NG9-1-1 Solution Overview

WHITE PAPER

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As mobile technology allowing people to communicate via text, images and video in addition to voice has become mainstream, the emergency services community needs infrastructure enabling the delivery of 9-1-1 calls for help using such media. And being mobile, the ability to route a 9-1-1 call based on location rather than a phone number becomes paramount, along with the ability to share information among emergency services providers.

Next Generation 9-1-1 (NG9-1-1) provides the capability to enable standards-based Internet Protocol (IP) communications between the public and 9-1-1 call takers at public safety answering points (PSAPs) for multimedia calls. A North American Emergency Number Association (NENA) i3-compliant NG9-1-1 solution also provides both geospatial routing of 9-1-1 calls to the appropriate PSAP and interoperability between many functional components, databases and external entities. This white paper describes the framework and key attributes of a NG9-1-1 solution.

What are the Building Blocks of a NG9-1-1 Solution?

With the legacy Enhanced 9-1-1 (E9-1-1) solution, PSAPs are connected directly to originating voice communication systems through selective routers. This process typically uses analog circuits or digital trunks based on time division multiplexing (TDM) and centralized automatic message accounting (CAMA) signaling. Once the call is answered, the PSAP queries external databases about the received call's automatic number identifier (ANI) for location information. With NG9-1-1, PSAPs are indirectly connected to originating networks through the Emergency Services Internet Protocol network (ESInet) using data transport such as fiber, cable, copper, wireless, cellular or even satellite. This process serves as one of the benefits of IP-based communications- signaling and media packets can be transported over many mediums- allowing PSAPs to determine the most cost-effective method for their particular bandwidth, reliability and performance requirements.

One benefit of a NG9-1-1 architecture is an indirect connection to the origination networks. All PSAPs in a region connect to the ESInet to receive emergency calls destined for them. In addition, multiple regions can connect to the same ESInet to receive region-specific emergency calls. Since regional PSAPs connected to the ESInet share the same signaling and media protocols, the ability to easily transfer or conference calls between regional PSAPs is enabled. With the NENA i3 standard, ESInets can also send calls to each other with the same data retention and collaborative potential. Call routing rules and policies are defined within the ESInet, and can be changed for different dates or times on a scheduled or ad hoc basis.

With the NENA i3 standard, while emergency calls can include voice or text media, future support for images and videos are built into the framework of its signaling Session Initiation Protocol (SIP). SIP securely supports multimedia signaling over IP networks. By using SIP, NG9-1-1 systems can carry all information about an emergency call including calling party ID and location in a single payload, enabling faster response times and facilitating ease of collaboration among different PSAPs or emergency agencies. This means seconds are not wasted after answering the call to obtain location information and mapping. Instead, call takers will have the caller's location upon answer, allowing them to make important decisions earlier and potentially provide the margin to better help save lives and property.

While a NG9-1-1 system is based on IP networks and SIP signaling, the NENA i3 standard takes into consideration the connection of existing legacy emergency originating networks to next-generation emergency networks. This allows for planned and implemented migration from basic 9-1-1 and E9-1-1 without disruption to emergency services. This transitional functionality is provided by gateways used at points interconnecting legacy networks with the NG9-1-1 architecture.

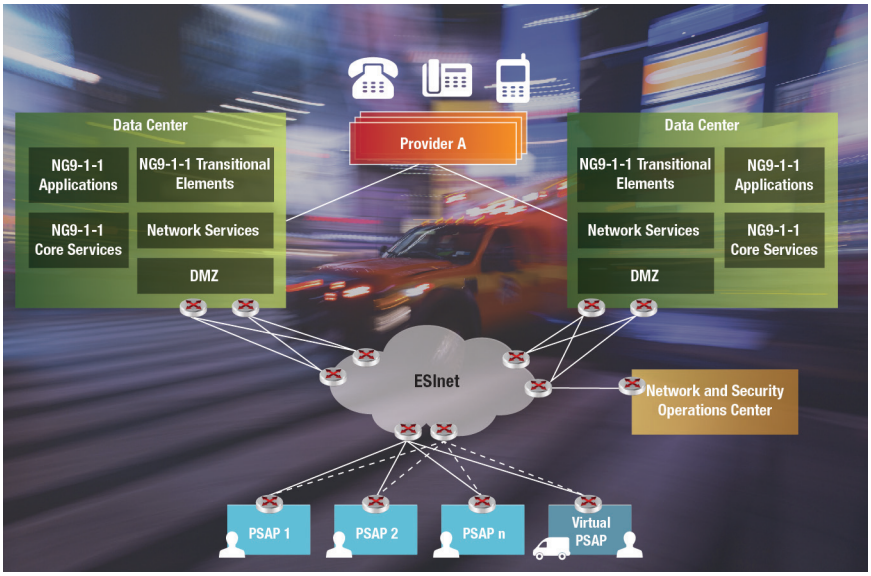

Figure 1. NG9-1-1 Architecture

The ESInet can be thought of as a wide area network (WAN) carrying only emergency services IP traffic with end-to-end quality of service (QoS) and resiliency. A PSAP uses redundant, geographically and network diverse IP circuits to connect to the ESInet. The IP circuits can be part of a regional IP network or be obtained from service providers operating within the PSAP jurisdiction. The PSAP and hosted NG9-1-1 applications are connected via IP circuits through the ESInet.

As illustrated in Figure 1, the high-level architecture of an NG9-1-1 solution includes ingress communications with service providers, end-to-end ESInet, network and security monitoring of geo-diverse redundant data centers hosting NG9-1-1 core services, applications, transitional elements and network services.

