EXECUTIVE SUMMARY

INTRODUCTION

A number of major, broadband-based developments are leading to a paradigm shift in the role of the public safety answering point (PSAP). Implementation of a new, interoperable, nationwide public safety broadband network (NPSBN) will place broadband communications into the hands of first responders. Next Generation 9-1-1 (NG9-1-1) technology will enable PSAPs to utilize broadband data in ways that will transform how the public reaches 9-1-1 and how public safety telecommunicators (PSTs) interact with first responders.

APCO launched Project 43, Broadband Implications for the PSAP, in April of 2016. This report is the outgrowth of the work of nearly 80 member practitioners assisted by APCO professional staff arrayed across several working groups focused on the following major topical areas: operations, governance, cybersecurity, technology, training, and workforce. Each working group consisted of experienced public safety and industry professionals who met regularly over the course of a year. The goal of Project 43 is to help public safety telecommunicators, PSAPs, PSAP directors, 9-1-1 authorities, elected and appointed officials, and others in the public safety community better leverage existing technology capabilities and prepare for the evolving broadband communications technologies that will impact PSAP operations and, at the same time, improve support to field responders.

This is necessarily just a start, and not the final word. Technology changes quickly, as does the nature of threats to public safety. APCO will be undertaking a number of follow-up actions and welcomes the beginning of significant dialogue and collaboration triggered by this report, for the months and years to follow. Comments are welcome and may be sent to broadband@apcointl.org.

An analysis of broadband implications requires new or more comprehensive definitions of fundamental terms. The literal language of the term "PSAP" becomes outdated in a broadband environment. 9-1-1 centers are increasingly and appropriately being called emergency communications centers (ECC).[1] Further, job titles of 9-1-1 professionals vary widely, but trends show decreasing use of "dispatcher" and increasing use of variants of "telecommunicator." The term "Public Safety Telecommunicator" fits better in a broadband environment because it encompasses call taking, dispatching, and other tasks associated with being responsible for mission critical communications during an emergency response. PST also better encompasses the diverse and complex technical nature of the various tasks performed by these professionals as a whole. And of course this term has been recognized at the national level since 1992 when Congress established National Public Safety Telecommunicators Week.[2]

NG9-1-1 must be defined in a way that ensures it is deployed in a comprehensive and uniform fashion nationwide. To truly achieve a full NG9-1-1 deployment, the definition must account not only for Internet Protocol (IP)-based network connectivity, but the functions and equipment necessary for broadband information to be received, processed, and acted upon at the PSAP. A common definition would help ensure that PSAPs across the country modernize 9-1-1 networks in a manner that to the public remains familiar. Further, policymakers at all levels, industry partners, and other stakeholders can all work in the same direction only if they share the same understanding of what is needed to accomplish NG9-1-1. Accordingly, NG9-1-1 should be defined as follows:

"NG9-1-1 is a secure, nationwide, interoperable, standards-based, all-IP emergency communications infrastructure enabling end-to-end transmission of all types of data, including voice and multimedia communications from the public to an Emergency Communications Center."

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Defining NG9-1-1 in this manner is also essential to recognizing the central role of the PSAP in a fully broadband-enabled environment. Additional broadband technologies such as the NPSBN being implemented by FirstNet,[3] when fully integrated with NG9-1-1, will enable a seamless exchange of broadband communications between the PSAP and responders in the field.

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IP-based technologies, including those supported through smartphones, tablets, and mobile apps, are widely prevalent throughout the general public and capable of sending an array of information to the PSAP. As a result, PSAPs of the future will be a nerve center, managing data-rich communications via broadband technology with 9-1-1 callers and first responders.

PUBLIC SAFETY COMMUNICATIONS TODAY

From the current ability of the public to stream services over multiple screens and devices to the complex, and compelling, world of cognitive enabled services,[4] broadband is already having an impact on public safety communications. As broadband transforms communications technology outside of public safety, it also impacts emergency communications. Geographic information systems (GIS) technology enabled a new way of mapping and tracking incidents and responders. Now, with broadband-enabled technologies and GIS-based, real-time location capabilities at the fingertips of smartphone users throughout the nation, there is a push towards more defined, comprehensive location technologies. High definition video streams are becoming available to PSAPs and responders, as well as other local governmental agencies and authorities from multiple sources, and in some cases in real time. Social media and mobile apps are also already impacting how PSAPs and responders communicate and receive information.

