First Responder Network Authority

ROADMAP

FirstNet® Authority

![FirstNet Authority logo]

The FirstNet Authority was established in light of 9/11 to lead the creation of a dedicated nationwide broadband network using spectrum set aside for the public safety community (Band 14). Through a combination of government, commercial, and public safety partnerships, we are committed to delivering a network and supporting ecosystem of apps, devices, and capabilities that are innovative, reliable, accessible and secure. By modernizing public safety communications with our partners, we can help responders keep America safe – every day and in every emergency.

To learn more, visit **FirstNet.gov**.

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LETTER FROM THE FIRSTNET AUTHORITY CEO

The First Responder Network Authority (FirstNet Authority) Roadmap is our guide to the future of FirstNet, the nationwide public safety broadband network.

First released in 2019, the Roadmap reflects public safety's most pressing needs for the network. The FirstNet Authority consults the Roadmap as we prioritize network investments, resources, programs, and activities to support public safety communications.

The results have been impactful. Since the Roadmap's initial release, the FirstNet Authority has invested in FirstNet, including indoor and rural coverage, a fleet of deployable assets that has aided in numerous disaster response operations, and 5G expansion.

The Roadmap provided a way forward to evolve the network, and now I am happy to present an update to the Roadmap.

This update comes at a pivotal point in time for the FirstNet Authority and the network. The initial five-year buildout of FirstNet is being completed. As we enter the next phase of the network, we're faced with the question—what's next? I am excited for what the future holds for public safety communications, and this Roadmap will help us shape the future of FirstNet.

To design this Roadmap, our team once again turned to public safety. Through our engagements and data collection efforts, we worked closely with public safety to understand their current communications challenges. We heard one theme emerge time and time again: We need it to work for us.

It's simple, but powerful. First responders face incredible challenges every day, and they need their tools to work—without question. This update to the FirstNet Authority Roadmap outlines ways our team can support that goal: ensuring the network remains dependable, connecting responders to each other and the critical information they need, and enhancing the network so public safety can take advantage of innovative technologies.

Feedback from public safety has always been the backbone of our work at the FirstNet Authority. With this Roadmap, we are working to transform that feedback into the future of public safety communications.

Joe Wassel
FirstNet Authority CEO

INTRODUCTION

Committed to a differentiated public safety network experience

The Middle Class Tax Relief and Job Creation Act of 2012 charged the First Responder Network Authority (FirstNet Authority) with ensuring the building, deployment, and operation of FirstNet, the nationwide public safety broadband network. The FirstNet Authority's programs, activities, and investments support the creation and evolution of a dedicated and differentiated broadband communications network that transforms public safety operations to save lives. The FirstNet Authority Roadmap (Roadmap) is essential to this mission.

Since its original publication in August 2019, the Roadmap continues to reflect stakeholder input and expresses areas of focus for the FirstNet Authority in evolving and advancing the FirstNet experience—from the FirstNet solution being delivered by network contractor AT&T to the FirstNet Authority's value-adding activities and network investments that make FirstNet different from any other network.

Roadmap leads to investments

The Roadmap is designed to guide the growth, evolution, and advancement of FirstNet. This will be accomplished through focusing programs, activities, and investment dollars in areas that make an impact for public safety. Since the release of the original Roadmap in 2019, the FirstNet Authority has made a series of investments:

In June 2020, the FirstNet Authority Board approved the first set of investments to upgrade the FirstNet Core to be 5G ready[1] and further expand the dedicated fleet of deployable

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[1] The "5G ready" Core allows FirstNet users with 5G devices to access the commercial 5G network where available. It also enables some basic 5G services. Once the network radios on FirstNet-allocated Band 14 spectrum have been upgraded, 5G user devices will have full 5G high-speed throughput and all enabled 5G services on Band 14.

assets. These investments were a direct result of Roadmap priorities in the Core and Coverage domains.

In September 2021, the FirstNet Authority issued a task order that requires AT&T to conduct feasibility assessments focusing on low Earth orbit (LEO) satellites as backhaul, maritime operations, and air-to-ground operations. If warranted, the studies may lead to potential network reinvestment.

In May 2022, the FirstNet Authority Board approved an investment to boost coverage where public safety operates indoors. This investment was also a direct result of Roadmap priorities in the Coverage domain and was an important step in addressing a common challenge for first responders.

FirstNet Authority Roadmap evolution

As the public safety mission, operations, and technology evolve, so do the FirstNet Authority's priorities. In 2020, the FirstNet Authority team reviewed the original 2019 Roadmap to ensure the priorities and focus were aligned with the current and continuously evolving needs of public safety, leading to the release of an updated Roadmap in 2020.

The 2019 and 2020 Roadmaps concentrated on the key technology domains that enable critical public safety operations, as identified through engagement with public safety stakeholders. The domains are: **Core**, functioning of the network; **Coverage**, access to that network; **Secure Information Exchange**, secure and reliable access; **Situational Awareness**, access, collection, and distribution of critical information; **User Experience**, how responders use and interact with the network; and **Voice Communications**, mission critical services with an emphasis on mission critical push-to-talk (MCPTT).

The FirstNet Authority has made significant progress on the priorities within these domains. Through efforts such as studies, focus groups, field tests, and investments, the FirstNet Authority has increased capabilities for public safety.

But there is more work to be done, and the FirstNet Authority continues to make progress in addressing goals within the six domains. At the same time, the FirstNet Authority recognizes the need to evolve its focus to support and address public safety's ongoing operational needs.

As a result, the FirstNet Authority evaluated the priorities and focus areas from the 2020 Roadmap to ensure they continue to align with the needs of public safety. The team determined that to best support the operational needs of public safety, the FirstNet Authority will continue to make progress toward the six domains, but also focus on three main goals: supporting solutions that ensure a **Dependable Network**, enable **Connected Responders**, and prepare for **Operationalizing Advanced Technologies**.

THREE-YEAR PROGRESS UPDATE

Since the release of the 2020 Roadmap, the FirstNet Authority team has been working to address the priorities identified for each domain and bring first responders the technology they need. The following subsections highlight the progress made in each domain as of April 2023.

For more details on the progress made on each priority from the 2020 Roadmap, see Appendix A.

Core

Launched in 2017, the dedicated FirstNet Core is the first-ever nationwide enhanced packet core infrastructure built and designed specifically for public safety. In 2020, following the approval of an investment from the FirstNet Authority Board, AT&T began the first phase of upgrading the FirstNet Core to enable 5G capabilities. In the spring of 2021, AT&T announced these initial upgrades were complete, and since then, first responders have had access to AT&T's 5G spectrum in parts of a growing number of cities and venues. This is the first step in a phased plan and sets the stage to provide FirstNet users with reliable, secure 5G. First responders will maintain voice communications with priority and preemption on LTE, while the intuitive FirstNet network determines the best route for data traffic, which now includes 5G.

Additionally, in April 2021, AT&T announced the launch of tower-to-core user plane (S1-U) encryption on FirstNet based on 3rd Generation Partnership Project (3GPP) industry standards. With this encryption, FirstNet traffic is now secure as it moves from the user device to the cell towers, through backhaul, to the Core, and back again.

Coverage

As of March 2023, the FirstNet network covers more first responders than any other broadband network, reaching more than 2.91 million square miles across the nation. Tens of thousands of existing AT&T cell sites have been upgraded to include Band 14, and more than 99% of the U.S. population is covered using Band 14 and all AT&T 5G or LTE commercial bands.

