THOUGHT LEADERSHIP

Reliability in Mission Critical Communications in a World of Uncertainty

People working on the frontline of public safety are not impressed with marketing hype or theoretical data speeds when it comes to communications. They want to be sure that the kit will function reliably under stress, when coverage degrades, when infrastructure fails, when conditions are against them.

Lessons from History

At the height of the 2017 London Bridge terror attacks, we had a stark lesson in what can go wrong when critical communications face a crisis. The enquiries that followed revealed several failures in communications. Critical information could not be shared among first responders, as the police radio system was overloaded as officers pressed the emergency button at the same time, stopping all other message traffic. The control room was, at first, not able to establish the location of some ambulances and a number of paramedics were prevented from entering secured zones, leading to delays in treatment.

In New South Wales and Victoria, during the 2020 bushfires, many mobile and radio masts were put out action, either by the fire itself or because battery backups and generators could not be accessed in time.

These are extreme cases, but they underline the point that, in mission critical situations, whether it's a natural disaster, managing a medical emergency or maintaining public safety, critical communications need a level of reliability and resilience beyond the normal needs of the consumer. A dropped video call on the train is frustrating, but a failed radio link can sabotage an entire operation and cost lives.

Reliability in a Data Driven World

Commercial mobile networks are pretty reliable for everyday consumer use, delivering uptime of 95-99% uptime. So, you can pull up in your car and pick up emails, or video-call the kids on the way home from a business trip and you'll be fine. Emergency services however are looking for something closer to the so-called "five nines" availability. That's an availability of 99.999%. In the real world, emergency services are interested in "message reliability" of over *99% which is what we at Simoco aim for and what we have consistently delivered. Small percentage differences could mean you don't get to save the patient suffering a cardiac arrest in time to administer treatment.

While voice over mission critical push-to-talk (PTT) radio is still the cornerstone of public safety, successful emergency response is increasingly reliant on data driven applications like mapping and telemetry, so reliability trumps vanity metrics like router speed and tick box, nice-to-have features every time.

Mission critical operators are more likely to ask: "What happens when I can't communicate at a large gathering or when a major incident occurs, or both, as in the case of the 2017 Manchester Arena bombing? What happens when there is a power outage in the vehicle? How does the system continue to function when the mercury goes above 40 degrees or when navigating a boulder-strewn forest track." Practical things that actually impact their ability to do their job.

And what adaptations have you made to enable the system to work in the unforgiving physical environment of an ambulance, police vehicle or fire appliance? That means ruggedised enclosures and components that will withstand the rough treatment demanded of an emergency services vehicle. It means systems that will cope with electrical interference of other devices and the voltage spikes of starting and stopping the vehicle engine. It means power management so that comms are not interrupted by unforeseen outages.

And mobile systems need to be able to demonstrate the resilience to ensure message reliability in the middle of a natural disaster like flooding or forest fires or the site a major public transport incident in a remote location with poor cellular or PTT radio network coverage.

Life Saving Applications Put a Strain on Comms

For ambulance services, reliability isn't a nice-to-have. It's vital. Crews depend on uninterrupted connectivity for voice and data to provide route optimisation and real time patient telemetry while on the move. A momentary network drop can delay hospital notifications, interrupt vital data streams, or disrupt coordination with control rooms. It is for this reason that ambulances have one of the most highly regulated workflows in the emergency services sector.

Similar trends are at play in the world of law enforcement. Criminals are a notoriously unpredictable community, and this makes a structured approach to data-driven dispatch systems harder to apply. Despite this, there is a concerted drive to deliver more real time intelligence to the police vehicle with some forces coining the phrase: "moving the police station into the vehicle," to cut down on non-productive travel. In January 2026, the UK Home Office announced a significant expansion of Live Facial Recognition (LFR) technology across England and Wales, aiming to boost AI-driven policing, including LFR vans. Again, this means sophisticated data-intensive applications that require robust communications as well as the provision of high-quality PTT radio for access to emergency services networks.

Fire services use a range of digital tools in areas of fire prevention, operational efficiency and, most critically, incident response. Real time information on critical factors like hydrant locations, building layouts and the presence of hazardous materials can be fed directly to firefighters' mobile device while on route to the scene of the fire. The intelligent fire appliance is a reality, and these are lifesaving applications, whose impact we can underpin by providing resilient communications on the move, be that in an inhospitable remote location or a high-density urban setting.

