

Utilizing a 5G network slice for public safety communications provides first responders with the reliable, high-performing, prioritized, and preempted connectivity critical for incident response while providing a future-proof platform for new digital use cases adoption.

5G Network Slicing Delivers Mission Critical Communications for First Responders and Drives Public Safety Innovation

December 2024

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Introduction

Reliable communication is just as vital for first responders as other tools of the trade like fire hoses and patrol cars. From the initial emergency call to accurately identifying incident locations and coordinating the activities of various agencies, robust and reliable connectivity forms the foundation of any public safety response. Disruptions in a first responder's connection due to network congestion, variable performance, or a lack of coverage are more than inconvenient — they can endanger the lives of first responders and the people they protect.

Digital Transformation of Public Safety

Connected technology is transforming the way first responders operate, far beyond the traditional image of a police officer using a land mobile radio (LMR). While public safety agencies have sometimes been slow to embrace digital transformation (DX), they are now progressing steadily.

The range of devices used by first responders is expanding and will benefit from advancements in 5G. For example, while body-worn cameras (BWCs) are standard issue for most police officers to collect evidence, the imagery and audio captured often must be downloaded manually for storage and processing. With a prioritized 5G network slice, however, BWCs can deliver real-time video to incident commanders, whether they are onsite or remote.

The expanding public safety technology landscape includes drones, augmented reality/virtual reality (AR/VR) headsets and displays, wildfire detection systems, AI-enabled traffic cameras, IoT devices, and dedicated cloud-hosted applications. Yet, to unlock the full potential of these tools, they must be supported by robust, secure, high-performance connectivity. A dedicated 5G network can offer the reliability needed to make these innovations truly seamless.

AT A GLANCE

KEY TAKEAWAYS

- » High-speed, low-latency 5G connectivity, delivered via a dedicated network slice, provides the priority and preemption that first responders have always enjoyed while ensuring resilient communications with minimum baseline speed performance.
- » A 5G network slice also provides a future-proof innovation platform that streamlines the adoption of new digital tools — such as real-time AR/VR, autonomous dispatch, and drone-enabled search and rescue — for first responders.

Connectivity Pain Points for First Responders

First responders face multiple connectivity challenges that can hinder their ability to perform in critical situations:

- » **Coverage gaps:** First responders must be able to operate across a variety of different operational scenarios and terrains. The range of direct LMR communications is generally less than a mile, though that range can be extended by installing LMR repeater systems. Even then, the range of those systems can be affected by weather, radio power settings, frequency bands, and terrain. During natural disasters, for example, coordinating a response across a wide area (and multiple agencies) can be problematic, with some first responders operating well beyond the range of many LMR systems.
- » **Variable performance:** As public safety agencies become more digitally native and use more advanced digital tools, accessing (and responding to) critical data in real time becomes essential. Many new digital tools for first responders will be built with minimum connectivity performance thresholds for speed and latency. If the data and communication flows that underpin these new tools become unreliable or too variable when network traffic volumes ramp up, as they sometimes do in emergency situations, first responders will hesitate to use those tools. High-quality and performance communications are paramount for advanced public safety use cases like drones and AR/VR.
- » **Disparate communications platforms:** Coordinating the activities of multiple agencies during large-scale emergencies, such as wildfires or incidents that cross state borders, becomes a challenge when those agencies are using different LMR systems, often on discrete frequencies with differing power levels. While some emergency management agencies (EMAs) try to centrally coordinate the frequencies and systems in use at the state level, those efforts are not universal.

Understanding 5G: Key Components and Their Impact on Public Safety

To level set the conversation around 5G network slicing's significance for the first responder/public safety community, it is important to clarify some key terms:

- » **5G:** 5G refers to the fifth-generation technology standard for cellular or mobile networks. Its specifications are defined globally via the Third Generation Partnership Project, which is a collaboration between local and regional telecom standards bodies, with input from operators, telecom network infrastructure providers, and regulators. The first commercial 5G networks were launched in April 2019, and as of November 2024, 343 operators have launched some form of 5G service. 5G networks deliver significantly faster speeds than 4G LTE and are poised to offer sub-10ms network latency benefits and improve the ability to support a substantial increase in the number of simultaneous connections supported. In addition to providing priority and preemption for first responders, the faster and more responsive 5G networks will fuel future innovation in public safety services. For example, 5G's low-latency connectivity will enable remote doctors to provide real-time AR guidance for EMS personnel with medical imaging overlays for precise intervention points. Faster throughput can support the real-time processing, analysis, and sharing of thermal image feeds from inside burning buildings, which improves first responder safety and can aid in locating trapped victims faster.
- » **5G standalone (SA) network:** The initial versions of 5G networks were known as 5G non-standalone (NSA), in which the radio access network (RAN) was built to 5G specifications, but data and voice transited the network on a

legacy 4G LTE network core. Deploying 5G NSA was cost-effective, accelerated the buildout of 5G networks, and provided increased throughput, but it left many more advanced 5G network capabilities unavailable to consumers and businesses. 5G SA is a network architecture that provides an end-to-end 5G experience: data traffic remains on standard 5G RAN but uses a new 5G (often cloud native) core that allows for advanced functionality such as ultra-reliable low-latency communications (URLLC) and network slicing, along with improved coverage, better security, and increased capacity. Of the 343 operators that have deployed 5G networks, just 63 have launched public 5G SA networks.

- » **5G network slice:** A network slice is a dedicated virtual network that can be created within a traditional physical 5G network. Traffic on a network slice operates independent of and is isolated from the broader macro network. Connectivity performance (speed, latency, and connection density) on a network slice can be tailored for a specific customer, a user group persona like first responders, or a particular functional solution, such as drone operations. A network slice for first responders can provide extra, protected network capacity and establish the minimum connectivity performance baselines essential for prioritized calling and advanced digital use cases. The ability to use a network slice to scale performance on demand can make first responder communications more resilient when the network faces the massive data surges that often accompany disasters. Because network slices are created virtually, they can be stood up quickly and at far lower costs than building a bespoke wireless network. And since network slices sit within the broader macro network, they can be accessed and used anywhere the operator's 5G SA network is found. 5G SA deployment is required to leverage network slicing.
- » **Wireless Priority Service (WPS):** WPS is a U.S. federal program overseen by the Department of Homeland Security that lets mobile operators prioritize calls and traffic on their cellular networks. Operators participating in WPS can provide priority status for qualified user communications. Eligible organizations include federal, state, and local law enforcement agencies; fire departments; 911 call centers; EMS personnel; and others performing public health and safety services.

5G Network Slicing Alleviates First Responder Communications Pain Points

Leveraging a 5G network slice for public safety communications solves many first responder connectivity challenges.

Priority Access and Preemption

A 5G network slice can isolate, virtually, first responder communications from regular traffic on the network. The mobile operator can designate traffic on that slice for priority access. This can help mitigate the dramatic increases in traffic that typically accompany emergencies or large-scale activities like concerts or sporting events while maintaining the connectivity experience of first responders. First responder communications will take precedence and remain at the front of the line for network resources.

Tailored Connectivity Performance

5G network slices can be customized for not only the broad first responder community but also bespoke tasks within public safety, such as real-time body camera streaming or drone operations. Such use cases require higher and more stable bandwidth than voice calls, and a 5G slice helps ensure that performance is consistent and reliable.

Enhanced Security of Communications

Ensuring the security of public safety communications is paramount for both safety and regulatory reasons. First responders must be able to trust that dispatch locations and directions from incident command are coming from reliable, trusted sources and are not subject to interference or deception. In addition, first responders are required to safeguard protected health information (PHI) and personally identifiable information of both patients and staff that may be broadcast during an emergency response. LMR systems primarily use encryption, specifically Advanced Encryption Standard (AES-256 is recommended), as a means of protecting first responder communications. However, in a January 2022 report, the U.S. Cybersecurity and Infrastructure Security Agency (CISA) highlighted the availability of web-based apps, frequency jammers, radio cloning devices, and encryption-breaking software as threats to public safety communications. Encryption alone isn't enough, and there are empirical examples of interoperability issues when encryption is leveraged during multiagency incidents.

Isolating public safety traffic on a 5G network slice creates a common architecture accessible by multiple agencies for interoperability. It can also provide more robust access controls that help ensure only authorized, preapproved users can participate in first responder communications.

