NEXT GENERATION FIRST RESPONDER
CASE STUDY
Deployable Communications

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Homeland Security
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EXECUTIVE SUMMARY

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) launched the Next Generation First Responder (NGFR) Apex program in January 2015 as a strategic initiative to develop and integrate next-generation technologies with the goal of expanding first responder mission effectiveness and safety. The NGFR Apex program seeks to help tomorrow's first responder be better protected, connected and fully aware.

NGFR has conducted three integration demonstrations to assess how prototype technologies integrate to support the NGFR Apex program. The first demonstration in January 2016 was primarily a tabletop demonstration, and the second in May 2016 was a combined tabletop and field demonstration in a large urban area. For the third NGFR integration demonstration, the NGFR Apex program wanted to collaborate with a more rural community where cutting-edge technologies face a unique set of deployment challenges.

NGFR partnered with first responders in Grant County, Washington, to assess the capabilities of several NGFR technologies to support their public safety operations. This effort, known as the *Grant County – DHS Science and Technology Directorate Next Generation First Responder Apex Program Technology Experiment* (TechEx), involved deploying a suite of technologies. This study identifies and explains the technologies that were used in the TechEx, and presents a case study that can be used by public safety agencies as an example of how deployable broadband communications could be implemented in rural areas.

Initial discussions with Grant County identified the following five areas as priority needs for the Grant County first responders:

- Geo-location of first responder units and personnel on map displays at the Grant County Multi-Agency Communications Center (MACC), command posts and on smartphones.
- Wireless data service at the Gorge Amphitheatre concert venue, campgrounds and along the Columbia River valley using various broadband technologies, including cellular broadband [Long Term Evolution (LTE)], Wi-Fi and digital television datacasting.
- Ability to stream and view real-time video from small Unmanned Aircraft Systems (sUAS) at the MACC, command posts, emergency management and other destinations from an sUAS and smartphones.
- Capability to monitor first responders' physiological condition and send the data wirelessly to the MACC and command post(s) for viewing using a video "dashboard" on a monitor.
- Support for communications and information dissemination using a combination of County-owned land mobile radios (800 MHz P25), commercial mobile networks and a deployable government-band public safety broadband network (Band 14 LTE, FirstNet) for data communications.

After further discussions, extensive planning, site visits, an integration and testing event, and a dry run of the experiment, NGFR and Grant County conducted the TechEx on June 6 and 7, 2017. The TechEx deployed over 50 first responders from multiple Grant County first responder agencies, as well as 15 NGFR staff and support contractors to complete the experiment.

The scenario-based event was executed using three operational scenario vignettes, illustrated in Figure 1:

- **Vignette A** functioned as a systems check of the new technologies. Each technology was tested for the corresponding responders and units (as applicable).
- **Vignette B** involved tracking down two "lost hikers" who wandered down into the Columbia River gorge. One hiker fell off a cliff and broke a leg. Sheriff's deputies were sent down into the gorge to find the victims with an sUAS used to assist in finding the hikers. Once the hikers were located, the Fire District responders were dispatched to perform a "ropes rescue" to transport the victim up the cliff to be treated by responders.
- **Vignette C** involved the report of a brush fire, which was located by the sUAS. Fire Districts 3 and 5 personnel were dispatched to fight the fire. Soon after, an altercation occurred at the nearby campground and deputies pursued the perpetrator.

Figure 1: Grant County Responders During the NGFR TechEx

The TechEx scenario provided sufficient realistic opportunities to assess the various technologies' utility and integration with existing systems (technical and human). The scenario also provided opportunities for participating first responders to identify gaps and required enhancements for future NGFR events. The evaluation team was able to verify that the NGFR system architecture implemented and configured in Grant County was easy to install, easy to use and provided capabilities that were valued by the first responders.

The NGFR Apex program and their partners developed a communications architecture to support the TechEx that incorporated commercial LTE, Wi-Fi hotspots, Band 14 LTE, Band 14-capable Sonim smartphones and a point-to-point microwave link for backhaul from the Band 14 LTE system to the Internet. This enabled first responders to track each other, capture and transfer video, monitor their physiological condition (heartbeat rate and respiration), and maintain situational awareness during the scenario vignettes.

INTRODUCTION

Next Generation First Responder Apex Program

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) launched the Next Generation First Responder (NGFR) Apex program in January 2015 as a strategic initiative to develop and integrate next-generation technologies with the goal of expanding first responder mission effectiveness and safety. The NGFR Apex program seeks to help tomorrow's first responder be better protected, connected and fully aware. When firefighters, law enforcement officers and emergency medical services have enhanced protection, resilient communications and advanced situational awareness, they are better able to protect our communities and make it home safely. The NGFR Apex program develops, adapts and integrates cutting-edge technologies using open standards, increasing competition in the first responder technology marketplace and giving responders more options to build the systems they need for their mission and budget.

NGFR Integration Demonstrations

NGFR has conducted three integration demonstrations to assess how prototype technologies integrate to support the NGFR Apex program. The first demonstration in January 2016 was primarily a tabletop demonstration, and the second in May 2016 was a combined tabletop and field demonstration in a large urban area. For the third NGFR integration demonstration, the NGFR Apex program wanted to reach out to a more rural community where cutting-edge technologies face a unique set of deployment challenges.

One key component of the NGFR Apex program is that it is both modular—meaning that responders can select diferent components that will easily integrate via open standards and interfaces—and scalable—meaning that responders can build a large and complex system or a small and streamlined system, depending on their mission needs and budget. Throughout the course of the NGFR Apex program, it is essential to test both the modularity and scalability of the system with first responders, so that by the end of the program, responders will be able to build their own Next Generation First Responder system from tested, integrated and demonstrated components that have already been proven in real-world environments.

NGFR Technology Experiment in Grant County

The DHS S&T Next Generation First Responder (NGFR) Apex program partnered with the Grant County, Washington, Sheriff's Office to assess how NGFR technologies could improve the mission capabilities of Grant County public safety. The county, comprised of more than 2,700 square miles of river valleys, rolling hills and agricultural farmland, is decidedly rural, and Grant County responders have frequently struggled with poor communications coverage when supporting major events, managing wildland fires and coordinating multi-agency responses to large incidents.

