



Improving Public Safety Outcomes with Mission Critical Communications & 5G

Introduction

First responders bear the important responsibility of keeping our communities safe. When decision making can become a matter of life or death, timely reaction becomes an absolute necessity. First responders must react to critical situations in real-time, and make decisions quickly and accurately in order to ensure the safety of citizens and restore peace in a chaotic situation.

The challenge is that in the heat of the moment, a first responder may not have all of the information at hand nor the situational awareness in order to make the optimal decision. That is one of the reasons the CRTC (Canadian Radio-television and Telecommunications Commission) has mandated

the introduction of the Next Generation 911 (NG-911) service across Canada. The migration will begin in late 2021 and is expected to be completed by early 2025.

NG-911 allows people to send video, pictures and data, including location-based texts, to 911 dispatchers. First responders can then leverage this data to improve situational awareness and enhance coordination of emergency resources.

Empowering first responders with critical information and improving situational awareness for emergency coordinators will improve the quality of timely decision-making and drive better outcomes.

The critical drivers for next generation communication systems

The Critical Communications Association (TCCA), a global standards organization, cited that the economic and social drivers for evolved mission critical communications using broadband include:¹



Improved operational efficiency: Public Safety operations and mission critical field services are expected to leapfrog to the next levels of efficiency by applying new applications utilizing broadband data communications.



Demand for improved safety: Terrorist attacks have placed security and safety questions high in governmental agendas. The question of safety is relevant, not only for citizens but also for first responders. Certain mission critical applications requiring broadband data connections, such as situational awareness applications, can significantly improve the safety of first responders and citizens.



Reduction of costs: Government budgets are under constant cost reduction pressure and critical communications services need to contribute to this cost control too. Cost related benefits are a combination of improved efficiency and productivity as well as new business models where, for instance, significant day-one CAPEX investments could be replaced by monthly OPEX fees.²

- LMR is often unreliable inside buildings and dense metropolitan areas.
- In many cases, fragmented standards hamper interoperability between different groups such as police and ambulance organizations or different provincial organizations.

The scenarios in this paper, highlight how and why public safety systems need to experience the benefits of improved collaboration enabled with greater mobility reach, video, data and AI (artificial intelligence) capabilities.

The Answer: broadband mobility and MCPTX

As NG-911 will allow people to record video, take pictures and send data such as locations and texts to emergency dispatchers, first responders can leverage this information to improve situational awareness and enhanced coordination of critical resources. To do this, public safety authorities will need access to a broadband network and responders will need smartphones and related applications - this requires the transition from today's mission critical push to talk (MCPTT) solution on legacy LMR networks to mission critical push to voice-video-data (MCPTX) solutions on broadband networks.

Public safety agencies will have two choices to gain this broadband capability. They can build it themselves or they can rely on the telecommunications industry to supply it. It is our contention that a public broadband network provided by the telecommunications industry gives public safety agencies access to the best devices, the latest applications, economies of scale, and life cycle management through successive generations of technology giving citizens the best service with the lowest tax burden.

Technologies like pre-emption on LTE and network slicing with 5G ensure that these networks are secure and perform to exacting quality of service levels required by these mission critical agencies.

The limitations of mission critical communications today

First responders currently use thirty-year-old P25 land mobile radio (LMR) systems for push-to-talk (MCPTT) communications with other team members. However, LMR communication is limited in a number of ways.

- The distance or range within which a first responder can communicate is limited to anywhere between 5 to 32 km depending on the terrain. This may constrain them to only access the help of other first responders who are accessible within this limited range.

¹ https://tcca.info/documents/2017-march_tcca_4g_and_5g_for_public_safety.pdf/

² https://tcca.info/documents/2017-march_tcca_4g_and_5g_for_public_safety.pdf/

First Responder Scenarios

Let's look at some scenarios that first responders deal with and how the outcomes might be improved with next generation mission critical communications (MCPTX) or 5G networks.



Scenario 1 - Police Officers

First responders may need to call upon other resources outside of the specific situation in order to assist in managing the critical instance. This might include accessing knowledge and expertise from their peers in different locations, or even other public safety agencies. What if they could all communicate with each other in real-time in order to resolve a public emergency?

For example, a police officer pursues a suspect and attempts to apprehend them. Currently, they are limited by their own reactive judgement and are only able to call in help that is available within their limited LMR push-to-talk coverage area.

What if they could **activate a body camera, enabling video** to be pushed immediately to dispatch a coordinated response? As well, a **map of the officer's location** could be shared with other police officers on the ground, in their cars, or in a helicopter, to help accelerate the capture of the suspect more immediately during the chase. This improves both the likelihood of success and promotes the safety of the officer.