Future Proofing First Responder Innovation

In addition to the aforementioned benefits, as agencies continue to explore the digital transformation of public safety communications and the tools used in emergency response, the 5G network slice also serves as an innovation platform that will streamline the deployment of new, advanced use cases and tools. Instead of building command-and-control communications from scratch, new advanced use cases such as autonomous police drone operations, connected ambulances, automated dispatch from gunshot detection systems, and AR vision for firefighters can be deployed using the standard, secure, high-performing connectivity of a network slice. This allows such use cases to be deployed and piloted faster than in a scenario where the connectivity layer is not established.

5G Network Slicing Delivers Agency Cost and IT Resource Benefits

First responders also benefit from using a 5G network that doesn't require additional infrastructure to install or maintain beyond the end-user device. Since the first responder 5G network slice exists within the broader macro cellular network, the mobile operator is responsible for the radio access network and towers. This can lower operating costs and ease some of the IT burden for public safety agencies.

New Trends and Technologies Transforming First Responder Communications Needs

Ubiquitous 5G Connectivity

5G connectivity in the United States has become nearly ubiquitous, with some operators claiming 98% of the U.S. population is covered. And for those parts of the United States that are not currently covered by cellular service, mobile operators are announcing partnerships with satellite companies for non-terrestrial 5G service, helping ensure that first responders can be connected no matter where an emergency takes them. The faster speeds, lower latency, and improved connection density provided by 5G networks are more consistent and reliable than any prior cellular generation, and these performance attributes are fueling a wave of innovation in hardware design and solution development. Cloud-native technologies supported by robust 5G connectivity allow devices to offload compute, which

improves durability, cost, and battery life. Hardware original equipment manufacturers would not be able to incorporate multi-access edge computing (MEC) into their design process without the broad coverage and robust performance of 5G networks. Similarly, software and service development are also accelerating innovation by enabling real-time viewing and analysis of onsite data to inform incident command and automate core responses. However, it is important to note that 5G SA networks, which are a prerequisite for network slicing, significantly lag overall 5G network deployments.

Next Generation 911

Public safety agencies are moving toward replacing the current decades-old, analog-based 911 infrastructure with a new digital IP-based communications platform known as Next Generation 911 (NG911). NG911 will still support voice calls but will also enable the public to share photos, videos, and text messages during 911 calls. These data-intensive activities require the more robust connectivity layer that 5G provides for timely delivery of multimedia inputs. In addition, leveraging a 5G network slice to share multimedia information directly and securely with first responders improves situational awareness and decision-making.

New Data-Driven Use Cases in Public Safety

Similar to NG911, public safety agencies are increasingly adopting new technologies to be more effective and efficient when responding to emergencies. These new tools and approaches go beyond basic phone or radio calls and typically involve more complex integration of data inputs and compute resources to deliver their intended outcomes. In detail:

- » Real-time HD video from BWCs and drone footage requires the high speeds and low latency of mature 5G networks.
- » A number of companies are testing heads-up displays (HUDs) mounted to firefighter helmets to provide blueprints for structural navigation and infrared sensing to locate victims. These types of displays require robust, bidirectional connectivity to collect onsite inputs, upload them to an edge compute instance for processing, and then deliver the imagery back to the HUD.
- » EMS and healthcare organizations are piloting connected ambulance initiatives in which sensors are attached to a patient en route to an emergency room (ER), transmitting their vital signs to ER staff automatically instead of being manually transmitted by radio. This reduces the need to operate a radio and ensures greater accuracy.
- » Public safety agencies are also leveraging cellular connectivity for asset management. With the help of 5G connectivity, personnel, vehicles, and tools can be geo-located with precision.

T-Priority from T-Mobile Poised to Enhance the First Responder Digital Experience

T-Mobile is a leading provider of wireless connectivity and networking solutions. T-Mobile's portfolio begins with the company's top-rated 5G network, which, according to various independent testing agencies, provides market-leading 5G speed, coverage, latency, and reliability. T-Mobile has a wide reach, with its 5G network covering 98% of Americans and its faster Ultra Capacity 5G covering 300 million people, coverage that is of particular importance to first responders who must operate across a wide range of metro, suburban, and rural areas.

At present, T-Mobile is also the only U.S. carrier to offer the most mature version of 5G, 5G standalone. 5G SA represents a full end-to-end 5G experience and does not rely on legacy 4G LTE technology. 5G SA is a prerequisite for network slicing and enables T-Mobile to provide the first commercially available network slice for first responders in the United States.