Hosted NG9-1-1 Services Delivered in a Centralized Manner

One of the primary architectural attributes of a NG9-1-1 solution is the complexity of the technology itself deployed in a centralized (hosted) manner at data center locations. The data centers are geographically dispersed from each other, but connected together and to PSAPs via the ESInet. As discussed earlier, connections to the ESInet are made through diverse redundant connections using local and national service providers. This architecture reduces complexity at each PSAP location because NG9-1-1 applications are hosted in data centers instead of running on equipment located in each PSAP. In this environment, 9-1-1 calls are input into data centers in a redundant manner with the NG9-1-1 applications providing security, signaling normalization, policy routing and geo-spatial routing on a per-call basis within the data center. The 9-1-1 calls are then routed to the correct PSAP, which increases call routing speed, accuracy and flexibility.

Overall activities and costs (including maintenance and operations) are significantly reduced because of the hosted nature of the NG9-1-1 applications. Performance of regular functions such as monitoring, recording and data application backups are simpler and easier to accomplish. They can all be done from the data centers or from a single remote location using a secure network connection. Similarly, the provisioning of systems for different users for authentication, authorization and accounting is more efficient because of the hosted NG9-1-1 solution.

With 9-1-1 calls being directed to hosted NG9-1-1 applications in data centers and PSAPs connected via the ESInet, a “virtual PSAP” concept can be implemented. This helps 9-1-1 authorities deliver impromptu remote mobile emergency services to areas within or surrounding major sporting or political events, industrial accidents or natural catastrophes. Emergency telecommunicators can log into the NG9-1-1 solution through a secure network connection using software on their computer at a PSAP, at a temporary location or mobile position.

The processes’ binding glue is the NENA i3 standards defining what the critical functional elements are, what they are directed to do and how they interface with each other. Standards are important for NG9-1-1 because they ensure a level playing field to share information across multiple vendors, use proven technology and eliminate systems locking users into costly proprietary equipment, maintenance and operations. The telecommunication and networking standards that comprise the NENA i3 standards

have been used for decades and are today used for most all voice and data traffic across the country and the world. As a result, 9-1-1 authorities gain the advantage of commoditization by implementing successfully deployed technology used by governments, enterprises and service providers for many years, along with the associated lower costs of voice and data convergence.

A change in technology at the PSAP to enable NG9-1-1 technology and move from a distributed to a centralized model. The PSAP equipment is the technology needed at the "edge", including routers to connect to the ESInet, switches to connect devices and security to detect, monitor and protect against unauthorized access, network attacks and malware. The equipment at the data centers is the technology that runs the NG9-1-1 applications and interfaces originating service providers in a "hosted" manner that includes servers, routers, gateways, switches and security.

Delivering NG9-1-1 Solutions with an Experienced Systems Integrator

Since a one-size-fits-all approach is not viable across our diverse country, General Dynamics IT can help design, implement and maintain a NG9-1-1 solution with its role as a large system integrator, bringing best-of-breed solutions to bear for specific needs. Since 2009, the General Dynamics IT NG9-1-1 systems integration lab provides the ability to validate, integrate and test the different components of a complete i3-compliant NG9-1-1 solution. General Dynamics IT takes a very methodical and detailed approach to planning, implementing, monitoring and managing a complex solution such as NG9-1-1, which helps ensure components are correctly installed and the overall system is delivered within budget and time constraints.

A General Dynamics IT solution supports a standards-based approach to designing, implementing, managing, monitoring and maintaining a NG9-1-1 system. General Dynamics IT has more than 20 years of experience in communications and emergency services by implementing and managing U.S. Department of Defense 9-1-1 operations and the U.S. Federal Aviation Administration unified communications systems including voice, conferencing, call center, network security operations center and 9-1-1. In July 2014, General Dynamics IT successfully implemented and cutover an NG9-1-1 system for several counties in Ohio, and is currently deploying large NG9-1-1 systems for other state and local customers.

For more information on NG9-1-1 solutions from General Dynamics IT, visit our website at http://www.gdit.com/Capabilities/Enterprise-IT/Unified-Communications/ng9-1-1/.

About the Author

Tom Sammons serves as Principal Systems Engineer for Sales in the Global Solution Division of General Dynamics Information Technology. In this role, he is responsible for providing subject matter expertise of NG9-1-1 solutions and their components, meeting with customers, technical pre-sales systems engineering, writing white papers and speaking at industry events.

Tom is a member of the 9-1-1 community through his membership with APCO and NENA, his NENA Emergency Number Professional (ENP) certification and regular speaking engagements at conferences across the country. Tom holds a bachelor's degree in Computer Engineering from Florida Institute of Technology. Throughout his 30-year career in telecommunications and IP network engineering, he has been recognized by his leaders and peers for his passion and focus in leading teams, building quality solutions and for his technical writing and public speaking. Tom can be contacted at tom.sammons@gdit.com.

About General Dynamics Information Technology

As a trusted systems integrator for more than 50 years, General Dynamics Information Technology provides information technology (IT), systems engineering, professional services and simulation and training to customers in the defense, federal civilian government, health, homeland security, intelligence, state and local government and commercial sectors. Headquartered in Fairfax, Va., with major offices worldwide, the company delivers IT enterprise solutions, manages large-scale, mission-critical IT programs and provides mission support services. General Dynamics Information Technology is one of two business units that comprises the General Dynamics Information Systems and Technology business group.

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