The overarching objective for the event was to conduct a Technology Experiment (TechEx) in Grant County, Washington, in collaboration with Grant County public safety officials and first responders. The TechEx integrated several NGFR technologies to support an operationally-relevant, mission-based scenario centered on law enforcement and emergency response operations. The goal of this TechEx was to demonstrate the various technologies and assist Grant County in incorporating them into their daily operations, and to gather responder feedback to help improve both individual NGFR technologies and the program as a whole.

Purpose of This Case Study

This case study describes NGFR's recent efforts to provide a deployable broadband communications capability to Grant County, Washington, as part of a TechEx. This study identifies and explains the technologies that were used in the TechEx and presents a case study that can be used by public safety agencies as an example of how deployable broadband communications could be implemented in rural areas to increase capabilities.

TECHEX OVERVIEW

Background

The NGFR Apex program and Grant County partnership resulted in the *Grant County – DHS S&T NGFR Technology Experiment*. The two-day experiment was held in and around Grant County's Gorge Amphitheatre, a popular music venue and campsite surrounded by open farmland and canyons. The venue draws crowds that increase the county's population by 30,000—a 30% increase from Grant County's regular 93,000 residents—on weekends during summer events, and poses a strain on existing responder communications capabilities. This particular venue provided the optimal environment to test various NGFR technologies during the TechEx.

Objectives

The overarching objective for the event was to conduct a TechEx in Grant County, WA in collaboration with Grant County public safety officials and first responders. The TechEx was based upon the integration of identified NGFR technologies to support an operationally-relevant mission-based scenario centered on law enforcement and emergency response operations. The goal of this TechEx was to demonstrate the various technologies and assist Grant County in incorporating them into their daily operations and existing systems. By gathering feedback from first responders on the technologies and how they did or did not augment Grant County emergency response capabilities, the NGFR Apex program will seek to better align the program to better meet rural as well as urban responder needs.

Figure 2: Grant County Command Center Monitors TechEx Activities

Requirements

Initial discussions with Grant County in December 2016 resulted in the identification of the following technology requirements for the TechEx:

- **Extended and Increased Communications:** Provide a broadband ([Long Term Evolution (LTE)] communications infrastructure that both works with existing commercial LTE providers and with a temporary public safety Band 14 LTE system to provide connectivity for the various technologies being demonstrated.
- **Video Capture, Storage and Distribution:** Capture video from responders' smartphones, small unmmanned aerial systems (sUAS) "drones" and other devices to forward to a centralized video storage service; distribute captured video from centralized service to responders, Incident Commanders (IC) and the Grant County Multi-Agency Communications Center (MACC).
- **Location Tracking:** Track location of first responder units and smartphone-equipped first responders on map displays at the MACC, command posts and on smartphones.
- **Responder Physiological Monitoring:** Monitor first responders' heart rate and respiration rate data to send to the MACC and/or command post.
- **Situational Awareness:** Share first responder location, physiological data and captured video to the MACC, command posts, emergency management and other destinations for display on dashboards and maps.

TechEx Activities

Site Survey

NGFR and their primary support partners, Johns Hopkins University Applied Physics Lab (JHU APL) and the U.S. Department of Commerce National Institute of Standards and Technology's (NIST) Public Safety Communications Research (PSCR) division, performed a site survey of Grant County in February 2017, which specifically focused on the technology currently in use by the Sheriff's Office, the Fire Districts and at the Gorge concert venue. This survey enabled NGFR to identify the types of technologies that would fulfill the requirements and objectives of the TechEx. As part of the survey, the NGFR TechEx team developed an "as-is" configuration of Grant County's communications infrastructure and capabilities for use as a baseline.

Integration Testing

Once the technologies were identified and preliminary development and integration was complete, NGFR and their partners met at PSCR in Boulder, Colorado, in April 2017 to perform further integration testing. This three-day session enabled the technical participants to connect all technologies in both laboratory and radio transmitter test-range field locations to test the integration of the components as a system of systems.

Dry Run

Soon after the Boulder integration testing, the team reassembled at the Gorge concert venue in Grant County to install antennas, test coverage and perform a dry run of the scenario vignettes. This testing assisted the participants in finalizing the systems, testing the new capabilities in the actual event setting and preparing for the actual TechEx.

Technical Experiment

The TechEx was conducted June 6-7, 2017. It was executed using an operational scenario with three vignettes:

- **Vignette A** functioned as a systems check of the new technologies. Each technology was tested for each of the corresponding responders and units (as applicable).
- **Vignette B** involved tracking down two "lost hikers" who wandered down into the Columbia River gorge. One hiker fell off a cliff and broke a leg. Sheriff's deputies were sent down into the gorge to find the victims with an sUAS used to assist in finding the hikers. Once the hikers were located, the Fire District responders were dispatched to perform a "ropes rescue" to transport the victim up the cliff to be treated by responders
- **Vignette C** involved the report of a brush fire, which was located by the sUAS. Fire Districts 3 and 5 personnel were dispatched to fight the fire. Soon after, an altercation occurred at the nearby campground and deputies pursued the perpetrator.

The TechEx scenario provided sufficient realistic opportunities to assess the various technologies' utility and integration with existing systems (technical and human). The scenario also provided opportunities for the first responder to identify gaps and required enhancements to be addressed in future NGFR events and technical development. The evaluation team was able to verify that the architecture implemented and configured in Grant County was easy to install, easy to use and provided capabilities that were valued by the first responders.

Communications Architecture

Based upon the site visits, the baseline assessment and ongoing collaboration with Grant County, a notional architecture was developed to establish the foundation for the architecture for the TechEx, as well as to ensure consistency with Grant County first responders' expectations and needs as shown in Figure 3.

