. Training PSAP personnel to understand and use NG9-1-1 functions and features is essential to ensuring the system performs as intended. Training development (i.e., the production of recommended training standards, courses, and materials) must focus on how to receive, manipulate, and use new types of call-related information (e.g., video, text, and data); new methods and procedures for disseminating information to responders; and new and updated applications and software.

Because the NG9-1-1 system is designed to be highly adaptable and evolving, new system and application development will be continuous. Therefore, training requirements and/or programs for PSAP personnel must undergo periodic revision, and employees should receive ongoing training, as appropriate and necessary. Further, because of the sharing of applications and networks within the NG9-1-1 environment and because of the increased interaction across jurisdictions and between agencies, groups should engage in collaborative training to ensure a continuity of services throughout the emergency response chain and across geographic boundaries.

4.3.1.6 Contingency Planning

PSAP administrators must be prepared to handle contingency planning in the newly designed NG9-1-1 environment. Call handling is no longer limited to the PSAP's local area. To ensure that PSAPs are prepared to respond to component and system failures, PSAP administrators should consider the following actions:

- Review and assess the current level of resiliency across their operations

- Conduct operational impact analyses to identify scenarios where facilities, systems, equipment, or operations could be disrupted or destroyed, and use the results to determine any opportunities for hazard mitigation or system improvement, e.g. shared access to or control of public safety radio systems
- Determine requirements for continuity of operations and develop strategies based on its requirements
- Considering the impact of interruptions on critical business functions, define thresholds for minimum and maximum down time
- Develop PSAP contingency and continuity of operations plans based on continuity requirements and strategies, with associated training, testing, and exercises designed accordingly.

4.3.1.7 Alternate PSAP Call Processing

Procedures for the PSAP's processing of 9-1-1 calls for another PSAP in an overflow, backup, or disaster situation must be developed. PSAPs will have more options for increasing their resilience in the future, particularly as the benefits of NG9-1-1 are realized. One of the main goals of NG9-1-1 is to provide additional options for call handling, congestion control, and system reliability and recovery. Procedures must be developed that consider the full capability of NG9-1-1, including the rerouting of calls from other PSAPs in response to overflow, backup, and disaster situations. Unlike existing 9-1-1 systems, NG9-1-1 PSAP support would not be limited to neighboring PSAPs and jurisdictions. Please also see Section 4.3.2.14 (Call Distribution Policy Rules).

4.3.1.8 Geographic Information System Based Systems or Applications

Telecommunicator applications are required to be geographic information system (GIS) based. Leveraging geographic information system (GIS) in a Public Safety environment provides both telecommunicators and emergency responders with access to critical information across their organization and allows them to share data with multiple agencies in the local, state, and federal government. Virtually every Public Safety task has a geographic component and benefits from GIS technology. An enterprise-wide GIS solution integrates information such as street network, imagery data, hazardous material storage locations, officer safety information, fire department preplans, and critical infrastructure. The ability to display an aggregation of this GIS data for the telecommunicator will enhance responder safety and situational awareness, and support a more effective response.

Because of the reliance on accurate and timely GIS data, telecommunicator applications must include GIS-based tactical mapping displays with typical map display features (e.g., pan, zoom, search by location, and object identification) and functions geared to Public Safety (e.g., turn on/off data layers, real-time display of events and resources [e.g., automatic vehicle location (AVL)], and auto-zoom on caller's location).

4.3.1.9 Multimedia Call Data

The increased quantity of available multimedia data will enhance and expand existing call-taking functions. Issues related to the receipt, display, triage, distribution, tracking, and recording of the data must be addressed. Business rules for the distribution of 9-1-1 calls within the PSAP must be developed. The privacy and security of the additional data must be addressed. The system must alert the telecommunicator that additional data related to the call is available

and provide the telecommunicator with the ability to retrieve and manage that data. The telecommunicator must have the capability to provide a call record, telecommunicator notes, and other data associated with the call to the dispatcher for the appropriate response agency. Call-handling protocols must be available for display to the telecommunicator based on the call type or the nature of the incident.

4.3.1.10 Text Messaging

Several issues related to the processing of text messages must be addressed, including which texting technology should be used and the requirements for texting, including prioritization of text messages compared with voice calls, management of multiple text messages simultaneously by a single telecommunicator, and routing of 9-1-1 calls to PSAPs and within the PSAP to certain positions based on whether they are text or voice. Once 9-1-1 services include processing of text messages, these messages may go into the same queue as all other 9-1-1 calls. They will be prioritized along with all other 9-1-1 calls by the local PSAP priority classifications.

4.3.1.11 Telecommunicator Workload Impact

The time required to process a call in the NG9-1-1 environment is unknown. Once next generation technology is available, benchmark studies will needed to determine the length of time required for telecommunicators to process the different types of calls in the NG9-1-1 environment. Once these studies are completed, the PSAPs will be able to forecast their workload and determine the number of telecommunicators needed to meet their performance measurement goals. NG9-1-1 provides opportunities to use regional teams of experts to handle complex calls.

4.3.1.12 Visual Impact of Calls

The impact on telecommunicators of seeing incidents rather than only hearing them must be assessed and addressed. In a NG9-1-1 environment, telecommunicators will be equipped with technology to see still and moving images of incidents that may be, at times, graphic in nature. However, they will be expected fulfill their job duties and provide the highest level of service at all times. As such, telecommunicators must have access to training materials and mental health services to prepare for incidents of this nature and minimize the potential for stress-induced illnesses, such as Post-Traumatic Stress Disorder.

4.3.1.13 Human Resource Management

NG9-1-1 will allow the PSAP to manage how calls are processed and what telecommunicator skills and proficiencies are required for different kinds of calls. Under the existing voice call processing procedures, the call must be received and processed in varying ways, i.e., TTY, "Language Line," or similar third-party service. In some PSAPs, there may be some division of incoming calls depending on the selection of a language preference. This might be accomplished via the automatic call distributor (ACD) or a voice recognition system. NG9-1-1 will provide the opportunity to receive, process, and dispatch calls for service based on the type of communications device and type of additional associated call data. The ability to allow telecommunicators to specialize based on the type of communications device and associated additional call data, i.e., text, video, pictures, and/or language, may be easier for larger PSAPs than it will be for smaller PSAPs. The establishment of business rules could allow smaller PSAPs to route selected calls to a "specialty" multi-PSAP team. Multiple smaller PSAPs could

band together to specialize in call processing and thereby reduce training needs and costs, as well as increase the efficiency and quality of customer service.

4.3.1.14 Virtual PSAP Resource Management

Policies, processes, and training to support telecommunicators working in virtual PSAPs from remote locations need to be established, including recruitment, employee selection, and hiring practices; collective bargaining; retention; training; teamwork; staffing and scheduling; and supervisory management. Use of virtual PSAPs may mean that any PSAP within a structure can be connected to any other physical PSAP. It also means that an entire PSAP will not be in one physical location. It is important to identify the possible types of virtual PSAPs and the issues related to each type. Possible configurations include—

- Multiple PSAPs tied together via a network
- One PSAP with numerous smaller physical locations tied together via a network
- One PSAP with multiple single-position call taker and/or dispatcher workstations
- One PSAP with a single or multiple mobile communication capabilities
- One PSAP tied to a non-Public Safety communications center via a network.

Some authorities will use virtual PSAPs in daily operations to spread the workload. Others may implement a virtual PSAP only in a disaster situation.

Perhaps the most critical type of virtual PSAP will be the single position setting that might be located in the home of a PSAP employee. The need for and the ability to provide for supervision, guidance, and mentoring will present a daunting challenge for the administration of any PSAP organization. How an individual(s) in a remote location asks a question of supervision, how the remote individual can receive immediate assistance in handling a problem call, and how the individual(s) obtains support after handling an especially mentally challenging call must be addressed. Will the call taker in a remote location, as part of a virtual PSAP, have access to all the support systems that the person in a physical PSAP would have? If not, what plans are there to provide the supplementary tools the individual might need? Addressing these issues may require additional network capabilities and may necessitate multiple display screens. Will the virtual PSAP location have the space to accommodate the additional equipment?

4.3.2 Overview, Definition, and Scope of NG9-1-1 System Operational Issues

System operational issues are defined as any issues related to the roles and responsibilities of 9-1-1 Authorities in the operation of the NG9-1-1 system. There will be increased coordination at the regional, state, and national level. The public will need to be educated on the appropriate use of NG9-1-1. Training on the management of NG9-1-1 systems will need to be developed. Procedures for distribution of calls within the NG9-1-1 system, and management of data and PSAP geographic coverage areas, will be needed. There will be opportunities to use virtual PSAPs and to share workload among multiple PSAPs. The subgroup assessed issues related to the following areas: 9-1-1 Authority Roles and Responsibilities, Education, Standards and Certification, Training, Operations, and Contingency Planning.

4.3.2.1 Expanded 9-1-1 Authority Responsibility

9-1-1 Authorities will need to manage a wider set of shared resources than is typical in the current system, enhancing capabilities while ensuring personnel can expeditiously and correctly handle the new workload. Responsibilities will likely expand, particularly with regard to configuring and managing the NG9-1-1 system. By definition, NG9-1-1 is a "...system composed of managed IP-based networks, [applications and databases] that augment present-day E9-1-1 features and functions and add new capabilities."[21] Inherent in that definition is a distinction between an ESInet shared by emergency service agencies and the specific application environment that supports the delivery of a request for emergency services and represents NG9-1-1. The ESInet will provide connectivity and interoperability with emergency response and other critical stakeholders involved in incident management that goes beyond the delivery and processing of an emergency service request. NG9-1-1 represents a specific application environment riding on that ESInet that will support these additional functions. Other application environments will also ride on the ESInet, supporting emergency response, incident management, and similar functions (e.g., computer-aided dispatch [CAD], radio interoperability, and responder communications). With this in mind, the ESInet will be a "shared" resource among multiple stakeholders.

This environment will add a degree of complexity to 9-1-1 Authority roles and responsibilities. The latter will include, but not be limited to, the need for enhanced planning and coordination among the stakeholders involved—efforts involving more complex governance structures, oversight of multiple vendors, integrated operational schemes and system management, and cost sharing. While the 9-1-1 Authority is necessarily focused on the NG9-1-1 aspects of that environment, the overall emergency communications system complexity cannot be ignored.

4.3.2.2 Educating 9-1-1 Authorities and Other Stakeholders

Because 9-1-1 Authorities have a role in virtually every aspect of NG9-1-1—transition planning and system implementation, funding, operations, standards and technology adoption, and governance and policy—their education is essential throughout the process. If 9-1-1 Authorities are not adequately informed and engaged, or do not receive the tools with which they can inform and engage others, NG9-1-1 implementation becomes exponentially more challenging because it competes with other industries and initiatives seeking the same monetary and human capital in an increasingly competitive marketplace. A number of enabling stakeholders also require education, such as Public Utilities Commissions (PUC), state Chief Information Officers (CIO), and other government IT professionals, in order to establish a coordinated approach to NG9-1-1 planning, funding, and implementation.

4.3.2.3 IP-Based System Administration

9-1-1 Authorities will need to be prepared to handle IP-enabled 9-1-1 system administration, including configuration management, database management, quality assurance, and SOPs. By nature, NG9-1-1 involves IP-based networks and applications that require oversight and management. The latter includes, but is not limited to, configuration management, mission-critical database functions, quality of service (QoS), security, and similar functions. Much of this activity may be new to many if not most 9-1-1 authorities, and they will be required to obtain new skills and/or acquire those skills through third parties. As discussed above, such

[21] See *NENA Master Glossary of 9-1-1 Terminology*. NENA 01-001 v14, September 29, 2010, p.76. Available at: http://www.nena.org/standards/master-glossary

administration may need to factor in a more complex system environment involving multiple stakeholders and shared operations and/or facilities. Particular attention will need to be paid to security risks in an IP environment, including major denial of service (DoS) attacks.

4.3.2.4 System Operations Roles and Responsibilities

Roles and responsibilities to be shifted from local to regional to state and national-level coordination should be examined. Regional, state, or even multi-state 9-1-1 Authorities will share and manage NG9-1-1 systems that support multiple PSAP operations over large geographic areas. Shared costs should be considered. The standardization of training and operations should be encouraged. System operations will be controlled at the different levels by policy-based business rules. Who decides the rules and who can change the rules must be determined. Authorized personnel will need to make changes to the rules dynamically. NG9-1-1 is often characterized as using a network of interconnected networks—an environment that will ultimately be national in scale. The process of establishing those different levels of networks will require greater degrees of coordination and cooperation to maximize the benefit of facility sharing and joint service arrangements. New institutional arrangements and relationships that address how stakeholders interoperate will have to be determined.

More specifically, the new and potentially more effective service arrangements fostered by the environment described above will require common best practices, operational environments, and training (i.e., common at least to the extent that these arrangements involve multiple stakeholders serving regional geographies). Some functions, such as security and data rights management, may be addressed most effectively at regional and state levels, based on the nature of interconnection and data sharing involved. In turn, that may require regional and state 9-1-1 Authorities to take on new operational responsibility or responsibility that has shifted from other levels. Call diversion to PSAPs that are nearby may become more common, but diversion to PSAPs that are far from the PSAP that serves the location of the caller may occur in disaster scenarios. Diversion can only occur if both the originally intended PSAP and the PSAP that receives the call agree, before the call is placed, that such diversion will be permitted. This means new kinds of relationships between PSAPs and groups of PSAPs at regional, state, and national levels must be created.

While such 9-1-1 Authorities may have options for acquiring and deploying ESInet and NG9-1-1 functions and services, most likely the actual provisioning of those functions and services will be provided by third-party vendors acting under contract to the 9-1-1 Authorities involved or the latter's governing entities. NG9-1-1 system (including ESInet) operational responsibility will be shared among the 9-1-1 Authority(s) and the contracted vendors involved. The latter may or may not be traditional 9-1-1 service providers. That, in itself, may require a shift in role and responsibility. Even when traditional 9-1-1 service providers assume new NG9-1-1 system (including ESInet) responsibilities, that assumption may not involve the same business units that were previously responsible (e.g., the incumbent local exchange carrier [ILEC] unit) and will require new regulatory and commercial arrangements. The ESInet is envisioned as a shared network supporting *multiple* public safety applications. Getting *appropriate* Public Safety agencies to share a network will require establishing and managing new relationships. The entity operating the ESInet may be different if it is a shared resource rather than a 9-1-1 resource.

4.3.2.5 State-Level 9-1-1 Leadership and Coordination

State-level 9-1-1 leadership and coordination is required, including establishment of statewide ESInets. The confidentiality, disclosure, and retention of 9-1-1 calls and data should be addressed at the state level. NG9-1-1 liability issues must be addressed. The "network of interconnected networks" for each state will ultimately be statewide. That type of interconnected environment will logically require state-level ESInet functions that must be addressed and managed at that level. For many states, this will mean new state-level duties and responsibilities.

Beyond traditional planning, leadership, and funding responsibilities, state-level operational mechanisms will have to be developed and/or identified to support the statewide functions involved. As discussed above, these range from the operation of state-level ESInets and necessary NG9-1-1 applications (e.g., legacy gateways, border control, and routing), to operational best practices and standards necessary to ensure statewide connectivity.

4.3.2.6 Transitional Regulation, Legislation, and/or Tariff Modifications

Transitional regulation, legislation, and/or tariff modifications may be needed to address NG9-1-1 deployment. Traditional regulations, policies, and statutes surrounding how 9-1-1 services are delivered today are not consistent with the emerging world of IP-based telecommunications. This inconsistency potentially affects transition to NG9-1-1 systems, both in terms of service origination and the acquisition and deployment of NG9-1-1 functions and services. For example, as discussed above, new and/or different stakeholders may be responsible for key components of the NG9-1-1 systems involved. To what extent should these new stakeholders (including both vendors and 9-1-1 authorities) be regulated is a question that must be addressed. Other issues include how the cost of these new arrangements will be funded and shared, and the division of regulatory responsibility between federal and state levels. These issues will be a challenge for both state and federal policy makers and regulators.

4.3.2.7 9-1-1 Institutional Responsibility Consolidation

Some consolidation and centralization of 9-1-1 institutional responsibilities will be essential to avoid excessive administrative burdens as well as to provide uniform, high-quality 9-1-1 Authority functions. As discussed earlier, the shared, interconnected environment of NG9-1-1 will logically foster some degree of coordinated and consolidated institutional responsibility. For example, system security needs to encompass the entire interconnected environment represented by the overall system involved. How that will be addressed is an issue.

4.3.2.8 Public Education and Awareness Programs

Effective public education and awareness programs about NG9-1-1 and the appropriate use of NG9-1-1 must be developed. Educating the public about NG9-1-1 should be done in two phases, with two distinct results in mind. First, the public should be educated about the benefits of NG9-1-1 to create a groundswell of support for its implementation. An informed and engaged public will act as an extremely powerful and influential lobbying group with decision makers who may be under-informed about the creation of NG9-1-1. Later, when transition is nearing completion, the public must also be educated about NG9-1-1's expanded capabilities for receiving information and about how they can best use these new options for contacting emergency services, as well as the limitations of the new system.

Public education campaigns over the past several decades were critical to the success of the current 9-1-1 system. Educating the public about the availability of 9-1-1 for accessing emergency services has been so successful that most (if not all) PSAPs are experiencing congestion on their emergency lines with calls of a non-emergency nature. With the transition to NG9-1-1, the 9-1-1 community has an opportunity to "re-train" the public about the proper use of 9-1-1—when it is appropriate to call and how to best use the 9-1-1 system. This education campaign should be initiated at the national level to ensure a consistent message nationwide.

4.3.2.9 Fostering Private–Public Policy Stakeholder Support

Private and public policy stakeholders should be encouraged to support and promote the changes through effective education programs. Barriers to use of IP-enabled 9-1-1 should be reduced through education programs. Support from various stakeholder communities is directly tied to the success of NG9-1-1 adoption and implementation. Educating those stakeholders about what NG9-1-1 is and is not and the benefits and value of transitioning to NG9-1-1 is the first step in building a consensus among decision makers and agents of change that this transition is imperative. The message should be developed at the national level and then delivered by the national, state, and local levels.

Stakeholder groups will not all share the same roles or responsibilities during the transition to NG9-1-1 or after its implementation. For this reason, a "one-size-fits-all" approach to educating the various parties, who may at times represent divergent interests, is not recommended. Instead, materials must be crafted to address the concerns and areas of responsibility of each individual stakeholder group.

NG9-1-1 implementation will require educated policymakers willing to invest in broadband-enabled NG9-1-1 systems. Therefore, an awareness campaign targeting policymakers is essential. Messages should focus on the benefits of NG9-1-1, including cost savings, improved information sharing capabilities, and better access to emergency services for citizens. With these materials providing a roadmap to deployment, the implementation process will be accelerated.

4.3.2.10 Certification of Service Delivery

The certification of services delivered to the PSAPs should be developed. Transition to future 9-1-1 services will also depend on the ability of OSPs and underlying networks to locate IP-enabled 9-1-1 calls and route them appropriately. National certification and authentication processes will ensure security and system access requirements are met.

A gap analysis of existing standards, complete and acceptable IP-enabled 9-1-1 open standards, and future technology trends must be conducted to ensure system interoperability and data sharing. In addition, established system access and security controls to protect and manage access to the IP enabled 9-1-1 system must be in place.

4.3.2.11 PSAP Minimum Criteria and Certification

Minimum criteria and certification for PSAPs should be developed. Individual 9-1-1 authorities need to work with neighboring jurisdictions to upgrade to IP-enabled 9-1-1 to coordinate call and data handling. Until baseline operational requirements are developed, selected, fully vetted, and ultimately adopted, uncertainty among 9-1-1 decision makers and service and equipment providers may hinder migration to IP-enabled 9-1-1.

4.3.2.12 NG9-1-1 Technical Training

Technical training on the management of NG9-1-1 systems should be developed. NG9-1-1 will use services, systems, and networks that may be shared or overseen by multiple PSAPs, emergency response agencies, 9-1-1 Authorities, and/or non-emergency governmental entities. Consequently, technical experts (e.g., network engineers, software and applications developers, and systems analysts) who may not have previously supported 9-1-1 services may have a significant role in the implementation and maintenance of NG9-1-1 systems. This inexperience necessitates that they receive thorough education and training on the core purposes of NG9-1-1, information sharing and rights management, privacy and security concerns, etc. to ensure the integrity and stability of all system components.

4.3.2.13 NG9-1-1 Management Training

Management training for NG9-1-1 systems should be developed. Training will be needed on the management of services, systems, and networks that are shared or overseen by multiple agencies. Training on the 9-1-1 authority roles and responsibilities outlined above will be necessary.

4.3.2.14 Call Distribution Policy Rules

Call distribution within the NG9-1-1 system will be based on policy rules. Call processing will be based on call type, such as telematics, alarms, etc. Certain PSAPs may not take certain types of calls or may only take calls during certain hours. NG9-1-1 technology allows the delivery method of a call to be altered dynamically based on conditions that exist at the time of the call and information included with the call. Software rules that control how this processing takes place are known as "policies." Policy rules may be established at the national, state, regional, and local levels. Policy rules may be implemented by the different entities responsible for a particular function or portion of the NG9-1-1 system. In general, 9-1-1 Authorities establish the policies for call routing and handling within their PSAP coverage area. Where multiple parties are affected by policies, the parties must agree on the use of the policies, for example, when a call is to be diverted from one PSAP to another PSAP based on a policy.

NENA 71-502, *Overview of Policy Rules for Call Routing and Handling in NG9-1-1*, defines two broad types of policy rules:

- Management rules modify call flow within the NG9-1-1 system before PSAP call delivery.
- Routing policy rules modify normal call routing for time, date, PSAP availability, or similar conditions.

Specific policy rules must be developed to support local needs. For example, policy rules must be established for—

- Telling the system what to do with a call that does not have adequate location information to determine the serving PSAP for the caller (default routing)
- Determining where to route a call when all of the telecommunicators at the primary PSAP are currently taking other calls (overflow routing)

- Governing non-voice calls like alarms, which could go directly to the response agency and only alert the PSAP with the location, type of alarm, and the response agency where the alarm message was sent
- Routing calls to PSAPs based on the capabilities of the PSAP to accept media types, language, or other properties associated with the call
- Routing calls based on properties of the PSAP such as time of day or state of the PSAP.

4.3.2.15 Multi-Agency Business Rules

The ability to set up business rules to permit the sharing of call workload among multiple PSAPs or telecommunicator work groups in diverse geographic locations must be established. This includes the criteria that start the sharing process; the criteria under which another PSAP/work group would accept overflow calls; and the training, PSAP operations, administrative processes, legal authority, and interlocal agreements to establish the multi-agency cooperation. Implementation of NG9-1-1 will have a significant impact on existing business rules because the additional capabilities will require development of new processes and procedures. The interconnectivity of PSAP IP networks will provide considerable flexibility to reroute calls according to changing operational scenarios (e.g., call surge and evacuation), regardless of physical location. Given this flexibility, criteria will be required to control the involvement and subsequent interaction between PSAPs. In particular, SOPs, mutual aid, and intra-agency agreements will need to be much more expansive to include wider intrastate, and potentially interstate, cooperation and coordination.

4.3.2.16 System Logging Requirements

All system events and data, including voice, must be received and associated with each call to enable multi-agency, wide-area sharing of logging functions and capabilities. Logging systems will be implemented that will begin to collect information associated with a call from the time the call sets up and connects to the ESInet and continue all the way through the call-handling process, including the voice, data, routing, and event timing, until the event is concluded. The logging service may not be located in the PSAP; the logger can be set up in the ESInet and shared by several agencies. More than one logger may have data about a call or incident, especially in a multi-agency incident. Unlike existing systems, all inputs and outputs to the logging service are standardized so a logger can store and retrieve data from multiple independent implementations of other functional elements. While this increases the quality and quantity of data logged, it introduces new operational and management challenges. Continuous logging will give the different entities involved in the event management process access to the information necessary to troubleshoot, manage, and provide quality control throughout the system. Who has access to the log information will be controlled by the business or policy rules. For example, the entity responsible for ESInet call routing could have access to the network router information or routing databases but would not have access to the PSAP dispatcher or responder radio traffic audio recordings. PSAP A would not have access to PSAP B information. A regional 9-1-1 Authority may have access to all of the logging information.

4.3.2.17 PSAP Geographic Coverage Area Management

Procedures for maintaining PSAP geographic coverage areas and reconciling boundary issues must be developed. The NG9-1-1 system will depend on accurate GIS information for call routing and handling. The GIS data will be maintained by the entities responsible for a given geographic area. The processes and procedures for ensuring the GIS data remain consistent from

one geographic area to another must be developed to ensure that there are no gaps, overlaps, or conflicting information where the two data sets meet. Maintaining the data at regional or state levels will make it easier to deal with edge issues between data sets but will require cooperative efforts between the local data creators and the regional or state GIS systems in the data development, maintenance, and error correction processes.

4.3.2.18 Location Validation and Call Routing Databases

Validation procedures for entering and updating location information in relevant databases must be developed, including the process of the 9-1-1 Authority creating the NG9-1-1 Location Validation Function (LVF) and making it available to access networks and other entities that operate the Location Information Servers (LIS) that store location and must validate location information before it is stored in the LIS. 9-1-1 Authorities will be responsible for maintaining the GIS that provides the data that populates the LVF and the corresponding ECRF. The ECRF is used to route 9-1-1 calls to the correct ESInet and route calls within the ESInet to the correct PSAP and responders. The 9-1-1 Authority can provide a provisioning feed for an access network to maintain an online replica of the LVF and/or ECRF, or an access network can use the Authority's ECRF or LVF on the Internet. ECRF and LVF replicas must also be established and geographically distributed widely so that in the event of a disaster, routing and validation data will be available no matter where the call originates or which PSAP answers it.

The NG9-1-1 system will allow location information associated with calls to come from a variety of systems and location determination methods. Location will always be provided in the signaling with the call but procedures must be developed to document any location information errors, distribute the error information to the source, and confirm the correction of such errors. Development of the GIS database must be initiated for PSAPs that do not already have a GIS, and updates and new rules for consistent use of data must be made so all PSAPs create consistent data, which facilitates out-of-area call handling. Existing Master Street Address Guide (MSAG) databases must be validated against the GIS in accordance with NENA recommendations. ECRF and LVF data should be aggregated at the state level and new agreements, policies, and procedures must be developed to achieve a statewide database.

4.3.2.19 Integrated Data Error Correction Process

The system must contain an integrated data error correction process to document the error, distribute it to the appropriate entity for correction, and log the error correction process and status. Users throughout the NG9-1-1 system must have the ability to document errors whenever a data error is identified. The documented error information must then be able to be sent to the entity responsible for correcting the error. All activity associated with the error correction process must be logged for accountability, troubleshooting, and auditing purposes. For example, if a telecommunicator receives a call with inaccurate location information, the telecommunicator will have an error-reporting interface that will collect the information as it was presented to the telecommunicator. The interface will have fields where the telecommunicator can provide the correct information as provided by the caller and route the error and corrections to the service provider or GIS data provider. The provider will verify and correct the information in the system so that it displays correctly the next time the caller dials 9-1-1, including the date/time of the call, error distribution, error receipt, and error correction.

4.3.2.20 Virtual PSAPs 9-1-1 Authority Responsibilities

9-1-1 Authorities will need to be prepared to handle the use of virtual PSAPs. NG9-1-1 systems will be set up to serve large geographic areas (regional, statewide, or even multi-state systems are possible), including sharing call-handling applications among multiple agencies. This type of WAN/data center configuration will give telecommunicators access to all of their call-handling applications, including radio communications, from anywhere they can sign on to the network, regardless of their physical location. This will allow PSAP operations for a specific city or county to be conducted from a remote location or locations on the WAN. This capability will make contingency planning and workload sharing easier to accomplish from a technical perspective but will require the political and procedural agreements, training, and policy to be worked out in advance. Telecommunicators can be physically located where they can be used most effectively. Shared equipment and applications can be monitored and maintained with greater resources and expertise to ensure a higher level of capability, reliability, and availability than individually based PSAP applications. NG9-1-1 provides the ability to place test calls to PSAPs without involving a call taker or other PSAP personnel. This test capability may be used to test contingency plans and other scenarios by simulating calls.

4.3.2.21 Contingency Planning 9-1-1 Authority Responsibilities

As part of the implementation strategy, 9-1-1 Authorities should consider how the additional capabilities of NG9-1-1 will affect existing contingency procedures and future planning. Preparations should include—

- Developing "what if" scenarios to help identify a range of possible situations that will inform the response strategies developed to mitigate the impact
- Identifying extreme circumstances, such as hurricanes, but also take into account some of the more mundane situations (such as a sewer backup) that could adversely affect normal operations
- Creating plans using anticipated scenarios to reinforce a pragmatic response approach, which can be leveraged to respond to incidents that are beyond imagination, such as the September 11 attacks
- Leveraging publicly available resources to begin the planning process and consider engaging experts (such as Certified Business Continuity Professionals) who have knowledge and experience in developing, implementing, testing, and maintaining critical plans.

4.4 NG9-1-1 Funding Challenges

This section describes the high-level scope of funding challenges that must be addressed in the NG9-1-1 transition environment, including: an analysis of current funding methods, evaluation of the reliability and sustainability of funding methods, requirements for sound fund management and the need to identify new sources of funding.

4.4.1 Overview, Definition, and Scope of NG9-1-1 Funding Challenges

New methods for funding the next generation of 9-1-1 are necessary for our national communications systems to transition from legacy systems to a next generation network environment that is capable of handling today's emergency calling needs and provides the kind of communications security Public Safety requires to ensure reliability and interoperability. This

endeavor is not cheap and not without challenges, but it is necessary to continue to provide effective service with reliable systems. Current funding challenges include those associated with collecting from access service providers who either are not governed by regulation or escape the current rules because of the lack of consistent fund auditing and appropriate accountability mechanisms.

4.4.1.1 Current Methods

Present methods of funding a 9-1-1 system vary widely and range from surcharges for wireline and wireless consumers to general tax funds collected either on a statewide or local basis. Periodically, other sources, such as one-time grants for specific and narrowly defined purposes, may also assist the 9-1-1 system. Revenues from long-established funding methods are eroding as more and more wireline subscribers disconnect their traditional wireline service in favor of more flexible and mobile wireless devices and sometimes even other non-revenue generating services such as mobile VoIP. As stated in the USDOT NG9-1-1 Procurement Toolkit, "*If traditional revenue streams fall short of funds sufficient to support even current needs, elected officials and 9-1-1 authorities may face difficulties in obtaining funds to enable NG9-1-1 and the conversion and building of networks and databases as part of NG9-1-1. Diversion of existing surcharges further erodes the ability of 9-1-1 authorities to maintain or expand 9-1-1 services*."[22]

In addition to the problems described above, the funding model for today's 9-1-1 operational environment is challenged by a variety of other factors, including inequity in collections across all service types, shifting of communications technologies by the subscriber where there are varying levels of surcharges, collection challenges with services such as prepaid wireless, auditing issues such as ensuring the correct amount is being collected and remitted, and raiding of fund balances for non-9-1-1 purposes.

4.4.1.2 Sound Fund Management

For those states or 9-1-1 Authorities with sound fund management processes and established equitable funding structures, the erosion of funds does not appear to be a significant problem. Those well-managed funds are growing and report having sufficient collections to take care of current operations as well as plan for next generation systems in the future. However, this is not the case for all states or 9-1-1 Authorities. States that have not established fee equitability among all technologies continue to experience funds depletion as subscribers shift their communications of choice from traditional wireline service to more mobile devices such as wireless or mobile VoIP. For states or 9-1-1 Authorities that do not have a solid and equitable mechanism for collecting from VoIP providers, the challenge of fund collections is even more of a problem. Finally, for states or 9-1-1 Authorities that have not established a clear and workable process for collecting on prepaid cellular sales, the erosion is even greater.

4.4.1.3 New Funding Models Required

The transition to NG9-1-1 will require development of new funding models. Possible models explored by the subgroup included fixed-amount surcharges on all calling services, a surcharge on access infrastructure providers, a general statewide communications surcharge, a common federal communications surcharge, and the more traditional use of bonding for capital

[22] USDOT *NG9-1-1 Procurement Toolkit*. Available at: http://www.its.dot.gov/ng911/pdf/USDOT_NG911_Procurement_ToolKit_2009.pdf

expenditures. It is expected that a combination of these sources will likely be used to fully fund NG9-1-1 systems.

The need for a next generation system for 9-1-1 that processes requests for service from new non-voice technologies is upon us. [23] The designs are complete and agreed upon by industry and Public Safety groups. Standards are in development to assist industry and Public Safety in building the new systems. Public safety procurement processes have begun to plan capital improvement budgets that include NG9-1-1 elements. Not only must adequate new funding for NG9-1-1 be obtained, but also sufficient ongoing support and maintenance funding must be made available for legacy systems during and beyond the transition period.

Without implementation of new funding models to provide an adequate alternate and additional source of revenue for NG9-1-1 systems, the transition period to NG9-1-1 will be protracted and compromised, service to our citizens will be jeopardized, and Public Safety's ability to keep pace with technological developments will be hampered.

The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

4.4.1.4 Summary of Funding Scope

The 9-1-1 system that serves most of the United States fundamentally exists to save lives and property. Protection of the citizenry through a network of Public Safety organizations has grown and developed over the past 35 years into a capable legacy 9-1-1 system. Throughout its evolution, the 9-1-1 system has managed, with some struggle, to be moderately adaptable to technologies that were never anticipated when the 9-1-1 service began. The technological challenges of wireless service, and more recently VoIP, have stretched the existing 9-1-1 system to its limit and, in some cases, beyond its capabilities. Public Safety services are challenged to keep up both technologically and operationally. The technological challenges, coupled with increasingly difficult economics and funding challenges for the existing system, barely permit a 9-1-1 operation to keep pace (and in many cases they lose ground) in providing the response to emergency services that the American public expects and demands.

Using the results of various efforts already complete or still underway,[24] the Funding Subgroup investigated and evaluated currently available funding models related to 9-1-1 and E9-1-1 for

[23] According to CellSigns, Inc.: "Every 6 months since the launch of the [Common Short Code Administration] CSCA (June 2003), SMS traffic volumes have increased at least 37 % in the U.S. It has quickly changed the way people communicate and access information. Currently over 75 Billion text messages are being sent each month, and experts project [this volume] to grow to 100 billion a month by the end of 2008. The[se] insights come from Nielsen Mobile, a service of The Nielsen Company, which directly measures billing activity through an opt-in panel of more than 50,000 personally liable, postpaid U.S. mobile lines across the top four carriers. See http://www.cellsigns.com/industry.shtml

[24] The National E9-1-1 Implementation Coordination Office, *A National Plan for Migrating to IP Enabled 9-1-1 Systems*, September 2009. Available at: http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf, USDOT NG9-1-1 Initiative's Transition Plan (http://www.its.dot.gov/ng911/pdf/NG911_Transition_PlanFinal.pdf) and NG9-1-1 Analysis of Cost, Value and Risk Report (http://www.its.dot.gov/ng911/pdf/USDOT_NG911_4-A2_FINAL_FinalCostValueRiskAnalysis_v1-0.pdf), NENA's NG Partner Program 9-1-1 Funding Report

effectiveness. The subgroup has attempted to identify any gaps, including challenges related to implementation of such best practices and models by stakeholders within the 9-1-1 system.

The research into the funding challenges for NG9-1-1 was both informative and frustrating. At this point, no known full NG9-1-1 deployments exist, specific, concrete, and reliable data is lacking. Next generation projects underway or portions of next generation transition projects currently funded in states or localities are so varied that any funding models related to these projects are not valid for comparison purposes. Feasibility studies and projections are available from several states but there are so many variables associated with how an implementation is undertaken that the projects are not comparable to any significant degree. Without a comprehensive deployment "map" or national next generation strategy that tracks the same data elements, analysis and comparable data is not possible.

4.5 Improving Access to 9-1-1

This section discusses the 9-1-1 access challenges faced by people with disabilities as well as non-English speakers, which must be addressed in the NG9-1-1 transition environment.

4.5.1 Review of People with Access Challenges (People with Disabilities/Non-English Speaking)

It is important to attempt to identify those specific groups within the general population of the United States whose needs might be better served in future 9-1-1 systems by taking into consideration achievable specific system capabilities that would aid in the provision of 9-1-1 service to all individuals that might access the system.

The Individuals with Disabilities Education Act[25] (IDEA) defines 13 categories of disability:

- Autism
- Deafblindness
- Deafness
- Emotional disturbance
- Hearing impairment
- Intellectual disability
- Multiple disabilities
- Orthopedic impairment
- Other health impairment
- Specific learning disability
- Speech or language impairment
- Traumatic brain injury
- Visual impairment, including blindness.

In addition to persons with disabilities as defined by IDEA, the following groups of persons are also addressed in this report:

(http://www.nena.org/ng-partner-program/911-funding-report), and ongoing NENA Operations Committee (http://www.nena.org/operations-committee) efforts.

[25] http://idea.ed.gov/explore/view/p/%2Croot%2Cstatute%2C

- Elderly
- Persons speaking traditional verbal languages (i.e., Chinese, English, French, Spanish, Native American languages, etc.).

The two lists combined result in 15 access categories that have been reviewed by the Access Subgroup in an effort to identify achievable modifications that would improve access to the 9-1-1 system**.** Reporting statistics for this area is challenging. They can vary owing to definition differences and data gathering procedures.

Census statistics state**: "**There are 54.4 million Americans who have disabilities, and 35 million Americans who have a severe disability. For those aged 15 and older, this includes 7.8 million who have difficulty seeing the words in ordinary newsprint; 7.8 million who have difficulty hearing a typical conversation; 2.5 million who have difficulty having their speech understood; 27.4 million who have lower body limitations; 19 million with upper body limitations; and 16.1 million with cognitive, mental and emotional functioning disabilities. (3/2005 Census Report at 6-7)."[26]

The National Institute on Deafness and Other Communication Disorders (NIDCD) reports "Approximately 17 percent (36 million) of American adults report some degree of hearing loss."[27]

Approximately 38 million Americans (12.4 percent of the total population) are over the age of 65 years (United States Census Bureau, 2008) and represent a population that frequently faces many of the same limitations as people with disabilities. By 2030, the population over 65 will double to 70 million or 20 percent of the total U.S. population.[28]

Based on a 2007 U.S. Census *American Community Survey Report*, approximately 24.5 million people (8.7 percent of the population) reported their ability to speak English as below "very well" (i.e., "well," "not well," or "not at all")—and were thought to need English assistance in some situations. The report also notes, "Languages spoken at home are not evenly distributed throughout the nation."[29] Language Line Services notes in its LanguageTrak report that there have been significant increases in demand for "less common languages." As an example, "…in [the] First quarter of 2010, the demand for Nepali support increased by more than 300 percent for Language Line Services customers based in the Chicago metro area." [30]

---

[26] A Giant Leap & A Big Deal: Delivering on the Promise of Equal Access to Broadband for People with Disabilities—OBI Working Paper Series No. 2, Federal Communications Commission by Elizabeth E. Lyle, Policy Advisor, Omnibus Broadband Initiative. Available at: http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-(obi)-working-report-giant-leap-big-deal-delivering-promise-of-equal-access-to-broadband-for-people-with-disabilities.pdf

[27] http://www.nidcd.nih.gov/health/statistics/quick.htm

[28] Wireless Emergency Communications Summary of Initial Findings, October 2006–September 2009, Rehabilitation Engineering Research Center on Wireless Technologies. Available at: http://www.wirelessrerc.org/about-us/projects/development-projects/WEC%20Summary%20Rpt%20FINAL%20for%20SOT%202009.doc

[29] http://www.census.gov/population/www/socdemo/language/ACS-12.pdf

[30] http://www.languageline.com/page/news/202/

4.5.1.1 People with Hearing Loss

Everyone with any kind of hearing loss experiences some barriers to accessing 9-1-1 services. This is not a single monolithic group whose needs can be addressed with one set of solutions. Functional needs must be considered rather than the labels sometimes assigned to people in this community. The following four functional needs categories are useful in defining and grouping access challenges:

1) People who are deaf *and* use a manual language (American Sign Language [ASL], signed English, Pidgin Sign English [PSE], Cued Speech, foreign signed language)
2) People who are late deafened or oral deaf *and* rely on text
3) People who are hard of hearing *and* rely on residual hearing and assistive devices and/or text
4) People who are deaf-blind (ranging from profoundly deaf and totally blind to someone with some vision and some hearing loss).

4.5.1.2 Access Challenges

Functional Needs Category 1—People in Functional Needs Category 1, (i.e., who are deaf and use manual languages, may worry they will not be able to effectively communicate with hearing populations during emergencies and life-threatening situations). This community benefits from outreach efforts in their own language on the current ways to successfully connect with 9-1-1 for people who are deaf and use manual languages. Access challenges include—

- **Education of the population**—People who are most comfortable using sign language need access to information about how to access 9-1-1 in ASL (or other sign language) via online videos and presentations by and for people who are deaf. This should be an ongoing program of outreach to the community and address both the older community, which still relies on TTYs, and younger deaf people who may assume that they can send a text message in an emergency through various means (including social media) or believe that they can connect to 9-1-1 directly via their mobile video telephones or home video telephone.
- **Education of call takers**—If call takers do not know and meet people who are deaf, they may not understand the needs of the community and how to best communicate. Efforts should be made to make the education process two way.
- **Hearing and being heard**—For many people who are deaf, the biggest challenge is lack of access to voice communication. This is not simply a matter of the deaf person being unable to hear what is being said on a telephone call; it may also mean that the speech of the deaf person is not easily understood. Call takers will need training in understanding someone who is deaf and has difficulty enunciating clearly.
- **Lack of access to TTYs**—The TTY was once the mainstay of emergency communication for people who are deaf. With the coming of text communication, TTYs have been rapidly abandoned. Young deaf professionals typically do not own a TTY. Older deaf people might still own them, but there are fewer and fewer TTYs.
- **Written English skills**—For some deaf individuals, English is a second or third language. Their written English skills may be poor, and they may be more comfortable with text messaging. So, even if they have access to a TTY, or any other text device, they may not be understood if the call taker has no training in communicating with people with limited written language skills.

Functional Needs Category 2—People in Functional Needs Category 2, (i.e., people who are late deafened or oral deaf and rely on text, or depend on their verbal and written English skills) may be able to speak, but will not understand what is being said unless there is a visual connection. Access challenges include—

- **Public telephones**—People who are late deafened may initiate a call from a public telephone but be unable to hear once the call has begun. Education of consumers is important: they need to know what is essential to say to a call taker in an emergency. Call takers should also be trained to properly respond to such calls.
- **Use of TTYs**—Because they are deaf but dependent on text, many in this group still depend on TTYs. PSAPs cannot abandon TTYs at this point.
- **Reliance on text**—People who are late deafened will likely either have no mobile telephone at all, or have text or email access only. This group tends to be older and more aware that 9-1-1 is a voice-based system. However, they would benefit greatly from a text-based system.
- **Use of Relay**—People in this group may initiate 9-1-1 calls using captioned telephones, voice carry over (VCO), or IP Relay. Call takers need to be trained in the receipt of these kinds of calls.

Functional Needs Category 3—People in Functional Needs Category 3, (i.e., people who are hard of hearing, or depend on voicing for themselves and their residual hearing for communication depend for their comprehension much more on the fidelity of the telephone connection, the amount of noise in the background, and visual distractions, than for any of the other groups). They often find that they can hear and know a person is speaking but be unable to both hear and understand (discriminate) each and every word. They struggle to understand in a quiet situation; in a noisy emergency, it is much more difficult for that person to understand what is being said.

It is also much more likely that someone will age into hearing loss and have yet to treat the loss with a hearing aid, cochlear implant, or assistive technology, and may suffer with a poor quality mobile telephone, exacerbating any hearing difficulties.

Access challenges include—

- **Voice telephone calls**—People who are hard of hearing typically depend on voice telephone calls. However, they may initiate a call but be unable to hear well once the call has begun. Education of consumers is important: they need to know what is essential to say to a call taker in an emergency. Call takers should also be trained to properly respond to such calls and to be patient when they need to repeat.
- **Reliance on text**—This group will be less dependent on text, although they too have been adopting smart phones and other means of communicating via text.
- **Use of Relay**—These individuals may initiate 9-1-1 calls using captioned telephones or VCO. They are much less likely to use TTYs or IP Relay. Call takers need to be trained in the receipt of these kinds of calls.

Functional Needs Category 4—People in Functional Needs Category 4, (i.e., people who are deaf-blind, ranging from profoundly deaf and totally blind to someone with some vision and

some hearing loss). Each person who is deaf-blind relies on a variety of accommodations, depending on the extent of his or her hearing and vision loss, when those losses occurred, how they manifest themselves, and at what age they manifest. Access challenges may include any of the challenges associated with the other three functional needs categories and others.

4.5.2 Communication Methods in Use Today

While considering changes to move forward, it is quite important to understand the varied communication methods in use by people who are deaf, hard-of-hearing, have a speech disability, and others today, being sure that those methods can be used to access emergency services in the future.

The following list summarizes the communication methods used by access-challenged users of 9-1-1:

1. Voice
2. SMS
3. RTT, TTY emulation
4. IM (near real time and real time)
5. Text-conferencing
6. Email
7. Multi-Media System (MMS) (pictures, pre-recorded video)
8. Real-time video (may include audio, text capabilities)
9. Video-conferencing (caller who uses a sign language, interpreter and telecommunicator)
10. Video-conferencing with VCO[31] and Hearing Carryover (HCO)[32] capabilities (caller with hearing loss or speech disabilities, interpreter, and telecommunicator)
11. Three-way voice conferencing (caller with a speech disability, speech communication assistant, and telecommunicator)
12. TTY
13. Web-based TTY
14. Web-based text chat
15. Web-based captioned telephone (VCO)
16. Captioned telephone
17. VCO using telephone (cellular or landline) and computer
18. HCO using telephone (cellular or landline) and computer
19. VCO using cellular telephone that includes both voice and data network at the same time

[31] VCO is a type of Telecommunications Relay Service (TRS) that allows a person with a hearing disability, but who wants to use his or her own voice, to speak directly to the called party and receive responses in text from the Communication Assistant (CA). No typing is required by the calling party. This service is particularly useful to senior citizens who have lost their hearing but who can still speak. Source: *FCC TRS Consumer Facts* (http://www.fcc.gov/cgb/consumerfacts/trs.html)

[32] HCO is a type of TRS that allows a person with a speech disability, but who wants to use his/her own hearing, to listen to the called party and type his/her part of the conversation on a TTY. The CA reads these words to the called party, and the caller hears responses directly from the called party. Source: *FCC TRS Consumer Facts* (http://www.fcc.gov/cgb/consumerfacts/trs.html)

20. HCO using cellular telephone that includes both voice and data network at the same time
21. Smart phone applications
22. Social media/networking
23. Devices/sensors that may include two-way voice path and/or messaging capabilities.

