

VOLUME ONE

NEXT-GENERATION 9-1-1: THE ESSENTIAL GUIDE TO GETTING STARTED

An Introduction to Next-Generation 9-1-1 Terminology,
Concepts and Considerations



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NEXT-GENERATION 9-1-1: THE ESSENTIAL GUIDE TO GETTING STARTED

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This document contains materials developed from various sources committed to deploying NextGen 9-1-1 services. This document is intended for use as reference material and may be modified to fit the needs of the user.

Preface

Next-Generation 9-1-1 (NextGen 9-1-1) is one of the most broadly discussed yet narrowly understood subjects within the public safety community. It is a topic that elicits both excitement and trepidation among emergency communications professionals. While there is a significant amount of valuable work being done within the industry to define what the end-state architecture will look like, many decision makers are unclear about how to get started.

Given the current 9-1-1 environment, the demands on the legacy system, the expectations of the public and the overwhelming departure from analog technology in modern communications, the migration to NextGen 9-1-1 technology is essential. It is so critical that in 2008 the federal government passed **The New and Emerging Technologies 9-1-1 Improvement Act** calling for “a national plan for migrating to a national IP-enabled network capable of receiving and responding to all citizen-activated emergency communication and improving information sharing among all emergency response entities.”¹ While the legislation does not mandate the migration, it does encourage public safety answering points (PSAPs) to begin the process.

¹ *New and Emerging Technologies 9-1-1 Improvement Act*, HR 3403, House, 110th Cong., 1st sess., sec. 102.

Even though the federal government is calling for action at the national level, Next-Generation 9-1-1 is not a federal initiative, and aside from some high-level guidelines developed by the U.S. Department of Transportation, the federal government is not responsible for providing detailed guidance or setting standards. While industry efforts, such as the National Emergency Number Association's (NENA) i3 architectural framework, are working to establish standards, the transition to an IP-based 9-1-1 emergency communications system will be driven, overseen and managed by state and local 9-1-1 authorities.

For many, the idea of a nationwide next-generation architecture has been a future consideration. The reality is that first steps are possible today, and the sooner that local entities begin the process, the sooner they will achieve the benefits. Emergency communications jurisdictions and PSAPs that do not prioritize this effort will eventually find themselves left behind and unable to interoperate with local and state agencies as other PSAPs move forward with this essential transition. The difficulty is in knowing how to successfully begin the migration.

This guide is designed to educate you on the next-generation migration process, show you how to get started and demonstrate that the path to NextGen 9-1-1 does not have to happen as one monumental and overwhelming project. It can be an evolutionary road that is approached in manageable phases in order to control the operational, as well as the financial, impact of the transition.

By understanding your political landscape, your operational needs, your constituency and the scope of your project, you can successfully launch a NextGen 9-1-1 initiative now. Getting started is easier than you think, and, if managed appropriately, each step of the journey will bring added value to your citizens as well as to every area of public safety that is impacted by the 9-1-1 system.

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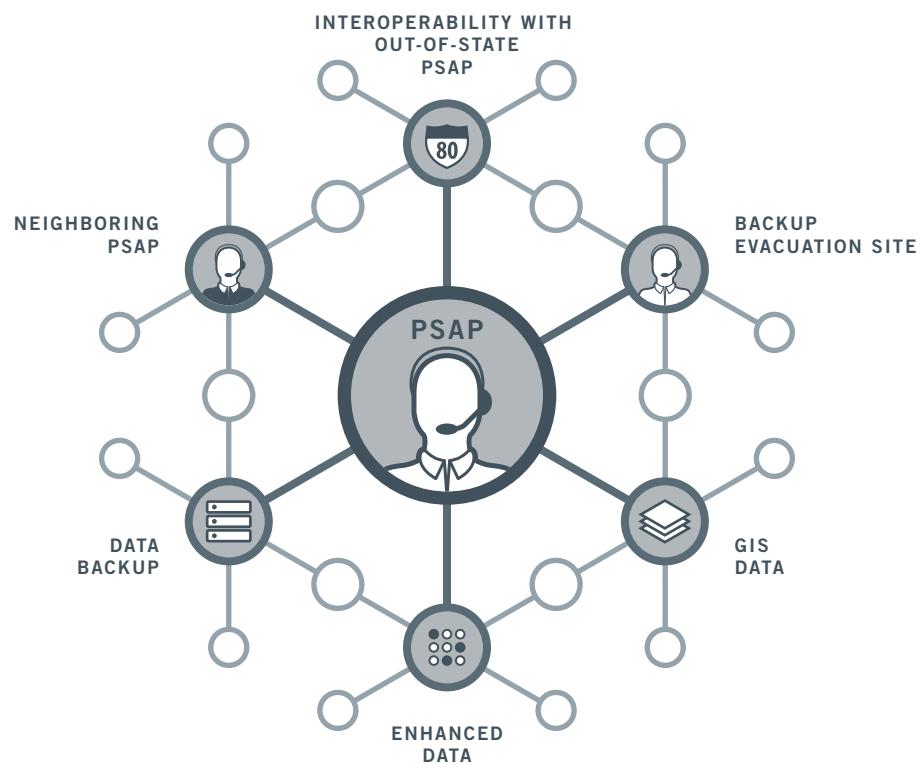
THE WHAT AND WHY OF NEXT-GENERATION 9-1-1

1

Today, the key underpinnings of the legacy 9-1-1 framework are based on the same wireline, analog, circuit-switched technology that was the foundation of the original 9-1-1 architecture in 1968. Aside from an enhanced data environment and the ability to support wireless and Internet telephony, the system has not significantly changed in more than 40 years. The truth is that 9-1-1 has not evolved as quickly as modern, digital communications, and the gap is quickly becoming a chasm that broadens every day. In order to close this gap and benefit from the monumental advancements that are taking place in commercial communications, the public safety community must begin planning for the transition to a next-generation IP-based model.

Next-Generation 9-1-1 (NextGen 9-1-1) reflects an industry vision that defines advanced services and collaboration capabilities across emergency response entities employing a nationwide network of interconnected IP-based networks. During a citizen-initiated call for help, typical NextGen 9-1-1 processing activities include call handling, emergency response dispatch, the coordination of necessary services and the correlation of events that may be related to the 9-1-1 call as well as a wide variety of post-event activities ranging from log review and data sharing to evidence inquiries and forensics.

1.1 A NETWORK OF NETWORKS



Why Next-Generation 9-1-1 Should Be Implemented

Fundamentally, the Next-Generation 9-1-1 migration is focused on transitioning the current legacy operating environment to an operational model based on secure IP transport, geographic information systems (GIS), modern network functional elements and changing responsibilities between a telecommunications service provider and a local 9-1-1 authority. Tactically, NextGen 9-1-1 will replace analog, circuit-switched and point-to-point technology with digital broadband technology using packet switching facilities to support voice, data, text, image, video and multimedia applications on a secure, robust multipurpose network. These technology changes will allow for vast improvements to the current analog system, including:

- more robust feature functionality
- enhanced survivability and resiliency
- increased quality of service
- faster call set-up time
- improved alignment with public expectation for text and data
- immense information sharing across PSAP and public safety jurisdictions
- seamless evolution with the technological advancements in modern communications
- significant adaptability to the unique needs of individual PSAPs and public safety jurisdictions

In basic terms, a NextGen 9-1-1 network will provide a modern technology platform that will deliver more effective communication between the public and public safety agencies while allowing for dynamic communication between interconnected public safety agencies. But the advantages do not end there. The authors of *The 9-1-1 Industry Alliance 2008 Study on the Health of the United States 9-1-1 Emergency Network: A Call to Action on 9-1-1* outline three motivating reasons why NextGen 9-1-1 supported by an IP-based protocol should be embraced:

- 1** Since the various technologies used today to access 9-1-1 have or will soon be utilizing an IP network, the 9-1-1 system must follow suit in order to ensure compatibility with the public.
- 2** It will become increasingly expensive and difficult to maintain traditional circuit-switched infrastructures because the technology is being abandoned across commercial communications.
- 3** The decentralized control provided by a digital technology, IP-based, open network allows network packets to be rerouted around network failures creating greater reliability and redundancy.¹

It is important to note that the lack of such reliability and redundancy in the legacy architecture was a compounding factor in the failure of 9-1-1 systems during major catastrophes such as 9/11, Hurricane Katrina, the Joplin, Missouri, tornado and Hurricane Sandy.

¹ *The 9-1-1 Industry Alliance 2008 Study on the Health of the United States 9-1-1 Emergency Network: A Call to Action on 9-1-1*, pp. 38-39.

The Advantages of Next-Generation 9-1-1

As more attention is paid to the migration to a next-generation IP-based architecture, it will be easy to get distracted by the challenges that will inevitably arise. The task will demand a significant amount of work, and it will bring change to the industry as well as to individual PSAPs. However, Next-Generation 9-1-1 is certainly a case in which the result justifies the effort.

NextGen 9-1-1 will introduce a broad array of robust new feature functionality that will significantly expand public safety capabilities and bring enhanced value to an increasing number of stakeholders. The broad systemic advancements will be a significant victory as well. If implemented properly, the resulting benefits of this shift will bring improvements to the resiliency, reliability and overall performance of the emergency communications network.

NEXT-GENERATION 9-1-1 BENEFITS

- Diverse IP paths will make 9-1-1 service more resilient and survivable.
- Static emergency service numbers (ESNs) for call provisioning and routing will be replaced with methods that better accommodate modern communications devices with dynamic location information and no fixed service address.
- The ability to connect to remote PSAPs and command centers will improve operational continuity.
- Platform flexibility will improve interoperability with technologies and service providers and open the door to future advancements in functionality.
- Geographically distributed PSAPs and consolidated infrastructures will allow for remote call takers and expanded service.
- Cloud-based services, including correlation of events across many information sources, will improve incident intelligence and advanced services options to all stakeholders, including call takers, dispatchers and responders.
- The viability of multiple types of requests for assistance will give emergency callers greater access to 9-1-1 emergency response services.
- The implementation of smart applications will protect public safety personnel, assist with emergency response and enhance situational awareness.
- The adaptability of solutions will allow for local and timely customization of 9-1-1 services.
- Increased modular change capacity will allow for faster deployment of solutions to meet public safety needs while reducing associated risks.