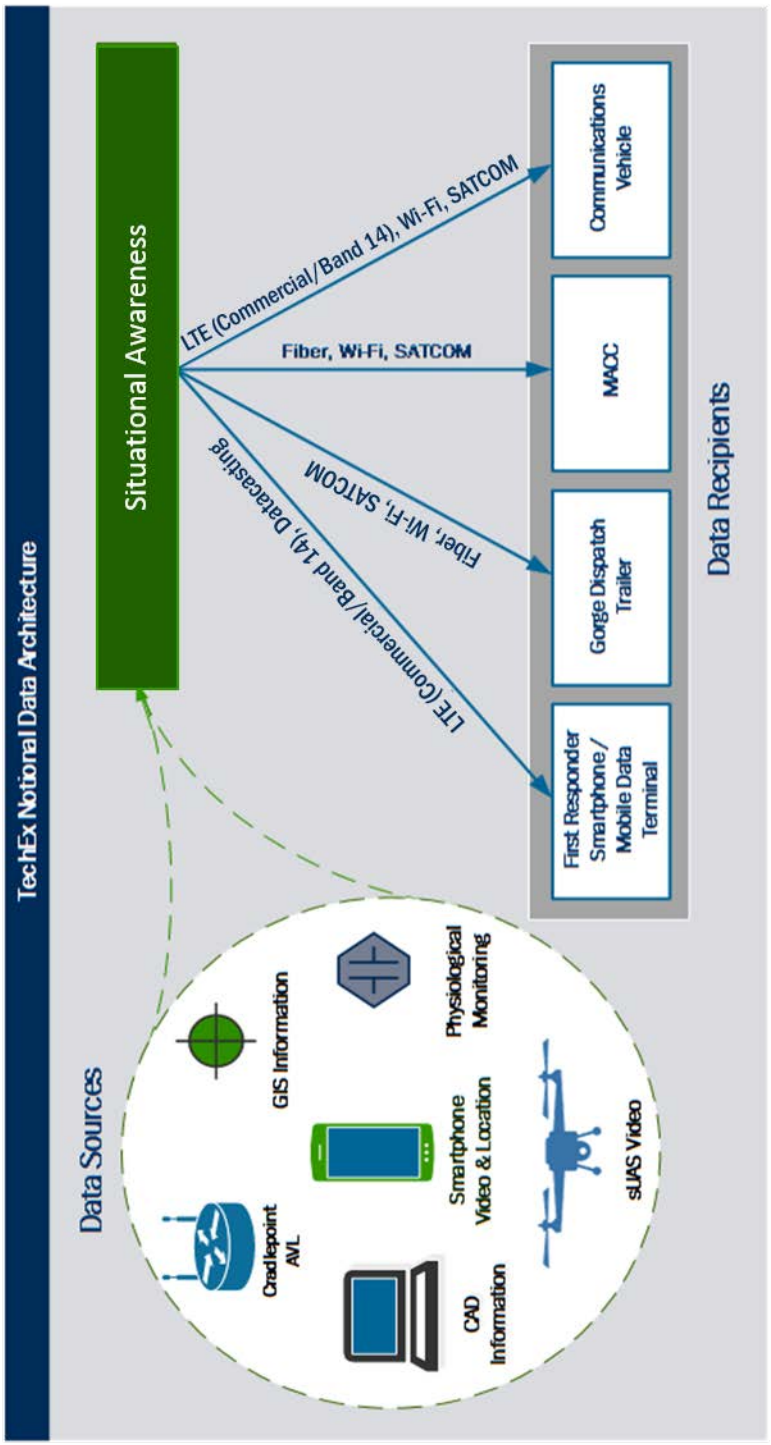
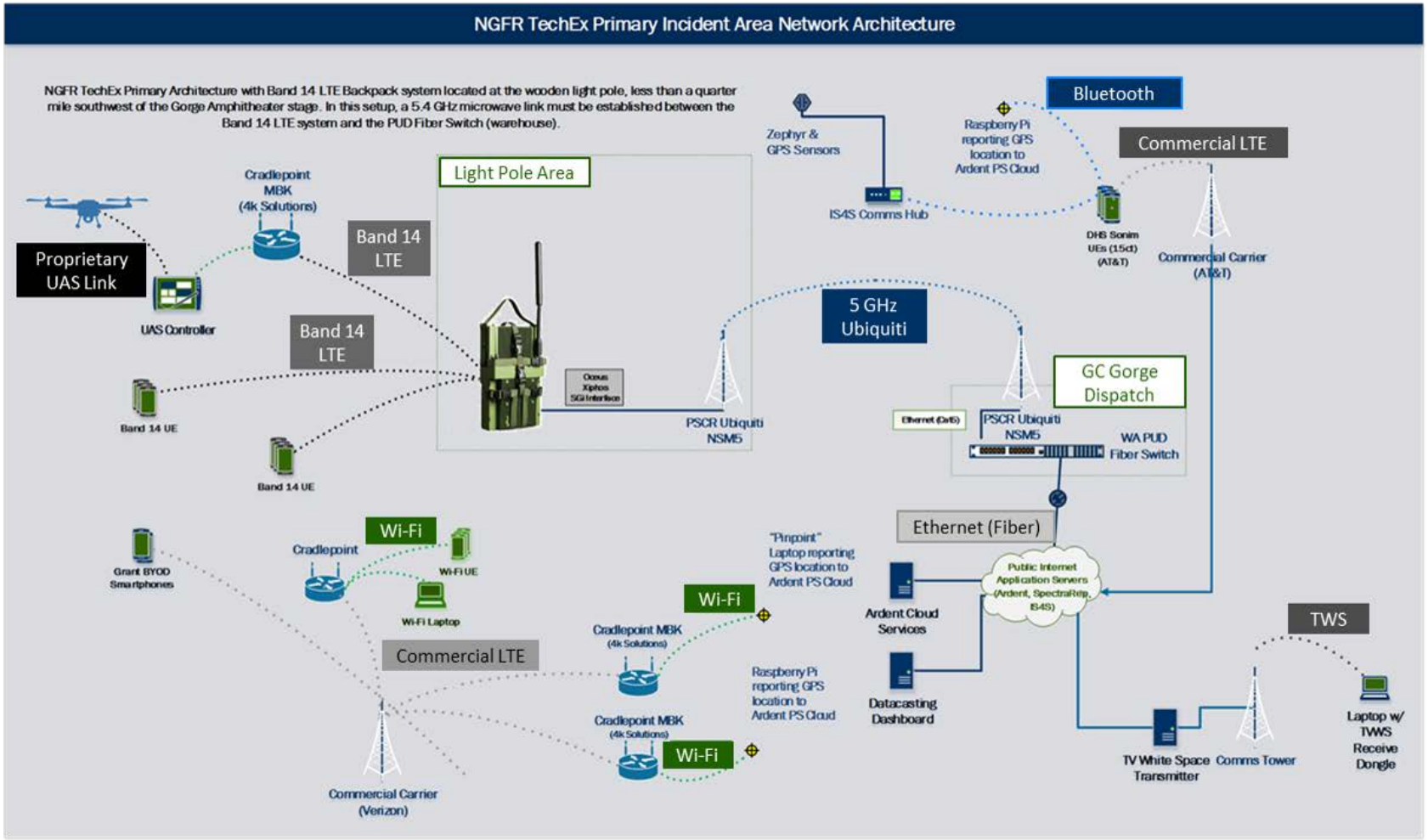


Figure 3: TechEx Notional Data Architecture

After the integration testing and the dry run, additional refinement occurred before the design was finalized as depicted in Figure 4.