5 Analysis, Findings, and Recommendations

5.1 Analysis and Findings

Based on the research and transitional issues identified, Working Group 4B categorized these issues and analyzed current best practices, examples and models that could address the challenges presented. In some cases, a gap analysis was utilized to identify issue areas requiring new action. Existing efforts and work already underway to address these challenges and shortcomings are identified as appropriate. Significant study and discussion addressed the role and technical aspects of non-voice communications (specifically SMS), in today's PSAP and during the transition to NG9-1-1. Additionally, several subgroups conducted an assessment of current and proposed standards as part of their analysis.

5.1.1 Technology Issues in the NG9-1-1 Environment

This section address the technology issues anticipated in the transition to NG9-1-1. The section explores the technology required to support NG9-1-1, OSPs, NG9-1-1 SSPs, and an overview of PSAP technology issues in NG9-1-1.

5.1.1.1 Issue—IP-Based Next Generation 9-1-1

Public Safety is still adjusting to the wireless revolution. Citizens are opting to forego landline telephones in favor of complete reliance on wireless telephones, and, therefore, they are no longer tethered to a single location when calling 9-1-1. Wireless handsets have more capabilities than the traditional landline telephone; many are capable of sending and receiving text, photographs, and even streaming video. It is generally accepted that for most PSAPs, more than 50 percent of all 9-1-1 calls originate from wireless telephones. The trend to forego landline telephones will likely continue. Use by the public of text, photographs, and streaming video from wireless devices will increase.

No sooner had the 9-1-1 industry come to grips with the wireless revolution than additional advanced technologies, including VoIP, text messaging, and transmission of pictures and video from cellular telephones, have combined to make the legacy E9-1-1 infrastructure increasingly obsolete. Even more revolutionary are "smart phone applications" that access Public Safety via data paths and voice paths completely outside the 9-1-1 architecture and provide data from sources not related to 9-1-1. The E9-1-1 service enjoyed by most Americans is solid, reliable, and has served America well since 1972, but it has been enhanced and expanded as much as is possible. In response to this development, the 9-1-1 industry has committed to revolutionary technology to completely overhaul the way 9-1-1 services are delivered. This next generation technology employs an IP network and packetized data to replace legacy analog, circuit-switched networks. The new 9-1-1 architecture, developed by NENA, is known by the shorthand name "i3."

5.1.1.2 Originating Service Providers in NG9-1-1

In this document OSPs are defined as—

- **Commercial Mobile Radio Service (CMRS) Providers**—This category relates to wireless carriers, and their resellers, as defined in 47 CFR 20.3,[33] Commercial Mobile Radio Service.
- **Wireline Service Providers**—This category represents ILECs, Competitive LECs (CLEC), Cable Operators that emulate the wireline service model, and other such carriers that provide wireline services within their service area.
- **VoIP Service Providers (VSP)—**This category includes several different types of providers, including for example: interconnected and non-interconnected ISPs and Access Infrastructure Providers (AIP). Interconnected VoIP services use the Public Switched Telephone Network (PSTN), including wireless networks, to originate and terminate calls. Non-interconnected VoIP services are currently not subject to the FCC 9-1-1 requirements.
- **Mobile Satellite Service Carriers**—This category provides voice service that is interconnected to the PSTN, including wireless networks to originate and terminate calls.

Each category of OSP will migrate to next generation networks as appropriate standards are developed and individual company business drivers support the migration. As an example, 3GPP is defining standards for CMRS providers' networks to evolve to IMS and Long Term Evolution (LTE). These next generation networks will be introduced as a way to provide new services and revenue opportunities for the carriers. As these next generation networks are introduced, support for new features in NG9-1-1 can begin to be phased in (in cooperation with the migration of 9-1-1 services and PSAPs to NG9-1-1).

As OSPs consider the transition to support NG9-1-1, numerous topics must be considered. Early in the transition of the emergency services systems to NG9-1-1, OSP networks are not likely to be affected when gateways are implemented to provide the interworking between the OSP and the new NG9-1-1 system. As OSPs migrate to their next generation networks, they and their customers may take advantage of the enhanced emergency calling services and capabilities that NG9-1-1 can offer once end-to-end service connectivity is tested and enabled for NG9-1-1.

The following topics are among those that must be considered:

- **Data Validation**—For those carriers that validate subscriber addresses, the methods for validation may change.
- **Interconnection to NG9-1-1 networks (ESInets)**—There must be cooperation between the OSP and the NG9-1-1 provider to migrate traffic to the ESInets.
- **Coexistence of E9-1-1 and NG9-1-1**—OSPs may have to interconnect to both within their service area.
- **Location Acquisition**—Legacy techniques for location acquisition may evolve to support the capabilities of NG9-1-1.
- **Multimedia Messaging**—As some OSPs deploy new media types (e.g., text, video, etc.), they may provide those services to NG9-1-1 and emergency entities, including PSAPs.

[33] http://edocket.access.gpo.gov/cfr_2004/octqtr/pdf/47cfr20.3.pdf

5.1.1.2.1 Limitations on the Use of SMS for Texting to 9-1-1

The wireless industry is developing standards for next generation non-voice communications to emergency services. Until that service is defined, standardized, and deployed on next generation wireless networks, any solution that relies solely on the use of SMS does not provide the full capability required for texting to emergency services (such as location-based routing, session control, etc.).

There are significant limitations for the use of SMS for texting to 9-1-1. The following issues must be considered:

- Because SMS to 9-1-1 is a best effort service with no delivery or performance guarantees, liability protections for SMS to 9-1-1 have to be far broader than those that exist today for voice 9-1-1 because the probability of error is so much greater and there are more areas where errors can occur. Therefore, CSRIC recommends that explicit liability protection for SMS texting to 9-1-1 must be addressed at the federal level for wireless operators, service providers, and all other stakeholders.
- If SMS to 9-1-1 is used, both call takers and consumers need to be educated on what to expect because the experience for both the call taker and end user when texting to 9-1-1 will be significantly different from voice or TTY to 9-1-1.
- In the current SMS environment, the originating network or mobile device provides no location information. The only location information that might be available is whatever is typed into the message by its originator and that may be subject to mobile device and other functional element capabilities and limitations.
- Because SMS does not provide location information, the wireless network operator cannot perform initial call routing to the appropriate PSAP. External mechanisms would need to be developed and provided to perform location-based routing to the appropriate 9-1-1 system and PSAP.
- SMS messages receive no priority or special handling.
- SMS to 9-1-1 messages should be less than 160 characters in length to eliminate the need for segmentation and reassembly of long SMS messages. Long SMS messages are broken into a sequence of independent messages. Each segment can be delayed, causing out-of-order delivery of the entire message, which may result in confusion because devices are inconsistent in the way they reassemble long messages.
- The originating network provides no acknowledgments of sent, delivered, or read SMS messages.
- No security, authentication, or non-repudiation of any SMS message is provided.
- The originating network will not prevent any spam, SMS spoofing, or DoS attacks on messages delivered to the “911” central address.
- As with other communications technologies, the SMS originating network needs to protect itself from network spikes, DoS attacks, and other congestion issues. This network management requirement must be part of statutory liability protections.
- SMS is not a session-based protocol. Therefore, if a series of SMS messages is exchanged between the caller and the PSAP, the originating network is not responsible for the association and proper ordering of those messages, which would ensure the routing of subsequent SMS text messages in a call for assistance to the same call taker if that is possible.

- "911" is not currently a valid short code for routing of SMS; therefore, some method, such as a standard valid short code (e.g., 91163 or "911me"), would need to be defined and communicated.

There is ongoing work in the wireless industry and NENA to develop a non-SMS-based solution for non-voice emergency services in the next generation wireless networks. The wireless industry fully understands the desires of the people with disabilities community and is focused on finding a reliable solution for their needs instead of a short-term incomplete solution.

At today's level of technology, there are significant limitations inherent in the operation and design of the current SMS that make it impractical to rely solely on SMS for emergency services.

However, it is important to address the requirements for people with disabilities as soon as possible. To that end, it is recommended to study techniques such as "silent" 9-1-1 voice calls that provide caller location data and are supplemented by non-voice communications using SMS.

In the near term, research and development into emerging technologies, such as handset/device-based TTY emulation, should be accelerated (which may require new handsets/devices that can support such a capability). The benefit of TTY emulation is the use of standard TTY capabilities in equipped PSAPs, and thus does not require a PSAP upgrade to support other text methods. For the longer term, research and development of real-time text standards and emerging technologies should be accelerated while the next generation systems are being designed.

While it is impractical to rely solely on SMS for emergency services, especially for the general public, CSRIC recognizes that solutions are appearing in the marketplace in limited areas that may allow the use of SMS-based messaging for some emergency situations. However, deployment of such solutions is inhibited by public expectations that SMS to 9-1-1 mirrors voice calling to 9-1-1 characteristics, addressing all the technology challenges for SMS especially on a national level, and the lack of explicit liability protection for SMS texting to 9-1-1. Therefore, if SMS-based messaging will be used despite the limitations, CSRIC recommends that the FCC support introduction of appropriate legislation to address the liability protection concerns, as well as support national efforts to provide appropriate public education. In addition, the considerations of the current limitations must be well understood, especially with regard to the significantly difference in behavior of SMS versus voice calling, characterized by the lack of key essential features previously described.

A list of current or developing text to 9-1-1 authority messaging services is included in Appendix C.3, Text to 911 Authority Messaging Services.9-1-1

5.1.1.2.2 Review of NG9-1-1 Transition Issues (OSPs)

The initial goal of the transition to NG9-1-1 is to be as transparent as possible to legacy OSP networks. As OSPs evolve their networks, they can provide to their customers the capabilities that NG9-1-1 may offer. OSPs should consider the following issues as emergency services networks and PSAPs evolve to NG9-1-1 within their serving area.

- **Data Validation—**For those carriers that validate the location of their subscribers, there may be an impact on how and with whom validation is performed in NG9-1-1. Currently, wireline service providers validate through a Database Management System (DBMS) (or related databases), and the validated location is stored in an ALI system. VSPs, or their third-party provider, validate location addresses and store them in a VoIP Positioning Center (VPC). Those OSPs may have to work with the new operator of the NG9-1-1 LVF to obtain access to validation data or systems.

- **Interconnection to NG9-1-1 Networks**—To facilitate the interconnection to new NG9-1-1 networks, legacy gateways have been defined. At a minimum, OSPs may have to migrate their emergency calls to these gateways for calls destined for PSAPs that begin using NG9-1-1 systems at a time before an OSP network has NG9-1-1 capability. As OSP networks evolve to IP-based technology, the interconnection may be SIP-based through Session Border Controllers (SBC). In addition, the demarcation between the OSPs network and the NG9-1-1 ESInet needs to be clearly defined. For example, the King County Washington ruling on CMRS connection to E9-1-1 defines the "Selective Router port" as the demarcation. With the introduction of an IP-based NG9-1-1 network, this ruling would be antiquated.

- **Coexistence of NG9-1-1 and E9-1-1**—It is clear that the transition to NG9-1-1 will be phased in across the country. That implies that during the transition, an OSP may have to interconnect to both NG9-1-1 and E9-1-1 within its service area. The OSPs and 9-1-1 Authorities will need to manage these relationships and the associated phasing of the transition.

- **Location Acquisition**—An NG9-1-1 solution requires knowledge of the location of the calling device to route the call and to be available to the PSAP for dispatch. In the early stages of transition, the NG9-1-1 systems will have to query legacy systems to obtain that location. There is the potential of longer term opportunities for OSP networks to evolve to provide location to the NG9-1-1 system in a more timely and efficient manner as location technologies mature. In some cases, such as wireless technologies, a more accurate location may also be available.

- **Multimedia Messaging**—The standards defining NG9-1-1 specify a range of media that includes voice, text, and video. For text and video the issue arises of who deploys the capability first. That is, does the PSAP deploy capabilities to support these new media in anticipation of the OSPs deploying it? Or does the PSAP wait until market penetration and user acceptance dictates deploying the capabilities? In general, it is likely that OSPs will deploy these new media capabilities for revenue-generating services. Emergency services can then take advantage of these new media types as the standards and OSP networks evolve. In some cases, there may be interworking solutions that allow migration independent of changes in the OSP networks.

5.1.1.2.3 Assessment of Current/Proposed Standards and Best Practices (OSPs)

While it is too early in the process to know what specific best practices will be needed to address the transition to NG9-1-1, the Technology Subgroup has identified the following existing and new best practices that can be used as the transition to NG9-1-1 commences.

The following are the identified best practices forwarded by the 4A Working Group Report that the Technology Subgroup assessed and the changes required in these current best practices for use in the transition activities associated with NG9-1-1.

1. Subject: Defining Network Diversity Requirements for Delivery of IP-Enabled 9-1-1 and Enhanced 9-1-1 Calls [BP 7-7-0566, 7-7-0567]

Network operators and service providers (of any technology type) should spread 9-1-1 access connections across similar equipment to avoid single points of failure. Network elements used for 9-1-1 should have their plug-in level components and termination points marked with a red tag (if applicable) to notify maintenance personnel that the equipment is used for critical, essential services and is to be treated with a high level of care. This service provider equipment identification applies to E9-1-1 and may apply to some elements of NG9-1-1.

2. Subject: Defining Network Diversity Requirements for Acquiring Location and Routing Information with IP-Enabled 9-1-1 and Enhanced 9-1-1 Calls [BP 7-7-0575]

Network operators and service providers (of any technology type) should deploy location identification systems used by Public Safety in a redundant, geographically diverse manner (i.e., two identical ALI/Mobile Positioning Center (MPC) Gateway Mobile Location Center (GMLC)/VPC/LIS database systems with mirrored data located in geographically diverse locations). These include, but are not limited to, ALI, MPC/GMLC, VPC systems, and LIS.

3. Subject: Call-Handling in the Event of Call Overflow or Network Outages [BP 7-5-0569]

In E9-1-1, the PSTN may be used as a backup to dedicated trunks. Two implementation options exist:

Option 1: PSTN as a Backup for Normal 9-1-1 Connectivity—An alternative for handling E9-1-1 calls during periods of failure in the connectivity between an originating network and the emergency services network is to use the PSTN as a backup (i.e., fallback) connection mechanism between the caller's originating network and the PSAP. Such connectivity may route calls to the appropriate PSAP without the associated information that would normally be present.

If the primary path to the emergency services network is interrupted by a "failure" (not when all trunks are simply busy), the call may be forwarded over the PSTN to a number specified by the PSAP that is answered at the PSAP on a 24/7 basis. It is desirable for that specified number to be a type that can provide the original CallerID/Automatic Number Identification (ANI). This best practice does not propose that any 9-1-1 call delivery stakeholder bypass acceptable congestion control techniques commonly applied within the industry for 9-1-1 calls.

Option 2: Wireless Public or Private Networks as Backup for 9-1-1 Dedicated Trunks—Similar to Option 1 above (PSTN backup) for completing 9-1-1 calls when the primary transport facility is interrupted by a "failure" (not when all trunks are simply busy), wireless public or private networks, or satellite-based services may be used to provide an additional alternate path

to the PSTN, providing IP multimedia connectivity for next generation networks or used solely as an alternate call delivery path for the voice component of 9-1-1 calls.

4. Subject: Call-Handling in the Event of Call Overflow or Network Outages [BP 7-7-0574]

Network operators and service providers (of any technology type) should remotely monitor and manage the 9-1-1 network components using network management controls, where available, to quickly restore 9-1-1 service and provide priority repair during network failure events. When multiple interconnecting providers and vendors are involved, they will need to cooperate to provide end-to-end analysis of complex call-handling problems.

In NG9-1-1, the mechanism used to handle call congestion and outages is diversion of calls to alternate PSAPs that have the capability to effectively answer and provide assistance. PSAPs should create relationships with other PSAPs that have the capabilities to serve as a backup so that their calls can be answered even under extreme overload or network failure scenarios. ESInets must be designed with redundant interconnect to OSPs and PSAPs to maintain connectivity in the face of extensive disaster damage. The characteristics of IP routing are of great assistance in ensuring 9-1-1 calls will reach a PSAP if there is any path possible.

5. Subject: Defining Network Diversity Requirements for Delivery of IP-Enabled 9-1-1 and Enhanced 9-1-1 Calls BP 7-7-3224

Network operators and service providers (of any technology type) should use dedicated signaling system 7 (SS7) or multi-frequency (MF) controlled trunk groups for the normal routing of E9-1-1 calls from originating switching entities to E9-1-1 SRs rather than using shared PSTN trunking. Where the OSP uses IP-based connection arrangements for routing to a 9-1-1 system service provider (SSP) or Public Safety agency, those transport facilities should be diverse private facilities or their functional equivalent, e.g., generic routing encapsulation (GRE) tunneling or virtual private network (VPN) connections or equally secure industry protocols. In addition, appropriate and necessary service level agreements for network performance should be implemented with the transport network provider.

The following are new best practices identified by the Technology Subgroup for use in the transition activities associated with NG9-1-1:

1. Subject: Common Baseline Imagery for Routing and Mapping\Defining Geographic Coverage Areas for PSAPs

Public Safety Authorities should be allowed access to Department of Homeland Security—National Geospatial-Intelligence Agency (DHS—NGA) data, which can be provided on a monthly basis or as needed. The importance of 9-1-1 for Public Safety and for national intelligence should be emphasized. Common baseline imagery should be used to align GIS maps with streets and Public Safety Authority jurisdictional boundaries. One way to achieve that goal is to grant Public Safety Authorities access to federal or military imagery databases such as DoD–NGA and/or DHS–GMO (Department of Defense—Geospatial Management Office) that

can be provided monthly or as-needed. This access should be justified through acknowledgement that 9-1-1 is of importance for public safety and national intelligence. [34]

2. Subject: NENA Recommendation to Test All Emergency Services Query Keys Before Use

Routing errors are encountered when a VPC or MPC/GMLC operator sends bad shell record data (pseudo automatic number identification [pANI]-to-emergency service number [ESN] relationship) to the E9-1-1 SSP for entry into the routing database. These errors result from an incorrect MSAG-to-ESN-to-PSAP relationship. To avoid such errors, the VPC should follow the recommendations in NENA 56-504, *NENA VoIP 9-1-1 Deployment and Operational Guidelines* (see Testing in Section 5.1.4), to fully test routing for every pANI placed in service. That testing process should reduce the need for post-provisioning verification, which would only prove that bad data had been entered into the routing databases (typically ALI and SR). Another step that can help ensure pANI assignment accuracy during the original pANI provisioning process is for the E9-1-1 SSP to send a list of all applicable MSAG ranges to the VPC and MPC operators, so they can ensure their shell records are built correctly. Doing so helps reduce the negative impact of errors related to data entry.

NG9-1-1 does not use any form of pseudo ANI except with legacy network gateways.

3. Subject: VSP Campus Testing

VSPs should conduct extensive 9-1-1 call-through testing for environments that have a high user capacity (e.g., university campuses, large commercial enterprise campuses, and densely populated multi-tenant buildings/complexes). This testing immediately reduces the risk of misrouting a block of callers at a particular facility and in turn reduces the liability for those same entities. Because the "originating end user" customers are also stakeholders in the success of a 9-1-1 call, they should also participate in testing with the VSP. This best practice is also applicable to legacy private branch exchange (PBX) environments; the PBX service provider should perform the extensive call-through testing steps.

4. Subject: Emergency Services Gateway Testing

When service providers or carriers reconfigure their network, for example, make changes to VPC/MPC/GMLC/Emergency Services Gateway (ESGW) providers, they must assess the impact on the routing of 9-1-1 calls. Service providers and/or carriers should coordinate and perform necessary testing of all new call paths between their network and the emergency services network (e.g., SRs, or the ESInet). This testing should include a test call using all routing elements (e.g., pANI, Emergency Route Tuple [ERT], and Emergency Services Gateway Route Identifier [ESGWRI]).

NG9-1-1 does not use ESGWs, although VSPs may be sending calls through ESGWs in early stages of transition. In those stages, this best practice applies.

[34] It should be noted that this new best practice may have been addressed. See, for example: *NAVTEQ Agreement with NGA Extends Access to Map Data for State and Local Entities*. September 28, 2010. Available at: http://press.navteq.com/index.php?s=4260&item=14071

5.1.1.2.4 Gap Analysis of Standards and Best Practices (OSPs)

The Technology Subgroup acknowledges that it may be too early in the transition to NG9-1-1 to write best practices. However, the items listed below are issues or gaps that will need new best practices when consensus can be found concerning what constitutes an appropriate best practice.

Subject: VoIP GIS Accuracy

Issue/Gap—IP routing (VoIP in E9-1-1 and all of NG9-1-1) is based on GIS address information and mapped jurisdictions that are not always accurate. Currently, 9-1-1 Authorities use self-obtained imagery to align GIS maps with actual accurate data on streets and jurisdictional boundaries. This practice is costly and requires updates. In addition, common imagery can be used by the PSAP's mapping equipment to help with emergency response. To address this problem, NGA could provide timely and accurate imagery and in return obtain the accurate PSAP jurisdictional boundaries for its Homeland Security Infrastructure Protection (HSIP) Program.

5.1.1.3 System Service Providers in NG9-1-1

In a next generation environment, the role of a 9-1-1 SSP includes the following primary areas of responsibility:

- Has the statutory and regulatory authority to establish, administer, and maintain connection arrangements with 9-1-1 OSPs. These connection types include voice, non-voice, and the associated 9-1-1 data as defined in national standards.
- Has the statutory and regulatory authority necessary for the processing, routing, and delivery of emergency communications to 9-1-1 authorities and other associated Public Safety entities.
- Establishes, administers, and maintains the various next generation technologies that provide the services required for emergency message processing.

This list of responsibilities is not intended to be all-inclusive, and the SSP may provide other types of services.

The goal of the SSP is to provide a business and technical operations process that results in a public-initiated emergency communication being received from the OSP, processed, and delivered to the proper 9-1-1 Authority.

9-1-1 SSPs may have varying roles in the transition to NG9-1-1 and in ongoing NG9-1-1 operations. In general, both historically and for the future, there are incumbent SSPs. There may also be more recently formed SSPs, composed of entities from the vendor community and 9-1-1 Authorities or groups of 911 Authorities. Any of these, acting alone or in various combinations, could fulfill or take on the role of an SSP as part of the conversion to an NG9-1-1 environment.

Incumbent SSPs have typically provided E9-1-1 systems applied across multiple counties or equivalent jurisdictions, where they receive 9-1-1 calls from OSPs, process them against pre-established controlling databases, and deliver the calls to the appropriate 9-1-1 Authority and PSAPs, including support for call transfers between PSAPs.

The physical PSAP equipment and software for 9-1-1 call and data handling is usually supplied by a vendor and, in some cases, by the SSP separately from its overall SSP role. Historically, some (not all) ILECs serve as SSPs. Over time, 9-1-1 Authorities have taken on all or part of the E9-1-1 SSP roles in specific cases, usually at the county level (or equivalent) or in small or regional groupings.

Within the future environment of NG9-1-1, the opportunity exists for groups of counties within a state, or, at the state level, for 9-1-1 Authorities to organize together and implement NG9-1-1 more economically as a wide-scale service system. In these types of governance situations, the combined 9-1-1 Authority may contract with a vendor or vendors to supply the NG9-1-1 system components, test them, and operate the service system as an ongoing service to the 9-1-1 Authority and related PSAPs and other emergency entities. This may or may not involve services provided by the legacy 9-1-1 SSP. Alternately, the 9-1-1 Authority itself may choose to acquire NG9-1-1 components, integrate them, and then operate the NG9-1-1 system as part of its internal structure.

In summary, there are various alternatives within these options. If the 9-1-1 Authority has chosen to use a vendor to operate the NG9-1-1 system, the vendor is the SSP. If the 9-1-1 Authority is operating the NG9-1-1 system itself, the 9-1-1 Authority is the SSP. In either case, the 9-1-1 Authority is the responsible party for 9-1-1 services to the public.

5.1.1.3.1 Review of NG9-1-1 SSP Transition Issues

Changes in how 9-1-1 service is provisioned and managed as a result of the transition from E9-1-1 to NG9-1-1 mean that 9-1-1 Authorities, PSAPs, and SSPs must re-educate themselves technically (and operationally). NG9-1-1 will be based on IP networks, using IP-based applications for both databases and call processing. There will be new features in NG9-1-1, and all will require new knowledge and processes. The specifics of these areas are discussed elsewhere in this report.

Technically, several planning and preparation actions must take place. First, determination and adjustments of the roles of the PSAP, the 9-1-1 Authority, and the SSP (where different), at the local, regional, and state levels are required to support technical transition (and ongoing operations).

The following major technical activities are associated with transition to NG9-1-1:

- There are options for interconnecting OSPs to the NG9-1-1 network of the 9-1-1 SSP. During transition to the long-term all-IP based design, the SSP must be able to administer and ensure its fail-safe implementation of various options, such as actions surrounding the LSRGW, LNG, and direct IP interfaces.
- As long as ALI servers and links to MPC/GMLC and VPC servers continue to be used with NG9-1-1 during transition, OSPs will see changes largely in network interfaces, such as to LSRGWs or LNGs into the NG9-1-1 system.
- Installation, testing, and implementation of IP networks will provide the underlying transport for emergency services (ESInets) and other authorized applications.
- Changes from MSAG to GIS-based geospatial databases for address validation and routing control will require SSPs and 9-1-1 Authorities (where these are different

entities) to significantly restructure and reorient their database update and management processes.
- Installation, testing, and implementation of NG9-1-1 database components, call processing components, and capable PSAP components will be required as specified by industry standards.[35]

Planning, coordination, and implementation of new and revised operational procedures are required for OSPs, the NG9-1-1 system up to the PSAP, and at the PSAP and other applicable emergency entities.

Numerous E9-1-1 Authorities have already issued Requests for Proposals (RFP) or are in the process of formulating RFPs for NG9-1-1 services, beginning a transition into mixed mode E9-1-1 and NG9-1-1 environments. Because of the complexity of migrating originating 9-1-1 service providers, 9-1-1 SSPs, and 9-1-1 Authorities simultaneously, it is unlikely that a next generation solution will be implemented via a "flash cut."

Therefore, it is imperative that both legacy and next generation technologies operate simultaneously and seamlessly. This requirement creates critical transition issues in the migration to NG9-1-1. The transition involves more than just emulating legacy services in an IP-centered environment.

Defining a detailed best practice would consist of detailing network architectures, regulatory and implementation issues, and operational considerations. That is beyond the scope of a few declarative statements. Parties making the change from E9-1-1 to NG9-1-1 should carefully consider how their plan will incorporate the following key best practice areas:

- Ensuring the full operation, interoperability, and cross-platform support for all stakeholders that have a presence, connection, or association with both the legacy platform and the NG9-1-1 platform
- Replicating all existing E9-1-1 services and fail-safe transitional support for stakeholders that are migrating to the NG9-1-1 platform
- Maintaining fail-safe levels of support for stakeholders that will continue to use only the legacy systems, including operating procedures and interoperability for those stakeholders that will not be associated with the NG9-1-1 platform.

These best practice areas should be the focus in the creation of transitional connection arrangements. Additional considerations should include the transitional impact on voice services, various databases, (ALI, selective routing, and GIS and their successors in the NG9-1-1 environment), as well as the provision of operational support on an intra- and inter-agency basis.

In developing a successful migration plan, the following concepts used in developing the current E9-1-1 systems have been helpful:

- Properly prioritized and detailed steps and goals
- Effective stakeholder communications process

[35] In many cases, standards for NG9-1-1 specifications are still under development

- Safe and easy roll-back to the prior configuration at any step in the process
- Fewest changes at any one time to simplify the conversion process.

It is important to note that in the process of evolving to an NG9-1-1 system, 9-1-1 Authorities and SSPs will have to implement technical solutions that are made more complicated by political and regulatory considerations. Effective planning will need to consider these barriers to the transition. CSRIC encourages the FCC to continue to apply directive influence to help overcome these types of political and regulatory barriers.

Associated reference materials

Most states will seek to develop their NG9-1-1 system in compliance with evolving national standards. For reference, 08-002, *NENA Functional and Interface Standards for Next Generation 9-1-1*, and 08-003 (pre-publication draft standard, as of September 2, 2010), *Detailed Functional and Interface Specification for the NENA i3 Solution—Stage 3*, are the blueprint for the final architecture.

Other i3-related documents include NENA 08-001, 08-002, 08-003 (pre-publication), 08-501, 08-502, 08-505, 08-751, and 08-752, and the IETF standards that these NENA documents reference. These resources (among others) are available at: http://nena.org/technical-standards.

3GPP, in 3GPP TS 23.167[36] and 3GPP TS 24.229,[37] provides procedures and technical interface specifications supporting IMS emergency voice sessions.

5.1.1.3.2 Assessment of Current/Proposed Standards and Best Practices (SSPs)

The following best practices were forwarded by CSRIC Working Group 4A to the Technology Subgroup. The subgroup assessed them and the changes required in these current best practices for use in the transition activities associated with NG9-1-1. It should be noted that some subject areas in these best practices will disappear or transform if and when next generation impacts are fully realized. Examples may be ESGW networks, MPCs, and VPCs.

1. **Subject: Common Baseline Imagery for Routing and Mapping/Defining Geographic Coverage Areas for PSAPs**

Public Safety Authorities should be allowed access to DHS—NGA data, which can be provided on a monthly basis or as needed. The importance of 9-1-1 for Public Safety and for national intelligence should be emphasized. Common baseline imagery should be used to support development of routing rules, and it assists in mapping of 9-1-1 calls to align GIS maps with streets and Public Safety Authority jurisdictional boundaries. One way to achieve that goal is to grant Public Safety Authorities access to federal or military imagery databases such as DoD–NGA and/or DHS-GMO, which can be provided on a monthly or as needed basis. This should be justified through acknowledgement that 9-1-1 is of importance for Public Safety and national intelligence.

[36] 3GPP, IP Multimedia Subsystem (IMS) emergency sessions (3GPP TS 23.167). Available at: http://www.3gpp.org/ftp/Specs/html-info/23167.htm
[37] 3GPP, IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3, (3GPP TS 24.229). Available at: http://www.3gpp.org/ftp/Specs/html-info/24229.htm

2. Subject: VoIP Geocoded Address Inaccuracies

For any technology type, data conversions, e.g., geocoding and reverse geocoding, very likely will introduce errors. Therefore, geocoding should not be used for routing or dispatch until completely accurate and applicable synchronized GIS data is in use between the PSAP and the provider of location data. This will reduce confusion for the call taker by presenting only the most accurate and reliable information for call handling. In addition, reverse geocoding should not be used.

5.1.1.3.3 Gap Analysis of Standards and Best Practices (SSPs)

The CSRIC 4B Technology Subgroup acknowledges that it may be too early in the transition to NG9-1-1 to write best practices. However, the items listed below are issues or gaps that will need new best practices when consensus can be found concerning what constitutes an appropriate best practice.

Subject: LVF Application Elements

Issue/Gap: Development is continuing on the integration of the LVF into the NG9-1-1 system. Further analysis will be needed to develop any associated best practices for the LVF.

Subject: VoIP Geocoded Address Inaccuracies/Defining Geographic Coverage Areas for PSAP 9-1-1 Calls Handled by a VSP

Issue/Gap: When a traditional 9-1-1 call handled by a VSP is received at the PSAP, sometimes the latitude/longitude (lat/lon) does not correlate exactly with the actual address. Although some PSAPs may receive the VPC geocoded lat/lon with the VoIP calls from the registered address of fixed and nomadic customers, these locations have proved inaccurate in the PSAP mapping equipment. At the PSAP, the CAD or GIS plots the lat/lon but sometimes this information does not align with the address provided.

Subject: ESGW Provisioning

Issue/Gap: ESGWs, which are a critical link between the OSP network and the SR entity, risk having service congestion block legacy calls if the two technologies are combined on the same paths.

NENA addressed this topic in a Technical Information Document (TID) published March 17, 2010. NENA 03-508 looked into the impacts of sharing a common Trunk Group (TG) with multiple service types.

That NENA document reviews the topics associated with the practice of delivering more than one type of an emergency call over the same trunk group into a legacy type E9-1-1 SR. It describes the market forces leading to implementation of the practice as well as the technological pros and cons associated with it. The technical and operational implications of the practice are addressed from the perspective of many different groups, including the OSPs, network aggregators, E9-1-1 SSPs, Public Safety agencies (i.e., PSAP management/call takers), and regulatory bodies that govern 9-1-1 operations.

Subject: Routing and Network Reliability, Reliability of 9-1-1 Calls Using VoIP

Issue/Gap: Appropriate industry experts need to be identified who will determine whether specific CSRIC-sanctioned best practices are needed to help ensure the reliability of 9-1-1 calls initiated using VoIP services.

Subject: Non-Service Initialized Calls Related to VSP Nomadic Backup Routing

Issue/Gap: Unless changes are made in the non-service initialized (NSI) rule, nothing can be done about the routing of NSI calls to VSP nomadic backup routing. No action will be taken by the Technology Subgroup related to VSP nomadic backup routing.

5.1.1.4 Overview of PSAP Technology Issues in NG9-1-1

NG9-1-1 will require public safety to adopt new IP-based technologies in order to interface to ESInets and to consume new multimedia information from citizens and other sources. PSAPs will need the capabilities to handle and process this new information to interact with citizens and to provide responders with additional information to make more informed decisions. More specifically, PSAPs will need to be capable of receiving IP-based signaling and media for delivery of emergency calls that conforms to national standards. Emergency calls will now enter the NG9-1-1 PSAP using SIP signaling on an IP network instead of through legacy analog, circuit-based technology. However, along with the opportunity come many new technical challenges, such as new networks and call routing technology, security, and new database management. See Appendix C, Section 4 (NG9-1-1 Service Relationships and Responsibilities) for further information.

5.1.1.4.1 Review of NG9-1-1 Transition Issues (PSAPs)

5.1.1.4.1.1 Networks

9-1-1 Authorities and NG9-1-1 PSAPs will need to design, build, and maintain IP networks that can support any media type, including, but not limited to, voice, data, streaming videos, pictures, text messaging, and instant messaging. These IP networks will be both internal to the PSAP as well as networks that provide connectivity to other ESInets, other PSAPs, etc. Moving to IP networks will improve PSAPs' ability to provide emergency services by—

- Increasing the overall reliability of 9-1-1 emergency services by improving reliability and redundancy in the delivery network
- Supporting flexible call routing (including policy-based routing and backup/fail-over functionality), and enhanced call transfer functionality
- Improving interoperability between PSAPs
- Facilitating transfer of call-related data
- Providing flexibility to accommodate changing requirements and integrate new technology as it becomes available.

As 9-1-1 Authorities and PSAPs start to make the transition from legacy E9-1-1 to NG9-1-1 networking, they should inventory and evaluate the IP networks that they are already using because it is likely that multiple, limited-purpose networks will already exist. For example, a

9-1-1 Authority may have now or in the near future a number of local and wide area IP networks for its E9-1-1 systems, CAD systems, two-way radio systems, and public safety broadband data systems. One NG9-1-1 transition goal should be to consolidate the legacy networks into single or as few as possible networks, rather than multiple limited-purpose networks, and to accommodate any required separation logically rather than physically.

Bandwidth on these IP networks will need to be sufficient to not delay, disrupt, or otherwise impede emergency communications to, from, and within the PSAP. ESInets should be designed to provide non-blocking service for high-priority traffic. Appropriate traffic engineering should be applied to PSAP IP networks, with consideration given to concerns such as traffic marking, traffic policing, traffic shaping, and QoS. QoS of the packet-based ESInet should be actively managed to ensure that voice calls have equivalent audio quality to carrier-grade circuit-switched calling (as measured by Perceptual Evaluation Speech Quality [PESQ] or other techniques). Networks should use appropriate network traffic prioritization mechanisms for the real-time media (such as Real-time Transport Protocol [RTP] packets for voice and video) as well as the call signaling (such as SIP). For network types that support it, it is recommended to follow the DiffServ (RFC2475) packet QoS prioritization scheme as described in NENA 08-003 (section 3.6). For networks that do not support DiffServ (for example, a wireless network used for redundant backhaul to a PSAP), it is recommended to set up equivalent prioritization schemes to assure end-to-end QoS.

IP network performance parameters, such as throughput, latency, jitter, and packet loss, need to be carefully considered to provide the media quality required. Network throughput must match the expected traffic profiles given call volumes, media types, etc., as well as provide for the ability to withstand peak loads caused by inevitable DoS attacks. Minimal network latency is especially important for full duplex audio calls both to minimize the noticeable effect to callers and to enable effective echo cancellation. In addition, the audio CODEC used and the use of transcoding will affect audio quality. High-quality (low-compression) audio CODECs, such as G.711, are recommended, and if transcoding is required, it is recommended that it occur as close to the source as possible because the audio is less likely to have degraded through compression, packet loss, etc. closer to the source.

As mentioned in the draft of the NENA Emergency Services IP Network Design (ESIND) document, availability and reliability are important considerations in the design of the PSAP IP networks. Many factors affect network availability and reliability, from the reliability of individual network components to the existence of redundant and diverse networks paths. Historically, telecommunications companies have strived to provide 99.999 percent (five 9s) availability for the 9-1-1 emergency services equipment that they provide (i.e., SRs, DBMS, ALI, Dual Mated Tandems, etc.). Legacy E9-1-1 PSAPs are rarely able to achieve this level of availability largely because of limitations at the physical layer (i.e., Centralized Automatic Message Accounting [CAMA] trunks are single threaded from the Central Office [CO] to the PSAP). The cost of building an infrastructure capable of achieving five 9s availability for a PSAP has been beyond the resources available to most 9-1-1 entities. With the introduction of IP networks for emergency services, PSAP management and 9-1-1 Authorities have more options to provide overall five 9s availability of emergency services to citizens. The highly dynamic nature of call routing in an NG9-1-1 system allows quick routing of calls to other PSAPs if there is a network or other equipment failure at a given PSAP. In addition, PSAP management and 9-1-1 Authorities can build physically and logically diverse network connections to the external

ESInet to prevent a single point of failure. For example, wireless networks, such as point-to-point broadband connections or commercial wireless data services, can be used to provide physically redundant paths into the PSAP.

Another technical consideration for PSAP management and 9-1-1 Authorities when building out PSAP and ESInet networks is the application and network protocols that must be supported on the network and within the applications themselves. While most deployed networks use IPv4, it is generally accepted that no new IPv4 addresses will be available at some point in 2011 based on current consumption rates. It is anticipated that IPv6 will be put into practice as the effects of this IPV4 address shortage become more widely felt. It is also likely that IPv4 and IPv6 environments will coexist for some time to come. For that reason, ESInets and PSAP networks should be designed and deployed with technologies to allow interoperability between existing IPv4 devices and future emergency services devices and infrastructure that will be constrained to operate only with IPv6 addresses. In addition, it is expected that the network will have to support a wide variety of established technologies and protocols.

5.1.1.4.1.2 Network Management/Administration

9-1-1 Authorities and PSAP management will face significant challenges when transitioning to next generation network systems. Identifying the technical expertise required to implement and administer mission-critical networks will be a priority. In many cases, this expertise will not be available from within the staff of PSAPs or 9-1-1 Authorities. Municipal information technology departments also may not be prepared to assume these additional responsibilities. Assessing the need for external resources and/or additional technical training of existing personnel must be a priority.

PSAP network managers will need to manage both local area networks (LAN) for communications between equipment inside the PSAP as well as connections to WANs for connectivity to the ESInet. Because the IP network is core to the function of the PSAP and the ability to "take calls," the network must be managed with great care and attention. Network managers should be able to easily determine real-time network performance characteristics and should immediately be notified when performance degrades or failures occur. If the ESInet administrator role is separate from the PSAP network administrator role, those two management authorities must work together to ensure end-to-end system performance, reliability, and availability.

5.1.1.4.1.3 Security

IP-based NG9-1-1 systems will introduce connectivity to external systems and will convey new types of media such as text, images, and video. This will likely increase PSAPs' exposure to typical cyber security issues that affect IP-based systems such as DoS attacks and computer viruses. The design and engineering of NG9-1-1 systems must take into account the impact on 9-1-1 systems and PSAPs as standardized security practices are implemented where they have not been in place before. 9-1-1 Authorities will face particular challenges when transitioning from the closed E9-1-1 network environment to the more open architecture of an ESInet or next generation network. Identifying the technical expertise required to administer security in a complex network architecture for mission-critical systems will be a priority. In many cases, this expertise will not be immediately available, and external resources may be required.

NG9-1-1 standards include a full complement of modern security mechanisms designed to control access to information and to guard against eavesdropping and malicious alternation of data. The security mechanisms are uniformly specified for use on every interface, and the entire ESInet is treated as untrusted. ESInets should have rigid controls on access, but the elements in an ESInet treat the network as if it was the open Internet. Similarly, the NG9-1-1 standards have a sophisticated, uniformly applied data rights management system that allows data owners to control who has access to their data. Data rights management is role based and allows fine-grained control over all aspects of data access. Authorities and managers will have to create data rights policies for their data and arrange for credentials to be issued to bona fide agencies and their agents (both employees and contractors). All elements use the same security mechanisms (single sign on) and the same data rights management system. This assures data owners that even if calls are diverted to alternate PSAPs, their data will be protected as if the normal PSAP had taken the call.

Adherence to the best practices drafted in the NENA 75-001, *Security for Next-Generation 9-1-1 Standard (NG SEC)*, is recommended as systems are designed and implemented. 9-1-1 Authorities must apply a comprehensive approach to assessing security vulnerabilities and implementing the appropriate policies and processes for—

- Functional policies and procedures
- Roles and responsibilities
- Information classification and protection
- Application, system, and network administration
- Safeguarding of information assets
- Physical security
- Remote access
- Change control and compliance processes
- Risk identification and response planning.

Further specifications are currently being drafted in the NENA ESInet Design work group and the next phase of the NENA NG SEC work group. In addition, other applicable existing standards for network security should be considered. ESInet design and implementations should take into account the following best practice examples found within the NENA NG9-1-1 standards:

- Traffic on ESInets should be authenticated, encrypted, and integrity protected.
- All traffic into the ESInet, regardless of source must pass through an NG9-1-1 Border Control Function (BCF). The BCF incorporates both SBC and firewall elements, and includes standardized interfaces for mitigating deliberate attacks on PSAPs.
- The 9–1–1 ESInet that connects to the Internet must have firewall protection at every entrance and egress point.

Of considerable concern to NG9-1-1 systems designers is the very real possibility of deliberate attack. 9-1-1 Authorities and ESInet operators must assume their networks will be subject to distributed DoS attack, and their systems must be prepared to withstand massive attack. Best practice for IP networks that can be attacked is to have extremely large bandwidth into the main network ingress points (which would be the NG9-1-1 BCF). A recent report indicated that attack

traffic "reached peaks of up to 14 Gbps"[38] and is expected to increase over time. This means ESInets should have at least that much bandwidth to their upstream bandwidth providers and their BCFs should be scaled for at least that much traffic. It is recommended that ingress points be configured at state level ESInets, with local networks receiving traffic from state BCFs and Emergency Service Routing Proxy (ESRP). No ingress to the network should be permitted that does not pass through the BCF. This means all LNGs, and all call sources, regardless of how trusted they are, remain outside the ESInet and are connected to it though a BCF. If all ESInet traffic is configured as recommended, BCFs between state and local or regional ESInets can be much smaller scale, and BCFs between the ESInet and PSAPs (which are recommended) can be scaled to match normal expected traffic.

Attacks will occur. Plans must be made to deal with them. CSRIC recommends the creation of a national Computer Emergency Response Team (CERT) with specialized knowledge of NG9-1-1 systems and deployments that can assist local authorities in dealing with attack.

Despite all of the mechanisms and protections described, experience suggests that during the initial phases of a DoS attack, many bad calls will get through the BCF until its filtering mechanisms can be adjusted to deal with the particular attack pattern observed. During that time, it is recommended that calls be spread out to all available PSAPs nationwide. It is estimated that at any time, there are at least 20,000 call takers on duty. These call takers can very quickly identify good calls from attack calls and transfer the good ones back to the proper PSAP.

5.1.1.4.1.4 General Information Display

In an NG9-1-1 environment, all PSAP components that handle media from citizens and to first responders will be required to render or generate any media type and the media formats required for that type (e.g., G.711 for voice, H.264 for video). The technical impact on NG9-1-1 (PSAP) functional elements such as call handling, incident creation, dispatch, and first responder systems will be significant. All of these systems will need to intelligently evolve their capability to recognize specific media and to automatically adjust the user's information display according to user-defined specifications. Current and logged information will need to be presented to users when appropriate to their current working context. Systems will need to provide intelligent correlation of information to draw users' attention to important events that may be overlooked in an environment where much more information will be available and displayed to users. It is recommended that NG9-1-1 PSAP equipment conform to the specifications detailed in NENA/APCO 54-750, *Human Machine Interface and PSAP Display Requirements*.[39]

5.1.1.4.1.5 Database Management and Auditing

In today's E9-1-1 call routing, location validation and ALI display are the result of large, complex databases managed primarily by external sources such as the OSPs or SSPs. Many of the functional elements used in an NG9-1-1 system also consist of databases, and the number of databases and their complexity will increase significantly. The technical impact of database management and auditing on 9-1-1 Authorities and PSAP management will be proportional to how much of the NG9-1-1 system falls under their technical responsibility. For example, 9-1-1 Authorities at the state level may be the primary SSPs for the municipalities under their

[38] Akamai. *Akamai Shields Leading Retailers from DDoS Attacks During Critical Holiday Shopping Period.* December 13, 2010. Available at: http://www.akamai.com/html/about/press/releases/2010/press_121310_1.html
[39] Available at: http://www.nena.org/operations/standards/HMI

jurisdiction. In these cases, the 9-1-1 Authority may be responsible for many, if not all, of the system databases that reside within its networks. The following are categories of database management that 9-1-1 Authorities and/or PSAP management will be responsible for during the transition to and implementation of NG9-1-1.

GISs and Location Validation/Routing Databases

NG9-1-1 places significant importance on up-to-date and precise spatial data. It is extremely important for 9-1-1 Authorities and PSAP management to understand the level of accuracy and precision required and how spatial data can best be verified and maintained. Having MSAG, ALI, and GIS datasets reconciled and synchronized as part of an NG9-1-1 transition is crucial to creating the NG9-1-1 databases responsible for both routing the NG9-1-1 call and providing telecommunicators with the information they need to correctly verify the location of a caller and provide proper emergency response. 9-1-1 Authorities will need to possess the technical database skills necessary to create, edit, and maintain these complex geospatial datasets.

9-1-1 Authorities will be responsible for comparing the applicable MSAG and GIS databases and identifying synchronization and accuracy issues such as—

- Inconsistent naming conventions
- Inaccurate address ranges/information
- Improper ESN assignments to MSAG records
- Improper community assignments
- Improper exchange designations
- Data that exists in only one database but should be in both
- Attribute errors
- Overlapping boundaries.

To the extent possible, the data synchronization process should be automated.

Once the MSAGs and GIS datasets are synchronized and reconciled, the 9-1-1 Authority can work with its ALI database provider to geocode its ALI dataset against the GIS centerline data as another quality assurance.

In NG9-1-1, all aspects of call routing, including routing of a call to the right PSAP and routing of calls and data to the proper responders, are driven by the GIS using an online, real-time data push mechanism. Routing changes are accomplished by updating the GIS. All the route data is created, on the fly in near real time from the GIS updates and automatically pushed to the route database, the ECRF and the LVF.