In a nutshell, Next-Generation 9-1-1 will create an environment conducive to interoperability, flexibility and innovation that will significantly enhance public safety agencies' ability to communicate with each other and with the public and to effectively respond to emergency situations.

NENA i3

Architectural Framework for NextGen 9-1-1

The proposed next-generation improvements to the legacy 9-1-1 network are the most sweeping changes the emergency communications industry has ever seen, dwarfing the work done to implement wireless Phase I and Phase II functionality. In order to provide industry-wide guidance to this significant and necessary task, in 2011, the National Emergency Number Association (NENA) approved the i3 architectural framework, which is designed to provide key technical guidelines for the implementation of NextGen 9-1-1 systems. The adoption of this document was one of the key milestones on the road to nationwide Next-Generation 9-1-1 implementation. While the framework is not a “build-to” specification for a complete NextGen 9-1-1 system, it does carefully define an end-state vision for this important architecture.² Using a Long-Term Definition (LTD) approach, the i3 framework outlines an architecture designed as an IP-based network of networks utilized by all agencies that may be involved in an emergency. In conjunction with the proposed architecture, NENA has also issued a recommended set of technical requirements to guide the functions and interfaces between the various elements involved with an IP-based 9-1-1 public safety emergency services architecture. While NENA states that there remains significant work to be done to provide end-to-end migration standards, the adopted document “establishes a clear vision for the future and a foundation on which successful transitions to Next-Generation 9-1-1 service can be built.”³

Please note that all information provided in Next Generation 9-1-1: The Essential Guide to Getting Started aligns with NENA i3 standards.

² Understanding NENA's i3 Architectural Standard for NG911, http://c.ymcdn.com/sites/www.nena.org/resource/collection/2851c951-69ff-40f0-a6b8-36a714cb085d/NENA_08-003_Detailed_Functional_&_Interface_Specification_for_the_NENA_i3_Solution-Stage_3.pdf?hhSearchTerms=i3

³ <http://urgentcomm.com/psap-news/nena-approves-i3-standard>

FUNDAMENTAL CONSIDERATIONS

2

One of the most beneficial aspects of the road to a Next-Generation 9-1-1 system is that it is not a singular linear path. Every local initiative will be different because it will reflect the unique circumstances surrounding that PSAP or jurisdiction. Because of this flexibility, however, there is no singular linear way to describe the necessary steps to getting there. Despite the variances that will arise as public safety agencies across the country begin this journey, there are important common fundamental issues that every next-generation initiative will need to explore in order to make the transition as successful and as smooth as possible.

The Cost of Next-Generation 9-1-1

The cost of the Next-Generation 9-1-1 migration will vary depending on the individual migration strategy and level of next-generation functionality that a PSAP implements. However, it is important to understand that the figure may be significant. A next-generation architecture will require upgrades to key technical components, and there will be additional components and ongoing costs as the technology continues to evolve. Furthermore, agencies must be prepared to fund two parallel systems—legacy and next-generation—during the migration process.

The reality is that the cost of operating and maintaining NextGen 9-1-1 will be more than that of legacy 9-1-1, but cost need not be a deterrent to implementation. The transition is inevitable, and the costs can be managed by implementing a phased approach to migration. Additionally, there are strategies available that can allow for cost sharing among PSAPs as well as methods for stabilizing cash flow while minimizing upgrade and maintenance costs that add to the overall NextGen 9-1-1 value proposition.

Planning

An important aspect to remember about the migration to a next-generation model is that it is not going to happen overnight. In fact, agencies should understand that NextGen 9-1-1 is not a final destination; it is an ongoing journey of phased projects that will carry on as technology continues to evolve and innovative new features are introduced to help public safety agencies.

As with any long-term venture, there will be challenges along the way, and they will differ as widely as the circumstances surrounding individual PSAPs and emergency communications jurisdictions. In order to achieve a NextGen 9-1-1 system that can function as envisioned, it is essential that next-generation decision makers do not simply seek the path of least resistance, but instead, plot a course that leads toward a long-term solution focusing on the real needs of the public and public safety. To successfully build a robust, interoperable, nationwide Next-Generation 9-1-1 system, detailed planning will be essential at the core of every local initiative.

A deep understanding of the public safety landscape is a foundational element to a sound strategy. Project drivers should take into consideration:

- political realities
- regulatory and funding environment
- ongoing PSAP pain points
- legacy network weaknesses
- geographic vulnerabilities
- projected population trends
- public expectations
- future needs and expectations
- realistic and prioritized use cases

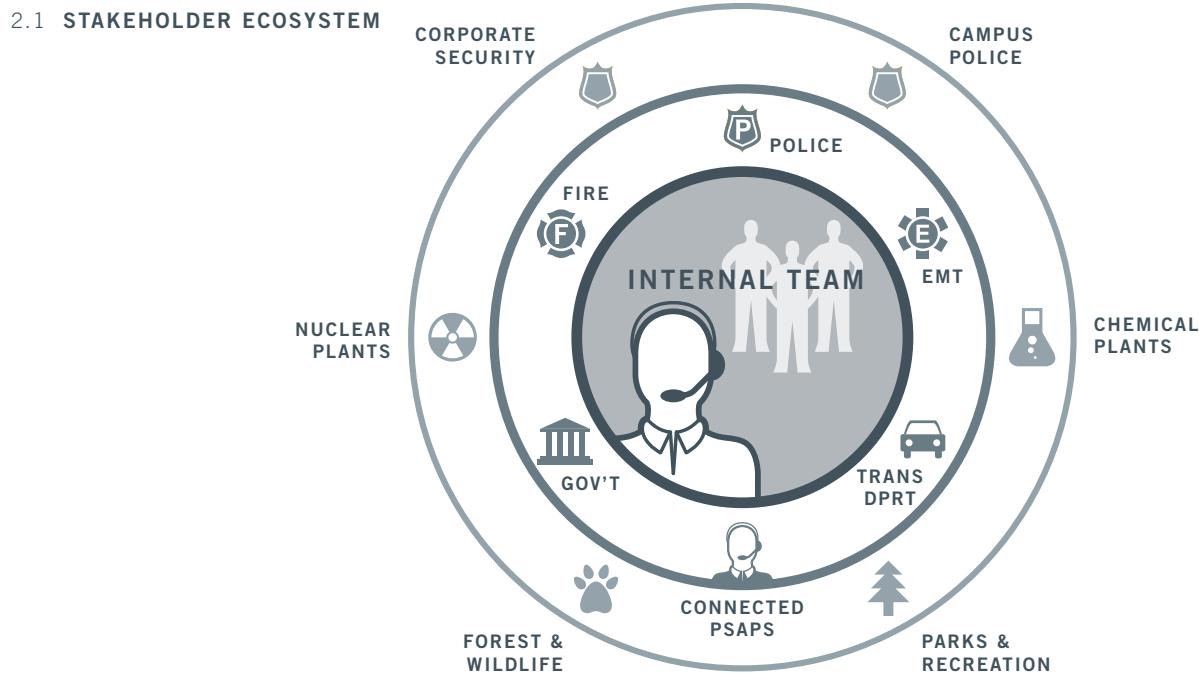
By structuring a long-term strategy based on a comprehensive knowledge of the current and future public safety environment, agencies will be prepared to take on the inevitable challenges that are inherent in any project of this magnitude.

A Checklist to Get Started is included at the end of this book to help guide you through the planning phase of your migration.

Stakeholder Groups

One distinct difference between legacy 9-1-1 and Next-Generation 9-1-1 is the increased number of stakeholders. Because NextGen 9-1-1 allows for expanded information gathering and sharing as well as greater public safety agency interoperability, there are more constituents impacted by the implementation of a next-generation system. A tremendous amount of NextGen 9-1-1 value will be experienced outside the PSAP or emergency communications center due to the introduction of robust feature functionality that will directly support first responders in the field. It is important that each 9-1-1 authority carefully considers who will benefit from and be impacted by its unique next-generation system and include these groups in the planning and management of the transition.

Next-Generation 9-1-1 will have a growing and significant impact on law enforcement and fire agencies, EMS, specialized rescue and state and local departments of transportation. It is imperative that all these groups have a voice in the migration process. If a jurisdiction includes a large educational or corporate campus, campus police should be considered. If an agency is in a rural area, wildlife agencies as well as search and rescue operations may need to be included. If an area is impacted by geographic or geologic circumstances or chemical or nuclear plants, specialists from those areas should be considered. Every region of the country faces its own unique circumstances that can impact crisis situations. Those factors have constituency groups that should influence how a next-generation architecture is developed if this essential migration is to succeed.



Project Management

Effective project management is the cornerstone of any successful next-generation migration strategy. This effort cannot be an additional task given to public safety staff members who have other areas of ongoing responsibility. A dedicated project management team should be created to oversee any next-generation initiative. Finding the right team is critical. The primary oversight group should include experienced professionals who understand the day-to-day demands of a project of this scope. As discussed earlier, there will also be a larger constituency group involved at a higher level that represents the entire emergency communications ecosystem. These two teams must work together to establish the long-term vision as well as proactively manage the details of the migration.

Once the project management team has been identified, a strategic plan should be created that divides the migration into manageable phases that can be accomplished in a reasonable amount of time. The transition to a next-generation network is going to be a long-term, ongoing project. Again, NextGen 9-1-1 is an evolutionary path, not a final destination. The network will continue to change and transition as long as new applications and capabilities continue to be added. Because of this, every phase needs to be managed in a way that will introduce some quantifiable benefit for as many of the constituency groups as possible or the project may lose support over time.