Figure 4: Overall TechEx Architecture



Constraints and Limitations

The identified constraints and limitations for the TechEx event include:

- **Cost:** The NGFR Apex program had a limited budget for the TechEx. This precluded the use of the Band 14 LTE Cell-on-Wheels and instead the manportable "backpack" Band 14 LTE solution was selected.
- **Schedule:** The Special Temporary Authority (STA) to transmit in the Band 14 LTE spectrum was only granted for three weeks, so Band 14 LTE could not be tested as part of the dry run that occurred four weeks prior to the event.
- **Staffing:** The number of NGFR and partner support staff was limited due to both staff availability and the cost of travel. This resulted in a limited ability to support any elaborate communications systems and required support from some of the technolgy developers who assisted in the configuration and training of their systems prior and during the TechEx.
- **Technology Maturity:** Some of the communications-based technologies were still in the prototype phase, but were chosen for this event as the technology, when complete, had the potential of addressing Grant County's needs.
- **LTE vs. LMR:** Because of the agreed-upon requirements (as identified above), the solutions that NGFR provided did not rely on or affect Grant County's existing Land Mobile Radio (LMR) infrastructure or system. LMR was only used during the TechEx for standard responder-responder and dispatch-responder communications.

Communication Solutions Implemented

Band 14 LTE

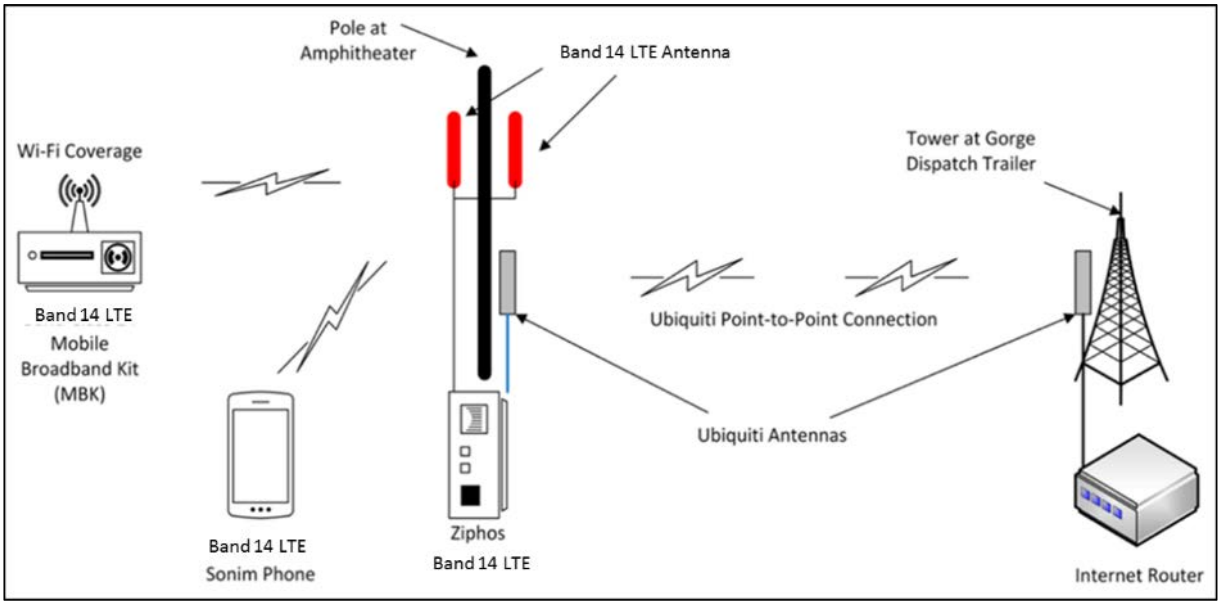
An Oceus Networks Xiphos Micro low-powered, small form-factor self-contained 4G Band 14 LTE "backpack" system was installed at the Gorge Amphitheater to provide Band 14 LTE coverage for the Gorge amphitheater, the Gorge campground and the Columbia River Gorge adjacent to (to the west of) the Gorge Amphitheater. This provided an LTE network (separate of the commercial providers AT&T and Verizon) for first responder data communications. The backpack unit enables high-speed voice, video and data communications for mobile field personnel. It was equipped with 2x5W RF output power providing up to six hours of operation when connected to two military grade field swappable batteries. For the TechEx, however, it was powered from a standard 110VAC outlet.

To make use of the Band 14 LTE system, Sonim phones were provided and configured to use Band 14 LTE, but only for data, as no voice communications were enabled for Band 14 LTE units. The Band 14 LTE phones had a location and situational awareness application installed (ArdentMC's "Watchtower" application) that displayed the location of other first responders on a map and transmitted their location to the Ops Dashboard situational awareness system at the Gorge dispatch trailer and the MACC. There was also a video capture application ("Wowza") that allowed the responders to capture video from the sUAS via the video client application, and send it to the video server for viewing and redistribution. A description of the video capture, transfer and transmission systems used will be the subject of a separate NGFR case study.

Microwave Backhaul for Band 14 LTE Portable Site

Backhaul between the Band 14 LTE backpack unit and the nearest Internet router connection was provided using a miniature Ubiquiti NanoStationM 5.8 GHz microwave point-to-point system with a range of up to 2 miles line-of-sight distance and speeds of 20+ Mbps. It operated in the frequency range from 5.745 to 5.825 GHz, and provided the link between the network drop and the Band 14 LTE backpack system, a distance of approximately ¾ mile. An overview of the Band 14 LTE solution is shown in Figure 5.