NG9-1-1 databases are more standardized than existing MSAG data. While current systems tolerate wide variation in how fields are used, NG9-1-1 imposes strict adherence to data standards. This is required so that calls can be handled in PSAPs that do not understand local conventions, and so that automated processes can be used to create and maintain the NG9-1-1 data. NG9-1-1 standards are fully harmonized to the latest Federal Geographic Data Committee (FGDC) standards. Backward conversion routines are provided in the NG9-1-1 system to allow older systems dependent on current data to continue to operate. 9-1-1 Authorities must restructure their GIS layers to conform to NG9-1-1 standards during transition. Much of the

conversion can be automated.

The 9-1-1 Authority may be responsible for coalescing GIS data from multiple PSAPs or authorized provisioning entities into a coalesced NG9-1-1 call routing and location validation systems.. It will also be the responsibility of the 9-1-1 Authority to provision its GIS data to the location validation and emergency call routing databases. The provisioning interface (a GIS layer replication mechanism) will require the use of a web feature service (WFS) (an Open Geospatial Consortium [OGC] standard that performs insert/delete/modify operations) and a Really Simple Syndication (RSS) feed of WFS commands as described in NENA 08-003. It will be the responsibility of the 9-1-1 Authority to control what additional service area boundary types (towing areas, poison control jurisdictions, etc.) will be provisioned to the ECRF for its service area.

The 9-1-1 Authority will need to maintain an authorized access mechanism to grant access to other authorized agencies to provision their boundaries to a designated ECRF/LVF database. This mechanism is being defined within NENA at this time.

Call Management and Policy Routing Databases

As mentioned in NENA 71-502, the E9-1-1 system primarily relies on pre-programmed decision trees to route 9-1-1 calls and has a limited range of capabilities that could be compromised by widespread outages. NG9-1-1 technology allows the delivery method of a call to be dynamically altered based on conditions that exist at the time of the call and information that will come with the call. Software and databases within the i3-based NG9-1-1- system, such as the ESRP and the ECRF, affect how calls will be processed and delivered to PSAPs. The software rules that control how this processing takes place are known as “policies.” Policy rules are used to evaluate the many conditions (states) that exist within the NG9-1-1 functional elements and to accordingly alter how each call is delivered. Policies are stored in a Policy Store, edited with a Policy editor, and evaluated at call time by the policy routing function of the ESRP. PSAP/9-1-1 Authorities will be, at the very least, responsible for providing the content that is stored in these databases.

In some cases, the 9-1-1 Authority will also be responsible for implementation and ongoing administration of these databases. Technical impacts include, but are not limited to—

- Technical staff must be granted authority and have the appropriate skills to develop, create, modify, test, and implement the policy rules within a complex database.
- Network interfaces and authorized access agreements must be in place between all entities that share the ESInet or ESN.
- A policy editor must be available at the PSAP level for appropriate personnel to use.
- Discrepancy reporting mechanisms must be implemented within the call management functional elements to assure that errors are immediately identified. The role of the 9-1-1 Authority/PSAP in addressing these errors will vary depending on the level of system responsibly assumed.
- Policies must be harmonized within the entire NG9-1-1 system so that all possible states are accounted for and all calls will route to a PSAP designated to take them.

5.1.1.4.1.6 Software Applications and Services

NG9-1-1 will affect every aspect of PSAP operations and technology. Not only will today's voice communications be changed to use IP, but there will be new media types to process and store, the ability to communicate and work more closely with other PSAPs, and the ability to share these new media with responders over end-to-end IP-based systems. These capabilities will require new call-handling equipment as well as dispatch and logging equipment. The PSAP will need to continue to support both civic and geodetic forms of location, but the use of GIS technology will increase.

Information will be handled very differently in an NG9-1-1 PSAP than in a legacy E9-1-1 PSAP. Because of the effects of flexible call routing, new data sources, and the expanded ability to share and exchange data, a rich set of information will now be exchanged between component equipment in the PSAP as well as between PSAPs (e.g., as a result of call overflow or backup/fail-over scenarios). PSAP management and 9-1-1 Authorities will need to understand these information flows and the implications for data security and short- and long-term data management. Traditionally, logging/recording has been segregated by product in legacy E9-1-1 PSAP equipment (e.g., voice call logging is separate from CAD data logging). In addition, agencies have traditionally each purchased their own logging solutions. In NG9-1-1 systems, logging systems may be much more converged to enhance data correlation between the various types of media (e.g., unified playback of all media related to an incident) to reflect the data sharing between various PSAP equipment that NG9-1-1 will use and to provide optimal economies of scale (e.g., when sharing loggers between PSAPs). PSAP management and 9-1-1 Authorities will need to continue to enforce data privacy and data retention policies in this new environment, and any logging or data sharing equipment should allow agencies to enforce their existing and (likely) modified policies.

5.1.1.4.1.7 Supporting Elements

The time used by all NG9-1-1 systems, including PSAP components, must be synchronized to ensure the consistency of time stamps added to event records, reports, and media recordings. Network Timing Protocol time service as specified in NENA 08-003 should be used.

Discrepancy Reporting

In today's E9-1-1 system, PSAP managers and 9-1-1 Authorities have varying levels of responsibility with regard to managing and resolving discrepancy (error) reports generated against ALI records. 9-1-1 Authorities will need to remain involved in the discrepancy reporting and resolution process for NG9-1-1. However, the process will become significantly more complex as systems transition to NG9-1-1. Discrepancy reports will be generated automatically from multiple functional elements within the NG9-1-1 system such as the ECRF, LVF, ESRP, and LIS. 9-1-1 Authorities and PSAP management will be responsible to assure that electronic discrepancy reporting processes are in place to identify call routing, network, and location database issues as they are discovered and to manage their resolution or referral to appropriate entities.

5.1.1.4.2 Assessment of Current/Proposed Standards and Best Practices (PSAPs)

The following best practices were forwarded by CSRIC Working Group 4A to the Technology Subgroup. The subgroup assessed them and the changes required in these current best practices for use in the transition activities associated with NG9-1-1.

1. Subject: Call Handling in the Event of Call Overflow or Network Outages [BP 7-5-0569]

In E9-1-1 system, there are two options:

Option 1: PSTN as a Backup for Normal E9-1-1 Connectivity—An alternative for handling E9-1-1 calls during periods of failure in the connectivity between an originating network and the emergency services network is to use the PSTN as a backup (i.e., fallback) connection mechanism between the caller's originating network and the PSAP. Such connectivity may route calls to the appropriate PSAP without the associated information that would normally be present.

If the primary path to the emergency services network is interrupted by a "failure" (not when all trunks are simply busy), the call may be forwarded over the PSTN to a number specified by the PSAP that is answered at the PSAP on a 24/7 basis. It is desirable for that specified number to be a type that can provide the original CallerID/ANI. This best practice does not propose that any 9-1-1 call delivery stakeholder to bypass acceptable congestion control techniques commonly applied within the industry for 9-1-1 calls.

Option 2: Wireless Public or Private Networks as Backup for 9-1-1 Dedicated Trunks—Similar to Option 1 above (PSTN backup) for completing 9-1-1 calls when the primary transport facility is interrupted by a "failure" (not when all trunks are simply busy), wireless public or private networks, or satellite-based services may be used to provide an additional alternate path to the PSTN, providing IP multimedia connectivity for next generation networks; or used solely as an alternate call delivery path for the voice component of 9-1-1 calls.

NG9-1-1 routes calls from the PSTN through routing nearly identical to normal IP-based emergency call routes and does not use dedicated trunks. Therefore, PSTN backup has very limited applicability in NG9-1-1. Instead, origination networks should have many independent IP paths, including via the Internet to maintain routing to an ESInet. ESInets should be redundant and geographically diverse. Arrangements for diversion of calls to alternate PSAPs should be established when there are no available routes to the intended PSAP.

2. Subject: Call Handling in the Event of Call Overflow or Network Outages [BP 7-7-0574]

Network operators and service providers (of any technology type) should remotely monitor and manage the 9-1-1 network components using network management controls, where available, to quickly restore 9-1-1 service and provide priority repair during network failure events. When multiple interconnecting providers and vendors are involved, they will need to cooperate to provide end-to-end analysis of complex call-handling problems.

NG9-1-1 emphasizes the ability to divert calls to alternate PSAPs when congestion or outages occur. By replicating the data, standardizing CAD interfaces, and providing standardized policy mechanisms, such alternate PSAPs can effectively handle calls when the primary PSAP cannot. It should not be necessary for any caller to receive a busy indication for a 9-1-1 call, although the policy routing functions allow local decisions on how calls are routed and when busy should be returned. All systems have limits, and busy may be the only feasible response in some circumstances.

3. Subject: PSAP Certification and Testing Requirements [BP 7-7-0577]

Network operators and service providers (of any technology type), and Public Safety agencies responsible for PSAP operations should develop and maintain operations and disaster recovery plans that address network reliability issues. All stakeholders should periodically and jointly team as needed to develop, implement, test, evaluate, and update plans for 9-1-1 disruption contingencies (e.g., share contact information and other details regarding network and system security, reliability, and other appropriate topics). Such joint periodic planned activity should also include drills or simulated exercises aimed at operational and disaster recovery readiness. This joint activity should be as authentic as practical. (Test scripts should be prepared in advance, and team members should play their roles as realistically as possible.) This will provide verification that critical components, e.g., automatic re-routes, make-busy keys, policy-based routing, call congestion control techniques, PSAP evacuation plans, and other elements included in their contingency plans work as designed.

4. Subject: Telecommunications Service Priority (TSP) Registration [BP 7-7-0488]

Network operators and service providers (of any technology type) should ensure that critical circuits (i.e., high priority switching elements, SS7 or IP transport facilities, dedicated 9-1-1 circuits, etc.) are registered with the Telecommunications Service Priority (TSP) program.

The following are new best practices that have been identified by the Technology Subgroup for use in the transition activities associated with NG9-1-1.

5. Subject: Common Baseline Imagery for Routing and Mapping/Defining Geographic Coverage Areas for PSAPs

Public Safety Authorities should be allowed access to DHS—NGA data, which can be provided on a monthly basis or as needed. The importance of 9-1-1 for Public Safety and for national intelligence should be emphasized. Common baseline imagery should be used for routing and mapping of 9-1-1 calls to align GIS maps with streets and Public Safety Authority jurisdictional boundaries. One way to achieve that goal is to grant Public Safety Authorities access to federal or military imagery databases such as DoD–NGA and/or DHS-GMO that can be provided on a monthly or as needed basis. This should be justified through acknowledgement that 9-1-1 is of importance for public safety and national intelligence.

6. Subject: VSP Voice Call Compression

Option 1—OSPs and 9-1-1 SSPs should use the highest quality CODEC available. NG9-1-1 standards require a toll quality CODEC (e.g., G.711) or better. If providers must transcode the

voice, the transcoding service should be as close to the source as possible, and degradation of voice quality should be minimized.

Working Group 4A recognizes a need to update or create applicable documents to promote reliable and higher quality E9-1-1 VoIP for the PSAP. Specific considerations will need to be made based on the available IP connection bandwidth in a fixed or nomadic environment.

For 9-1-1 calls, the VSP should prioritize the voice data and use the highest quality compression CODEC available. Because this requirement only pertains to a small percentage of the actual call volume, the VSP should be able to provide reliable and quality service.

Option 2—VSP User Agent Clients (UACs) must set priority on emergency calls (SIP resource priority—RFC 4412). They should also apply a toll quality CODEC (G.711 or better) and, to the extent possible, apply prioritization of elements in their control (proxies, etc.) over call control aspects.

In addition, the VSP should adhere to the recommendations in the IETF phonebcp for UAC design. Although it is still in draft, this document is presumed to become an IETF Request for Comments (RFC) soon. Additional information is available at: http://tools.ietf.org/html/draft-ietf-ecrit-phonebcp-16

5.1.1.4.3 Gap Analysis of Standards and Best Practices (PSAPs)

The Technology Subgroup acknowledges that it may be too early in the transition to NG9-1-1 to write best practices. However, the items listed below are issues or gaps that will need new best practices when consensus can be found concerning what constitutes an appropriate best practice.

Subject: Disaster Planning and Testing Requirements

Issue/Gap—BP 7-7-0579, 7-7-0599, and 7-7-3211 are also applicable, but highly redundant with 7-7-0577. They all address disaster planning and testing of such plans on a routine basis. Perhaps those four best practices should be reevaluated to determine whether they could be combined into one comprehensive best practice covering this subject. CSRIC Working Group 4A stops short of describing this as a "gap" but does feel it deserves consideration because other best practice related gaps might be addressed in the future.

Subject: TSP Registration for VSPs (Applicability of Best Practices to VoIP)

Issue/Gap—BP 7-7-0488 is not directly applicable to VoIP but the concepts as written for wireless technology can be applicable to VSPs. Therefore, this NRIC best practice, like others, really constitutes a gap in the NRIC best practices because, as written, it is wireless specific. CSRIC Working Group 4A believes this best practice (and others) needs to be reviewed and investigated to determine applicability to VoIP and then updated as needed to specifically address VoIP and VSPs.

Subject: Effects of Compression on VoIP Voice Quality

Issue/Gap—VoIP calls may not come through as clearly as traditional analog or digital calls for E9-1-1. VSPs compress calls to maximize capacity within their networks, and 9-1-1 calls are not

given any priority or special treatment to ensure that all possible voice quality and background sounds are accurately heard by the PSAP call taker.

5.1.2 Operational Issues in the NG9-1-1 Environment

This section address the operational issues anticipated in the transition to NG9-1-1. The section explores both the PSAP Operational and System Operational issues in NG9-1-1.

5.1.2.1 Overview of PSAP Operational Issues in NG9-1-1

An assessment and gap analysis of operational standards and best practices was conducted, based on the operational issues in the NG9-1-1 environment, described in Section 4.3 of this document.

5.1.2.1.1 Assessment/Gap Analysis of Operational Standards and Best Practices

Table 5-1 below references the section and issue title from Section 4.3, along with the assessment and identified gap(s). References, where available, are also provided.

Table 5-1: Gap Analysis of PSAP Operational Standards and Best Practices

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.1.1	Nationwide Call Routing and Transfer	Various PSAP databases exist today. Participation in their use is voluntary, and the PSAP information may be incomplete or incorrect. There is no single, official database that contains this necessary information.	State and National ECRFs/Forest Guides need to be developed. An entity that has responsibility to maintain these resources at the national level must be identified. National procedures for transfers do not exist today.
4.3.1.2	Virtual PSAPs	NENA Operations Standard 53-507, *NENA Virtual PSAP Management Operations Information Document,*[40] assesses this issue.	An assessment of the appropriateness of virtual PSAPs does not exist today.
4.3.1.3	PSAP Personnel Roles and Education	An APCO/NENA task force is working to identify specific training packages based on roles and responsibilities.	There are no existing training tools.
4.3.1.4	Telecommunicator Certification	NENA Operations Standards—Standard Operating Procedures and APCO Operational and Training Standards assess this issue.	Existing standards do not apply to NG9-1-1.
4.3.1.5	Introductory and Continuing Education	No existing standards address this issue.	Training for telecommunicators on providing service in an NG9-1-1 environment does not exist today.

[40] http://www.nena.org/standards/operations/virtual-psap-management

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.1.6	Contingency Planning	*NENA Operations Standards for Contingency Planning*, 53-001 through 53-507[41] and National Fire Protection Association (NFPA) *Standard on Disaster/Emergency Management and Business Continuity Programs (NFPA 1600)*[42] assess this issue.	Much can be done by PSAP administrators to improve their continuity of operations planning both today and into the future, as the benefits of NG9-1-1 are realized. NG9-1-1 provides additional options for call handling, congestion control, and system reliability and recovery, and system administrators must plan how these features will be implemented.
4.3.1.7	Alternate PSAP Call Processing	NENA Operations Standard 53-506, *Intra-Agency Agreements Model Recommendations Operations Information Document,*[43] provides rationale and guidance for the development, promulgation, and implementation of agreements between public safety communications and affiliated agencies to share information as needed to provide the highest level of service to the citizens. *FCC CSRIC WG1A—Public Safety Consolidation—Best Practices and Recommendations*[44] includes some recommendations and best practices that are equally applicable for enhancing intra-agency cooperation and should be considered during the development of memoranda of understanding (MOU).	Historically, PSAPs have been self-sustaining and have not generally relied on other PSAPs for assistance.
4.3.1.8	GIS Based Systems or Applications	A joint NENA/APCO requirements document, *Human Machine Interface and PSAP Display Requirements Operations Requirements Document* (NENA 54-750 v1, October 20, 2010),[45] was recently approved and published. Section 3.6 of that document includes 16 requirements specific to mapping displays.	GIS-based map displays need to be updated for NG9-1-1.

[41] http://www.nena.org/operations-standards
[42] http://www.nfpa.org/assets/files/pdf/nfpa1600.pdf
[43] http://www.nena.org/standards/operations/intra-agency-agreements
[44] http://www.fcc.gov/pshs/advisory/csric/wg-1a.pdf
[45] http://www.nena.org/operations/standards/HMI.

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.1.9	Multimedia Call Data	*NENA Operations Standards—Standard Operating Procedures*, 56-001 through 56-508 address this issue.[46]	The SOPs need to be updated for NG9-1-1.
4.3.1.10	Text Messaging	NENA *Use Cases and Suggested Requirements for Non-Voice Initiated (NVI) Emergency Services*, also known as Non-Voice Emergency Services (NOVES), and the 4G Americas report *Texting to 9-1-1: Examining the Design and Limitations of SMS*, October 2010, address this issue.	Standards for processing 9-1-1 text messages do not exist today.
4.3.1.11	Telecommunicator Workload Impact	NENA Operations Standards 56-005, *Call Answering Standard/Model Recommendation,*[47] and 56-006, *Emergency Call Processing Protocol Standard,*[48] address this issue. The APCO Project RETAINS report[49] is a nationally recognized and recently updated document that could be used in this effort.	The time required to process 9-1-1 calls in the NG9-1-1 environment is currently unknown.
4.3.1.12	Visual Impact of Calls	NENA's Post-Traumatic Stress Disorder working group initiative is in progress. The group includes several members who are mental health professionals.	The impact on telecommunicators of seeing incidents in the NG9-1-1 environment is unknown.
4.3.1.13	Human Resource Management	No existing standards address this issue.	Standards for the assignment of telecommunicators by skill sets must be developed.
4.3.1.15	Virtual PSAP Resource Management	NENA Operations Standard 53-507, V*irtual PSAP Management Operations Information Document*[50] addresses this issue.	Policies, processes, and training to support telecommunicators working from remote locations need to be established.

5.1.2.2 Overview of System Operational Issues in NG9-1-1

An assessment and gap analysis of the system operational standards and best practices was conducted based on the system operational issues in the NG9-1-1 environment described in Section 4.3 of this document.

5.1.2.2.1 Assessment/Gap Analysis of Operational Standards and Best Practices

Table 5-2 below references the section and issue title from Section 4.3, along with the assessment and identified gap(s). References, where available, are also provided.

[46] http://www.nena.org/operations-standards
[47] http://www.nena.org/standards/operations/911-call-answering
[48] http://www.nena.org/standards/operations/emergency-call-processing
[49] http://www.apco911.org/about/911/retains/
[50] http://www.nena.org/standards/operations/virtual-psap-management

Table 5-2: Gap Analysis of System Operational Standards and Best Practices

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.2.1	Expanded 9-1-1 Authority Responsibility	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook*[51] and NENA's additional work with the service originating industry at the state and national level address this issue.	PSAPs will need to be connected to regional ESInets. Additional NG9-1-1 staff will be needed in all states.
4.3.2.2	Educating 9-1-1 Authorities and Other Stakeholders	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook* addresses this issue.	Additional education of 9-1-1 Authorities on their specific role in NG9-1-1 is needed.
4.3.2.3	IP-Based System Administration	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook* addresses this issue.	There are an insufficient number of NG9-1-1 experts in the industry today. 9-1-1 Authorities will have to recruit a workforce with the specific skill sets and experience involved, or train existing staff.
4.3.2.4	System Operations Roles and Responsibilities	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook* addresses this issue.	9-1-1 Authorities will need to work together. Consortium arrangements that specify governance will be needed.
4.3.2.5	State-Level 9-1-1 Leadership and Coordination	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook* addresses this issue.	Additional resources at the state level will be needed in both funding and workforce. Trust from the local level to empower the states will be needed. Education, policies, and infrastructure will be needed for this leadership and coordination to be feasible.
4.3.2.6	Transitional Regulation, Legislation, and/or Tariff Modifications	NENA Next Generation Partner Program is addressing this issue.	The FCC has begun to address this need with a new advanced Notice of Proposed Rulemaking (NPRM).
4.3.2.7	9-1-1 Institutional Responsibility Consolidation	*NENA Next Generation 9-1-1 Transition Policy Implementation Handbook* addresses this issue.	State-level statewide ESInets and administration, and regional ESInets and administration will be needed.
4.3.2.8	Public Education and Awareness Programs	The Joint APCO/NENA Next Generation 9-1-1 Education work group is addressing this issue.	No public education programs about NG9-1-1 exist today.
4.3.2.9	Fostering Private–Public Policy Stakeholder Support	The NENA Next Generation Partner Program is addressing this issue.	No education programs about NG9-1-1 for policymakers exist today.
4.3.2.10	Certification of Service Delivery	NENA and APCO Technical Standards address this issue.	No certification of NG9-1-1 services delivered to PSAPs exists today.

[51] http://www.nena.org/government-affairs/stories/ngpp-transition-policy-implementation-handbook

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.2.11	PSAP Minimum Criteria and Certification	NENA and APCO Operational and Technical standards address this issue	No minimum standards and certification of PSAPs in the NG9-1-1 environment exist today.
4.3.2.12	NG9-1-1 Technical Training	NENA is working to establish a work group to address this issue.	There is currently no technical training on the management of NG9-1-1 systems available.
4.3.2.13	NG9-1-1 Management Training	NENA and APCO should establish a work group to address this issue.	There is currently no management training on the management of NG9-1-1 systems available.
4.3.2.14	Call Distribution Policy Rules	NENA Technical Standard 71-502, *Overview of Policy Rules for Call Routing and Handling in NG9-1-1*, and NENA Technical Standard 08-003, *Detailed Functional and Interface Specification for the NENA i3 Solution—Stage 3* address this issue.	Additional follow-up to NENA 71-502, *Overview of Policy Rules for Call Routing and Handling in NG9-1-1*, is needed, with the development of more detailed policy rules.
4.3.2.15	Multi-Agency Business Rules	NENA Operations Standard 53-506, *NENA Intra-Agency Agreements Model Recommendations Operations Information Document,*[52] addresses this issue.	Although NENA developed some operational recommendations for the logistics of developing and managing intra-agency agreements, little or no work has been done on the business rules, processes, and methodologies required to implement the call sharing and distributed telecommunicator resource capabilities provided by NG9-1-1 functionality. 9-1-1 Authorities will need this information to help them implement these features.
4.3.2.16	System Logging Requirements	NENA Technical Standards and i3, NG Operations, PSAP, and Technical Requirements Documents address this issue.	Policies and procedures must be developed to assure all appropriate people have access to log data when needed. Tools must be developed to aggregate data from multiple logs to create an incident-wide view.
4.3.2.17	PSAP Geographic Coverage Area Management	Established by Office of Management and Budget (OMB) Circular A-16, the FGDC promotes the coordinated development, use, sharing, and dissemination of geographic data.[53] The FGDC has many standards for digital spatial data, including— • FGDC-STD-007.1-1998—*Geospatial Positioning Accuracy Standards Part 1: Reporting Methodology*, provides a common methodology for reporting the accuracy of	A number of projects are underway that will help to identify future best practices; however, gaps exist in the establishment of PSAP geographic coverage areas and reconciling overlapping boundary issues (and identifying gaps in coverage). In addition to developing the data for PSAP coverage areas, maintaining the data at regional or state levels will require a level of coordination between public safety,

[52] http://www.nena.org/standards/operations/intra-agency-agreements
[53] http://www.fgdc.gov/standards/standards.html

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
		horizontal coordinate values and vertical coordinate values for clearly defined features where the location is represented by a single point coordinate. • FGDC-STD-007.2-1998—*Geospatial Positioning Accuracy Standards Part 2: Standards for Geodetic Networks*, provides a common methodology for determining and reporting the accuracy of horizontal coordinate values and vertical coordinate values for geodetic control points represented by survey monuments, such as brass disks and rod marks. It provides a means to directly compare the accuracy of coordinate values obtained by one method (e.g., a classical line of-sight traverse) with the accuracy of coordinate values obtained by another method (e.g., a GPS geodetic network survey) for the same point. • FGDC-STD-007.3-1998—*Geospatial Positioning Accuracy Standards Part 3: National Standard for Spatial Data Accuracy*. The National Standard for Spatial Data Accuracy (NSSDA) implements a statistical and testing methodology for estimating the positional accuracy of points on maps and in digital geospatial data, with respect to geo-referenced ground positions of higher accuracy. This standard does not define threshold accuracy values. Agencies are encouraged to establish thresholds for their product specifications and applications and for contracting purposes. This standard is classified as a Data Usability Standard. A Data Usability Standard describes how to express "the applicability or essence of a dataset or data element" and includes "data quality, assessment, accuracy, and reporting or documentation standards."	PSAPs, and GIS experts that does not currently exist. Some of the FGDC standards previously described will assist in the maintenance of this data; however, oversight groups must be established to ensure consistency across the nation.

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
4.3.2.18	Location Validation and Call Routing Databases	New policies and procedures for providing replicas of ECRF and LVF data must be created. Mechanisms for aggregating data statewide must be developed.	NG9-1-1 LVF and ECRF data must be developed by upgrades to GIS systems. Validation of GISs to existing MSAGs must be completed.9-1-1
4.3.2.19	Integrated Data Error Correction Process	NENA Technical Standard 02-011, *Data Standards for Local Exchange Carriers, ALI Service Providers, and 9-1-1 Jurisdictions*[54] addresses this issue.	Additional standardization work is needed. A standard database interface at the PSAP that can support multiple databases needs to be developed. The NENA Technical Committee in conjunction with the APCO Data Transfer Committee should develop one standard database interface at the PSAP that can support multiple databases
4.3.2.20	Virtual PSAPs 9-1-1 Authority Responsibilities	NENA Operations Standard 53-507, *NENA Virtual PSAP Management Operations Information Document,*[55] addresses this issue.	Practical experience in the use of virtual PSAPs is needed.
4.3.2.21	Contingency Planning 9-1-1 Authority Responsibilities	NENA Operations Standard 53-505, *APCO-NENA Service Capability Criteria Rating Scale*,[56] addresses this issue. APCO and NENA have jointly developed this document to assist PSAP managers and their governing authorities to identify their current level of service capability. A self-evaluation assessment tool is provided to facilitate an objective review of the current capabilities of the PSAP against models representing the best level of preparedness, survivability, and sustainability amid a wide range of natural and manmade events. The NFPA *Standard on Disaster/Emergency Management and Business Continuity Programs* (NFPA 1600)[57] is designed to be a description of the basic criteria for a comprehensive program that addresses disaster recovery, emergency management, and business continuity. The following best practice and	There are no requirements for 9-1-1 Authorities to implement Continuity of Operations Plans.

[54] http://www.nena.org/standards/technical/data/911-Data-Management
[55] http://www.nena.org/standards/operations/virtual-psap-management
[56] http://www.nena.org/operations/standards/service-capability-criteria-rating-scale
[57] http://www.nfpa.org/assets/files/pdf/nfpa1600.pdf

Section	Issue	Assessment of Operational Standards and Best Practices	Gap Analysis of Standards and Best Practices
		standard provide guidance on the locating a PSAP facility: • NENA 56-506, *NENA Public Safety Answering Point Site Selection Criteria Operations Information Document*[58] • NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*.[59]	

5.1.3 NG9-1-1 Funding Considerations

This section addresses methods in place today throughout the United States used to fund the various aspects of 9-1-1 service. The section explores how legacy systems are funded and summarizes the status of current funding mechanisms.

5.1.3.1 Assessment of Current Funding Sources

The funding sources currently used at state or local levels pay for elements related to the delivery of the 9-1-1 calls to a PSAP. One of the most challenging issues related to funding today is knowing whether current funding mechanisms to collect 9-1-1 fees are accurate and comprehensive. There is limited ability, even with state legislation or rules, to know whether the correct amount is being collected. Auditing, which verifies whether collections match numbers of subscribers; accurate reporting of subscribers; regular true-up processes to confirm accuracy and currency; and accurate reporting of the location of subscribers in a jurisdiction are modest at best.

5.1.3.1.1 Underserved Communities of the United States

The need to move forward in upgrading 9-1-1 systems and the necessity for focusing effort and funds to transition from the current system of limited technologies and service to a more robust and adaptive system is certainly upon us. However, effort must continue to establish 9-1-1 service in those areas of the country that still lack even the most basic of services. In moving to a more secure and change-capable network of networks, a way must be found to bring a basic level of 9-1-1 emergency communication technology to the part of the population that does not enjoy these services today. That should be the first priority.

Services to people who are deaf or hard of hearing, which for the most part elects to communicate via text message, are limited because the 9-1-1 systems in place today frequently do not have adequate means to respond to their chosen method of communicating. Further, current text services were not designed to provide the quality of service necessary for emergency communications. New funding sources will be necessary to facilitate the enhancements necessary to ensure adequate service to this community. This is a problem today, and an entire population is not being adequately or ubiquitously served. This problem is likely to increase in severity in the future if not addressed. Efforts are currently underway to provide emergency

[58] http://www.nena.org/operations/standards/psap-site-selection
[59] http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=1221

services grade texting service in future wireless communications. These services will be required to make this service a reality.

5.1.3.1.2 Legacy Systems

Legacy 9-1-1 systems will be required to work alongside NG9-1-1 systems for a period of time. The length of time legacy systems will be necessary is unknown but partially depends on the time required to deploy NG9-1-1 nationwide. How long that will be is also a projection. However, without new funding sources that are sufficient and sustainable for a "new" network, current funding for 9-1-1 cannot absorb the additional costs of implementing or maintaining a parallel network.

Transition from legacy systems to NG9-1-1 is likely to require a phased approach. In most cases, NG9-1-1 in all likelihood may not be implemented on a PSAP-by-PSAP basis but rather in partnership with other system users. Collaboration will be essential. It is anticipated that regions or states will come together to organize their NG9-1-1 efforts, and costs will be shared. Individual 9-1-1 PSAPs may or may not go away. That decision will be local, and such discussion is often politically charged.

5.1.3.1.3 Summary of Current Funding Mechanisms

Table 5-3 represents a summary of the current 9-1-1 funding mechanisms throughout the United States. Each current source presents challenges today and will often have those same or new challenges in a next generation environment. The table illustrates current examples and offers cautions to be aware of in an effort to mitigate those issues and help to ensure more sustainable funding structures as we plan for a next generation environment.

Table 5-3: Current Funding Sources

Current 9-1-1 Funding Method	Today's Funding Issues	Future Next Generation Funding Challenges
9-1-1 surcharge on wireline telephone subscribers (local and/or state)	• The number of subscribers continues to decline. • Funds are insufficient in most cases to fund what is necessary today. • States with good fund management and equity in collections among all service types are in better shape fiscally.	• Subscribership is predicted to continue to decline. • Funds will continue to be insufficient for current operations let alone for investment required to implement NG9-1-1 and to maintain parallel systems for a period of time. • It is unknown whether funds will be sufficient.
E9-1-1 surcharge on wireless telephone subscribers (local and/or state)	• The number of subscribers continues to rise as subscribers shift from traditional wireline service to wireless service. • Funds may not be sufficient in some applications. • Cost recovery (if applicable) to carriers erodes funds available.	• The number of subscribers is expected to continue to increase for a period and then plateau over time. • Subscribers are shifting service from wireline to wireless or VoIP. • Location accuracy enhancements will likely escalate costs. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.

Current 9-1-1 Funding Method	Today's Funding Issues	Future Next Generation Funding Challenges
V9-1-1 surcharge on VoIP subscribers (local and/or state)	• Surcharge reporting and remitting is voluntary in most states. • Even with legislation, methods to collect are inconsistent.	• Regulations must require VoIP provider to "register" and report subscribers so accurate funds can be collected; however, regulation and forced registration may not be possible with "offshore" service providers. • Collections methods will continue to be a challenge for some time to come and are complicated further by non-US-based providers. In states where legislation has been adopted to equalize collections on VoIP 9-1-1 access (as with wireline and wireless), this fund will continue to grow. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.
Prepaid cellular point of sale (POS) charge	• Erratic collection mechanisms are used • Few states have legislative requirements.[60] • Services have resisted collecting the 9-1-1 fee from their customers on the basis that the law, as written, does not apply to them.	• No monthly billing/no contract exists as a mechanism for collections. • Eighty percent of prepaid services are sold by third parties such as Wal-Mart, K-Mart, Radio Shack, and Target, which do not have a relationship with the customer. • Collection methods will continue to be a challenge for some time to come. • It is unclear where to assess the fee. • Retail POS legislation is needed to ensure collections.[61] • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.
General fund tax	• In current difficult economic times, increases in taxes are a difficult political position. • Sometimes levy limits prohibit additional taxing for Public Safety application. • The mechanism has not always kept pace with costs.	• Already stressed funding mechanism will not likely be able to provide all necessary additional funding needed for NG9-1-1. • Good fund maintenance and fiscal responsibility are key.

[60] Texas, Louisiana, Maine, South Carolina, Virginia, Tennessee, Oklahoma, and Indiana to date.
[61] CTIA's Retail POS Model provides formula that can be used by states as an example.

Current 9-1-1 Funding Method	Today's Funding Issues	Future Next Generation Funding Challenges
State "Universal Service" type fee	• This fee is Vermont specific—"universal service" in name; it is not a true Universal Service as defined in federal law. • This mechanism is not to be confused with post-1996 federal universal service rules that explicitly prohibit the use of Federal Universal Service Fee (FUSF) for support of a dedicated 9-1-1 service network, including PSAPs. Thirteen states have their own state Universal Service Fee (USF)-type collection mechanism but none, other than Vermont, can use it for 9-1-1. • In all cases, state USF-type mechanisms must be coordinated with FUSF. [62]	• See federal Act Sec 254(f) State Authority: State in this context means State PUC, not state 9-1-1 authority. Vermont's Enhanced 9-1-1 IT Manager reports[63] that local 9-1-1 funding sources are not aligned with the current trend of mobility. The funds are collected to pay for 9-1-1 at the point of billing—not the POS. Before widespread cellular and VoIP usage, these two points were the same, but this is not true today. Out-of-state visitors call 9-1-1; out-of-state college students use cellular telephones billed to their home area; in-state residents have out-of-state service (either cellular or VoIP). In all of these cases, a local agency provides 9-1-1 response service but sees no 9-1-1 revenue. This is coupled the fact that competition in the telecommunications marketplace is driving down what subscribers pay, and thus the percentage-based 9-1-1 funding. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.
Percentage of toll revenue	• In Texas and California, legacy 9-1-1 is funded, in part, with explicit assessments against intrastate (predominantly wireline) toll revenue. • The Federal Telecommunications Act of 1996[64] opened all communications markets to competition, thus continuation/expansion of such legacy methodology is neither competitively nor technologically neutral.	• Owing to wireless and VoIP substitution, toll is a seriously declining revenue source for service providers. As such, it is an unsustainable source of funding for Basic 9-1-1, E9-1-1, *and* NG9-1-1. • Assessment and collection methodologies should be equitable among *all* communications service providers that have an obligation to provide subscribers with access to 9-1-1. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.
Percentage of local service revenue	• This mechanism is applicable to wireline only. • It does not take into account most of the calling methods employed today. • This is an inconsistent and declining source of funds.	• This mechanism will not provide sufficient funding for NG9-1-1 needs.

[62] Section 254 of the 1996 Telecom Act (47 U.S.C. §254[f]): "STATE AUTHORITY- …A State may adopt regulations to provide for additional definitions and standards to preserve and advance universal service within that State only to the extent that such regulations adopt additional specific, predictable, and sufficient mechanisms to support such definitions or standards that do not rely on or burden Federal universal service support mechanisms." Available at: http://www.fcc.gov/Reports/tcom1996.txt

[63] Are Phone Bill 9-1-1 Surcharges Obsolete? James Lipinski, Enhanced 9-1-1 IT Manager, Vermont Enhanced 9-1-1 Board, June 6, 2010

[64] http://www.fcc.gov/telecom.html

Current 9-1-1 Funding Method	Today's Funding Issues	Future Next Generation Funding Challenges
Grants	• This mechanism is often one time and limited in scope.	• This funding source is unreliable and limited in scope. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.
Other	• In New York, the Targeted Accessibility Fund (TAF) assesses, collects, and houses support for E9-1-1, Lifeline, and Telephone Relay Service.	• This mechanism has limited application for funds. • It is unknown whether funds will be sufficient. Good fund maintenance and fiscal responsibility are key.

Most funding methods employed today by state and/or local governments are a combination of two or more of the above methods. No one source has been adequate.

Weiser, Hatfield, and Bernthal reported finding "that misallocation and misuse of 9-1-1 funds present important funding challenges for most jurisdictions."[65] Aside from these problems, the majority of individuals interviewed, as well as the majority of publicly available state reports, suggest that current funding models appear generally sufficient to sustain the status quo of their 9-1-1 systems. To be sure, this is very much a case-by-case determination specific to individual jurisdictions, and the subgroup found several areas in which funding is regularly insufficient to maintain existing levels of 9-1-1 service. In particular, areas that rely heavily on wireline surcharges are experiencing difficulty as wireless and VoIP substitution results in lower wireline revenues. In addition, rural areas with smaller fee bases commonly struggle and, in the absence of grant programs or outside assistance, rural localities often lag in E9-1-1 service. Finally, high call volume in areas where mobile traffic is frequent—such as along interstates and in tourist destinations populated by out-of-state residents—often burdens a jurisdiction's 9-1-1 services. This demonstrates that mobile telephony is problematic for existing surcharge models—mobility partitions the location from which a call is made from the address where a surcharge is collected. This is important for high mobile call volume jurisdictions because traditional surcharge models do not provide for contributions from 9-1-1 callers who live outside their jurisdiction.[66] This finding is also demonstrated in Vermont (see above Source of Funds, Table 5-3), where current funding structures are challenged by increasing service demands and decreasing revenue streams.

5.1.3.1.4 The Challenge of Prepaid Cellular Services

Prepaid cellular and VoIP services continue to be the biggest challenges for states and 9-1-1 Authorities because no clear method securely establishes successful collections mechanisms. Even if states or 9-1-1 Authorities legislate registration or rules related to 9-1-1 surcharge collections, they are difficult to enforce. VSPs have difficulty determining subscriber billing location because all interaction with their subscribers occurs over the Internet, and the subscriber's location is often self-identified. With the mobility of their subscribers, there is often not a clear "home" operations location that can be determined and assessed.

[65] Phillip J. Weiser, Dale Hatfield, and Brad Bernthal. *The Future of 9-1-1: New Technologies and the Need for Reform*, Journal of Telecommunications and High Technology Law, Vol. 6, No. 2, p. 287, June 5, 2008, University of Colorado Law School. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1146803
[66] Ibid.

For prepaid services, few states currently have legislation in place to ensure collection of surcharge revenues, and even with legislation, states or 9-1-1 Authorities experience extreme difficulty in tackling the enforcement issue. Wireless subscribers are not renewing long and restrictive contracts but are opting for prepaid services to afford them more flexibility. This means that in those states and locales without equitable surcharge fees across all service types, the increasingly more popular prepaid cellular service is not remitting 9-1-1 fees to the appropriate jurisdiction, and consequently, 9-1-1 Authorities are experiencing declines in surcharge revenue. For this reason, prepaid cellular service is often considered the most problematic collection issue facing Public Safety and government in general. Only eight states have enacted legislation to collect a 9-1-1 fee at the POS, which helps with collections; however, all states need to review their legislation and modify it accordingly. Texas has done just that. In 2009, working with the wireless carriers in Texas and the POS retailers, Texas collaborated on changes to state statute to capture appropriate revenues from POS retailers on prepaid cellular sales. A detailed synopsis of the Texas legislation is available in Appendix C, Section 2 (Retail Point of Sale Model Legislation). If the goal is to be both technologically and competitively neutral, all services that provide access to 9-1-1 need to collect and remit 9-1-1 fees, preferably at the same rate. CTIA has worked with Public Safety, 9-1-1 associations, the wireless industry, and the retail industry to establish a retail POS formula and model legislation. All states should avail themselves of this resource and pursue the changes in statute necessary to ensure 9-1-1 funding.

5.1.3.1.5 Review of Current Funding Adequacy

The current funding model in State of North Carolina provides a unique example of a model that has recently undergoing a significant overhaul. This adjusted and modified funding model is best reviewed with some historical perspective. At its inception, the 9-1-1 Board in North Carolina was strictly a wireless board with a narrow focus of dealing with the issues of wireless 9-1-1 Phase II deployment and fee collections. Over the years, the wireless board evolved to a full spectrum 9-1-1 board responsible for all aspects of 9-1-1 service in the state. PSAP funding in North Carolina followed a traditional funding model. Local governments, cities, and counties, were able to enact a 9-1-1 surcharge against wireline-only telephone subscribers. The surcharge varied locally and did not have a cap on the amount. The fee was collected by the local telephone providers and remitted to the local government. A wireless fee per subscriber was also collected statewide and remitted to the state board. Distribution to primary PSAPs was based on a formula using per capita and pro rata data. The Board determined that a new distribution model should require a single fee for all devices and should have a central collection and distribution point. That change occurred in 2008 after it was determined that collection statewide would generate adequate revenue to each primary PSAP to match its previous year total collections of wireline and wireless fees.

While this method provided the single fee parity requested by telecommunications companies, large 9-1-1 fund balances were still being maintained, and even grown, by many primary PSAPs while others appeared to be struggling to "make ends meet." The North Carolina 9-1-1 Board commissioned the East Carolina University (ECU) College of Business to research the operations of each primary PSAP in the state and provide a suggested funding model that would lead North Carolina to the next generation[67]. The NC 9-1-1 Board adopted the new funding

[67] Elaine Seeman and James E. Holloway, East Carolina University. *A Report on Findings and Recommendations on 911 Costs and Funding Models for the North Carolina 911 System*. January 6, 2010. Available at:

model process recommended by the ECU to fund primary PSAPs based on their average 5-year expenditure. Addition information, including a report on findings and recommendations on 9-1-1 costs and funding models is available on North Carolina's 9-1-1 website[68].

5.1.3.1.6 Authorized Collections

To illustrate the wide variety of 9-1-1 fees and surcharges in place today, Figures C-1, C-2, C-3, and C-4 included in Appendix C demonstrate, on a state-by-state basis, the level of collections authorized. The figures show the various categories of 9-1-1 fees or surcharges by service type—wireline, wireless, VoIP, or prepaid, and may only show the primary method of funding. Note that—

- Wireline, wireless, and VoIP are self-reporting numbers of subscribers. Some states/locales may audit this self-reporting but this factor was not verified by the subgroup.
- While VoIP fee levels may be established in state statute or local ordinance, collection and enforcement of collections varies widely.
- Although prepaid collections levels may be in place by state statute, here again, unless there is a corresponding mechanism for collection, the appropriate and correct amount may or may not be actually collected by the 9-1-1 Authority.

Be advised that the data is for a snapshot in time and is constantly changing as laws or regulations change in every state. Also, the abbreviated data provided on the maps is representational and should be viewed in the context of the entire 9-1-1 fee structure for that state. Refer also to the table of state fees in Appendix C, Section 1 (9-1-1 Fee Summary and Overview by State) for more complete information, including links to state 9-1-1 legislation.

5.1.3.1.7 Changing Service Trends

Trends in communications services demonstrate that there is a shift beginning to occur from traditional wireline service to more mobile devices such as wireless or VoIP. States or locales that rely either solely or partially on wireline 9-1-1 surcharge revenues will be increasingly challenged for adequate funding for their current operation, let alone have sufficient revenue for transition to a next generation environment. Those 9-1-1 Authorities or states that have equity in the 9-1-1 surcharges for wireless service compared with wireline will also experience shifting of services, but they will be less challenged for adequate funding for current operations. However, they will experience the same concerns about sufficient funds for transitioning to NG9-1-1. 9-1-1 Authorities or states with a solid collection mechanism for VoIP surcharges as well as wireline and wireless may be in the best position to have adequate funding to move forward with NG9-1-1 implementations.

5.1.3.1.8 State Funding Models Should Be Reviewed

State models of analysis and evaluation of current costs and historical perspectives on collections would assist a state in determining what funds will be required going forward. It may be necessary, as it was for North Carolina, for a state's funding mechanism and level to be re-

---

https://www.nc911.nc.gov/Board/agenda/Book/20100108_Item%2006a%20ECU%20E911-final-report-jan-6-2010.pdf

[68] https://www.nc911.nc.gov. Additional NC 9-1-1 research, reports and models conducted by ECU is available at: https://www.nc911.nc.gov/911Board/Pastagendabooks.asp?year=2010

evaluated using both historical analysis and its vision for NG9-1-1 implementation as outlined in a State Next Generation Plan.

5.1.3.1.9 Competitively Neutral Mechanisms

While all current and anticipated funding methods present collection challenges, a principle that should be applied to any future 9-1-1 funding mechanism is that it should be technologically and competitively neutral. All service providers, both traditional and non-traditional should be viewed as equal with regard to 9-1-1 surcharges. No one service should be collecting more than its competitors, and no one technology should be responsible for collecting all of the surcharge fees. All communications providers and those who provide access to 9-1-1 should collect and remit the same amount, whatever is deemed to be appropriate in that community, to the 9-1-1 Authority.

5.1.3.1.10 Fund Diversion and "Raiding"

Fund-diversion is said to occur when state and/or local authorities assess and collect 9-1-1 surcharges/fees for certain purposes, but those funds (or some portion thereof) are appropriated by state authorities for purposes other than that originally intended. Although a variant of diversion, termed "raiding," has received much attention recently, it is incumbent on policymakers to fully understand the causes and consequences of both. This is true because closer inspection of recent reports of "raiding" reveal that it is an imprecise and potentially misleading term when applied to all instances where funds are diverted from one public purpose to another. Moreover, the prevalence of non-cost-based 9-1-1 funds, coupled with the mere appearance of reserves in excess of authorized collections, raises serious questions about prudent fund administration.

Thus, the important public policy question is not whether diversion and/or raiding occurs, but rather, *why* it occurs and what measures must be taken to lower the risk of diversion/raiding in the future. The public that pays for the 9-1-1 system has every right to expect that the money collected and distributed bears some rational relationship to the actual cost necessary to provision and maintain that service on an ongoing basis. Knowledge of these causal relationships will be critical for policy makers and other stakeholders as they wrestle with the reforms necessary to ensure specific, predictable, and sufficient 9-1-1 funding mechanisms.