Tribal nations are also benefiting from FirstNet, with the network expanding by more than 40% on federally recognized tribal lands between 2020 and 2022. Efforts include building out Band 14 and AT&T commercial LTE across more than 100 sites across the Navajo Nation and launching new cell towers on tribal lands. One such cell tower launched in Kenwood, Oklahoma, bringing the 1,000 members of Cherokee Nation access to AT&T 5G and FirstNet. Previously, members of this community had to drive more than 10 miles to get any cellular service.

A FirstNet Compact Rapid Deployable in the field in Colorado.

A FirstNet Cell Booster Pro set up in a police headquarters.

The FirstNet Authority has also been working with AT&T to deploy additional coverage solutions to support public safety. In June 2021, the FirstNet Authority invested in the addition of new assets to the dedicated FirstNet deployable fleet. The fleet now contains more than 150 assets, including Flying COWs (cell on wings), COWs (cell on wheels), Communications Vehicles, SatCOLTs (satellite cells on light trucks), Compact Rapid Deployables (CRDs), and Mini Compact Rapid Deployables (miniCRDs™). CRDs are smaller form factor deployables that can be deployed by a single person in 15 minutes and can provide more than a one-mile radius of coverage. Their compact size allows for more flexibility, as they can travel to places larger deployables cannot. MiniCRDs™ are even more compact, consisting of two ruggedized cases that link to FirstNet via satellite and can provide coverage up to a half mile. CRDs and miniCRDs™ are available for public safety agencies to purchase to deploy and use when and where they need it.

First responders have made it clear that in-building connectivity can be a challenge, and communicating indoors is important to public safety operations. In 2022, the FirstNet Authority invested in "Agency-Deployed RAN" to extend the benefits of Band 14 to where public safety operates indoors, such as police headquarters, fire stations, emergency communications centers, and emergency operations centers. Through the Agency-Deployed RAN program, agencies can install Cell Booster Pro devices to enhance coverage and fix dead spots within their buildings.

In January 2021, AT&T introduced its high-power user equipment (HPUE) solution, FirstNet MegaRange™. HPUE is a differentiating feature of Band 14 and improves connectivity at the edge of network coverage and in challenging locations. For rural and remote responders, this can improve the user experience significantly. For urban and suburban responders, it can assist when connecting in hard-to-reach places, such as parking garages, basements, and building shadows.

Additionally, the FirstNet Authority issued a task order to AT&T for feasibility studies to explore how technology can support public safety operations. The initial feasibility studies are designed to test LEO satellite backhaul capabilities and potential adjustments to the network to provide enhanced coverage in aerial (e.g., helicopter, drone) and maritime (offshore) environments.

Secure Information Exchange

Due to the sensitive nature of the data responders access every day, the ability to securely view, share, and manage that information is extremely important. Identity, Credential, and Access Management can support first responders in keeping sensitive data protected.

Since the 2020 Roadmap, FirstNet Single Sign-On has been released for public safety use. It is an application in the App Catalog[2] that provides a single, secure authentication process for accessing mobile applications. Instead of having to log into each app separately, responders can log on once to a secure, multi-factor, standards-based authentication platform. This allows responders to spend less time preparing to begin their tour of duty and more time in their communities.

The FirstNet Authority also continued to support the development of an integrated platform for public safety to securely access common information. The FirstNet Authority team conducted a series of deep dive focus groups to gain a better understanding of the types of data responders need and use most and what information is most important to share with other responders. The feedback gathered from these focus groups provided the FirstNet Authority with critical insight into the priorities and impacts of integrating data, and this information will support further exploration of data sharing and integrated services.

Situational Awareness

Situational awareness refers to the ability to aggregate and synthesize information in real time from multiple sources (e.g., humans, machines, sensors) and derive and present actionable insights to public safety professionals. The FirstNet Authority envisions real-time access, collection, and distribution of information concerning personnel, threats, hazards, and conditions in a manner tailored to public safety operations.

A key component of situational awareness includes the ability to track the location of responders, especially in terms of vertical positioning, during an incident or event. In January 2021, AT&T introduced z-axis (vertical location) capabilities, giving responders a new level of indoor spatial awareness not available using traditional GPS-based location methods. In 2022, these capabilities were further enhanced to give public safety an "altimeter view" or vertical visualization that shows the relative positions of first responders and incidents, as well as the ability to mark important areas within the building. The

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2 FirstNet Single Sign-on browser apps, mobile APIs (application programming interfaces), and native SDKs (software development kits) are available for developers.

CORE

- Generational updates (e.g., 4G to 5G)
- Priority and Preemption, including uplift on 5G
- Mission Critical Services platforms and enablers on 5G
- Network security on 5G

COVERAGE

- Outdoor coverage expansion
- Indoor coverage expansion
- Unique coverage solutions advancement

SITUATIONAL AWARENESS

- Locate and present personnel location
- Location services integration

VOICE COMMUNICATIONS

- Operationalize FirstNet Push-to-Talk
- Active role in standards
- Critical features

SECURE INFORMATION EXCHANGE

- Database integration
- Application integration

USER EXPERIENCE

- Mission-enabling applications
- Mission-capable devices

FirstNet Authority worked with public safety in the field to test this technology and gather feedback on its real-world utility. Five agencies from the Major County Sheriffs of America tested Z-Axis for FirstNet, provided insight on its utility, and suggested opportunities for advancing the capabilities.

The FirstNet Authority Standards team works continuously to represent the needs of public safety in the development of global communications standards. The team participates in the 3GPP quarterly meetings and ensures the interests of first responders are considered. The FirstNet Authority Standards team continues to evolve location services to support enhanced positioning accuracy and the development of ranging based services for public safety personnel in both in-network and out-of-network coverage scenarios.

In May 2022, the FirstNet Authority announced the launch of the Public Safety Immersive Test Center in Boulder, Colorado, in partnership with the National Institute of Standards and Technology's Public Safety Communications Research (PSCR) Division. This facility enables research and development, education, and training for public safety agencies. The center also has a motion capture system and more than 60 high-speed optical tracking cameras, allowing for its use as a ground truth system to validate the accuracy of indoor location tracking technologies. The FirstNet Authority plans to explore and enhance location services through the Immersive Test Center.

In 2022, PSCR began the First Responder Smart Tracking (FRST) Challenge focused on tracking first responders indoors in 3D to one-meter accuracy. Through a multi-phased process, participants move from concept to design to live field tests of their solutions. FirstNet Authority experts are supporting the challenge by serving as judges. The winners of the challenge will be awarded funding and entrepreneurial support to bring their critically important solutions to market to benefit situational awareness for first responders.

User Experience

The FirstNet Authority envisions a user experience driven by public safety operational needs that enables users to stay focused on their primary mission. For a positive user experience, first responders need simple, easy-to-use, mission-enabling apps and mission-capable devices. These devices and apps should be designed to help responders communicate, collaborate, and access information during routine operations and emergency response. Due to the critical nature of public safety communications, device and app developers must consider the various ways that responders can and will interface with, or experience, the network. Device and application technologies must be

effective, reliable, and resilient, and they must enhance rather than hinder public safety operations.

As of January 2023, there are more than 560 devices on the National Institute of Standards and Technology's list of devices certified for use on the FirstNet network, including both commercial and purpose-built ruggedized devices. In order to be included on this list, a device must go through a rigorous certification process to ensure it can operate on Band 14, meets certification standards, and serves the needs of public safety. The FirstNet Authority performs oversight to make sure devices support the needs of first responders. In an effort to further understand those needs, the FirstNet Authority team conducted a series of engagements, including focus groups and surveys with responders representing all disciplines and levels. This feedback gave the FirstNet Authority insight into the factors that influence public safety's deployment and choice of devices in their operations, and this information provides invaluable insight as the FirstNet Authority strives to create a differentiated broadband user experience.