Smart cities, already in existence in various forms, are representative of how broadband is used in the current environment. A "smart city" is one that has developed technological infrastructure that enables it to collect, aggregate, and analyze real-time data to improve the lives of its residents.[5] Examples of smart city technologies with applicability to

PSAPs include fire detection (from public parks and wooded areas to buildings), gunshot detection, traffic conditions (for emergency vehicle routing and overall situational awareness), street lamp outages (for night safety), infrastructure sensors (such as at bridges, for damage), municipal vehicle tracking (situational awareness of public safety and support vehicles), connected drones, surveillance cameras, and responder body cameras. These networks are empowered by broadband connectivity, which is becoming increasingly widespread thanks to new and future generations of wireless technologies.

Each of these examples demonstrates how broadband is already changing public safety. In addition, a number of broadband-based services are available to the PSAP and other government agencies such as fusion centers, hospitals, and utility departments. Whether as part of an interconnected smart city, or via use of a combination of commercially available technologies such as automatic vehicle location data, mobile apps, or even unmanned aerial vehicles with broadband connectivity, communications during routine operations as well as during emergencies are already being redefined by broadband technologies.

VISION OF THE FUTURE

The following two scenarios help illustrate how broadband will alter emergency communications.

Scenario: MULTI-VEHICLE COLLISION, **CURRENT DAY**, Anywhere USA

Multiple 9-1-1 calls are received (voice only) about a multi-car pileup on Interstate 10, somewhere just outside a large metro area. There is reportedly a tanker truck involved, on its side with flames coming either from or nearby the tanker. At least two vehicles are reported to have people trapped in them. Callers differ on the exact location and number of vehicles involved. Callers are unable to see the placard on the tanker, and cannot see the condition of the vehicles with entrapment. There are multiple parties reported as injured.

Not knowing the type of hazardous material (HAZMAT) involved, the number or trauma level of the patients at the scene, or the precise location, PSTs continue to question the callers, and continue to receive mixed information. They select relevant information based on their training and experience, and pass that information along to a number of units for dispatch, including the two closest HAZMAT response teams. Multiple ambulances are dispatched, and several local air medical evacuation helicopters are put on standby in case they are needed. As responders go en route, they are provided with the latest available information via radio, and their onboard mobile data terminals receive computer-aided dispatch (CAD)-based text updates.

Scenario: MULTI-VEHICLE COLLISION, **THE FUTURE**, Anywhere USA

NG9-1-1 calls, with multimedia streaming audio and video, are received by the PSAP. The PSAP is a fully integrated, broadband-based, multimedia-capable command, control, and communications center. In its legacy version, the PSAP was limited by technology and less integrated with both the public and responders. Now, PSAPs around the country represent the “nerve center” of emergency response and serve multiple roles from integrated intelligence gathering (with fusion centers and federal, state, and local partners), to shared cybersecurity, communications, and incident management capabilities. The geo-tagged information received by the PSAP indicates the incident is located on Interstate 10, at mile marker 101. An orbiting public safety unmanned aerial vehicle (UAV) immediately shifts course, and begins obtaining live video of the scene. The video from the UAV, in conjunction with video and audio live from callers at the scene, conclusively show eight vehicles involved in the

incident, including a tractor-tanker with a four sided, diamond shaped red placard clearly affixed onboard. The placard has the number "1203" printed in white letters in the middle, with a smaller number "3" underneath.

Along with a visual of the placard, received from multiple sources over broadband-enabled networks, the fully integrated CAD system performs a simultaneous lookup of the placard and presents both the video information and the listing of the United Nations Hazardous Material (UN HAZMAT) code definition. The information indicates that this placard represents a Class 3 flammable liquid, which is a flammable liquid with flashpoint of not more than 60.5°C (141°F), or any material in a liquid phase with a flashpoint at or above 37.8°C (100°F). In this specific case, based on the numbers "1203," the liquid is gasoline.

The cognitive dispatch system makes immediate resource and dispatch recommendations to the PST, along with recommending tasking the UAV with orders for a new set of video information based on wind speed and direction also provided via broadband information services directly linked to the PSAP systems. Additionally, based on ground, airborne, and satellite imagery and audio, in combination with automatic crash notification and biometric data from callers' wearables, streamed directly to the PSAP via broadband, the NG9-1-1 center's systems determine there are at least two Level 2 trauma patients and one Level 1 trauma patient at the scene. Per local protocols, three airborne medical evacuation helicopters are dispatched at the push of a button by the tactical PST,[6] and immediately upon powering up onboard systems, the crew begins to receive common information about the scene and their patients.