If surcharges are collected from subscribers with the justification that they are paying a 9-1-1 fee or surcharge, those funds need to be protected for use in the 9-1-1 system. Raiding of 9-1-1 funds should not be tolerated, should be avoided at all costs, and mechanisms should be in place to discourage such fund raiding as has been experienced in a number of states. While $2 billion is collected annually from wireline and wireless subscribers,[69] in 2008 and 2009, some 13 states were reported to have diverted or raided their 9-1-1 funds[70].

On March 10, 2010, the leadership of NENA, APCO, the National Association of State 9-1-1 Administrators, International Association of Chiefs of Police (IACP), and 32 state or local 9-1-1 officials, sent a letter to Congress urging stronger incentives to discourage the raiding of 9-1-1

[69] FCC. *Second Annual Report to Congress on State Collection and Distribution of 911 and Enhanced 911 Fees and Charges*. August 13, 2010. Available at: http://fjallfoss.fcc.gov/edocs_public/attachmatch/DOC-300946A1.pdf
[70] Ibid; also, some states do not appropriate all the funds but rather use the collections (or interest on those funds) for other budgetary purposes.

funds. They called for Congress to consider legislation that would withhold federal funds from states that divert 9-1-1 funds (such as federal highway safety or homeland security funds). The Funding Subgroup supports such a recommendation. In addition, the Funding Subgroup further supports a cost-based fund that is properly administered (including a reasonable reserve to ensure sufficient funds on current need basis) and one that does not result in the excesses. The letter further asked that Congress require the FCC to share the results of its report to Congress on the collection of use of 9-1-1 funds with the OMB and all federal agencies charged with administering Public Safety programs. Finally, the letter suggested the FCC be direct in enforcing requirements that states be truthful about fees they impose that are collected by carriers. On June 15, 2010, the chairs of the 9-1-1 Caucus (Representatives Eshoo and Shimkus and Senators Klobuchar and Burr) sent a request to Chairman Genachowski asking the FCC to "explore additional steps that the Commission could take within its existing jurisdiction to prevent diversions." The Caucus suggests that perhaps enforcing a "truth in billing" requirement involving the states' truthfulness to the consumer via collections handled by carriers. An August 6, 2010, response from the Chairman indicated that he had directed staff to explore steps the Commission could take within existing jurisdiction to address the practice of some states to divert 9-1-1 funds to other purposes.

Where 9-1-1 funds are (a) cost-based; (b) reflect assessment, collection and disbursement methods that are competitively and technologically neutral; (c) are administered by a neutral third party; and (d) are audited on an ongoing basis, the Subgroup believes those funds can be protected and used for, and only for, 9-1-1 purposes. Without such assurances, not only does the ability to sustain a 9-1-1 program suffer, but public trust in government is eroded.

5.1.3.1.11 Audit of Funds

As a further protection of the public trust, appropriate auditing and accountability for collection and use of the 9-1-1 funds should be established and encouraged. Proper auditing techniques should be required. Good fund management is essential for confidence in government and in the 9-1-1 system.

5.1.3.1.12 Funding and Forging New Partnerships Will be Necessary

A combination of surcharges, general fund tax support, and grants will be required to adequately fund an NG9-1-1 system. In addition, innovative partnerships, and shared costs will be necessary as well as leveraging of current infrastructures and new service provision models will be highly desired.

5.1.3.2 Analysis of Current Funding Models

Based on the institutional knowledge of this subgroup, coupled with its commitment to "think outside the box," funding models are categorized initially as either recurring support mechanisms (e.g., ongoing monthly support for operations and maintenance) or non-recurring support mechanisms (e.g., one-time infusions of capital for network investments). Included in the recurring category are the end-user surcharge, end-user retail rate(s), usage tax, franchise fee, and general tax policy. Analysis of the recurring category is further complicated when jurisdictional issues are introduced as, for example, when surcharges may be derived from future federal support mechanisms coincident with continued reliance on state and local surcharges albeit redesigned with the transition to NG9-1-1 as the paramount goal.

Given current political and practical realities discussed elsewhere in this report, as well as the unknown potential of federal support in the future, the subgroup's main focus defaulted to continued reliance on the surcharge mechanism and taxes in all of its variants—current and future—presumably reliant on continued state and/or local authority. In addition, as discussed elsewhere in this report, the subgroup suggests that the very nature of NG9-1-1, which is envisioned to be a nationwide network of networks, will require that several functions occur at a national level. These might include use of broadband spectrum, priority for roaming technology, interoperable requirements to ensure data and call transfer compatibility, a national routing hub, and international call transport. Thus, the Federal Government will play a significant role to ensure that integration of that nationwide network of networks occurs effectively. There is a cost associated with that administration and oversight. Surcharges may be a more stable funding source for ongoing support but that collection mechanism may not be as suitable for the national-level functions and responsibilities.

There is currently language in pending legislation associated with spectrum auction such as the "D" block spectrum that supports the concept of funding some of the NG9-1-1 transition with proceeds from the auction of spectrum to support public safety functions. While there is controversy regarding the use of auction funds, it is important to note that seeking funding for NG9-1-1 transition from a variety of sources available to the Federal Government will be very important to successful deployment of NG9-1-1 and to move the transition forward rapidly and equitably with an overall national strategy that works for the entire population. A portion of revenues from all auctions should be designated for the support of public safety functions.

5.1.3.2.1 Recurring Support Mechanisms

For this discussion, recurring support mechanisms are defined as ongoing support, collected either monthly or annually, for operations and maintenance. It is a consistent and dependable method that provides funding for the repeating costs associated with financing a 9-1-1 operation. While the mechanism is "consistent" in that it is generally established in legislation or ordinance by some level of government, the amount of the funding may not be consistent in that it is typically based on a floating base, that is, subscribership. Recurring support mechanisms take several forms but are normally methods such as surcharges, prepaid POS fees, or a percentage of service provider revenue.

5.1.3.2.1.1 Surcharges

The surcharge model currently used to fund 9-1-1 throughout most of the country assesses a government-established surcharge or fee on wireline and most often wireless telephone service subscribers. In some cases, VoIP services subscribers are also assessed a surcharge. The levels or amounts of applicable surcharges vary widely from state to state and even jurisdiction to jurisdiction depending on 9-1-1 enabling legislation and limits established on the fee. They may even vary by the type of service to which the surcharge is applied. Surcharge models have been compromised in recent years because many wireline subscribers are giving up their wireline service and replacing it with Internet-based communications services. This has caused a significant decline in surcharge revenue in those areas where surcharges are not applied to Internet-based communication services, the surcharge is not at the same level as traditional wireline services, or there is no successful or appropriate collection mechanism.

5.1.3.2.1.2 End-User Retail Fee

With an end-user retail POS fee, no long-term relationship exists with the consumer, and no regular billing occurs; thus, there is no ongoing mechanism for collection of a 9-1-1 fee as there is for a surcharge on wireless or wireline service. For this reason, 9-1-1 surcharges must be collected at the POS. The rate of the surcharge applicable in this situation must be established and is best determined in a collaborative manner with the 9-1-1 Authority, the wireless carriers who offer prepaid services, and the retailer who will be responsible for collection and remittance.

5.1.3.2.1.3 Usage Tax

A usage tax is the concept of charging a fee on a per 9-1-1 call basis. This concept of funding 9-1-1 has been suggested periodically but with little basis or acceptance. While it was discussed by the Funding Subgroup, it is not recommended for a number of reasons. Such a tax mechanism is difficult if not impossible to implement successfully. It presents difficulty in collection from individuals, non-initialized telephones, and other wireless subscribers when no specific billing address is provided with the call, or from VoIP callers who, in some cases, do not have a specific address associated with the call but rather a geocoded location such as a lat/lon coordinate. These issues add huge billing and administrative process complexity. However, perhaps the most important reason is that such a fee is counterintuitive—it discourages the public's usage if such a fee is applied with each call.

5.1.3.2.2 Franchise Fee

A franchise fee is a payment made to operate a franchise branch of a larger company and for doing so, the franchise holder is allowed to enjoy the profits from that business relationship.. In the traditional mode, a franchise fee in communications services has involved, as an example, a cable or VoIP provider that requires use of public right of way. Payment to government for use of that public right of way has been known as a franchise fee. The term may also be used to describe a concept whereby a company providing communications services or interconnection is permitted to offer services in a particular area or jurisdiction after payment of a "fee" to the franchisee, which might be local or state government. The concept of a franchise fee in the context of 9-1-1 service might require a fee from a service provider before it is permitted to offer service, and that fee would be remitted to the appropriate 9-1-1 Authority to offset the cost of processing 9-1-1 calls from the company's subscribers. Such a fee may be in addition to a 9-1-1 surcharge.

However, significant jurisdictional issues may arise, with providers outside the state or overseas. In addition, wireless signals emanate without regard to political boundaries, complicating the jurisdictional claims to the surcharge.

5.1.3.2.2.1 General Tax Policy

General tax policy provides some level of funding for essential services at a federal, state, and local level today. However, current fiscal conditions pose a threat to the concept of predictability, sustainability, and sufficiency—all goals of a core service of government. For this reason, it has become more and more essential that 9-1-1 and NG9-1-1 be established as a "core essential service" of government in legislation to, among other things, prevent raiding of funds. The strength of the argument that general tax policy should be applied to 9-1-1 funding is that it helps to support the concept of core services (arguable 9-1-1 being a core service of

government) being funded by the tax base. The level of 9-1-1 service and support in a community speaks to its desire to provide, and adequately fund, quality of life services in that community. The weakness in this argument is that taxes continue to be the subject of contentious political debate, with many governments finding creative ways to divert funding to other sources. While this general tax method of funding 9-1-1 does simplify accounting and collections, there is an alternate argument that some users of the 9-1-1 system and its associated response services are not always taxpayers (e.g., real estate owners) and thus this percentage of the population that helps to drive the costs of a system (via usage) is not paying its fair share of the systems costs.

5.1.3.2.2.2 Funding for Increased Federal Responsibilities

The Federal Government's responsibilities will increase with NG9-1-1, and these responsibilities will need to be funded adequately for that enhanced role to be functional. As NG9-1-1 continues to evolve, policy at the national level will be required to address system security issues, interoperability between and among networks, including international call routing, and state networks. Increased federal involvement of both a policy and planning scope, will necessitate a greater role and function to be funding at the federal level. A funding mechanism for these newly acquired functions will need to be established.

According to CTIA, more than 292 million wireless devices are in use today[71] that have access to 9-1-1 services across this country. This number represents just wireless devices. If a national NG9-1-1 fee of just $.01 was collected from each of those devices, it would raise more than $3 million monthly or $36 million annually. While many recognize that these revenues will not be sufficient, coupled with a fee on all devices or access points capable of accessing 9-1-1, they could begin to fund the transition to NG9-1-1. The revenues could be specifically designated for NG9-1-1 transition projects and new functions and responsibilities under the direction of the Federal Government. A "National NG9-1-1 Transition Fee" would help to fund the transition between legacy 9-1-1 systems and NG9-1-1 and may taper off or sunset at an appropriate time in the future should the need for such funding be no longer necessary.

The subgroup has already reported that it expects that the next generation transition will take place over a period of time, and without strong federal guidance, it will be protracted over an even longer period of time than may be reasonable.

The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

5.1.3.2.3 Non-recurring Mechanisms

For this discussion, non-recurring support mechanisms are defined as one-time, infrequent or occasional funding mechanisms, usually designed for capital expenses. This funding model is an inconsistent source of funds reserved for specific projects and typically cannot be depended on for the repeating costs associated with financing a 9-1-1 operation. Non-recurring support

[71] http://www.ctia.org/media/index.cfm/AID/10323

mechanisms can take several forms but are most often characterized as grants (e.g., direct, indirect and public/private grants).

5.1.3.2.3.1 One-Time Grants

The one-time category includes grants, loans, and any other one-time infusion of financial or in-kind support that has quantifiable financial value and that originates with the federal, state, and/or local jurisdiction. Analysis of the one-time category is further complicated because Public Safety NG9-1-1 can be supported either as the *direct* recipient of a one-time award (e.g., the federal E9-1-1 Grant Program enabled by the ENHANCE 9-1-1 Act[72]) or is an *indirect* recipient of a one-time award (e.g., Broadband Technologies Opportunity Program [BTOP]/Broadband Initiatives Program [BIP] enabled by the American Recovery and Reinvestment Act of 2009.) [73] This is an area where the Federal Government can play a key role as it does in other public safety areas, such as the Department of Justice's (DOJ) Community Oriented Policing Services (COPS) grants, that fund emergency response services but not the public's ability to request those services through their 9-1-1 system.

5.1.3.2.3.2 Direct Grants

Grants targeted to NG9-1-1 with states or 9-1-1 Authorities as the grantees or primary recipients would typically be created through enabling legislation (state or federal) and rules promulgated by the designated granting agency. Rules would, in turn, define and specify eligible projects. One-time distributions would likely be targeted to projects with discernable benchmarks over a discrete time horizon and as such are well-suited to the initial deployment of networks and other capital infrastructure or startup costs such as training for NG9-1-1. The application process is competitive, complex, and comprehensive. Follow-on compliance measures and auditing procedures set forth by government costing and accounting processes are, likewise, complex and comprehensive.

5.1.3.2.3.3 Indirect Grants

When 9-1-1 Authorities are indirect recipients of grants and other one-time awards, the primary difference is that the application itself is under the purview of the primary recipient, and it is the primary recipient that distributes funds to the 9-1-1 Authority. The expectation, however, should be that a similar level of compliance and auditing obligation will flow through to the 9-1-1 Authority.

5.1.3.2.3.4 Public/Private Grants

In addition to the federal, state, and local grants identified above, there are also grants available from public and private organizations. Grants offered by organizations could be specific to an initiative or more flexible in how they are used. Organizational grants are typically one-time grants, may have many requirements, could be first-come first-served, may be competitive among requestors, and may be limited in scope. Organizational grants may be harder to find because there typically is no "clearinghouse" or specific organization to assist in finding organizational grants. Public Safety membership organizations can be a good source for available grants. Frequently, unused grant dollars are available for those who are willing to do the research to find them.

[72] *Ensuring Needed Help Arrives Near Callers Employing 9-1-1 Act of 2004,* 47 C.F.R. Part 400
[73] *American Recovery and Reinvestment Act,* Title VI, Section 6001(b)(4) and (g)(5)

Some examples of possible grant sources are listed below:

- **U.S. Department of Agriculture—Rural Development Program (USDA RUS)—**The financial programs of USDA RUS support such essential public facilities and services as water and sewer systems, housing, health clinics, emergency service facilities, and electric and telephone service. USDA RUS promotes economic development by supporting loans to businesses through banks, credit unions, and community-managed lending pools. It offers technical assistance and information to help agricultural producers and cooperatives get started and improve the effectiveness of their operations. USDA also provides technical assistance to help communities undertake community empowerment programs.

  USDA RUS has a $115 billion portfolio of loans and will administer $20 billion in loans, loan guarantees, and grants through its programs in the current fiscal year. It achieves its mission by helping rural individuals, communities, and businesses obtain the financial and technical assistance needed to address their diverse and unique needs. More grant information can be found at: http://www.rurdev.usda.gov/RD_Grants.html.

- **DHS—**DHS, through the Federal Emergency Management Agency (FEMA), manages a number of grant and assistance programs "to help strengthen the nation against the risks associated with potential terrorist attacks and other hazards." Currently, the Homeland Security Grant Program (HSGP) is the primary funding mechanism for DHS to build and sustain the nation's preparedness capabilities. Besides the HSGP, other grant programs may be available to offer funding, including the Interoperable Emergency Communications Grant Program (IECGP) or the State Homeland Security Program. An overview of these DHS grant programs can be found at: http://www.fema.gov/government/grant/index.shtm. In addition, http://www.grants.gov/ is a government-wide system used by federal agencies for posting grant announcements and access to online grant submissions, and may be an additional source of data.

- **National 9-1-1 Program—**In September 2009, the USDOT's NHTSA and the Department of Commerce's (DOC) National Telecommunications and Information Administration (NTIA) announced more than $40 million in grants to help 9-1-1 centers nationwide implement next generation technologies and enabling other features that could improve emergency response or enhance safety. More information about the grants that were awarded is available at: http://9-1-1.gov/grants.html. This has been the extent of funding for 9-1-1 to date.

- **Other Options—**Funding options at the federal, state, and local level (and even within the private sector) may exist that may provide options to help improve emergency communications in rural areas. For example, the Food, Conservation, and Energy Act of 2008, (also known as the 2008 Farm Bill),[74] included language to permit loans to improve 9-1-1 and other emergency communications capabilities in rural areas.[75]

[74] P.L. 110-234
[75] See also "Federal Funding for 9-1-1 in Rural Areas," Congressional Research Service, *Emergency Communications: Broadband and the Future of 9-1-1*. Report R41208. p. 22–23. Available at:

Factors impeding obtaining grants could include—

- Not knowing where to look to find grants
- Finding out too late
- Technical gaps or mistakes in proposals
- Complexity of proposal requirements
- Leveraging requirements
- Partnership requirements requiring time to address.

Some examples of resources for grants are—

- Catalogue of Federal Domestic Assistance (CFDA) (www.cfda.gov)
  - Provides a database of all federal programs, not just grants
  - Allows browsing by a variety of categories (e.g., agency, function, deadline, etc.)
  - Includes grant proposal tutorial
- Grants.gov (www.grants.gov) (main federal grants search engine)
  - Allows search by agency, category
  - Has a new grants section
  - Allows users to sign-up for alerts
  - Offers a way to find a grant you've heard about
  - Includes tutorials.

5.1.3.2.3.5 National Transition Fee

Throughout this document there has been considerable discussion about the need to keep the transition period from legacy systems to NG9-1-1 as short as possible in order to contain the cost of operating and managing duplicative systems. The only way this is going to be accomplished is to provide adequate funding both at a federal and local level to incent the transition.

A National Transition Fee should be considered both to assist with funding the responsibilities of the Federal Government and also to provide funding for a federal block type grant such as that in which the state receives disbursement and has authority to establish criteria related to distribution of funds to achieve the goal of the block grant, which in this case would be next generation service. Such a program would initiate and encourage next generation development.

Funds from this fee may also support a National 9-1-1 Office and any additional responsibilities assigned to that office related to next generation deployment.

The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

---

http://opencrs.com/document/R41208/

5.1.3.3 Review of Cost Differentials Based on New Funding Structures

As NENA notes in its *Funding 9-1-1 into the Next Generation* report:

> *The NG9-1-1 model envisions a system with shared networks, databases, and applications in which the communications costs of Public Safety agencies are shared among all participants in the NG9-1-1 system. This will result in less reliance on individual 9-1-1 centers paying for all aspects of the system at the local level, and will potentially reduce costs through sharing with many non-9-1-1 agencies.*[76]

The practical application of this viewpoint, for example, is that the costs involved may potentially be shared by different groups of stakeholders dealing with different groupings of functions like those below.

By nature, NG9-1-1 will potentially involve complex interconnected systems composed of many functions at different geographic and institutional levels, all of which potentially affect cost and funding considerations. Conceptually, these functions can be grouped into three broad areas, starting with the most generic and building to the more specific:

Funding Transport and Basic Network Functions

Generic transport, connectivity, and basic network functions and applications

- Includes lower layer network services like Multi Protocol Label Switching (MPLS)
- Supports broad agency data and network needs (data sharing and data center services, IP connectivity, basic network platform, etc.)
- Has potentially large geographic areas (e.g., statewide)
- May involve multiple vendor services
- By nature may support a broad service environment not necessarily limited to Public Safety

Funding ESInet[77]

Specific network applications and data services supporting Public Safety services

- Is an inter-network environment for emergency services
- Broadly supports emergency services, including, but not limited to, broader public safety services like first responder communications, emergency preparedness, homeland security, etc.
- May be a large geographic area depending on the services involved and the interconnectivity desired
- May have functions operated by different stakeholders (e.g., supporting applications for functions other than 9-1-1, etc.)

Funding NG9-1-1 Functions

Specific NG9-1-1 Applications and data services supporting the delivery and processing of 9-1-1 calls

---

[76] NENA Next Generation Partner Program, *Funding 9-1-1 Into the Next Generation: An Overview of NG9-1-1 Funding Model Options for Consideration*, March 2007, p. 3.

[77] An ESInet (Emergency Services IP Network) is a privately managed IP transport network that is capable of supporting (but does not include) the core routing functional entities necessary for NG9-1-1 call delivery. The latter include, but are not limited to, the ESRP and the ECRF.

- Has applications and data services specific to the delivery of citizen requests for emergency services
- Is characterized by a geographic area that relates to coordinated 9-1-1 services (may involve one 9-1-1 authority, or groups of such authorities joined through interagency agreements, etc.)
- May have functions operated by different stakeholders (e.g., routing and data services, etc.)

These functions and their characteristics will be unique to the regions and states involved, and no one system will be exactly like another. They will vary based on a variety of factors, including—

- Local, regional, and state emergency event response considerations
- Historical institutional, statutory, and geo-political cultural arrangements
- Joint service environment (both existing and proposed)
- Resource sharing opportunities, factors, and constraints.

All of these factors potentially affect cost considerations, including the specific costs involved, along with the degree to which the agency has the ability to share those costs. Consequently, it is extremely difficult to project the "cost of NG9-1-1" in any consistent way without defining what is to be included in those projections and how the above factors apply to a specific geographic area.[78] Ultimately, 9-1-1 authority system and financial planning will need to address this process. That does not mean, however, that state and federal (or national-level) cost studies cannot be useful. The FCC's "National Broadband Plan," in fact, recommends that "…the National Highway Traffic Safety Administration (NHTSA) should prepare a report to identify the costs of deploying a nationwide [NG9-1-1] System and recommend that Congress allocate public funding" for said study.[79] Rather than focusing on an overall, bottom-line cost calculation, the analysis could more productively identify generic costs for specific NG9-1-1 functions and explain how key stakeholders might logically share in those costs.[80]

5.1.3.3.1 Costs at a National Level

If the vision of NG9-1-1 calls for a nationwide system of systems that potentially allows calls and associated data to be relayed or transferred between states and across the country, then certain functions need to be in place at the national level. For example, NG9-1-1 routing (i.e., the ECRF) at that level would require the management of national-scale resources to allow the function to work.[81] Four elements of NG9-1-1 require national infrastructure: the national "forest

[78] Indeed, the USDOT Next Generation 9-1-1 (NG9-1-1) System Initiative's *Final Analysis of Cost, Value, and Risk*, necessarily did not consider detailed design, governance models, funding alternatives, regulations, and local jurisdictional organizational/PSAP structures. In addition, the cost estimates involved were based on a variety of assumptions, including economic factors such as discount and inflation rates, and program-specific drivers regarding the development and deployment of the alternatives evaluated. See USDOT Next Generation 9-1-1 (NG9-1-1) System Initiative, *Final Analysis of Cost, Value, and Risk*, USDOT, March 5, 2009, pp. 5 and 13

[79] *Connecting America: The National Broadband Plan*, the Federal Communications Commission (FCC), Chapter 16, Recommendation 16.13. Available at: http://www.broadband.gov/plan

[80] The *National Broadband Plan* Recommendation 16.13 suggests the kind of study, when it states "A NHTSA analysis should determine detailed costs for specific NG9-1-1 requirements and specifications, and specify how costs would be broken out geographically or allocated among PSAPs, broadband service providers, and third-party providers of NG9-1-1 services," on p. 325. Available at: http://www.broadband.gov/plan

[81] For example, NG9-1-1 standards call for the existence and maintenance of a so-called "forest guide," or a

guide," the PSAP Certificate Authority, a national ESInet backbone, and a CERT.

NG9-1-1 standards call for the existence and maintenance of a forest guide—a resource that has knowledge of the coverage region of each state ESInet to support routing and is used to support routing of calls from one state to another. Each agency on an ESInet will need a set of cryptographic credentials that are used with the NG9-1-1 security mechanisms to protect communications to and within ESInets. The PSAP Authority is the entity that issues such credentials. ESInets are envisioned as local or regional networks interconnected to form state networks. The state networks will be interconnected to form a national network, but a national ESInet "backbone" would optimize traffic transiting from one state to another, especially in disaster situations. Finally, deliberate attack on the NG9-1-1 system is a real possibility, and if it occurred, a specialized response team (CERT) would assist local ESInet operators in responding to attack. All of this infrastructure will require funding.

How those costs will be funded must be addressed in the context of who will be responsible for the management and support of the functions involved. There are options for funding such functions, ranging from federal funding to state assessments coordinated through a national-level organization, or a combination of both.[82] In support of this perspective, Weiser, Hatfield, and Bernthal, in *The Future of 9-1-1: New Technologies and the Need for Reform*, also suggest that "the diversity of funding models across jurisdictions means that the sufficiency of funds to support 9-1-1 can only be determined on a jurisdiction-by-jurisdiction basis. Notably, starkly different resources are available in different states and, frequently, between localities within a state."[83] This fact makes the analysis of whether sufficient funds are being collected for 9-1-1 sustainability today *and* sufficient funds will be available for next generation transition and sustainability into the future exceedingly difficult and perhaps only answerable on a local level.

5.1.3.3.2 Costs at a State Level

NG9-1-1 envisions a larger role for states in the deployment of ESInets and the services that operate on them. To withstand DoS attacks on NG9-1-1 infrastructure, the entry points to the ESInet must be well defended, and that includes substantial amounts of bandwidth (see Section 5.1.1.4.1.3). Considering that level of attack, mitigation capacity could not effectively be achieved at an individual PSAP or regional level. Only by aggregating traffic ingress at the state level (or even small groups of states in some circumstances) would the cost of the mitigation be practical. In addition, responding to regional disasters requires interconnection of ESInets statewide to be able to divert calls to PSAPs able to handle them. Statewide ESInets are required, which are formed from interconnecting local or regional ESInets, and, optionally, installing a state ESInet backbone to optimize interconnection across a state. The BCF, a statewide ESRP, and a state ESInet backbone will have to be constructed and funded at the state level.

---

resource that has knowledge of the coverage region of "self-contained authoritative mapping servers" (to support routing) serving smaller scale regions. The forest guide resource keeps track of which self-contained hierarchy of mapping servers serves what geographic area. There will be a cost associated with the support of that guide.

[82] Nlets (the interstate justice and public safety network), for example, is primarily supported by its users through membership dues. Members include both non-federal and federal criminal justice and law enforcement agencies.

[83] Phillip J. Weiser, Dale Hatfield, and Brad Bernthal. *The Future of 9-1-1: New Technologies and the Need for Reform*, Journal of Telecommunications and High Technology Law, Vol. 6, No. 2, p. 283, June 5, 2008, University of Colorado Law School. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1146803

5.1.3.4 Review of Regulatory and Legislative Issues

In the Governance and Policy section of *A National Plan for Migrating to IP Enabled 9-1-1 Systems*,[84] the National 9-1-1 Program states that "As NG9-1-1 deployment begins, current roles and responsibilities among all entities involved in providing 9-1-1 services will change and the existing legal and regulatory environment will likely not effectively accommodate new technologies and arrangements. The deployment of NG9-1-1 will require increased coordination and partnerships among government and Public Safety stakeholders, 9-1-1 Authorities, service and equipment providers, and PSAP Administrators in planning and implementing NG9-1-1. A new infrastructure will require a new delineation of roles and responsibilities among the parties, defined by common practices and statutes. Coordination with the general public will also be important to address concerns and to manage expectations. As a result, legislative and regulatory arrangements and demarcation points at every level of government may need to be reexamined and some modified to effectively support NG9-1-1 deployment."[85] The Funding Sub Group concurs that current roles of those responsible for 9-1-1 service in an area or region will change with NG9-1-1 and that new partners and stakeholders will be active participants in the planning and deployment of an effective NG9-1-1 system.

5.1.3.4.1 Transition Requires Standardization

Transitioning to NG9-1-1 requires cooperation and collaboration among governmental units on the federal, state, and local levels. Typically, the roles of each level of government are not well differentiated. Possibly the key role for the Federal Government is to ensure that uniform standards are provided to guide the implementation. The importance of standards cannot be overemphasized. Thoughtful and inclusive yet swift completion of the standards-setting process associated with next generation systems is essential to moving forward with implementations.

5.1.3.4.2 Federal Grants Needed

States will be looking to the Federal Government for some type of grant program to assist in funding the costs to be incurred. For those states without an IP network that can be readily adapted for NG9-1-1, federal funds may be especially necessary.

5.1.3.4.3 State Legislation Needs Review

Although current state statutes related to 9-1-1 services may be the springboard for going forward in a next generation world, they will need careful review. They will need to be examined for any references that may limit implementation and that may be technology specific. Technology-neutral language would reduce the need for future legislative changes as new technologies emerge. States should review their statutes to ensure all costs will be eligible for funding associated with new services, networks, software, hardware, databases, and any other elements that may be needed in an IP-based NG9-1-1 universe. In addition, states should consider defining 9-1-1 services as "essential services" to ensure that adequate funding for the transition and implementation of NG9-1-1.

5.1.3.4.4 State Policy on Fee Collection

Two basic areas of state policy should be addressed (among others). First, those states that have some type of 9-1-1 governing board or 9-1-1 office tend to deploy 9-1-1 services more successfully. Second, each state must set the amount of fees collected from wireline, wireless,

[84] http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf
[85] Ibid., p.1–4

and VoIP devices or any future communications technologies that might interact with 9-1-1. States must determine the best practice for collecting these fees and distributing the funds to the appropriate parties.

5.1.3.4.5 Strong Fund Management Policies

The management of these funds is the critical policy matter for each state. These funds must be protected from raiding by the state for purposes other than 9-1-1. As stipulated in the ENHANCE 9-1-1 Act of 2004 "any funds that are collected from fees imposed on consumer bills for the purposes of funding 9-1-1 services or enhanced 9-1-1 should go only for the purposes for which the funds are collected."[86] Some states have found it helpful to collect and manage these funds outside the state treasury as a means of protection. Whenever public funds are the subject, adequate measures of accountability, transparency, and auditing are necessary to ensure the public trust. For those states that raid their funds for non-9-1-1 uses, the subgroup recommends the Federal Government continue the practice of disallowing these states future federal grants and possibly invoking further penalties. These penalties should be commensurate with the amount of money diverted to other purposes.

5.1.3.4.6 9-1-1 Fund Limitations

Currently, all states or local 9-1-1 authorities limit how funds committed to 9-1-1 may be spent by the local PSAPs. Generally, 9-1-1 funds should be used for equipment within the PSAP up to the ESInet. The local governments should pay for the buildings and personnel needed for PSAPs. The radios needed outside the walls of the PSAP for emergency response vehicles or responders should also be provided by the local government.

5.1.3.4.7 Allowance of Cost Recovery

States must determine whether cost recovery for wireline and wireless companies (and any other providers today as well as any future communications providers) will be allowed. Once cost recovery is allowed for one entity, anyone in the system tends to expect this consideration.

5.1.3.4.8 Point of Sale (POS) Collection Policy Encouraged

States are especially challenged to determine the best way to collect fees from prepaid cards and cellular telephones. Prepaid services are the fastest growing area of wireless service.[87] It is important that these customers pay into the system created for their safety. Collecting these fees from the retailer at the Point of Sale (POS) may be the best option to ensure the end user of this service is paying the fee. This approach is consistent with standard contractual cellular telephone agreements.

5.1.3.5 Funding Subgroup Findings

The Funding Subgroup's research and findings have led to the following observations:

- Over the past several years, communications services have shifted from traditional wireline to wireless, but this does not necessarily represent a decline in the total number of subscribers to communications services. It may, however, represent a change in the revenue realized depending on the state or local funding mechanisms.

[86] Public Law 108–494—December 23, 2004, Section 102(3)
[87] http://connectedplanetonline.com/mobile-apps/news/Prepaid-wireless-subs-increase-0331/index.html. March 2010

- More recently, a transition has been occurring from traditional wireline services to either strictly mobile service in either wireless technologies or mobile VoIP without any static wireline service.
- When states or 9-1-1 Authorities do not have parity in their surcharge rates across all technologies and services, they experience declining 9-1-1 revenues.
- Methods for funding 9-1-1 are limited and generally include surcharges or taxes.
- For funding mechanisms that are dependent on the number of subscribers, any decline in subscribers is a significant concern.
- In states, locales, or regions where 9-1-1 fund management is sound (good collections mechanisms, transparency in fund management, appropriate auditing and accountability, fund is used for intended purpose), there is less concern about funding shortfalls today or in the foreseeable future.
- In states, locales, or regions where there is equity in surcharge amounts across all technologies, there is more possibility for sufficient funding for current operations and for future NG9-1-1 implementation.
- In states, locales, or regions where there is inequity or fund collections are not based on the number of subscribers, insufficient funding is more likely.
- When raiding of 9-1-1 funds occurs, it compromises the ability to adequately fund future 9-1-1 technologies and operations and increases threats to the communications network, not to mention eroding public trust.
- NG9-1-1 will further test even adequate funding because it will operate in parallel (with associated costs) with the current system for a yet undefined period of time.
- Unless funding legislation is written in a technologically and competitively neutral manner, disputes concerning collections of 9-1-1 fees or surcharges for newer communications technologies will continue to surface.
- Current economic conditions present challenges for increased surcharges or taxation to fund NG9-1-1.

5.1.4 Improving Access to 9-1-1

This section addresses methods in place today for accessing 9-1-1 and proposed functional and technical solution to improve access to 9-1-1, in particular for those who are deaf, hard of hearing or have a speech disability. Communications methods and procedures to improve access in NG9-1-1 are also explored.

5.1.4.1 Assessment of Current and Proposed Functional and Technical Solutions

In 2005, the vision and expanded capabilities of NG9-1-1 were the subject of increased attention across various entities that would help guide its development during subsequent years.

The NG9-1-1 System Initiative published its first document, *Concept of Operations*,[88] stating, "The Nation's 9-1-1 system, based on decades-old technology, cannot handle the text, images, and video that are increasingly common in personal communications and critical to future transportation safety and mobility advances." This important guiding document paid considerable attention to the needs of the various communities deserving and needing improved

[88] http://www.its.dot.gov/ng911/#docs

accessibility to emergency communications. It also stated, "With NG9-1-1, non-voice callers have more choices for accessing 9-1-1 to request emergency services and can use standard consumer-oriented communications devices."

The NENA Next Generation Partner Program,[89] a collaborative effort between public and private emergency services "anytime, anywhere, from any device," stated in its 2005 annual report, "Increased use of text messaging must also be supported, in general and to accommodate persons with disabilities."

The FCC's NRIC,[90,] predecessor of CSRIC, was completing its seventh term, and for the first time in its history had spent 2 years analyzing 9-1-1 issues, with relevant attention to long-term issues.[91] Among the recommendations in one of its reports, was "PSAPs should be able to receive and reply to e-mail, SMS, and store and forward messages. However, because of their latency and unreliable delivery, such messaging is problematic for emergency communication and users should be educated as to of limitations inherent to these services."[92]

During the 5 years since then, there have been some amazing changes in communications in use by the public. For example, the CTIA has reported that while 7.7 percent of US households were wireless only in June 2005, that has grown to 24.5 percent in the same month of 2010.[93] It also reports that while there were 7.2 billion (SMS) messages sent in June 2005, there were 173.2 billion in the same month of 2010. This method of communication (texting), in earlier years reserved mostly for people who are deaf, hard-of-hearing, deaf-blind, and have a speech disability, has definitely become a mainstream communications choice.

5.1.4.1.1 Next Generation 9-1-1 (NG9-1-1)

NG9-1-1 offers the opportunity for realizing not only improved access to emergency services but also equal access for those with disabilities and for non- or limited-English speaking callers.

The NENA Next Generation Technical Specification—NENA 08-003 ("i3 Stage 3") in conjunction with related documents within ATIS and 3GPP—lays out mechanisms to provide equivalent 9-1-1 service to a very wide range of callers with disabilities as well as the people who serve them in various capacities. These mechanisms include—

1. Multimedia—all PSAPs must support audio, video, and several forms of text (real time, IM, TTY)
    a. Media preferences are offered in signaling
    b. Any combination of media in one call is possible
2. "Language Preference" in signaling; can include ASL or other sign language
3. PSAPs accept calls from the Internet; no carrier is needed (but carriers are desirable)
4. PSAPs fully support third-party calling for all kinds of relay
    a. Real 9-1-1 call
    b. Routing of 9-1-1 call delivery on location of caller
    c. Multimedia for all parties (PSAP bridge is multimedia)

[89] http://www.nena.org/ng-partner-program
[90] http://www.nric.org/
[91] http://www.nric.org/fg/index.html
[92] http://www.nric.org/meetings/docs/meeting_20051019/NRICVII_FG1B_Report_September_2005.pdf, page 4
[93] http://www.ctia.org/advocacy/index.cfm/AID/10323

   d. Identification of all parties available to others
   e. Full conference controls, including selective mute available to call taker
5. Callbacks can be multimedia and to Internet Uniform Resource Identifiers (URI)
6. Greatly expanded data mechanisms potentially can provide medical information, emergency contacts, and other call, caller, and location-based data to the PSAP and any responders.

It is important to recognize that these mechanisms are built into the NENA NG9-1-1 system specification and are available to a wide range of callers for reasons other than disability. For example, the "Language Preference" mechanism is used to inform the PSAP, and to automatically engage a language translator, and can also be used to route to call takers who speak the language preferred by the caller. Similarly, the third-party calling mechanism is used by any call center in the path of the call, for example, OnStar or other telematics call centers, or Lifeline or other assisted living aids.

Considering each of the above mechanisms in a bit more detail, the multimedia aspects of NG9-1-1 are a profound improvement in 9-1-1 call handling. PSAPs will support a wide range of audio, video, and text formats, and all aspects of call handling must accommodate multiple media. For example, the recording (logging) and bridging mechanisms are specified to handle all of the media choices the PSAP handles on the call. Audio CODECs include the familiar G.711, compressed CODECs native to wireless networks, as well as wideband CODECs that may be found on videophone devices. The standard video CODEC is H.264. Text is supported for RFC4103 (T.140) RTT and several forms of IM. NG9-1-1 requires support for legacy TTY calling also. All calls are signaled with SIP, and calls originating from devices or networks that are not native SIP can inter-work their signaling to SIP. That allows commercial IM providers such as AOL, Yahoo, or MSN to provide IM to 9-1-1. SIP signaling includes media preferences in the signaling—the PSAP will know before it answers the call which medium is requested. Media details are negotiated so that the highest quality service that both ends can support will be provided. Any mix of audio, video, and text can be supported in a single session. Media can be added or subtracted from the session at any time.

SIP signaling provides a "Language Preference" header in which the caller informs the called party (the PSAP) which language the caller prefers. If the calling party, for example, specifies that his/her preferred language is ASL, the call could be routed, based on that request, to a call taker proficient in ASL, or an ASL interpreter could be added to the call automatically. This also works for non-English-speaking callers, and the same mechanisms can route calls or automatically engage interpreters on the call.

While most calls will be processed through carriers, PSAPs will accept calls directly from the Internet. All calls, regardless of source, pass through multiple layers of security mechanisms to defend against deliberate attack on the 9-1-1 system. This means that callers who have devices such as videophones, where there is no carrier, can directly call 9-1-1. PSAPs prefer calls to go through carriers or other service providers because those providers can often assist when there are problems in the call signaling or media, but if there is no carrier, a 9-1-1 call can still be completed. A byproduct is that the "address" of a caller is not limited to a 10-digit telephone number, but can be an Internet address (URI) or an international telephone number.

A major improvement to the 9-1-1 system available with NG9-1-1 is the handling of third-party calls. Third-party calls are those that pass through a third party, such as a relay provider or other call center (for example, OnStar or Lifeline). The third party can cause a 9-1-1 call to be created that is—

- Routed based on the location of the caller, not the call center
- Established as a three-way call with the caller, the third party, and the PSAP call taker
- Permits multimedia for all parties.

The PSAP knows that a three-way call is being established. It can control, if desired, which third parties can initiate such calls. The identity of all parties is sent in the signaling to all other parties. The PSAP bridge is multimedia, so, for example, a Video Relay Service (VRS) call would be established as a three-way call with all three parties having audio, video, and if desired, text media streams. This allows the PSAP to receive background video for the caller and judge the caller's emotional state much better than would be possible through an audio-only connection to the video interpreter. The bridge provides a full set of media controls to the call taker so that the call taker can selectively mute or sidebar participants. These mechanisms are also useful when the third party provides only a mechanical service such as captioning and there is no (apparent) call agent at the third party.

All of the multimedia features described above are also available when a PSAP must call back a caller. The system provides mechanisms whereby the service provider can annotate the signaling such that a callback will trigger attempts to reengage the same interpreter, if that is possible and desirable to maintain as much continuity as possible for the response. Callbacks to URIs are possible, as are callbacks to international numbers for roamers.

NG9-1-1 provides the location or location estimate of the caller, media preferences, language preferences, and several other items of data in the signaling with the call. Mechanisms are under development that potentially can enable the PSAP or responder to obtain additional data about the call, caller, or location of the call. These mechanisms all share some common characteristics:

- The call signaling or location infrastructure passes a URI, not the actual data itself. In some cases, however, the actual data may be present elsewhere in the signaling, so a separate dereference is not needed.
- Any authorized entity on the path of the call can use the URI to retrieve the data the URI addresses.
- The data is eXtensible Markup Language (XML) structured and extensible.
- The protocol used to retrieve the data is Hypertext Markup Language (HTTP) protected by Transport Layer Security (TLS). (When the data is present in the SIP INVITE body, no HTTP or TLS is needed.)
- The standard NG9-1-1 authentication and authorization mechanisms can be used to control who can see what data. In theory, the data owner asserts the controls, and the controls can be role based.

There are three data structures: Additional Call Data, Additional Caller Data, and Additional Location Data. Each has a defined XML data structure with extension points.

Additional Call Data is passed from the calling device, or any carrier or service provider in the path of the call. Multiple Additional Call Data structures can be provided if multiple entities are in the call path. For example, a device may provide one per potential device user, a third-party service provider such as Lifeline may provide more, and the carrier handling the call may provide more. The data may be specific to the call; some elements may vary from call to call. This structure includes items such as—

- Identity and contact data for the entity providing the data
- Kind of service provided to the subscriber
- Subscriber name and contact information
- Device-specific identity and type information
- A "hook" for device-specific data—this would include telematics data, medical sensor data, and other similar data structures.

Additional Caller Data is specific to the human(s) owning or frequently using the device. It includes contact information, medical information, and emergency contact information. It is envisioned that the data will be gathered and stored by a trusted entity, perhaps an insurance company or an organization such as American Association of Retired Persons (AARP). This entity collects and stores the data and provides an opaque key that is either given to the carriers to add to 9-1-1 calls or given to an independent entity that makes it accessible to PSAPs. On a 9-1-1 call, the PSAP or responders can retrieve the data from the entity that holds it. The emergency contact data can contain a notation that requests that someone be added to the call if the caller places a 9-1-1 call. The contact might be a parent (for a child caller) or a son/daughter (for an elderly caller). The PSAP controls whether it adds the emergency contact or not. Because Additional Caller Data is specific to the person or persons who use the device, the same data can be provided, regardless of whether the caller used a home, cellular, or office telephone to place the 9-1-1 call. There may be any number of Additional Caller Data structures associated with a call or calling number, one per potential user of the device.

As a precautionary note, there are no mechanisms defined that can assure that the Additional Caller Data will be accurate or timely, or which can make sure that the Additional Caller Data for one person is not sent when a different person uses a device. Not all carriers have agreed to support this mechanism nor to be responsible for storing and maintaining the data and adding a reference to it to the call; the mechanism to provide this data may use an independent entity accessible to PSAPs and separate from carriers.

Additional Location Data is specific to the location of the call. Two calls from the same location would have the same data. Unlike the Call and Caller data, the URI is not passed in the signaling with the call but is obtained from the NG9-1-1 route database (the ECRF). This structure includes contact information for the building owner and tenant, contacts for security, engineering, and front desk, etc. It also contains building floor plans and interior details, hazardous materials (HAZMAT) locations and other similar information. It provides access to surveillance video; heating, ventilation, and air conditioning (HVAC); building sensors and alarms; and elevator status and controls.

5.1.4.1.2 Next Generation 9-1-1—Enhanced Accessibility Services

While the NG9-1-1 high-level technical solution above covers features with some mention of how they can be used to favorably increase emergency access accessibility, the list in Section

4.5.2 shows some examples for each category. It should be pointed out that the examples are in no way intended to be all-inclusive; other benefits will definitely accrue. In addition, the examples are related to the call taker function interaction—providing data related to various categories will benefit first responders in many cases in their role in the emergency incident in various ways:

The key to providing enhanced accessibility services in a next generation environment is providing call data indicators related to the various accessibility categories with each call. For example, if a caller contacts 9-1-1 via a communications device and the call data indicator identifies the caller as being hearing enabled but cannot speak, the system should automatically enable those technical features that will enhance the call processing capability. In this example, the system would automatically enable HCO functionality, which will enable the call taker to handle the call efficiently by providing the capability for the call taker to speak to the caller while the caller communicates via text. The system should automatically present to the call taker appropriate pre-arrival instructions for a HCO caller as well as identify HCO-appropriate resources when available. In addition to such technical solutions, call takers must be trained to identify an HCO call for service so that they are prepared for HCO-specific elements of the call such as a latency in communication while the caller types in a text message. With proper training, the call taker will also provide pre-arrival instructions suitable for a HCO caller, use appropriate HCO call-back methods, and ensure that responding entities are properly advised of the caller's special needs and that necessary social services entities are engaged. It is also of utmost importance that the callers receive education to ensure successful communication with the 9-1-1 call taker occurs.

All 15 of the disability categories identified in this report have category-specific technical, operational, and educational considerations that must be identified and accounted for in future 9-1-1 deployments by relevant industry experts. By conducting a thorough and comprehensive analysis of the technical, operational, and educational requirements for providing enhanced accessibility services, the 9-1-1 community will ensure a successful deployment of NG9-1-1 services for all callers.

5.1.4.1.3 Text Messaging

Although 1.81 trillion SMS messages are sent in the United States annually,[94] there is no nationwide single solution in place for providing emergency services access (9-1-1) using SMS. Various interim, often locally based, services are in place but there remains disagreement about whether this method of access should even be considered for 9-1-1 because of its unreliability and other factors.

An NRIC VII 2005 report provided a path forward, recommending development and implementation of real-time interactive text transmission for emergency communications on IP.[95] While providing high-level requirements, the same report added that the group advocated support for existing messaging (SMS) when voice and real-time text was not available.

5.1.4.1.4 Text Messaging and 9-1-1—Overview

[94] http://www.ctia.org/advocacy/index.cfm/AID/10323
[95] NRIC VII, September, 2005 Focus Group 1B—Long Term Issues for Emergency/E9-1-1 Services Report, Section 5.1.1.8.1. Available at: http://www.nric.org/fg/index.html

Accessibility to 9-1-1 has not kept pace with the technology currently in the marketplace. The current requirement is that the 9-1-1 Authority must accept TTY calls, which rely on a voice communications channel in the current E9-1-1 environment. However, there are other forms of texting in use in the marketplace.

The NENA i3 model, which is the basis of NG9-1-1 standards' development, includes provisions for non-voice and non-traditional emergency communications. The Access Subgroup discussed and viewed presentations on various interim solutions that would improve (and in some cases are today improving) accessibility in the near term while the transition to NG9-1-1 takes place. A number of methods have been created to improve accessibility, and an analysis of the technical characteristics of these services has been provided by the Technology Subgroup in its section of this report.