Scenario 2 - Catastrophic Events

Consider also the scenario of a catastrophic event which drastically increases cellular usage. The mobility network is congested with many people trying to reach their loved ones or peers. What if you could prioritize the communications needs of first responders so that they will not be impacted by the congestion? This calls for **priority** of responder communications over the broadband network.



Scenario 3 - Traffic Control for emergency services

In some cases, getting to the scene of an accident or a crime-in-progress is the most critical and dangerous aspect of a first responder's job. Traffic and congested intersections slow down first responders from reaching the scene quickly and safely. One of the most dangerous aspects is driving through an intersection when the light is red. What if a **traffic route map** for emergency vehicles could be transmitted to all intersections and traffic lights? This would clear the way for an emergency vehicle to quickly reach the emergency event with "green lights" all along the route to the scene, getting the first responder to the destination faster.



Scenario 4 - Firefighters

Another high-risk public safety scenario involves firefighters entering a structure fire. Limited visibility and lack of situational awareness can hamper their efforts to save lives, while also increasing their personal risk. **5G can enable real-time AR (augmented reality) on their helmet visor**, which gives fire fighters the additional visibility of the building schematic. They can then safely navigate through the building, stairwells, and towards water sources within the building more efficiently and safely. This protects the lives of brave firefighters who are focused on saving others and enables them to achieve higher turnout times based on industry standards.

Fire-department proficiencies are measured in a number of ways, including cost per capita, underwriter surveys, annual fire losses and governmental benchmarks.³

The most commonly applied response-time standards are contained within the NFPA (National Fire Protection Association). The turnout time standards are 80 seconds for fire and special operations response; and 60 seconds turnout time for EMS response.

³ Realistic response times - Fire Fighting in Canada.

However, a study showed that only about 60% of the fire calls met the benchmark and only about 54 % of the EMS calls met the standard benchmarks.⁴ Next generation mission critical communications systems can **improve these turnout statistics** to meet and exceed the expected standards levels.

Note: The turnout time is about the NG-911 call to the station. This metric would include staging or getting ready for the truck role. Improved situational awareness would improve getting the right level of response (including agency, number of responders like three-alarm fire, and the right equipment) dispatched to the scene. This would ensure that the response time (time from dispatch to on-the-scene) is optimized for all relevant assets.



Scenario 5 - Drones

The impressive features of 5G - such as greater bandwidth capacity; the ability to support up to one million devices and sensors in one square kilometer; and ultra-reliable, ultra-low latency communications - will also serve to enhance public safety to significant new levels.

In addition to leveraging cameras in static locations, 5G will enable the use of **drones to extend the reach, visibility and timely reaction of first responders**, while also protecting their **safety**. Potential applications include rescue missions, searching for a person of interest, or simply to obtain a wide area, aerial view during an accident, flooding situation, or fire.



Scenario 6 - Connected Ambulance

In the overburdened healthcare industry, a connected ambulance accessing 5G is one way to treat patients in a timelier fashion. It optimizes the time of doctors in emergency rooms and it saves more lives.

For example, a paramedic treating a patient with a potential pericardial effusion or deep venous thrombosis situation can use a portable ultrasound and a haptic glove, guided by an emergency room doctor to diagnose the situation. If either of these ailments are diagnosed by the remote doctor, it allows the paramedic

to immediately give the patient the right medications, such as blood thinners, while enroute to the hospital. Misdiagnosis of this life-threatening condition, and administering the incorrect medication, could result in a fatality. In this case, the ultrasound has to go through a **priority and preemptive network**.

A study in the Greater Toronto Area confirmed that “OHCA (out of hospital cardiac arrest) patients who had shorter first-responder response times were significantly more likely to survive.” The findings support the use of response times to track the performance of the prehospital health care system. The absolute survival rate increased by 1.2% and 2.3% if 4 minutes and 3 minutes response time targets were achieved.”⁵

The projected benefit for a shorter response time target was largest in patients who were witnessed by bystanders. MCPTX enables bystanders to share information via their smartphones to NG-911 dispatch, which improves response times significantly for enhanced triage.

(*First-responder response time was defined as the time interval from emergency services activation (911 call) to the time firefighters or paramedics arrived on the scene.⁶)

Evolutionary Communication Systems to address these opportunities for greater public safety

As demonstrated by these examples, one can see that technology evolution has created many new ways to make public safety more efficient and help improve outcomes. The key to success is gaining help from a broader spectrum of people as well as accessing shared data in real-time. However, today's first responders' communications network is restricted to push-to-talk only in a small radius, limiting its reach and capabilities. By extending the capabilities of the communications network and applications to a broadband mobility network, the positive outcomes on public safety will be significantly improved.