The PSAP dispatches units, including specialty resources such as HAZMAT technicians, from multiple jurisdictions. Despite the disparity of devices and software used by the various agencies, all PSAPs and responding units including law enforcement, fire/rescue, and EMS agencies begin receiving real-time feeds of audio and video data via NPSBN-based systems from the host PSAP. Fully interoperable voice and data communications allow the units who arrive first on scene to provide up to date, real-time information to additional units responding to the scene regardless of which agency they are from. PSAPs, though they have different CAD and radio systems, can communicate and receive common updates via interoperable, standardized CAD interfaces. This is possible due to the interoperable nature of the NPSBN, and the fact that NG9-1-1 will enable transfer of data, in real time, from one PSAP to another. As a result, not only will the PSAPs be able to keep each other informed, each PSAP will be able to communicate the same data directly to responders. By design, FirstNet will enable subscribers to exchange incident data among agencies. Therefore, even if the responding agencies would be limited by having different radio systems (for voice communications) in today's environment, in the broadband-based PSAP and responder agency of tomorrow FirstNet and NG9-1-1 have overcome proprietary limitations to afford both PSAPs and responding agencies data communications capabilities.

Upon arrival and establishment of command, the on-scene incident commander is immediately provided with control of the UAV, and can obtain a direct feed of incoming audio and visual data to the command vehicle or hand-held portable device and begin a size up and tasking of resources. In addition, the incident commander has a direct link to the company operating the tanker, and gathers specifics about the amount of fuel still in the truck, the type of vehicle, etc. while also gathering wind speed and wind direction data. Additionally, responding EMS units receive any updates available from patient telemetry linked directly to each individual's smartphone or biometric device. Airborne medical resources arrive within minutes of the first responder arrival, and orbit waiting for landing instructions. A clear landing zone (LZ) has been identified by the orbiting UAV and communicated to the incident commander, who has already moved resources to that location to secure the LZ and begin patient evacuation. Throughout the incident, PSTs monitor biometric sensors on first responders, assisting the incident commander with resource management based on data analytics that assess exertion levels of fire/rescue personnel and exposure sensors on HAZMAT technicians.

As should be evident by now, the future holds great promise for public safety communications. The ability to link multiple systems, as illustrated by this scenario, is only one part of the future. Fully interconnected vehicle and patient sensors, cognitive systems in the PSAP, FirstNet-based broadband services to the responders, and the availability of almost any needed service at the touch of a button are possible. At the center of this future and critical to fully realizing this vision of a fully interconnected public safety world is the PSAP. Whether processing initial calls, texts, and multimedia feeds or making use of multiple "smart" resources, the PSAP and the professionals who make it function are truly the nerve center of every response. From routine calls to major events, it is the PSAP that represents not only the first link in the response chain, but the critical hub through which all communications flow from start to finish of any incident. The PSAP is now the focal point of a fully interconnected public safety communications landscape. No longer just an "answering point," the PSAP of tomorrow is an emergency communications hub, a tactical intelligence center, and a unified command and control entity for all responding agencies and personnel.

ACHIEVING THE VISION

As the previous examples illustrate, the broadband-driven future promises new opportunities for public safety communications professionals to vastly improve the efficiency and effectiveness of emergency response. APCO's vision of the future for public safety communications is where devices, people, and places are all interconnected in an interoperable, secure, real-time, location-defined environment with multimedia-based interactive communications.

To achieve this vision, Project 43 was established to identify the impacts of broadband technologies and develop recommendations to maximize the benefits and minimize the challenges for the public safety communications community.

In the sections that follow, the report presents findings and recommendations concerning the implications of broadband technology on operations, governance, cybersecurity, technology, training, and the workforce. Operations are the starting point because, notwithstanding any other factors, this report is focused on what is necessary

to ensure an effective emergency response. PSAPs must have the resources needed to effectively incorporate and utilize broadband and NG9-1-1 technologies, including methods of processing and preserving the new data and information that will become available. This will require development of new or modified standard operating procedures, best practices, and protocols.

Ensuring interoperability from the outset is an essential component of successful adoption of broadband technologies. Interoperability requires use of widely deployed commercial standards,[7] and other standards approved through organizations such as the American National Standards Institute (ANSI)[8] (which accredits the procedures of standards development organizations to ensure openness, balance, consensus, and due process) and that are proven to achieve and maintain seamless interoperability among PSAPs, emergency services IP networks (ESInets), originating networks, FirstNet, and other government and public safety enterprise networks.