As a summary presentation, the various accessibility solutions fit within diagram presented in Figure 5-1.

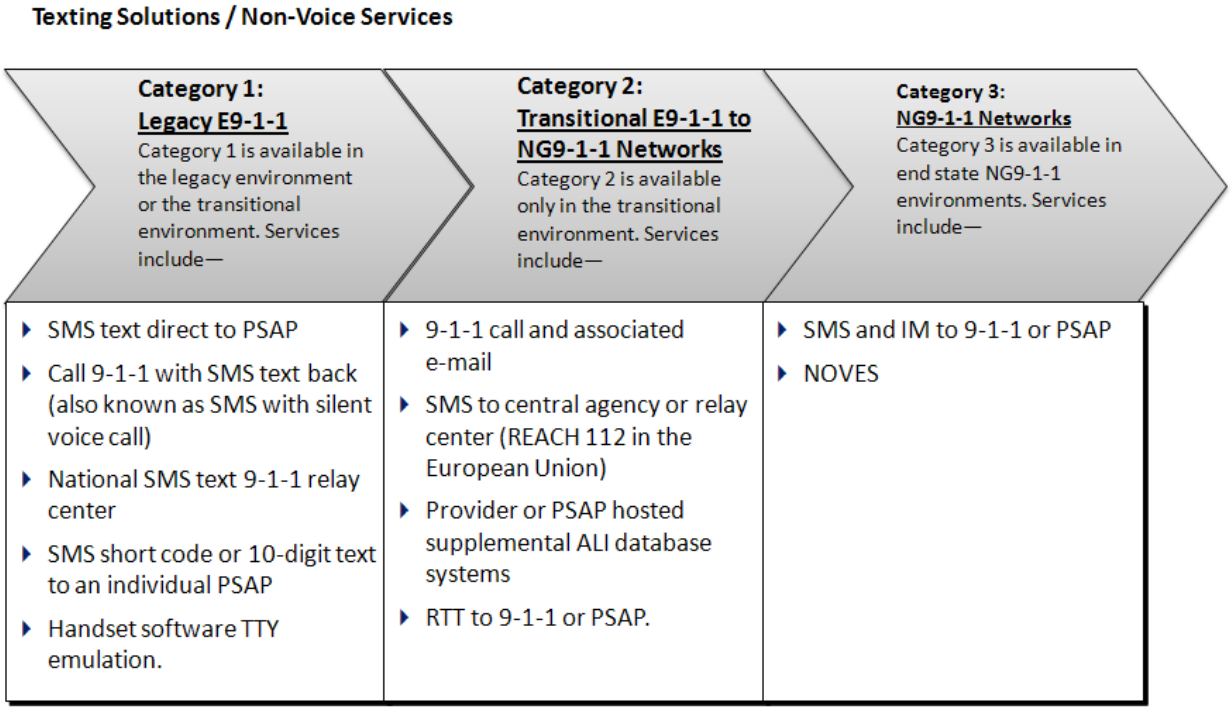

Figure 5-1: Texting Environment

A full description of the services listed in Figure 5-1 and their technical capabilities are contained in Appendix D of this report, in the section entitled Text to 911 Authority Messaging Services.

Existing interim emergency access (9-1-1) solutions via SMS are outlined in Category 1 above are either available from vendor(s) today and/or are in various stages of development, testing, or trials.

5.1.4.1.5 SMS and IM in NG9-1-1—Technical Developments

There has been at least one project focusing on the issue that "Even in the Next Generation 9-1-1 system, an IP/SIP-based emergency communication system, there has been no investigation into how text communications such as Instant Messaging (IM) and Short Message Service (SMS) can be integrated. We identify the technical challenges in the integration of IM and SMS networks with the NG9-1-1 system, and propose a solution for each challenge."[96]

The research and subsequent white paper were done by Verizon and Columbia University, and led to an IETF Internet-Draft.[97]

Although this project describes a possible path forward for one operator's existing SMS and IM services, wireless industry groups have also been working on new messaging methods that could replace SMS and IM at some future point.

The Canadian Radio–Television and Telecommunications Commission (CRTC) Interconnection Steering Committee (CISC) also developed a Report to the CRTC by the Emergency Services Working Group (ESWG) on Text Messaging to 9-1-1 (T9-1-1) Service[98]. The ESWG has identified a potential near-term solution that uses wireless SMS and wireless location technology. Basically, a pre-registered user places a "silent" 9-1-1 voice call. The call is routed to the designated PSAP and location information is made available (using traditional wireless voice 9-1-1 call routing and location capabilities). The PSAP identifies this as a registered "silent 9-1-1 user," and the PSAP initiates and exchanges SMS text messages with the caller to service the emergency response. It was recommended that the ESWG undertake a 12- to 18-month technical trial of the proposed near-term SMS T9-1-1 solution.

5.1.4.1.6 New Technology Solutions for Next Generation Messaging from Service Providers

NOVES, a new service for which requirements are currently being developed in the NENA Next Generation Messaging Group and in the 3GPP SA1 group, is intended to be an end-to-end citizen-to-authority communications method. NOVES may support the following examples of non-verbal communications to an emergency services network:

- Text messages from citizen to emergency services
- Session-based IM type sessions with emergency services
- Multimedia (e.g., pictures, video clips) transfer to emergency services either during or after other communications with emergency services
- Real-time video session with emergency services.

NOVES does not include support for non-human-initiated devices.

In addition to supporting the general public, this capability would facilitate emergency communications to emergency services by individuals who are deaf, hard of hearing and have a speech disability.

---

[96] *Using IM and SMS for Emergency Text Communications*, Available at: http://iptcomm.org/iptcomm2009papers/1569204635.pdf

[97] *Emergency Text Messaging using SIP MESSAGE* (draft-kim-dispatch-text-00), Available at: https://datatracker.ietf.org/doc/draft-kim-dispatch-text/

[98] http://www.crtc.gc.ca/cisc/eng/cisf3e4g.htm

The NENA Next Generation Messaging Working Group is initially focusing on IP-based originating networks (e.g., 4G wireless, and subsequently, other wireless and wireline technologies), that send non-voice messages into an ESInet.

NOVES uses trusted applications in support of non-voice communications between citizens and emergency authorities using real-time session-based text and multimedia messaging. NOVES supports location determination of the reporting device and location transport in a manner similar to next generation emergency voice communications, in addition to providing two-way voice emergency communications between citizens and emergency authorities (e.g., PSAPs). NOVES does not preclude the support of specialized emergency services designed for the deaf, hard of hearing or speech disabled community, including non-support of two-way emergency voice communications.

The NENA Next Generation Messaging Working Group is currently developing use cases and requirements for NOVES, and those requirements are expected to be aligned with those in the ATIS Wireless Technology and Systems Committee (WTSC) and 3GPP SA1, which will be, at some future point, standardizing NOVES.

When 3GPP SA1 completes the requirements for NOVES, other 3GPP groups will determine whether network architecture changes are needed and whether any new protocols (or changes to existing protocols) are needed to support NOVES. When standards are completed, NOVES will represent a potential technical solution for next generation network messaging that will benefit both the general public and the special needs community.

The estimated schedule for 3GPP work includes a possible March 2012 completion date and is located in Appendix C, Section 5, NOVES Schedule and Description. What appears unknown is whether this will be affected (including delayed) by any ATIS or other standards development organization work not found in the 3GPP schedule.

A concern needing resolution when a next generation messaging solution is available involves legacy wireless handsets (those that consumers already have). Because the transition to NG9-1-1 will not be a flash cut, questions arise, for example, about how an emergency text from an LTE handset to a legacy handset will work from a technical perspective. Will the LTE handset text message be processed as a "legacy" store-and-forward text message (no emergency processing, no location, store-and-forward delays, etc.) by the 9-1-1 system? How will it be processed if the carrier network is not yet LTE capable? This concern will need attention and resolution particularly within the wireless industry.

5.1.4.2 Identification of Communication Methods and Procedures to Improve Access in NG9-1-1

The USDOT's *Next Generation 9-1-1 System Preliminary Concept of Operations*, published in December 2005 states "NG9-1-1 changes the core capabilities of emergency services in three areas—(1) types of calls received; (2) ability to transfer/receive calls from PSAPs outside the local region; and (3) capability to accept additional information designed to facilitate emergency services, states."[99]

[99] http://www.its.dot.gov/ng911/pdf/ConOps.pdf, section 2.1

In section 3, it also states, "The public demand for non-tradition telecommunications services is increasing. These services—VoIP, instant messaging, SMS, VRS, telematics, and more—cannot use the [9-1-1] telephone network and consequently cannot access PSAPs. Although voice and TTY text will remain at the core of emergency communications for the near term, nontraditional services will be demanded by the public and can offer new information options for improving response. New devices for callers with disabilities will supplant existing systems, offering improved access to PSAPs and responders."

With the implementation of the NG9-1-1, there is an entirely new list of communication methods to improve access. These methods range from text messaging to social media/ networking. It becomes imperative that the needs of persons with disabilities and those who communicate using languages other than English (Spanish, Chinese, ASL, etc.) are recognized during the transition from traditional E9-1-1 to NG9-1-1. Emergency location and related information that is sent through text messaging, audio relay/VRS, and other means must be transmitted through the networks to the appropriate PSAPs in a format that is readily recognizable and understandable by the call takers. This information must also be transferable to the appropriate local/state/federal/Canadian/Mexican authorities in adjacent (or distant) geographic areas when necessary. Policies and procedures will need to be coordinated and standardized (as best as possible) across jurisdictional boundaries. Similar, appropriate technologies should be employed in all geographic areas to ensure that persons requesting emergency assistance in rural areas can readily access the same services available in urban areas.

Many persons with hearing and/or speech limitations (along with many young persons without disabilities) use text messaging as their primary means of communications. There is a need to ensure that a person initiating a 9-1-1 call through text messaging is aware that his or her message has been received by the call takers. The PSAPs might need to convert text to audio and vice versa to ensure that the "texter" can understand any instructions provided to them by the call takers. Braille keyboards, along with similar text-to-audio capabilities, might improve emergency services access for the blind and vision-impaired community. Adequate funding must be provided, and PSAP staff will need to be trained in the appropriate procedures for handling 9-1-1 calls containing text, video, and/or multimedia data.

Not surprisingly, as weaknesses and limitations in new communications services/devices are discovered, initiatives begin the process of providing fixes. An example is the inability of some devices with video capabilities to present the interactive video so that it is usable for sign language conversations. The University of Washington's MobileASL Project team is working on video compression technology that would allow real-time sign language communication on cellular telephones. Although wireless service providers are upgrading their throughput in metropolitan areas, users outside those upgraded areas will continue to suffer with relatively poor wireless throughput for the foreseeable future. The MobileASL Project has developed a video compression methodology that takes into account the semantics of ASL, resulting in an intelligible ASL conversation, even at lower bandwidths.

Having 9-1-1 call takers better able to communicate with appropriate callers via voice, video, and text, while bringing in interpreters with appropriate skill sets, increases the need and desirability to deliver emergency medical dispatch (EMD) and pre-arrival instructions in languages other than English and methods other than voice, including video and/or text.

Use of smart phone devices to receive a medical instruction "application" should be evaluated. This application could be sent to a 9-1-1 caller with audio and video pre-arrival instructions that could be played or viewed on the caller's device (and would be specific to the victim's medical situation). In addition, if the caller is non-English-speaking, the application could provide those instructions in his/her native language.

There is need to further identify expanded capabilities such as those available in some call centers in Spain, where the 1-1-2 operator can determine the need and call the user back to take full control of the user's handset. Usually, this means turning on the video camera and activating the speakerphone. In situations where the caller cannot speak, the ability to gain more information by listening and seeing what can be seen from the user's device may assist in effecting a response.

The Canary Islands boasts the ability to natively answer 1-1-2 calls in five different languages 24/7/365 in its call center. Languages include Spanish, English, Italian, French, and German. The Canary Islands center believes it is the only center that supports that many languages in its center. There should be some consideration to promote multilingual capabilities within an area with NG9-1-1, such as a team of regional and/or state level language skill set call takers who can be used immediately.

If the categories in IDEA (as listed and referenced in Section 4.5.2) are examined, two common threads can be found: (1) increased education of the public (caller) and (2) specialized training for 9-1-1 call takers and others in the 9-1-1 community.

Table 5-5 lists system, caller, and call taker considerations associated with use of NG9-1-1 by each of the IDEA categories. For all those listed below, when identifying data is provided as part of NG9-1-1 call, the system should be capable of analyzing the data and providing EMD appropriately scripted instructions/procedures.

Table 5-5: Considerations for Use of NG9-1-1 by IDEA Category

Group	System Considerations	Caller Considerations	Call Taker Considerations
Elderly	• In addition to the traditional voice calling services likely to be used by elderly callers, the system must accommodate relay type services that provide to the caller both audio and text of the call taker's conversation in as near real time as possible. • The system must provide call takers with readily available access to social service agencies.	• Elderly callers may be less likely to use newer technologies such as text messaging, e-mailing, social websites, and videoconferencing. • The elderly population must be educated to understand that traditional voice type 9-1-1 services will continue to be provided, and that additional methods of contacting 9-1-1 are available should they choose to use them. • Elderly callers are much more likely than the general population to	• Call takers must receive training specific to the needs of the elderly caller. • Training should include, but not be limited to, providing the call taker with an understanding that members of the elderly access group often having hearing impairments, may have difficulty processing information provided by a fast-speaking call taker, may not be suitable candidates for initiating non-traditional type communications such as text messaging, and

Group	System Considerations	Caller Considerations	Call Taker Considerations
		have disabilities such as deafness, blindness, and the cognitive disabilities often found in the elderly population.	likely will not to be comfortable with social network type communications. • Call takers should be trained to use appropriate social services entities when appropriate. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate. Because the calls may be via a third-party center providing the elderly with a service, call takers should be trained regarding this access method, how to receive appropriate data electronically and/or verbally, and its utilization.
Autism	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.	• Callers and/or their sponsors will be educated in the means by which to ensure that suitable methods of initiating a 9-1-1 call are available to the autistic person, including data-only calls. • Callers and/or their sponsors will be educated to ensure that proper pre-populated data accompanies a 9-1-1 call from an autistic person.	• Call takers should be trained to understand the various types of devices that will be used by autistic persons to contact 9-1-1. • Call takers should all be trained to understand and use data that accompanies a call to 9-1-1 from an autistic person. • Call takers should be trained to use appropriate social services entities for this type disability. • Call takers will have the mechanisms and be trained regarding when it is appropriate to conference in sponsors (family members, caregivers).
Deafness	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's	• Callers should be educated in proper formats/abbreviations to use to ensure accurate communications with call taker.	• Call takers will be trained in various methodologies used to communicate with deaf callers. • Call takers will be trained to use appropriate social

Group	System Considerations	Caller Considerations	Call Taker Considerations
	disability. • The system should have VCO capabilities. *For sign language via interactive video:* • The system should provide video conferencing capability via both a third-party relay service and direct access to the PSAP. • The system should provide automatic call routing of video conference calls to a call taker with the proper skill set to process the call if the data stream provided with the initial call indicates that the caller communicates in ASL (or other sign language). • The system should provide the capability for a call taker to conference into an active call a sign language trained call taker within the system if available.	• Caller should be educated to use the most suitable communications method(s) when available. • The system should allow a caller to supplement a voice call with text. *For sign language via interactive video:* • The system should allow a caller to supplement a video conference call with written text. • The system should allow a caller to initiate a video conference call with an ASL (or other sign language) trained call taker.	services entities for this type of disability. *For sign language via interactive video:* • Call takers who are designated with an ASL (or other sign language) skill set within the system must meet a minimum training standard. • All call takers must be trained and provided the capability to conference in another call taker with an ASL (or other sign language) skill set, which also can be automatically done by the system prior to call answering, similar to linking automatically with a video sign language interpreter.
Emotional Disturbance	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.		• Call takers should be trained to use appropriate social services entities for this type of disability. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate.
Mental Retardation	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.		• Call takers should be trained to use appropriate social services entities for this type of disability. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate.
Multiple Disabilities	• Devices/technology used to deliver calls to the system should, when		• Call takers should be trained to use appropriate social

Group	System Considerations	Caller Considerations	Call Taker Considerations
	available, include data with the call to alert the PSAP regarding the nature of the caller's disability.		services entities for this type of disability. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate.
Orthopedic Impairment	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's impairment/disability.		• Call takers should be trained to use appropriate social services entities for this type of disability.
Other Health Impairment	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.		• Call takers should be trained to use appropriate social services entities for this type of disability. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate.
Specific Learning Disability	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.	• Caller should be educated to use most suitable communications method(s) when available.	• Call takers should be trained to use appropriate social services entities for this type of disability. • Call takers should have the ability to and be trained in conferencing in family members, caregivers, or friends as appropriate
Speech or Language Disability	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability. • The system should provide various means for people with a speech disability to contact 9-1-1. • The system should have HCO capabilities.	• Callers should be educated to use the most suitable communications method(s) when available.	• The call taker will have the capability and be trained in bridging in a speech-to-speech communications assistant with appropriate expertise when applicable. This bridging can also be done automatically as the call is processing prior to answering. • Call taker will be trained to use multiple communication methods as appropriate to properly process call. • Call taker should be

Group	System Considerations	Caller Considerations	Call Taker Considerations
			trained to use appropriate social services entities for this type of disability.
Traumatic Brain Injury	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.		• Call takers should be trained to use appropriate social services entities for this type of disability. • Call takers will be trained in various methodologies used to communicate with members of this access group.
Visual Impairment Including Blindness	• Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability. • The system should provide multiple means by which a visually impaired or blind caller can contact 9-1-1.	• The caller should be educated to use the most suitable communications method(s) when available.	• Call takers should be trained to use appropriate social services entities for this type of disability.
Traditional Verbal Languages	• The system should accommodate traditional voice calls. • The system should accommodate text calls in various languages. • The system should provide for transfer/ conferencing capability to an interactive language interpreting service with voice and text. • The system should provide for transfer/ conferencing of call takers within the system with specific language skill sets. • Language recognition software for text calls and voice calls should be considered at system implementation or when technology permits. • Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the	• The system should accommodate text calls in various languages. • Public education regarding means to indicate preferred language prior to implementing call needs to be initiated.	• Call takers should be trained in transferring/ conferencing calls to a call taker or service with the appropriate language skill set. This can be as simple as clicking or touching a button or tab on a workstation screen. The system may also automatically link to the appropriate interpreter during initial call processing.

Group	System Considerations	Caller Considerations	Call Taker Considerations
	PSAP regarding the preferred language of caller. • When possible, data indicating the preferred language of caller should be used to route call to a call taker with the appropriate language skill set.		
Deaf Blindness	• The system should provide a means through which deaf-blind persons can initiate a 9-1-1 call. • Devices/technology used to deliver calls to the system should, when available, include data with the call to alert the PSAP regarding the nature of the caller's disability.	• The caller should be educated to use most suitable communications method(s) when available.	• Call takers should be trained to understand various methods by which a deaf-blind person may initiate a 9-1-1 call. • Call takers should be trained to use appropriate social services entities for this type of disability.

The various communications services that may be used by those with hearing challenges are listed below—consumers need to be educated regarding which is best to use when, for emergency access, and how best to use them. 9-1-1 personnel need to be trained in the various communications methods in place and how best to interact with callers using the various methods.

1. For people who are deaf and use manual language as their primary mode of communication, solutions having access challenges include—
   - Text-based communication: SMS, RTT, e-mail
   - Video-based communication: video to video
   - Relay services: VRS, IP Relay

2. Late deafened
   - Text-based communication: SMS, RTT, e-mail
   - Relay services: Captioned Telephones, IP Relay
   - Possible VRS using lip-reading skills

3. Hard of Hearing
   - Text-based services: SMS, RTT, e-mail
   - Relay Services: Captioned Telephone, VCO IP Relay
   - Augmented voice communication: volume-controlled telephones, accessible mobile telephones, mobile telephones with coupling

4. Deaf-Blind
   - All of the above
   - Braille systems attached to home telephones

5. For all groups
   - Education of consumers in how to best access 9-1-1
   - Training of call takers in different approaches to working with people who are deaf or hard of hearing.

The common themes throughout this section are (1) develop national operational guidelines and recommendations regarding various communications methods, (2) provide focused public education, and (3) provide focused PSAP training as well as emergency call handling training for the various kinds of interpreters who may be involved.

5.2 Recommendations

There are many recommendations in this section and throughout the document for the FCC and other federal agencies to pursue, in support of the transition to NG9-1-1. However, one reality was clear at the formation of Working Group 4B, namely that 9 months to undertake such a broad topic, was simply an insufficient amount of time to adequately research, analyze, and make recommendations on what is a matter of national importance. This lack of time, coupled with a volunteer working group membership, made it difficult to address more issues and challenges facing the transition process. First and foremost, the FCC should undertake additional advisory panels, similar to CSRIC, with sufficient time to delve into each of the four main topic areas (technology, operations, funding and access) individually. Additionally, while this working group was not charged with a review of governance and policy issues, these issues will be critical to the successful transition to NG9-1-1 and should be studied further.

The following sections address the technologic, operational, funding and access-related recommendations for the transition to NG9-1-1.

5.2.1 Technology Recommendations in the NG9-1-1 Environment

Although technology-related work has been underway in the 9-1-1 community for some time, there is much work that still must be completed to support the technical needs of a transition to NG9-1-1. Both NENA and APCO, along with a host of standards development organizations have been working to establish the technical requirements, system design, network and database needs for the overall NG9-1-1 system. This work must continue and be supported by 9-1-1 stakeholders and additional participation in the technical working groups, committees and standards development should be encouraged.

The Technology Subgroup's recommendations are included as part of the analysis and findings, within Section 5.1.1 of this document. Additionally, a review of current and proposed technology best practices are included in Section 5.1.1.2.3 of this document.

5.2.2 Operational Recommendations in the NG9-1-1 Environment

Much work needs to be done to address the operational issues in the NG9-1-1 environment. A great deal of collaboration will be required to accomplish the work, and strong leaders need to emerge to help with the collaboration.

NENA and APCO as associations have already started to address operational issues. These organizations will play key roles going forward. Both associations should be encouraged to continue their collaborative efforts. More participation on the NENA/APCO joint work groups is encouraged. In particular, state, regional, and local managers and administrators in the 9-1-1 field need to participate. NENA and APCO need to assess as quickly as possible what can be done to increase the efficiency of their committee work process to address next generation issues. In addition, funding for this work should be identified.

States will have an important role in the operation of NG9-1-1. States must have the authority to take decisive action. Today, many states are already taking action, but many others have done nothing to move toward NG9-1-1. In addition, regional coordination among PSAPs is needed within the states. APCO and NENA state chapters may be able to play a role in encouraging this coordination within regions.

5.2.2.1 Overview of PSAP Operational Recommendations in NG9-1-1

Table 5-6 summarizes the operational recommendations identified in this report along with the section where that issue is discussed.

Table 5-6: Operational Recommendations in NG9-1-1

Section	Recommendations
4.3.1.1—Nationwide Call Routing and Transfer	The National 9-1-1 Program Office, as well as other entities, should be considered for the role of establishing and maintaining the National Forest Guide. It may be possible to add PSAP information to the routing tables, and PSAPs could pull this information from the routing databases. A boilerplate MOU for call transfer procedures should be developed. Procedures should be developed by NENA and APCO that consider the full capability of NG9-1-1, and these procedures should be implemented at the state, regional, and local PSAP level.
4.3.1.2—Virtual PSAPs	An assessment of preparation to use virtual PSAPs should be conducted at the regional and local level using the NENA document as a guide.
4.3.1.3—PSAP Personnel Roles and Education	The APCO/NENA task force should complete its work. Much of this training needs to be developed and provided at the local level.
4.3.1.4—Telecommunicator Certification	Certification is usually done at the state level. These certifications need to be updated to include NG9-1-1 standards and may be required to be eligible for federal 9-1-1 funding.
4.3.1.5—Introductory and Continuing Education	APCO, NENA, emergency responders, states, regions, and local PSAPs should be involved in the development of this training.
4.3.1.6—Contingency Planning	PSAP administrators should review and assess their current level of resiliency across their operations. Operational impact analyses should be conducted to identify scenarios in which facilities, systems, equipment, or operations are interrupted or disrupted, and any opportunities for hazard mitigation. As part of the research, the organization should determine continuity requirements and develop strategies based on the requirements, so that a more general continuity plan can be formulated with training, testing, and exercise. Focusing on the impact of interruptions on critical business functions will help define thresholds for minimum/maximum down time.

Section	Recommendations
4.3.1.7—Alternate PSAP Call Processing	During the transition to NG9-1-1, PSAP administrators should develop relationships with PSAPs outside of their normal service jurisdiction in an effort to improve their ability to handle calls in an overflow, backup, or disaster situation. In addition, features within NG9-1-1 will help foster the capabilities available to PSAP administrators to meet these enhanced operational needs. Procedures must be developed that consider the full capability of NG9-1-1, including the rerouting of calls from other PSAPs as a result of overflow, backup, and disaster situations. Intra-agency agreements should be updated to reflect the updated procedures.
4.3.1.8—GIS Based Systems or Applications	With the recent publication of the joint NENA/APCO Human Machine Interface and PSAP *Display Requirements Operations Requirements Document* (NENA 54-750 v1, October 20, 2010), both organizations should foster adoption of these requirements. In addition, the GIS data and NG9-1-1 displays at the local PSAPs will need to be updated to meet these requirements.
4.3.1.9—Multimedia Call Data	The NENA Operations Committee, with APCO participation, should develop the national requirements or American National Standards Institute (ANSI) standards, and the local PSAPs will need to update their SOPs.
4.3.1.10—Text Messaging	NENA and APCO should contact entities that currently use text messaging, such as Internet relay centers, to develop operational guidance to PSAPs.
4.3.1.11—Telecommunicator Workload Impact	Benchmark studies should be conducted to determine whether changes in telecommunicator staffing are needed. NENA should establish updated guidelines for NG9-1-1, and then ask local PSAPs to assess the impact and send the results back to NENA. The National 9-1-1 Program Office and states may have a role in setting 9-1-1 call answering standards. The APCO Project RETAINS (Responsive Efforts to Assure Integral Needs in Staffing) report is a nationally recognized and recently updated document that could be used in this effort.
4.3.1.12—Visual Impact of Calls	NENA's Post-Traumatic Stress Disorder working group should complete its work. Local PSAP human resources departments should revise their pre-hire screening practices and engage in regular stress evaluations of all telecommunicators to gauge the effect multimedia calls may be having on them. Appropriate services and support should be provided.
(Corresponds to Issue 4.3.1.13—Human Resource Management)	NENA and APCO should develop standards, which should be implemented at the state, regional, and local PSAP levels.
(Corresponds to Issue 4.3.1.15—Virtual PSAP Resource Management)	The NENA Operations Committee, in concert with the appropriate APCO committee, should develop the national requirements or ANSI standards, to be implemented at the state, regional, and local PSAP levels.

5.2.2.2 Overview of System Operational Recommendations in NG9-1-1

Table 5-7 summarizes the system operational recommendations identified in this report along with the section where that issue is discussed.

Table 5-7: System Operational Recommendations in NG9-1-1

Section	Recommendations
4.3.2.1—Expanded 9-1-1 Authority Responsibility	The 9-1-1 community will need to raise awareness of the shortage of personnel. The APCO/NENA NG9-1-1 task force would be an appropriate group to work on this issue.
4.3.2.2—Educating 9-1-1 Authorities and Other Stakeholders	9-1-1 authorities, working cooperatively with the statewide 9-1-1 coordinators, should have the responsibility to educate themselves, through educational opportunities offered by the National 9-1-1 Program Office, NENA, and APCO.

Section	Recommendations
4.3.2.3—IP-Based System Administration	A list of skills that will be necessary should be developed. The APCO/NENA NG9-1-1 task force would be an appropriate group to work on this issue.
4.3.2.4—System Operations Roles and Responsibilities	Models of consortium arrangements and governance should be identified by NENA and the National 9-1-1 Program Office.
4.3.2.5—State-level 9-1-1 Leadership and Coordination	NASNA, APCO, and NENA should identify the list of needed elements.
4.3.2.6—Transitional Regulation, Legislation, and/ or Tariff Modifications	FCC should work with NARUC, and NCSL to evaluate regulations, legislation, and tariffs to identify needed modifications.
4.3.2.7—9-1-1 Institutional Responsibility Consolidation	The CSRIC 1A Working Group report should be reviewed.
4.3.2.8—Public Education and Awareness Programs	No public education programs about NG9-1-1 exist today. The APCO/NENA NG9-1-1 Education work group should complete its work. The National 9-1-1 Program Office, NENA, and the National Governors' Association are some of the agencies that should be involved in development and distribution of the nationwide message.
4.3.2.9—Fostering Private-Public Policy Stakeholder Support	This issue should be addressed through a collaborative effort at the national, state, regional, and local levels. The National 9-1-1 Program Office and the National Governors' Association should work with the states to ensure that the education takes place at the regional and local levels.
4.3.2.10—Certification of Service Delivery	NENA, APCO, and ATIS need to develop certification requirements. The state and local levels will be tasked with implementing the operational requirements. Service providers and 9-1-1 agencies must coordinate the certification of services delivered to PSAPs.
4.3.2.11—PSAP Minimum Criteria and Certification	The development of actual defined requirements at the state and local levels should be based on baseline operational requirements developed by NENA, APCO, and the National 9-1-1 Program Office.
4.3.2.12—NG9-1-1 Technical Training	NENA should continue with establishing a work group. The work group should conduct an assessment of the technical training available through private vendors on the systems, databases, and networks associated with NG9-1-1.
4.3.2.13—NG9-1-1 Management Training	APCO and NENA should work on with establishing a work group.
4.3.2.14—Call Distribution Policy Rules	A NENA joint data committee should develop a white paper on suggested detailed policy rules.
4.3.2.15—Multi-Agency Business Rules	NENA's Next Generation Transition Planning Committee may be best suited to developing recommendations and guidance for 9-1-1 Authorities as they develop SOPs, expanded mutual aid, and intra-agency agreements.
4.3.2.16—System Logging Requirements	Vendors should complete their development according to the NENA standards.
4.3.2.17—PSAP Geographic Coverage Area Management	One group that may have an important role in this process is the National Alliance for Public Safety GIS (NAPSG) [http://www.publicsafetygis.org]. Established in 2006, the NAPSG is a consortium of national public safety organizations focused on the importance of geospatial technologies that support public safety and homeland security. The NAPSG has developed a GIS data model template to support standard disaster-related fire operations at the local level. 9-1-1 Authorities should identify best practices within their local, region, state (or other states) that can be used as a model when developing and maintaining PSAP geographic coverage areas and reconciling boundaries.
4.3.2.18—Location	A NENA committee and perhaps the NAPSG should work to identify

Section	Recommendations
Validation and Call Routing Databases	appropriate processes to provide this functionality. 9-1-1 Authorities should follow the recommendations made by these entities.
4.3.2.19—Integrated Data Error Correction Process	The NENA Technical Committee in conjunction with the APCO Data Transfer Committee should develop one standard database interface at the PSAP that can support multiple databases.
4.3.2.20—9-1-1 Virtual PSAPs 9-1-1 Authority Responsibilities	The NENA Operations Committee should monitor implementations of virtual PSAPs, and evaluate and summarize the experience. A user or focus group of representatives of PSAPs that have implemented virtual PSAPs should be formed.
4.3.2.21—9-1-1 Contingency Planning 9-1-1 Authority Responsibilities	9-1-1 Authorities should use the APCO/NENA Service Capability Criteria Rating Scale to assess the validity and completeness of their continuity of operations for PSAPs within their authority. In addition, the NFPA 1600 standard addresses methodologies for defining and identifying risks and vulnerabilities, and provides planning guidelines that will assist 9-1-1 Authorities in development of a comprehensive continuity of operations program.

5.2.3 Recommendations on Funding the NG9-1-1 Environment

Individual state or local laws vary widely regarding "in scope" or "out of scope" 9-1-1 costs, so there is no single set of eligible costs nationally. For example, New York does not allow state grant money to be used for salaries but these funds can be used for training on customer premise equipment (CPE), CAD equipment, and EMD procedures. North Carolina prohibits the use of state funds for real estate, salaries, or vehicles but does allow the lease, purchase, or maintenance of emergency telephone equipment, including necessary computer hardware, software, and database provisioning, addressing, and nonrecurring costs of establishing a 9-1-1 system; telecommunicator furniture; dispatch equipment located exclusively within a building where a PSAP is located; and the nonrecurring costs of establishing a 9-1-1 system, among other items.

One approach is to generally fund anything "within the four walls" of the PSAP that is required for PSAP operations. Another approach is to fund only the "core services" required for PSAP operation. In any case, the decision to allow or disallow particular items has traditionally been made at the state/local or PSAP level. Because it is impossible to determine a finite list of eligible costs today, the subgroup uses the term "core services" to describe those services and functions that it suggests should be considered as eligible for NG9-1-1 funding.

For an undefined period of time, legacy systems will have to operate during the transition to next generation services. Funding of these legacy system costs will have to be maintained during, through, and even for a period of time after the transition. While many of the cost categories associated with legacy 9-1-1 will carry over to NG9-1-1, there will also be a number of new or modified costs. Because NG9-1-1 funding may become more federally based as the Federal Government connects to and relies more on the PSAPs for incident notification and monitoring, there may eventually become a federal core services list that enumerates exactly what can be funded with federal contributions. Until an overarching list is developed, there will continue to be significant variation across the country regarding the definition of core services.

The USDOT NG9-1-1 System Initiative *Preliminary Analysis of Cost, Value, and Risk*[100] characterizes the general cost categories as—

- **System Costs**—Voice/data network, selective routing, ALI database equipment, ALI data links by PSAP, dynamic update (by MPC/VPC vendor and ALI server), central system DBMS, security costs
- **PSAP Costs**—Hardware and software used by the PSAP to receive and transfer incoming data. Includes CPE costs and interfaces, but not Public Safety dispatch/responder systems or related expenses
- **Data Services (with GIS)**—Data management equipment, local DBMS software, cost of GIS database, mapping system, base layer data, any provider costs for telephone number subscriber extraction records, security costs, application software costs
- **Personnel**—*In Scope*: PSAP staff and management, system administrators, system operators, DBA, 9-1-1 Authority. *Out of Scope*: dispatchers/responders.

Given the lack of a unified set of legacy core services, it is difficult to create a finite list of what should and should not be funded under NG9-1-1. In the following sections, however, the subgroup does identify a number of items that should be high on the list for funding consideration using the same categories as outlined in the USDOT document. This is not a comprehensive list of all items that could be or even should be funded. The funding source, whether federal, state, or local, will need to provide clear guidance on appropriate uses of the funds.

5.2.3.1 Eligible Uses of Funding

In this section, the Funding subgroup provides its recommendations for eligible uses of NG9-1-1 funding. The section addresses implementation costs, transitional costs and maintenance costs including examples of what might be considered.

5.2.3.1.1 Implementation Costs

Clearly, a broadband network must be established to carry NG9-1-1 communications. In some instances, a local or state IP network can be leveraged to minimize or share the expense but it will most likely need to be extended or otherwise modified to serve the covered PSAPs. In any event, the initial design and deployment costs should be anticipated in the implementation cost estimate. There will also be some security, control, and monitoring functions that accompany the network and are critical to its creation and maintenance. Table 5-8 lists core implementation costs and is delineated by National level costs, and potential state or PSAP, data and personnel level costs.

Table 5-8: NG9-1-1 Implementation Costs

Cost	Recommendation
National-Level Costs	National Forest Guide, PSAP Certification Agency, National ESInet backbone must be deployed; IP networks, backup power, physical security, storage capabilities, integration with legacy systems.

[100] http://www.its.dot.gov/ng911/pdf/NG911_FINAL_PreliminaryCostValueRiskAnalysis_v2.0_021208.pdf

Cost	Recommendation
	Policy development, planning and system architecture for interstate and international routing for high-level network architectures that interoperate and effectively handle call routing will be necessary.
State-Level Costs	Management and oversight of new IP networks and integration of legacy systems will be an essential function of states and regions in NG9-1-1. Planning and system architecture for statewide or regional networks that interoperate will be necessary. State Emergency Services Routing Proxy (ESRP), State Emergency Call Routing Function (ECRF), State Border Control Function (BCF), State ESInet backbone must be deployed; IP networks, backup power, physical security, storage capabilities, integration with legacy systems.
PSAP Costs	Computers, backup power, physical security, and similar items currently required for legacy PSAPs will need to be reviewed and potentially updated to handle NG9-1-1. PSAP managers will face new tasks concerning exactly what data will be displayed on the call taker screens versus what data will simply pass through the PSAP to the first responders. Avoiding data overload while providing robust data sources to responders will require coordination with all agencies involved.
Data Costs	Data retrieval, formatting, and storage capabilities will be much more vital under NG9-1-1 and will most likely need upgrades in capabilities and capacity. Ongoing maintenance of GIS and other legacy systems, such as logging recorder data and legacy ALI/MSAG data, will continue to be a necessity in the implementation phase. In addition, revamping a GIS data set will require significant effort on the part of the PSAP to prepare for the transition to NG9-1-1, which is data rich and inherently reliant on GIS data to fulfill its location functions. This overhaul is a huge endeavor, and the PSAP or system planners should not minimize its importance and the time it will take to accomplish. Outreach efforts to other sources of data (hospitals, HAZMAT facilities, banks, traffic cameras, and any other source of data that the PSAP wants to use during emergency response) will require significantly more effort and resources than before. Considerable effort may also be required to address the confidentiality of both externally and internally generated data, and handling requirements for the data and processes related to how to handle public requests for access to data because some information used in response to incidents may be business confidential or sensitive from a homeland security perspective.
Personnel Costs	PSAP personnel will certainly need some additional training on the new equipment, functionality, and capabilities of NG9-1-1. The transition will also drive a need for new or revised policies and procedures for both the PSAP personnel and the responders (police, fire, and medical but also responders such as emergency management that depend on the 9-1-1 system in their activities). PSAP technical support staff will also require expanded skills and capabilities to perform their jobs appropriately in the NG9-1-1 environment. Training, both at the implementation stage and the transition stage of NG9-1-1, will increase costs at the PSAP. New equipment, new policies, and new procedures all add training elements, and training costs money. This factor, however, should not be ignored, and dedication to planning and conducting a high-quality and appropriate training program will be essential to the successful NG9-1-1 transition.

5.2.3.1.2 Transitional Costs

Nearly all the elements in a next generation environment will be an additional cost. While collaboration with new partners to share infrastructure will provide opportunities to share costs, there will be additional and new costs to contend with both through the transition stage of next generation implementation and on an ongoing maintenance basis. The i3 diagram in Figure 5-2

below, offers a view of the envisioned as system cost elements. The ESInet is the IP network (or within a more general IP network) dedicated to emergency service use; "i3" is the functional components (software and databases) that run on the ESInet, and NG9-1-1 is all of that and more, including the human procedures that control all of it. Table 5-9 presents the core transition costs. This table is also delineated by National level costs, and potential state or PSAP, data and personnel level costs.

Table 5-9: NG9-1-1 Transition Costs

Cost	Recommendation
National-Level Costs	Resources will be required to establish the necessary national and international policies to govern the NG9-1-1 transition, planning and management of the national and international components of transitioning the legacy systems to NG and establishing the appropriate security controls to protect the integrity of the NG systems.
State-Level Costs	States must manage transitions to NG9-1-1 according to a comprehensive plan, which will involve oversight and coordination activities; State or regional resources will be required to establish the necessary statewide and regional policies to manage the transition to NG9-1-1, planning and management of the statewide components of transitioning the legacy systems to NG as well as establishing the appropriate security controls to protect the integrity of the statewide NG systems.
PSAP Costs	While it has been observed that less 9-1-1 specialized equipment used by the PSAP personnel will be required in NG9-1-1 and more off-the-shelf and commonly available equipment will be used, there is no question that a large percentage of the equipment used today will be replaced to properly transition to NG9-1-1. However, costs for legacy equipment that will continue to be used during and for some time after transition, as well as the cost for any new functionality, will need to be added to the PSAPs' cost model.
Data Costs	Rebuilding or modifying data files for new systems is generally time intensive and costly. In all likelihood, this experience will be replicated in a legacy-to-next generation transition as well. 9-1-1 support systems are heavily data reliant for caller location information, resource allocation, events in proximity, vehicle tracking, other GIS-related information, etc. Given the anticipated increase in data associated with each call, PSAPs and first responders may find it more efficient to maintain all data on a consolidated system rather than continuing to use the separate data storage and incident reporting systems that are common under legacy 9-1-1. In the next generation environment, many new partnerships will provide the services or integrate the "network of networks" that will become NG9-1-1. Because of these new partners and the ability of the 9-1-1 system to be a part of larger systems, there will also be a migration from contract-specific and proprietary services from a single provider to subscription services with many providers or entities. This transition to subscription services will increase the flexibility and options available to 9-1-1 and should, theoretically, drive down costs.
Personnel Costs	Project management will be a critical function to the implementation of and transition to NG9-1-1. The legacy system must continue to operate until the cutover to NG9-1-1 can occur. This activity will drive a very intense period of activity across a number of functional areas. Testing each subsystem and ensuring they all work together as planned will consume considerable man-hours. Training PSAP personnel on the new tasks associated with NG9-1-1, and working with emergency responders to ensure they understand the changes and are ready to receive and use the enhanced data available under NG9-1-1 will likewise take a concerted effort across these agencies. The transition will also drive additional legal and administrative workloads as policies and procedures, mutual aid agreements, data access and sharing agreements, and other items will need review and updating.

5.2.3.1.3 Maintenance Costs

Many PSAP maintenance costs are covered today under current funding mechanisms and normal operational costs. However, NG9-1-1 will introduce new equipment, network elements, data storage, and other associated costs. The increased level of technical sophistication of NG9-1-1 equipment and networks compared with legacy systems may also drive PSAPs to hire people with new or enhanced technical skills or contract with outside entities for these services. In reality, there are maintenance costs associated with the implementation and transitional phase of transition to NG9-1-1. For discussion purposes, however, these costs have been separated out for more clarity in presentation. Table 5-10 presents the core maintenance costs delineated by National level costs, and potential state or PSAP, data and personnel level costs.

Table 5-10: NG9-1-1 Maintenance Costs

Cost	Recommendation
National-Level Costs	Forest Guide, national backbone and CERT have ongoing maintenance and service costs. Costs associated with the ongoing maintenance of the national components of NG9-1-1 will require new funding mechanisms as this is a new element of the emergency communications network.
State-Level Costs	ESRP, ECRF, BCF and state ESInet backbone have ongoing maintenance and service costs. Some states currently operate, pay for or maintain portions of the existing legacy systems and those costs will remain a state cost until these systems can be removed from operation. The period of time they may be in place is an unknown at this time. It is anticipated and encouraged that states will attempt to transition as quickly as funding will allow. However, until new systems are appropriately tested and their function is evaluated, these legacy systems and their associated costs will remain as a cost to the state. In addition to the state's legacy costs, funding for statewide next generation costs will also be required. Thus, for some time, the costs of our 9-1-1 system will escalate while parallel systems are in operation.
PSAP Costs	Legacy systems used by the PSAP will remain a cost until these systems can be removed from operation. The period of time they may be in place is an unknown at this time. Most PSAPs will attempt to transition as quickly as funding will allow. However, until new systems are appropriately tested and their function is evaluated, these legacy systems and their associated costs will remain. In addition to the legacy costs, funding for next generation costs will also be required. Thus, for some time, the costs of our 9-1-1 system will escalate while parallel systems are in operation.
Data Costs	Ongoing data maintenance of legacy ALI and other traditional support systems for E9-1-1, as well as new data-rich functions, GIS, and other support data systems, will continue to be required in a next generation system.
Personnel Costs	The ongoing staffing costs that are traditionally part of a 9-1-1 operation will remain part of the cost of doing business. Recruitment and retention will need to be examined as the transition to next generation services progresses to determine whether a new skill set is required for PSAP personnel. Important factors for the NG9-1-1 manager will include how recruitment programs will need to change to attract the proper caliber of individual with the necessary set of skills to effectively manage the job of call taker or dispatcher in a next generation environment, as well as how the work environment, supervision, and training may need to be modified in a next generation PSAP. The following three examples provide a minimum set of costs for a high-level list of core services that might be considered for funding with NG9-1-1 resources. As previously mentioned, it is impossible to create a finite list of items that should be covered by NG9-1-1 funding because the local and regional nature of 9-1-1 laws does not provide the

Cost	Recommendation
	level of consistency necessary to draw such conclusions.

US DOT, Next Generation 9-1-1(NG9-1-1) System Initiative, Final Analysis of Cost, Value, & Risk, March 5. 2009, Version 1.0.[101]

System Costs: Voice/Data network, Selective Routing, ALI Database Equipment, ALI data links by PSAP, dynamic update downloads (by Mobile Positioning Center/VoIP Position Center [MPC/VPC] vendor and ALI server), central system database management system (DBMS), and security costs.

PSAP Costs: Hardware and Software used by the PSAP to receive and transfer incoming data. Includes CPE costs and interfaces but not public safety dispatch/responder systems or related expenses.

Data Services (with GIS): Data management equipment, local DBMS software, cost of GIS database, mapping system, base layer data, any provider costs for telephone number (TN) subscriber extraction records, security costs, and application software costs.

Personnel:

In Scope:	PSAP staff and management, System Administrators, System Operators, Data Base Administrator (DBA), 9-1-1 Authority
Out of Scope:	Dispatchers/Responders

SOURCE: North Carolina 9-1-1 legislation related to funding:

SECTION 7.(c) G.S. 62A-46(c) reads as rewritten:
"(c) Use of Funds.—A PSAP that receives a distribution from the 9-1-1 Fund may not use the amount received to pay for the lease or purchase of real estate, cosmetic remodeling of emergency dispatch centers, hiring or compensating telecommunicators, or the purchase of mobile communications vehicles, ambulances, fire engines, or other emergency vehicles.

Distributions received by a PSAP may be used only to pay for the following:
(1) The lease, purchase, or maintenance of emergency telephone equipment, including necessary computer hardware, software, and database provisioning, addressing, and nonrecurring costs of establishing a 9-1-1 system of: SL2010-0158 Session Law 2010-158 Page 5
a. Emergency telephone equipment, including necessary computer hardware, software, and database provisioning.
b. Addressing.
c. Telecommunicator furniture.
d. Dispatch equipment located exclusively within a building where a PSAP is located, excluding the costs of base station transmitters, towers, microwave links, and antennae used to dispatch emergency call information from the PSAP.
(1a) The nonrecurring costs of establishing a 9-1-1 system.
(2) Expenditures for in-State training of 9-1-1 personnel regarding the maintenance and operation of the 9-1-1 system. Allowable training expenses include the cost of transportation, lodging, instructors, certifications, improvement programs, quality assurance training, and training associated with call taking, and emergency medical, fire, or law enforcement procedures, and training specific to managing a PSAP or supervising PSAP staff. Training outside the State is not an eligible expenditure unless the training is unavailable in the State or the PSAP documents that the training costs are less if received out-of-state. Training specific to the receipt of 9-1-1 calls is allowed only for intake and related call taking quality assurance and improvement. Instructor certification costs and course required prerequisites, including physicals, psychological exams, and drug testing, are not allowable expenditures.