⁴ Realistic response times - Fire Fighting in Canada.

⁵ https://www.ahajournals.org/doi/10.1161/circ.136.suppl_1.15378

⁶ https://www.ahajournals.org/doi/10.1161/circ.136.suppl_1.15378

Real-world application: Case Study

How MCPTX and 5G can enable better emergency responses for BC Ministry of Health

An audit⁷ conducted on the British Columbia Emergency Health Services (BCEHS) determined that:

1. Targets for timely, quality care were not consistently met
2. BCEHS coordination with fire dept first responders needs strengthening
3. Data-sharing between agencies needed to happen to better understand whether patients are getting the right medical interventions at the right time.

Coordination of access to emergency health services needs improvement:

Emergency health services provided by fire department first responders were not subject to medical oversight by BCEHS. BCEHS and fire departments did not share data with each other, and consent agreements with some local governments were not in place.

Impact: The absence of a coordinated approach increases the risk of inconsistent application of medical standards, limits understanding of the care provided and the opportunities for improvement, and increases the risk that first responders are not deployed to match patient needs.

Solution: Using a mobile network and MCPTX multi-mode communications and a smartphone, accelerates timely responses by connecting different agencies without the limitations of needing different devices or access to the LMR network. More interactive and timely communication takes place and more lives are saved. Further, the sharing of data sharing and medical profiles over a high capacity 5G network means first responders get all the information they need in the critical moment in order to give the right care to victims at the right time.



⁷ https://www.bcauditor.com/sites/default/files/publications/reports/OAGBC_EHS_RPT.pdf



How TELUS is making NG-911 happen sooner than later

Over the next 3 years agencies will need to work quickly to stand-up the infrastructure to support this transformation of 911 services. To enable the NG-911 service, TELUS is working with the PSAP's (public safety answering point) by installing fiber based connections that will allow the transmission of voice, video and data traffic. This will require the PSAPs to upgrade their call-handling equipment as well as upgrade their security and the requisite knowledge of the new technologies and privacy issues. This will ensure that they are able to best interact with not only the core NG-911 solution, but also the opportunities with an array of other services that will be sent over the circuits to the first responders including video, building information, street cameras, medical records, and Wi-Fi data. One example of getting started today on this transformation journey is TELUS' collaboration with EComm in helping British Columbia begin modernizing their 911 system.

To improve situational awareness and the application of NG-911 data, a first responder needs a smartphone.

In order to bridge the collaboration between citizens and first responders, citizens will use their smartphone to capture incidents, and then patch it to the dispatcher, who will forward it to first responders. It is important for first responders to have a smartphone in order to receive this real-time information and apply it to the incident for faster resolution. Only having a P25 radio (push-to-talk device) does not enable the first responder to receive the multimedia modes of communication, a requirement that is also mandated by NG-911.

Empowering first responders with MCPTX begins with replacing their existing voice-only Land Mobile Radios (LMR) or P25 radios with smartphones. Long the standard for emergency communications, LMR systems will be phased out over time, as data-enabled devices become the essential tools supporting improved situational awareness and better safety resolutions and outcomes.

The Cost Advantage of MCPTX

Supporting the existing LMR infrastructure includes both financial and physical costs. LMR devices are expensive, costing up to \$5,000. As well, users are required to carry this device in addition to their mobile phones and other devices, which is burdensome, heavy and bulky. Consolidating communication functions on a single smartphone device solves both of these problems. Changing devices to a smartphone also satisfies the mandated migration to NG-911 by 2025, as LMR/ P25 radios are not compatible with NG-911 systems. Smartphones enable first responders to take advantage of situational awareness capabilities provided by NG-911.

MCPTX not only amplifies the communications reach geographically and by different modalities, and is more convenient from a device perspective, but it offers a significant operational cost advantage.

Let's look at the cost comparison between a P25 network or migrating to an MCPTX solution using a real-world example.