One of the most important things to understand about NextGen 9-1-1 is that this is not a plug-and-play project. It is not a question of purchasing a next-generation kit and simply turning off the old and turning on the new. In fact, for a time, agencies should be prepared to manage and fund two parallel but interoperating systems while elements of the network are transitioned from analog to next-generation technology under the guidance of an overall transition plan and architecture.

Options for Implementation

As agencies develop a strategic plan, there are multiple paths for moving forward with implementation of a Next-Generation 9-1-1 system. The best option depends on your specific goals, circumstances, staff and budget.

PSAPs may choose to design and manage their NextGen 9-1-1 migration in house. Using this strategy, internal personnel can purchase and integrate network elements and engineer the overall network from within. This approach provides a high degree of control over every aspect of the next-generation architecture, deployment and system maintenance. It also allows you to determine the overall design in a phased approach and more closely monitor the cost structure of the migration. However, next-generation network solutions are constantly changing as advancements are made. This deployment and management strategy must be able to financially accommodate a high rate of change and recognize that the agency is responsible for complete system operation.

PSAPs that do not have the appropriate staff to manage the design and implementation process independently may choose to work with a consultant. With this option, PSAPs can benefit from the expertise of a specialist, while having significant input to the final configuration and maintenance strategy. Before choosing to work with a consultant, however, it is important to explore the financial implications, including ongoing consultation fees and the impact to your operational budget.

PSAPs can also choose to work with a 9-1-1 service provider that has a fully integrated solution offering. With this option, all major network elements are inherently structured to work together. For PSAPs starting with a complete legacy system or that have some next-generation elements in place, an integrated offering allows you to purchase a system that incorporates the existing environment into the overall solution. Typically, with the purchase of an integrated solution, the 9-1-1 services provider will be responsible for the overall network design, implementation, maintenance and ongoing operational updates.

Regardless of the option, it is important to consider not just the implementation or conversion issues, but ongoing impacts to personnel, systems, operations and costs as well.

Operational Impacts

Next-Generation 9-1-1 will provide call takers and dispatchers with the most comprehensive data-gathering possible. It will revolutionize the way they extract, manage, correlate, interpret and dispatch essential information in an emergency. Future next-generation capabilities will allow 9-1-1 communication center staff and field personnel to access shared event information, photos, videos, building schematics and personal medical information, all of which will lead to better situational awareness for responders.

While the benefits of these new capabilities are immeasurable, they will definitely impact operations, possibly in ways that cannot yet be predicted. Despite the fact that operations will change, PSAP directors and call takers will remain in control of every emergency call as well as the decisions surrounding how and when the new information will be made available to their personnel. Careful planning and the development of a NextGen 9-1-1 operations training program will help manage the changes that result from next-generation data.

In many ways, the operational impacts that are inherent in a next-generation transition are not changes as much as extensions of what is already taking place within a PSAP today. Data has always been an essential element in emergency communication, and there are workflow processes and rules in place to handle that information. In a next-generation environment, there will be more data and computerized services to allow for the effective use of the data, thus the existing processes and rules will need to be expanded to accommodate the additional information. In order to ensure that call takers do not get inundated with information during an emergency, PSAP directors can establish the boundaries of what data is available to whom, when they have access to it and where it is used. Moreover, the solutions being developed and offered by 9-1-1 service providers today seamlessly correlate and display information in a way that can streamline the manner in which call takers manage the information. In many cases, the additional data can be delivered directly to the appropriate first responders, eliminating the need for the PSAP to be involved with information that does not directly impact their operations.

Training will play a key role in ensuring that call takers, dispatchers and responders are at ease with the increasing amount of data as well as how to interface with it. Interacting with next-generation call screens will be similar to the graphical user interface (GUI) that is common on many modern digital devices. Formal training will need to be organized to teach call takers how to interpret some of the data and will need to include instruction on newly established workflow processes and procedures. With the introduction of NextGen 9-1-1, individual PSAPs should customize their training to match their next-generation environment as well as their operational needs.

The procedures and processes guiding the use of data, however, should not be limited to the time of a call. One of the most beneficial aspects of a next-generation environment is the opportunity for improved resiliency and redundancy. If a PSAP's operation is compromised for any reason or if call volume suddenly spikes, calls can seamlessly be transferred to another PSAP as defined by the affected PSAP's policies. With the increase in data, guidelines must be established to ensure that this valuable information follows the transferred call in order to protect operational continuity. This level of interconnectivity will require agreements between the connected agencies to determine the procedures, workflows and rules governing call handling, the associated data and emergency services response. There must be regional collaboration with documented processes to ensure effective interoperability.

Data retention rules should also be considered. While all PSAPs have established guidelines for the archiving of call logs and other 9-1-1 information, those procedures should be reviewed and potentially expanded to include various other sorts of data. As part of the records retention process, PSAPs should also consider:

- Who is in charge of this information?
- Who has access to the information in the future for situations such as criminal or arson investigations?
- Will legal documentation such as a subpoena be required to access the information?
- Where will the data be housed?
- How long will the data be retained?

Because the deployment of nationwide NextGen 9-1-1 is still in its infancy, operational procedures and training programs are still under development, and no uniform standards exist to guide PSAPs on the management of next-generation data. Despite the lack of precedence, however, as PSAPs begin to implement NextGen 9-1-1 capabilities, it will be extremely important to create customized operational procedures and training programs, including the detailed development of use cases, that reflect the unique environment and specific needs of individual emergency communication centers. It is important to remember that as the transition takes place, PSAPs will be functioning in an interim state with both legacy and next-generation characteristics. Workflow processes, procedures, planning and training must accommodate that dual system and be flexible enough to evolve with the environment. While this may sound intimidating, if an agency uses the base legacy environment as a starting point and begins to think of operations in regional terms, policies can be expanded to minimize and manage the operational impacts of NextGen 9-1-1 on emergency communications.

Regulatory Concerns and Funding

Regulatory and funding issues are two of the most complex, interrelated and, at times, murky topics surrounding the transition to NextGen 9-1-1. To complicate matters, it is difficult to discuss any other aspect of the transition without at least a basic understanding of these subjects because they impact so many elements of this national initiative. Any meaningful discussion of regulatory and funding issues needs to consider the boundaries of federal, state and local governments, varying technology platforms, as well as disparate implementation costs, cost recovery methods and funding mechanisms. The difficulty is that these are rapidly evolving issues that require comprehensive and ongoing analysis. This guide does not provide such an analysis, but rather offers a high-level summary at this point in time. In order to give you the most accurate and in-depth insight into NextGen 9-1-1 regulatory and funding issues, subsequent volumes of this guide will be released to provide focused information as it becomes available.

Given the fact that legal and policy changes notoriously lag behind technological advances, it is not surprising that the industry as a whole lacks a coherent strategy for the regulatory and funding modifications necessary for nationwide NextGen 9-1-1 implementation. While some jurisdictions have anticipated the migration and begun to make initial reforms,¹ there is activity at the federal level that provides hope for a logical and clear path forward.

After seeking comment on the topic,² the FCC's Public Safety and Homeland Security Bureau recently made recommendations to Congress on the legal and regulatory framework for Next-Generation 9-1-1 services³ in accordance with the Next-Generation 911 Advancement Act of 2012.⁴ Additionally, the Middle Class Tax Relief and Job Creation Act of 2012 will have positive implications for how NextGen 9-1-1 will be deployed and governed. This legislation envisions a fully-integrated, emergency services ecosystem centered around a national, interoperable, public safety broadband network (NPSBN), which will be fully integrated with NextGen 9-1-1 networks (ESInets). Although the NPSBN is governed by the First Responder Network Authority (FirstNet)⁵ which holds the single 700 MHz spectrum license dedicated to public safety users, these two pieces of federal legislation assure that state and local agencies retain authority over NextGen 9-1-1 services. Since FirstNet's initial meeting in September 2012, it has solicited input from government agencies, first responders, commercial carriers, third-party vendors, consultants and other stakeholders. It has exercised its broad authority to begin designing the NPSBN and to begin negotiating with state and local jurisdictions so they can integrate their emergency communications systems with the NPSBN.⁶

¹ See, "The Now-Generation 9-1-1 ... The State of Washington Is Successfully Blazing Trails To Modernize Its Statewide 9-1-1 Emergency Communications Network." See also, Nebraska Public Service Commission, Order Setting Hearing and Seeking Comment, Discussion of Requirements, Costs and Impacts to Implementation of NG9-1-1 in Nebraska, Application No. 9-1-1-045 / PI-166, October 30, 2012. See also, Nebraska state legislature, NE LB 595 authorizing Next Generation 9-1-1 study and appropriating \$650,000 for the PSC to conduct the study.

² Public Notice DA 12-1831, November 13, 2012, P.S. Docket No. 10-255, P.S. Docket No. 11-153, P.S. Docket No. 12-333, Federal Communications Commission.

³ Federal Communications Commission, "Legal and Regulatory Framework for Next Generation 911 Services – Report to Congress and Recommendations," February 22, 2013. See also, Federal Communications Commission, "Connecting America: The National Broadband Plan" (NBP), March 16, 2010, section 16 (public safety communications), available at <http://www.broadband.gov/plan/>.

⁴ Included as Title VI within the Middle Class Tax Relief and Job Creation Act of 2012, Pub.L. No. 112-96 signed into law February 22, 2012.

⁵ FirstNet is housed in the National Telecommunications and Information Agency (NTIA), U.S. Department of Commerce, and is comprised of a 15-person board with broad powers to design, build and operate the NPSBN.

⁶ Id., Subtitle B, Sec 6205(b).