[101] http://www.its.dot.gov/ng911/pdf/USDOT_NG911_4-A2_FINAL_FinalCostValueRiskAnalysis_v1-0.pdf

SOURCE: THE FUTURE OF 9-1-1: NEW TECHNOLOGIES AND THE NEED FOR REFORM , Phillip J. Weiser, Dale Hatfield, & Brad Bernthal, June 5, 2008[102]

-Procurement/Purchase of Hardware/Software to handle 9-1-1 PSAP infrastructure/building
-Recurring Trunks/Network (9-1-1 & Admin)
-CAD (Computer Aided Dispatch)
-Records Management
-MSAG
-ALI Database, Addressing, Project Management, Consulting
-Training, Salaries
-Public Education

The Funding Subgroup recommends a tiered approach to determine which cost elements receive support from particular funding streams. The Federal Government will be involved in NG9-1-1 more than it has been in legacy 9-1-1 systems because NG9-1-1 offers a wide range of information sharing, situation monitoring, and forecasting opportunities. Thus, the Federal Government should determine what infrastructure, equipment, and services it should logically provide to deploy and maintain these capabilities. State or regional 9-1-1 authorities should likewise determine which items are best established and maintained to maximize efficiency and minimize overall costs, and then provide funding for these items. PSAPs would then be well positioned to determine what elements they need within the four walls of the PSAP to provide the desired level of service. This approach allows all levels of government involved in the provision of emergency services to focus their efforts on the items most valuable to them within the overall system and minimizes duplication of efforts, and costs.

5.2.3.1.4 Next Generation Cost Elements

As another approach for evaluating cost eligibility, the Funding Subgroup examined the elements of a NG9-1-1 system and established a methodology for determining eligibility. Figure 5-2, the NENA NG i3 9-1-1 Network diagram, illustrates, at a high level, the various components of the future service. It is important to remember that while this diagram represents a next generation network, all the currently operational legacy 9-1-1 system elements are still required, will continue to be needed functionally, and will concurrently have maintenance and ongoing operational costs even while implementation and transition to a next generation system occur.

[102] Phillip J. Weiser, Dale Hatfield, and Brad Bernthal. *The Future of 9-1-1: New Technologies and the Need for Reform*, Journal of Telecommunications and High Technology Law, Vol. 6, No. 2, June 5, 2008, University of Colorado Law School. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1146803

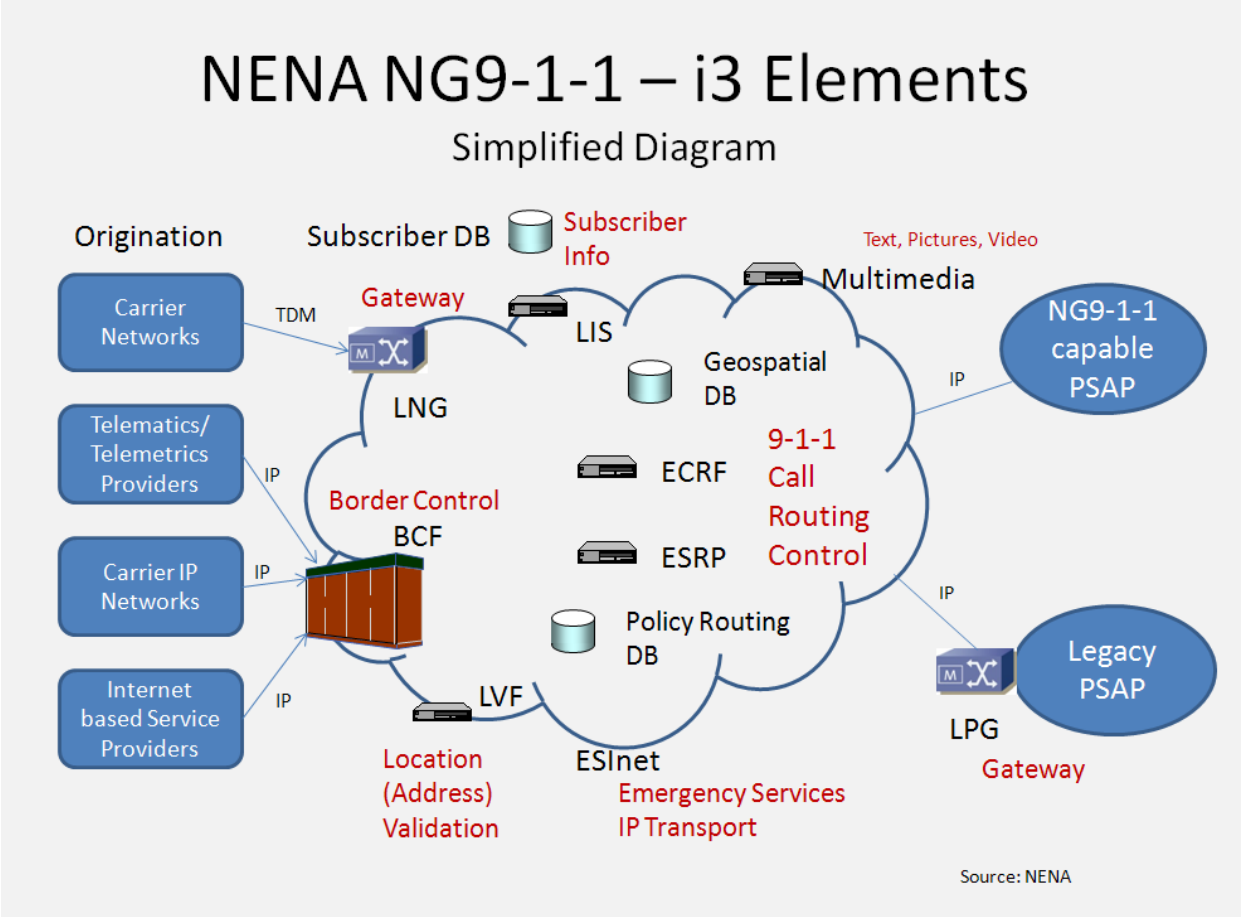

Figure 5-2: NENA i3 Architecture for NG9-1-1 Transition

It is important to keep in mind the concept that databases, functions, processes, and networks all make up NG9-1-1. These components, coupled with the personnel and policy administration in the PSAP, are what make up the NG9-1-1 system. It is the belief of the Funding Subgroup that *none* of the elements in the NG9-1-1 environment should be precluded from funding consideration at this time.

Local authorities will be responsible for both the costs associated with operating the existing legacy 9-1-1 system as well as their portion of the new NG9-1-1 system for some period of time while transition is in process. Serious planning needs to take place to keep the transition period as short as possible without degrading service in order to minimize the costs during transition

There will also need to be gateways that bridge between legacy E9-1-1 selective routers, PSTN telephone networks, and legacy PSAP equipment and the new NG9-1-1 system. In some cases, such as with the legacy selective router gateway, the gateway is only needed for the transition itself, after which it is no longer required. Legacy PSAP gateways will be needed until a PSAP upgrades to NG9-1-1. Legacy network gateways will be needed until an origination network upgrades its switch to have NG9-1-1 interfaces. Who has to pay for these gateways remains a vexing problem—do the entities that do their own upgrades have to pay for gateways for the legacy systems that do not upgrade, or do the legacy systems that have not asked for anything to change, but see other PSAPs and networks upgrade around them have to pay for the gateways they need to remain part of the transitioning system?

5.2.3.2 The Need for Predictable and Sustainable Sources of Support

This section discusses need for support mechanisms that are both predictable and sustainable and calls for national leadership to address the issue of fund diversion or raiding along with development of a comprehensive NG9-1-1 planning strategy.

5.2.3.2.1 9-1-1 Is a Reasonable Expectation

The ability to initiate an emergency communication request for help is a reasonable expectation of citizens of this country. This ability to have access to emergency services should be independent of the network and access technologies deployed or the physical abilities of the citizen. It is by design that the Enhanced 9-1-1 Act states: "For the sake of our Nation's homeland security and Public Safety, a universal emergency telephone number (9-1-1) that is enhanced with the most modern and state-of-the-art telecommunications capabilities possible should be available to all citizens in all regions of the Nation."[103] However, many locations throughout this nation do not have access to 9-1-1. In some of the most rural areas, on some of the Native American lands, and in some of the poorest areas of the country, no 9-1-1 system exists. As planning begins for an NG9-1-1 system, it is essential to ensure that if communications services are available, 9-1-1 is as well. While this level of access to Public Safety services is essential for everyone, nowhere is it more important than for the people who are deaf or have a hearing loss. If people who are deaf or have a hearing loss are communicating by text and that is available in some areas but not in others where they have communication services, then the basic tenets of the Americans with Disabilities Act has not been adequately addressed. If they can text, they should be able to communicate with 9-1-1.

NENA estimates that 99 percent of the US population has access to some form of 9-1-1 service in 96 percent of the counties or parishes.[104] The map of the United States shown in Figure 5-3 illustrates an example of pockets of the nation where 9-1-1 service is not available or where there are disparate levels of 9-1-1 or E9-1-1 service. Where there is no 9-1-1 funding or state coordination, the level of 9-1-1 service is fragmented and in some cases non-existent. The Funding Subgroup concludes that there is a direct link between the level of 9-1-1 funding and statewide coordination and the provision of 9-1-1 service to the citizens. The subgroup does not propose that landline or wireless communication service should be made available everywhere even if there is no commercially beneficial rationale for implementing such services—that would not be prudent or fiscally responsible. What the subgroup does recommend is that if a citizen has communication service, he or she should have access to 9-1-1 as well, and transitioning to the next generation system is an appropriate time for that to occur.

[103] Sec. 102(1)
[104] http://www.nena9-1-1.org/911-statistics

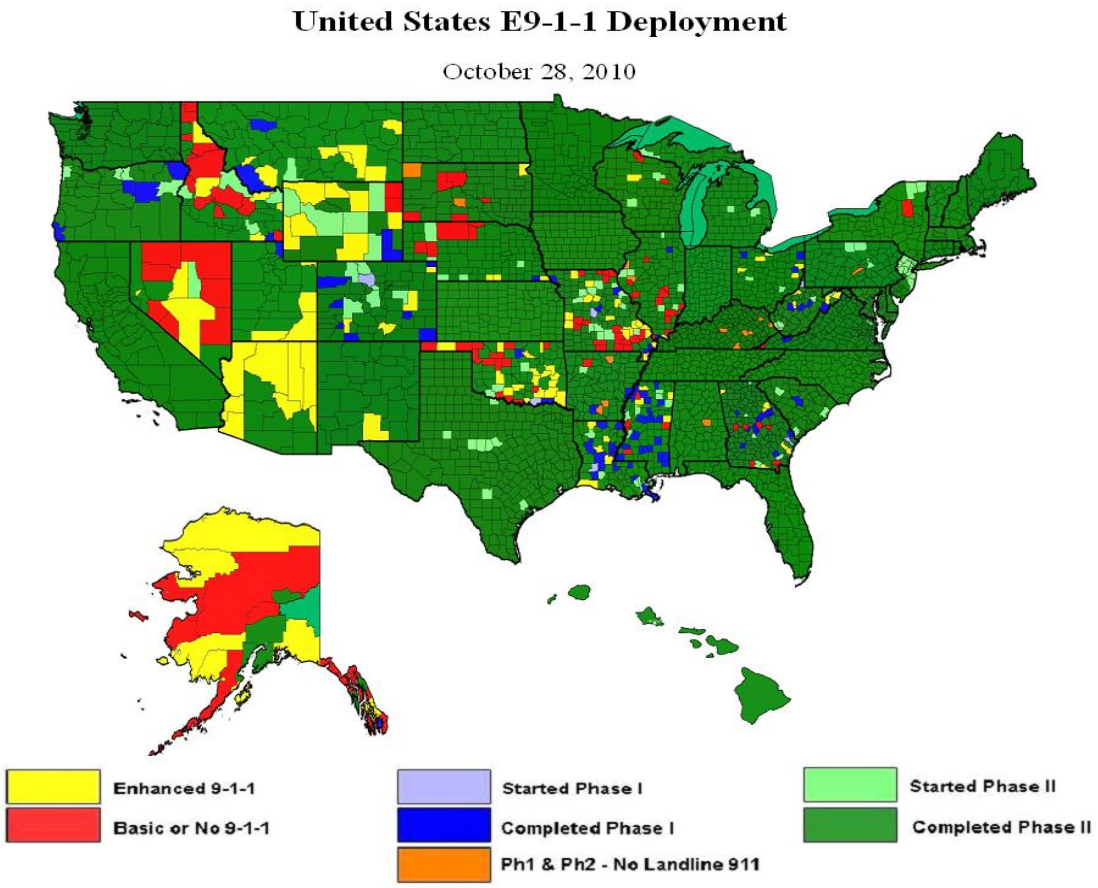

Figure 5-3: Deployment of E9-1-1 in the United States[105]

5.2.3.2.2 9-1-1 Service Is a "Public Good"

Flowing directly from this national policy position, it is understood that NG9-1-1 service is a "public good" that, in turn, calls for public funding that is specific, predictable, and sufficient. Although such funding will be designed in the context of economic and political realities, the achievement of this important public policy goal cannot be allowed to be impeded by current political or economic conditions. The role of government, rightfully, is to protect its citizens. Because the outcome of an emergency call or request for assistance could be the difference between life and death, the only legitimate question is: Does this essential *government* service "work" for its citizens as intended? Without adequate funding, and the political will to ensure it, the reasonable expectation of citizens as articulated above becomes a hope—not a policy.

Regardless of the funding sources, many agree that effective access to emergency services is a "public good" that benefits all citizens, although most will never need to call 9-1-1. Essential government services, by definition, often include fire and police services. Including 9-1-1 services in the state's legal definition of "essential government service" is one option available to policymakers to prevent any future NG9-1-1 fund diversion.[106]

[105] NENA and DDTI. 9-1-1 Deployment Reports and Maps. Available at: http://nena.ddti.net/
[106] National Conference of State Legislatures, Next Generation 9-1-1, Robert Boerner, July/August 2010, Vol. 18, No. 28. Available at: http://www.county.org/resources/news/pdf/911Briefing.pdf

5.2.3.2.3 Funding Sources Must Be Predictable and Sustainable

In some cases, current funding structures are insufficient to sustain even current 9-1-1 systems, while in other cases, so much money is collected that it is the target of raiding by some states and some locales to balance economically challenged budgets. In some situations, states have had to override local authority to equalize collections to ensure sufficient, predictable funding.

One area where many states and 9-1-1 jurisdictions have fallen short in the predictability and sustainability of 9-1-1 support is in the area of collection of fees or surcharges related to prepaid cellular service. Prepaid services are becoming the service of choice because wireless subscribers are tending not to renew their long-term contract commitments to their carriers and opting for a "bucket of minutes" approach. While desiring to stay with their current carrier, they are not likely to tie themselves to a service contract for a 1- or 2-year period. Thus, prepaid service has become more attractive by allowing the subscriber more flexibility as technology or service trends change. It allows them more opportunity to take advantage of service improvements while keeping closer control of their financial situation in a "pay as you go" type of model. States and 9-1-1 Authorities should be encouraged, and perhaps even assisted, with models that will seek to collect the appropriate level of 9-1-1 support in a retail POS circumstance. Collaboration with both the retail industry and the wireless carriers serving in the region has proven to be an effective means of collectively crafting legislation or regulation that ensures proper 9-1-1 support collections. It is essential that all states or 9-1-1 Authorities address this lapse in 9-1-1 support.

Changes in consumer communication preferences and different technology choices used by the public should not affect revenue; however, without predictable and sustainable support mechanisms that are not reliant on one specific service type, this vulnerability in 9-1-1 funding is experienced in many jurisdictions. The funding for 9-1-1 needs to be reliable and sustainable.

5.2.3.2.4 9-1-1 Fund Diversion or Raiding Should Be Prohibited

Diversion or raiding of 9-1-1 funds by states or local jurisdictions must cease. Collecting fees or surcharges from the public as a 9-1-1 fee and then using those collections for other purposes is disingenuous and deceitful to the public. Sound account management practices call for transparency and accountability in the collection of funds by government, and such fiscally responsible actions related to 9-1-1 funds is vital to the people's trust in their government.

Because it is not just states that might divert or raid 9-1-1 funds but local jurisdictions as well, the Funding Subgroup supports any and all efforts to prevent this practice and suggests that raiding should be prohibited by every level of government.

The establishment and enforcement of standards may be another way government can be held accountable for use of the funds collected in the name of 9-1-1. Federal funding for NG9-1-1 should be contingent on standards that may be called for in a national NG9-1-1 transition plan[107] and should further be contingent on the state or 9-1-1 Authority's appropriate use of 9-1-1 funds.

[107] "Even when collected, subscriber fees are often diverted by State government to pay for programs and projects unrelated to 9-1-1. It is recommended that State 9-1-1 Authorities should not be allowed to procure necessary equipment enabling the transition to NG9-1-1 unless 9-1-1 fees are preserved." The National E9-1-1 Implementation Coordination Office, *A National Plan for Migrating to IP Enabled 9-1-1 Systems*, September 2009. Available at: http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf

5.2.3.2.5 Call for a National Next Generation Plan and Strategy Should be Established and National Leadership is Essential

In the *New and Emerging Technologies 9-1-1 Improvement Act of 2008 (NET 9-1-1 Improvement Act),* Congress tasked the National E9-1-1 Implementation Coordination Office to develop "a national plan for migrating to a national IP-enabled emergency network capable of receiving and responding to all citizen-activated emergency communications and improving information sharing among all emergency response entities."[108]

A comprehensive plan must be developed in sufficient detail to provide direction to states and to establish the framework at a national level for the system of systems to make next generation services effective, and it is the Federal Government's role and responsibility to do so. Just as the National Broadband Plan is setting the tone for a national forward rollout of broadband services, a similar effort is needed for 9-1-1 and in particular NG9-1-1 services. Oversight by the Federal Government, such as the National 9-1-1 Office, will be necessary to ensure that state and local systems are interoperable and that this interoperability is a system communication security issue as well as a national security issue. It is incumbent on the Federal Government to provide leadership in this area. International routing can only be appropriately addressed in a national strategy that should also encourage and foster coordination, cooperation, and collaboration among all industry partners and governmental entities.

While providing 9-1-1 services has traditionally been the role of local, regional, and state government, as the infrastructure of 9-1-1 migrates to a digital, IP-based model, some responsibilities will necessarily transfer to a higher level of government. An assessment of function and responsibilities should be performed to identify those functions that might be better handled by a different level of government in the new structure. It is agreed that *response* to emergencies will typically be a local responsibility; however, some system management or administrative and data security functions may be better served by shifting to a regional, state, or national model.[109]

5.2.3.2.6 Capital Funding Should Be Established and Permissible for NG9-1-1

The need for future capital upgrades will necessitate setting aside sufficient funding for capital improvements. This buildup of large funds frequently leads to the issues discussed earlier regarding raiding by state government or other jurisdictions. Policymakers should view an NG9-1-1 system as a critical infrastructure that must be valued by the public and supported as such. [110] While the subgroup acknowledges the need for future capital upgrades by the collection of funds over time, this process needs to be subject to the same fiscally responsible processes and rigor (such as audits, fiscal accountability, and government transparency) to properly manage the fund.

---

[108] P.L. 110-283, Sec. 102(3)(d)(1)
[109] The National E9-1-1 Implementation Coordination Office, *A National Plan for Migrating to IP Enabled 9-1-1 Systems.* September 2009. Available at: http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf
[110] Phillip J. Weiser, Dale Hatfield, and Brad Bernthal. *The Future of 9-1-1: New Technologies and the Need for Reform*, Journal of Telecommunications and High Technology Law, Vol. 6, No. 2, p. 285, June 5, 2008, University of Colorado Law School. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1146803

Borrowing or saving funds for future capital upgrades should be allowed under local statute. Accordingly, state and federal grants, bonds, lines of credit, and other tools should be appropriately considered to support build-out of NG9-1-1 systems.

5.2.3.2.7 New Funding Models Must Be Explored

Existing surcharges and taxes alone may no longer be adequate to fund both a legacy 9-1-1 system and a transition to next generation services, let alone the ongoing maintenance requirement of parallel systems. Surcharges and taxes will necessarily be combined with a variety of other sources to ensure adequate funding for legacy and NG9-1-1. Because the current tax and surcharge methods are no longer adequately predictable or equitable among all service types in some cases, new support mechanisms should be considered to sustain 9-1-1 service.

There is an extremely urgent, essential need to examine existing 9-1-1 fee structures and identify a funding model that will support NG9-1-1. The transition to NG9-1-1 will be significantly delayed and the full benefit of NG9-1-1 will not be realized without consistent, reliable funding. Discussion of possible recommendations regarding specific funding sources for NG9-1-1 has revealed divergent opinions among CSRIC Working Group members. Forming a funding model that will coalesce all parties is not possible in the timeframe allowed by CSRIC.

Working Group 4B recommends that FCC encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues, including, but not limited to:

- Assessing funding needs;
- Evaluating current fee structures;
- Examining current funding sources at the local, regional State, national and Federal levels;
- Making recommendations to create consistent, reliable, dedicated funding mechanisms; and
- Developing strategies to dedicate and protect funding.

The Panel should be comprised of representatives from the diverse 9-1-1 stakeholder community including, but not limited to, subject matter experts from public safety, service providers and those with a specialty in economics. The recommendations of this Panel will form the basis for subsequent actions on the part of both public and private sectors.

A range of options or potential new support mechanisms are described below.

5.2.3.2.7.1 Support Mechanisms

Any support mechanism determined to be appropriate for NG9-1-1 must be based on "cost" as determined by the 9-1-1 Authority. The Funding Subgroup recommends that the following criteria should be present in the chosen support mechanism to meet the desired principle of sustainability:

- **Specific**—This criterion includes the concept of economic efficiency, promotes competition, and reduces risk of raiding.
- **Predictable**—This criterion ensures a forward view to the future, considers equitable treatment of all service types and providers, and includes a measure of ongoing support and sustainability.

- **Sufficient**—This criterion in this context means that there is enough funding to support the transition to NG9-1-1, as well as ongoing NG9-1-1/Public Safety communications system operations, and administration. The fund must be properly sized to ensure adequate funding both today and into the future.

5.2.3.2.7.2 Federal Policy on NG9-1-1 Funding

Federal policy on NG9-1-1 funding for transition support is one approach that was recommended by the public safety community and accepted by members of the 4B Funding Subgroup. While several concepts of a Federal policy on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on a specific surcharge recommendation. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

5.2.3.2.7.3 Subscriber Access Network Surcharge Model

If surcharges are to be continued as a legitimate source of funds, it may be necessary to modify the surcharge model to ensure its applicability going forward. One modification discussed by the subgroup has been dubbed the Subscriber Access Network Surcharge (SANS) Model.

A SANS model is an extension of the current surcharge model to include subscribers to networks that provide Internet service, in addition to the current wireline and wireless service subscribers. By including Internet access subscribers and broadening the pool of subscribers paying the surcharge, the amount of individual surcharges may be reduced while stabilizing the revenue stream needed to support the 9-1-1 system and thereby ensuring that all potential users are contributing. In addition, the SANS model focuses on levying a surcharge on the network access subscription rather than on the actual telecommunications service that may be carried over that particular network.

Internet service-based communications technologies already make up a measurable percentage of 9-1-1 calls, and that percentage is expected to grow. Today's Internet service-based communications used for 9-1-1 service are primarily voice technologies, but text and streaming video applications are expected to also be supported in NG9-1-1. In most cases, the Internet-based communications technologies involve one entity providing the physical access network (copper wire, fiber optic cable, WiFi, WiMAX, LTE, etc.) and Internet access for the customer, and another entity providing the communications application. This is a significant difference between Internet-based communications and traditional wireline and wireless communications. In the traditional wireline and wireless world, the communications service and the underlying network supporting access to the service are provided by the same company.

Another difference between the technologies involves the ability of government to regulate or control. Traditional wireline and wireless service providers are regulated by government. Internet access providers also have a physical presence within the communities they serve and have to deal with some level of regulation by government, either locally or nationally. The entities that provide a subscriber with communications services over the Internet can be physically located anywhere in the world and are not easily regulated by government. This inability to regulate the communications service provider, because of lack of legal jurisdiction, is

the basis for suggesting the 9-1-1 surcharge should be levied against the subscriber for access to any network capable of supporting communications applications or technology.

Traditional residential wireline or wireless services are capable of supporting only one call at a time, and the surcharge can be based on the assumption that it represents a single user. Internet access uses many different bandwidths and is priced accordingly.

In the legacy 9-1-1 system, caller location is provided by the wireline or wireless service provider. Because of the increasingly mobile nature of communications technology, in the NG9-1-1 environment, there is an expectation that the caller's device, the access network, or a combination of the two, will provide the caller location. This expectation may generate some additional expense for the access providers for which they will want to be reimbursed. If the access providers collect the surcharge in a manner similar to the way the wireline and wireless service providers do today, all the access providers could be allowed to keep a percentage of the surcharge to help offset the costs of providing the caller location or any other call-related information during a 9-1-1 call. This approach would also level the playing field for different types of access providers.

The reader should note that while several concepts on NG9-1-1 funding were discussed in the CSRIC 4B Working Group, there was a lack of consensus on specific recommendations. Consensus was reached on the recommendation that the FCC should encourage the National 9-1-1 Program to convene a Blue Ribbon Panel as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.

5.2.3.2.7.4 Federal Grant Funding Opportunities Will Be Necessary

The Funding Subgroup believes that (1) federal grant fund infusion will be necessary to truly initiate and foster NG9-1-1 deployment rapidly across this country; (2) the Federal Government's role in a national strategy will have to involve funding in some way; and (3) states will be looking to the Federal Government for some type of grant program to assist in funding the costs that will be incurred in the transitional process to NG9-1-1 services. For those states without an IP network that can be easily adapted for the purpose of NG9-1-1, federal funds may be especially necessary.

If federal grant funds are established for next generation transition, a list of eligible costs will be essential. Several examples of *current* eligible costs are provided in this report and may be the basis for consideration of future costs that will be present in a next generation environment. As federal grant funds become available, it will be incumbent on the granting entity to determine the appropriate "list" of eligible components and any qualifying requirements, such as standards that must be met for the funds to be received.

Compliance with a national next generation strategy called for earlier in these recommendations should be a minimum requirement for states or localities to receive federal funding or grants, as should compliance with appropriate standards. In addition, for distribution of federal funds, states should identify a single office where funds would be disbursed and where assurances of proper reporting and auditing would be demonstrated.

To encourage deployment of NG9-1-1 as rapidly as possible, existence of next generation infrastructure should be considered an acceptable criterion in any federal funding opportunity related to homeland security, communications security, or broadband infrastructure grants.

Any new funding structure will need to be secured and dedicated to funding the NG9-1-1 system at a federal level. The National NG9-1-1 Plan or Strategy to be developed as recommended by the Funding Subgroup should establish the demarcation point for the states or local entities at the edge of the ESInet. The Federal Government can benefit from the data-rich components expected in an NG9-1-1 system as well as enhanced opportunities to improve national communications and national security. For example, opportunities for notification to the Centers for Disease Control and Prevention of high numbers of illness reports in a region to suppress or better control a pandemic outbreak or automatic notifications to the National Transportation Safety Board of multi-casualty aircraft crashes or hazardous chemical spills might significantly enhance the integrated response capabilities. If this situational awareness is a desired outcome, there may need to be some build-out by the Federal Government of a backbone or portion of the NG9-1-1 infrastructure to which state or local jurisdictions can connect. In this way, portions of the NG9-1-1 communications infrastructure are already in place, designed and built by a national strategy to ensure interoperability and funded by the highest level of government, leaving the remainder of the NG9-1-1 network to be built by local or state strategies and subsequent funding. The benefits of NG9-1-1 could be recognized and leveraged by many levels of government process and function.

5.2.3.2.8 Effective Fund Management Practices Should Be Encouraged

Sound fund management practices will be the cornerstone of an effectively and properly managed 9-1-1 fund. Public funds are frequently, and appropriately, subject to scrutiny, and the handling and use of those public funds needs to be protected with unassailable and reasonable accounting and management practices. It would be beneficially if best practices were developed that would assist 9-1-1 Authorities to better manage their 9-1-1 funds. These effective practices should include criteria for administering the public funds to allow the permissible uses of the funds while prohibiting raiding of those dedicated funds for non-9-1-1 purposes. There should also be means to strongly discourage questionable practices, support mechanisms that are technologically and competitively neutral and are equitable across all service types and all communications providers, collection and reporting methods that ensure that all that is due is being correctly remitted, neutral third-party administration that ensures transparency, and auditing and accounting principles that demonstrate sound acceptable government practices.

5.2.3.2.9 Model Legislation Should be Endorsed and Promoted

States should be analyzing their existing 9-1-1 enabling legislation and subsequent rules, interpreting their 9-1-1 statute to ensure that it properly addresses a transition to NG9-1-1. As part of this review and analysis, there may be other factors legislators will want to consider as improvements to their existing legislation. A useful tool, such as model legislation, should be developed and encouraged to assist states. This model legislation might include the following concepts:

- Affirming 9-1-1 as an essential service
- Reviewing the statute to ensure NG9-1-1 elements, which may or may not be provided by a traditional “telephone company,” are permissible costs

- Encouraging a state NG9-1-1 strategy/plan as a requirement for receiving any federal grant funds
- Allowing capital acquisition for specific NG9-1-1 purpose
- Incorporating strong language to prohibit raiding, including enforcement clauses
- Incorporating appropriate auditing and accounting principles
- Requiring any government entity that receives federal or state funding for broadband services to demonstrate how its application for funding meets the objectives for the national or state NG9-1-1 plan
- Encouraging/providing incentives for efficient and accountable 9-1-1 operations at the local and state levels
- Whatever the 9-1-1/NG9-1-1 funding design mechanism that is determined appropriate by the state, engaging a neutral third-party fund administrator
- Ensuring the amount of support (size of the funding) is sufficient to pay for legacy 9-1-1 and NG9-1-1 transition and beyond (maintenance)
- Using technology neutral language to reduce the need for future legislative changes as new technologies emerge.

Model legislation that encourages some level of standardization in the way 9-1-1 is viewed, handled, and managed will assist communications providers who are doing business in multiple states or regions and thus potentially reduce administrative costs. In addition, because NG9-1-1 will permit more cross-state cooperation and movement of 9-1-1 calls more easily from state to state as necessitated by the mobility of the consumer, standardization of methods and organizational administration will encourage better partnerships among and between states. Neutralizing the statute language related to technologies, funding, and support mechanisms will not only be more equitable, but it may decrease the need for legislative changes going forward.

5.2.3.2.10 Standards Should Be Developed and Adopted

The development and adoption of next generation best practices and technical requirements is one of the key components for a successful implementation of NG9-1-1 across the country. Next generation best practices and technical requirements should be developed in a collaborative and coordinated manner within and among the appropriate standards organizations. Members and participants in the relevant standards organizations have the necessary expertise and involvement to identify and resolve the issues, gaps, and specific areas of concern where next generation best practices and technical requirements are required. Standards organizations should be encouraged to develop next generation best practices and technical requirements quickly and accurately to avoid stranding investment or impeding the implementation of NG9-1-1. One possible key role for the Federal Government is to support and ensure that uniform standards are developed to guide the implementation and interoperation of NG9-1-1's network of networks. The FCC should foster the adoption of industry guidelines and best practices along with the necessary technical requirements as early as is practical and appropriate.

5.2.3.2.11 Eligible Costs Should be Defined

The Federal Government must take a leadership role in the coordination, implementation, and funding of NG9-1-1 to minimize the time needed for widespread implementation. It can encourage the transition best by establishing the basic capabilities needed across the country.

If federal grant funds are made available for next generation implementation or transition, the Federal Government should consider defining a list of eligible technology or elements so that states and/or localities could readily identify the remaining items that would need to be funded from local or non-federal funds. By taking this approach, the funding needs can be assessed from the broadest (federal) to the narrowest (local) levels, with each stratum able to determine the importance of each cost element to its own needs and leaving other entities the ability to customize cost eligibility to their own needs.

Implementation, transition, and maintenance costs should be eligible for funding at all levels. NG9-1-1 system cost elements within four walls of the PSAP and that directly support 9-1-1 operations should be among the highest priority cost elements because they enable the basic provision of 9-1-1 service.

Technical standards development and application throughout the NG9-1-1 network are critical to ensure interoperability and minimize cost. To focus all parties on the health of the overall system, items that do not follow established standards should be ineligible for funding.

5.2.3.2.12 National 9-1-1 Program Should Serve as a Grant Clearinghouse

A function of the National 9-1-1 Program should be to act as a collector of grant opportunities available and a repository of information available to 9-1-1 Authorities about grants to assist with NG9-1-1 transition.

Unless there is a commitment to a federal funding source, the transition to NG9-1-1 will be funded in accordance with unique state/local needs based on distinctive state/local variables, including current revenue, network scope/scale, accredited standards for originating emergency services IP and PSAP networks, state level plan, federal strategy or model for NG9-1-1, and mandates that may arise from either the FCC or the DOJ. It is the Funding Subgroup's expectation, therefore, that the findings and conclusions of this section of the report, coupled with the findings of the Technology, Operations, and Access Subgroups, will point directly to multiple models of funding for the transition to NG9-1-1.

Grants are a complex and specialized endeavor. Efforts to research grant availability and seek possible sources for grants that might be applicable, the intricacy of the grant process itself, the specificity of the grant application, and the institutional knowledge about grant procedures present unique and often insurmountable challenges to the grant candidate. 9-1-1 Authorities generally do not have sufficient staff to assign to this type of a project; however, local governments may have staff specifically devoted to researching grant opportunities for their general programs. 9-1-1 should be part of this process. With recent cutbacks in governmental staff, local governments may no longer have the opportunity to dedicate personnel to grant research, leaving 9-1-1 without a skilled advocate to discover opportunities in either federal grant programs or other public or private potential sources. A clearinghouse or repository agency that could assemble grant opportunities and provide resources to assist agencies in grant applications processes would increase the potential for NG9-1-1 to compete for funding opportunities beyond the normal surcharge and tax models in place today.

5.2.4 Recommendations on Improving Access to 9-1-1

This section addresses the recommendations of the Access Subgroup to improve access to 9-1-1.

5.2.4.1 Improving Access to 9-1-1

As the FCC's Section 504 Handbook states, "The starting point for providing access is simple courtesy and common sense…. It is when people with disabilities are overlooked as potential or actual consumers that barriers are raised. And, ironically, it is these, often unconscious, barriers that can be the hardest to overcome." [111]

The Access Subgroup makes the following recommendations.

5.2.4.1.1 Texting in E9-1-1

In the existing E9-1-1 environment, "PSAPs should be able to receive and reply to e-mail, SMS and store and forward messages. However, because of their latency and unreliable delivery, such messaging is problematic for emergency communication and users should be educated as to of limitations inherent to these services."[112] This recommendation is an exact duplicate of the recommendation made in the referenced NRIC VII report in late 2005—it continues to be recommended.

5.2.4.1.2 Transition Texting

The first recommendation should remain in effect through transition to NG9-1-1 and until there is a generally available real time text solution, such as NOVES, throughout the wireless industry and across devices. Recommendations 1 and 2 would both benefit from FCC guidance.

5.2.4.1.3 Non-Voice Emergency Services

NOVES, as covered in Section 5.1.4.1.6, is the subject of technical standards in development. An understandable concern exists that if any future regulatory requirements are announced, there could be a negative impact on what has already been developed, slowing down the process. It is recommended that the technical standards leaders in this area reach out to the accessibility community so that all parties are in agreement on what is being done. FCC guidance and assistance in coordinating could be helpful.

5.2.4.1.4 International Awareness and Coordination

It is also becoming increasingly clear that international awareness and coordination is needed. "As a primary measure to ease the access emergency services for persons with special needs in communication, it is suggested to establish a service whereby facilities for the use of Short Messaging Services (SMS) as a means for communication between Public Safety Answering Points (PSAPs)/Emergency Control Centres and the public," states *SMS in Emergency Communication*, a report issued in late 2009 regarding trials and studies in progress in Iceland. REACH112—Responding to All Citizens needing Help[113]—a European Union effort, is conducting and/or monitoring trials in various countries regarding text messaging and video (sign language) access to emergency services.

5.2.4.1.5 Interpreter Training

---

[111] The second edition of the *Federal Communications Commission Section 504 Programs & Activities Accessibility Handbook* (*Section 504 Handbook*), Section 2, Basic Principles of Access, p. 8. Available at: http://www.fcc.gov/cgb/dro/504/introduction.html

[112] NRIC VII—September 2005, Focus Group 1B—Long-Term Issues for Emergency/E9-1-1 Services Report , p. 55, section 6.1.5. Available at: http://www.nric.org/fg/index.html

[113] http://www.reach112.eu/view/en/index.html

Interpreter training needs to be in place for the emergency call environment. This includes training for various languages, audio, video (sign language), and text. Some form of certification should be considered. This would help fill a gap as identified in "National Certification for Medical Interpreters," which has been developed to improve communications between patients and healthcare providers.[114] Identified as still needing attention is the provision of interpreting services in a pre-hospital or emergency call environment (such as EMD).

5.2.4.1.6 Federal Guidance

A wider choice of devices and services promise to, and in most cases, can improve the communications methods needed and improve the lives of many. However, just as with the devices that have been in place for many years (such as hearing aids), federal agencies should consider how best to certify these or develop other processes to ensure that the devices and services can properly provide emergency services access as/when needed.

5.2.4.1.7 Reexamining Telecommunications Relay Services Funding Model

The TRS (including VRS/IP Relay) funding model developed and managed by the FCC needs to be reexamined as NG9-1-1 implementations near. If a video caller (using sign language) uses VRS as part of the path to 9-1-1 to report an emergency, the service, including use of the video interpreter throughout the call, is paid via federal funding. If, in NG9-1-1, the callers can immediately and simultaneously access a 9-1-1 call center and a video remote interpreter, there may be no federal funding to pay for the interpreter's service. The logic of what is being paid for, why, and by whom needs to be reexamined so that providing improved service via NG9-1-1 directly is not monetarily penalized by federal rules.

5.2.4.1.8 Consumer Education

Consumer education regarding communications methods and emergency service access will need significant attention and appropriate changes as NG9-1-1 implementations begin. The FCC can provide excellent guidance to assist this effort. Also, national efforts in this area should be encouraged. They include the National Education Coalition formed by the E9-1-1 Institute and the APCO/NENA NG9-1-1 education initiative.

5.2.4.1.9 Technology Advancements

In all access groups, technology is advancing rapidly. New mechanisms are arising, both intelligent devices capable of providing assistance directly, as well as new forms of relay, where a trained "interpreter" who can communicate with people with disabilities to provide interpretation to 9-1-1 call takers and responders. Any mechanisms, services, protocols, and regulations that arise from this work should take into account that new technologies will arise and new services will be fielded and used. The mechanisms, services, protocols, and regulations should accommodate them as much as possible.

5.2.4.1.10 Location Acquisition

Location acquisition is critical for new devices and services offering expanded communication possibilities for those with special needs. Very often, the customer's service provider is not the access/network provider; therefore, providing location information for 9-1-1/emergency call processing, including routing to the correct 9-1-1 center, is problematic. Interim solutions tend

[114] http://www.certifiedmedicalinterpreters.org/

to focus on customer self-registration of his/her location. At best, this is inconvenient and sometimes prone to errors, and it does not seem feasible in a mobile environment. The FCC should provide guidance on establishing cooperative efforts between OSPs and access/network providers so that the location known by the latter can be shared when an emergency call is placed via the former.

5.2.4.1.11 Additional Federal Guidance

Throughout this report, it has been shown that considerable change will occur in the 9-1-1 environment. From new devices and services, to additional data, to working together as teams beyond existing physical building sites on a regional/state level, and more, it is apparent that it is a much more significant change than in the past, such as occurred when a single new technology, wireless service, was added to 9-1-1. Training in the 9-1-1 center and with all 9-1-1 personnel becomes paramount—without it, failure is a real possibility. However, existing processes, particularly funding, may not be adequate to ensure that all 9-1-1 personnel receive the right training. This area needs federal guidance and dependable funding source(s).

5.2.4.1.12 Personal Data Confidentiality/Privacy

Availability of personal caller data, often medically related, has been shown to have a definite positive impact on improving services to those with special needs. The NG9-1-1 system can take such data into account during call processing and make choices, allowing the 9-1-1 call taker as well as first responders, to provide improved service. However, the confidentiality and privacy of this data must be respected and protected. This too can benefit from federal guidance and assistance.

5.2.4.1.13 Fraudulent Misuse

While recommendation 5.3.4.1.12 is an important security issue going forward, there are others that need to be taken into account—one of importance is protecting various new access methods from fraudulent use, from misuse overload, and from intentional overload such that real emergency calls and requests have difficulty getting through to those who can help. This too can benefit from federal guidance and assistance.

5.2.4.1.14 Caller Identity

Another security-related issue, caller identity, can assist in dealing with misuse, while also providing critically needed information to properly deal with a request for emergency assistance. With the expanded access methods (whether it is NOVES, e-mail, IM, SMS, RTT, or others), finding the real identity (name, address, and other details) of a caller when the caller is unable to continue to communicate is important. This has been true since 9-1-1 began. However, with each new technology added to 9-1-1, it continues to be problematic. This area can also benefit from federal guidance and assistance.

5.2.4.1.15 Call Taker and Dispatcher Training

Although some states do address 9-1-1 call taker and dispatcher training requirements and have mandated programs, too many others do not. This too is very important going forward. A national standard states that it is essential that emergency call processing protocols be in place.[115] With the expanded access capabilities, complying with this guidance, developed by

[115] http://www.nena.org/standards/operations/emergency-call-processing

NENA, APCO, National Academies of Emergency Dispatch (NAED), PowerPhone, and others, is increasingly necessary.

5.2.4.1.16 9-1-1 Center Staffing

Throughout this report, emergency access (9-1-1) via new devices and services, including those already existing and the many others that will continue to rapidly appear, both near and long term, has been discussed. Although they improve access, the impact on 9-1-1 center staffing has not been discussed. It is apparent that this issue needs to be more thoroughly considered—can existing personnel handle everything, will specialized regional/statewide teams assist in minimizing workload negatives, and more. Too often in the past, 9-1-1 access was provided via new technologies without addressing staffing level impacts. This too can benefit from federal guidance and assistance.

5.2.4.1.17 Timely Issue Resolutions

NG9-1-1 implementations will begin in the months ahead. Recommendations in this report mainly cover topics that need action or attention before NG9-1-1 deployment. While resolving issues takes time, it is important that plans for resolution be in place and timelines take into account real implementations.

5.2.4.1.18 Timely Transition Strategy

More than a decade into the upgrade to support wireless calls (Wireless Phase II), and the United States still has some number of PSAPs who have not upgraded. In general, those that have found the means to transition to Phase II have dedicated the necessary funding, and those that have not dedicated funding to the transition are not serving their constituents equally. Even grant funding often does not reach less well funded local 9-1-1 systems because even with a grant, there are usually substantial local costs. The CSRIC 4B Working Group recommends that the "one PSAP at a time" upgrade process that has characterized 9-1-1 since its inception be discouraged.

In its place, the group suggests that states receive incentives to create a statewide implementation plan that provides for all PSAPs in the state to be upgraded within a reasonable time frame, perhaps 3 to 5 years. Grant programs and other national incentives might be made dependent on creation and approval of, and progress against, such a statewide plan. In some states, regions may decide to create NG9-1-1 implementation plans, which would form part of such a statewide plan. Regional planning should be strongly encouraged.

6 Conclusions

CSRIC Working Group 4B has spent nearly a year researching, analyzing and evaluating a wide variety of models, best practices, standards and examples to address the technological, operational, funding and access issues that must be addressed as part of a successful transition to NG9-1-1 across the Nation. While this report is extensive, it is not meant to represent an exhaustive list of issues or recommendations and its content is limited to those topics covered during the allowed timeframe. The intent of this document is to frame NG9-1-1 transition issues within the context of the CSRIC process, and offer recommendations for further action.

6.1 Conclusions of the Technology Subgroup

As a result of its research and deliberations, the Technology Subgroup reached the following conclusions:

- The FCC must establish clear rules for accomplishing the transition to NG9-1-1. The transition must occur in a reasonable time frame without unduly burdening any party. The FCC's rules must make clear which party is responsible for infrastructure used between entities, and where the lines of demarcation exist for such elements as LNGs, LPGs, and LSRGs.
- Industry associations and other standards organizations need to provide harmonized NG9-1-1 standards that foster the development and transition to NG9-1-1, including non-voice accessibility. The FCC may have to either assist or set policy when industry conflict is not resolved by the parties.
- Throughout CSRIC deliberations, SMS became (and remains) a contentious issue. If SMS has a role as an interim non-voice service used to contact a PSAP, how it is deployed and funded will need to be resolved by the FCC. There is no current consensus within the industry, and the legislative and regulatory environment does not adequately enable non-voice services.
- Existing legislation, regulations, and liability issues for NG9-1-1 must be addressed and updated by the FCC and the states. Significant NG9-1-1 implementation will not proceed until the legacy legislative and regulatory framework allows the features and applications of NG9-1-1 to exist.
- Local, regional, and state NG9-1-1 Authorities must create plans for the transition to NG9-1-1 and communicate them to OSPs and access providers. OSPs and access providers must create plans for transition to NG9-1-1 and communicate them to local, regional, and state 9-1-1 Authorities.
- 9-1-1 Authorities must receive adequate education and the skills to allow them to update, validate, and correlate existing databases—especially their GISs—to be in a state of readiness and usability for NG9-1-1 deployment.
- The FCC, in coordination with the National 9-1-1 Program Office, must facilitate the nation's transition to NG9-1-1. This may include the necessary infrastructure to support or directly contract for and fund NG9-1-1 transitional systems.

6.2 Conclusions of the Operations Subgroup

As a result of its research and deliberations, the Operations Subgroup reached the following

conclusions:

- In support of NG9-1-1 nationwide call routing and transfer capabilities, the National 9-1-1 Program Office, as well as other entities, should be considered for the role of establishing and maintaining the National Forest Guide.
- Promoting collaboration by PSAP administrators through developing relationships with PSAPs outside of their normal service jurisdiction, in an effort to improve their ability to handle calls in an overflow, backup, or disaster situation.
- NENA and APCO should develop standards, which should be implemented at the state, regional, and local PSAP levels, on a variety of operational needs, including: virtual PSAPs, multimedia call processing, text messaging to 9-1-1, and nationwide call transfer procedures.
- Increase educational opportunities offered to 9-1-1 Authorities, Statewide 9-1-1 coordinators, and 9-1-1 stakeholders through educational programs provided by NENA, and APCO, and the National 9-1-1 Program Office.
- Development of models of consortium arrangements and governance supporting system operations roles and responsibilities, regional and state-level coordination should be identified by NENA and the National 9-1-1 Program Office.
- FCC should work with appropriate Federal agencies and non-governmental organizations (e.g., National Association of Regulatory Utility Commissioners [NARUC] and National Conference on State Legislatures [NCSL]) to evaluate regulations, legislation, and tariffs to identify and make recommendations on needed modifications.
- Development of public education programs to inform stakeholders about NG9-1-1 is needed. The APCO/NENA NG9-1-1 Education work group should complete its work and enlist the assistance of the National 9-1-1 Program Office, NENA, and the National Governors' Association in development and distribution of a nationwide message.