Figure 5: Band 14 LTE and Microwave Backhaul Architecture



Wi-Fi with Band 14 LTE or Commercial LTE Backhaul

To provide a wireless local area network (LAN), 4K Solutions Mobile Broadband Kits (MBK) were used. These kits combine a high capacity battery with a Cradlepoint model IBR1100 Wi-Fi hotspot/4G LTE router, and a dual dock to support a Band 14 LTE modem, packaged in a Pelican 1450 case for safe storage, transport and use. For the Grant County TechEx, PSCR configured the MBKs to use either Verizon or Band 14 LTE for network connectivity to the Internet, while the Wi-Fi hotspot acted as the local access point for compatible devices to connect to a data network. The MBK, configured to work with the Band 14 LTE modem, was placed at the Gorge Amphitheater for the Incident Commander and sUAS operator while another MBK, configured to work with the Verizon network, was installed at the large campground for the foot patrol officers.

Deployment

Decisions regarding the deployment of the technologies for the June event was based on the outcomes from the technical integration and the dry run (i.e., system location, existing coverage gaps, environmental factors). These pre-event tests allowed for an early analysis of configuration needs, an assessment of Grant County's existing systems and an awareness of what was needed for successful integration for the June 2017 TechEx. Figure 6 shows the physical location and setting of the equipment deployed for the TechEx.

Figure 6: Equipment Locations for Grant County TechEx

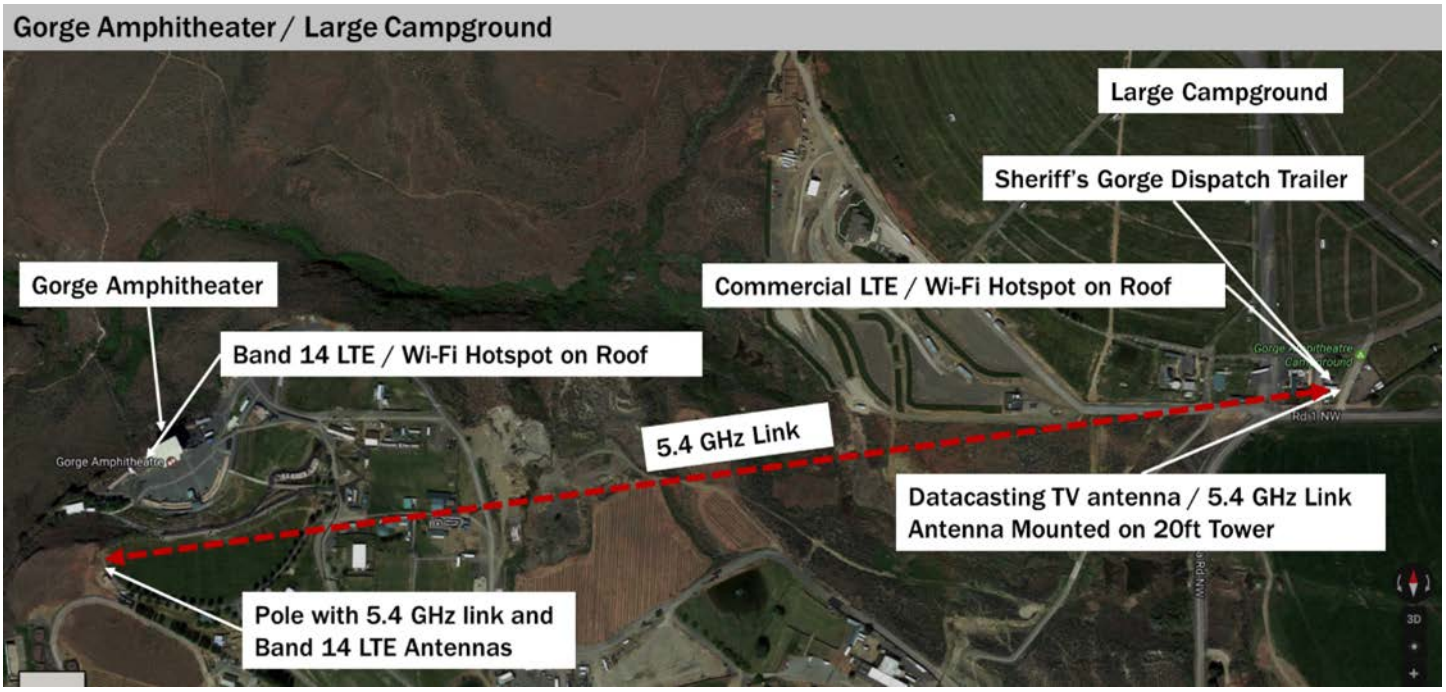
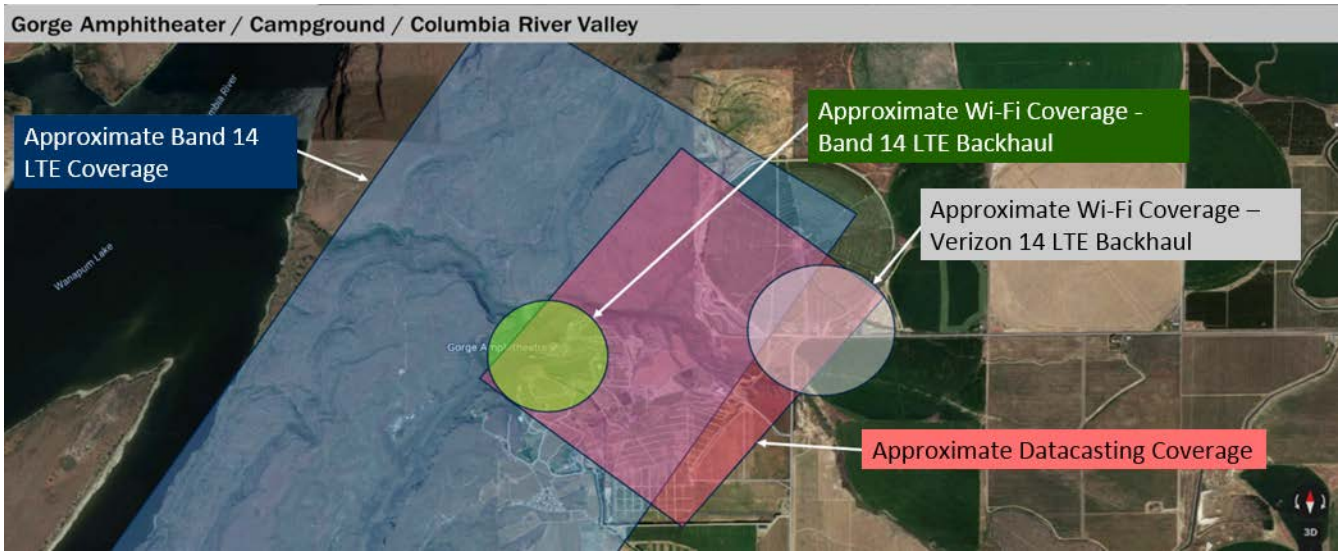


Figure 7 depicts the coverage areas that influenced the placement of the equipment.