In addition to the initial steps to address NextGen 9-1-1 regulation, a funding transition is essential to successfully implement NextGen 9-1-1 on a national scale. This will take time and political guidance and will most likely need to be led by Congress with the support of various federal agencies. To that end, the U.S. Department of Transportation, National 9-1-1 Program office, has convened a blue-ribbon panel on NextGen 9-1-1 funding to examine the current state of 9-1-1 funding nationwide and to identify and promote better ways to finance 9-1-1 and NextGen 9-1-1 into the future.⁷ However, the importance of state and local participation in the funding dialogue cannot be overstated. Private and public participants in the emergency communications industry have an historic opportunity.⁸ Lagging behind their federal cousins, state policy makers would be wise to immerse themselves in the topic. The inevitability of NextGen 9-1-1 and its benefits are undisputed. It is clearly time for state and local governments, particularly state legislatures, state regulators and state and local 9-1-1 agencies, to take center stage. In most cases, the transition away from a legacy system calls for revised state statutes and/or rules that:

- recognize new technologies without lowering the bar on the high standards for 9-1-1 service that have been gained over time
- enable competitive 9-1-1 service providers for the benefit of the public
- remove legal and regulatory obstacles to NextGen 9-1-1 deployment
- provide for an equitable state funding mechanism that is competitively and technologically neutral in all respects while not interrupting existing funding

Without question, the time to get started is now. There are several actions that state and local officials can take today to better prepare for the migration to Next-Generation 9-1-1:

- Just get started ... even if it's "a plan for a plan."
- Consult with all state authorities that have duties surrounding NextGen 9-1-1 activities and the NPSBN. This will vary by state, but as a general rule, these positions are Department of Homeland Security designations, which may include a statewide interoperability coordinator, chief technology officers, chief information officers and, in some instances, dedicated 9-1-1 boards. In many cases, these people will also be involved with the distribution of federal grant money that has been made available to help offset the cost of planning and consultation with FirstNet.
- Become familiar with the current 9-1-1 related regulatory and legislative activity—understand what is being proposed and the timelines involved.

⁷ The panel of approximately 15 subject matter experts recently met in Washington, D.C. on April 2, 2013.

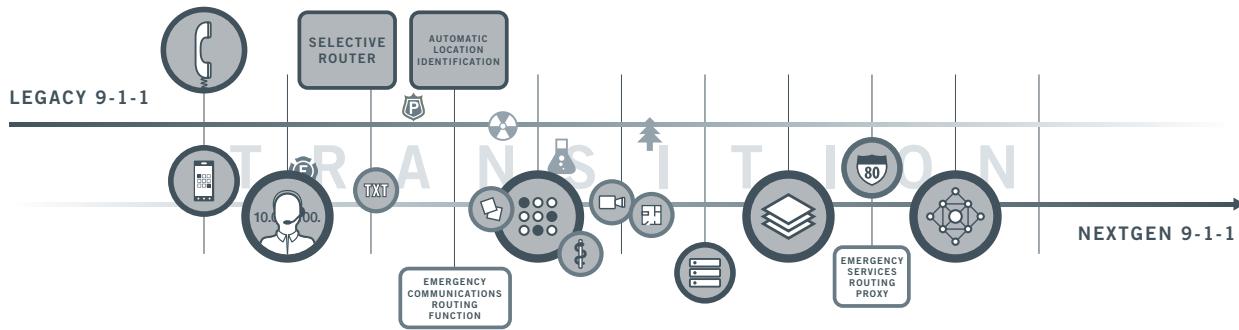
⁸ See, *Opportunity for NG9-1-1 in the States – An Analysis* - Pew Center for the States, October, 2011, e.g., "Government leaders and policy makers need education on the current problems with 9-1-1, the benefits of NG9-1-1, and the path forward. Moreover, the education, both in person and with accessible materials, needs to be presented in simple, non-technical language that policy makers can understand without becoming 9-1-1 experts. Therefore, there is a clear opportunity for an advocacy organization to bridge the gap as well as to provide the message and the material in the layperson language needed by [policy makers]." Pew report, page 32.

NEXT-GENERATION IMPACT ON LEGACY ELEMENTS

3

The migration to a Next-Generation 9-1-1 architecture will inevitably introduce new elements to a PSAP's operational environment and some existing elements will have to evolve in order to reap the greatest benefit from a next-generation system. While this type of change is unavoidable, be assured that it will not happen overnight. With careful planning, the evolution can happen in measured phases that will allow PSAPs to manage the cost and impact to PSAP operations.

3.1 TRANSITION FROM LEGACY TO NEXTGEN 9-1-1



The migration from legacy 9-1-1 to Next-Generation 9-1-1 will be most effective if handled in a phased approach. PSAPs should be prepared to fund and oversee two parallel systems as the migration takes place and should understand that NextGen 9-1-1 will continue to evolve as new technology and solutions are developed.

Location Information

Precise location information plays an invaluable role in public safety communications. Today's PSAP call takers rely on the information provided by automatic location information (ALI) databases and the master street address guide (MSAG) to effectively and efficiently dispatch appropriate emergency services to the correct location when a wireline 9-1-1 call is received. As with most functions within today's legacy 9-1-1 model, the acquisition and delivery of location information will change in a NextGen 9-1-1 environment. In fact, once NextGen 9-1-1 is fully realized, the essential services provided by ALI and MSAG will be accomplished in significantly different ways.

In the current analog emergency communications network, the established data flow for collecting, validating, verifying and staging accurate caller information is known as provisioning. Individual telecommunication service providers deliver basic information relative to their wireline customers to a 9-1-1 service provider. This data includes the name and service address associated with individual phone numbers. When the information is received, the 9-1-1 service provider utilizes an enhanced 9-1-1 (E9-1-1) database management system to confirm the data in a process known as address validation. The validation process runs the data through a set of rules based on the MSAG. Once the data is verified, the telephone number is tagged with the appropriate 9-1-1 attributes called the emergency service number (ESN). This designation identifies the appropriate PSAP to receive the call as well as the responding police department, fire department and ambulance service based on the physical address of the telephone number.

In terms of location information, the current analog-based network and the i3-defined next-generation architecture share one common talking point. They both identify independent data paths for provisioning. While the data flows in each model are designed to accomplish the same outcomes of collecting, verifying, processing, staging and accessing location information, the next-generation model goes about it differently than the existing architecture. Provisioning in the legacy model is comprehensively predetermined and validated by the 9-1-1 service provider before it is used to route a 9-1-1 call or delivered to the PSAP at the time of the call via the ALI database. In NextGen 9-1-1, call routing and some provisioning needs to take place at the time of the call in order to accommodate modern communication devices that have no fixed service address. If done properly, the information received by the PSAP at the time of the call looks the same in both a legacy and a next-generation architecture. However, the transition to NextGen 9-1-1 will significantly impact the distribution of responsibility for provisioning location information. Once the migration has been fully accomplished, this valuable data will fall under the authority of the individual subscriber's telecommunications service provider rather than the 9-1-1 service provider. In a fully realized next-generation architecture, each individual provider will be required to create and maintain a location information server (LIS). The LIS and its companion, the call information database (CIDB), will eventually replace ALI functionality.

Geographic Information Systems

In today's legacy architecture, mapping displays have become a fundamental element of effective public safety emergency response. Maps allow 9-1-1 call takers and dispatchers to accurately identify the location of wireless callers and effectively coordinate response units. Geographic Information Systems (GIS) are the data management tools behind map displays as well as many of the advanced services coming with NextGen 9-1-1. The legacy wireline 9-1-1 GIS systems are primarily based on textual (or civic/postal) addresses while newer mobile-based communications provide geographic (or X/Y) coordinates. The introduction of NextGen 9-1-1 systems that require location information is leading to the association of X/Y coordinates with other address information, also known as geocoding. With the increasing focus on nationwide NextGen 9-1-1 deployment, the potential of GIS as a powerful life-saving and decision-making tool is becoming more apparent, though current GIS systems will need to expand in order to reach their full next-generation potential. (*For information on GIS as a next-generation starting point, see Chapter 4: Where to Begin/GIS.*)

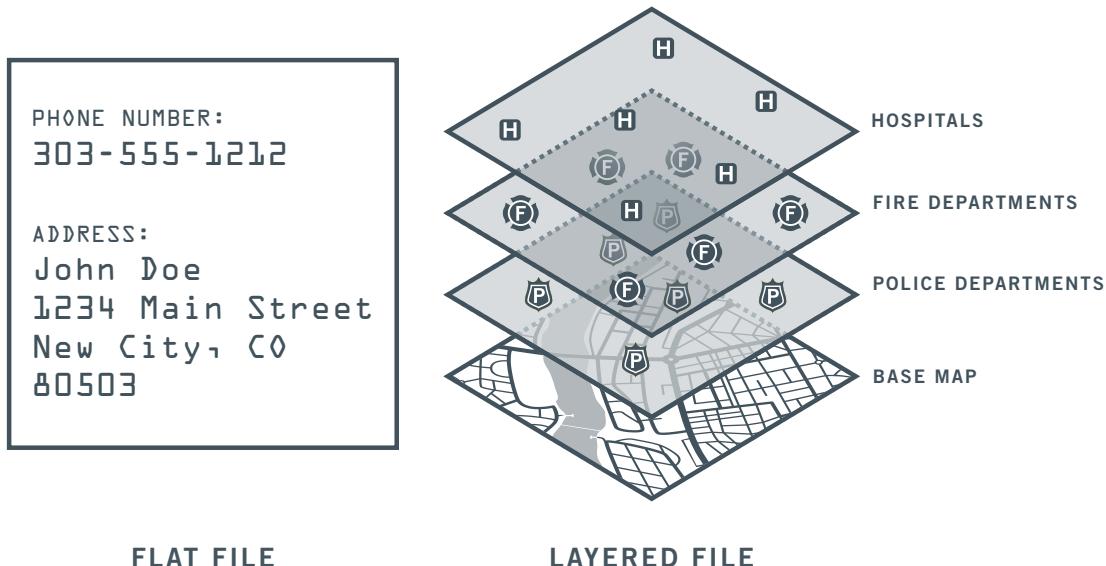
In the context of legacy 9-1-1, public safety agencies have been collecting tabular GIS information for decades in order to populate the information found in automatic location information (ALI) and master street address guide (MSAG) databases and to assign emergency service numbers (ESNs). This data is collected at the street level based on specific boundaries and street ranges with some interpolation to achieve address information. When a wireless emergency call comes into a legacy GIS-equipped PSAP, associated X/Y coordinates are delivered, though the coordinates are meaningless on their own. In order to be valuable, this data must be plotted on a map in either the call-handling or computer-aided dispatch environment. Once plotted, the information can be applied to perform dispatch functions. In this way, GIS is a supplemental tool used solely to verify location.