6.3 Conclusions of the Funding Subgroup

As a result of its review of the state of 9-1-1 funding for transition to NG9-1-1, the Funding Subgroup identified a number of areas that require further study or development:

- An NG9-1-1 cost study, as called for in National Broadband Plan, is essential and must be comprehensive, adequately funded, completed, and published as soon as practical.
- A National Policy/Plan on NG9-1-1 is required and must be developed.
- A Blue Ribbon Panel should be formed as soon as possible, to address 9-1-1 funding issues and make recommendations for funding construction and maintenance of NG9-1-1 systems.
- The results report of the USDOT Pilot Study of Proof of Concept and the testing of the proposed standards should be funded, completed, and distributed as soon as practical.
- Next generation case studies of partial or transitional implementations, and full implementations as they occur, should be collected and published. Current examples include those of Texas, Southern Illinois, States of Washington, Indiana, Minnesota, Vermont, and Connecticut.
- Development of Effective Fund Management Practices guidelines must be funded and published.

- A Federal Block Grant Program should be established.
- A next generation "eligible costs list" should be developed.
- 9-1-1 Fund "excess"—real or imagined—which may have created some of the diversion problem originally, calls for further "systematic" study.
- Accurate cost-based funding models will need to be identified that reflect fully funding 9-1-1 needs rather than using models that result in underfunding or creation of potential excesses to be diverted.
- Model legislation, including POS retail for prepaid service and appropriate auditing and accountability measurements for states and local 9-1-1 Authorities, should be developed.
- Local, regional and state agencies who will have ongoing costs to maintain ESInets and NG9-1-1 infrastructure should evaluate the adequacy and sustainability of existing funding mechanisms and prepare to take whatever action is deemed appropriate to secure reliable levels of support.
- Continuing funding for national infrastructure will also need to be initially funded and maintained on an ongoing basis.

Local, regional, and state ESInets will need to be built, and planning related to local, as opposed to regional or state ESInets, will vary by location. Regional ESInets may be constructed by interconnecting local networks, but statewide ESInets would most often benefit from a state backbone network in addition to regional/local interconnects. Similarly, consideration should be given to whether it is most effective for statewide ESInets to be interconnected with neighbor states, which will form a national ESInet. Even with this consideration were implemented, a national backbone would better optimize traffic moving interstate, especially in disasters. The costs of local interconnect are typically shared by the interconnecting parties. The cost of a statewide ESInet must be born by the state, and the cost of a national backbone by a some national entity.

The NG9-1-1 elements that use the ESInet will need to be defined and purchased. Again, local elements (ESRPs, ECRFs, LVFs, and BCFs) will be needed as well as state level elements. In some cases, regional networks will deploy regional ESRPs and ECRFs. The national forest guide will need to be funded.

Addressing these outstanding issues will advance the implementation of NG9-1-1 and, with sufficient support, will assist the nation's 9-1-1 programs to transition its services in a reasonable time frame. The transition from legacy systems to NG9-1-1 systems is necessary to serve our citizens and will improve communications interoperability and communications security in the United States.

6.4 Conclusions of the Access Subgroup

Throughout the first decade of the 21st century, use of text and video as communication methods have escalated, particularly among people who are deaf, hard-of-hearing, deaf-blind, and have a speech disability. However, at the end of the decade, there remains no generally available direct 9-1-1 access. Recommendations by NRIC VII in 2005 are still valid.

In addition, as NG9-1-1 implementations in some parts of the country near, the use of personal caller information, which can be received as part of the 9-1-1 call, offers hope that improved services, especially in life-threatening emergency, will bring benefits to many, especially those

in various disability categories (as defined by IDEA, and listed in Section 4.5.1 of this report).

Federal guidance on a timely basis will be of considerable value in assuring that NG9-1-1 provides what it is capable of to improve emergency services access and response for those with access challenges (people with disabilities and/or special needs and the non-English speaking/signing/texting community).

While many groups, public and private, local and international, are essential to implementation of recommendations, it is critical to those with access challenges that the Federal Government provide leadership and guidance to ensure timeliness and that needs are met.

6.5 Recommendations of Group(s) Responsible for Implementing Recommendations

Throughout this report, there is repeated call for more involved federal action to drive and coordinate the mission and funding of NG9-1-1. Congressional action is needed to establish an adequate and sustainable funding mechanism and federal leadership and fortitude will be essential. Although the transition to NG9-1-1 will not be inexpensive, the nation cannot afford to not move forward. Not only is it essential for the nation's communication system to keep pace with communication technologies used by our citizens, the current 9-1-1 system neglects a growing population of people with disabilities, who remain un-/underserved.

Working Group 4B sees FCC's role in the transition to NG9-1-1 as one of citizen advocate and protector, a role consistent with the FCC's mission. Since its inception in 1934, the FCC has been "charged with regulating interstate and international communications by radio, television, wire, satellite, and cable." More specifically, the Policy Division mission states that the FCC "serves the public interest by developing policies that advance public safety communications for first responders, health care, 9-1-1 services, and persons with disabilities. These policy areas include 9-1-1/E9-1-1, operability and interoperability, communications infrastructure protection, network security and reliability." The FCC should not only be a key participant in the development of the national strategy for NG9-1-1, they should seek from Congress a clarification, or if necessary an expansion, of responsibilities that will assist, promote and facilitate the transition to NG9-1-1. Just as the FCC has protected the citizen's rights in radio, television and wireline/wireless communications, FCC oversight is necessary to ensure that these new communications services do not diminish, but rather enhance and advance communications capabilities and services.

The National 9-1-1 Program should be directed to, as appropriate, develop and assist in the implementation of a comprehensive national strategy for the transition to NG9-1-1 and provide a Federal focus for 9-1-1 issues. The Program should facilitate stakeholder coordination among public and private stakeholders at local, state and federal levels. In addition to serving as an information clearinghouse, the Program should administer a grant program for the benefit of

State government and legislators should consider legislation that identifies a state agency or other state-level mechanism (where one does not already exist) to be responsible for statewide 9-1-1 planning and coordination, and granting it appropriate authority and power. State and local government policymakers are responsible to ensure state laws are readied for NG9-1-1 and that a state strategy or NG9-1-1 plan is developed. Both states and local government should protect

any 9-1-1 funds entrusted to it and ensure appropriate auditing and accounting principles are secured as a part of funds distribution so that fund diversion or raiding is prohibited. Supporting public safety related organizations, both on a national and local level, should advocate for legislative activity or effective practices adoption, and advise and guide their respective members in the appropriate advocacy activities.

Industry groups should participate in the development of standards and best practices according to the mission and scope of their respective groups. It would be beneficial to the industry to have the subject matter experts from these groups build on the findings of this report to give the OSPs, SSPs, 9-1-1 Authorities, and PSAPs the tools to transition to NG9-1-1. The following industry groups have primary responsibility for the development of NG9-1-1 Standards and Best Practices includes, but is not limited to: NENA, ATIS, IETF, APCO, TIA, 3GPP/3GPP2, and IEEE. Additional stakeholder groups include: state utility commissions, service and equipment providers, non-governmental organizations, responder agencies, and the general public.

6.6 Notional Timeline for Adoption of Recommendations

The speed in which a transition to NG9-1-1 occurs is dependent on a number of factors, because end-user devices, OSP networks, ESInets and PSAP upgrades will all progress at different paces. Progress is also affected by regulatory and legislative issues and most of all, by the availability and adequacy of funding.

There are however, specific “enablers” that must be addressed and resolved quickly, in order for other aspects of the transition to commence or be successful. For example, discussions on SMS texting to 9-1-1 indicated that wireless operators and service providers alike are seeking explicit protection to address their liability concerns.

These enablers and specific enactment of funding legislation for next generation services will be required no later than the 112th Congress. National strategy development should precede the legislation, and preparation of that strategy should commence as soon as possible within the next 12 months. Key stakeholders and legislators should be engaged at the earliest possible point because a thoughtful and inclusive process that is allowed to mature over a modest time frame will likely achieve the most successful outcome.

Appendix A—Glossary/Acronym List

Glossary

The 9-1-1 community has a distinct lexicon to describe the features and functions of 9-1-1 components and functionality. The *NENA Master Glossary of 9-1-1 Terminology*[116] serves as a guide to define the terms, acronyms and definitions associated with the 9-1-1 industry. A few select terms are included in this glossary to assist the reader in reviewing this document and the *NENA Master Glossary of 9-1-1 Terminology* should be consulted as an additional resource.

Term	Definition
9-1-1 Authority	The organization having administrative jurisdiction over a particular 9-1-1 system. This could be a county/parish or city government, a special 9-1-1 or Emergency Communications District, a Council of Governments or other similar body.
Border Control Function (BCF)	Provides a secure entry into the ESInet for emergency calls presented to the network. The BCF incorporates firewall, admission control, and may include anchoring of session and media as well as other security mechanisms to prevent deliberate or malicious attacks on PSAPs or other entities connected to the ESInet.
CODEC (Coder/DECoder or Compression/DECom-pression)	A codec is an algorithm or a device that implements an algorithm to encode and/or decode a digitized media stream to a bit stream sent on a communications network, in a standardized form.
Emergency Call Routing Function (ECRF)	Receives location information (either civic address or geo-coordinates) as input and uses this information to provide a Uniform Resource Identifier (URI) that can be used to route an emergency call toward the appropriate PSAP for the caller's location.
Emergency Services IP Network (ESInet)	An IP-based inter-network (network of networks) shared by all agencies that may be involved in any emergency.
Hearing Carry Over (HCO)	A method which utilizes both voice and text communications on the same call, allowing a person who is speech impaired to listen to the other party's conversation and respond by typing via a Teletypewriter (TTY) or other means of text communications.

[116] NENA. *NENA Master Glossary of 9-1-1 Terminology*. NENA 01-001 v14, September 29, 2010. Available at: http://www.nena.org/standards/master-glossary

Term	Definition
Multi-Line Telephone System (MLTS)	A system composed of common control units, telephone sets, control hardware and software, and adjunct systems, including network- and premises-based systems, such as Centrex and VoIP, as well as PBX, Hybrid, and Key Telephone Systems (as classified by the FCC under Part 68 of Title 47, Code of Federal Regulations) and that includes systems owned or leased by governmental agencies and non-profit entities, as well as for profit businesses.
pseudoANI (pANI)	As the industry has evolved, a term used generically in lieu of terms such as ESRK (emergency service routing key), ESQK (emergency service query key), and ESRD (emergency service routing digits), depending on the classification of the originating service provider or the stage of use during call processing or inflected meaning by the technology of the call. For practical purposes, it can be assumed pANI, ESRK, ESQK, and ESRD are functionally equivalent terms, and for call routing purposes, they are all synonymous with the concept of ANI. For consistency, this document refers to—and uses—the term pANI.
Perceptual Evaluation of Speech Quality (PESQ)	A family of standards comprising a test methodology for automated assessment of the speech quality as experienced by a user of a telephony system. It is standardized as ITU-T recommendation P.862 (02/01).
Perceptual Evaluation of Video Quality (PEVQ)	A standardized end-to-end measurement algorithm to score the picture quality of a video presentation by means of a 5-point mean opinion score (MOS). The measurement algorithm can be applied to analyze visible artifacts caused by a digital video encoding/decoding (or transcoding) process, RF- or IP-based transmission networks, and end-user devices.
Quality of Service (QoS)	The ability of a network to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
Telecommunications Relay Service (TRS)	A federally mandated service provided by states that provides communication relay between Teletypewriter (TTY) users and voice telephone users, via a third party, for communications assistance.
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.
Virtual PSAP	A set of telecommunicators, together with the networks and systems they use, under common management and policies, that may be physically distributed in multiple locations, but act as if they were a conventional PSAP.

Term	Definition
Voice Carry Over (VCO)	A method which utilizes both voice and text communications on the same call, allowing a person who is hearing impaired to speak directly to the other party and receive response via a Teletypewriter (TTY) or other means for text communications.

Acronym List

ACRONYM	DESCRIPTION
3GPP	Third Generation Partnership Project
4G	Fourth Generation
9-1-1SCC	9-1-1 State Coordinating Committee
AAND	Alabama Association of Nine-One-One Districts
AARP	American Association of Retired Persons
ACD	Automatic Call Distributor
AIP	Access Infrastructure Provider
ALI	Automatic Location Information
ALNENA	Alabama National Emergency Number Association
ANGEN	Alabama Next Generation Emergency Network
ANPRM	Advanced Notice of Proposed Rulemaking
ANI	Automatic Number Identification
ANSI	American National Standards Institute
AOL	American Online
APCO	Association of Public-Safety Communication Officials
ASL	American Sign Language
ATIS	Alliance for Telecommunications Industry Solutions
AVL	Automatic Vehicle Location
BCF	Border Control Function
BIP	Broadband Initiatives Program
BTOP	Broadband Technologies Opportunity Program
CA	Communication Assistant
CAD	Computer Aided Dispatch
CAMA	Centralized Automatic Message Accounting
CDMA	Code Division Multiple Access
CERT	Computer Emergency Response Team
CFDA	Catalogue of Federal Domestic Assistance
CIO	Chief Information Officer
CISC	CRTC Interconnection Steering Committee
CLEC	Commercial Local Exchange Carrier
CMRS	Commercial Mobile Radio Service
CO	Central Office
COPS	Community Oriented Policing Services
CPE	Customer Premises Equipment
CRTC	Canadian Radio-Television and Telecommunications Commission
CSEC	Commission on State Emergency Communications (State of Texas)
CSI	Counties of Southern Illinois 9-1-1
CSRIC	Communications Security, Reliability, and Interoperability Council
DBMS	Database Management System
DHS	Department of Homeland Security
DIR	Department of Information Resources
DOC	Department of Commerce

ACRONYM	DESCRIPTION
DoD	Department of Defense
DOJ	Department of Justice
DoS	Denial of Service
E9-1-1	Enhanced 9-1-1
ECRF	Emergency Call Routing Function
ECRIT	Emergency Context Resolution with Internet Technologies
ECU	East Carolina University
EMD	Emergency Medical Dispatch
ENHANCE	Ensuring Needed Help Arrives Near Callers Employing 911 Act of 2004
ERT	Emergency Route Tuple
ESGW	Emergency Services Gateway
ESGWRI	Emergency Services Gateway Route Identifier
ESIND	Emergency Services IP Network Design
ESInet	Emergency Services IP Network
ESN	Emergency Service Number
ESQK	Emergency Services Query Key
ESRP	Emergency Service Routing Proxy
ESWG	Emergency Services Working Group
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FUSF	Federal Universal Service Fee
GIS	Geographic Information System
GMLC	Gateway Mobile Location Center
GMO	Geospatial Management Office
GPS	Global Positioning System
GRE	Generic Routing Encapsulation
HAZMAT	Hazardous Material
HCO	Hearing Carryover
HSGP	Homeland Security Grant Program
HSIP	Homeland Security Infrastructure Protection
HTTP	Hypertext Transfer Protocol
HVAC	Heating, Ventilation, and Air Conditioning
IACP	International Association of Chiefs of Police
IDEA	Individuals with Disabilities Education Act
IECGP	Interoperable Emergency Communications Grant Program
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
ILEC	Incumbent Local Exchange Carrier
IM	IP Multimedia
IM	Instant Messaging
IMS	IP Multimedia Subsystem
IP	Internet Protocol

ACRONYM	DESCRIPTION
ISP	Internet Service Provider
ITS	Intelligent Transportation Systems
ITU	International Telecommunication Union
IWAB	Indiana Wireless E9-1-1 Advisory Board
LAN	Local Area Network
Lat/lon	Latitude/Longitude
LBS	Location-Based Service
LIS	Location Information Server
LNG	Legacy Network Gateway
LoST	Location-to-Service Translation (protocol)
LPG	Legacy PSAP Gateway
LSRG	Legacy Selective Router Gateway
LTE	Long Term Evolution
LVF	Location Validation Function
MESB	Metropolitan Emergency Services Board (Minnesota)
MF	Multifrequency
MID	Mobile Internet Device
MLS	Mobile Location Services (see OMA)
MMS	Multimedia System
MOA	Memorandum of Agreement
MOS	Mean Opinion Score
MOU	Memorandum of Understanding
MPC	Mobile Positioning Center
MPLS	Multi Protocol Label Switching
MSAG	Master Street Address Guide
NAED	National Academies of Emergency Dispatch
NAPSG	National Alliance for Public Safety GIS
NARUC	National Association of Regulatory Utility Commissioners
NASEMSO	National Association of State EMS Officials
NASNA	National Association of State 9-1-1 Administrators
NCS	National Communications System
NCSL	National Conference on State Legislatures
NENA	National Emergency Number Association
NESIC	N-1-1/8XX Essential Services Interoperability Council
NFPA	National Fire Protection Association
NG9-1-1	Next Generation 9-1-1
NGA	National Geospatial-Intelligence Agency
NGPP	Next Generation Partner Program
NGSC	Next Generation Safety Consortium
NG-SEC	Security for Next Generation 9-1-1 Standard
NGTPC	Next Generation 9-1-1 Transition Planning Committee
NHTSA	National Highway Traffic Safety Administration
NIDCD	National Institute on Deafness and Other Communication Disorders
NIST	National Institute of Standards and Technology
NOVES	Non-Voice Emergency Services

ACRONYM	DESCRIPTION
NPRM	Notice of Proposed Rulemaking
NPSTC	National Public Safety Telecommunications Council
NRIC	Network Reliability and Interoperability Council
NSI	Non-Service Initiated
NSSDA	National Standard for Spatial Data Accuracy
NTIA	National Telecommunications and Information Administration
NVC	Non-Voice-Centric
NVI	Non-Voice Initialized
OCIO	Office of the Chef Information Officer
OGC	Open Geospatial Consortium
OMB	Office of Management and Budget
OSP	Originating Service Provider
OUC	Office of Unified Communications (District of Columbia)
pANI	Pseudo Automatic Number Identification
PBX	Private Branch Exchange
PESQ	Perceptual Evaluation of Speech Quality
PEVQ	Perceptual Evaluation of Video Quality
PHB	Per Hop Behavior
POC	Point of Contact
POS	Point of Sale
PRF	Policy Routing Function
PSAP	Public Safety Answering Point
PSE	Pidgin Sign English
PSTN	Public Switched Telephone Network
PUC	Public Utility Commission
QoS	Quality of Service
R3TF	Real Time Text Task Force
RAN	Radio Access Network
RETAINS	Responsive Efforts to Assure Integral Needs in Staffing
RFC	Request for Comments
RFP	Request for Proposals
RITA	Research and Innovative Technology Administration
RSS	Really Simple Syndication
RTP	Real-time Transport Protocol
RTT	Real Time Text
SANS	Subscribe Access Network Surcharge
SBC	Session Border Controller
SIP	Session Initiated Protocol
SMS	Short Message Service
SOP	Standard Operating Procedure
SR	Selective Router
SS7	Signaling System 7
SSP	System Service Provider
T9-1-1	Text Messaging to 9-1-1
TAF	Targeted Accessibility Fund

ACRONYM	DESCRIPTION
TAMU	Texas A&M University
TCS	Telecommunication Systems, Inc.
TDD	Telecommunication Device for the Deaf
TDM	Time-Division Multiplexing
TG	Trunk Group
TIA	Telecommunications Industry Association
TID	Technical Information Document
TLS	Transport Layer Security
TRS	Telecommunications Relay Services
TSP	Telecommunications Service Priority
TTY	Teletypewriter / Teletype
UAC	User Agent Client
UMTS	Universal Mobile Telecommunications System
URI	Uniform Resource Identifier
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USF	Universal Service Fee
VCO	Voice Carryover
VoIP	Voice over Internet Protocol
VPC	VoIP Positioning Center
VPN	Virtual Private Network
VRS	Video Relay Service
VSP	VoIP Service Provider
WAN	Wide Area Network
WFS	Web Feature Service
WG	Working Group
WTSC	Wireless Technology and Systems Committee
XML	eXtensible Markup Language
XMPP	eXtensible Messaging and Presence Protocol

Appendix B—Sources and Documentation

Sources

Congressional Research Service. *Emergency Communications: The Future of 9-1-1*, R41208. Linda K. Moore, March 16, 2010. https://www.911resourcecenter.org/code/ContentDetail.aspx?ContentID=353

Data.gov. *Telephone Subscribership in the United States* (Data through March 2010), August, 2010. http://www.data.gov/raw/2120

DoJ. *ANPRM on Nondiscrimination on the Basis of Disability in State and Local Government Services; Accessibility of Next Generation 9-1-1*, July 26, 2010. http://www.ada.gov/anprm2010/nextgen_9-1-1%20anprm_2010.htm

FCC. *FCC White Paper: The Public Safety Nationwide Interoperability Broadband Network: A New Model for Capacity, Performance, and Cost*, June, 2010. http://fcc.gov/pshs/docs/releases/DOC-298799A1.pdf

FCC. *Internet Access Services: Status as of June 30, 2009*, issued September 2010. http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0902/DOC-301294A1.pdf

FCC. *Local Telephone Competition Status as of June 30, 2009*, issued September, 2010. http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0903/DOC-301310A1.pdf

FCC. Notice of Inquiry. *Framework for Next Generation 911 Deployment*, December 21, 2010. http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db1221/FCC-10-200A1.pdf

FCC. *NPRM on USF*, Federal Register/Vol. 75, No. 179/Thursday, September 16, 2010/Proposed Rules. http://fjallfoss.fcc.gov/ecfs/proceeding/view?name=96-45

FCC. *Report to Congress on State Collection and Distribution of 9-1-1 and Enhanced 9-1-1 Fees and Charges*, July 22, 2009, FCC. http://www.fcc.gov/pshs/services/9-1-1-services/statecollections.html

FCC. *Second Annual Report to Congress*, August 13, 2010. http://www.fcc.gov/ftp/Daily_Releases/Daily_Business/2010/db0817/DOC-300946A1.pdf

FCC. *Trends in Telephone Service*, August, 2008. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-284932A1.pdf

Federal Chief Information Officer (CIO) Council, Best Practices Committee. *Value Measuring Methodology*. http://www.cio.gov/documents/ValueMeasuring_Highlights_Oct_2002.pdf

Intrado. *Next Generation 9-1-1 Cooperative Governance Policy Paper*, August, 2010.

ITS USDOT. *Next Generation 9-1-1 (NG) System Initiative Transition Issues Report*, V. 1.0, February, 2008.
http://www.its.dot.gov/ng9-1-1/pdf/NG9-1-1_POC_DeployPlan_FINAL_v1.0.pdf

ITS USDOT. *Next Generation 9-1-1 (NG) System Initiative Transition Plan*, V. 1.0, February 2, 2009. http://www.its.dot.gov/ng9-1-1/pdf/NG9-1-1_Transition_PlanFinal.pdf

ITS USDOT. *Next Generation 9-1-1 (NG) System Initiative: Final Cost, Value, and Risk*, V. 1.0, March 5, 2009.
http://www.its.dot.gov/ng9-1-1/pdf/USDOT_NG9-1-1_4A2_FINAL_FinalCostValueRiskAnalysis_v1-0.pdf

ITS USDOT. *NG**9-1-1** Initiative-Cost, Value Risk Report, Executive Summary*, V.10, March 5, 2009.
http://www.its.dot.gov/ng9-1-1/pdf/USDOT_NG9-1-1_4A2ES_FINAL_FinalCostValueRiskAnalysis_ExecSum.pdf

L. Robert Kimball & Associates. *State of Michigan Next Generation 9-1-1 Feasibility Study*, April, 2010,
http://www.michigan.gov/documents/msp/RPT110103maj_SNC_MAJ_v8_FINAL_with_cover_342498_7.pdf

L. Robert Kimball & Associates. *State of Minnesota NG9-1-1 Trend Assessment, The Statewide Network Modernization Project*, February, 2008.
http://www.911.state.mn.us/PDF/MN_NG911_TrendAssessment.pdf

L. Robert Kimball & Associates. *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy*, March, 2008.
http://www.911.state.mn.us/PDF/MN911_Network_Modernization_Final_Report.pdf

National Conference of State Legislatures. *Next Generation 9-1-1*, Robert D. Boerner, Vol. 18, No. 28, June-July, 2010. http://www.ncsl.org/default.aspx?tabid=20553

National E9-1-1 Implementation Coordination Office. *A National Plan for Migrating to IP Enabled 9-1-1 Systems*, September, 2009.
http://www.911.gov/pdf/National_NG911_Migration_Plan_FINAL.pdf

National Regulatory Research Institute. *State Universal Service Funding Mechanisms: Results of NRRI's 2005–2006 Survey*, Jing Liu, M.A. and Edwin Rosenberg, Ph.D., July, 2006.
http://nrri.org/pubs/telecommunications/06-09.pdf

NENA Next Generation Partner Program. *Funding 9-1-1 Into the Next Generation: An Overview of NG 9-1-1 Funding Model Options for Consideration*, March, 2007.
http://www.nena.org/sites/default/files/NGFundingReport.pdf

NENA Next Generation Partner Program. *NG9-1-1 Transition Policy Implementation Handbook, A Guide for Identifying and Implementing Policies to Enable NG9-1-1*, March 2010,
http://www.nena.org/sites/default/files/NG9-1-1%20Transition%20Policy%20Implementation%20Handbook_FINAL.pdf

Phillip J. Weiser, Dale Hatfield, and Brad Bernthal. *The Future of 9-1-1: New Technologies and the Need for Reform*, Journal of Telecommunications and High Technology Law, Vol. 6, No. 2, June 5, 2008, University of Colorado Law School.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1146803

State of Tennessee, Office of the Attorney General, *Opinion No: 09-87*, May 18, 2009.
http://tn.gov/commerce/911/documents/09-87vw.pdf

Texas. Commission on State Emergency Communications. *Next Generation 9-1-1 Master Plan.* Austin: TX: Commission on State Emergency Communications, July, 2009.
http://www.911.state.tx.us/files/pdfs/ng911_master_plan_july_2009.pdf

The Colorado 9-1-1 Resource Center. *Report on the State of 9-1-1 Services in Colorado 2010*, May 15, 2010.
http://www.co9-1-1resourcecenter.org/2010%20annual%20state%20of%20911%20report.pdf

Washington. Next Generation 9-1-1 Subcommittee. *Next Generation 9-1-1 in Washington State, A Six-Year Deployment Plan*. Camp Murray: WA October 15, 2009. Available at:
http://www.emd.wa.gov/e911/documents/RPT090122KRS-WashingtonStateNG911FundingStudy-Final1-29-09.pdf

Appendix C—Other Documentation

C.1 9-1-1 Fee Summary and Overview by State

Table C-1 summarizes the fees charged consumers for 9-1-1 service. Please note that this data is a "snapshot in time" and may have changed since its publication. For the most current data, refer to sources provided.

Table C-1: 9-1-1 Fee Summary by State

State	Wireline Fee	Wireless Fee	Prepaid Fee	VoIP Fee	Source
Alabama	5% of tariff rate up to $2.00	$0.70	$0.70	5% of tariff rate up to $2.00	http://codes.lp.findlaw.com/alcode/11/3/98/11-98-6
Alaska	Up to $2.00	Up to $2.00	None	None	http://codes.lp.findlaw.com/akstatutes/29/29.35./01./29.35.135.
Arizona	$0.20	$0.20	None	$0.20	http://law.onecle.com/arizona/state-government/41-704.html
Arkansas	5% or 12% of tariff rate	$0.65	$0.65	$0.65	http://law.justia.com/arkansas/codes/2010/title-12/subtitle-2/chapter-10/subchapter-3/
California	0.50% of intrastate telephone service	0.50% of intrastate telephone service	None	0.50% of intrastate telephone service	http://www.oclaw.org/research/code/ca/RTC/41136./content.html
Colorado	$0.45 to $1.25 ($.70 in most counties)	$0.45 to $1.25 ($.70 in most counties)	None	$0.45 to $1.25 ($.70 in most counties)	http://www.state.co.us/gov_dir/leg_dir/olls/sl2008a/sl_194.htm
Connecticut	$0.47	$0.47	None	$0.47	http://www.cga.ct.gov/2009/pub/chap518a.htm
Delaware	$0.60	$0.60	None	$0.60	http://delcode.delaware.gov/title16/c101/index.shtml
District of Columbia	$0.76 wireline; $0.62 centrex; $4.96 PBX trunk	$0.76	None	$0.76	http://www.michie.com/dc/lpExt.dll/dccode/b48c/fc13/10191/101d3/101da?f=templates&fn=document-frame.htm&2.0#JD_34-1802
Florida	$0.50	$0.50	None	$0.50	http://www.flsenate.gov/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0365/Sections/0365.172.html
Georgia	Up to $1.50	Up to $1.50	Up to $1.50	Up to $1.50	http://law.justia.com/georgia/codes/2006/46/46-5-134.html
Hawaii	$0.27	$0.66	None	None	http://www.capitol.hawaii.gov/hrs2008/Vol05_Ch0261-0319/HRS0269/HRS_0269-0016_0095.htm

State	Wireline Fee	Wireless Fee	Prepaid Fee	VoIP Fee	Source
Idaho	Up to $1.00	Up to $1.00	None	Up to $1.00[117]	http://www.legislature.idaho.gov/idstat/Title31/T31CH48SECT31-4804.htm
Illinois	$0.25 to $5.00	$0.73; City of Chicago: $2.50	$0.73	$0.25 to $5.00	http://law.onecle.com/illinois/50ilcs750/15.4.html
Indiana	3% to 10% of monthly access charge	$0.50	$0.25	3% to 10% of monthly access charge	http://www.in.gov/legislative/ic/code/title36/ar8/ch16.html
Iowa	$0.45 to $1.50	$0.65	None	None	http://coolice.legis.state.ia.us/cool-ice/default.asp?category=billinfo&service=iowacode&ga=83&input=34A
Kansas	Up to $0.75	$0.50	1% of Retail	$0.50	http://www.kslegislature.org/legsrv-statutes/getStatute.do
Kentucky	$0.36 up to $4.50	$0.70	$0.70	$0.36 up to $4.50	http://lrc.ky.gov/KRS/065-00/760.PDF
Louisiana	Up to $2.00	$0.85	2% of Retail	None	http://www.legis.state.la.us/lss/newWin.asp?doc=91735
Maine	$0.37	$0.37	$0.37	$0.37	http://www.mainelegislature.org/legis/statutes/25/title25sec2927.html
Maryland	$1.00	$1.00	None	$1.00	http://law.justia.com/maryland/codes/2010/public-safety/title-1/subtitle-3/1-309/
Massachusetts	$0.75	$0.75	$0.75	$0.75	http://law.onecle.com/massachusetts/6a/18H.htm
Michigan	$0.19 State Fee; $0.18 to $3.00 by county	$0.19 State Fee; $0.18 to $3.00 by county	$0.19 State Fee; $0.18 to $3.00 by county	$0.19 State Fee; $0.18 to $3.00 by county	http://www.legislature.mi.gov/(S(cuuqjq45em2qke45pu1usf45))/mileg.aspx?page=getobject&objectname=mcl-408-384a
Minnesota	$0.80	$0.80	$0.80	$0.80	https://www.revisor.mn.gov/statutes/?id=403.113
Mississippi	Up to $1.00	Up to $2.00	Up to $2.00	Up to $1.00	http://www.mscode.com/free/statutes/19/005/0307.htm
Missouri	15% of tariff rate	None	None	15% of tariff rate	http://www.moga.mo.gov/statutes/c190.htm
Montana	$1.00	$1.00	None	$1.00	http://data.opi.mt.gov/bills/mca/10/4/10-4-101.htm
Nebraska	$0.50 up to $1.00	$0.50 up to $0.70	None	$0.75	http://law.justia.com/nebraska/codes/s86index/s8604039000.html
Nevada	Up to $0.25	Up to $0.25	None	None	http://www.leg.state.nv.us/nrs/NRS-244A.html#NRS244ASec7645
New Hampshire	$0.57	$0.57	None	None	http://law.justia.com/newhampshire/codes/2009/TITLEVII/CHAPTER106-H/106-H-9.html

[117] Idaho VoIP may include an additional enhanced E9-1-1 fee of 25 cents per month on each wireline access and inter-connected VoIP service line to fund E9-1-1 service in certain areas

State	Wireline Fee	Wireless Fee	Prepaid Fee	VoIP Fee	Source
New Jersey	$0.90	$0.90	None	$0.90	http://www.state.nj.us/911/resource/statute/index.html
New Mexico	$0.51	$0.51	$0.51	None	http://law.justia.com/newmexico/codes/2006/nmrc/jd_63-9d-3-179c5.html
New York	$0.35 or $1.00	$1.20 up to $1.50	None	None	http://law.justia.com/newyork/codes/2006/county/idx_cnt0a6.html
North Carolina	$0.60	$0.60	None	$0.60	http://www.ncga.state.nc.us/gascripts/statutes/StatutesTOC.pl?Chapter=0062A
North Dakota	$1.00 to $1.50	$1.00 to $1.50	None	$1.00 to $1.50	http://www.legis.nd.gov/cencode/t57c406.pdf
Ohio	Property tax and/or fee up to $0.50; In all counties LEC: $0.12 to $0.60	$0.28	None	None	http://codes.ohio.gov/orc/4931
Oklahoma	Varies up to 15% of tariff rates	$0.50	$0.50	$0.50	http://www.acogok.org/Newsroom/Downloads08/ok911wlact.doc
Oregon	$0.75	$0.75	$0.75	$0.75	http://www.leg.state.or.us/ors/403.html
Pennsylvania	$1.00 to $1.50	$1.00	None	$1.00	
Rhode Island	$1.00	$1.26	None	$1.26	http://www.rilin.state.ri.us/statutes/title39/39-21.1/39-21.1-14.HTM
South Carolina	$0.50 up to $1.00	$0.61	None	None	http://www.scstatehouse.gov/code/t23c047.htm
South Dakota	$0.75	$0.75	None	$0.75	http://legis.state.sd.us/statutes/DisplayStatute.aspx?Type=Statute&Statute=34-45-4
Tennessee	Up to $1.50	Up to $2.00	$1.00	$1.00	http://www.michie.com/tennessee/lpext.dll/tncode/4acd/5cc4/6222/62ee/630d#JD_7-86-303
Texas	$0.50 plus it varies by HRC & ECD	$0.50	2% of Retail	$0.50	http://law.onecle.com/texas/health/chapter771.html
Utah	Up to $0.61 local fee plus $0.08 state fee	Up to $0.61 local fee plus $0.08 state fee	None	Up to $0.61 local fee plus $0.08 state fee	http://le.utah.gov/~code/TITLE69/htm/69_02_000500.htm
Vermont	In state USF surcharge	USF	None	None	http://e911.vermont.gov/laws_rules
Virginia	5% of sales tax	$0.75	$0.75	$0.75	http://law.justia.com/virginia/codes/2006/toc5600000/56-484.17.html

State	Wireline Fee	Wireless Fee	Prepaid Fee	VoIP Fee	Source
Washington	$0.20/ State & $0.50/ County	$0.20/ State & $0.50/ County	None	None	http://apps.leg.wa.gov/rcw/default.aspx?cite=38.52.540
West Virginia	$0.98 to $5.34 by county	$3.00	6% of sales	$0.98 to $5.34 by county	http://www.apco911.org/about/911EI/WV.pdf
Wisconsin	$0.36 to $1.00	$0.92	None	None	http://www.lawserver.com/law/state/wisconsin/wi-laws/wisconsin_laws_25-98
Wyoming	Up to $0.75	Up to $0.75	None	Up to $0.75	http://legisweb.state.wy.us/statutes/statutes.aspx?file=titles/Title16/T16CH9.htm

Source: Intrado, Inc., data as of July 1, 2010.

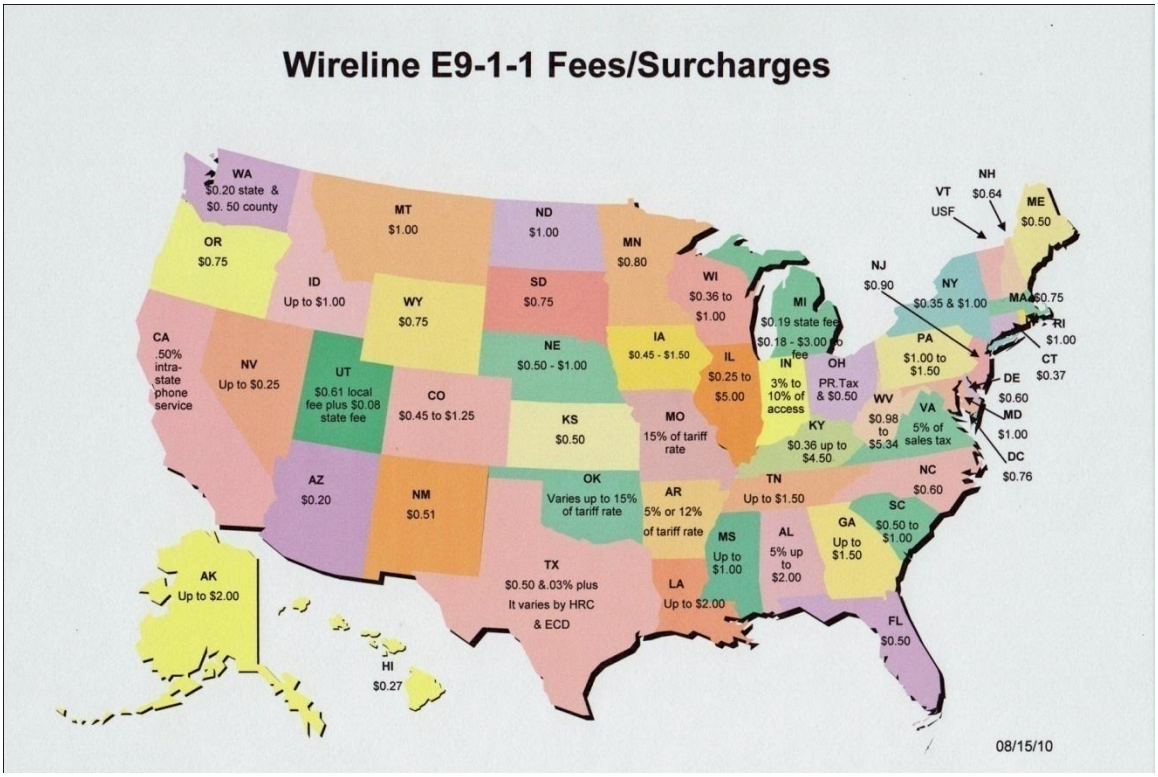

Figure C-1: Wireline E9-1-1 Fees/Surcharges

In some cases the wireless 9-1-1 fee (Figure C-2) level mirrors that of wireline (e.g., Minnesota) while in other cases, the wireless 9-1-1 fee is either non-existent (Missouri) or not on par with wireline (e.g., West Virginia).

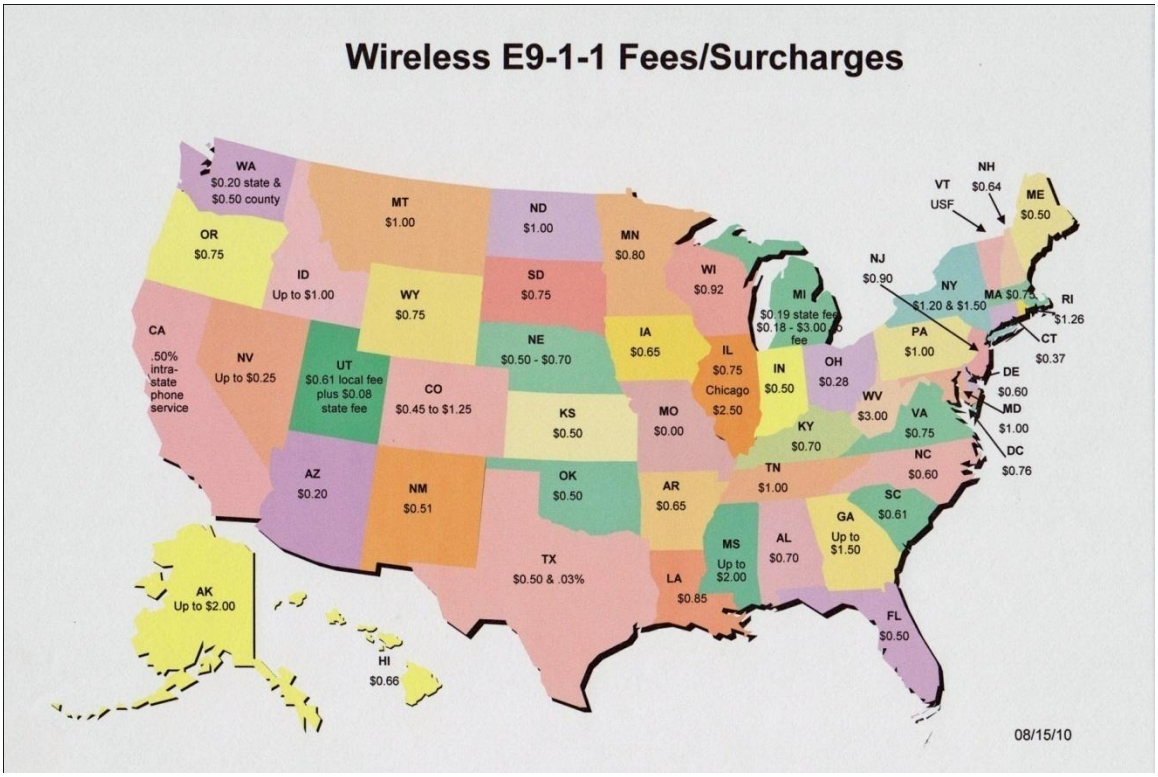

Figure C-2: Wireless E9-1-1 Fees/Surcharges

In some cases, VoIP fees (Figure C-3) mirror those of wireline and wireless (Kansas), and in other situations, no VoIP subscriber fees exist (New York, South Carolina, and Wisconsin).

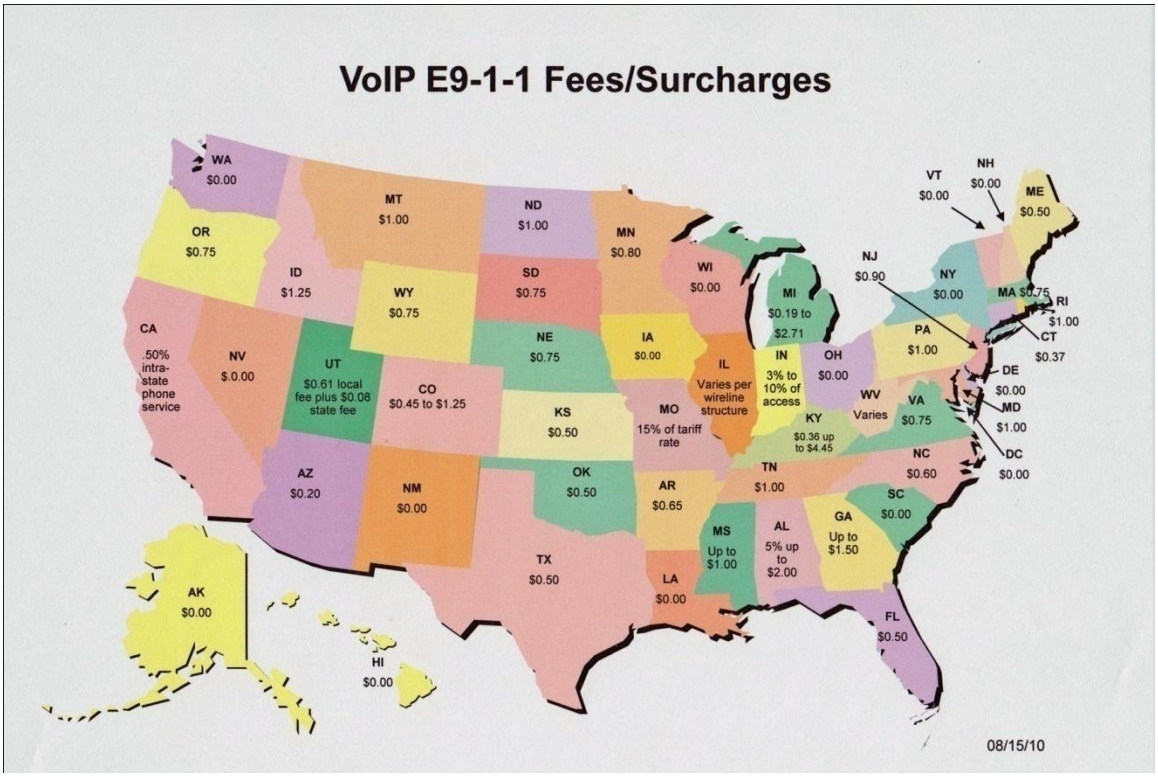

Figure C-3: VoIP E9-1-1 Fees/Surcharges

Prepaid (Figure C-4) is the most problematic fee collection model to date. Most states (31 of 50) have not effectively addressed the issue of 9-1-1 fee collections on prepaid services.

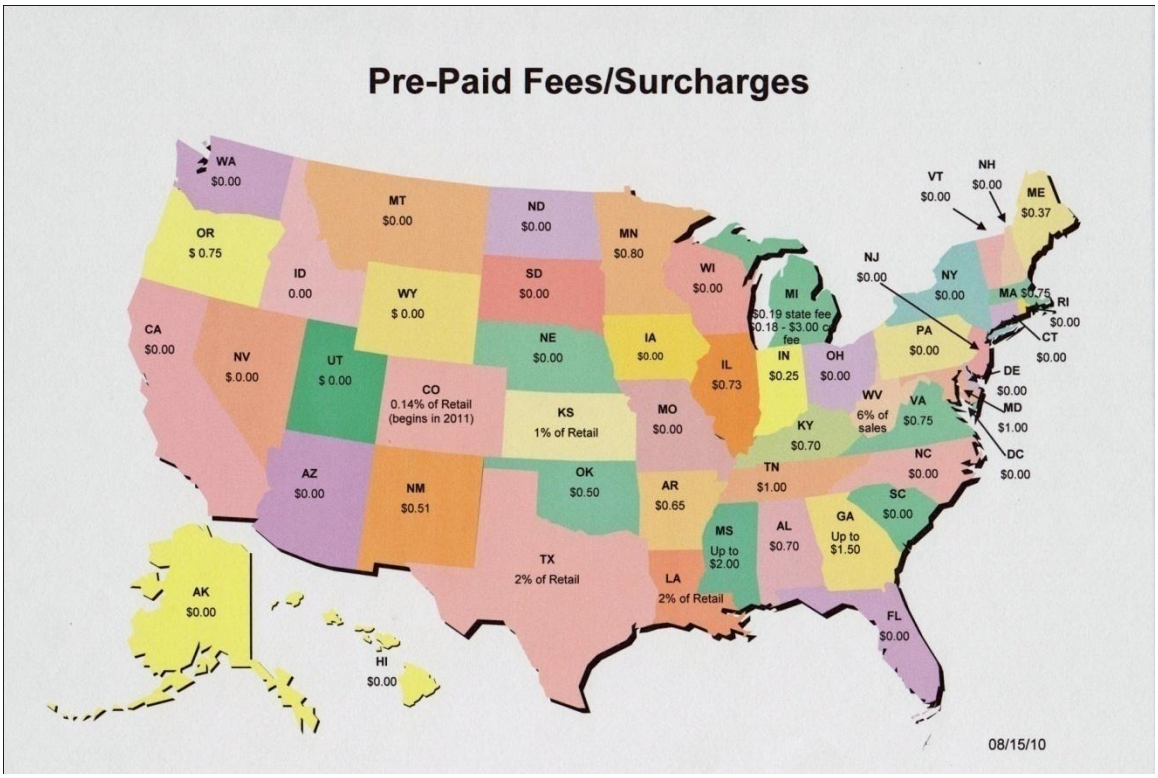

Figure C-4: Prepaid E9-1-1 Fees/Surcharges

Source: Intrado, Inc., data as of August 15, 2010.