In addition to interoperability, success also depends upon establishing effective governance and cybersecurity foundations. Governance structures may take several forms, but with the right features can lead to well-planned, sufficiently-funded, and accountable deployments and operations. Cybersecurity is a present and evolving challenge that requires significant vigilance through training and best practices. Threat detection and prevention can be accomplished via shared resources, which can help to concentrate the expertise necessary for this complex field, reduce costs, and lead to more effective and efficient cybersecurity of NG9-1-1 and other public safety networks.

The technical implications of broadband are profound – PSAPs will be making a large leap from decades-old, legacy technology to current technologies enjoyed by consumers and soon by FirstNet users. From video, to hosted and cloud-based services, data analytics and cognitive technologies, the opportunities for broadband technology to enable a more effective and efficient emergency response are significant.

These technologies, accompanied by a new operational environment, updated governance and related laws and regulations, and cybersecurity awareness, all point to substantial emphasis on the need for training. Training requires initial and sustained attention and priority to ensure PSTs are best equipped to perform the increasingly complex and critical tasks they will confront and embrace. This includes the changed nature of stress that PSTs will face due to both the increased volume and intensity of data and imagery that will flow from the public and field responders into the PSAP.

To meet the new NG9-1-1 opportunities and challenges, the future PSAP workforce will need to evolve. While attributes such as professionalism and dedication to service will remain essential, PSTs will need new skills and training to manage the opportunities and challenges of a broadband environment.

Most findings and recommendations throughout the sections of this report focus on state and local stakeholders but a key recommendation is the opportunity for congressional action to assist with modernizing 9-1-1 networks throughout the country. Achieving NG9-1-1 is essential to the safety and security of the general public and first responders, and a national imperative. A significant federal grant program is needed to: provide the capital to upgrade legacy networks and equipment to IP-based, broadband-enabled, NG9-1-1 systems; provide incentives to achieve interoperability, economies of scale, and sustainable funding mechanisms by states and localities; and eliminate, once and for all, the practice of some states to divert fees collected for 9-1-1 to other purposes.

This report compiles the major findings and recommendations for achieving the stated vision. It concludes with summarizing next steps and particular commitments of APCO to begin addressing the broadband implications for the PSAP. ■

Notes

1 For simplicity, "PSAP" is used throughout this document. One of this report's recommendations, however, is broader adoption of the term "ECC" to better encompass the nature of public safety communications centers.

2 http://www.npstw.org/.

3 www.firstnet.gov.

4 Cognitive services analyze and interpret a wide variety of data, including unstructured text, images, audio, and video. Basically, they "learn" from each transaction and become capable of analyzing "big data" and differentiating actionable information from background information. In addition, if properly implemented, these services can provide advanced capabilities which would include recommendations based on learned "personalities," tone, and even emotion. Advanced solutions will utilize machine learning to grow knowledge in applications and systems and will also provide the benefit of advanced quality assurance capabilities.

5 Trends in Smart City Development, National League of Cities (Jan. 5, 2017), http://www.nlc.org/find-city-solutions/city-solutions-and-applied-research/urban-development/trends-in-smart-city-development-report-landing-page.

6 A "tactical PST" operates in the field as part of a critical incident management team to support tactical command staff.

7 "Widely deployed commercial standards" means those that are proven to achieve and maintain seamless interoperability among the hundreds of millions of connected devices and networks in use around the globe, regardless of manufacturer, device, operating system, platform, etc. Examples include standards developed by the Third Generation Partnership Project (3GPP), the Institute of Electrical and Electronics Engineers (IEEE), the Alliance for Telecommunications Industry Solutions (ATIS), the Internet Engineering Task Force (IETF), and the International Telecommunications Union (ITU), and successfully implemented in truly interoperable, device and network agnostic fashion. These are the standards that have led to the notable success of the industries encompassing the current, planned, and future origination networks delivering voice and data to PSAPs, and that will be employed by FirstNet.

8 ANSI coordinates the development and use of voluntary consensus standards in the United States and represents the needs and views of U.S. stakeholders in standardization forums around the globe. ANSI accredits Standards Development Organizations (SDOs). To produce an American National Standard, an ANSI-accredited SDO must adhere to certain due process requirements that ensure openness, balance, and consensus in standards development, which are designed to help make standards development in the U.S. an equitable and open process that serves both U.S. business and the public good. See https://share.ansi.org/shared%20documents/Standards%20Activities/American%20National%20Standards/Procedures,%20Guides,%20and%20Forms/2017_ANSI_Essential_Requirements.pdf.