Next-generation GIS has moved beyond basic coordinate-based capabilities. It is an integral tool used to guide and enhance response strategies, and geographic information is the basis for many advanced service capabilities. In a NextGen 9-1-1 environment, the tabular data, or flat files, of ESNs, ALI and MSAG databases will transition into geospatial intelligence in the form of GIS databases that can render maps and information for sophisticated emergency response services. While the determination of X/Y coordinates will remain a key function, next-generation geographic information systems are designed to capture, store, manipulate, analyze, manage, and present a wide variety of geographical data. In this type of geospatial environment, every piece of data about a geographic area can be represented using layers of information on a map or site plan. As more information is collected, additional layers of data can be created. Ultimately, layers of information will correlate with a specific PSAP, police department, fire department, medical response agency, poison response and so on. If a call originates in a specific geographic area, the call will be routed and the response will be dispatched according to the rules assigned within the geographic information database. The big differentiator with NextGen 9-1-1 is that these relationships will be determined dynamically at the time of a 9-1-1 call versus pre-staged in complex data management tools.

Moving forward, GIS data will become more and more refined and will correlate with other data sources to support the continuing evolution of next-generation capabilities. The next step in gathering geographic information will involve the geocoding of actual addresses. Some agencies have already completed this level of detail. At some point in the future, next-generation functionality will require the geocoding of property parcels or building envelopes so that PSAPs can determine the exact location of a caller within a structure. With the development of more enhanced data, NextGen 9-1-1 will allow citizens to optionally provide details about a geographic location, such as the number of residents, medical information, floor plans and the presence of hazardous materials or other important information. Next-generation GIS and associated technology will be able to correlate this valuable information with an incoming request for assistance in order to improve response times and provide first responders with better situational awareness.

To make this idea a reality as migration begins to take place, PSAPs will need precise GIS databases that are accurate, up-to-date and synchronized at the local, regional and state level. Typical sources of GIS information must be supplemented with 9-1-1 attributes and modified to support the special needs of public safety applications and processes. Additionally, workflows and processes will need to be created to collect, verify, correlate, maintain and manage the vast amount of data that is associated with these systems.

3.2 LEGACY FLAT FILE VS. LAYERED FILE



Customer Premises Equipment

Public safety customer premises equipment (9-1-1 CPE) is the epicenter of the PSAP. These essential systems ensure the smooth delivery of a voice-generated request for assistance from a 9-1-1 caller to a call taker or, in some situations, an emergency services dispatcher. The transition to a next-generation environment will alter traditional methods for processing emergency calls in order to take full advantage of the next-generation IP-based capabilities, including the support of multiple types of requests for assistance such as voice, text, alarms, personal devices and crash notification.

Legacy 9-1-1 CPE evolved out of early operator services technology that was modified to meet the unique needs of emergency communications. The majority of these systems were purpose-built hardware and software that utilize analog CAMA¹ trunks to deliver 9-1-1 calls from telecommunication service providers to a legacy 9-1-1 call handling system. In the absence of IP technology, legacy 9-1-1 call handling is limited to processing voice calls and requires a call taker to interface between incoming calls and outgoing dispatch of emergency responders. In a legacy environment, the call taker must interpret the caller's verbally relayed information and make all dispatch decisions based on that information. These legacy systems were designed such that the majority of the equipment resides in the PSAP's premises. In most of these systems, the primary answering point is determined and may interoperate with secondary PSAPs within a county but cannot interoperate with the larger state and national PSAP community. Some PSAPs have begun to transition to an IP-based infrastructure, but the majority are still using the 50-year-old analog CAMA trunk technology. More recently, PSAPs have started to replace outdated CPE with IP-based equipment, but many of these systems are deployed using CAMA gateways to accept the incoming 9-1-1 call. Only a select few can receive native IP-based calls without the use of outdated CAMA technology, and few can interoperate with text messages to 9-1-1.

¹ During setup of a legacy 9-1-1 call, the calling number is transmitted to each selective router via a protocol known as Centralized Automatic Message Accounting (CAMA). CAMA was originally designed as a protocol for long-distance billing, because it provides for carrying both calling and called number using in-band signaling. This allows the telephone system to send a station identification number to the PSAP via multifrequency (MF) signaling through the telephone company's E911 equipment.

With the migration to Next-Generation 9-1-1, call processing takes on a new structure. The Next-Generation solution will evolve over time away from traditional call processing equipment and introduce a combination of a PSAP call-handling user interface, connectivity elements that join the PSAP to the emergency services IP network (ESInet),² new functional elements that provide choices on how to receive calls and data, and core routing/delivery components to ensure the reliable delivery of calls. Each solution will be highly configurable and NextGen 9-1-1 decision makers can determine how to best balance these components between the PSAP and the ESInet based on their network and operational goals.

Unlike its legacy counterpart, next-generation call handling is a solution that will leverage technology to make emergency call handling more efficient and effective and to interoperate with a larger NextGen 9-1-1 infrastructure. These solutions are designed to evolve with changing technology and industry standards so that technology platforms can expand and adapt into the future rather than requiring a multi-year replacement cycle. Standards are being written, updated and ratified continually based on significant public safety community input. Because next-generation systems are able to accept dynamic updates, PSAPs can quickly and easily move forward as the technology and standards evolve.

3.3 CONVERGENCE OF SCREENS



² The Emergency Services IP Network is a NENA-prescribed element of a Next-Generation i3 network.

Computer-Assisted Dispatch and Radio

Historically, 9-1-1 has been a communication system between a caller in need of emergency help and a call taker/dispatcher who will orchestrate a response to that request. With the introduction of Next-Generation 9-1-1 and the increased amount of data that can potentially be available relative to an emergency event, that continuum is extended throughout the 9-1-1 communication center and to the first responders in the field. In this new environment, computer-assisted dispatch (CAD) and mobile radio play an increasingly important role.

Legacy public safety CAD systems are a fundamental work tool within a PSAP. They are vast repositories of information relating to the resources and the capabilities of the PSAP, including the who, what and where of your available police, fire and EMS responders. CAD systems can track and prioritize requests for assistance, make recommendations based on PSAP-established rules about the type of response that should be dispatched and display available responders to the dispatcher.

In a next-generation environment, CAD will still be used to coordinate emergency response, but it will play an additional role as well. Enhanced CAD capabilities in conjunction with mobile radio systems will be capable of linking 9-1-1 call processing functionality and vast amounts of enhanced data in order to deliver life-saving information to the field in the most effective way possible. While a PSAP can benefit from NextGen 9-1-1 without the use of a CAD system, the implementation of advanced services tightly integrated between CAD functionality and an IP-based environment has the ability to significantly enhance next-generation capabilities and streamline PSAP workflow. With the introduction of enhanced CAD capabilities, incoming requests for assistance can be automatically linked to various types of enhanced data. The system can innately direct that information to the user who will most benefit from it, whether that is to the dispatcher or directly to first responders in the field.

Beyond enhanced dispatching, enhanced CAD capabilities can be used to document and time stamp every aspect of an emergency response. It can track and record the type and volume of calls for a given time frame as well as the actions of all responders during the course of a shift.

While the CAD system is integral to the correlation of an event with the enhanced data, the public safety radio system plays a significant role in delivering it to the field. In order to accomplish that effectively, it is imperative that agencies have access to sufficient quality bandwidth that is capable of moving appropriate real-time and historical data from a repository—whether that is a camera, video, database, etc.—to first responders.

Significant legislation has recently passed relative to high-quality radio spectrum designated specifically for public safety. While this valuable resource will likely be more readily available in the near future, PSAPs should not wait on this matter. The integration of 9-1-1 call handling equipment, CAD and mobile radio systems should be a focus in next-generation planning, and PSAPs would be wise to explore all options for expanding broadband access as soon as possible.