In March 2022, AT&T announced the release of FirstNet Emergency Response Kits. These kits include a cache of more than 20 FirstNet Ready™ devices that can easily be dispersed to responders in the field during a major incident. They are designed to keep devices charged as they are stored, ensuring the devices are ready to support agencies in executing public safety operations during disasters, emergencies, or planned events.

Feedback from first responders has consistently emphasized the need for different solutions that address challenges in various settings. With the launch of the HPUE solution for FirstNet in January 2021, public safety agencies have access to equipment that can transmit stronger signals to provide increased connectivity where they need it. This is a feature unique to FirstNet—the signal can only be transmitted using Band 14. HPUE provides first responders with another tool to support connectivity for their operations.

Additionally, there are more than 200 apps in the FirstNet App Catalog. A rigorous vetting and approval process is required before an app can be included in the catalog. During this process, an app is reviewed to verify it is relevant to the needs of first responders, completes a rigorous security review, and completes a battery of tests to verify its availability, mobility, resilience, and scalability.

Voice Communications

Voice communications remain the foundational method of communication for public safety, with video and data sharing often playing a complementary role. On FirstNet, responders

have two options for MCPTT[3] services, including several FirstNet-certified push-to-talk (PTT) focused devices and accessories. Both solutions are standards-based and allow for data sharing (messaging and file sharing) and video streaming in addition to voice capabilities. Interoperability/interworking with land mobile radio (LMR) is also available for each service. These solutions give public safety additional situational awareness, help expand coverage beyond the traditional LMR footprint, and provide redundancy in communications.

The FirstNet Authority worked with public safety in the field to test these technologies and conducted multiple engagements to gather feedback on needed enhancements. Five agencies from the Major County Sheriffs of America tested FirstNet PTT and reported that this solution enabled real-time information sharing, which enhanced situational awareness. The test group also provided suggestions on further improvements.

The FirstNet Authority Standards team is also focused on supporting public safety's voice communications needs in the development of 3GPP standards. Releases 15-18 have included a focus on public safety-specific voice communications. For example, the FirstNet Authority has supported the mission-critical work items in Release 18, including enhancements to 5G multicast-broadcast services and 5G Proximity Services.

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3 Mission Critical Push-to-Talk is push-to-talk technology that aligns with 3GPP's standards for public safety communications.

Analysis methods

For the 2023 update to the Roadmap, the FirstNet Authority incorporated qualitative and quantitative methods to inform the 2023 Roadmap priorities. Efforts included:

- A series of interviews with public safety technology decision-makers focused on current challenges related to technology, including budgetary constraints and the impact of changing technologies on public safety communications.
- A rigorous technology prioritization survey of first responders.
- Engagement with stakeholders[4] through focus groups, one-on-one meetings, conversations with organizations, and conferences.
- A review of applicable publications related to public safety technology challenges and adoption.

The data collected from these efforts was aggregated and parsed out by topic to inform the 2023 Roadmap. Additional information on the methodology can be found in Appendix B.

Analysis impacts: COVID-19

Interactions with public safety stakeholders indicated that recent global events had a significant impact on their operations. The FirstNet Authority recognized that COVID-19 changed the world and added COVID-19-specific questions to capture how it affected public safety operations.

Interview, focus group, and survey participants indicated that their agencies are increasingly reliant on broadband data and voice services and that public safety operations and technology were pushed to evolve much faster than anticipated. Due to the challenging nature of pandemic response, several technology gaps were uncovered that public safety needed to address to continue operations. For example, for emergency communications centers (ECCs), call-taking and dispatching capabilities could not easily transition to remote operations. This meant many ECCs struggled with keeping emergency telecommunicators safe through social distancing while also keeping their centers fully staffed. Additionally, remote testing sites had to be set

up quickly and in areas that could support many people coming through each day, requiring strong technological infrastructure to communicate and send information as needed. Addressing these gaps allowed for quick innovation and provided an opportunity to further incorporate technology into public safety operations to avoid similar challenges in the future.

Several research participants indicated that their agencies implemented technology solutions that enable more flexible operations, increasing their ability to work and/or train remotely. The pandemic also affected the administrative functioning of public safety agencies, such as budget cuts and staffing issues. To offset these complications, public safety has had to reinvent their operating methods and deploy new capabilities, such as remote call-taking and dispatching capabilities.

Because COVID-19 changed the landscape for public safety to include more technology in daily operations, reliable broadband coverage, high-bandwidth connections, and access to data via broadband are increasingly important to maintain connectivity and communications.

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4 The FirstNet Authority captures feedback from these formal and informal engagements. This feedback is regularly reviewed and organized to inform decisions and activities.

Operationalizing Advanced Technologies

Connected Responders

Dependable Network
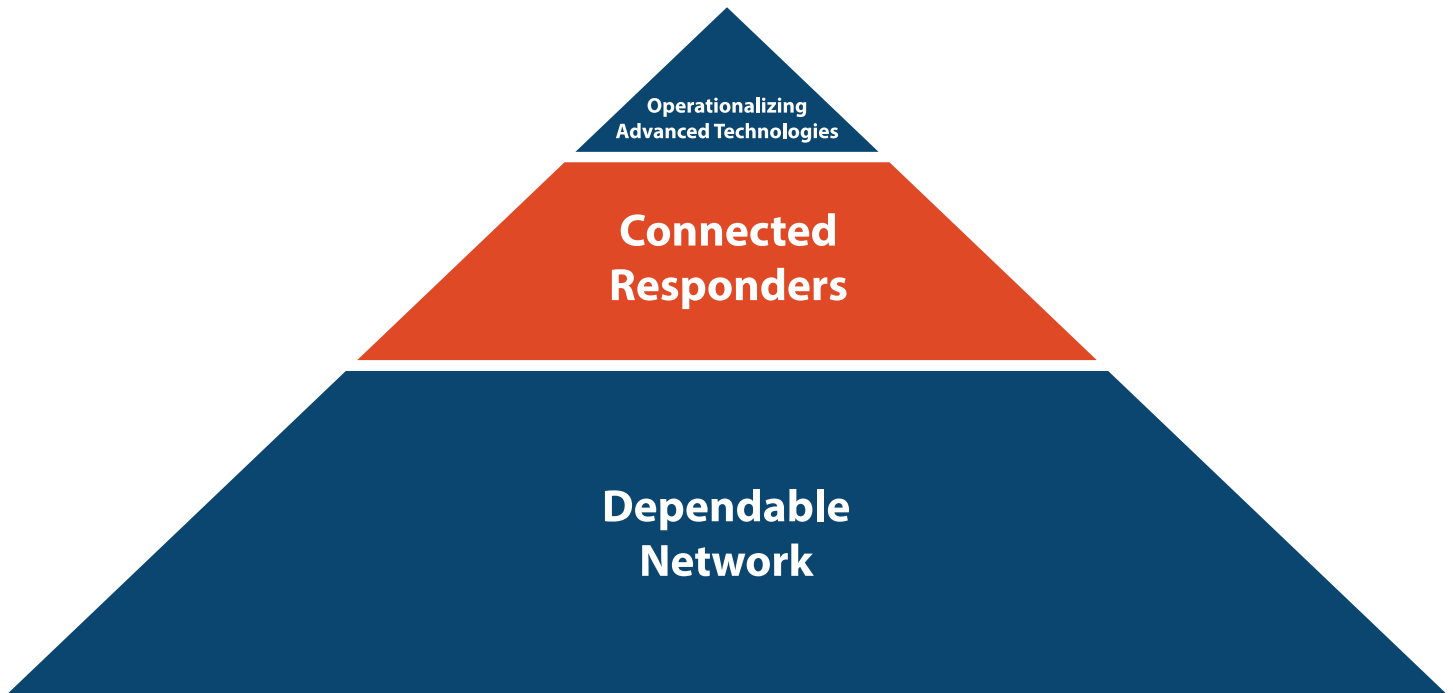
Creating solutions that work