Beyond robust connectivity, nationwide 5G SA deployment from T-Mobile fuels its Advanced Network Solutions (ANS) platform, which includes a full portfolio of voice, collaboration, IoT, edge computing, security, and productivity offerings that bring new innovation to first responders' ability to serve and protect the public. With 5G-enabled ANS from T-Mobile, public safety organizations can mix and match performance features to meet the connectivity and computing needs of the diverse set of automated, data-intensive use cases driving digital transformation for first responders. T-Mobile for Business is also known for its inception to deployment customer service that provides end-to-end support across public safety organizations' entire connectivity journey.

T-Mobile is no stranger to public safety communications. In 2020, the company launched "Connecting Heroes," a 10-year commitment to provide free talk, text, and unlimited data to first responder agencies, providing estimated savings of up to \$7.7 billion. T-Priority service from T-Mobile, resting on the only nationwide end-to-end 5G SA network, further assists first responders by placing public safety communications on a dedicated 5G network slice. First responders using T-Priority get enhanced services with priority access and preemption.

Challenges

First responders are not usually first in line to adopt emerging technologies. The legacy communication network founded in LMR is durable, with form factor advantages and ease of use in emergencies that is unlikely to be supplanted by cellular technology any time soon. An "if it isn't broke, don't fix it" approach, however, can limit the pace of adoption. T-Mobile for Government is a relatively new entrant to the public safety wireless networking landscape. AT&T's FirstNet and Verizon's Frontline have more established reputations among first responders. Engaging agencies on base connectivity and use case innovation with T-Priority may face some headwinds. A relentless focus on building trust and using successful deployments to establish T-Mobile bona fides will be necessary. In addition, using T-Priority as a gateway to more advanced use cases that leverage 5G ANS from T-Mobile will require detailed road maps that streamline the adoption and integration of new business and operational models. Emerging communication technologies represent a substantial change to the way first responders have historically operated. T-Mobile for Business will need to establish solid, high-touch, and highly customized partnerships with public safety clients to ensure that solutions for agencies are interoperable with existing legacy communications and to avoid disruptions. Understanding and accommodating the digital maturity of individual first responder agencies, along with the integration and interoperability of existing systems, will be key to successful implementation of advanced communications by public safety agencies.

Conclusion

5G network slicing is poised to accelerate the next phase of digital transformation for first responders. Building on 5G's enhanced performance, insulating communications traffic on a dedicated network slice ensures first responders will continue to receive the priority access and preemption they are accustomed to. A 5G network slice also provides more robust, secure, reliable, and higher-performing connectivity that serves as an innovation platform for new devices, services, and solutions to enhance first responder safety, situational awareness, and incident response effectiveness.

5G network slicing is poised to accelerate the next phase of digital transformation for first responders.

About the Analysts

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Jason Leigh is a research manager for IDC's Mobility team responsible for 5G and Mobile Operator research. Leigh's research focuses on the strategic implications and market opportunities presented by the emerging 5G ecosystem, including commercial availability, installed base forecasts, regional adoption trends, content and services enablement, device impacts, 5G's role in IoT, and innovative use cases leveraging 5G.

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MESSAGE FROM THE SPONSOR

T-Mobile for Government is helping first responder agencies improve connected experiences with the country's largest and fastest 5G network*. First responders face many communication challenges, including network congestion, limited bandwidth, and coverage gaps. Current broadband solutions rely on older 4G LTE technology, limiting advanced capabilities. T-Priority from T-Mobile delivers the world's first 5G network slice dedicated exclusively to public safety, offering unprecedented priority access on the nation's most advanced 5G network. With faster 5G speeds and 40% more 5G capacity, T-Priority empowers first responders with advanced tools like drones, real-time video streaming, and IoT sensor integration — dramatically enhancing situational awareness when it matters most. To learn more about how T-Mobile is building integrated solutions for first responders that revolutionize digital transformation by leveraging the power and capabilities of 5G, visit our [T-Priority page](#).

*Fastest: Based on median, overall combined 5G speeds according to analysis by Ookla of Speedtest Intelligence data 5G download speeds during Q1-Q2 2024. See 5G device, coverage, and access details at [T-Mobile.com](#).



The content in this paper was adapted from existing IDC research published on www.idc.com.

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