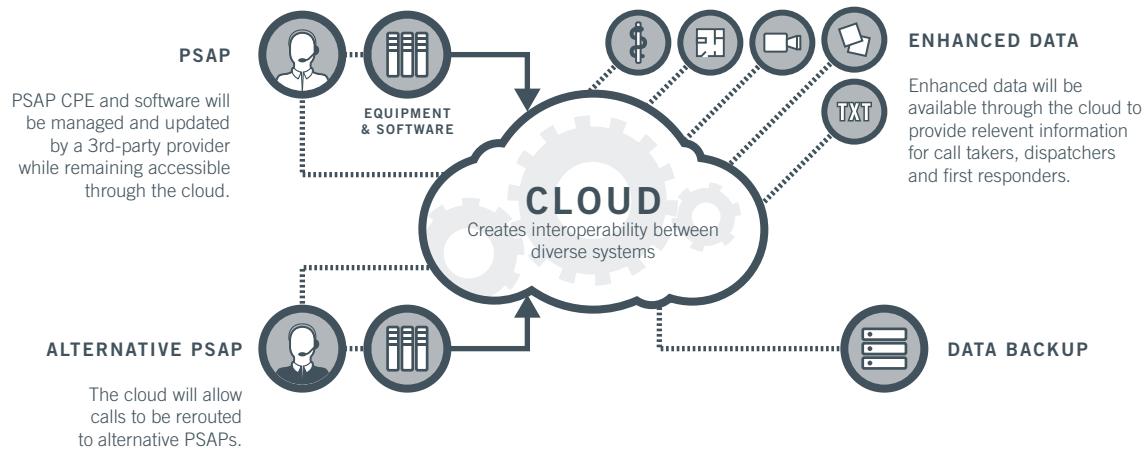
The Cloud

In a NextGen 9-1-1 discussion, it is difficult to talk about The Cloud as an isolated element because it is not a single, tangible component like a GIS system or call-processing equipment. In generic commercial services terms, the idea of The Cloud is a system model in which a collection of shared computing elements, both hardware and software, is centrally housed at one or more remote locations and delivered over a public network—typically the Internet in a commercial environment—to a diverse community of end users. In a commercial setting, cloud-based applications are accessed by a web-browser or mobile app while the software and users' data are stored on servers at the centralized hub. In a public safety environment, cloud computing is similar to the commercial world except that the network connections are limited to a secure private, dedicated emergency services IP network (ESInet), the hardware and software are focused solely on public safety applications, and end-users are strictly public safety agencies. These constraints create a much more secure and reliable environment than that of commercial services. Because cloud computing does not play a significant role in a legacy environment, it will not necessarily be impacted by the introduction of next-generation capabilities in the same way as location information, GIS, 9-1-1 CPE, and radio. However, cloud computing can significantly enhance next-generation capabilities and, thus, should be considered as a potential element of a NextGen 9-1-1 migration strategy.

Beyond providing access to significant next-generation functionality, the innate and remote redundancy of a cloud-based system offers simplified and improved operational continuity when an emergency event threatens the physical structure of a PSAP. On-premises systems are directly tied to the primary emergency communications center because there are physical connections between the call-taking equipment and the technology infrastructure. Cloud-based solutions are independent of location because the connectivity to the cloud system is IP based and utilizes broadband distributed networks. As long as a PSAP maintains an IP connection to the cloud, whether it is based on terrestrial access, wireless broadband or other access mechanisms, calls can be answered and solutions can be accessed from anywhere, whether it is a neighboring PSAP or a mobile communications vehicle. This provides a virtual replica of PSAP operations without costly static backup locations that are often geographically vulnerable to the same crisis that compromised the primary facility.

The Cloud (*continued*)

3.4 THE POWER OF THE CLOUD



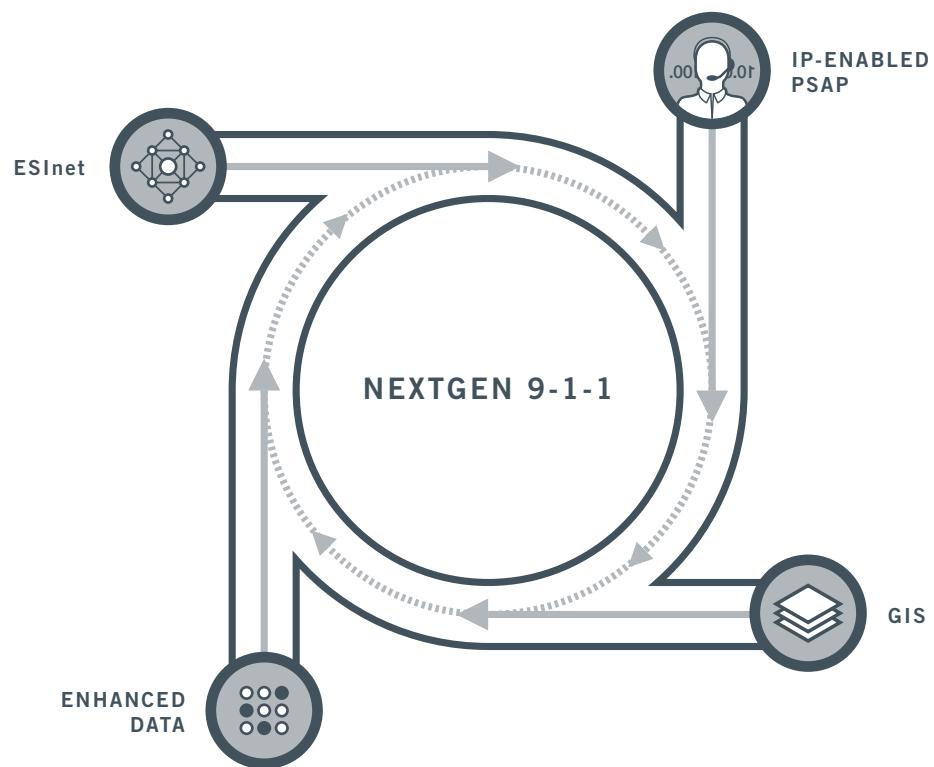
In next-generation terms, a public safety cloud-based environment means that 9-1-1 calls or emergency requests in a particular jurisdiction are processed by equipment and infrastructure that may or may not be in the PSAP facility. With that in mind, the redundancy and security of a cloud-based 9-1-1 architecture and the data stored in that system are critical. Because of this, all public safety cloud-based architectures should be dedicated infrastructures that have been purpose-built from the ground up to offer emergency communication solutions to public safety agencies exclusively. These systems should be isolated from commercial and public clouds. While a single public safety cloud platform may service multiple PSAPs in numerous states and support multiple public safety systems, each entity should maintain control of their individual features and functionality and have virtual segregation of data and security. In order to guarantee the security of a public safety cloud, solutions should incorporate physical-level security in the types of connections used to deploy solutions to the PSAP. Application-level security should also be implemented as well as personnel access and process security.

WHERE TO BEGIN

4

As mentioned earlier, one of the most beneficial aspects of the Next-Generation 9-1-1 migration is that there are multiple ways to get started, and no matter which entry point you choose, it will introduce immediate improvements to your 9-1-1 emergency communications. This flexibility allows individual PSAPs to address key pain points within legacy systems without making a monumental shift to an entirely different processing environment with one significant and potentially overwhelming effort. There are various entry points that make sense as a first step depending upon the current environment of the individual PSAP. As soon as you have established one of these key foundational elements, additional NextGen 9-1-1 capabilities and value-added functionality can be layered on top.

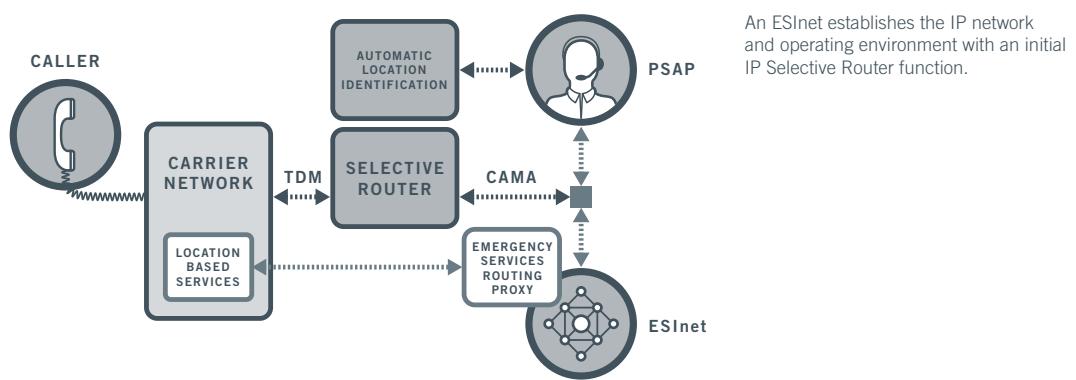
4.1 NEXT-GENERATION 9-1-1 STARTING POINTS



Emergency Services IP Network

An Emergency Services IP Network (ESInet) is a flexible communications infrastructure that replaces legacy telecommunications transport technology. An ESInet can be a network of networks that is shared by all agencies involved in any emergency. A modern IP infrastructure that supports multiple public safety agencies to provide high availability, new advanced services and nationwide integration will create the best foundation to realize NextGen 9-1-1 goals. The industry vision is that there will eventually be numerous ESInets across the United States as defined by regional 9-1-1 authorities that are linked together to provide seamless public safety operations.

4.2 START ESInet

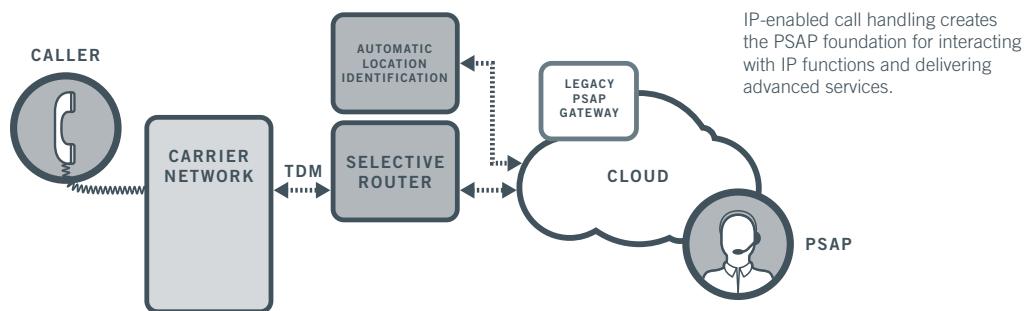


An ESInet is the foundation for interfacing with external entities, transporting information and implementing advanced capabilities. For PSAPs that list connectivity as a primary concern or who are considering the development of new brick and mortar facilities, this is a logical starting point. For PSAPs using legacy call-processing rules based on the originating telephone number and selective router database (SRDB), the ESInet remains a viable starting point if it is implemented with an IP selective router. This approach provides the IP network foundation until the PSAP is ready to transition to a next-generation model for call processing based on dynamic caller location information. The ability of an ESInet to apply legacy selective routing rules in addition to next-generation processes eliminates the need to make system-wide changes at one time and supports the idea of a phased approach to migration. It is important to understand that a typical regional IP network is not equal to a public safety-grade network. While regional networks may be the starting point for an ESInet, the basic requirements of a 9-1-1 IP network are far more stringent than those of a general IP network. A public safety-grade ESInet must be uniquely managed and is best as a dedicated network that is parallel to regional networks in order to ensure security, resiliency and availability. Various additional benefits can be achieved after the ESInet foundation is established, such as achieving end-to-end IP connectivity between 9-1-1 callers and PSAPs, thereby eliminating legacy CAMA trunks and improving call setup time.