Figure 7: Coverage Areas Provided by Deployed Communication Devices



RESULTS

The TechEx proved to be successful in demostrating both the advantages of the systems and their shortfalls as currently implemented. All of the requirements (noted above) were fulfilled with the delivered capabilities, but with varying degrees of success. A complete TechEx After Action Report is available upon request from NGFR at NGFR@hq.dhs.gov**.**

The Grant County TechEx can be extrapolated to a variety of use cases, such as those defined in the NPSTC document, *NPSTC-CSS Broadband Deployables Report, Broadband Deployable Systems in the Nationwide Public Safety Broadband Network*. This document provides very detailed discussions of the steps required to successfully plan and operate a deployable communications system. Additional sources are found in the References and Recommended Reading section.

Use Case: Surge Capacity & Emergency Communications Deployment

The Grant County TechEx benefitted from months of planning, discussion, analysis and development, as well as a three-day integration testing session and a three-day dry run to fully exercise the technologies. Most agencies, especially agencies in more rural areas, most likely do not have the luxury of such involved planing and systems testing prior to the ocurrence of a major disaster or other emergency event.

One critical takeaway from the exercise is for an agency to determine their coverage area requirements for various emergency scenarios, and assess how to provide the requisite broadband LTE and Wi-Fi coverage to meet their operational requirements. By determining coverage areas and resource requirements in advance, jurisdictions of all sizes can better prepare themselves for emergencies and disasters where deployable broadband communications systems are required. As an example, for non-LTE capable equipment (personal computers;, tablets, etc), agencies will need to deploy MBKs and equip them with the proper SIM cards to operate with the LTE provider to provide broadband services for those devices.

From review of online references, there are a variety of deployable emergency communications systems available to communities of all sizes. Some of these resources include:

- Federal Emergency Management Agency (FEMA) Disaster Emergency Communications (DEC) has regional assets available;
- Regional and state emergency management agencies should be able to bring assets to bear to assist with an unplanned event; and
- Commercial broadband providers (e.g., AT&T, Verizon, Sprint, etc.) may have deployable LTE systems—Celluar-on-Wheels (COW), Celluar-on-Light-Truck (COLT) or man portable systems—that can be provided to provide LTE coverage or supplement existing coverage.

In order to rapidly deploy communications in emergencies, agencies should execute Memorandum of Understandings (MOUs) and Service Agreements with service providers and emergency management agencies prior to the events to ensure that deployable communications equipment will be available in the time frame required to support the event or emergency. The choice of Band 14 LTE or commercial LTE will be dictated by the availablity of FirstNet in the location where equipement is to be deployed, and also what equipment and provider the agency is using for its LTE services. As FirstNet is implemented, state by state, agencies should work with FirstNet to identify surge capabilities that FirstNet can provide.

Case Study Scenario

This scenario is provided as an example of how deployable broadband services could be implemented in the event of a disaster. The disaster envisioned is a rail car derailment in a rural area, involving both toxic and flammable cargo. The agencies responding to the derailment are expected to be onscene for several days, and need broadband access during that period of time to ensure situational awareness and resource management.

Day 1: 0-12 Hours

In the first 12 hours, the primary first responders will arrive onscene with their organic communications capabilities (e.g., LMR, LTE in the vehicles and on agency/personal smartphones) and start to take action to mitigate the damage and plan

for remediation. Communcations capabilities will be somewhat limited, and commercial LTE systems may experience overloading and slow response. Other federal, state and local response agencies will start to arrive and will bring with them a mix of communications capabilities. Some of the responding agencies may have communications vans equipped with limited connectivity via LTE and/or satellite, but a true broadband data Incident Area Network (IAN) will not exist until the provision of broadband coverage by either FirstNet Band 14 LTE or another commercial LTE provider.