During research efforts for the 2023 Roadmap, the FirstNet Authority team repeatedly heard responders alluding to one thing: "I need *it* to work." The "it" could refer to the network, a specific technology, or capability being discussed. Responders need to have confidence that the technology will work at the exact moment and place that helps them carry out their duties, and they don't want to think about *how* the tech works. Thus, the overarching sentiment from responders was, 'We need this to work *for us*.' This serves as the theme for the 2023 Roadmap priorities, with efforts centered around how to support and enable solutions and capabilities that give responders tools that work for them— wherever and whenever needed.

The FirstNet Authority team identified three overarching areas in which current and future efforts can ensure that solutions work for first responders: the continued evolution of a **Dependable Network**, which enables **Connected Responders**, and ultimately allows for **Operationalizing Advanced Technologies**. These areas represent end goals that enhance public safety operations today and into the future.

Research for the 2023 Roadmap indicated that some of the domains (Core, Coverage, Secure Information Exchange, Situational Awareness, User Experience, and Voice Communications) and priorities identified in the 2020 Roadmap remain accurate and important to addressing the needs of public safety, while others were shown to be enablers of capabilities, rather than needed as standalone priorities. In crafting the 2023 Roadmap update, the FirstNet Authority incorporated elements and priorities from the 2020 Roadmap, as appropriate, into the end goals and priorities that are outlined below. This provides opportunities for the FirstNet Authority team to work in new ways across the domains to develop ideas and solutions that address the goals of the 2023 Roadmap.

2023 Roadmap goals

Dependable Network

Evolve the network to ensure reliable indoor and outdoor connectivity through comprehensive coverage solutions and upgrade the foundational Core to enable advanced technologies.

Public safety is clear that broadband coverage and a reliable network are critical to their operations. This goal focuses on ensuring the network works, is dependable, and continuously evolves to meet public safety's needs.

Enable advanced technologies through 5G Core upgrades.

Under this priority, the FirstNet Authority will continue efforts to evolve the FirstNet network. Through initial investments, the FirstNet Authority supported the first step in making the FirstNet Core 5G ready. Over the next several years, efforts will be made to further evolve the Core to ensure responders have full access to new and emerging 5G capabilities with unique FirstNet services and applications. With 5G, FirstNet subscribers will experience lower latency, higher capacity, and faster data speeds. These capabilities are critical to operationalizing advanced technologies on the network.

Enhance coverage indoors and in rural areas.

From 2018 to 2023, network enhancement efforts largely focused on building out coverage through new towers and Band 14 expansion, as well as growing the FirstNet deployable fleet. Moving past the initial phase of the network contract with AT&T, the FirstNet Authority remains committed to ensuring public safety gets the coverage they need.

The FirstNet Authority will work with AT&T to use complex data-driven and public safety input models to expand coverage, focusing on rural areas, to help enhance public safety operations. This will take into account the operational needs of public safety and how coverage impacts their ability to carry out their mission.

The FirstNet Authority will also work to help solve indoor coverage issues through solutions such as Agency-Deployed RAN and will explore opportunities to further enhance indoor coverage.

Expand access to innovative coverage technologies, such as deployables, high-power user equipment, low Earth orbit satellite, and direct mode.

More than 1,200 portable coverage solutions were deployed for public safety in 2022, highlighting the need for on-demand coverage in specialized circumstances and various outage scenarios. Under this priority, the FirstNet Authority will continue to monitor public safety demand of deployables and ensure the fleet of deployables has the appropriate number and types of solutions to meet those ongoing demands. Unique solutions that can quickly provide coverage in situations and locations where access connectivity may be limited, such as CRDs and other agency-owned assets, will also continue to be explored.

The FirstNet Authority is also looking beyond those solutions and into the future. For example, there are areas where public safety regularly operates that pose a challenge for cellular connectivity. Cellular networks were designed and built for terrestrial use, and responders working in aerial and maritime environments cannot currently use the full capabilities of broadband while in the air or on the water. The FirstNet Authority established a cross-functional working group to study and understand public safety's current use of broadband communications in aerial and maritime environments, identify the challenges experienced in using broadband communications, and explore desired future capabilities of broadband communications in these environments.

Under this priority, the FirstNet Authority will seek to bring to light the unique challenges faced by public safety and provide industry with feedback in an effort to find solutions. Additionally, the FirstNet Authority will explore other evolving coverage technologies. This may include solutions like HPUE that can give first responders access to Band 14 in hard-to-reach places and at the edge of the network's typical signal coverage, or LEO satellite integration capabilities, which have shown potential to extend coverage through backhaul and direct-to-device connectivity.

Connected Responders

Enable critical features and solutions that allow the transfer of and access to regular and mission-critical data among responders, agencies, and jurisdictions.

Access to information and real-time data gives responders situational awareness, supports good decision-making, and informs response to incidents. By enabling effective and rich communications across voice, video, *and* data, responders become connected—to one another and the tools they need.

Public safety wants the ability to access and share usable/actionable information in various forms, via multiple delivery methods, and quickly, to get the right information to the right people at the right time.

> *"Society now is data-driven and so much of the work that we do gets based off of that data, and if we can't have it at the snap of our fingers or relatively easily accessible, it cripples us."*
>
> *-Emergency management coordinator, 2023 Roadmap update interview*

Within this goal, the FirstNet Authority seeks to support responders in developing those connections that ultimately enhance their operations and make their responses safer and more efficient.

Enable reliable access to actionable information, focusing on voice, video, images, messaging, file transfer, location, and identity.

Interviews and additional research for the 2023 Roadmap update showed that responders across disciplines need to be able to share and access voice communications, video (real-time and recorded) and images, messages and files, location data, and identity data. If actionable information can be readily passed between responders and accessed while on scene, responding to the scene, or monitoring the situation, situational awareness is greatly enhanced, and more advanced capabilities can be leveraged to collect and disseminate information. This is a theme identified in the 2020 Roadmap, and it continues to be important today.

In many situations, responders rely heavily on PTT through their radios as the primary way to communicate, and audio is the only tool to share information. There is room to leverage broadband communications to expand technology in a way that can give public safety new ways to communicate and share information beyond voice, such as documents, videos, images, and location. This is especially important for places where lots of information is being gathered and disseminated, such as emergency operations centers, incident command centers, and emergency communications centers. Under this priority, the FirstNet Authority aims to explore features and solutions that support the sharing of these data types to give responders actionable information and enhanced situational awareness.

Expand access to multiple data sources and enable a common operating picture through an information exchange solution.

When approaching a scene, managing an incident, or overseeing an event, first responders must sort through a great deal of information relevant to their situational awareness. During the FirstNet Authority's research, public safety indicated a need for a solution that allows access to multiple data sources in a single place that gives the right responders the right information at the right time. Public safety stated this would help with ease of access to information, as well as sharing information with other responders and agencies during incidents.