C.2 Retail Point of Sale Model Legislation

The NCLS noted that "current collection methodologies are not well suited to prepaid wireless service which can cause administrative disputes that inhibit the collection of E9-1-1 fees on prepaid wireless service" and subsequently adopted a resolution endorsing a uniform methodology that would collect prepaid wireless 9-1-1 fees on end users at the retail POS[118].

In 2009, Texas adopted "prepaid" legislation similar to language proposed by the NCSL Executive Committee Task Force on State & Local Taxation of Communications and Electronic Commerce (the "NCSL Model"), promulgated in July 2009. Under the Texas model, the fee was effective June 1, 2010. The fee is collected by the seller from the consumer at the time of and with respect to each retail transaction of prepaid wireless telecommunication services in Texas. The fee is 2.0 percent of the purchase price of each prepaid wireless telecommunication service sold via retail transaction or used by a seller in the state. The amount of the fee must be separately stated on an invoice, receipt, electronic communication, or other similar document that is provided to the consumer by the seller and is not subject to any other tax or fee imposed by the Tax Code. Essentially, a seller or a wireless service provider is liable for the fee on: (a) the retail price; or (b) the value of a prepaid wireless telecommunication service not sold at retail but used by a seller or other person in Texas. A seller may deduct and retain 2.0 percent of the fees it collects during each report period to offset its costs in collecting and remitting the fee.

Under the legislation, a retail transaction is deemed to have occurred in Texas when the transaction occurs at a business location in the state or when the consumer's primary business address or residential address is in Texas. Each seller must determine the consumer's address for each retail transaction made by telephone and over the Internet. The fee is due when the consumer's primary business address or residential address is in Texas.

Because the issue of prepaid wireless service and wireless 9-1-1 fees/surcharges should be considered or studied by legislative, administrative, regulatory, tax, and/or policy-making bodies, specific basic model guidelines for drafting such legislation may assist government and other interested parties on the issues. NENA has drafted model legislation[119]. The enactment of legislation to collect the appropriate 9-1-1 surcharge in states that have not already adopted such legislation should be encouraged to promote greater fairness, parity, and stabilization of wireless 9-1-1 fees and 9-1-1 funding associated with growing consumer use of prepaid wireless service.

[118] http://texinfo.library.unt.edu/texasregister/html/2010/oct-15/adopted/34.PUBLIC%20FINANCE.html
[119] http://www.nena.org/sites/default/files/Model_guidlines_for_prepaid_9-1-1_fees_v1_9.24.08.pdf

C.3 Text to 9-1-1 Authority Messaging Services

This is an incomplete list of current or developing text to 9-1-1 Authority messaging services. Any omission is an unintended oversight. This list was compiled as a guide to discussion for the Technology Subgroup, and is not intended as an endorsement of any service provider or technology.

> **"Emergency text services"** is defined or abstracted in various NENA NG9-1-1 documents, and is proposed for inclusion in the Baseline NG9-1-1 definition (pending final release by NENA).
>
> "**SMS**" is defined as the text messaging service defined by international standards and offered by the wireless service providers. SMS excludes text messaging applications or services that are over-the-top applications or services operating outside of the wireless networks. Examples of these applications (e.g. "Free SMS" and "SMS bypass").are not included in the definition of "SMS."
>
> **"Pilot projects"** is defined to mean that the service is available on a limited basis, and may or may not be in commercial production.
>
> "**Developing**" is defined to mean a service that has been publicly displayed or is pending implementation, which may be limited only to a proof of concept.
>
> **"In research"** is defined to mean that published white papers or draft specifications are generally available for review and analysis.
>
> **"NOVES"** Non-Voice Emergency Services is a 3GPP study looking at solutions and enhancements to wireless networks for providing non-voice emergency communications to emergency services (e.g., NG9-1-1). This activity includes emergency text services as defined above.

All of these services can also be labeled "non-voice" or "non-traditional" public to authority communication. To include the broadest base of service types and eliminate misconception of one type of text service versus another, this classification of access to a 9-1-1 Authority by the public is referred to as *non-voice services.*

The infrastructure and certain technologies required to fully support non-voice services in the NENA i3 model is not currently available via 9-1-1 OSPs. OSPs indicate that non-voice communication to a 9-1-1 Authority will not be possible until the development and deployment of certain LTE technologies and the standardization and deployment of NOVES. In discussion within the Technology Subgroup, OSPs offered this position as the prerequisite for the general availability of non-voice accessibility to the 9-1-1 Authority.

As of the date of this report, some 9-1-1 OSPs have set out LTE deployment timelines. LTE is just now entering the marketplace in selected geographic areas, and it is important to note that many of the announcements contain forward-looking statements. This report has a goal of determining what is available in a close-in time frame.

Through discussion, research, and investigation, the Technology Subgroup has attempted to

compile currently available methods and development concepts to provide non-voice access from the public to the 9-1-1 Authority. This list was compiled by contributions of the entity offering or developing the service or by investigation of those subgroup members that were familiar with the service.

In addition to the work performed by the Technology Subgroup, relevant portions of a similar work group from Canada have been incorporated into this report. These are noted by citation. Specifically, excerpts are from the ESWG report ESRE 0051, *Text Messaging to 9-1-1 (T9-1-1) Service*, dated January 21, 2010, prepared for the CRTC[120]. This citation and the extracts from this report are provided because of the commonality of the subject matter with the work of the Technology Subgroup.

A limited analysis of the characteristics of a non-voice service is presented in the matrix on the following pages. The analysis contains subjective as well as measurable metrics where those are available.

In cases where subjective values were incorporated into the matrix through the assignment of characteristics of a specific service element, assignments were reached by consensus discussion. An empty cell in the analysis matrix should be interpreted as either a lack of consensus or the lack of adequate information or knowledge to present any ranking or analysis.

Because of the limited nature of deployment and competitive environment that brings these services into the marketplace, the assignment of analysis values, ratings, rankings, operating characteristics, or other values should not be viewed as an endorsement or rejection of one service type over another.

Assumptions for Table C-2:

> **General assumption 1:** A number of operational characteristics affecting these services should also be considered, such as overall security; prevention from "spoofing" (i.e., taking on the identity of another); DoS attacks; and the time frame of implementation. An assessment of these characteristics and service elements was not considered by the working group.
>
> **General assumption 2:** The working group did not consider the cost of deployment in its review.

Descriptions of the services in Table C-2:

Column A—SMS Text Direct to PSAP: One example of this SMS text to PSAP service is the Intrado Blackhawk, Iowa, implementation, which is a specific implementation of SMS to the PSAP. This particular version of the service uses a "911" short code.

The participating wireless carrier modified its network to facilitate this implementation, which is exclusive to one PSAP[121].

[120] The CRTC order adopting the report is available at: http://www.crtc.gc.ca/eng/archive/2010/2010-224.htm
[121] More about this service is available at: http://www.intrado.com/assets/documents/blackhawk.pdf

In the general case of these types of text to the PSAP services, there is no caller location information provided with SMS message sub-system.

Column B—Call 9-1-1, w/SMS text back (SMS T9-1-1): This type of service is scheduled for field trials approved by the CRTC [refer to previous citation]. This service currently targets people who are deaf, hard of hearing, and have a speech disability.

Users enroll for the SMS T9-1-1 service, and their wireless handset is identified via a specialized ALI database entry. The user places a conventional 9-1-1 voice call but does not speak (referred to as a silent 9-1-1 call). The ALI database alerts the call taker that the caller has requested an SMS text response.

Using a text gateway or even a wireless handset at the 9-1-1 Authority, the silent 9-1-1 call remains active (where possible) and provides Phase II location information. The remainder of the 9-1-1 call continues by SMS text.

In cases where the caller's handset and the wireless provider's network support simultaneous voice and SMS text, the silent voice call will continue to provide Phase II location information as well as background audio from the caller's location. This also enables HCO or VCO. This service category can be deployed on legacy E9-1-1 networks, on transitional NG9-1-1 networks or in an NG9-1-1 environment.

Column C—National SMS text 9-1-1 Relay Center: No specific examples of this service are cited by their inclusion in this table. The service represented in this matrix would be a provided on a nationwide basis, perhaps using a 5 or 6 digit short code.

Users would send a text message to the short code, which would be inter-mediated by a communications assistant. The communications assistant would ascertain the location of the caller by SMS message exchange, or perhaps by the use of location based services (LBS) in association with LBS access to a wireless carrier's network.

The Communications Assistant (CA) for this service is similar to the role of a CA in dual party relay service or video relay service, and may then use an emergency services gateway aggregator to route the 9-1-1 call to the appropriate local authority.

This service category can be deployed on legacy E9-1-1 networks, on transitional NG9-1-1 networks or in an NG9-1-1 environment.

Column D – SMS Short Code or 10-Digit Text to an Individual PSAP: This service is similar to column A, but there have been no modifications to the wireless carrier's network or other specialized connections created or established. Various local authorities have implemented these types of services. One example of this service is referenced here: http://www.ocala.com/article/20100811/ARTICLES/100819945

Column E—Handset Software TTY Emulation: This text to local authority service consists of a downloadable software package (or other distributable wrapper) that enables specific models of handsets to have the ability to emulate a TTY device.

In use, the 9-1-1 caller would dial and establish a 9-1-1 call, and then start the emulation

software, (or the emulation software may be capable of passing a dial command to the phone.) The TTY emulation system uses the legacy voice path for communications, and where available, also provides phase II location information. All local authorities have TTY capability, making this service generally available. Reference information about one type of this service is at: http://www.nirmalpatel.com/docs/deaf_911_rerc_2009.pdf

This service category can be deployed on legacy E9-1-1 networks, on transitional NG9-1-1 networks or in an NG9-1-1 environment.

Table C-2: Characteristics of SMS/TTY Messaging Services

		(A)	(B)	(C)	(D)	(E)
Line No.	**Characteristics**	**SMS Text Direct to PSAP**	**Call 9-1-1 w/SMS Text Back *(caller dials 9-1-1 and the PSAP initiates a text message session)***	**National SMS Text 9-1-1 Relay Center**	**SMS Short Code or 10-Digit Text to an Individual PSAP**	**Handset Software TTY Emulation**
1	What service request initiation method is used?	SMS text	silent 9-1-1 call with SMS text back	SMS text	SMS text	9-1-1 voice call with TTY emulation
2	Is the Universal Access Number used?	No (this example uses the non-standard specific short code “911”)	Yes (voice 9-1-1)	Yes, (using a single nationwide short code)	No (multiple short codes or 10-digit numbers)	Yes (uses voice 9-1-1)
3	Relies on what underlying service (grade or method of delivery)	SMS text	E9-1-1 voice call plus SMS	SMS text	SMS text	Voice 9-1-1 call
4	Is the 9-1-1 call directly or selectively routed to the proper authority?	No, routing is pre-set	Yes (voice call is routed automatically, text is a reply to the inbound SMS)	No	No	Yes
5	Does the service capture the 9-1-1 caller’s initial location?	No	Yes	No, without access to carrier location based services or information	Perhaps	Yes
6	Does the service provide continuous location updates?	No	Yes	No	No	Yes
7	Who is the initiator of the two-way text conversation?	Caller	Caller initiated voice call, PSAP initiates text	Caller	Caller	Caller or PSAP using TTY service
8	Does the service allow voice and text simultaneously?	Perhaps (may have handset or network limitations)	Perhaps (may have handset or network limitations)	Perhaps	Perhaps	Possibly, depending on handset software features

		(A)	(B)	(C)	(D)	(E)
Line No.	**Characteristics**	**SMS Text Direct to PSAP**	**Call 9-1-1 w/SMS Text Back *(caller dials 9-1-1 and the PSAP initiates a text message session)***	**National SMS Text 9-1-1 Relay Center**	**SMS Short Code or 10-Digit Text to an Individual PSAP**	**Handset Software TTY Emulation**
9	Does the service support HCO/VCO (hearing/voice carry over)?		Partial, limited by the service design			Possibly, depending on handset software features
10	Does the call taker have background audio or situation information and incident cues?	No	Yes	No	No	Possibly, depending on handset software features
11	Can the call taker "sample" audio from the caller?	No	Perhaps	No	No	Possibly, depending on handset software features
12	Can the call voice and text be recorded in a logging system?	Yes	Yes	Yes	Yes	Yes
13	Is the service focused for people who are deaf, hard of hearing, or have a speech disability?	No	Yes	Yes, text only		Yes
14	Can the service be used in "fully silent" or covert mode?	Yes	No	Yes	Yes	Yes
15	Can the caller reach a PSAP from a device with text-only capability (no active voice telephone service)?	Yes, but must have an SMS subscription	Yes, but must have an SMS subscription	Yes, but must have an SMS subscription	Yes, but must have an SMS subscription	No
16	Will the service work from a non-service initialized telephone (NSI handset)?	No	Voice call only, no SMS text	No	No	Possibly, depending on handset software features
17	Can the service be ubiquitous, with simultaneous deployment nationwide?	No	No	Yes	No	Yes
18	How much public education is required to work effectively if deployed nationwide? 1=limited through 5=more extensive	5	4	3	5	3

		(A)	(B)	(C)	(D)	(E)
Line No.	**Characteristics**	**SMS Text Direct to PSAP**	**Call 9-1-1 w/SMS Text Back *(caller dials 9-1-1 and the PSAP initiates a text message session)***	**National SMS Text 9-1-1 Relay Center**	**SMS Short Code or 10-Digit Text to an Individual PSAP**	**Handset Software TTY Emulation**
19	Is a MID (mobile Internet device) software application or software application on a MID required?	No	No	No	No	Yes
20	What is the status of this non-voice communication method?	Limited deployment as a pilot project	In trials	Developing	Developing as pilot projects	In research

Footnotes and errata for Table C-2:

Row 5 column C: Where carriers operate handset location determination services (often used in fleet management as a location-based service (LBS), the location of the handset could be queried by this type of service using a type of connection arrangement (a) where it is available for this class of service (9-1-1), and (b) from specific types of relay center providers who have access to or have incorporated this technology.

Row 6, column B and column E: See row 8 note, below. Column C, see a possible exception using LBS as noted in the note for row 5, above.

Row 8, all columns: Some telephones do not support text and voice simultaneously, or do not support text in emergency mode. Handsets that use Universal Mobile Telecommunications System (UMTS) or Code-Division Multiple Access 2000 (CDMA2000) (or more advanced over the air technologies) are designed to support simultaneous voice and text. Specific handsets or other network configurations may not be able to perform simultaneous voice and text.

Row 9, column E: See the note above for row 8, in addition to the notes in column E of the matrix.

Row 10, column B: See the note for row 8, above.

Row 10 and row 11, column B: For handsets and networks that can simultaneously send voice and SMS text, the background audio of the 9-1-1 call would be present within the "silent" (no verbal communication is present) voice path between the handset and the 9-1-1 Authority call taker.

Row 10 and row 11, column E: Depending on the features of the TTY emulation software, background audio may be present during periods when the caller is not sending TTY data via the handset keyboard.

Row 14, column B: TTY audio may "spill over" in HCO mode from the 9-1-1 caller's handset. This could prevent covert operation.

Row 20, column A: This is not currently a commercially available service. The Blackhawk Iowa pilot project is an example of an initial implementation.

Row 20, column B: Trials such as the one ordered by the CRTC in Canada are currently

underway.

Assumptions for Table C-3:

> **General assumption 1**: As in Table C-2, a number of operational characteristics that affect these services should also be considered, such as security, prevention of "spoofing" (that is taking on the identity of another), DoS attacks, and the time frame of implementation. An assessment of these characteristics and service elements was not considered by the working group.
>
> **General assumption 2**: The working group did not consider the cost of deployment in its review.

Descriptions of the services in Table C-3:

Column F—9-1-1 Call and Associated e-mail: One example of this service is provided by a software application used by the 9-1-1 Authority. In operation, a voice 9-1-1 call is placed, and during the call, it is indicated to the call taker that non-voice communication should be established. This non-voice communication channel uses technology defined by the provider as "Call Handler Systems and Methods."

In one embodiment of the service, a call handling system is configured for handling a variety of emergency and/or non-emergency related calls. For example, the call handling system may allow a call handler to recognize and respond to certain received call information. The call handling system comprises a call interface configured for receiving the non-voice call information. A process is communicatively coupled to the call interface and configured for processing the call information to initiate a non-voice communications protocol. One report of this service is located at: http://www.zdnet.com/news/new-york-to-use-cell-phone-photographers-to-help-fight-crime/150929

Column G—SMS to Central Agency or Relay Center (European Union REACH 112 service): REsponding to All Citizens needing Help is an initiative in the European Union to implement an accessible alternative to traditional voice telephony that will be suitable for all. REACH112 plans to implement a 12-month pilot in Sweden, the United Kingdom, The Netherlands, France, and Spain, allowing persons with disabilities to communicate at a distance with each other and directly with the emergency services. Additional information is available at: http://www.reach112.eu/view/en/index.html

Column H—Provider or PSAP hosted supplemental ALI database systems: This category includes competing services in the marketplace, but they share a common method of operation. The public creates a registered profile account, which contains information that is accessible to the 9-1-1 Authority when a call is placed from an enrolled handset. The registered user's handset number is the key to the information he/she has previously provided.

In some implementations, the completion and later activation of the profile also encompasses an authorization for the provider to query the location of the handset using LBS (with the assumption that the provider has access to the 9-1-1 OSP's LBS services).

In operation, the receipt of a 9-1-1 call from a registered user causes the profile information to

be presented to the call taker, in addition to any Phase II location information associated with the voice portion of the call.

The 9-1-1 Authority then invokes operating protocols, such as continuing the voice portion of the call and using SMS for non-voice communication, (either with the voice call active or inactive) and where possible, combining it with LBS data to display the location of the caller. Emergency communication then continues using the non-voice channel as appropriate. Additional information about this service is available at this provider's website portal: http://info.smart911.com/; or at this agency's website: http://www.nashville.gov/ecc/

This service category can be deployed on legacy E9-1-1 networks that have added IP access, on transitional NG9-1-1 networks or in an NG9-1-1 environment.

Column I—Real Time Text (RTT) to 9-1-1 or PSAP: This category of communications is frequently blended in with the category of IM. In operation, the two services have distinct differences.

In this matrix, and in standards development in general, RTT is defined to mean the character-by-character transmission of message information between the public and the 9-1-1 Authority. RTT is conversational text that is sent and received on a character-by-character basis. The characters are sent immediately once typed and are also displayed immediately to the receiving person or people. This allows text to be used in the same conversational mode as voice.

A common variant of RTT is line-by-line presentation of conversation content, which is presented in this matrix in the IM category that follows.

The development of standards related to RTT to 9-1-1 local Authorities is occurring within NENA; the International Telecommunications Union (ITU); IETF, and the Real Time Text Task Force (R3TF). More information on the Real Time Text Task Force is available at: http://www.realtimetext.org/

RTT can be deployed on transitional or end state NG9-1-1 networks. RTT cannot be deployed on legacy only E9-1-1 networks.

Column J—Instant Messaging (IM) to 9-1-1 or PSAP: In this matrix, this service is defined to mean the line-by-line presentation of non-voice communication from the public to the local Authority.

Service development and standards development mirror those of RTT listed above. IM services can be deployed on transitional or end state NG9-1-1 networks. IM services cannot be deployed on legacy only E9-1-1 networks.

Table C-3: Characteristics of E-mail, SMS, RTT, and IM Messaging Services

		(F)	(G)	(H)	(I)	(J)
	Characteristics	**9-1-1 Call and Associated e-mail**	**SMS to Central Agency or Relay Center EU (REACH 112)**	**Provider or PSAP Hosted Supplemental ALI Database Systems**	**Real Time Text (RTT) to 9-1-1 or PSAP**	**Instant Messaging (IM) to 9-1-1 or PSAP**
1	What service request initiation method is used?	9-1-1 call	SMS	9-1-1 voice call, then SMS text session with handset location by subscriber permission	9-1-1 from telephone operating system or application launch	9-1-1 from telephone operating system or application launch
2	What is the Universal Access Number?	911	varies	911	Unknown	unknown
3	Relies on what underlying service (grade or method of delivery)?	9-1-1 voice plus e-mail service	SMS	9-1-1 voice call, SMS text, and LBS	Uses handset IP service for SIP/XMPP data exchange, including location (character-by-character based)	Uses handset IP service for IM exchange, including location (line at a time based)
4	Is the 9-1-1 call directly routed to the proper authority?	Yes	Not initially	Yes	Unknown	Unknown
5	Does the service capture the 9-1-1 caller's initial location?	Yes	No	Yes	Implementa-tion dependant	Implementa-tion dependant
6	Does the service provide continuous location updates?	Yes, through the underlying voice call	No	Yes, initially with the underlying voice call, and then by location-based service	Implementa-tion dependant	Unknown
7	Who is the initiator of the two-way text conversation?	PSAP	Caller	PSAP	Caller	Caller
8	Does the service allow voice and text simultaneously?	Perhaps	Unknown	Yes	Unknown	Unknown
9	Does the service support HCO/VCO (hearing/voice carry over)?	Yes, through the underlying voice call	No	Yes	Unknown	Unknown
10	Does the call taker have ongoing audible location/situation information and incident cues?	Yes, through the underlying voice call	No	Yes, through the underlying voice call	Unknown	Unknown
11	Can the call taker "sample" audio from the caller?	Yes, through the underlying voice call	No	Yes, through the underlying voice call	Unknown	Unknown

		(F)	(G)	(H)	(I)	(J)
	Characteristics	**9-1-1 Call and Associated e-mail**	**SMS to Central Agency or Relay Center EU (REACH 112)**	**Provider or PSAP Hosted Supplemental ALI Database Systems**	**Real Time Text (RTT) to 9-1-1 or PSAP**	**Instant Messaging (IM) to 9-1-1 or PSAP**
12	Can the call voice and text be recorded in a logging system?	Yes	Unknown	Yes	Yes	Yes
13	Is the service focused for people who are deaf, hard of hearing, or have a speech disability?	Unknown	Unknown	No	Unknown	Unknown
14	Can the service be used in "fully silent" or covert mode?	Unknown	Unknown	Unknown	Unknown	Unknown
15	Can the caller reach a PSAP from device with text-only capability (no active telephone service)	No	Unknown	No	No	No
16	Will the service work from a non service initialized telephone (NSI handset)?	voice only	No	voice only	No	No
17	Can the service be ubiquitous, with simultaneous deployment nationwide?	No, individual PSAP deployment	Unknown	No, individual PSAP deployment	No, requires NG9-1-1	No, requires NG9-1-1
18	How much public education is required to work effectively if deployed nationwide? 1=limited through 5=more extensive	5	5	5	3	3
19	Is a MID (mobile Internet device) or software application on a MID required?	Yes, for the e-mail component	No	No	Yes	Yes
20	What is the status of this non-voice communication method?	Deployed, active (New York City)	Active in the European Union, not in the United States	Active	Developing	Developing

Footnotes and errata for Table C-3:

Row 1, column F: An example of these types of service platforms are those by PowerPhone, which has patented certain aspects of these technologies.

Row 1, column H: An example of these types of service platforms are those by Rave™ Mobile Safety and others.

Row 3, column F: Location is only known for the voice portion of the 9-1-1 call.

Column H, row 3: This service is dependent on handset and network capabilities. These features may not be available on all handsets or on all networks, and are an "opt-in" service whereby the

public enrolls and provides supplemental information to the PSAP, which is retrieved if the subscriber places a 9-1-1 call.

Row 5, column I and column J: This service is dependent on handset software and network transport capabilities.

Row 8, all columns: Some telephones do not support text and voice simultaneously, or do not support text in emergency mode. Handsets that use UMTS or CDMA2000 (or more advanced over the air technologies) are designed to support simultaneous voice and text. Specific handsets or other network configurations may not be able to perform simultaneous voice and text.

Row 9, 10, and 11; Column I and column J: Handset software and network features will affect the delivery of these service characteristics.

Row 18, column H: Customer education is part of the opt-in and registration process. The subscriber can provide various levels of information.

Row 19, column F: Voice service and mobile device e-mail service are required for the service to be used.

Row 20, column F: See http://www.911dispatch.com/2008/09/nyc-911-accepts-photos-videos-sorta/

C.3.1 ESWG – Text Messaging to 9-1-1 (T9-1-1) Service

The following section of this report is excerpted from the ESWG report ESRE 0051, *Text Messaging to 9-1-1 (T9-1-1) Service,* dated January 21, 2010, prepared for the CRTC.[122]

In many ways, the work of the ESWG parallels that of this CSRIC working group, and certain of its key findings are included here for their relevance.

From the ESWG final report as adopted by the CRTC, these areas affecting accessibility were studied by the ESWG:

1. Teletypewriter (TTY) technology
   a. TTY Emulation on Wireless Smartphones
2. Short Message Service (SMS)
3. SMS Short Code Access Method
4. Positron Public Safety Systems Canadian Proposal
5. SMS T9-1-1 Via a Relay Centre Solution
6. SMS T9-1-1 via Silent Wireless Voice Call
   a. Methods of Indicating to PSAP that a SMS Response is Required
   b. PSAP Lookup National Database
   c. TN Pre-Registration Method
   d. Abbreviated Dialing Code Method
   e. Unique Area Code Method
   f. Unique Central Office Code Method
   g. Wireless Subscriber Information (WSI) Indicator
   h. Long-Term SMS T9-1-1 Solution
7. Instant Messaging (IM)

[122] http://www.crtc.gc.ca/public/cisc/items/ESRE0051.doc

8. Real Time Text (RTT)
9. Blackhawk County (US) SMS to 9-1-1 Trial
10. UK Emergency SMS (ESMS) Trial
11. REACH112 – European Union

While this report does not seek to contradict the ESWG findings, we do call the reader's attention to item 6, which was the final recommendation of the ESWG to the CRTC.

> The CRTC then recommended that, **subject to ESWG work plans**, that the ESWG undertake a technical trial of the proposed near-term SMS T9-1-1 solution. This technical trial is expected to span approximately 12 to 18 months. It will include the following activities:
>
> - Determination of the most efficient method for "flagging" a silent T9-1-1 to a PSAP;
> - Determination of a SMS T9-1-1 registration process and architecture;
> - Development of a detailed technical specification for the service;
> - Development of a verification test plan;
> - Validation of the technical specification in a controlled telecommunications environment;
> - PSAP determination of the technical means, costs, funding, budgeting, and timing of implementing the T9-1-1 service;
> - Cost estimation to launch the service nationally, and proposing methods to fund same;
> - Determination of a reasonable rollout plan for all parties involved;
> - Identification of specific PSAP staff training requirements;
> - Identification of specific DHHSI community education requirements, e.g. how to register, how to place a T9-1-1 call, how to switch from voice to SMS;
> - Preparation of a technical trial concluding report to the Commission.

This CSRIC subgroup lacks the authority to investigate, compare, or make recommendations that was given to our Canadian counterparts. Additionally, the public safety environment in the US has critical differences from those of Canada.

The final recommendations are relevant in light of the common border, and that Canada is moving forward with field trials to improve accessibility today.

C.3.2 Considerations

Within the CSRIC WG 4B Subgroups, divergent opinions on the use of today's technology to ensure accessibility quickly surfaced. It was offered only with the contingency that the arrival of LTE in the wireless OSP space will provide a platform that includes provisions for emergency access that are not present in current technologies.

The concepts of E9-1-1 however, pre-dates nearly every sector of technology used in today's wireless infrastructure, and it is apparent that very few of these infrastructure elements include adequate provisions for adequate accessibility today.

9-1-1 OSP representatives offered reports, analysis, and anecdotal information leading the reader to the conclusion that—despite the tremendous public acceptance and use of SMS (text messaging)—today's current SMS service is not and cannot be made suitable for emergency communication.

Other sectors of the group offered information and analysis supporting their positions—that while SMS may not have been designed specifically for emergency communication—it has usability characteristics similar to wireless OSP voice services, and that additional development would broaden access to public safety by people who are deaf, hard of hearing, and have a speech disability.

As outlined in the tables above and as excerpted from the Canadian report, a number of alternatives have been developed and continue to be developed. Many of these have entered the marketplace, and others will follow. Deployment of innovation is inhibited by the current regulatory/legal framework, which makes it difficult to assess the benefits of one solution versus another.

The Access Subgroup sent certain submissions to the Technology Subgroup for additional analysis.

Upon review, it appears that the most concise analysis of the complex issues surrounding current accessibility issues is set out in the 4G Americas report *Texting to 9-1-1: Examining the Design and Limitations of SMS*[123] excerpted here from page 72:

> *"There is ongoing work in the wireless industry and NENA to develop a non-SMS based solution for non-voice emergency services in the next generation wireless networks. The wireless industry fully understands the desires of the people with disabilities community and is focused on finding a reliable solution for their needs instead of a short term incomplete solution.*
>
> *In conclusion, there are significant limitations inherent in the design of the current Short Message Services which make it impractical to be used for emergency service. However, it is important to address the requirements for people with disabilities as soon as possible. To that end, it is recommended that techniques which are readily available today, such as silent 9-1-1 calls, along with accelerating research and development into emerging technologies such as TTY Emulation, be undertaken while the next-generation systems are being designed."*

This work to adapt LTE technologies to include non-voice services is underway within 9-1-1 OSP forums. For completeness, Table C-4 this report also includes the analysis of NOVES using the characteristics of the preceding tables:

[123] 4G Americas. *Texting to 9-1-1: Examining the Design and Limitations of SMS*, October 12 2010. Available at: http://www.4gamericas.org/index.cfm?fuseaction=pressreleasedisplay&pressreleaseid=2914

Table C-4: Characteristics of NOVES

	Characteristics	(K) NOVES non-voice emergency services
1	What service request initiation method is used?	NOVES text or multimedia (being worked on in 3GPP)
2	Is a Universal Access Number used?	Perhaps, different access code or number on a country basis with international roaming support
3	Relies on what underlying service (grade or method of delivery)?	NOVES
4	Is the 9-1-1 call directly routed to the proper authority?	Yes
5	Does the service capture the 9-1-1 caller's initial location?	Yes
6	Does the service provide continuous location updates?	Yes
7	Who is the initiator of the two-way text conversation?	Caller
8	Does the service allow voice and text simultaneously?	Yes
9	Does the service support HCO/VCO (hearing/voice carry over)?	
10	Does the call taker have ongoing audible location/situation information and incident cues?	Yes
11	Can the call taker "sample" audio from the caller?	Yes
12	Can the call voice and text be recorded in a logging system?	Yes
13	Is the service focused for people who are deaf, hard of hearing or have a speech disability?	
14	Can the service be used in "fully silent" or covert mode?	
15	Can the caller reach a PSAP from device with text-only capability (no active telephone service)?	Yes
16	Will the service work from non-service initialized telephone (NSI handset)?	Yes, in accordance with country regulations
17	Can the service be ubiquitous, with simultaneous deployment nationwide?	Yes, as a long-term goal
18	How much public education is required to work effectively if deployed nationwide? 1=limited through 5=more extensive	5
19	Is a MID (mobile internet device) or software application on a MID required?	NOVES is being designed to work for both wireless and wireline devices with an IP connection
20	What is the status of this non-voice communication method?	See note

Footnotes for Table C-4:

Row 20, column K: NOVES is currently undergoing a study to be completed by fourth quarter

2010 in 3GPP. The study is publicly available in the specifications area of the 3GPP website at: (http://www.3gpp.org/ftp/Specs/Latest-drafts/) as Technical Report 22.871.

After the study item is completed, stage one requirements work will commence. Stage one requirements for 3GPP Release 11 are to be completed by September 2011. Stage two network flows are to be completed by December 2011. The Stage three protocol is to be completed by March 2012. The standard will be considered completed in March 2012. The product is expected to be available for testing typically within 18 to 24 months after completion of the standard. The standardization schedule described here is subject to change based on progress achieved and technical difficulties encountered in the development of the 3GPP NOVES specification in 3GPP Release 11.

C.4 NG9-1-1 Service Relationships and Responsibilities

As 9-1-1 Authorities begin to design NG9-1-1 systems, a number of service relationships will need to be developed. Developed by NENA, Figure C-5 illustrates some of the organizational responsibility scenarios, depending on whether or not the 9-1-1 Authority is also the SSP.

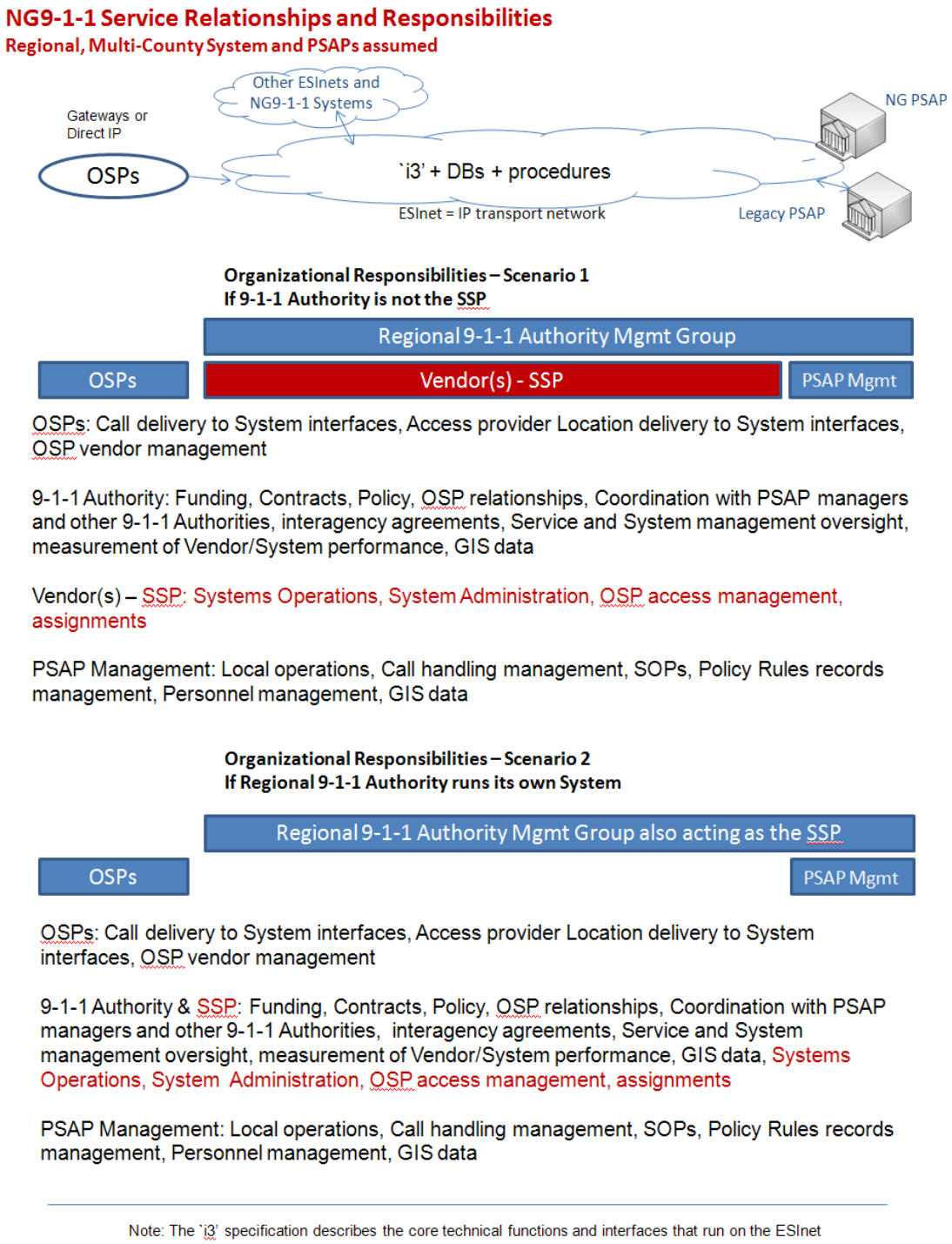

Figure C-5: NG9-1-1 Service Relationships and Responsibilities

C.5 NOVES Schedule and Description

Non-voice Emergency Services (NOVES) is a fairly new term in 3GPP. 3GPP is currently working on a NOVES study item for 3GPP Release 11 to explore the NOVES concept and determine whether it is desirable for standards work to formally begin on this topic. At this time, it appears that the industry will eventually approve a formal NOVES work item (also in 3GPP Release 11) to allow for standards work to progress on this topic.

There are three key definitions in the NOVES specification:

(1) Non-Voice Emergency Services: Emergency services with media other than, or in addition to, voice.

(2) Session-Based Non-Voice Emergency Services (NOVES): Next generation emergency services that use trusted applications in support of non-voice communications between citizens and emergency authorities using real-time session-based text and multimedia messaging. NOVES provides secure transport of messaging and media content, and location information regarding the reporting device to emergency authorities, in addition to providing two-way voice emergency communications between citizens and emergency authorities (e.g., PSAPs). NOVES does not preclude the support of specialized emergency services designed for the special needs communities, including non-support of two-way emergency voice communications.

(3) Non-Voice Emergency Services (NOVES) Device: A next generation end-user device (e.g., wireless LTE device) that uses trusted applications to provide secure transport of messaging and media content, and location information of the reporting device to the emergency authorities, in addition to two-way voice communications between citizens and emergency authorities (e.g. PSAPs). A NOVES device does not preclude the support of specialized emergency devices designed for the special needs communities, including non-support of two-way emergency voice communications.

The likely schedule for the NOVES work in 3GPP is as follows (and subject to change as with any standards schedule):

(1) 3GPP completes work on the NOVES study item in TR 22.871 in fourth quarter 2010.
(2) 3GPP agrees on a new NOVES work item for 3GPP Release 11 in fourth quarter 2010.
(3) Stage one (requirements) work for NOVES is completed by September 2011.
(4) Stage two (network flows) work for NOVES is completed by December 2011.
(5) Stage three (protocol) work for NOVES is completed by March 2012.

Vendor development schedules related to NOVES will determine when NOVES products would be available for testing in an operator network. If network changes for NOVES are required, development, testing, and implementation will take a significant amount of time. If no network changes for NOVES are required, implementation may occur more rapidly.

C.6 Early Adopters/NG9-1-1 Planning Efforts

Alabama Next Generation Emergency Network (ANGEN)

The Alabama Chapter of NENA (ALNENA) and the Alabama Association of Nine-One-One Districts (AAND) formed a joint committee tasked with developing a state 9-1-1 plan and submitting a grant request to the USDOT/DOC. The plan was drafted and approved, and the grant request was submitted by the Alabama Department of Homeland Security

The NG9-1-1 environment will differ considerably from the current 9-1-1 environment. NG9-1-1 will require an overhaul of all aspects of 9-1-1—from governance to the delivery of services. The Alabama NG9-1-1 plan establishes the 9-1-1 state coordinating committee (9-1-1SCC) to serve as the planning and implementation coordinating body for deployment and operation of the Alabama NG9-1-1 plan, and to represent the 9-1-1 community in the planning and operation of the proposed state emergency network, ANGEN. Conceptually, the transition begins with connecting all emergency agencies, including PSAPs, to IP networks, along with the implementation of the software applications that provide next generation functionality. The roles and responsibilities of 9-1-1 stakeholders, from PSAPs to state government, will evolve as NG9-1-1 matures. The 9-1-1SCC will facilitate the definition of roles and responsibilities of local, regional, and state government in 9-1-1.

ANGEN will be realized with the implementation of a state-level ESInet that will interconnect local and regional ESInets and individual emergency agencies, including PSAPs. The ESInet will enable call access, transfers, and backups among and between PSAPs within Alabama, and eventually, across the nation. It will also allow flexibility in call taking such that call takers will no longer be physically constrained to a specific communication center. The plan assumes ANGEN, the Alabama ESInet, will be managed by professionals and governed by a board representing the various emergency professions and agencies that will use it.

Indiana Statewide 9-1-1 Plan

The Indiana Statewide 9-1-1 Plan identifies the key goals and objectives for improving wireless E9-1-1 service and functionality across Indiana and influences Indiana's statewide decisions concerning wireless E9-1-1, and, where applicable, limited elements of landline E9-1-1 services. The successful achievement of the plan's goals and objectives will result in Indiana's ability to continue to meet the public's high level of expectations for 9-1-1 service, provide a consistent level of 9-1-1 service statewide, and contribute to the security of all.

The overarching vision is to assure that Indiana's citizens and visitors have E9-1-1 service no matter where they are calling from, no matter what sort of wireless device, protocol, or service they use, and whether they communicate by voice, text, or other media. The plan has the following goals:

Goal 1—Provide a functionally comparable level of E9-1-1 service statewide.

- Establish a stakeholder working group to make recommendations to the Indiana Wireless E9-1-1 Advisory Board (IWAB) on a variety of technical, operational, and policy matters to advance wireless E9-1-1 in Indiana

- Identify data elements to measure the technological progress of wireless E9-1-1 and the data collection mechanism
- Define the baseline level of wireless E9-1-1 service for Indiana
- Identify minimum technical and operational standards
- Draft legislation for governance, funding, and connectivity

Goal 2—Provide all cellular and wireless technology users with equal access to IN911 and ESInets that are interconnected with it.

- Identify the network architectural and application requirements for SMS protocol interfaces, Telecommunication Device for the Deaf (TDD) messaging, text messaging, instant messaging, wireless transmission of still images and video images, telematics, language line services, and video relay for people who are deaf, hard of hearing and have a speech disability
- Work with PSAPs and local government to develop funding sources

Goal 3—Achieve the seamless transfer of wireless E9-1-1 voice and data across state lines.

- Negotiate formal memoranda of agreement (MOA) with contiguous county governments from Michigan, Illinois, Kentucky, and Ohio
- Build out IN911 to the borders of Indiana and adjacent states, or to the borders of adjacent regional or state ESInets

Counties of Southern Illinois 9-1-1 (CSI)

Over a two year period, 18 Counties in Southern Illinois (CSI) formed a consortium with the purpose of planning and implementing NENA standards-based NG9-1-1 as a regional system and service, replacing their current E9-1-1 with a more technologically capable and future-proofed 9-1-1 process. The CSI plans included their consortium becoming the 9-1-1 service system provider, which required legal and regulatory change. The acquisition, installation, and testing of the CSI NG9-1-1 system involves many new or revised procedures, and transitional approaches, that CSI must identify and implement, utilizing emerging and evolving national standards and procedures from public safety and industry organizations. CSI anticipates implementation to take one year and will start later in 2011.[124]

Texas Next Generation 9-1-1 Project

The Commission on State Emergency Communications (CSEC) Next Generation 9-1-1 Master Plan was developed to communicate the vision of the Texas NG9-1-1 System and the transition effort so that stakeholders can become actively engaged in its development and deployment. It also charts the course of CSEC initiatives and activities on this extensive, multiyear effort to ensure successful transition. [125]

The CSEC staff is developing the documents required by the Texas Project Delivery Framework established by the Texas Department of Information Resources (DIR). Approval of the Business Justification Review Component of the DIR Framework is required for CSEC to proceed with the E9-1-1 Grant Project and must be forwarded to the state's Quality Assurance Team. The

[124] Jackson County, IL. *Counties of Southern Illinois Next Generation 9-1-1 Project*. August 1, 2009. Available at: http://www.jc911.org/news.php

[125] State of Texas, Commission on State Emergency Communications (CSC). *Next Generation 9-1-1 Master Plan* Available at: http://www.911.state.tx.us/files/pdfs/ng911_masterplan_04_23_2010.pdf

Business Justification Review includes the Business Case Analysis, Statewide Impact Analysis, and Project Charter for the Texas Next Generation 9-1-1 Project.

Washington State Next Generation 9-1-1 Plan

In 2007, the Washington E9-1-1 Advisory Committee created the Six-Year Plan Subcommittee. The subcommittee was directed to—

- Develop a 6-year plan for the operational needs of each county, including, but not limited to, the build-out of an NG9-1-1 network and system
- Develop a 6-year plan for the capital needs for the state and each county's E9-1-1 system, including, but not limited to, the build-out of a NG9-1-1 network and system
- Incorporate the 6-year plan into the State 9-1-1 Strategic Plan.

Phase 1 (Funded)—A state contract was awarded to QWEST and Intrado for an NG9-1-1 network and database pilot project in Benton, Ferry, Island, Lewis, Skamania, Spokane, Thurston, and Yakima counties.

Phase 2 (Funded)—Implementation of the NG9-1-1 network and database in the remaining 31 county and Washington State Patrol E9-1-1 PSAPs.

Phase 3 (On Hold Pending Funding)—Implementation of call answering equipment in accordance with national 9-1-1 standards. This will allow the 9-1-1 Public Safety call receivers to receive and process NG9-1-1 data and to access the NG9-1-1 features.

To accommodate NG9-1-1 and provide the citizens of Washington State with a modern IP system that will allow the 9-1-1 system to accept information from a wide variety of communication devices from consumers in emergencies, it is first necessary to update the network used to transfer voice/data information from the consumer to the PSAP. To accomplish this, there must be a switch from the antiquated legacy analog telephone system to a system as used in protocols for cellular and computer VoIP service by telephone and communication providers. The ESInet will also allow the transportation of ALI database information meeting the current NENA standard XML format. This solution must include, but is not limited to, network, transport, PSAP interfaces, 9-1-1 trunk support, selective routing, and *all* interfaces. The system must be scalable, affordable, reliable, redundant, and capable of overcoming the limitations of the current legacy system.

The second goal of the project is the migration of the E9-1-1 ALI database to the current NENA standard XML format and the ability to transport that information to the PSAPs using the ESInet. It is envisioned that the migration of this project will be implemented in two major phases.

Through a competitive bidding process, Qwest Communications Company, LLC (previously Qwest Communications Corporation) and its subcontractor, the Intrado Company, using existing technologies, will develop and implement an infrastructure of IP-capable, private, managed NG9-1-1 ESInet and ALI database provider for 9-1-1 services, The implementation of an ESInet using IP will meet the strategic goals of E9-1-1 and serve the needs of today as well as future NG9-1-1 applications.