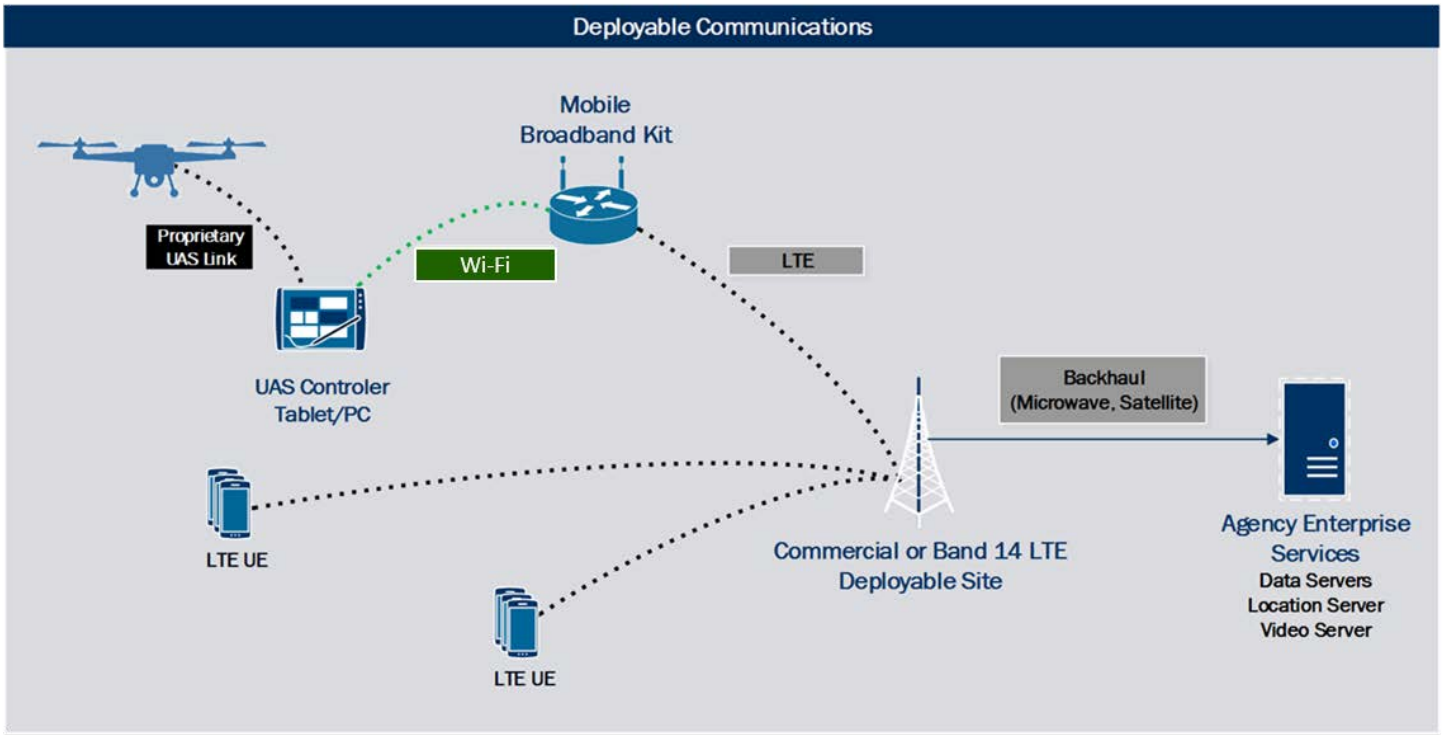
Day 1: 13 – 24 Hours

Within the first 24 hours, the arrival of COW, COLT or man-portable broadband system (as determined by agency requirements) will provide the agency with an operational LTE system with backhaul to support their data requirements on site. The backhaul communication link to the Internet and the Public Switched Telephone Network (PSTN) is typically established by the portable cellular system. Most portable cellular systems use either a LAN or satellite backhaul connection. LAN is useful when the portable cellular system is located in a non-remote area and the communication service problem is primarily due to the limitations of service network capacity. For connection to a LAN backhaul, access to a high-speed Internet connection is required.

However, a satellite backhaul is required in remote locations or when native cell-phone service coverage is not available. For this backhaul link, a separate satellite terminal is required for use with the portable cellular system. Most portable cellular systems use a portable very small aperture terminal (VSAT) designed for use in a deployed scenario, including the ability to auto acquire the satellite signal. One advantage of these terminals is that they are very small and portable, about the size of a small suitcase. However, one drawback with satellite backhaul is a communication latency of up to 1.5 seconds in each transmission due to the large distance the signal has to travel.

The notional configuration of the deployed LTE to furnish data services is shown in Figure 8.

Figure 8: Broadband Deployable LTE with Backhaul



Day 2

Once the LTE system is set up, the agency will then be able to deploy and configure the associated Wi-Fi hotspots to provide broadband access to non-LTE devices (e.g., tablets and desktop systems). These hotspots will have to be placed in locations where Wi-Fi coverage is required for ongoing operations, and provisioned with SIM cards for the LTE services provided. Agencies will have to ensure the hotspots are provided with the necessary power and security to ensure they can remain operational throughout the response.

Planning Factors

Beyond the scope of what was tested in the TechEx are many other planning factors. These incude (but are not limited to):

- **Preplanning and Prestaging:** Power outlets, antennas, cables and even entire communication systems can be prepositioned or staged in areas where events occur or are expected to occur. Prestaging just antennas and cables can preclude the need to climb poles or towers before or during events (e.g., as weather deteriorates in advance of a hurricane). Also, performing coverage analyses of potential transmitter locations before events occur can help identify potential locations for power, antennas and other equipment in preparation for possible events.
- **Involvement with Other Agencies:** Numerous agencies (e.g., local, state, federal) have deployable communications and can respond to events in an agency's area. Many agencies already have agreements with neighboring agencies for mutual aid, and states have arrangements to respond with their resources (both civilian and National Guard) to support communications in an emergency. FEMA, Naional Guard, Department of Defense (DoD) and others have deployable communication suites that can support local agencies' operations during emergencies and disasters. There are also numerous volunteer organizations that can provide communications support and equipment for emergencies.

IMPLEMENTATION FOR YOUR AGENCY

The NGFR TechEx deployed LTE communications equipment to provide supplemental broadband communications capabilities at the incident site. How can your agency take apply this case study and best practices to improve your capabilities? The NGFR Apex program has developed the following pre-deployment preparation and deployment activities checklists to assist your agency with planning how to deploy broadband communications capabilities duirng an emergency. While LMR equipment was not part of the TechEx, it is included as an item for consideration in the planning checklist provided below. In the planning process, if your agency identifies scenarios that will need deployable broadband communications, it may be helpful to include these as part of your agency's emergency management plans, training and exercise program, and ICS 205 incident radio communications plan.

Pre-Deployment Preparation Checklist

- ☐ Identify communications coverage weakness areas / additional temporary "surge" service areas
- ☐ Identify coverage technologies (e.g., LTE, LMR, Wi-Fi, other)
- ☐ Identify potential coverage solutions:
  - ☐ Commercial LTE provider deployable systems (COWs, COLTs)
  - ☐ Government provided deployable LTE systems (FirstNet)
  - ☐ Agency provided deployable LTE systems
  - ☐ Government provided deployable LMR systems
  - ☐ Agency provided deployable LMR systems
  - ☐ Agency provided deployable Wi-Fi systems
- ☐ Identify commercial LTE providers in the area(s)
  - ☐ Identify commercial providers' surge capabilities
  - ☐ Develop Memorandums of Understanding (MOUs) with commercial providers to provide systems for deployment
  - ☐ Assist commercial providers in identifying where agency can support necessary infrastructure upgrades to support surge deployments
  - ☐ Identify government LTE and LMR providers in area(s)
  - ☐ Identify government providers' surge capabilities
  - ☐ Develop MOUs with government providers to provide systems for deployment
  - ☐ Assist government providers in identifying where agency can support necessary infrastructure upgrades to support surge deployments
- ☐ Identify potential agency surge system deployment sites
  - ☐ Perform site surveys of potential sites
  - ☐ Identify possible equipment shelter / antenna locations
  - ☐ Determine infrastructure needs (power, generator, antenna, backhaul, etc.)
  - ☐ Install infrastructure
  - ☐ Install communications equipment and configure
  - ☐ Test communications equipment installed at site
  - ☐ Lock down configurations, put equipment in standby storage
- ☐ Develop talk groups, channels and frequency plans for devices
- ☐ Identify interoperable mobile apps and network servers that support voice/data/video sharing between agencies
- ☐ Determine / procure necessary subscriber / user devices
  - ☐ Identify and procure (as necessary) additional compatible user devices (commercial vs. Band 14 LTE vs. Wi-Fi)
  - ☐ Establish procedure for adding/removing users on the broadband network