The FirstNet Authority will support the development of solutions that can give public safety a common operating picture quickly and efficiently, focused on the capabilities that emerged through the FirstNet Authority's research: voice, video (real-time and recorded) and images, messages and file transfer, location, and identity. Public safety feedback is going to be critical to informing efforts under this priority. The FirstNet Authority team will engage with stakeholders across disciplines and ranks to better understand the needs, including what kind of information is most important to access and share.

Enhance end-user experience by exploring and addressing barriers to adoption of information exchange solutions.

During engagements with public safety, the FirstNet Authority team often hears first responders talk about technology solutions that would significantly benefit their operations or make tasks easier or more efficient. While some of these solutions come to fruition through apps or devices, in some cases, adoption rates remain low. As the FirstNet Authority explores features and solutions that can enhance access to and transfer of data for agencies, the team will also focus on potential barriers to adoption of those solutions.

Why are organizations not adopting technology that would address public safety's needs? Why are responders not using the features they've said they need in the field? Diving into questions like these can help enhance the end-user experience with these products, and the FirstNet Authority can use its unique role to explain these challenges and barriers to industry stakeholders to inform their products.

Ensure public safety needs are met in emerging 3GPP and other relevant standards development.

The FirstNet Authority Standards team represents the needs of public safety in the development of global communications standards. The team's standards activities focus primarily on 3GPP, the international standards organization that develops LTE and 5G technology and accompanying standards. In other standards bodies, such as the Alliance for Telecommunications Industry Solutions and the Telecommunications Industry Association (in collaboration with 3GPP), the FirstNet Authority Standards team continues to progress the interworking of LMR with 3GPP mission critical voice and data services. Under this priority, the FirstNet Authority will continue to advocate for the needs of public safety as global standards are developed for technologies that help responders connect and communicate.

In interviews, public safety emphasized that consistency and standardization among technologies is key to enabling responders to collaborate and efficiently share information. In addition to participating in global standards organizations, the FirstNet Authority will advocate for standardization across technologies to ensure they meet public safety's needs and enable more efficient and effective communication.

Operationalizing Advanced Technologies

Influence evolving technologies and empower public safety to transform operations using those technologies.

Technology is enabling society to do things that were only dreamed of years ago. And as technology continues to advance, so will capabilities. Public safety indicated that, while they remain largely focused on the near-term needs described above, they are also beginning to explore more advanced integrated capabilities that can support their operations, such as Internet of Things (IoT), sensors, unmanned aerial vehicles (UAVs), data analytics, and artificial intelligence. These are the features that many public safety agencies aren't quite ready for, or the technology is still being honed in a way that can be useful for public safety's mission. Enabling broadband connectivity for technologies like these will help enhance situational awareness, connectivity, and safety without impacting responders during public safety operations.

The FirstNet Authority strives to support public safety where they are now, but also seeks to explore capabilities ahead of responders' needs and have solutions ready when they are. The FirstNet Authority also recognizes that not every agency is in the same place with respect to their technology needs and goals—some agencies are not ready for these capabilities whereas others are actively using them today. To support the agencies currently using this technology and to innovate for the future, the FirstNet Authority determined these solutions need to be explored now to ensure they align with public safety's goals and needs.

Enable the operationalization of advanced technologies such as IoT, sensors, UAVs, data analytics, and artificial intelligence.

Under this priority, the FirstNet Authority will look at network-related technologies that can support enhanced operations for first responders. Some of these technologies may already be used regularly in mainstream society today (e.g., IoT). Through efforts such as current and future feasibility studies, the FirstNet Authority will delve into how these advanced technologies can be operationalized for public safety using broadband connectivity.

As described under the Dependable Network goal, the FirstNet Authority is evolving the FirstNet Core to support new and emerging 5G capabilities. 5G provides greater device capacity on the network and allows for increased resiliency, more redundancy, improved security, and lower latency. These features create an environment for new applications, such as augmented reality and IoT. As the FirstNet Authority continues efforts to ensure the network is ready to support these types of applications, the team will also explore what is required to integrate broadband into these capabilities in a way that is beneficial to, and built for, public safety. This, in turn, will allow public safety to enhance their operations using advanced technologies that provide greater levels of situational awareness.

The FirstNet Authority will focus monetary investments in the previous two goal areas to ensure that the network and systems allow advanced technologies to be operationalized. The FirstNet Authority will look to make progress in this area through programs and activities and use its unique role to explore and educate stakeholders on topics within this goal.

CONCLUSION

While conducting research for the 2023 Roadmap update, the FirstNet Authority repeatedly heard responders' need to have tools simply work. This sentiment appeared in the prioritization survey conducted by the FirstNet Authority and in interviews, and strong parallels emerged in documents published by other organizations. Technology has greatly enhanced abilities in society, and it can do the same for first responders—if designed and built with the unique needs of responders in mind.

Since its original publication in 2019, the Roadmap has guided the FirstNet Authority's efforts to support the unique needs of public safety. The work of the FirstNet Authority team within the six domains has increased capabilities for first responders. Moving to a focus on public safety's outstanding operational needs gives the FirstNet Authority team expanded opportunities to make a difference for public safety. As a result, FirstNet will continue to be a differentiated solution, designed to meet the very unique needs of first responders.

The 2023 Roadmap aims to highlight the ways current and future efforts within the six domains can overlap and work in tandem to evolve capabilities for public safety. Through our three end goals, we will work to support public safety where they are today and in the future. These goals stretch across all aspects of broadband technology—a Dependable Network enables Connected Responders and allows for Operationalizing Advanced Technologies—and the FirstNet Authority is dedicated to working with public safety to achieve these goals.

APPENDIX A: 2020 ROADMAP PROGRESS UPDATE

Core

Generational Updates (e.g., 4G/5G): Evolve the Core and radio access network consistent with 3rd Generation Partnership Project (3GPP) generational upgrades.

- In June 2020, the FirstNet Authority established Task Order 7, allowing for the first step in evolving the Core to support 5G.
- This task order was intended to enable FirstNet subscribers to access 5G services where AT&T has geographically deployed the technology.
- This first phase set the stage for further evolution of the Core to support 5G technologies.
- The FirstNet Authority is actively working with AT&T to develop an iterative, collaborative process to ensure the continued evolution of the FirstNet network and associated services is consistent with public safety needs and feedback.

Priority and Preemption, including Uplift on 5G: Advance Quality of Service, Priority, and Preemption (QPP) implementation in the network with new standards-based systems and features available in 5G.

- The FirstNet Authority Standards team is supporting 5G QPP capabilities and mission critical features in 3GPP Release 18, including enhancements to 5G multicast-broadcast services and 5G Proximity Services, as well as support for mission critical services over 5G.
- Since 2017, the FirstNet Authority has gathered feedback from public safety on their operational use of and needs for enhancements to FirstNet services. As a result, the FirstNet Authority created future investment funding priorities, including network evolution to 5G. The FirstNet Authority will continue to work with public safety to understand their needs and ensure the evolution of FirstNet addresses that feedback.

Network Security on 5G: Implement standards-based systems and features providing cybersecurity to public safety users on 5G in support of the network security requirements.

- In April 2021, AT&T announced the launch of tower-to-core user plane (S1-U) encryption on FirstNet based on 3GPP industry standards.
- FirstNet traffic is secure as it moves from the user device to the cell towers, through backhaul, to the Core, and back again.
- This encryption will happen if the user is on LTE or 5G.