The Government of Ontario recently spent \$765M to upgrade its P25 Public Safety Radio Network to support 38,000 users. Here's a snapshot breakdown of the potential savings with an MCPTX solution:

Consideration	P25 (monthly) Costs	MCPTX Cost
Device Cost	\$83 - 166 ¹	\$0
Operational Cost	\$45 ²	\$0
MCPTX	\$0	\$35
Comparison	\$128 - 211	\$35
Savings w/ MCPTX solution	72 - 83%	

The first column shows the expenses involved in supporting the high cost devices and the operational costs of the P25 upgrade. The second column demonstrates the cost savings with employees who already have a work-funded cell phone, which can be leveraged for mission critical communications as well. In this first scenario, the cost savings can be as high as 72-83%.

The bottom line is that the benefits of moving to a mobility network far outweigh the costs of investing in an upgraded P25 network for mission critical communications, as was demonstrated by this real world situation with the Government of Ontario. From a device cost perspective, there is a potential savings of 72-83% to be gained.

Samsung and TELUS: building the network of the future together to make citizens safer and save lives faster

The evolution of MCPTT (push to talk) to MCPTX (push to voice, data, video) over a mobile network, solves MCPTT limitations, helps to improve response times and situational awareness, and ultimately saves many more lives.

Features of the TELUS and Samsung co-developed network

More pervasive networks, 5G standards, and the ability to meet the standards of private networks on a carrier's mobile network, will make communication both faster and more secure in the coming years.


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Empowered by Samsung's MCPTX technologies, the TELUS solution is entirely developed on open 3GPP standards, a strategy that makes MCPTX both future-proof and expandable. Samsung Network technology with LMR interoperability is a proven solution deployed by AT&T and FirstNet, as the first-ever, nationwide mission-critical standards-based push-to-talk solution in the U.S. TELUS now brings this mission critical capability into Canada through our close collaboration via Samsung.

- Jérôme Birot
VP Chief Technology Office, TELUS

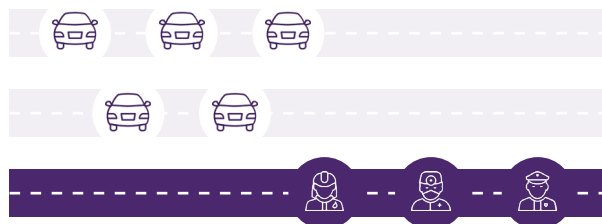
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With smart prioritization, pre-emption and network slicing, first responders can be guaranteed access to the broadband network. Enhanced communications will exist on a nationwide “state-of-the-art” network infrastructure, capable of supporting countless data-driven applications with unprecedented performance and increased resilience.

Priority allows your users to **be the first in line to connect to the LTE or 5G network**. If a network shortage or congestion of access are experienced, your team members with ‘priority’ enabled on their number have a better chance to connect to the network, as they are considered before all the other users.



MCPTX from TELUS offers **pre-emption** which allows you to **remove regular users from the network to re-allocate resources to your team**. With **pre-emption, MCPTX can deliver a guaranteed bit-rate** for instant communication (including voice, video and data).



5G will further transform public safety by adding intelligence to videos and by introducing drone technology to make cities safer. In addition, situational awareness will be enhanced by video and data-intensive communication — leveraging location, IoT, augmented reality and other emerging technologies.

Summary of Advantages of MCPTX

1. **Beyond Voice:** instant video communication and improved situational awareness with the ability to share data and location information
2. **Priority and Pre-emption:** Guaranteed connection and bit-rate
3. **LTE & 5G Networks:** Broadband provides better coverage indoors and quality of sound compared to Land Mobile Radio
4. **Smart Ruggedized Devices:** Waterproof, shockproof devices designed specifically for mission critical users
5. **Convenience of PTT on a smartphone:** one device for all your communication needs
6. **Cost savings:** lower operating costs and device cost

TELUS and Samsung are your public safety transformation partners

TELUS sees the future of mission critical communications as one where different technologies will work together to provide first responders with greater awareness in critical situations and a whole new set of capabilities to maintain real-time, critical information sharing with their team.



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Samsung is looking forward to deploying another leading edge MCPTX solution with TELUS as another ‘First’ in Canada.

- Stephen Wiktorski, Head of Networks, Samsung Canada

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TELUS is in a unique position to ensure that all of these applications can seamlessly work together, in one hyper-connected environment, powered by our next generation network. MCTPX (Mission Critical Push to Voice-Video-Data) is the first step towards an ecosystem that will encompass multiple partnerships with hardware, software, and solution providers.

How to engage in this evolution to revolution

TELUS is committed to supporting all of the Public Safety and First Responders organizations that work to keep our communities safe. This means commitment to delivering the highest standards of performance for our public safety solutions and optimizing traffic prioritization on our network. If your organization is considering a way to improve emergency preparedness and crisis response, we would like to help.

Get started
by contacting your
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