Away from the classic emergency services users, there are growing numbers of mission critical applications in areas such as flood monitoring and, with the planned investment in new nuclear energy, the vital work of monitoring radiation levels in and around nuclear power stations. All of which throw up masses of data that is, by definition, mission critical and requires mobile units with above *99% communication reliability.

Parallel Bearers; Built in Resilience

Modern mission critical applications require always-on connectivity, regardless of the terrain, regardless of 4G/5G coverage or fixed PTT radio infrastructure. Operators live in the real world, where they know that you cannot expect the same data rates in a remote valley gorge as you would in an urban setting, but they cannot afford to have a complete comms failure. Thankfully, there are many choices in terms of bearer signal from 4G/5G LTE, TETRA (as used by the UK emergency services Airwave Network) P25 or DMR radio and even Wi-Fi. In locations where these are not an option, there is low earth orbit satellite communications, using services like Starlink and Eutelsat's OneWeb. However, while it is possible to switch from one bearer to another, this approach always introduces a lag, where mission critical data could be lost.

The only proven way to ensure the levels of performance required for mission critical is to "back every horse in the race" at the same time. That means a system that uses several bearers in parallel with the onboard intelligence to prioritise the most effective one at any given time. Moving from 4/5G LTE mobile to DMR or from DMR to satellite is virtually instantaneous because they are already connected, so there is no delay in physically having to switch to another bearer.

This is the approach taken by the Simoco VX4700 which packs all these options into a single vehicle mounted unit. As well as giving access to multiple parallel bearers it has the sort of practical workaround where the signal choice is limited to narrowband radio like TETRA. The system compresses data to fit the bearer's bandwidth, rather than giving up altogether. This is, by definition, resilience thinking and requires deep engineering competence, as running multiple bearers in parallel requires functions like real-time policy prioritisation and failure intelligence at the edge.

Practical Concerns at the Frontline

Frontline workers often have a different set of priorities to the people in procurement and look to their suppliers to design ways around the problems they encounter in the real world. For example, why have a separate mobile router with additional PTT radio kit when you can combine all communications platforms in single unit? This not only maximises the limited physical space available in a vehicle but also makes the kit less susceptible to the bumps and knocks that emergency vehicles are subject to. With products like the VX4700 you can fit them in a space that's out of the way such as under a seat and there is normally no need to access the unit physically, as it can be managed and updated remotely over a mobile or radio connection. In a worst-case scenario, because it's an all-in-one unit, it can be quickly swapped out to ensure vehicles are out of service for the bare minimum time.

…And What Happens When the Power Fails?

It goes without saying that without power, the only communication you have left is a loud shout! If you don't build in some form of power resilience you are faced with missed calls, dropouts in telemetry and the delays of a system reboot. This is not an office environment where you take a break until the lights come back on. This is life threatening for emergency workers, so it needs to be taken seriously.

We needed to take into account factors like the transient loss of power and ensuing voltage spike that is delivered when a vehicle starts up. So, we equipped our VX units with an intelligent dual power supply unit to manage fluctuations and an on-board UPS. Not the behemoth that sits next to the office server but a compact on board Lithium Polymer (LiPo) battery that copes with the ups and downs of supply from the vehicle DC battery.

And as operators migrate their fleets to Battery Electric Vehicles (BEVs) there is a further power resilience concern. What if all my high-tech comms kit drains may vehicle battery? Having an all-in-one device can dramatically cut down the load on the vehicle battery and increase its range.

Change is the Only Certainty: the External "Unknowns"

Former US Secretary of State for Defense, Donald Rumsfeld famously referred to "unknown unknowns" and, while we in the mission critical communications sector have been strong in the area of mitigating known risks, we cannot always predict external factors beyond our control like the unpredictable progress of the UK's long delayed ESN network, now scheduled for 2029. Equally disruptive can be changes in government policy which may favour one satellite provider over another. In the current climate, one can imagine provision of satellite services being restricted to certain states for political reasons. **Our approach at Simoco, while we cannot predict the future, we can design solutions that don't leave us hostage to it** for example, by proving the option to integrate the bearer of your choice; be that satellite, LTE or PTT radio. We also help operators deal with the uncertainties like the UK's ESN roll out. Our platforms are ready for ESN, whatever that may look like, but give you access to today's services, with adaptations like data compression on narrowband radio to fill the gap between today's reality and tomorrow's broadband promise.

Reliability by design

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*Under real-world vehicle operation and typical network conditions for a dual LTE installation with supplementary network connectivity options