Mission Critical Services Platforms and Enablers on 5G: Implement standards-based systems and features providing mission critical services, such as mission critical push-to-talk (MCPTT), mission critical video (MCVideo), and mission critical data (MCData) on 5G.

- In March 2020, AT&T announced the launch of FirstNet Push-to-Talk (FirstNet PTT), based on 3GPP MCPTT standards.
- In March 2022, a second option for MCPTT for first responders was announced: FirstNet Rapid Response.
- The FirstNet Authority is supporting a SAFECOM/NCSWIC (National Council of Statewide Interoperability Coordinators) working group to develop a framework for mutual aid push-to-talk (PTT) talk groups using broadband. These efforts will result in governance and naming conventions public safety agencies can adopt, as appropriate.

Coverage

Outdoor Coverage Expansion: Increase outdoor coverage, particularly Band 14, at locations deemed to be strategic public safety priorities.

- Tens of thousands of existing AT&T cell sites have been upgraded to include Band 14 to support public safety.
- 99% of the U.S. population is covered between Band 14 and all AT&T LTE bands.

Indoor Coverage Expansion: Increase indoor coverage and advocate for changes in policies, codes, and standards to facilitate in-building coverage enhancements.

- In April 2022, the FirstNet Authority Board approved an investment to enhance in-building coverage.
- Agency-Deployed RAN extends Band 14 coverage where public safety operates in-building, such as police headquarters, a fire station, or an emergency communications center.
- Primary FirstNet subscribers can work with AT&T to install up to 50 devices at no cost.

Unique Coverage Solutions Advancement: Address and support unique coverage solutions that enable public safety to rapidly provide coverage in specialized circumstances and various outage scenarios.

- The FirstNet Authority issued a task order to AT&T for feasibility studies to test and assess the feasibility of potential coverage solutions designed to address public safety's unique needs. Initial studies are testing low Earth orbit (LEO) satellite backhaul capabilities and potential adjustments to the network for enhanced coverage in aerial and maritime environments.
- In June 2021, the FirstNet Authority Board improved an investment to increase the fleet of portable cell assets. The fleet now contains more than 150 deployables positioned across the country in strategic locations to respond to disasters, emergencies, or large planned events.
- Smaller form factor deployables, known as Compact Rapid Deployables (CRDs), are also available. CRDs may be owned, managed, and deployed by public safety agencies; there are also CRDs within the FirstNet deployable fleet. The CRD's small size makes it easily transportable, even over difficult terrain.
- In March 2023, AT&T announced the launch of miniCRDs™, highly portable deployable assets in two ruggedized cases. These assets can provide FirstNet cellular coverage up to a half mile and are small enough to be hand carried and checked on commercial flights. Similar to the larger CRDs, the miniCRD™ is designed to be owned, managed, and deployed by public safety agencies.
- In January 2021, AT&T launched its high-power user equipment solution. This solution can extend coverage for first responders, especially on the edge of network coverage. It can also support urban first responders in hard-to-reach areas.

Secure Information Exchange

Application Integration: Leverage standardized security controls and industry best practices for application-based access to critical data.

- FirstNet Single Sign-on is an app available in the FirstNet App Catalog. Instead of having to log into individual apps separately, it allows first responders to log on once to a secure, multi-factor, standards-based authentication platform. FirstNet Single Sign-on browser apps, mobile APIs (application programming interfaces), and native SDKs (software development kits) are available for developers.
- Throughout 2021 and 2022, the FirstNet Authority team conducted a series of focus groups to better understand the data responders are using and sharing, as well as the operational impact of not being able to efficiently share data.
- The FirstNet Authority team continues to work with its contract partner AT&T on the development of an integrated platform for public safety to securely access common information.
- The FirstNet Authority's Public Safety Advisory Committee formed an Identity, Credential, and Access Management Strike Team to explore public safety application use and promote the safe exchange of critical and sensitive information over FirstNet.

Database Integration: Integrate FirstNet's secure access and information exchange solutions with select national-level datasets.

- A relationship was established with CJIS (Criminal Justice Information Services) to enable agencies that did not already have CJIS access to do so using their FirstNet accounts.

Situational Awareness

Locate and Present Personnel Location: Promote technology solutions that provide accurate locations of first responders and the ability to display that information through effective mapping and visualization.

- In January 2021, z-axis capabilities were announced on FirstNet. Z-Axis for FirstNet offers vertical location mapping capabilities, allowing a new level of indoor spatial awareness not available using traditional GPS-based location methods.

- In 2022, z-axis capabilities on FirstNet were further enhanced to give public safety an "altimeter view" or vertical visualization that shows the relative positions of first responders and incidents, as well as the ability to mark important areas within the building.

- The FirstNet Authority partnered with the Major County Sheriffs of America (MCSA) for a field test of z-axis capabilities. Five MCSA agencies participated in the trial and provided feedback on the benefits of z-axis and opportunities for advancing the capabilities.

- The FirstNet Authority Standards team continues to evolve location services to support enhanced positioning accuracy and the development of ranging-based services for public safety personnel in both in-network and out-of-network coverage scenarios. Additionally, through work with the Alliance for Telecommunications Industry Solutions and the Telecommunications Industry Association, the Standards team has supported the interworking of land mobile radio (LMR) with 3GPP mission critical voice and data services. Basic interworking has been defined and is being enhanced by the interworking of location services to support the public safety needs for situational awareness.

- In May 2022, the FirstNet Authority and the National Institute of Standards and Technology (NIST) launched the Public Safety Immersive Test Center in Boulder, Colorado. In addition to research and development, education, and training for public safety, the Center also serves as a ground truth system to validate the accuracy of indoor location tracking technologies.

- In 2022, the NIST's Public Safety Communications Research division (PSCR) launched the First Responder Smart Tracking Challenge. Through this prize challenge, participants design, build, and test solutions to provide responder tracking indoors in 3D to one-meter accuracy. FirstNet Authority experts served as judges for various phases of this challenge.

- In 2022, the FirstNet Authority conducted a series of interviews with the emergency communications center community, focusing on the importance of location data. Analysis of these interviews revealed that responder location (both indoor and outdoor) remains a top need to keep responders safe, enhance incident response, and perform responder rescues when needed. The focus groups also revealed some of the challenges to location tracking, including cost, coverage, and privacy concerns.

Location Services Integration: Promote the integration of x-, y-, and z-axis data with 3D mapping solutions and with public safety's existing technology platforms.

- In 2021, the FirstNet Authority's team conducted a series of market research meetings to assess industry trends for location-based services. These meetings provided an opportunity for the FirstNet Authority to gain insight as to where industry is headed with solutions relevant to public safety. Integration with applications and sensors was a key point that all participating companies stressed.

- SDK/API for the z-axis solution are available for developers to leverage vertical location capabilities in their own solutions. This encourages innovation and the development of additional location-based service solutions for public safety. This also supports potential integration into existing technology platforms.

User Experience

Mission-Enabling Applications: Promote the development and use of applications that are operationally sound, offer intuitive user interfaces, and support seamless collaboration for public safety.

- As of January 2023, the FirstNet App Catalog includes more than 200 applications. The Catalog only lists apps that have undergone a rigorous vetting and approval process.

- In 2021, the FirstNet Authority conducted a series of focus groups, preceded by a quantitative questionnaire, to assess public safety's need for specific apps; understand how decision-makers identify, research, and vet apps; gauge responders' awareness of the FirstNet App Catalog; and identify opportunities for improving the Catalog.

Mission-Capable Devices: Promote the development and use of devices that support the successful execution of public safety operations.