- ☐ Establish user credentials and authentication to access network services
- ☐ Identify and procure (as necessary) additional compatible LMR user devices
- ☐ Identify and procure (as necessary) additional compatible Wi-Fi only user devices
- ☐ Configure user devices with necessary talk groups, channels and frequencies
- ☐ Configure interoperable mobile apps and network servers that support voice/data/video sharing between agencies
- ☐ Test, package and store user devices in standby storage

Deployment Activities Checklist

- ☐ Determine scope and area of supplemental coverage needed
- ☐ Determine technologies (LMR, LTE, Wi-Fi) to be deployed
- ☐ Contact technology providers (government, commercial, agency) to deliver solutions as per MOUs
- ☐ Provide support to technology providers onsite to assist in deployment
- ☐ Distribute user devices to first responders
- ☐ Monitor communications

SUMMARY

This NGFR case study provided an overview of the NGFR TechEx in Grant County, with a focus on the implementation of deployable wireless communications capabilities to augment mission response. In addition, this case study reviewed best practices for planning and implementing broadband incident area communications in remote areas.

If your agency finds this NGFR case study useful for improving your deployable communications capabilities, the NGFR Apex program would greatly appreciate your feedback. Please contact the NGFR team with stories from the field, questions or comments by emailing NGFR@hq.dhs.gov.

Figure 9: Grant County Emergency Medical Services During the TechEx

REFERENCES & RECOMMENDED READING

DHS Science & Technology Directorate

Next Generation First Responder Apex Program (https://dhs.gov/ngfr)
This website provides NGFR Apex program descriptions, updates, and knowledge products.

NGFR TechEx After Action Report, November 2017 (available upon request from NGFR@hq.dhs.gov)
This document thoroughly describes the planning, execution and results of the NGFR TechEx.

NGFR TechEx Playbook, June 2017 (available upon request from NGFR@hq.dhs.gov)
This document is the guide that was used to execute the NGFR TechEx in Grant County.

DHS Federal Emergency Management Agency (FEMA) References

Disaster Emergency Communications: Introduction to FEMA Disaster Emergency Communications. (http://www.napco.org/documents/2014-05_Benoit.pdf)
This document provides an overview of FEMA Disaster Emergency Communications capabilities.

DHS Office of Emergency Communications References

Portable Cellular System Application Note, Port-Cell-Sys_AppN_0714-508.pdf (https://www.dhs.gov/publication/portable-cellular-systems)
This document provides details regarding three broad categories of portable cellular systems – Cellular-on-Wheels (COW), Cellular-on-Light-Truck (COLT) and man-portable systems.

NIST PSCR References

Considerations for Identity Management in Public Safety Mobile Networks, NIST_IR_8014.original.1497299006-Identity-Mgmt (http://dx.doi.org/10.6028/NIST.IR.8014)
This document analyzes approaches to identity management for public safety networks in an effort to assist individuals developing technical and policy requirements for public safety use.

Public Safety Mobile Application Security Requirements Workshop Summary, NIST_IR_8018.original.1497299012-Mobile-App-Security (http://dx.doi.org/10.6028/NIST.IR.8018)
This document captures the input received from the half-day workshop titled "Public Safety Mobile Application Security Requirements" organized by the Association of Public-Safety Communications Officials (APCO) International, in cooperation with FirstNet and the Department of Commerce and held on February 25, 2014.

Usability and Security Considerations for Public Safety Mobile Authentication, NIST_IR_8080.original.1497299018-Mobile-Authentication (http://dx.doi.org/10.6028/NIST.IR.8080)
This report describes the constraints presented by first responders' personal protective equipment (PPE), specialized gear and unique operating environments, and how such constraints may interact with mobile authentication requirements. The overarching goal of this work is analyzing which authentication solutions are the most appropriate and usable for first responders using mobile devices in operational scenarios in the field.

Identifying and Categorizing Data Types for Public Safety Mobile Applications, NIST_IR_8135.original.1497299022-Data-Types (http://dx.doi.org/10.6028/NIST.IR.8135)
The Association of Public-Safety Communications (APCO), in cooperation with FirstNet and the Department of Commerce held a half-day workshop on June 2, 2015, "Identifying and Categorizing Data Types for Public Safety Mobile Applications." The goal of this workshop was to begin identifying different types of data that will flow through applications that operate on the National Public Safety Broadband Network (NPSBN).

An Overview of Mobile Application Vetting Services for Public Safety, NIST_IR_8136.original.1497299024-Mobile-App-Vetting (https://doi.org/10.6028/NIST.IR.8136)

This document is intended to be an overview of existing mobile application vetting services and the features these services provide and how they relate to public safety's needs. It is also meant to aid public safety organizations when choosing which mobile application vetting services are used to evaluate relevant mobile applications.

Guide to LTE Security, NIST_SP_800_187.original.1497299031-LTE-Security (https://csrc.nist.gov/csrc/media/publications/sp/800-187/draft/documents/sp800_187_draft.pdf)

This document serves as a guide to the fundamentals of how LTE networks operate, and explores the LTE security architecture. This is followed by an analysis of the threats posed to LTE networks and supporting mitigations.

National Public Safety Telecommunications Council (NPSTC) References

NPSTC-CSS Broadband Deployables Report, Broadband Deployable Systems in the Nationwide Public Safety Broadband Network. April 2017 (http://npstc.org/download.jsp?tableId=37&column=217&id=3903&file=NPSTC_CSS_BB_Deployable_Systems_Report_Final_170403.pdf)

This document provides an exhaustive analysis of public safety technical requirements for the use of LTE Broadband Deployable Systems to support first responder communications.

700MHz Nationwide Deployable Trunked Solutions: A Report by NPSTC and the NRPC. October 2015. (http://www.npstc.org/download.jsp?tableId=37&column=217&id=3559&file=NPSTC_NRPC_FCC_700MHz_Deployable_Trunked_Solutions_20151016_FINAL.pdf)

This document provides planning guidance for deployable trunked solutions.