IP-Enabled PSAP

Next-Generation 9-1-1 call handling introduces alternatives to individual, local customer premise equipment (CPE). In a next-generation environment, PSAPs can transition premises-based call handling to distributed systems in which ESInet connectivity is leveraged to establish a robust single, unified system among numerous PSAPs. This configuration enables a higher level of reliability by allowing for solutions at various interconnected geographic locations. For many IP-enabled PSAPs, the ultimate goal is to move the core systems into redundant hosted locations in order to protect operational continuity from large-scale, regional disasters. Next-generation call handling solutions allow 9-1-1 authorities to share costs, set up regional policy-based overflows and improve call handling capacity by using centralized call handling equipment for multiple 9-1-1 communication centers. For PSAPs that are currently dealing with inadequate or obsolete CPE as a part of their legacy architecture, transitioning to an IP-enabled PSAP is a logical entry point to the next-generation network migration.

4.3 START IP-ENABLED PSAP



IP-capable call handling equipment is essential to receiving emergency calls from an ESInet in IP format with NG 9-1-1 characteristics. However, emergency calls can be delivered from an ESInet and changed to the legacy communications protocol—typically CAMA trunks—expected by legacy call handling equipment. These transitional steps allow for deployment of NextGen 9-1-1 components in phases that meet the specific needs and readiness of local public safety authorities while allowing public safety agencies to realize some of the advantages inherent to an IP-based system.

An IP environment provides significant flexibility in the ways that calls can be routed, distributed and delivered within an individual PSAP as well as between interconnected IP-based PSAPs. In today's public safety environment, call volume can be more unpredictable than ever before due to the increase in wireless calls as well as the public's growing reliance on 9-1-1. PSAPs often experience significant peaks in volume surrounding a single incident due to the number of people with a wireless phone. This can lead to situations in which critical but unrelated 9-1-1 calls in the area cannot access help because of legacy network congestion or simply because a PSAP was not adequately staffed to handle an unexpected influx of calls.

IP-Enabled PSAP (*continued*)

In a legacy environment, there is limited control over how spikes in volume are routed, little recourse if phone lines become clogged, no insight to what happens to a call that cannot be delivered to the appropriate PSAP, and no guarantee that a rerouted call will arrive with basic location information, if it arrives at all. An IP-enabled PSAP has the ability to load share with other local IP-based PSAPs with the assurance that automatic location information (ALI) data will follow every re-routed call. Additionally, IP-enabled PSAPs have visibility to statistics concerning how calls were routed, where they were routed and how they arrived in order to optimize the business rules that govern the transfer of calls.

In the case of a major disaster, an IP environment offers even greater advantages in terms of redundancy and resiliency. In the legacy CAMA world, if a PSAP is rendered inoperable, calls will reroute to a single alternate PSAP. However, it may take time for rerouting to be implemented, and it may require manual intervention to initiate the transfer. If a large PSAP becomes inoperable, the rerouted call volume can overwhelm a neighboring, smaller operation. In an IP environment, however, calls can be rerouted quickly and easily based upon established business rules that are designed to distribute call loads efficiently and effectively across numerous PSAPs as desired by the 9-1-1 authority. Additionally, the time required to provision and restore alternate IP circuits is often much shorter than that needed to repair or divert CAMA trunks.

One of the greatest advantages of implementing IP-enabled call handling is the opportunity for cost sharing across multiple PSAPs. Because next-generation call handling is scalable and relies upon IP connectivity, it is possible for PSAPs within a region to share core system equipment. With this model, jurisdictions can deploy two sets of hardware in separate PSAPs—the second for redundancy and load sharing—with all other 9-1-1 communication centers accessing the technology remotely. This allows multiple PSAPs to share the cost of the deployment as well as the support and maintenance of the shared hardware. As PSAPs move into a NextGen 9-1-1 world, the equipment becomes more sophisticated with greater configurability than in a legacy system. As these investments are made, it is important to deploy a platform that has the ability to evolve with changing technology. By centralizing shared system elements, jurisdictions are able to implement fewer systems that are more robust and have greater capabilities than could be implemented as isolated stand-alone solutions. This model also simplifies and improves maintenance services. Technicians who are specifically trained and certified on the core IP system have fewer locations and less geography to accommodate while more basic equipment installed at the PSAP level will continue to be maintained by more general service technicians.

As PSAPs begin to consider the transition to IP-based call handling, it is important to remember that there is not a single solution that will work for every PSAP or jurisdiction. Like many aspects of next-generation technology implementation, IP-based call handling solutions offer significant flexibility in order to meet the specific needs of each deployment. Moving forward, it is important to assess the operational challenges that you are facing and determine how an IP-based system can minimize them. This next-generation approach offers PSAPs significant advantages in terms of efficiency within the communication center, redundancy, interoperability and fast, easy call transfer that includes data. Because of this, IP-based call handling establishes a solid foundation on which to build a comprehensive next-generation emergency communications environment.

To ensure the most effective Next-Generation 9-1-1 call handling solution for your PSAP, it will be important to first:

- determine your unique call-handling needs and goals
- research the NENA i3-defined Next-Generation 9-1-1 standards for both current deployment and future vision
- explore what next-generation call-handling solutions have already been deployed successfully
- discover which vendors are involved with setting and following standards
- compare solutions to determine what would be the best fit for your operations
- explore creative funding models that avoid large capital outlay and provide predictable budget forecasting

Geographic Information Systems

The use of geographic information systems (GIS) is not new to public safety. It first became broadly implemented with the introduction of wireless 9-1-1 service when fixed address location information could not be associated with wireless phones and 9-1-1 call takers needed a visual way to understand the geographic coordinates. As PSAPs consider implementing next-generation GIS, it is important to understand that Next-Generation 9-1-1 will introduce more functions that utilize GIS information in new ways, and significant effort will be required to enhance the legacy data to have the required attributes and level of quality. In order to accomplish this, data maintenance and quality programs will be a significant long-term concern.

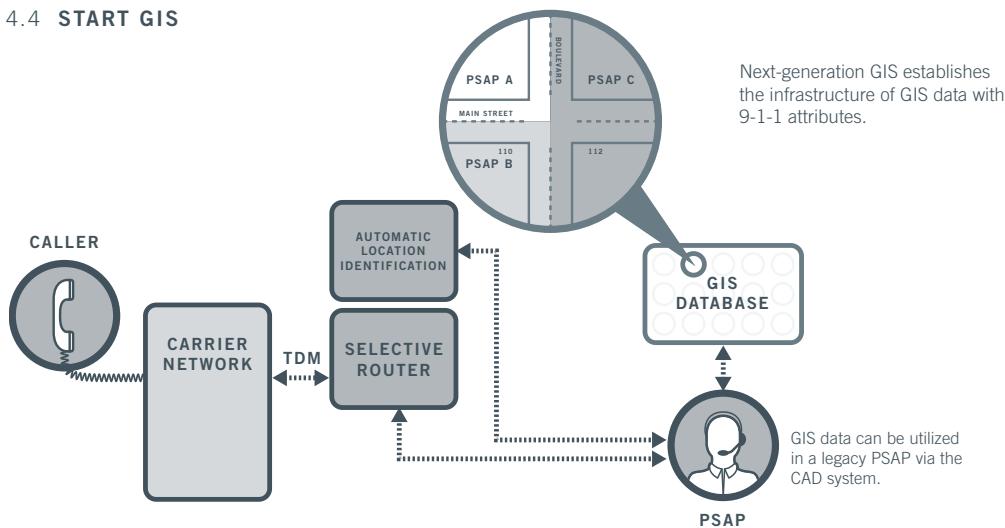
For decades, PSAPs have relied upon emergency service numbers (ESNs) defined within the master street address guide (MSAG) plus automatic location identification (ALI) databases to route 9-1-1 calls to the appropriate PSAP in order to dispatch help to the correct address. In a NextGen 9-1-1 environment, GIS will play an increasingly significant role combined with caller location information to determine 9-1-1 call routing and emergency response. With the introduction of next-generation GIS, PSAPs should be aware that several data elements and corresponding management responsibilities will change from the legacy environment:

- The use of ESNs will be replaced with geospatial data relating to PSAP jurisdictional and first responder boundaries.
- The ESN will disappear and the MSAG will be replaced. The address validation information contained within the MSAG will move to the GIS databases.
- Legacy ALI will be replaced with location information delivered by the communications service provider at call setup time as well as supplemental databases to provide information about the caller, calling location and communications service provider.

(For information on how GIS changes from legacy 9-1-1 to Next-Generation 9-1-1, see Chapter 3: Next-Generation Impact on Legacy Elements/GIS.)

While there are multiple ways to begin your NextGen 9-1-1 migration, it will be important to implement a program to establish and maintain GIS with the necessary 9-1-1 attributes as soon as possible. If your PSAP already has GIS capabilities, you will need to consider upgrading your system to support specific next-generation tools and understand the necessary modifications. As an example, typical GIS data sets do not include PSAP routing boundaries with the degree of accuracy necessary for call routing and selection of emergency service providers. The GIS tools should also allow comparison with legacy MSAG and ESNs to ensure the level of quality during the migration to Next-Generation 9-1-1.