- As of January 2023, there are more than 560 devices on the National Institute of Standards and Technology's List of Certified Devices that have gone through a rigorous process and are certified to operate on the FirstNet network.

- In March 2022, AT&T launched FirstNet Emergency Response Kits with a cache of more than 20 FirstNet Ready™ devices and chargers. These kits can be stored and deployed during major incidents or whenever agencies need extra communication capabilities.

- In 2021 and 2022, the FirstNet Authority conducted a survey and focus groups with first responders to better understand public safety's choice and use of devices. The feedback gathered from these methods informs efforts to meet the operational needs of responders in the field.

- With the launch of FirstNet's high-power user equipment solution in January 2021, public safety has access to unique equipment that can provide stronger signals that can only be transmitted over Band 14. With this solution, responders have more options to bring connectivity where their operations require it.

Voice Communications

Operationalize FirstNet PTT: Work with public safety to assist in operationalizing the FirstNet PTT solution by educating on relevant use cases and supporting efforts to establish relevant nationwide governance and policies.

- Responders have two options for MCPTT services, including a myriad of FirstNet-certified push-to-talk-focused devices. These offerings are foundational, and the vendors are continuously enhancing them based on public safety feedback.

- The FirstNet Authority engaged public safety including interviews, focus groups, and trials to gain insights to relevant use cases and education for support of operationalizing the MCPTT solutions. For example, the FirstNet Authority partnered with the Major County Sheriffs of America for a field test of FirstNet PTT. Five agencies trialed this solution, providing feedback on how it enhanced operations and opportunities for further advancement.

- The FirstNet Authority is supporting a SAFECOM/NCSWIC working group to develop a framework for mutual aid PTT talk groups using broadband. These efforts will result in governance and naming conventions public safety agencies can adopt, as appropriate.

Critical Features: Advocate for continued implementation of critical MCX (mission critical x) features such as device-to-device communications, LMR-LTE interconnection, and dispatch capabilities based on public safety operational needs.

- Since 2020, several new releases have launched with additional mission critical capabilities, now with two MCPTT offerings that include highest priority on the network PTT voice, mission critical video, mission critical data, and dispatch capabilities. Both MCPTT solutions include LMR interoperability and sharing of talk groups across agencies for mutual aid within the services.

- Engagements with public safety continue to gather key needed capabilities that are both passed on to AT&T and the vendors developing the next release of the solutions and leveraged as input to future investment effort.

- The FirstNet Authority has also collaborated with NIST PSCR in their Mission Critical Voice portfolio to help advance new technology such as direct mode, LMR-LTE, and the development of test process and solutions for 3GPP mission critical services.

Active Role in Standards: Continue to play an active role in emerging 3GPP and other relevant standards development focused on MCPTT, MCVideo, and MCData, as well as dispatch advancement.

- The FirstNet Authority Standards team continues to participate in 3GPP meetings, representing the voice of public safety in global standards development. Releases 15-18 have included a focus on public safety-specific voice.

- The FirstNet Authority is supporting mission critical features in 3GPP Release 18, including enhancements to 5G multicast-broadcast services and 5G Proximity Services, as well as support for mission critical services over 5G.

Background: Analysis methods

The First Responder Network Authority (FirstNet Authority) undertook a multifaceted effort to evaluate short-term first responder priorities and challenges and gain general industry perspective on the most promising emerging technologies relevant to public safety. These research efforts included:

- A series of interviews with public safety technology decision-makers focused on current challenges related to technology, including budgetary constraints and the impact of changing technologies on public safety communications.

- A rigorous technology prioritization survey of first responders.

- Stakeholder engagement through one-on-one meetings, focus groups, conversations with organizations, and conferences.

- A review of applicable publications, trade press, and reports spanning industry, general public safety, and specific disciplines.

The data collected from these efforts was aggregated and parsed out by topic to inform the 2023 Roadmap.

Executive interviews with technology decision-makers

The FirstNet Authority team conducted interviews with individuals responsible for making technology decisions within their public safety organization. This included discipline-specific leaders (e.g., chiefs, sheriffs, public safety directors) and non-discipline-specific leaders (e.g., information technology directors, chief information officers). Interviewees were selected randomly from a list of "technology decision-makers" within the FirstNet Authority customer relationship management system; attempts were made to keep the list diverse in interview participants' knowledge of FirstNet, geography, and discipline.

Interviewees were asked about the priority of communications within their agency's operating budget, what kind of technologies are purchased with that budget, and how the evolution of technology has impacted their agency's communications methods and solutions.

Interviewees overwhelmingly agreed that coverage is "king." They were able to extensively describe the challenges faced due to lack of coverage, especially in rural, remote,

and mountainous areas. Oftentimes land mobile radio (LMR) systems can be more reliable in these challenging terrains, so there is a heavy resistance to switching fully from LMR to LTE until "100%" coverage is achieved. Many participants indicated they are leveraging both LMR and LTE to fill in coverage gaps, and many prefer the idea of seamlessly "switching" between LMR and LTE in case they lose coverage on one. Interviewees shared that users want LMR and LTE functionalities simultaneously—they don't want to lose either or have to choose between them. Voice interoperability is also important to agencies, as there are some responses where multiple entities are involved but cannot talk to one another.

Data sharing was another common theme among interviewees. Participants indicated that the inability to share data continues to be a challenge. Data is mission-critical for agencies, and responders need access to accurate data while in the field. The lack of data can "cripple" personnel in the field—operationally as well as administratively. Interviewees identified a "common operating platform" as a solution to share information, especially in multi-agency response situations. Additionally, interviewees indicated that users show little tolerance for data-speed issues, and they would rather have quicker data response times, even if it means less functionality.

Most interviewees were well versed in how communications technology fits into the larger agency budgets. Due to the disparity in how budgets and funding are structured across jurisdictions, the purchase of technology—and the prioritization of technology solutions—differed across participants. Some interviewees explained that agreements are often made across the entire municipality, county, or state, making it difficult for individual agencies to advocate for specific or specialized solutions. Additionally, technology is often budgeted on an IT basis rather than a public safety communications basis, meaning spending on technology for public safety communications can suffer if an investment in computer systems or other hardware/software is needed elsewhere.

Interviewees mentioned other challenges and areas of interest related to communications technologies. These included security and cybersecurity, apps (free versions are preferred if they are useful), sensors and appropriately utilizing the information from sensors, and cloud storage solutions.

First responder technology impact prioritization survey

In September and October 2022, the FirstNet Authority conducted a prioritization survey of 19 operational needs/impacts. These are listed collectively in Figure 4. The 240 survey respondents are from all first responder disciplines, all levels of management, rural and non-rural areas, and represent 46 states. The overall sample size of 240 respondents affords a margin-of-error of plus or minus 6.3 percent at the 95-percent confidence level for proportional results.

The survey methodology leveraged the MaxDiff (best-worst scaling) exercise that presents a respondent with four impacts of various technologies at a time and asks the respondent to choose the single item with the most potential to improve first responder effectiveness and the single item with the least potential to improve first responder effectiveness. Respondents received 12 screens with four items at a time as demonstrated in Figure 3.

Results are presented in Figure 4 noting "average feature utility" ranked from highest to lowest; values represent the direct average calculation across respondents' individual utility scores. These numbers reflect the relative preference and importance of the needs/impacts asked about in the survey.