4.4 START GIS



PSAPs should understand that their next-generation GIS solution will require strategies for managing street address information and geographic coordinates to ensure that call routing can be achieved with the same level of accuracy as it is a legacy environment. The solution must determine if street addresses will be geocoded or if routing will be determined by the address information itself. Additionally, the GIS database will become the foundation for populating the next-generation network functions that allow telephone service providers to dynamically validate street address information. In order to structure an effective GIS solution, it will be important to address these processing models, connectivity from carrier to the next-generation network and the total transaction volume that must be achieved at any given point.

Next-generation GIS plays a vital role in fulfilling the vision of a nationwide IP-based emergency communications network that is capable of immense data sharing across jurisdictional boundaries. As you consider implementing GIS, it will be essential to seek out public safety-grade solutions that are backed by standards-based quality assurance and quality control (QA/QC) and:

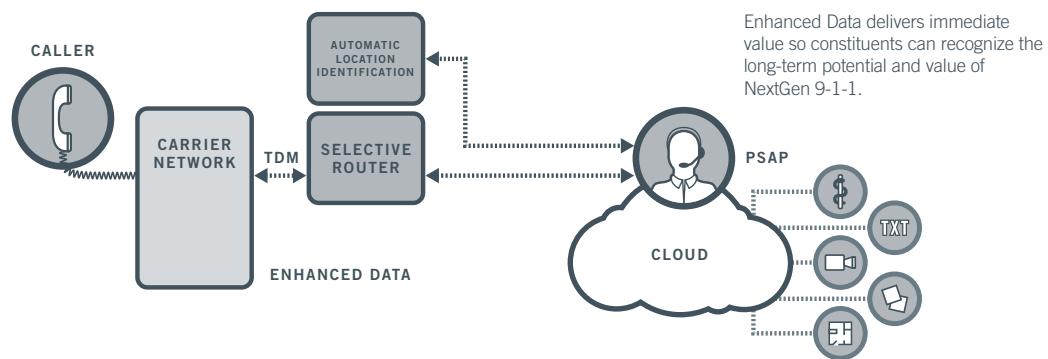
- include enterprise GIS data management with cooperative agreements between the parties that must contribute and maintain the information on an on-going basis
- include transitional capabilities from legacy MSAG/ALI data
- include map display applications
- include intelligence about locations and the ability to add and manipulate information
- comply and interoperate based on industry standards
- address security concerns

Enhanced Data

In order to reap the greatest benefit from a next-generation architecture, PSAPs need fast, easy access to rich data as well as a reliable way to deliver that data in a useful way to the most appropriate place in the least amount of time. PSAPs that implement enhanced data features will increase situational awareness, improve first responder safety and create valuable operational efficiencies.

In the legacy environment, ALI data is typically transmitted over analog data circuits. Information is limited to around 500 characters that usually includes caller name, originating telephone number, caller location and some basic caller and public safety data. In a next-generation architecture, however, data will travel over a high-capacity emergency services IP network (ESInet). This vast pipeline allows PSAPs to correlate any inbound request for assistance with a large amount of associated data from a variety of sources. That being said, PSAPs that do not yet have access to an ESInet can still benefit from enhanced data. While an ESInet is the future for all next-generation functionality, during the migration process, PSAPs can utilize the ANI/ALI information delivered with the traditional analog 9-1-1 voice call to query additional data sources to determine what, if any, additional information is available and contextually relevant to the situation. While work on a comprehensive ESInet continues, enhanced call data can initially be delivered to the PSAP via secure Internet connectivity or other data paths. These alternative paths should be replaced with the secure, robust ESInet when it becomes available.

4.5 START ENHANCED DATA



The availability of valuable enhanced data is increasing every day. While some data functionality, such as text-to-9-1-1 and gunshot detection alerts, will be delivered in real time as standards-based alerts sent directly to a PSAP, additional life-saving data is constantly being gathered at the commercial level in vast databases. This historical information can be registered with 9-1-1 service providers or other entities and made available to PSAPs at the time of an incident. While available data varies by service provider, the type of information available today includes:

- Medical Information
- HAZMAT Services
- Telematics
- Premises Data and Response
- Video Access and Alarm Monitoring
- Mobile Device Applications
- Private/Public Databases Access
- Tracking Technologies
- Weather Alerts
- News Feeds
- Intelligence Searches
- Language Services

Some of the enhanced data will be useful to call takers and dispatchers, however, the majority of this new information will provide significant benefit to first responders. With that in mind, when implementing enhanced data capabilities, whether it is as a starting point or later within the migration process, PSAPs may want to consider integrating this data functionality with a computer-aided dispatch system (CAD). This type of data integration will yield significant benefits by allowing information to be delivered directly to the field where it can effectively drive decision making.

Enhanced Data (*continued*)

While the introduction of enhanced data means that more information will be flowing into the PSAP, it is important to keep in mind that if properly implemented, the PSAPs retain complete control of the rules used to process and display the data they encounter at all times. Enhanced data functionality is completely rules based. Public safety agencies can choose to implement only the data that will benefit their PSAP, and it is possible to establish a comprehensive set of rules that will regulate how data flows throughout the call continuum, how it is presented within the system, who has access to it during, as well as after an incident, and how the data functions in certain decision-making situations. In a CAD-integrated data environment, for example, tasks such as automatic dispatching can take place based on imbedded calculations when specific rules are met. In the case of an automobile accident, incoming telematics information can determine the number of passengers in the vehicle and whether restraints were being used. The telematics information can be used to calculate a severity level and a PSAP's dispatch recommendation scheme can dispatch the appropriate number of transport units, thus saving precious time at the scene.

As PSAPs consider the benefits of enhanced data, it is important to remember that the path to implementation will be unique to every environment. To ensure the smoothest migration, you will need to consider ideas such as:

- What types of data will be most beneficial to your operations?
- What functionality will be required to create a common look and feel within legacy systems?
- What data will go to the call taker, be integrated with a legacy CAD system or go directly to the field?
- Is the correct infrastructure in place to get meaningful information directly to responders, i.e., cloud services and radio?
- With whom will this data be shared?
- What intergovernmental agreements will need to be established to regulate the access to and sharing of data?

CONCLUSION

Without question, transitioning the legacy analog 9-1-1 system is one of the most important initiatives that the public safety community has ever taken on. The path forward involves significant new ideas, processes and technologies, but the benefits of Next-Generation 9-1-1 certainly justify the effort. Getting started is easier than you think. With careful planning, a phased approach and an understanding of your emergency communications landscape, needs, constituency and project scope, you can successfully launch your NextGen 9-1-1 initiative now.

Additional References

For additional reference material on Next-Generation 9-1-1, please visit the following websites:

NATIONAL EMERGENCY NUMBER ASSOCIATION (NENA):

www.nena.org

www.nena.org/?NGPP_TransPolicy

NENA i3 SPECIFICATION:

www.nena.org/resource/collection/2851c951-69ff-40f0-a6b8-36a714cb085d/NENA_08-003_Detailed_Functional_&_Interface_Specification_for_the_NENA_i3_Solution-Stage_3.pdf?hh-SearchTerms=i3

NATIONAL 911 OFFICE:

www.911.gov

THE ASSOCIATION OF PUBLIC-SAFETY COMMUNICATIONS OFFICIALS (APCO):

www.apco911.org

DEPARTMENT OF TRANSPORTATION-NG911 INITIATIVE:

www.its.dot.gov/ng911/index.htm

NG9-1-1 SYSTEM PRELIMINARY CONCEPT OF OPERATIONS,

DEPARTMENT OF TRANSPORTATION:

www.its.dot.gov/ng911/pdf/ConOps.pdf

ALLIANCE FOR TELECOMMUNICATION AND INDUSTRY SOLUTIONS (ATIS):

www.atis.org

BROADBAND FORUM (FORMERLY THE DSL FORUM):

www.broadband-forum.org

CHECKLIST TO GET STARTED

The following checklist can help you get started today by guiding you through the initial phases of planning. This list is designed to be a starting point. It is important to keep in mind that every migration will be unique, and it is important that you carefully consider the unique circumstances and characteristics of your agency as you begin this important journey.

PLANNING:

UNDERSTAND YOUR PUBLIC SAFETY LANDSCAPE

- Identify legacy network weaknesses
- Identify geographic vulnerabilities
- Understand population trends
- Define public needs and expectations now and for the future
- Define political realities

STAKEHOLDERS:

CONNECT AND PLAN WITH YOUR EXPANDED SPHERE OF INFLUENCE

- First responders
- Local government
- State and local departments of transportation
- Campus police, parks and recreation, school districts and corporate security
- Chemical and hazardous material organizations

PROJECT MANAGEMENT TEAM:

PLANNING AND DRIVING THE MIGRATION

- Identify a team of dedicated experienced professionals that will guide the strategy, planning and execution of the migration
- Create an implementation strategy and identify implementation partners

CHECKLIST TO GET STARTED

REGULATORY AND FUNDING LANDSCAPE:

PREPARING FOR THE LEGAL AND FUNDING REALITIES

- Identify current legacy 9-1-1 funding mechanisms
- Recognize and contact FirstNet representative
- Research available federal funding grants
- Work with regional PSAPs for cost-sharing opportunities

OPERATIONAL IMPLEMENTATION:

DETERMINE THE ORDER OF IMPLEMENTATION

- ESInet
- IP-Enabled PSAP
- GIS
- Enhanced Data

OPERATIONAL IMPACT:

DEFINING THE WAY EMERGENCY INFORMATION IS DISPATCHED

- Identify data resources, workflow processes and rules
- Streamline data to ensure the information is effective but not overwhelming
- Create training strategy and schedule to ensure staff is effective with next-generation technology and methods

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