Resiliency stands out with the highest rating. Maintaining communications when FirstNet is unavailable, indoor coverage, and location sharing were next, followed closely by outdoor coverage and the ability to view all incident information in one solution or screen. Figure 4 represents the results for all 240 respondents. There were no statistically significant clusters, suggesting that there is little variance in preference share based on the captured demographics.
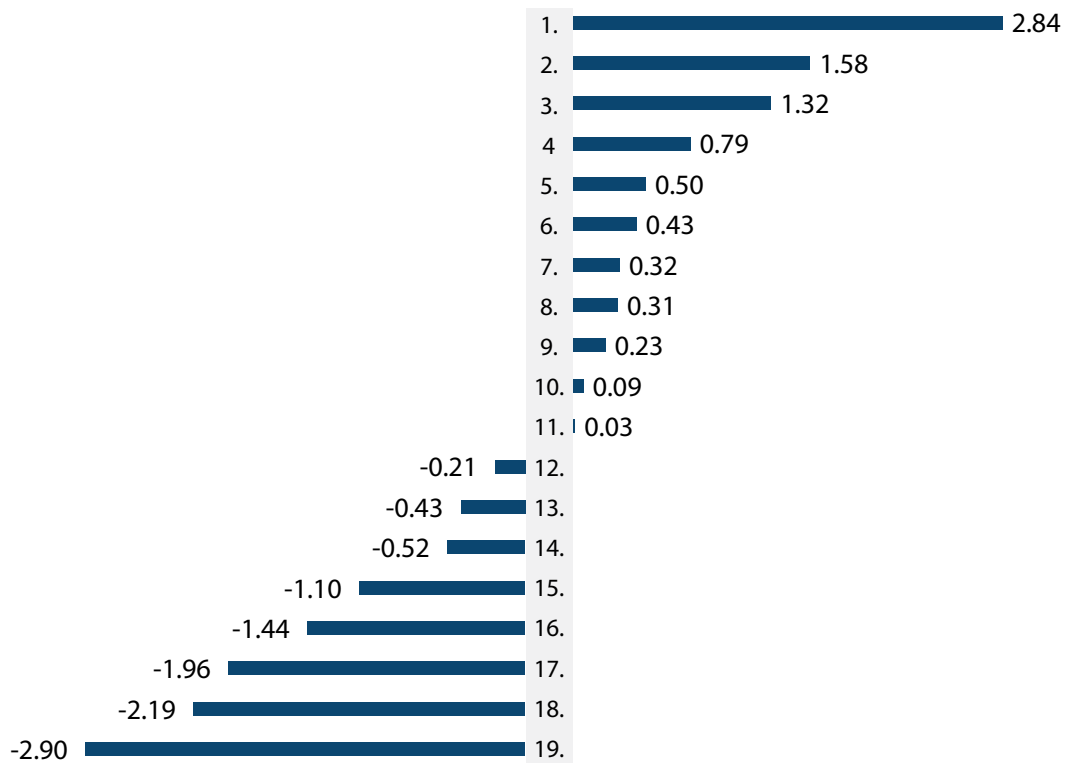
Figure 3: Sample MaxDiff question from FirstNet Authority technology impact prioritization survey

(1/12) Consider the four items show below. Please choose the capability that has the **greatest** and the capability that has the **least** potential to improve first responder effectiveness.

Greatest Potential		Least Potential
○	Leverage broadband voice and data services in unique operational environments (e.g., aerial, maritime, wilderness, tunnels)	○
○	Operate real-time video streaming **within** mission critical push-to-talk (MCPTT) application	○
○	Access real-time video from any location (e.g., dispatch, incident command)	○
○	Ability to deploy coverage without carrier support	○

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1. Maintain voice and data services despite impacts to network infrastructure

2. Maintain one-to-one and one-to-many communications when FirstNet network is down or unavailable

3. Access broadband indoors regardless of building materials or style

4. Ability to share location information across agencies, jurisdictions, and applications

5. Access broadband outdoors in typical areas of operation

6. View all relevant incident information (e.g., responder locations, images, video) in one solution or single screen

7. Ability to use broadband devices in poor weather conditions (e.g., rain) while wearing personal protective equipment (PPE)

8. Ability for applications to interoperate

9. Ability to deploy coverage without carrier support

10. Leverage broadband voice and data services in unique operational environments (e.g., aerial, maritime, wilderness, tunnels)

11. Dispatch via land mobile radio (LMR) and mission critical push-to-talk (MCPTT) from the same console

12. Determine responder location to correct floor and accurate location on that floor

13. Access real-time video from responders in the field from any location (e.g., dispatch, incident command)

14. Access to mission critical push-to-talk (MCPTT) application, device, and accessory combination tailored to specific mission

15. Login once and access all agency applications based on one set of access credentials

16. Operate real-time video streaming within mission critical push-to-talk (MCPTT) application

17. Visualize responder locations in 2D and/or 3D building layout

18. Connect and monitor Internet of Things devices (e.g., sensors, "smart" meters, connected equipment)

19. Pilot (conduct command and control for) drone or robot operations over broadband

Public safety engagement

The FirstNet Authority based updates to the Roadmap deliberately on stakeholder input. Since the 2020 release of the Roadmap, the FirstNet Authority has participated in more than 5,000 engagements with first responders and hundreds of discussions with industry and academia, as well as executed substantive engagement-driven polling and data collection.

While the pandemic impacted in-person discussions, the FirstNet Authority was able to quickly implement a series of virtual engagements with public safety across the country. The FirstNet Authority used various methods to engage with stakeholders and collect feedback, including one-on-one engagements, single and multi-organization engagements, conferences, surveys, interviews, and focus groups.

Additional sources

Additional documents and publications were reviewed to understand general industry trends and conclusions related to public safety technologies and communications. These included internal surveys and engagement reports, as well as external reports and white papers. The FirstNet Authority team reviewed Project Responder 6: The Evolving Response Environment from the Department of Homeland Security Science and Technology Directorate, 21st Century Fire and Emergency Services White Paper from the Center for Public Safety Excellence and ICMA (International City/County Management Association), Broadband Communications Prioritization and Interoperability Guidance for Law Enforcement from the RAND Corporation, and the Voices of First Responders series from the National Institute of Standards and Technology Public Safety Communications Research division, along with several publications focused on the impact of COVID-19 on public safety operations.

Many of the conclusions drawn from the prioritization survey and interviews were echoed in these documents. Coverage is critical; responders need to be able to maintain communications via voice, video, and data; they need to be able to incorporate real-time data into decision making; data sharing helps reduce information silos; and adapting to and leveraging technology is critical to improving service delivery. The FirstNet Authority team also saw the same general theme in many of these documents—if the technology isn't useful or doesn't work easily, it is useless for responders. It needs to work.

To learn more about the Roadmap or download a copy, visit FirstNet.gov/Roadmap.

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Enter commands

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Incidents   Unit Status   Query   Who's On

Units	Status	Beat	Duration	Incident Type	Pri.	MC
260B	Active	320	01:27:29	TEMP	2	PO
* 280B	Active	290	00:12:31	CRAS...	2	JO
* 360B	Active	360	00:05:42	PEDD...	3	PO
* 520B	Active	520	01:11:00	ASSIS...	2	IN
* 550B	Active	540	00:34:59	TRAFF...	3	JO
AR103	Active	470	00:08:38	CRAS...	2	JO
CIS3...	Active	310	07:40:06	TEMP...	2	PO
CR20...	Active	250	04:12:56	SPECI...	4	PO
CR302	Active	320	00:07:25	DIREC...	4	PO
* CR502	Active	510	00:12:45	FOLLO...	4	PO
HL8	Active	530	00:10:56	ANIMA...	3	IN

Self Dispatch   Mobile Speech Settings

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